

Multi-function Compact Inverter

M1 Series EtherCAT Type

User's Manual

3G3M1-A□□□□-ECT



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Introduction

Thank you for purchasing the Multi-function Compact Inverter 3G3M1 Series.

This User's Manual describes the installation/wiring of the 3G3M1 Series Inverter, and parameter setting method which is required for the operation, as well as troubleshooting and inspection methods.

Intended Readers

This manual is intended for the following personnel.

Those who have knowledge of electrical systems (an electrical engineer or the equivalent) and also are qualified for one of the following:

- Personnel in charge of introducing the control equipment
- Personnel in charge of designing the control systems
- Personnel in charge of installing and maintaining the control equipment
- Personnel in charge of managing the control systems and facilities

Notice

This manual contains information you need to know to correctly use the Multi-function Compact Inverter 3G3M1 Series.

Before using the inverter, read this manual and gain a full understanding of the information provided herein.

After you finished reading this manual, keep it in a convenient place so that it can be referenced at any time.

Make sure this manual is delivered to the end user.

Manual Configuration

This manual is compiled section by section for user's convenience as follows.

Section		Overview
Section 1	Overview	This section provides an overview of the 3G3M1 Series features, standard specifications, and external dimensions by inverter capacity. It also shows the differences of this inverter from conventional inverters for those who use previous models.
Section 2	Design	This section describes the installation environment and wiring methods.
Section 3	EtherCAT Communications	This section describes EtherCAT communications on the assumption of a connection with a Machine Automation Controller NJ/NX Series CPU Unit.
Section 4	Inverter Control	This section describes profiles for controlling the inverter.
Section 5	Operation and Test Run	This section describes the operation method of this product and the test run procedure.
Section 6	Basic Settings	This section describes the basic functions such as the Run command.
Section 7	Vector Control and Applied Functions	This section describes the vector control and applied functions characteristic of this inverter.
Section 8	Other Functions	This section describes the details of functions not described in Section 6 or Section 7.
Section 9	Troubleshooting	This section describes how to analyze the cause and take countermeasures if the inverter fails, and provides troubleshooting for possible troubles.
Section 10	Maintenance and Inspection	This section describes the maintenance and periodical inspection items.
Appendix		This section provides a description of profiles and a list of objects for controlling the inverter, and provides information on Sysmac error status codes, derating, capacitor life curve and inverter selection.

Manual Structure

Page Structure and Symbol Icons

The following page structure and symbol icons are used in this manual.

Level 2 heading — **2-2 Removal of Each Part**

Level 3 heading — **2-2-1 Removing Covers**

Operation Steps — Describes the operation steps.

Note, Supplementary Information, Reference Target — A note, supplementary information, reference target, etc. are provided with difference icons.

Manual Name — 3G3M1 Standard Type User's Manual #669E1-01

Level 1 heading — **2 Design**

Level 2 heading — **2-2 Removal of Each Part**

Level 3 heading — **2-2-1 Removing Covers**

Section Number of Level 1 heading — Shows which section the content of the current page belongs to.

Note: The above page is only a sample for illustrative purposes. It is not the actual content of the manual.

Special Information

Special information in this manual is classified as follows:



Precautions for Safe Use

Precautions on what to do and what not to do to ensure safe usage of the product.



Precautions for Correct Use

Precautions on what to do and what not to do to ensure proper operation and performance.



Additional Information

Additional information to read as required.

This information is provided to increase understanding or make operation easier.



References are provided to more detailed or related information.

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Information presented by Omron Companies has been checked and is believed to be accurate; however, no responsibility is assumed for clerical, typographical or proofreading errors or omissions.

Statement of security responsibilities for assumed use cases and against threats

OMRON SHALL NOT BE RESPONSIBLE AND/OR LIABLE FOR ANY LOSS, DAMAGE, OR EXPENSES DIRECTLY OR INDIRECTLY RESULTING FROM THE INFECTION OF OMRON PRODUCTS, ANY SOFTWARE INSTALLED THEREON OR ANY COMPUTER EQUIPMENT, COMPUTER PROGRAMS, NETWORKS, DATABASES OR OTHER PROPRIETARY MATERIAL CONNECTED THERETO BY DISTRIBUTED DENIAL OF SERVICE ATTACK, COMPUTER VIRUSES, OTHER TECHNOLOGICALLY HARMFUL MATERIAL AND/OR UNAUTHORIZED ACCESS.

It shall be the users sole responsibility to determine and use adequate measures and checkpoints to satisfy the users particular requirements for (i) antivirus protection, (ii) data input and output, (iii) maintaining a means for reconstruction of lost data, (iv) preventing Omron Products and/or software installed thereon from being infected with computer viruses and (v) protecting Omron Products from unauthorized access.

Safety Precautions

To ensure that the Multi-function Compact Inverter 3G3M1 Series is used safely and correctly, be sure to read this Safety Precautions section and the main text before using the product.

Learn all items you should know before use, regarding the equipment as well as required safety information and precautions.

Make an arrangement so that this manual also gets to the end user of this product.

After reading this manual, keep it in a convenient place so that it can be referenced at any time.



Indications and Meanings of Safety Information

In this user's manual, the following precautions and signal words are used to provide information to ensure the safe use of the Multi-function Compact Inverter 3G3M1 Series.





The information provided here is vital to safety. Strictly observe the precautions provided.





The following notation is used.

Meanings of Signal Words










 WARNING	<p>Indicates an imminently hazardous situation which, if not avoided, is likely to result in serious injury or may result in death. Additionally there may be severe property damage.</p>
 CAUTION	<p>Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or in property damage.</p>

Explanation of Symbols

	<p>⊘ This symbol indicates a prohibited item (an item you must not do). The specific instruction is indicated using an illustration or text inside or near ⊘. The symbol shown to the left indicates "non-specific general prohibitions."</p>
	<p>⊘ This symbol indicates a prohibited item (an item you must not do). The specific instruction is indicated using an illustration or text inside or near ⊘. The symbol shown to the left indicates "disassembly prohibited."</p>
	<p>△ This symbol indicates caution and warning. The specific instruction is indicated using an illustration or text inside or near △. The symbol shown to the left indicates "Caution against electric shock."</p>
	<p>△ This symbol indicates caution and warning. The specific instruction is indicated using an illustration or text inside or near △. The symbol shown to the left indicates "Caution against fire."</p>

	<p>△ This symbol indicates caution and warning.</p> <p>The specific instruction is indicated using an illustration or text inside or near △.</p> <p>The symbol shown to the left indicates “general caution.”</p>
	<p>△ This symbol indicates caution and warning.</p> <p>The specific instruction is indicated inside △ as well as by using text.</p> <p>The symbol shown to the left indicates “risk of hot surface.”</p>
	<p>● This symbol indicates a compulsory item (an item that must be done).</p> <p>The specific instruction is indicated using an illustration or text inside or near ●.</p> <p>The symbol shown to the left indicates a “general compulsory item.”</p>
	<p>● This symbol indicates a compulsory item (an item that must be done).</p> <p>The specific instruction is indicated inside ● as well as by using text.</p> <p>The symbol shown to the left indicates “grounding required.”</p>

WARNING

<p>Be sure to ground the ground terminal of the inverter. (200-V class: type-D grounding, 400-V class: type-C grounding)</p> <p>Not doing so may result in a serious injury due to an electric shock or fire.</p>	
<p>Do not remove the surface cover during inverter power supply and for 10 minutes after power shut off.</p> <p>Doing so may result in a serious injury due to an electric shock.</p> <p>Switch various switches, change wiring and perform inspections at least 10 minutes after the power supply has been shut off; after confirming that the Operator is OFF and that a tester or similar tool has been used to confirm that the voltage between the main circuit terminals P(+) and N(-) has dropped to a safe voltage (25 VDC or less).</p>	
<p>There is a risk of severe injury due to electric shock.</p> <p>Wiring work must be carried out only by qualified personnel. Do not touch cables when the power supply is turned ON. Additionally, only designated personnel should perform maintenance or inspections, or replace parts.</p>	
<p>There is a risk of severe injury due to electric shock.</p> <p>After confirming that the power supply is OFF, wait at least 10 minutes and then perform wiring.</p>	
<p>Do not operate the Operator or switches with wet hands. Also, remove metal objects (watches, rings, etc.) before starting work, and use insulating tools when using tools.</p> <p>Not doing so may result in a serious injury due to an electric shock.</p>	
<p>Do not touch the cooling fins, braking resistors and the motor, which become too hot during the power supply and for some time after the power shut off.</p> <p>Doing so may result in a burn.</p>	
<p>Inspection of the inverter must be conducted after the power supply was turned off.</p> <p>Not doing so may result in a serious injury due to an electric shock.</p> <p>The main power supply is not necessarily shut off even if the safety stop function is activated.</p>	
<p>There is a risk of severe injury.</p> <p>Do not enter the operating area during operation.</p>	
<p>There is a risk of severe injury due to electric shock.</p> <p>Do not perform maintenance while the power supply is ON.</p>	

Although this product is manufactured under strict quality control, install equipment to ensure safety when used with applications in which serious accidents or property damage can be anticipated in the event of its failure.

Not doing so may result in accidents.



The Multi-function Compact Inverter (3G3M1 Series) is designed to drive a three-phase induction motor and synchronous motor. Do not use it for single-phase motors or for other purposes.

Doing so may result in fire or accident.



Install the inverter on a non-flammable material such as metallic wall. Also, do not place flammable object nearby.

Doing so may result in fire.



Be sure to perform wiring after installing the inverter unit. Also, tighten terminals with specified torque.

Not doing so may result in injury, electric shock or fire.



Ensure that the specifications of the input power of the product match the power supply to which the product is to be connected.

Not doing so may result in fire or accidents.



Be sure to use the wire of specified size.

Not doing so may result in fire.



When wiring each inverter to the power supply, install a molded-case circuit breaker or earth leakage circuit breaker (with overcurrent protection function). Use recommended molded-case circuit breakers or earth leakage circuit breakers that do not exceed the recommended current capacity.

Not doing so may result in fire.



If no suitable equipment to detect leakage is installed in the upstream power supply line, in order to avoid the entire power supply system's shutdown due to operation of devices such as earth leakage circuit breaker as this is undesirable to operation, install an earth leakage circuit breaker individually to inverters to break the individual inverter power supply lines only.

Not doing so may result in fire.



When the capacity of the power transformer is 500 kVA or more and 10 times or more than the rated capacity of the inverter, ensure that a DC reactor is connected.

Not doing so may result in fire.



Never connect the power lines to the inverter output terminals U, V, or W.

Doing so may result in fire.



When connecting a braking resistor, do not connect it to any terminal other than terminals P(+) and DB.

Doing so may result in fire or accident.



Do not bundle multiple cables as one cable.

Doing so may result in fire.



Do not connect a surge suppressor to the output lines of the inverter.














Doing so may result in fire.



In general, sheaths of the control signal wires do not use reinforced insulation, therefore if a control signal wire comes into direct contact with a live part of the main circuit, the insulation of the sheath might break down. In these cases, there is a danger of the control signal wire being exposed to high voltage from the main circuit, therefore ensure that the control signal wires will not come into contact with live parts of the main circuit.

Not doing so may result in electric shock or accidents.



<p>Even if the inverter has interrupted power to the motor, if the voltage is applied to the main circuit input terminals L1/R, L2/S and L3/T, voltage may be output to inverter output terminals U, V and W. This may result in a serious injury due to an electric shock.</p>	
<p>Even if the motor is stopped due to DC braking or pre-excitation, voltage is output to inverter output terminals U, V and W. This may result in a serious injury due to an electric shock.</p>	
<p>Starting auto-tuning involves motor rotation. Sufficiently check that motor rotation carries with it no danger beforehand. Not doing so may result in injury or accidents.</p>	
<p>The inverter may operate with acceleration/deceleration time or speed different from as set due to stall prevention function. Design the machine so that safety is ensured even in such cases. Not doing so may result in accidents.</p>	
<p>The inverter can easily have high-speed operation set. When changing the speed setting, carefully check the specifications of motors or machine beforehand. Additionally, set the parameters only after fully understanding the User's Manual. If the user recklessly changes the parameters and then operates the inverter, the motor may rotate at a torque or speed not permitted for the machine. This may result in injury.</p>	
<p>If you enable the "Restart mode after momentary power failure" (F014 = 3 or 4), then the inverter automatically restarts running the motor when the power is recovered. Design the machine so that safety is ensured even after such restarts. Not doing so may result in injury or accidents.</p>	
<p>If the motor stops as a result of a trip, the inverter may automatically restart and drive the motor depending on the parameter setting. Design the machine so that human safety and the safety of surroundings is ensured at the time of restarting. Not doing so may result in accidents.</p>	
<p>Remove any cause of the protective functions operating, then check the RUN command is OFF and cancel the alarm. Canceling the alarm when the RUN command is ON means that the inverter will supply power to the motor, which may start rotation thus posing a danger. This may result in accidents.</p>	
<p>When switching start methods or speed by external input, the motor may start suddenly or the speed may abruptly change. This may result in injury or accidents.</p>	
<p>Input terminals have functions such as run, stop and speed change. If the parameters are changed while signals are input to the input terminals, the motor operation may suddenly change. Ensure that you change parameters only after fully securing safety. Not doing so may result in injury or accidents.</p>	
<p>The branch circuit protection being open may indicate an interruption in the fault current. In order to reduce the danger of fire and electric shock, inspect energized parts and other controller components, and replace if damaged. In the event of the overload relay current element burning out, the entire overload relay must be replaced. Not doing so may result in a serious injury due to an electric shock or fire.</p>	
<p>Output terminals (ROA, ROB) use relays, and may remain ON, OFF or undetermined when their lifetime is reached. For safety, equip the inverter with an external protective function. Not doing so may result in fire or accidents.</p>	
<p>Do not dismantle, repair or modify the product. Doing so may result in injury or electric shock.</p>	

Always carry out the daily and periodic inspections described in the User's Manual. Use of the inverter for long periods of time without carrying out regular inspections could result in malfunction or damage of the inverter, and an accident or fire could occur.
This may result in fire or accident.



It is recommended that parts for periodic replacement be replaced in accordance with the standard replacement frequency indicated in the User's manual. Use of the inverter for long periods of time without replacement could result in malfunction or damage of the inverter, and an accident or fire could occur.
This may result in fire or accident.



It is recommended that periodic inspections be carried out every one to two years, however, they should be carried out more frequently depending on the usage conditions.
Not doing so may result in fire or accident.



Using STO safety function, periodical inspection must be performed at least once in three months, to maintain reliability of the safety function.
Not doing so may result in serious accident.

- See 8-6-5 and 8-6-4 for detail of inspection



When using a DC reactor, AC reactor, braking resistor or noise filter, etc., there is the possibility that a human body may touch the main circuit terminal block (live parts). In such cases, take measures such as installing the inverters in an location not easily accessible by humans.
Not doing so may result in a serious injury due to an electric shock.



There are conditions for compliance with the EU Low Voltage Directive and Machinery Directive. Strictly observe the conditions listed in the instruction manual or user's manual.
Not doing so may result in a serious injury due to an electric shock or fire.



Security Measures

Anti-virus protection

Install the latest commercial-quality antivirus software on the computer connected to the control system and maintain to keep the software up-to-date.



Security measures to prevent unauthorized access

Take the following measures to prevent unauthorized access to our products.

- Install physical controls so that only authorized personnel can access control systems and equipment.
- Reduce connections to control systems and equipment via networks to prevent access from untrusted devices.
- Install firewalls to shut down unused communications ports and limit communications hosts and isolate control systems and equipment from the IT network.
- Use a virtual private network (VPN) for remote access to control systems and equipment.
- Adopt multifactor authentication to devices with remote access to control systems and equipment.
- Set strong passwords and change them frequently.
- Scan virus to ensure safety of USB drives or other external storages before connecting them to control systems and equipment.



Data input and output protection

Validate backups and ranges to cope with unintentional modification of input/output data to control systems and equipment.

- Checking the scope of data
- Checking validity of backups and preparing data for restore in case of falsification and abnormalities
- Safety design, such as emergency shutdown and fail-soft operation in case of data tampering and abnormalities



Data recovery

Backup data and keep the data up-to-date periodically to prepare for data loss.



When using an intranet environment through a global address, connecting to an unauthorized terminal such as a SCADA, HMI or to an unauthorized server may result in network security issues such as spoofing and tampering.



You must take sufficient measures such as restricting access to the terminal, using a terminal equipped with a secure function, and locking the installation area by yourself.

When constructing an intranet, communication failure may occur due to cable disconnection or the influence of unauthorized network equipment.



Take adequate measures, such as restricting physical access to network devices, by means such as locking the installation area.

When using a device equipped with the SD Memory Card function, there is a security risk that a third party may acquire, alter, or replace the files and data in the removable media by removing the removable media or unmounting the removable media.



Please take sufficient measures, such as restricting physical access to the Controller or taking appropriate management measures for removable media, by means of locking the installation area, entrance management, etc., by yourself.

Caution

If connecting a commercially available braking resistor or regenerative braking unit, this may result in a moderate burn due to the heat generated in the braking resistor or regenerative braking unit.



In case of a braking resistor, install a thermal relay that monitors the temperature of the resistor. Configure a sequence that enables the inverter power to turn OFF when unusual over heating is detected in the braking resistor or regenerative braking unit.

The inverter has high voltage parts inside which, if short-circuited, might cause damage to itself or other property.



Place covers on the openings or take other precautions to make sure that no metal objects such as cutting bits or lead wire scraps go inside when installing and wiring.

Install a stop motion device to ensure safety. Not doing so might result in a minor injury. (A holding brake is not a stop motion device designed to ensure safety.)



Be sure to confirm safety before conducting maintenance, inspection or parts replacement.



A breakdown of the built-in braking transistor could result in braking resistor heating or damage to the inverter's internal units. Shut off the main power of the inverter using Braking transistor broken signal (DBAL).



A breakdown of the built-in braking transistor or misconnection of the braking resistor could result in braking resistor heating or damage to the inverter's internal units.



If the inverter does not start up or continue being undervoltage (LU) after the main power of the inverter is turned ON, shut off the main power of the inverter.

When installing the product, use only the specified screws.



Not doing so may result in fire or accidents.

Do not install or operate an inverter with damaged external or internal components.



Doing so may result in injury, fire or accidents.

Prevent lint, paper fibers, sawdust, dust, metallic chips, or other foreign materials from getting into the inverter or from accumulating on the cooling fin.
Not doing so may result in fire or accidents.



Support the inverter case or cooling fin instead of the surface cover during transportation.
Not doing so may result in injury due to the inverter dropping.



The inverter, motor and wiring generate electric noise. Be careful about malfunction of the nearby sensors and devices. Take noise control measures to prevent them from malfunctioning.
Not doing so may result in accidents.



The inverter has an overload protection function. Set the protection level using parameters.



The brake function of the inverter does not provide any holding mechanism. Provide a separate holding brake if necessary.
Not doing so may result in injury.



Comply with the local ordinance and regulations when disposing of the product.
Not doing so may result in injury.



UL and cUL compliance is subject to conditions. Strictly observe the conditions listed in the instruction manual or user's manual.
Not doing so may result in fire or accidents.



Precautions for Safe Use

Installation and Storage

Do not store or use the product in the following places.

- Locations subject to direct sunlight.
- Locations subject to ambient temperature exceeding the specifications.
- Locations subject to relative humidity exceeding the specifications.
- Locations subject to condensation due to severe temperature fluctuations.
- Locations subject to corrosive or flammable gases.
- Locations subject to exposure to combustibles.
- Locations subject to dust (especially iron dust) or salts.
- Locations subject to exposure to water, oil, or chemicals.
- Locations subject to shock or vibration.

Transportation, Installation, and Wiring

- Do not drop or apply strong impact on the product. Doing so may result in damaged parts or malfunction.
- Do not connect an AC power supply voltage to the control input/output terminals. Doing so may result in damage to the product. Also, check the voltage and current of the connected circuit and implement wiring correctly.
- Take sufficient shielding measures when using the product in the following locations. Not doing so may result in damage to the product.
 - Locations subject to static electricity or other forms of noise
 - Locations subject to strong magnetic fields
 - Locations close to power lines
- If there is noise or other effects, install a ferrite core. When installing a ferrite core, do not allow the shield sheath to be caught between the communications connector and the cable. Not doing so may cause insufficient noise reduction effect, resulting in the Inverter to malfunction.
- Fix the shield wire or use other means so that it is not subject to a heavy load. Shield wire breakage may occur due to the weight of the ferrite core.
- When carrying out wiring of communications line and configuring network settings, refer to applicable sections of the manual to ensure correct connection and configuration procedures.
- Install an appropriate stopping device to ensure safety. In particular, if configured to operate continuously even in the event of a communications error, the Inverter may not stop, resulting in equipment damage.
- Do not use a broken cable. If the ring is disconnected, the device may malfunction.

Operation and Adjustment

- When checking a signal during the power supply and the voltage is erroneously applied to the control input terminals, the motor may start abruptly. Be sure to confirm safety before checking a signal.
- When changing parameters, do not turn OFF the inverter unit until saving is completed.
- Even when the inverter power is turned OFF, the counter-electromotive force occurs while the PM motor rotates, which may result in electric shock.

- Do not remove the surface cover of the inverter until the PM motor stops.
- When the ring disconnection status occurs and then you reconnect an EtherCAT communications cable, turn OFF the power supply to the EtherCAT master and to the slaves. Connecting a faulty EtherCAT communications cable while the devices are in operation may stop the entire EtherCAT communications system.

Maintenance and Inspection

- The capacitor service life is influenced by the ambient temperature. Refer to “Smoothing Capacitor Life Curve” described in the manual. When a capacitor reaches the end of its service life and does not work as the product, you need to replace the capacitor.

Precautions for Correct Use

Maintenance and Parts Replacement

- When a cooling fan reaches the end of its service life, replace it.
- If the ring disconnection status occurs, immediately perform inspection and take appropriate measures. Equipment damage may result.

Product Disposal

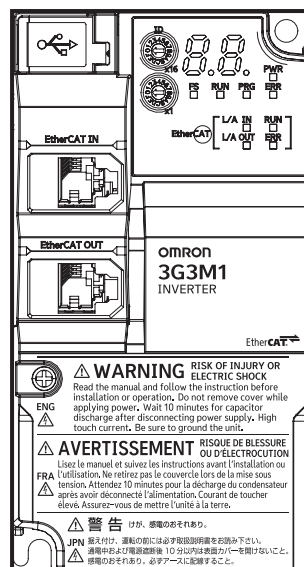
Comply with the local ordinance and regulations when disposing of the product.



■ This mark urges disposal in accordance with the WEEE Directive.

Warning Label

- This product bears a warning label at the following location to provide handling warnings.
 - Be sure to follow the instructions.
- The appearance differs depending on the capacity of the inverter.



Warning Description

<p>ENG</p> 	<p>⚠ WARNING RISK OF INJURY OR ELECTRIC SHOCK</p> <p>Read the manual and follow the instruction before installation or operation. Do not remove cover while applying power. Wait 10 minutes for capacitor discharge after disconnecting power supply. High touch current. Be sure to ground the unit.</p>
<p>FRA</p> 	<p>⚠ AVERTISSEMENT RISQUE DE BLESSURE OU D'ÉLECTROCUTION</p> <p>Lisez le manuel et suivez les instructions avant l'installation ou l'utilisation. Ne retirez pas le couvercle lors de la mise sous tension. Attendez 10 minutes pour la décharge du condensateur après avoir déconnecté l'alimentation. Courant de toucher élevé. Assurez-vous de mettre l'unité à la terre.</p>
<p>JPN</p> 	<p>⚠ 警告 けが、感電のおそれあり。</p> <p>据え付け、運転の前には必ず取扱説明書をお読み下さい。</p> <p>通電中および電源遮断後 10 分以内は表面カバーを開けないこと。</p> <p>感電のおそれあり。必ずアースに配線すること。</p>

Regulations and Standards

To export (or provide to nonresident aliens) any part of this product that falls under the category of goods (or technologies) for which an export certificate or license is mandatory according to the Foreign Exchange and Foreign Trade Control Law of Japan, an export certificate or license (or service transaction approval) according to this law is required.

Standard		Applicable standard
CE	EMC	EN 61800-3:2004/A1:2012
UKCA	Functional safety	EN 61800-5-2 :2017 STO SIL3 EN/ISO 13849-1:2015, Cat.3 / PLe
	Electrical safety	EN 61800-5-1:2007/A1:2017
UL	US	UL61800 -5-1, Edition 1, 2012
	CA	CSA-C22.2 No.274, 2017
KC		-
EAC		-
RCM		EN 61800-3:2004+A1:2012

The customer must check the conditions that must be met for compliance with the environmental standards and regulations of their respective country.

1. Checking use of regulated chemical substances

This product complies with regulated substances used in electrical parts based on the RoHS Directive.

For details on the Certificate of Conformance and other regulations, contact the place of purchase.

2. Motor efficiency regulations

This product is subject to energy efficiency regulations when it is used in motor systems that are driven by an inverter. For details on inverter efficiency with respect to motor output in accordance with EU efficiency regulations, refer to the following website.

<https://industrial.omron.eu/en/company-info/environmental/ecodesign-directive>

Items to Check after Unpacking

After unpacking, check the following items.

- Is this the model you ordered?
- Was there any damage sustained during shipment?

Checking the Nameplate




The nameplate is affixed to the product.


7.5 kW or lower


Inverter model	→	omron 3G3M1-A4004-ECT INVERTER																		
Input specifications	→	<table border="1"> <thead> <tr> <th></th> <th>ND</th> <th>HD</th> <th>HND</th> <th>HHD</th> <th>LOT No. 23456 Ver. 1.0</th> </tr> </thead> <tbody> <tr> <td>INPUT:</td> <td>2.7A</td> <td>2.7A</td> <td>2.7A</td> <td>1.7A</td> <td>50/60Hz, 380Y/220-480Y/277V, 3Ph</td> </tr> <tr> <td>OUTPUT:</td> <td>2.1A</td> <td>1.8A</td> <td>2.1A</td> <td>1.8A</td> <td>0.1-590Hz, 380-480V, 3Ph</td> </tr> </tbody> </table>		ND	HD	HND	HHD	LOT No. 23456 Ver. 1.0	INPUT:	2.7A	2.7A	2.7A	1.7A	50/60Hz, 380Y/220-480Y/277V, 3Ph	OUTPUT:	2.1A	1.8A	2.1A	1.8A	0.1-590Hz, 380-480V, 3Ph
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11 kW or higher

Inverter model	→	omron 3G3M1-A4110-ECT INVERTER																		
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 IND.CONT.EQ. 7B98

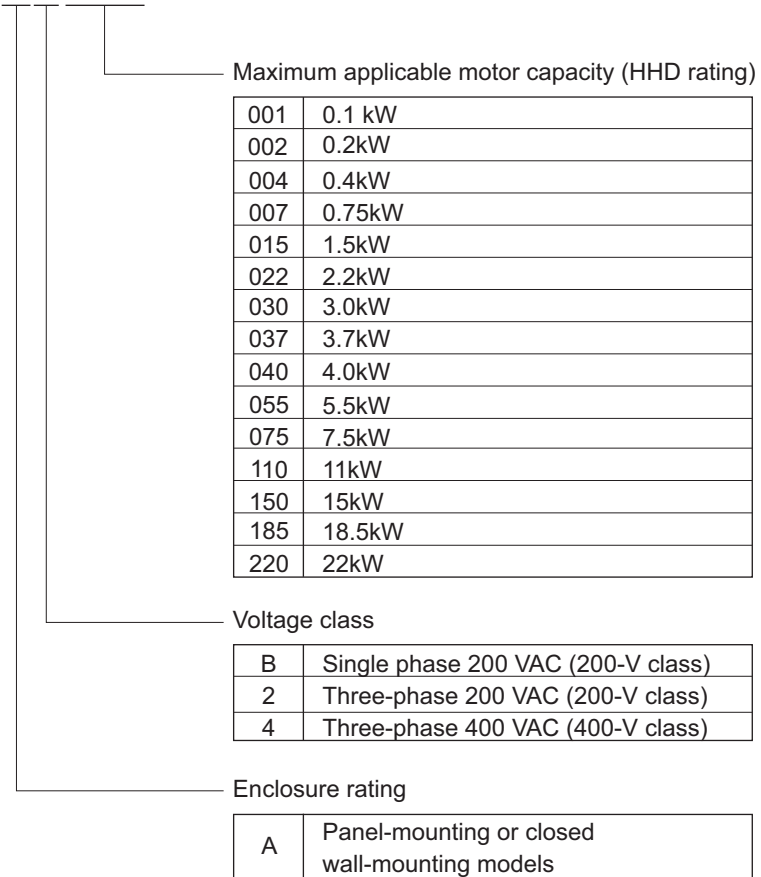

 Safety over


 TUV SUD



Checking the Model

3 G 3 M 1 - A 2 0 5 5 - E C T



Checking the Accessories

The instruction manual is the only accessory included in the Multi-function Compact Inverter (3G3M1 Series).

Mounting screws and other necessary parts must be provided by the user.

Related Manuals

The following table summarizes the manuals relating to this manual. Read these manuals together with this manual.

Name	Catalog No.	Model	Application	Description
Sysmac Studio Version 1 Operation Manual	W504	SYSMAC-SE2□□□	To learn about how to operate Sysmac Studio and its features.	Describes how to operate Sysmac Studio.
Sysmac Studio Version 1 Drive Functions Operation Manual	I589	SYSMAC-SE2□□□	To learn about how to set and adjust the inverter.	Describes how to operate Sysmac Studio.

Revision History

The manual revision code is an alphabet appended to the end of the catalog number found in the bottom right-hand corner of the front cover and in the bottom left-hand corner of the back cover.

Example

Man.No.	I670-E1-01
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↑
Revision code

Revision code	Revision date	Revised content
01	January 2023	Original production
02	March 2023	• Improved descriptions, etc

1

Overview

This section provides an overview of the 3G3M1 Series features, standard specifications, and external dimensions by inverter capacity. It also shows the differences of this inverter from conventional inverters for those who use previous models.

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1-1 Overview of Functions

The Multi-function Compact Inverter 3G3M1 Series is mounted with diverse motor control methods for bringing out the performance of motors, advanced position control based on PG input, and SIL3/PLe-compatible STO as part of the standard specifications, and has been designed to expand the potential of supported applications.

1-1-1 Features of 3G3M1 Series Inverter

Application Support

● Diverse motor control

PM motors up to 128 poles and conventional induction motors are supported which allows a diverse range of motors to be driven.

Motor options for implementing on devices have been expanded. This allows the performance of motors selected in accordance with nine motor control methods to be fully demonstrated. In addition, an auto-tuning function enables optimum PM motor parameters to be set to ensure smooth motor startup.

● Position Control

The inverter incorporates an encoder (PG) input function (ABZ phase, 1CH). Input of general encoder output as feedback position information enables position control of higher accuracy than that of previous models to be achieved. Position control suited to individual device applications, such as I/O input-based position control and Modbus communication-based commands from a host controller, is supported.

● Safety Function

STO functions (SIL3/PLe) are achieved by hard-wiring. Safety inputs on two channels and EDM output are supported.

FSoE (Safety over EtherCAT) protocol is supported for safe communications. Safe systems can be built by using the STO functions from a safety controller on the EtherCAT network.

● Conventional functions

Functions such as dual rating, multi-function I/O functions, analog I/O, relay output, PID functions, Modbus communication, torque control, and restart after momentary power failure are supported, and the inverter has been designed to achieve the same applications as on previous models.

Sustainability

● Improved device efficiency

Support for PM motors has been expanded. This has become all the more necessary as concern regarding energy savings has increased. Inverter efficiency has been improved, for example, by the removal of mechanisms such as speed reduction gears as a result of adopting a multi-pole motor and by drum motors with built-in conveyor, in addition to the support of high efficiency motors.

● Side-by-side installation

Side-by-side inverter installation (minimum clearance between inverters of 4 mm) is supported. This realizes the downsizing of control panels and the integration of devices into control panels, and helps reduce engineering costs.

Depending on the model, the reduction of the carrier frequency and the derating of the rated current are required. Refer to *2-1-2 Installation Environment* on page 2-2 for details.

Usability

● Same look and feel operability

In the design of Sysmac Studio, attention has been paid to operability so that it has the same look and feel as in OMRON's drive products. This minimizes the need to familiarize yourself with new operations generally required with software tools, and helps improve the efficiency of development when designing and starting up new systems.

1-1-2 Classes of 3G3M1 Series Inverter

There are three voltage classes for 3G3M1 Series Inverters: 200-V class supporting single-phase 200 VAC and three-phase 200 VAC, and 400-V class supporting three-phase 400 VAC.

The maximum applicable motor capacity for this inverter is 0.1 to 22 kW for the heavy load mode and 0.2 to 30 kW for the light load mode.

All models comply as standard with the EC Directives and UL/cUL Standards.

Rated voltage	Enclosure rating	Maximum applicable motor capacity		Model
		HHD: Heavy load	HND: Light load	
Three-phase 200 VAC	IP20	0.1 kW	0.2 kW	3G3M1-A2001-ECT
		0.2 kW	0.4 kW	3G3M1-A2002-ECT
		0.4 kW	0.75 kW	3G3M1-A2004-ECT
		0.75 kW	1.1 kW	3G3M1-A2007-ECT
		1.5 kW	2.2 kW	3G3M1-A2015-ECT
		2.2 kW	3.0 kW	3G3M1-A2022-ECT
		3.7 kW	5.5 kW	3G3M1-A2037-ECT
		5.5 kW	7.5 kW	3G3M1-A2055-ECT
		7.5 kW	11 kW	3G3M1-A2075-ECT
		11 kW	15 kW	3G3M1-A2110-ECT
		15 kW	18.5 kW	3G3M1-A2150-ECT
		18.5 kW	22 kW	3G3M1-A2185-ECT

Rated voltage	Enclosure rating	Maximum applicable motor capacity		Model
		HHD: Heavy load	HND: Light load	
Three-phase 400 VAC	IP20	0.4 kW	0.75 kW	3G3M1-A4004-ECT
		0.75 kW	1.1 kW	3G3M1-A4007-ECT
		1.5 kW	2.2 kW	3G3M1-A4015-ECT
		2.2 kW	3.0 kW	3G3M1-A4022-ECT
		3.0 kW	4.0 kW	3G3M1-A4030-ECT
		4.0 kW	5.5 kW	3G3M1-A4040-ECT
		5.5 kW	7.5 kW	3G3M1-A4055-ECT
		7.5 kW	11 kW	3G3M1-A4075-ECT
		11 kW	15 kW	3G3M1-A4110-ECT
		15 kW	18.5 kW	3G3M1-A4150-ECT
		18.5 kW	22 kW	3G3M1-A4185-ECT
		22 kW	30 kW	3G3M1-A4220-ECT
Single-phase 200 VAC	IP20	0.1 kW	0.2 kW	3G3M1-AB001-ECT
		0.2 kW	0.4 kW	3G3M1-AB002-ECT
		0.4 kW	0.55 kW	3G3M1-AB004-ECT
		0.75 kW	1.1 kW	3G3M1-AB007-ECT
		1.5 kW	2.0 kW	3G3M1-AB015-ECT
		2.2 kW	2.7 kW	3G3M1-AB022-ECT
		3.7 kW	-	3G3M1-AB037-ECT

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Maximum applicable motor capacity (HHD rating)

001	0.1 kW
002	0.2kW
004	0.4kW
007	0.75kW
015	1.5kW
022	2.2kW
030	3.0kW
037	3.7kW
040	4.0kW
055	5.5kW
075	7.5kW
110	11kW
150	15kW
185	18.5kW
220	22kW

Voltage class

B	Single phase 200 VAC (200-V class)
2	Three-phase 200 VAC (200-V class)
4	Three-phase 400 VAC (400-V class)

Enclosure rating

A	Panel-mounting or closed wall-mounting models
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1-1-3 Compliance with International Standards

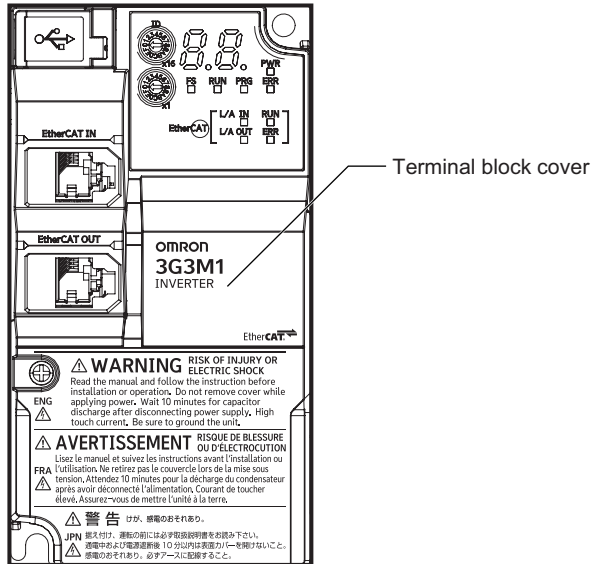
The 3G3M1 Series is compliant with the IEC international standard and so supports safety standards within Europe and other countries.

Standard		Applicable standard
CE UKCA	EMC	EN 61800-3:2004/A1:2012
	Functional safety	EN 61800-5-2 :2017 STO SIL3 EN/ISO 13849-1:2015, Cat.3 / PLe
	Electrical safety	EN 61800-5-1:2007/A1:2017
UL	US	UL61800 -5-1, Edition 1, 2012
	CA	CSA-C22.2 No.274, 2017
KC		-
EAC		-
RCM		EN 61800-3:2004+A1:2012

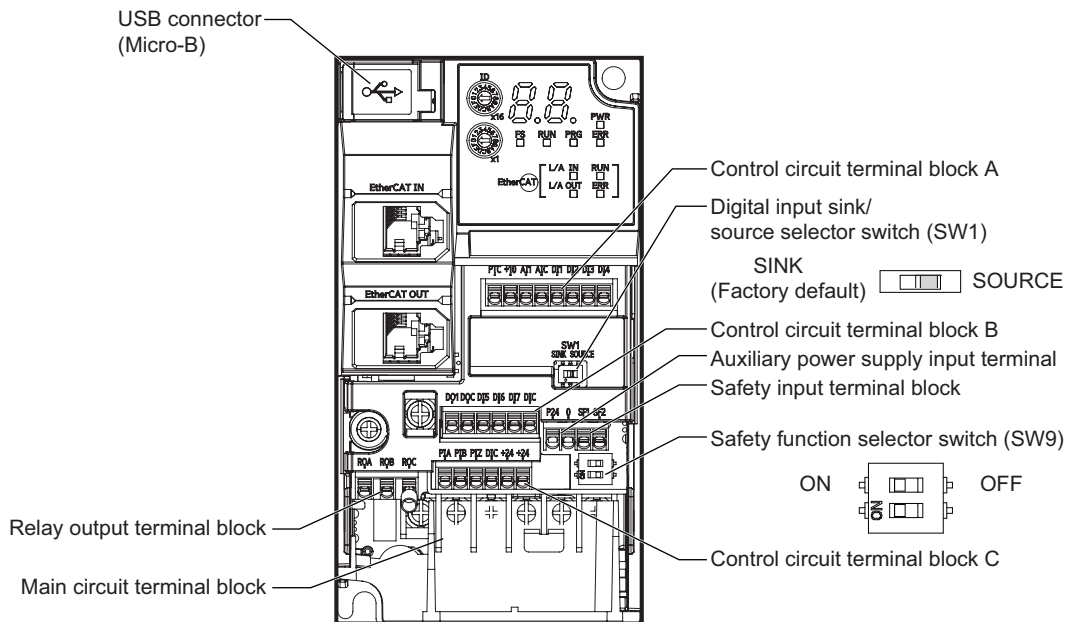
1-2 Appearance and Part Names

The following shows the front view when the product is unpacked.

(An example of 3G3M1-AB001/AB002/AB004/AB007/A2001/A2002/A2004/A2007-ECT)



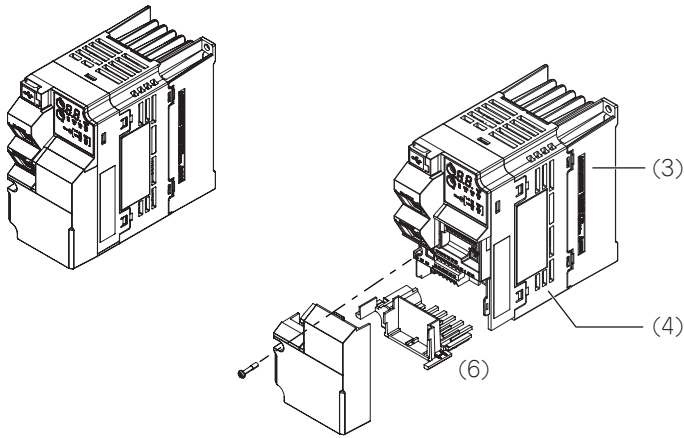
Open the terminal block cover to wire the main circuit terminal block and the control circuit terminal block.



The figures below show the components of each Inverter model.

Single-phase 200 V, 0.1/0.2/0.4/0.75 kW

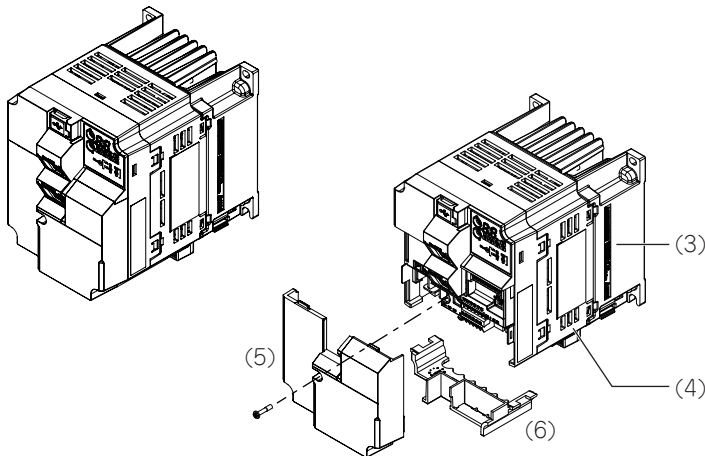
Three-phase 200 V, 0.1/0.2/0.4/0.75 kW



Single-phase 200 V, 1.5 kW

Three-phase 200 V, 1.5/2.2 kW

Three-phase 400V, 0.4/0.75/1.5/2.2kW



(1) Cooling Fan Cover

(2) Cooling Fan

(3) Cooling Fin

(4) Inverter Case

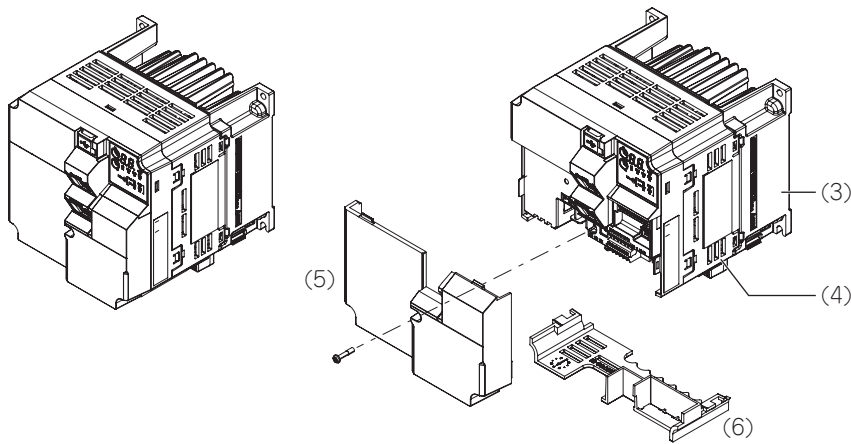
(5) Surface cover (Terminal block cover)

(6) Surface cover (Backing plate)

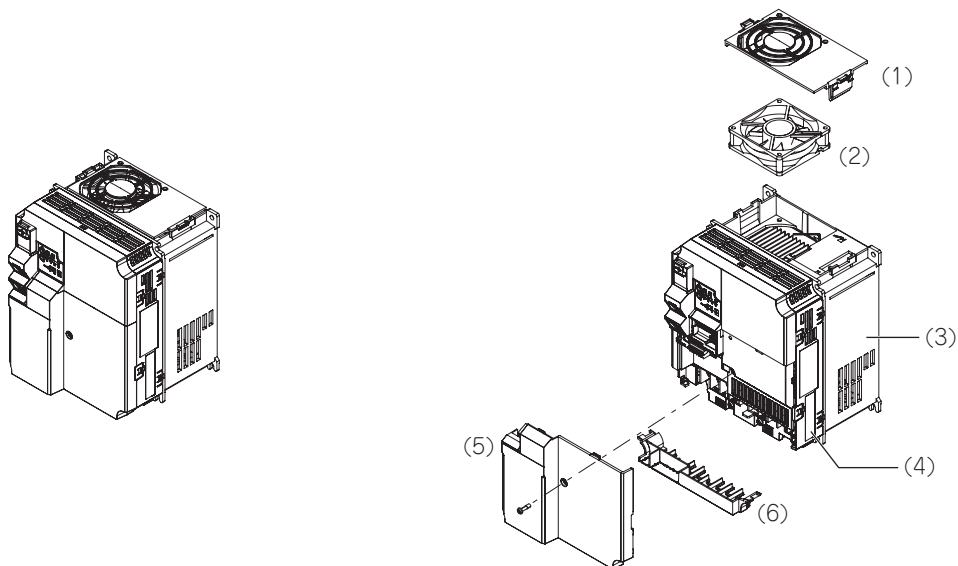
Note The single-phase 200-V, 1.5-kW and three-phase 200-V, 1.5-kW models have a cooling fan.

The three-phase 400-V, 0.4/0.75/1.5 kW model, however, has no cooling fan.

Single-phase 200 V, 2.2kW
 Three-phase 200 V, 3.7 kW
 Three-phase 400V, 3.0/4.0kW



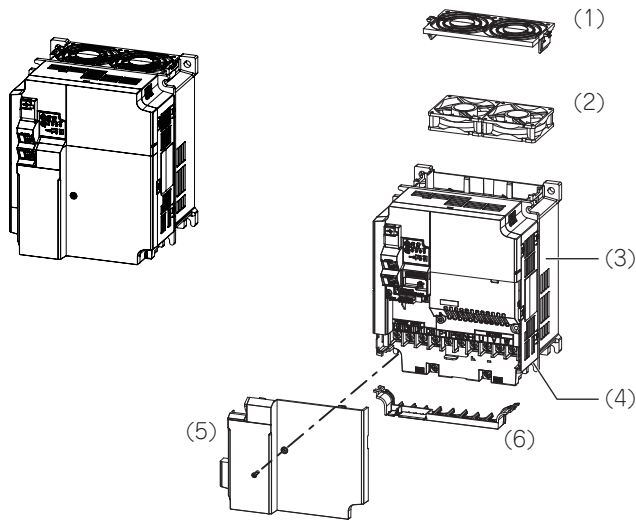
Single-phase 200 V, 3.7kW
 Three-phase 200 V, 5.5/7.5kW
 Three-phase 400V, 5.5/7.5kW



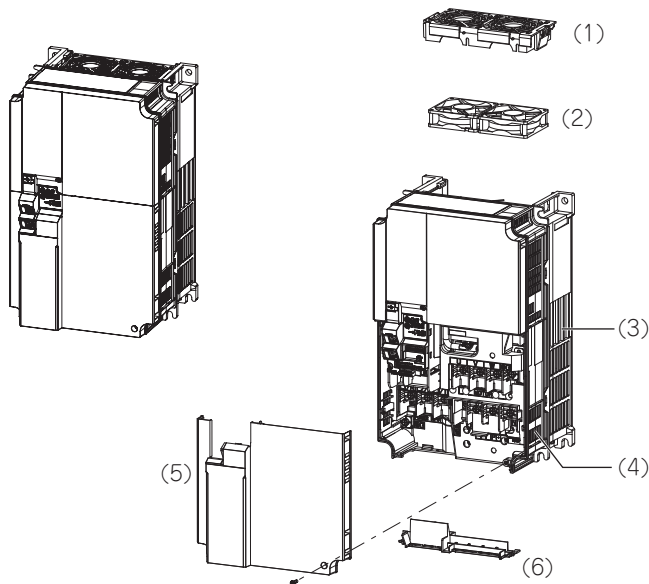
- (1) Cooling Fan Cover
- (2) Cooling Fan
- (3) Cooling Fin

- (4) Inverter Case
- (5) Surface cover (Terminal block cover)
- (6) Surface cover (Backing plate)

Three-phase 200 V, 11/15kW
 Three-phase 400V, 11/15kW



Three-phase 200 V, 18.5/22kW
 Three-phase 400V, 18.5/22kW



- (1) Cooling Fan Cover
- (2) Cooling Fan
- (3) Cooling Fin
- (4) Inverter Case
- (5) Surface cover (Terminal block cover)
- (6) Surface cover (Backing plate)

1-3 Specifications

1-3-1 Standard Specifications

Three-phase 200-V Class

HHD: Heavy load, HND: Light load

Item		Three-phase 200 V												
Model (3G3M1-A2□□□-ECT)		001	002	004	007	015	022	037	055	075	110	150	185	
Maximum applicable motor capacity*1	kW	HHD	0.1	0.2	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5
		HND	0.2	0.4	0.75	1.1	2.2	3*7	5.5*7	7.5	11	15	18.5	22
	HP	HHD	1/8	1/4	1/2	1	2	3	5	7 1/2	10	15	20	25
		HND	1/4	1/2	1	1 1/2	3	4	7 1/2	10	15	20	25	30
Rated output capacity [kVA]*2	200 V	HHD	0.3	0.6	1	1.7	2.8	3.8	6.1	8.7	11	16	21	26
		HND	0.5	0.7	1.2	2.1	3.3	4.2	6.8	10	14	19	24	30
	240 V	HHD	0.4	0.7	1.2	2.1	3.3	4.6	7.3	10	14	20	25	32
		HND	0.5	0.8	1.5	2.5	4.0	5.0	8.1	12	17	23	29	37
Rated input voltage*3		Three-phase 200 to 240 V, 50/60 Hz												
Rated input current [A]*4	HHD	1.1	1.8	3.1	5.3	9.5	13.2	22.2	31.5	42.7	60.7	80	97	
	HND	1.8	2.6	4.9	6.7	12.8	17.9	28.5	42.7	60.7	80	97	112	
Rated output voltage		Three-phase 200 to 240 V (with AVR)												
Rated output current [A]*5	HHD	1	1.6	3	5	8	11	17.5	25	33	47	60	76	
	HND	1.3	2	3.5	6	9.6	12*7	19.6*7	30	40	56	69	88	
Braking torque [%]*6	HHD	150		100		70	40		20					
	HND	75		53	68	48	29*7	27*7	15					
Braking resistor circuit	Regenerative braking	Built-in braking resistor circuit (discharge resistor separately mounted)												
	Minimum connection resistance [Ω]	100 to 120				40 to 120		33 to 120	20 min.	15 min.	10 min.	8.6 min.	4 min.	
Short circuit current rating [kA]		100												
Weight [kg]		Ap-prox. 0.5	Ap-prox. 0.5	Ap-prox. 0.7	Ap-prox. 0.9	Ap-prox. 1.4	Ap-prox. 1.4	Ap-prox. 1.7	Ap-prox. 3.8	Ap-prox. 3.9	Ap-prox. 5.3	Ap-prox. 5.4	Ap-prox. 11	

*1. The maximum applicable motor capacity is given for a standard four-phase motor. When selecting an inverter, select not just by kW but also ensure that the inverter rated output current is greater than the motor rated current.

*2. In calculating the rated capacity, the rated output voltage is assumed to be 200 V or 240 V.

*3. A voltage higher than the power supply voltage cannot be output.

- *4. When Carrier Frequency (3004Hex-1BHex) is set to the following or below, derating is required.
 HHD mode...A2001 to A2037: 8 kHz, A2055 to A2185: 10 kHz
 HND mode...A2001 to A2037: 4 kHz, A2055 to A2150: 10 kHz, A2185: 4 kHz
 For derating, refer to A-1 Derating Table on page A-2.
- *5. The following shows the calculated value when the power supply capacity is 500 kVA (10x the inverter capacity when the inverter capacity exceeds 50 kVA) and when a %X = 5% power supply is connected.
- *6. The numeric value is the average braking torque per individual motor. (Varies according to motor efficiency)
- *7. Allowable ambient temperature of 40°C or below of A2022 to A2037 in the HND mode.
 The rated output current in the HND mode decreases by 1% for every temperature increase of 1°C when the ambient temperature is 40°C or more.

Three-phase 400-V Class

HHD/HD: Heavy load, HND/ND: Light load

Item			Three-phase 400 V											
Model (3G3M1-A4□□□-ECT)			004	007	015	022	030	040	055	075	110	150	185	220
Maximum applicable motor capacity*1	kW	HD	0.75	1.1	2.2	3	4	5.5	7.5	11	15	18.5	22	30
		ND	0.75	1.5	2.2	3	4	5.5	11	15	18.5	22	30	37
		HHD	0.4	0.75	1.5	2.2	3	4	5.5	7.5	11	15	18.5	22
		HND	0.75	1.1	2.2	3*7	4	5.5*7	7.5	11	15	18.5	22	30
	HP	HD	1	1 1/2	3	4	5	7 1/2	10	15	20	25	30	40
		ND	1	1 1/2	3	4	5	7 1/2	15	20	25	30	40	50
		HHD	1/2	1	1 1/2	3	4	5	7 1/2	10	15	20	25	30
		HND	1	1 1/2	3	4	5	7 1/2	10	15	20	25	30	40
Rated output capacity [kVA]*2	380 V	HD	1.2	2.2	3.3	4.1	5.8	7.3	12	15	20	25	30	39
		ND	1.4	2.7	3.6	4.5	6.1	7.9	14	19	24	29	39	47
		HHD	1.2	2.2	3.2	3.6	4.7	6.1	9.7	12	16	20	26	30
		HND	1.4	2.7	3.6	4.5	5.8	7.3	12	15	20	25	30	39
	480 V	HD	1.5	2.8	4.2	5.2	7.3	9.2	15	19	26	32	37	50
		ND	1.7	3.4	4.6	5.7	7.6	10	18	24	31	37	49	60
		HHD	1.5	2.8	4	4.6	6	7.6	12.3	15	20	26	32	37
		HND	1.7	3.4	4.6	5.7	7.3	9.2	15	19	26	32	37	50
Rated input voltage*3			Three-phase 380 to 480V, 50/60 Hz											
Rated input current [A]*4	HD	2.7	3.9	7.3	11.3	14.2	16.8	23.2	33	43.8	52.3	60.6	77.9	
	ND	2.7	4.8	7.3	11.3	14.2	16.8	33	43.8	52.3	60.6	77.9	94.3	
	HHD	1.7	3.1	5.9	8.2	11.3	14.2	17.3	23.2	33	43.8	52.3	60.6	
	HND	2.7	3.9	7.3	11.3	14.2	16.8	23.2	33	43.8	52.3	60.6	77.9	
Rated output voltage			Three-phase 380 to 480V (with AVR)											
Rated output current [A]*5	HD	1.8	3.4	5	6.3	8.8	11.1	17.5	23	31	38	45	60	
	ND	2.1	4.1	5.5	6.9	9.2	12	21.5	28.5	37	44	59	72	
	HHD	1.8	3.4	4.8	5.5	7.2	9.2	14.8	18	24	31	39	45	
	HND	2.1	4.1	5.5	6.9*7	8.8	11.1*7	17.5	23	31	38	45	60	

Item		Three-phase 400 V											
Braking torque [%] ^{*6}	HD	53.3	68.2	47.7	29.3	29.3	26.9	15					
	ND	53.3	50.0	47.7	29.3	29.3	26.9	12					
	HHD	100		70	40	40	40	20					
	HND	53	68	48	29 ^{*7}	29	27 ^{*7}	15					
Braking resistor circuit	Regenerative braking	Built-in braking resistor circuit (discharge resistor separately mounted)											
	Minimum connection resistance [Ω]	200		160 to 200		130 to 200		80 min.	60 min.	40 min.	34.4 min.	16 min.	
Short circuit current rating [kA]		100											
Weight [kg]		Ap-prox. 1.2	Ap-prox. 1.4	Ap-prox. 1.5	Ap-prox. 1.4	Ap-prox. 1.8	Ap-prox. 1.8	Ap-prox. 3.7	Ap-prox. 3.8	Ap-prox. 5.3	Ap-prox. 5.4	Ap-prox. 11	Ap-prox. 11

- *1. The maximum applicable motor capacity is given for a standard four-phase motor. When selecting an inverter, select not just by kW but also ensure that the inverter rated output current is greater than the motor rated current.
- *2. In calculating the rated capacity, the rated output voltage is assumed to be 380 V or 480 V.
- *3. A voltage higher than the power supply voltage cannot be output.
- *4. When Carrier Frequency (3004Hex-1BHex) is set to the following or below, derating is required.
 HHD mode...A4004 to A4040: 8 kHz, A4055 to A4220: 10 kHz
 HND mode...A4004 to A4040: 8 kHz, A4055 to A4185: 10 kHz, A4220: 6 kHz
 HD and ND modes...All models: 4 kHz
 For derating, refer to A-1 Derating Table on page A-2.
- *5. The following shows the calculated value when the power supply capacity is 500 kVA (10x the inverter capacity when the inverter capacity exceeds 50 kVA) and when a %X = 5% power supply is connected.
- *6. The numeric value is the average braking torque per individual motor. (Varies according to motor efficiency)
- *7. Allowable ambient temperature of 40°C or below of A4022 to A4040 in the HND mode.
 The rated output current of A4022 and A4040 in the HND mode decreases by 1% for every temperature increase of 1°C when the ambient temperature is 40°C or more.

Single-phase 200-V Class

HHD: Heavy load, HND: Light load

Item		Single-phase 200 V							
Model (3G3M1-AB□□□-ECT)		001	002	004	007	015	022	037	
Maximum applicable motor capacity ^{*1}	kW	HHD	0.1	0.2	0.4	0.75	1.5	2.2	3.7
		HND	0.2	0.4	0.55	1.1	2 ^{*8}	2.7 ^{*9}	-
	HP	HHD	1/8	1/4	1/2	1	2	3	5
		HND	1/4	1/2	3/4	1 1/2	3	4	-
Rated output capacity [kVA] ^{*2}	200 V	HHD	0.3	0.6	1	1.7	2.8	3.8	6.1
		HND	0.4	0.7	1.2	2.1	3.3	4.2	-
	240V	HHD	0.4	0.7	1.2	2.1	3.3	4.6	7.3
		HND	0.5	0.8	1.5	2.5	4	5	-

Item		Single-phase 200 V						
Rated input voltage ^{*3}		Single-phase 200 to 240 V, 50/60 Hz						
Rated input current [A] ^{*4}	HHD	1.8	3.3	5.4	9.7	16.4	22	45.4
	HND	3.3	4.9	7.3	13.8	20.2	26	-
Rated output voltage		Single-phase 200 to 240 V (with AVR)						
Rated output current [A] ^{*5}	HHD	1	1.6	3	5	8	11	17.5
	HND	1.2	1.9	3.5 ^{*7}	6.0 ^{*7}	9.6 ^{*7}	12 ^{*7}	-
Braking torque [%] ^{*6}	HHD	150		100		70	40	40
	HND	75		73	68	48	29	-
Braking resistor circuit	Regenerative braking	Built-in braking resistor circuit (discharge resistor separately mounted)						
	Minimum connection resistance [Ω]	100 to 120				40 to 120		
Short circuit current rating [kA]		100						
Weight [kg]		Approx. 0.5	Approx. 0.5	Approx. 0.7	Approx. 0.9	Approx. 1.5	Approx. 1.7	Approx. 3.8

- *1. The maximum applicable motor capacity is given for a standard four-phase motor. When selecting an inverter, select not just by kW but also ensure that the inverter rated output current is greater than the motor rated current.
- *2. In calculating the rated capacity, the rated output voltage is assumed to be 200 V or 240 V.
- *3. A voltage higher than the power supply voltage cannot be output.
- *4. When Carrier Frequency (3004Hex-1BHex) is set to the following or below, derating is required.
HHD mode...AB001 to A2037: 8 kHz
HND mode...AB001 to A2022: 4 kHz
For derating, refer to A-1 Derating Table on page A-2.
- *5. The following shows the calculated value when the power supply capacity is 500 kVA (10x the inverter capacity when the inverter capacity exceeds 50 kVA) and when a %X = 5% power supply is connected.
- *6. The numeric value is the average braking torque per individual motor. (Varies according to motor efficiency)
- *7. Allowable ambient temperature of 40°C or below of AB004, AB007, AB015 and AB022.
The rated output current in the HND mode decreases by 2% for every temperature increase of 1°C when the ambient temperature is 40°C or more.
- *8. The maximum applicable motor capacity is 2.2 kW when the input voltage is 220 to 240 V.
- *9. The maximum applicable motor capacity is 3.0 kW when the input voltage is 220 to 240 V.

Common Specifications

Item	Specifications
Enclosure rating ^{*1}	Open type (IP20)

Item		Specifications
Control	Control Method	Phase-to-phase sinusoidal modulation PWM
	Output frequency range*2	5.00 to 590 Hz
	Frequency precision	Digital command: $\pm 0.01\%$ of the maximum frequency, Analog command: $\pm 0.2\%$ of the maximum frequency ($25\pm 10^\circ\text{C}$)
	Frequency setting resolution	Digital setting: 0.01 Hz, Analog setting: Maximum frequency $\times 5/10,000$
	Overload current rating of inverter	Heavy load rating (HHD): 150%/60 s or 200%/0.5 s Heavy load rating (HD): 150%/60 s Light load rating (HND/ND): 120%/60 s
	Instantaneous overcurrent protection	<ul style="list-style-type: none"> Digital setting: 0.01 Hz (99.99 Hz max.), 0.1 Hz (100.0 to 590.0 Hz) Analog setting: Maximum frequency $\times 5/10,000$ Communication setting: 0.005% of the maximum output frequency or 0.01 Hz (fixed)
	Acceleration/Deceleration time	0.00 to 6000 s (line/curve arbitrary setting), 2nd acceleration/deceleration setting provided
	Carrier frequency change range	<p>Three-phase 400-V class</p> <ul style="list-style-type: none"> 3G3M1-A4004 to A4185-ECT 0.75 to 16 kHz (HHD/HND/HD) 0.75 to 10 kHz (ND) 3G3M1-A4220-ECT 0.75 to 16 kHz (HHD) 0.75 to 10 kHz (HND/HD) 0.75 to 6kHz (ND) <p>Three-phase 200-V class</p> <ul style="list-style-type: none"> 3G3M1-A2001 to A2015-ECT, A2055 to A2185-ECT 0.75 to 16 kHz (HHD/HND) 3G3M1-A2022/A2037-ECT 0.75 to 16 kHz (HHD) 0.75 to 10 kHz (HND) <p>Single-phase 200-V class</p> <ul style="list-style-type: none"> 3G3M1-AB001 to AB022-ECT 0.75 to 16 kHz (HHD) 0.75 to 10 kHz (HND) 3G3M1-AB037-ECT 0.75 to 16 kHz (HHD) <p>The carrier frequency automatically drops according to the ambient temperature and output current. (This function can be disabled.)</p>

Item		Specifications
Control	Starting torque	<ul style="list-style-type: none"> 150% min. / Rated speed of 10% V/f control (IM motor) V/f control (slip compensation) V/f control with speed sensor (IM motor) 200% min./0.5 Hz Vector control without speed sensor (dynamic vector control) (IM motor) V/f control with speed feedback (Automatic torque boost) Sensorless vector control 200% min./0.0 Hz (0 Hz torque control) Vector control with speed sensor (IM motor) Vector control with speed and pole position sensor (PM motor) To obtain 200% starting torque at low speed, consider raising the capacity of the inverter to the next higher capacity. 200% min. / Rated speed of 10% Vector control without speed and pole position sensor (PM motor) To obtain these starting torques at low speed, the capacity of the inverter and motor must be taken into consideration. <p>The maximum torque that can be used is limited when the current capacity matched to the mode is exceeded. Current capacity of 200% in HHD mode, 150% in HD mode, and 120% in HND and ND modes</p>
	Protection function	Overcurrent, Overvoltage, Undervoltage, Electronic thermal, Temperature error, Ground-fault current at power-on, Inrush current protection circuit, Overload limit, Incoming overvoltage, External trip, Memory error, CPU error, USP error, Communication error, Overvoltage suppression during deceleration, Power interruption protection, Forced Stop, etc.
Input signal	Frequency setting	External analog input signal: Variable resistor/0 to 10 VDC
	RUN/STOP command	External digital input signal (3-wire input available)
	Multi-function Input*3	Seven points (DI1 to DI7, Functions can be selected from among 101)
	Analog input*4	One point (voltage AI1 terminal: 10 bits/-10 to 10 VDC)
	Pulse input	One point (A, B, Z phases can be input, max. 32 kHz, 5 to 24 VDC)
Output signal	Multi-function output*3	One point (DO1; Functions can be selected from among 92)
	Relay output*3	One point (SPDT contact (ROA, ROB, ROC), Functions can be selected from among 92)
Communications	USB	USB 2.0, Micro-B connector
	Other functions	AVR function, V/f characteristics switching, Upper/Lower limit, Multi-step speed (16 steps), Starting frequency adjustment, Jogging operation, Carrier frequency adjustment, PID control, Frequency jump, Analog gain/bias adjustment, S-shape acceleration/deceleration, Electronic thermal characteristics/ level adjustment, Restart function, Torque boost function, Fault monitor, Frequency conversion display, USP function, 2nd control function, UP/DOWN, Overcurrent suppression function, etc.

Item		Specifications											
General specifications	Operating ambient temperature* ⁵	-10 to 50°C (Derating required)											
	Storage ambient temperature	-25 to 70°C (Short-time temperature during shipment)											
	Operating ambient humidity	5% to 95% (with no condensation)											
	Vibration resistance	<table border="1"> <thead> <tr> <th>Vibration Frequency</th> <th>Specification</th> </tr> </thead> <tbody> <tr> <td>2 to less than 9Hz</td> <td>3mm (0.12inch) (Max. amplitude)</td> </tr> <tr> <td>9 to less than 20Hz</td> <td>1G</td> </tr> <tr> <td>20 to less than 55Hz</td> <td>0.2G</td> </tr> <tr> <td>55 to less than 200Hz</td> <td>0.1G</td> </tr> </tbody> </table>		Vibration Frequency	Specification	2 to less than 9Hz	3mm (0.12inch) (Max. amplitude)	9 to less than 20Hz	1G	20 to less than 55Hz	0.2G	55 to less than 200Hz	0.1G
		Vibration Frequency	Specification										
2 to less than 9Hz		3mm (0.12inch) (Max. amplitude)											
9 to less than 20Hz		1G											
20 to less than 55Hz	0.2G												
55 to less than 200Hz	0.1G												
Location	At a maximum altitude of 1,000 m, indoors (without corrosive gases or dust)												

- *1. The enclosure rating complies with JISC0920.
- *2. If you must use the motor at higher than 50/60 Hz, check the allowable maximum motor speed and other information with the motor manufacturer.
- *3. In the HND/ND (light load) mode or PM motor mode compared with the HHD/HD (heavy load) mode, for some parameters, the default data and setting range also differ. For details, refer to *6-2-2 Load Mode Selection* on page 6-10.
- *4. By default, the maximum frequency is adjusted to 10 V for a voltage input of 0 to 10 VDC. If necessary, adjust the default parameter settings. For details, refer to *8-3-2 Analog Input Adjustment Function* on page 8-34.
- *5. Derating of the rated output current of the inverter may be required depending on the heavy/light load mode selection, operating ambient temperature, side-by-side installation, and carrier frequency settings. Use the inverter in an appropriate environment according to *A-7 Derating Table* on page A-287.

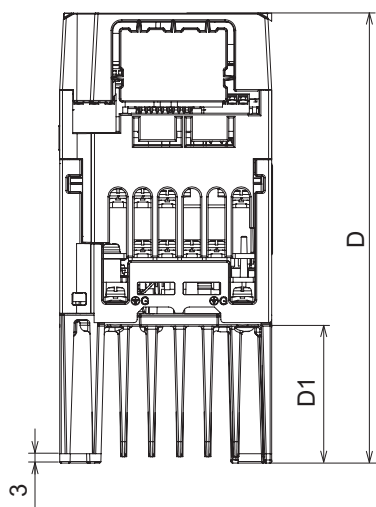
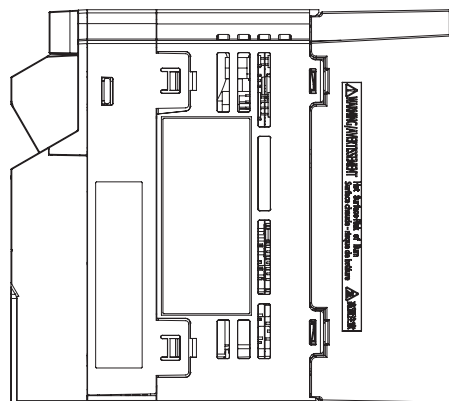
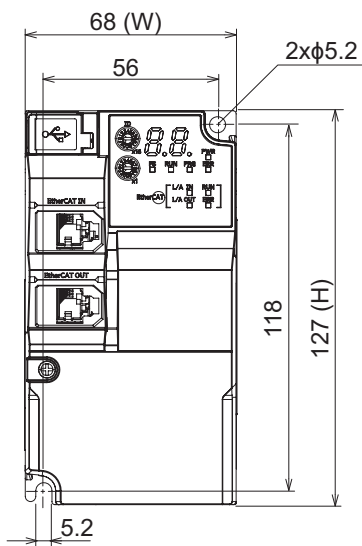
1-3-2 EtherCAT Communication Specifications

Item	Specifications
Physical layer	100BASE-TX (IEEE802.3)
Connector	RJ45 × 2 (shielded type)
	ECAT IN: EtherCAT input ECAT OUT: EtherCAT output
Communications media	Category 5 or higher (cable with double, aluminum tape and braided shielding) is recommended.
Communications distance	Distance between nodes: 100 m max.
Process data	Fixed PDO mapping User PDO mapping
Mailbox (CoE)	Emergency messages, SDO requests, and SDO responses
Synchronization mode	FreeRun mode* ¹
LED display	L/A IN (Link/Activity IN) × 1 L/A OUT (Link/Activity OUT) × 1 RUN × 1 ERR × 1
CiA402 drive profile	Velocity mode

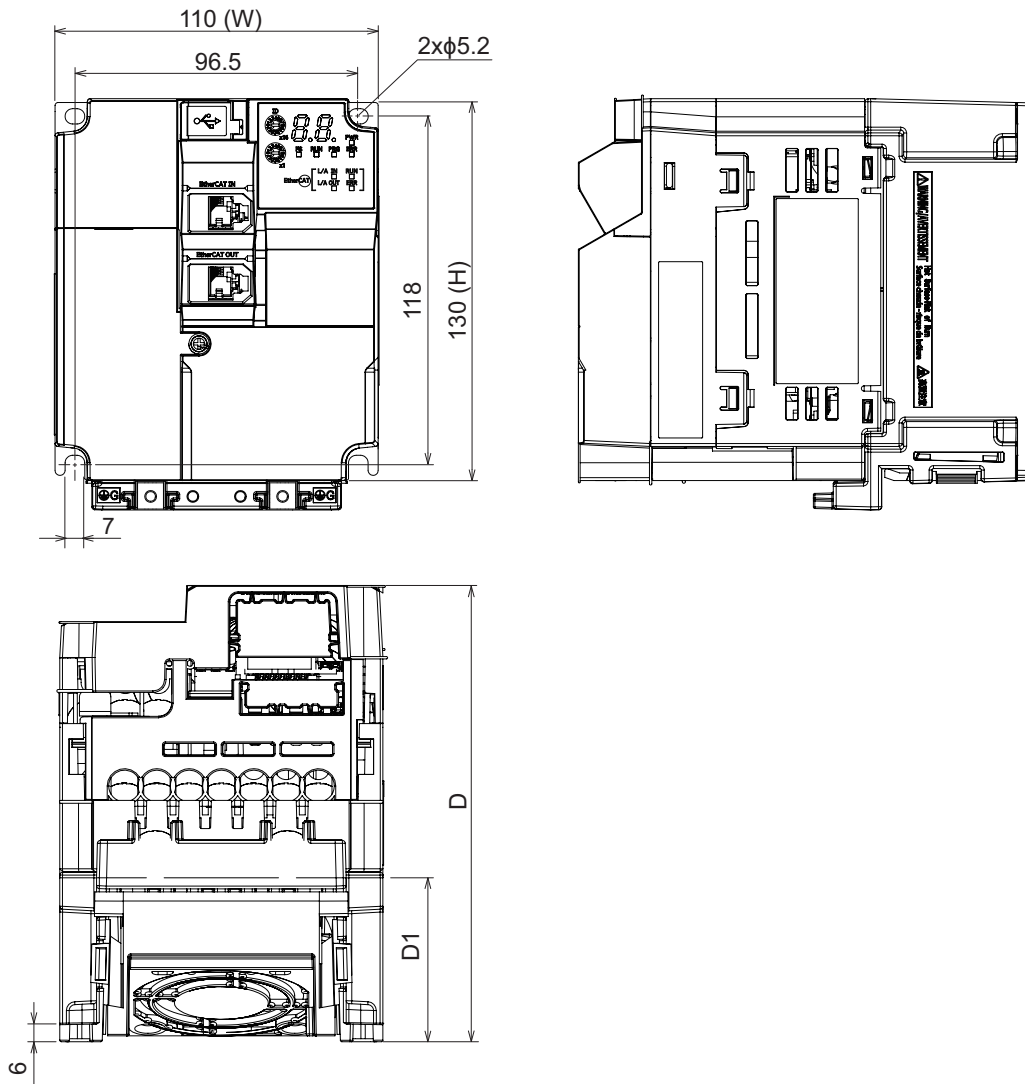
- *1. In FreeRun mode, slaves perform I/O processing, i.e., refresh I/O data asynchronously with the communications cycle of the master. The communications cycle is determined by the cycle time of the master. For the communications response time of the EtherCAT Communication Unit, refer to *A-6 Communications Response Time* on page A-286.

Note that FreeRun mode in the synchronization mode has a different meaning from free-run stop of an Inverter.

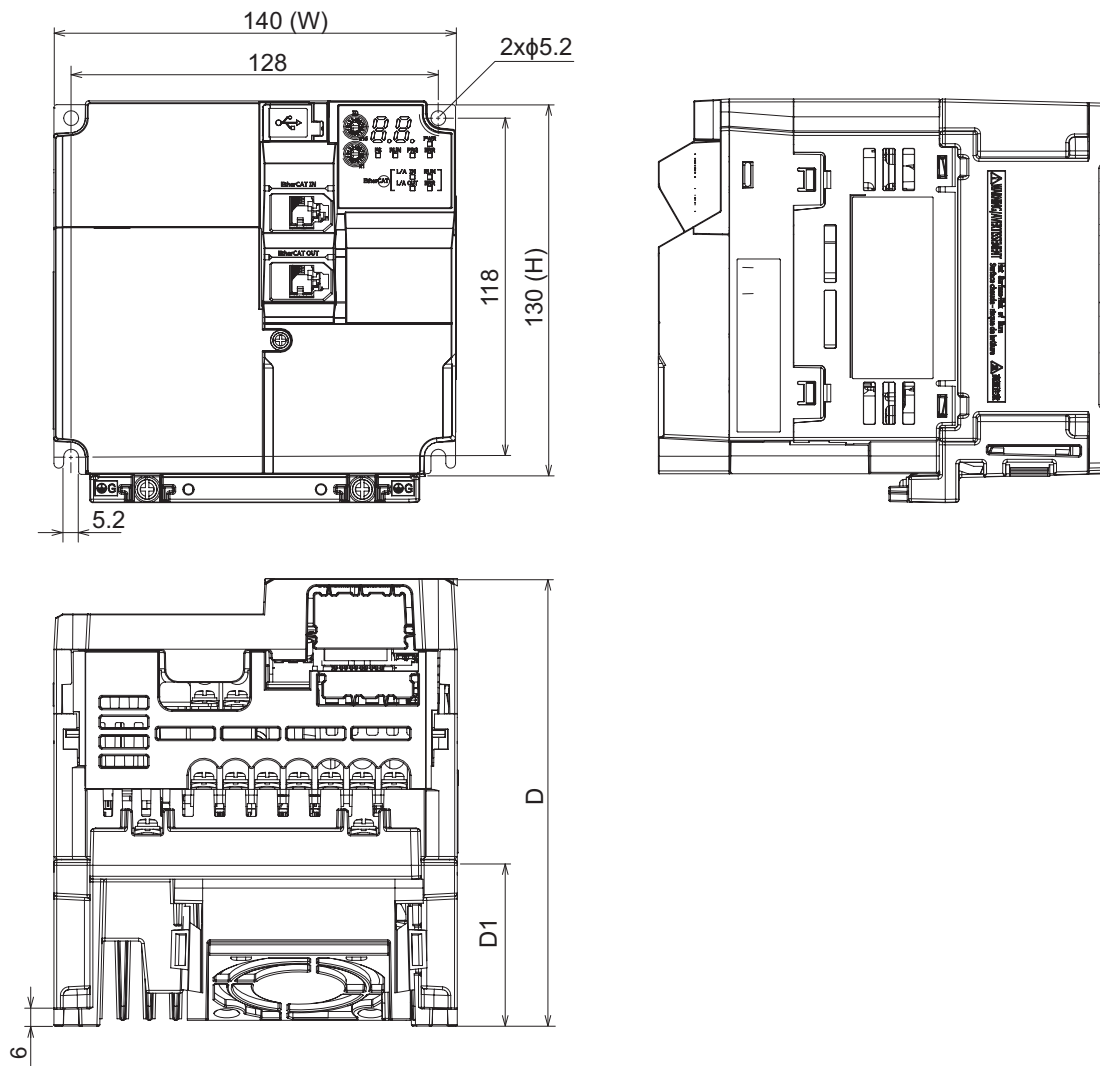
1-3-3 External Dimensions



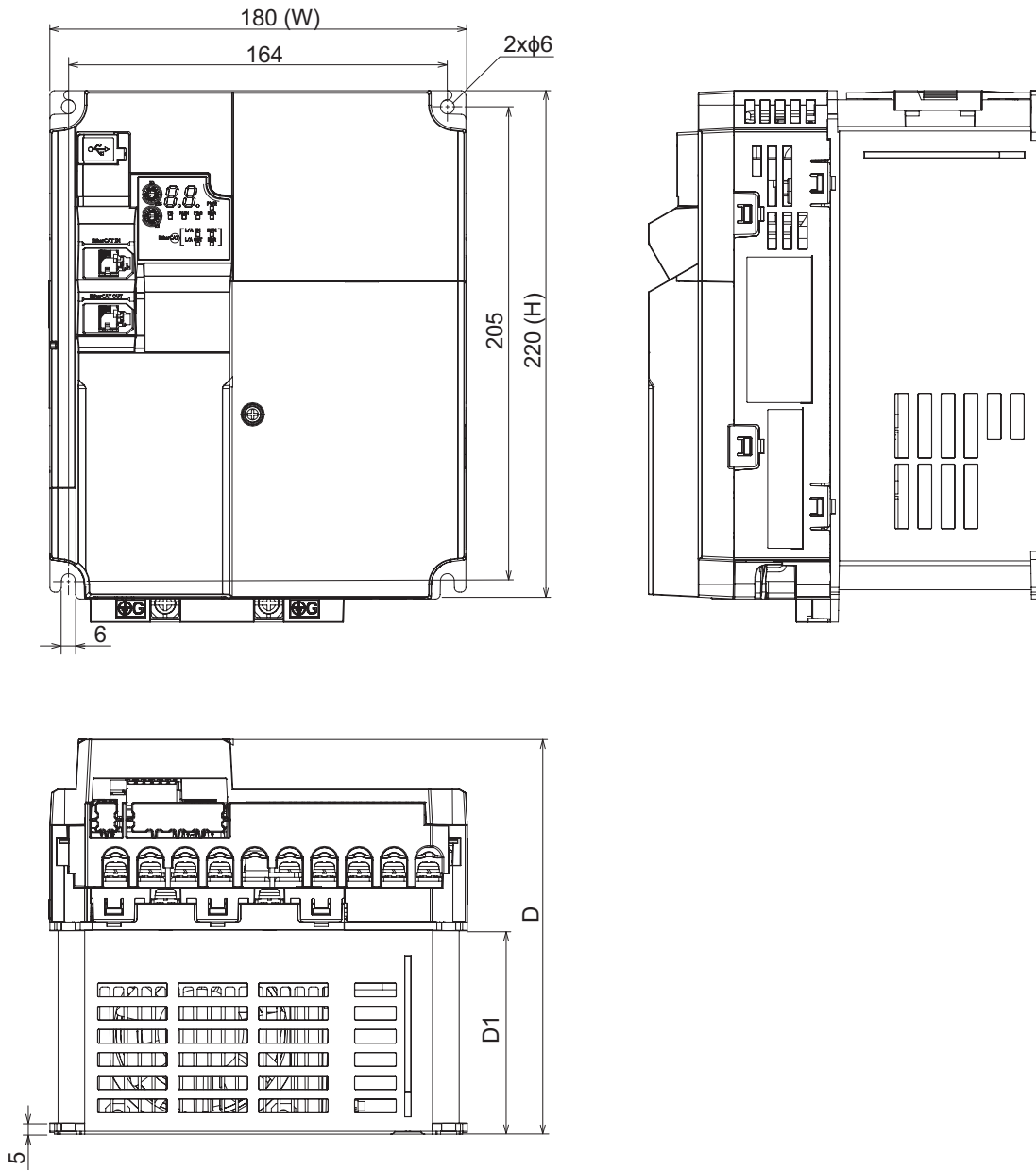
Power supply	Model	W [mm]	H [mm]	D [mm]	D1 [mm]
Single-phase 200 V	3G3M1-AB001-ECT	68	127	98	8
	3G3M1-AB002-ECT			120	23
	3G3M1-AB004-ECT				
	3G3M1-AB007-ECT			165	48
Three-phase 200 V	3G3M1-A2001-ECT	68	127	98	8
	3G3M1-A2002-ECT			113	23
	3G3M1-A2004-ECT				
	3G3M1-A2007-ECT			145	48



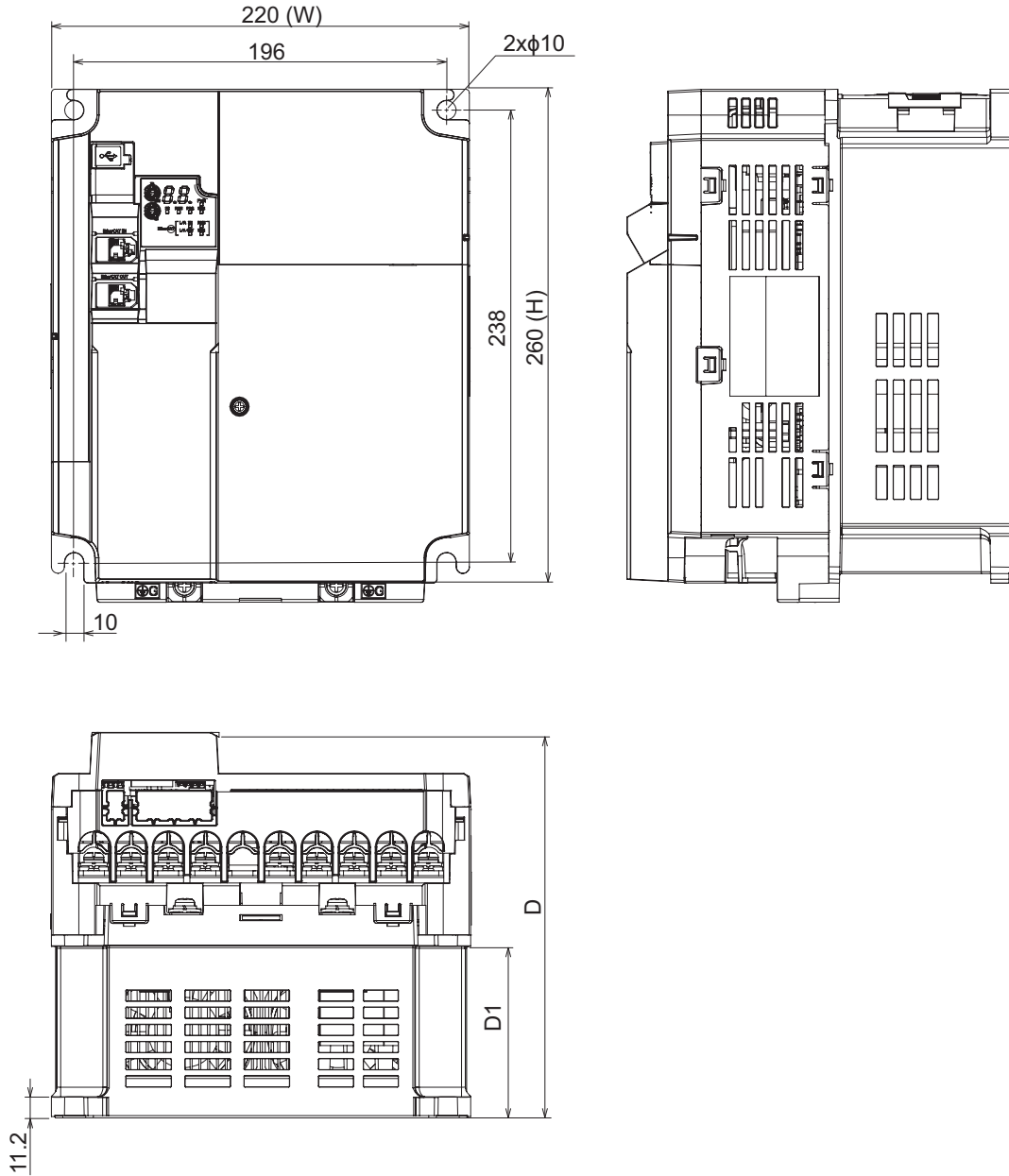
Power supply	Model	W [mm]	H [mm]	D [mm]	D1 [mm]
Single-phase 200 V	3G3M1-AB015-ECT	110	130	166	58
Three-phase 200 V	3G3M1-A2015-ECT 3G3M1-A2022-ECT			156	
Three-phase 400 V	3G3M1-A4004-ECT			132	38
	3G3M1-A4007-ECT 3G3M1-A4015-ECT 3G3M1-A4022-ECT	156	58		



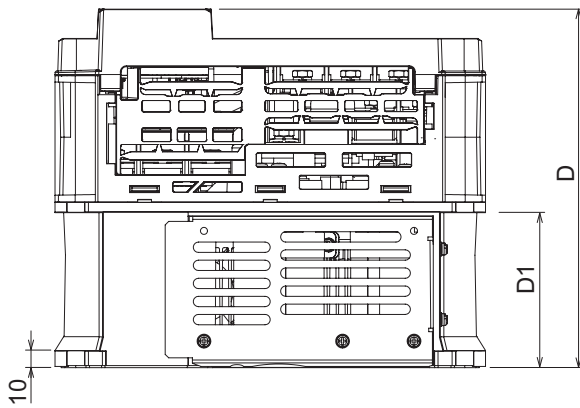
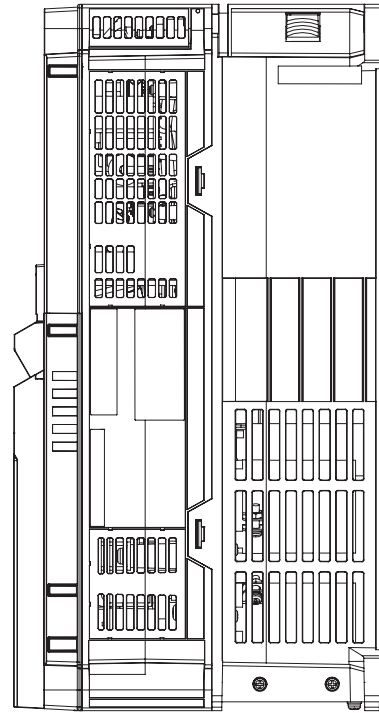
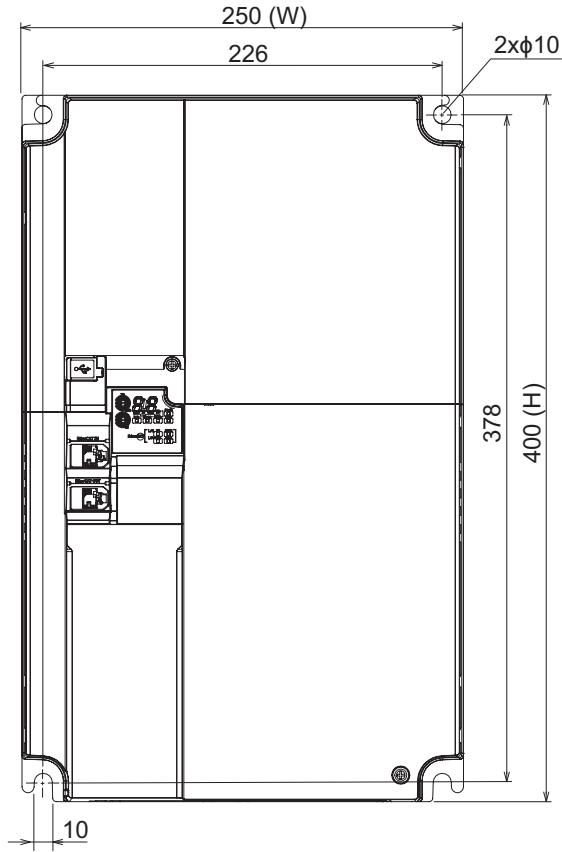
Power supply	Model	W [mm]	H [mm]	D [mm]	D1 [mm]
Single-phase 200 V	3G3M1-AB022-ECT	140	130	156	58
Three-phase 200 V	3G3M1-A2037-ECT				
Three-phase 400 V	3G3M1-A4030-ECT 3G3M1-A4040-ECT				



Power supply	Model	W [mm]	H [mm]	D [mm]	D1 [mm]
Single-phase 200 V	3G3M1-AB037-ECT	180	220	171	87.7
Three-phase 200 V	3G3M1-A2055-ECT 3G3M1-A2075-ECT				
Three-phase 400 V	3G3M1-A4055-ECT 3G3M1-A4075-ECT				



Power supply	Model	W [mm]	H [mm]	D [mm]	D1 [mm]
Three-phase 200 V	3G3M1-A2110-ECT	220	260	203	90
	3G3M1-A2150-ECT				
Three-phase 400 V	3G3M1-A4110-ECT	220	260	203	90
	3G3M1-A4150-ECT				



Power supply	Model	W [mm]	H [mm]	D [mm]	D1 [mm]
Three-phase 200 V	3G3M1-A2185-ECT	250	400	208	90
Three-phase 400 V	3G3M1-A4185-ECT 3G3M1-A4220-ECT				

1-4 Restrictions

Availability of Functions by Individual Control Method

Available functions are restricted depending on the selected control method.

“15:PM Vector control without speed and pole position sensor” and “16:PM Vector control with speed and pole position sensor” can be set to only 1st motor control.

Function name	1st Drive Control Selection (3004Hex-2BHex)/ 2nd Drive Control Selection (3009Hex-0FHex)							
	0: IM V/f control	1: IM Dynamic torque vector control	3: IM V/f control with speed sensor	4: IM Dynamic torque vector control with speed sensor	5: IM Vector control without speed sensor	6: IM Vector control with speed sensor	15: PM Vector control without speed and pole position sensor	16: PM Vector control with speed and pole position sensor
Torque boost manual adjustment	Available	N/A	Available	Available	N/A	N/A	N/A	N/A
Invalidation of automatic voltage control (AVR)	Available	N/A	Available	Available	N/A	N/A	N/A	N/A
Energy-saving operation mode	Available	Available	Available	Available	N/A	Available	N/A	N/A
Motor sound (Tone)	N/A	N/A	N/A	N/A	Available	Available	Available	Available
Invalidation of slip compensation	Available	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Direct current braking	Available	Available	Available	Available	Available	Available	N/A	N/A
Startup DC injection braking	Available	Available	Available	Available	N/A	N/A	N/A	N/A
Starting with active matching frequency	Available	Available	N/A	N/A	Available	N/A	N/A	N/A
Current limiter, instantaneous overcurrent limiting	Available	Available	Available	Available	N/A	N/A	N/A	N/A
Torque limit	Available	Available	Available	Available	Available	Available	Available	Available
Torque control	N/A	N/A	N/A	N/A	Available	Available	N/A	Available
Torque bias	N/A	N/A	N/A	N/A	Available	Available	Available	Available
Automatic speed control (ASR), Notch filter	N/A	N/A	N/A	N/A	Available	Available	Available	Available
Zero speed control	N/A	N/A	N/A	N/A	Available	Available	N/A	Available

Function name	1st Drive Control Selection (3004Hex-2BHex)/ 2nd Drive Control Selection (3009Hex-0FHex)							
	0: IM V/f control	1: IM Dynamic torque vector control	3: IM V/f control with speed sensor	4: IM Dynamic torque vector control with speed sensor	5: IM Vector control without speed sensor	6: IM Vector control with speed sensor	15: PM Vector control without speed and pole position sensor	16: PM Vector control with speed and pole position sensor
Servo Lock	N/A	N/A	N/A	N/A	N/A	Available	N/A	Available
Deceleration characteristics (heavy brake)	Available	Available	Available	Available	N/A	Available	N/A	N/A
Pre-excitation	N/A	N/A	N/A	N/A	Available	Available	N/A	N/A
Overload stop (contact stop)	Available	Available	Available	Available	N/A	N/A	N/A	N/A
Second control switch	Available	Available	Available	Available	Available	Available	N/A	N/A
Brake control	Available	Available	Available	Available	Available	Available	N/A	Available

Carrier Frequency Setting and Derating of Rated Output Current

Derating of the rated output current of the inverter may be required when a high carrier frequency is set, depending on the heavy/light load mode selection and operating temperature.

Use the inverter in an appropriate environment according to *A-7 Derating Table* on page A-287.

2

Design

This section describes the installation environment and wiring methods.

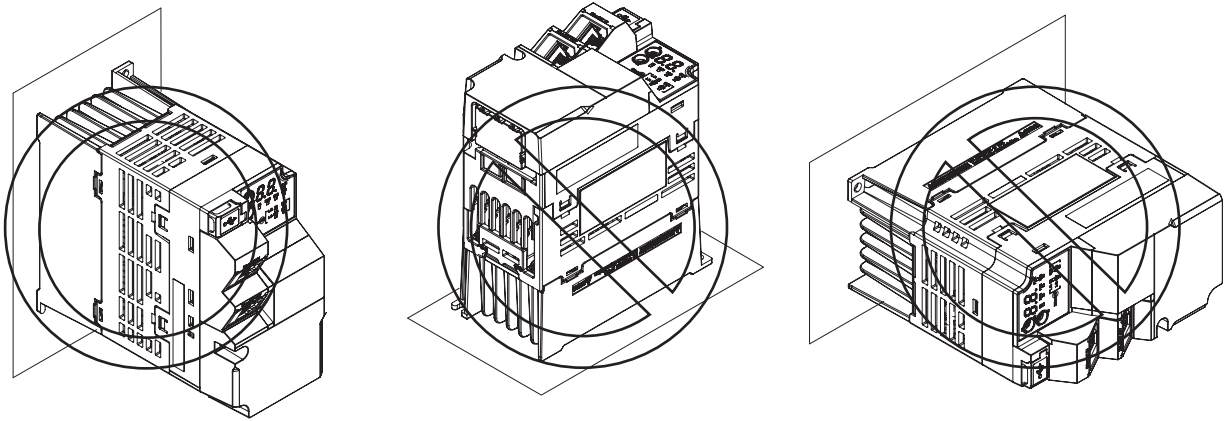
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2-1 Installation

2-1-1 Inverter Installation

Mount the 3G3M1 Series Inverter vertically on a wall with the product's longer sides upright so the model can be read correctly.

The material of the wall must be inflammable and capable of bearing weight such as a metal plate.



For the mounting dimensions, refer to 1-3-3 *External Dimensions* on page 1-17.

2-1-2 Installation Environment

Operating Environment Conditions

Install the inverter in a location that meets the following conditions.

Operating ambient temperature	Operating ambient humidity
-10 to 50°C	5% to 95% (with no condensation)

- Measure and check the ambient temperature at a point approx. 1 cm away from the center bottom of the inverter.
- For side-by-side installation, derating of the rated output current of the inverter may be required even at an ambient temperature of 40°C or lower.
- The inverter life (in particular, capacitor life) will be significantly shortened if the inverter is used at a higher ambient temperature.
- Do not install the inverter in hot and humid locations subject to condensation.
- Avoid installing the inverter in a dirty environment subject to oil mist, dust, or other airborne particles. Install the inverter in a clean place, or in a full-enclosure type panel.
- Take measures during installation and operation to prevent foreign objects such as metal particles, oil, and water from entering the inverter.
- Do not install the inverter in locations subject to direct sunlight.
- Do not install the inverter in locations subject to corrosive or flammable gases.

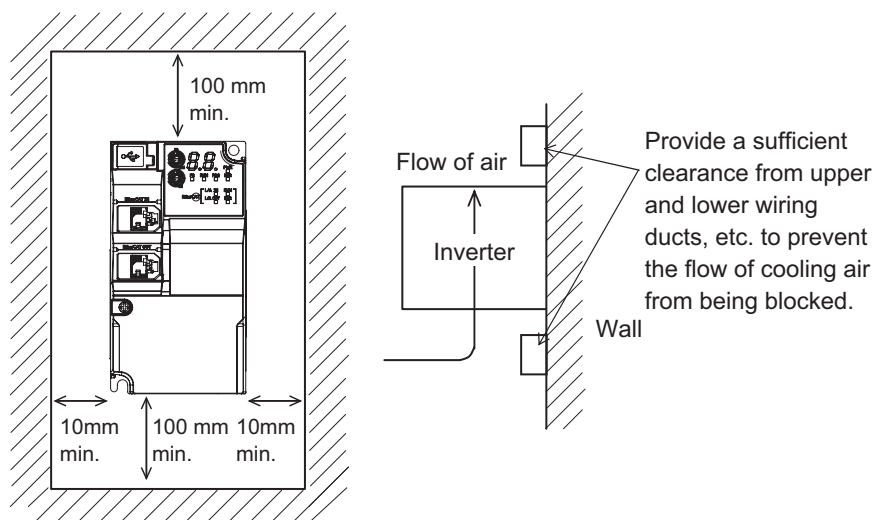
Installation Conditions

Keep the inverter clear of heating elements such as a braking resistor or reactor.

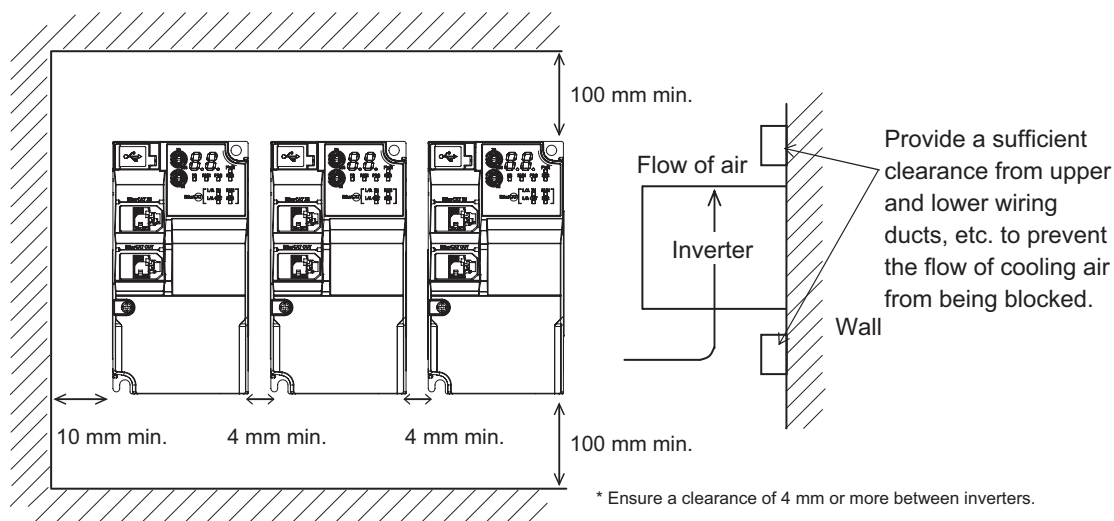
If the inverter is installed in a control panel, take into consideration dimensions and ventilation to keep the ambient temperature within the range of the specifications.

To allow heat dispersion from inside the inverter (approx. 150°C or lower), provide the clearance specified in the figure below during installation.

● Standard installation



● Side-by-side installation

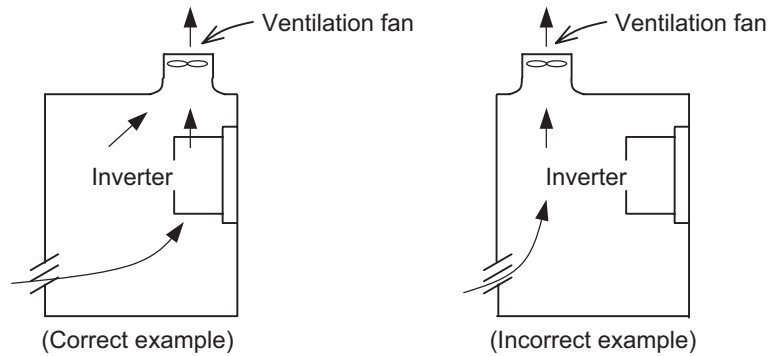


Ambient Temperature Control

To ensure reliable operation, use the inverter in an environment subject to minimal temperature rise as much as possible.

If you install a ventilation fan in a control panel where several inverters are installed, be careful about the layout of the inverters and the air intake and ventilation apertures.

Remember that poor air circulation around inverters causes an internal temperature rise, which may inversely affect the internal components of the inverters.



Entry of Foreign Objects during Installation

Place a cover over the inverter or take other preventative measures to prevent foreign objects, such as drill filings, from entering the inverter during installation.

Be sure to remove the cover after installation is complete. Using the inverter with the cover placed results in poor ventilation, which causes the inverter to overheat.

Heat generation by individual inverter model

The following table shows heat generation by individual inverter model for the calculation of heat radiation from a cabinet. Inverter heat generation also changes as the rated current changes according to the load mode.

Unit: W

Power system	Inverter type	Standby power	Carrier frequency (Parameter No.F26 (Object 3004Hex-1BHex) ^{*1})					
			ND	HD	HND		HHD	
			Factory shipment value	Factory shipment value	Factory shipment value	Maximum set value	Factory shipment value	Maximum set value
Three-phase 200 V	3G3M1-A2001-ECT	13	-	-	19	22	17	20
	3G3M1-A2002-ECT	13	-	-	29	34	23	27
	3G3M1-A2004-ECT	13	-	-	47	51	35	39
	3G3M1-A2007-ECT	13	-	-	66	71	54	58
	3G3M1-A2015-ECT	17	-	-	94	115	74	95
	3G3M1-A2022-ECT	17	-	-	115	145	98	125
	3G3M1-A2037-ECT	17	-	-	210	285	165	230
	3G3M1-A2055-ECT	31	-	-	280	360	170	230

Power system	Inverter type	Standby power	Carrier frequency (Parameter No.F26 (Object 3004Hex-1BHex))*1					
			ND	HD	HND		HHD	
			Factory shipment value	Factory shipment value	Factory shipment value	Maximum set value	Factory shipment value	Maximum set value
Three-phase 200 V	3G3M1-A2075-ECT	31	-	-	440	540	280	360
	3G3M1-A2110-ECT	34	-	-	520	700	440	540
	3G3M1-A2150-ECT	31	-	-	640	810	520	700
	3G3M1-A2185-ECT	38	-	-	770	970	660	860
Three-phase 400 V	3G3M1-A4004-ECT	14	33	32	33	58	32	56
	3G3M1-A4007-ECT	14	57	50	57	110	50	93
	3G3M1-A4015-ECT	17	73	69	73	140	67	120
	3G3M1-A4022-ECT	17	98	95	98	180	79	145
	3G3M1-A4030-ECT	17	120	120	120	230	100	190
	3G3M1-A4040-ECT	17	155	150	150	265	130	240
	3G3M1-A4055-ECT	31	260	190	190	370	170	320
	3G3M1-A4075-ECT	31	380	290	290	510	220	390
	3G3M1-A4110-ECT	31	460	390	390	630	300	490
	3G3M1-A4150-ECT	31	470	410	410	750	340	600
	3G3M1-A4185-ECT	31	710	510	510	870	440	770
	3G3M1-A4220-ECT	31	900	710	710	1000	510	900

Power system	Inverter type	Standby power	Carrier frequency (Parameter No.F26 (Object 3004Hex-1BHex))*1					
			ND	HD	HND		HHD	
			Factory shipment value	Factory shipment value	Factory shipment value	Maximum set value	Factory shipment value	Maximum set value
Single-phase 200 V	3G3M1-AB001-ECT	13	-	-	19	21	17	20
	3G3M1-AB002-ECT	13	-	-	29	31	23	27
	3G3M1-AB004-ECT	13	-	-	47	50	36	40
	3G3M1-AB007-ECT	13	-	-	66	69	55	59
	3G3M1-AB015-ECT	17	-	-	94	110	78	100
	3G3M1-AB022-ECT	17	-	-	115	140	100	130
	3G3M1-AB037-ECT	31	-	-	-	-	165	230

- *1. The inverter generating loss at rated output current.
The maximum set value (max. carrier) differs depending on specification.

2-2 Removal of Each Part

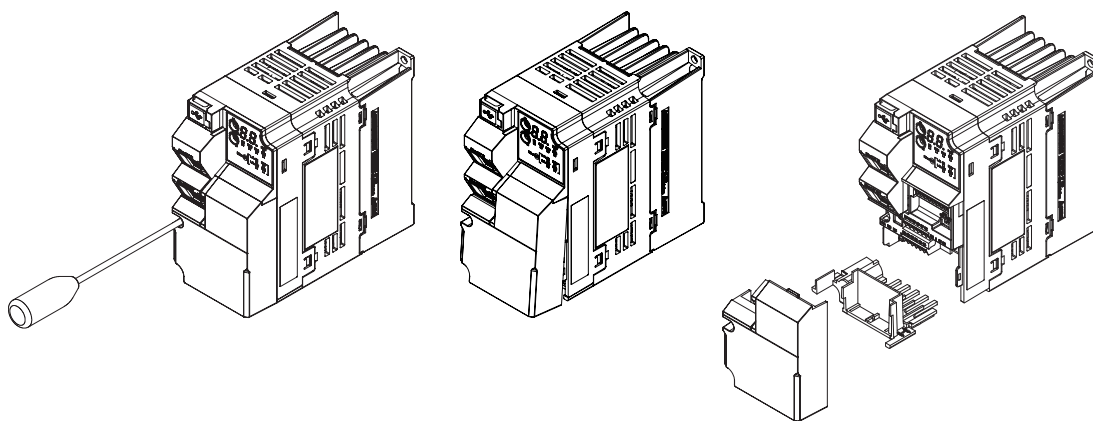
2-2-1 Removing Covers

Before wiring each terminal block, you need to remove the surface cover (terminal block cover and the backing plate).

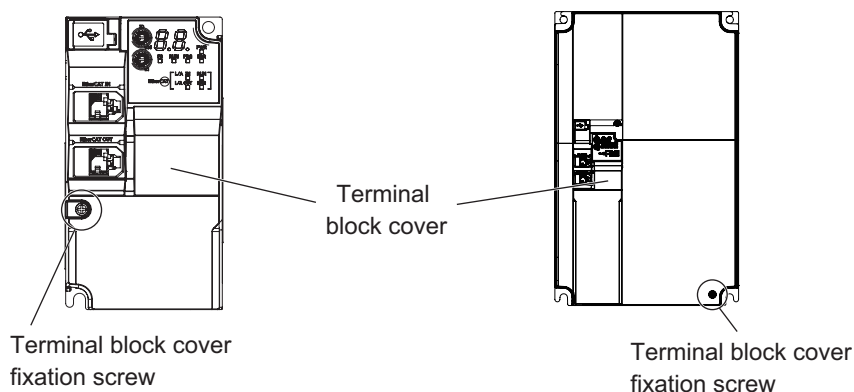
This section describes how to remove these covers.

Removing Terminal Block Cover

- 1 Loosen the terminal block cover fixation screw(s).
- 2 Remove the terminal block cover from the bottom.



You can find one terminal block cover fixation screw at left center for inverters with a capacity of 0.75 kW or lower, center for inverters with a capacity of 1.5 to 15 kW, and bottom right for inverters with a capacity of 18.5 kW or higher.



Installing Terminal Block Cover

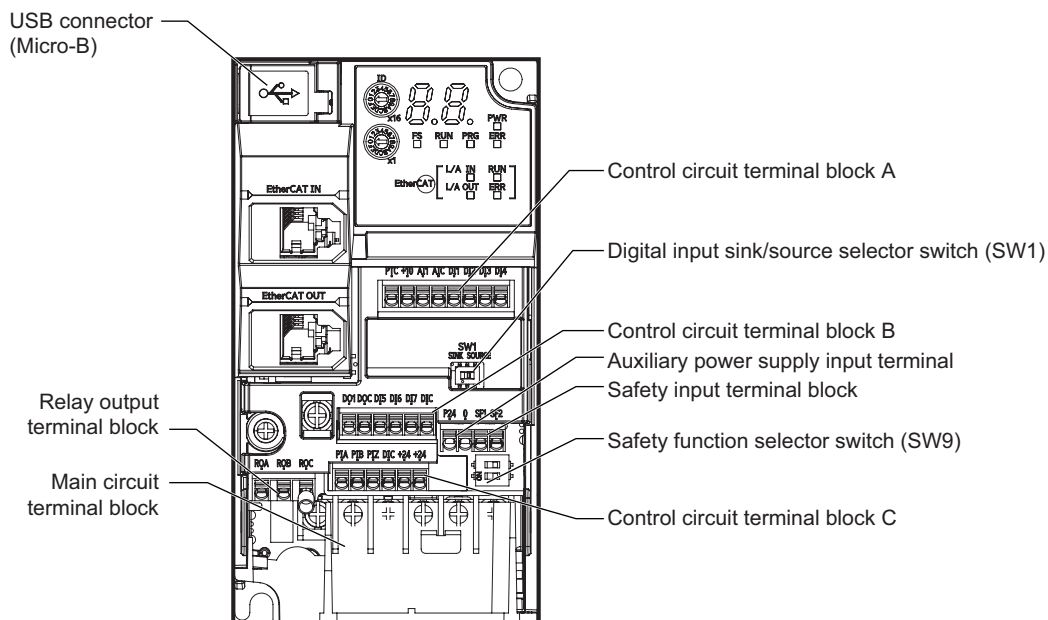
To install the terminal block cover, reverse the removal procedure.

Install the terminal block cover on the inverter from the top and press it until you here a click.

Tighten the terminal block cover fixing screws with the tightening torque of 0.3 Nm.

2-2-2 Terminal Blocks

Removing the terminal block cover and each connector cover reveals terminal blocks, connectors, and switches arranged as shown below.



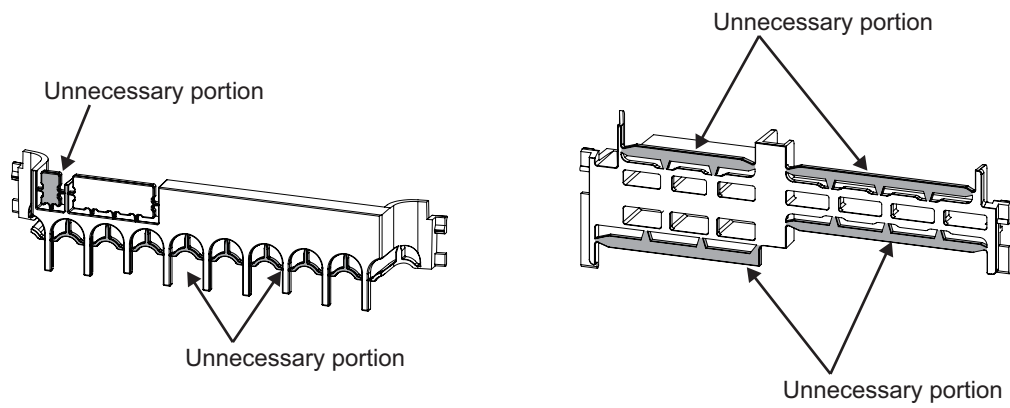
Name	Description
Digital input sink/source selector switch (SW1)	The switch for switching which of sink or source the digital input terminals DI1 to DI7 are to be used for. (Factory default setting is SINK side)
Safety function selector switch (SW9)	Turn this switch OFF to use the safety function. Before you turn ON/OFF this switch, be sure to turn off the power supply. For details, refer to <i>8-6 Safety Function</i> on page 8-61. (Factory default setting is ON side (safety function disabled))
USB connector	The Micro-B type USB connector for connecting a computer. Use this connector to connect the inverter to the Inverter/Servo support tool Sysmac Studio.
Control circuit terminal block A, B, C	The terminal block for connecting various digital/analog input devices used for inverter control.
Safety input terminal block	The terminal block for connecting the safety input signal.
Relay output terminal block	The SPDT contact terminal block for relay output.
Main circuit terminal block	The terminal block for connecting the main power supply for the inverter, outputs to the motor, braking resistor, etc.
Auxiliary power supply input terminal	Backup power supply for control circuit/communication function. The P24 terminal is insulated from the +24 terminal. For details on specifications, refer to <i>2-3-3 Arrangement and Function of Control Circuit Terminal Block</i> on page 2-12.

Note For the description of the data display, refer to *Section 5 Operation and Test Run* on page 5-1.

2-2-3 Preparing Backing Plate

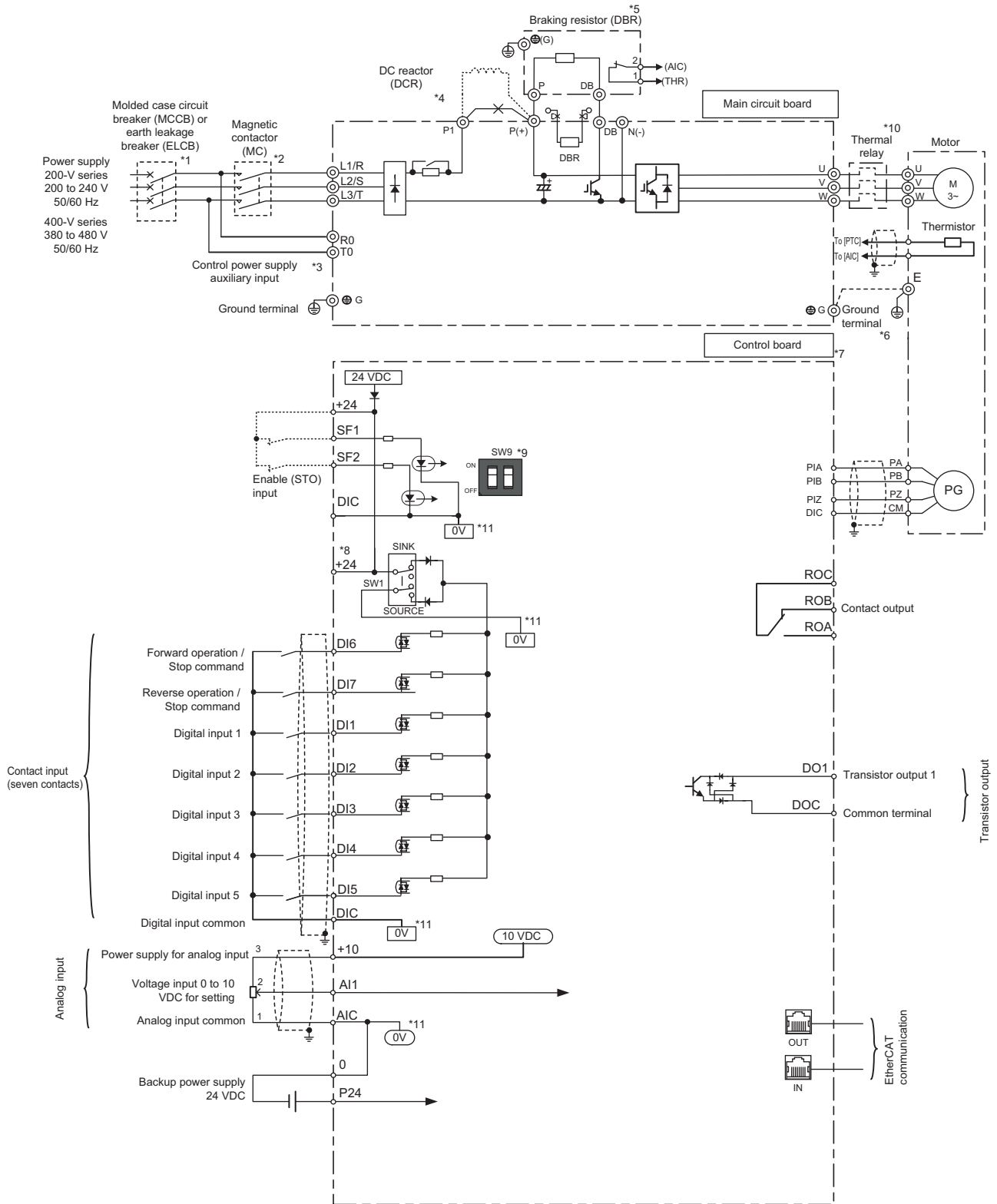
On some models, sometimes there is not enough space for wiring the main circuit. If this happens, before wiring, cut off the connecting points between the backing plate and unnecessary portions with nippers or a wire cutter.

Note that IP20 protection is no longer ensured when using the product with backing plate removed.



2-3 Wiring

2-3-1 Standard Connection Diagram

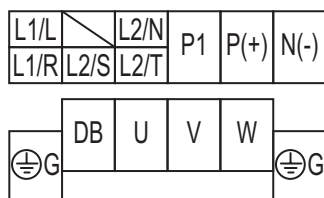


- *1. To protect the wiring, install a molded case circuit breaker (MCCB) or earth leakage circuit breaker (ELCB) (with overcurrent protection function) recommended for each inverter on the inverter input side (primary side). Do not use circuit breakers whose rated current exceeds recommended values.
- *2. The molded case circuit breaker and earth leakage circuit breaker are also used for insulation from the inverter's power supply. For this reason, install a magnetic contactor (MC) recommended for each inverter as required. When installing a magnetic contactor and solenoid or other coil near an inverter, connect surge absorbers in parallel.
- *3. To enable a batch alarm signal when the protection function is activated even if the main power supply of the inverter is cut off or to display the Digital Operator at all times, connect these terminals to the power supply. (3G3M1-A2185 or later or 3G3M1-A4185 or later products) The inverter operates even when these terminals are not connected to the power supply.
- *4. When connecting the optional DC reactor (DCR), remove the short-circuit bar between the main circuit terminals P1 and P(+) of the inverter before connecting.
When the capacity of the power transformer is 500 kVA or more and 10 times or more than the rated capacity of the inverter, or when a thyristor load is connected, use a DC reactor (DCR).
- *5. As a transistor for braking is built into the inverter, the braking resistor can be directly connected between P(+) and DB.
- *6. The terminal for grounding the motor. Connect this terminal, as required.
- *7. Use twisted wire or shield wire for the control signal wire.
Generally, shield wire is grounded. However, when inductive noise from an external source is large, the influence of noise can sometimes be suppressed by connecting the shield wire to a DIC. Separate control signal wire as far as possible (at least 10 cm is recommended) from the wiring of the main circuit, and do not pass control signal wire through the same wiring duct. When wires cross, be sure to cross them so that they are almost vertical to the wiring of the main circuit.
- *8. This switch on the printed circuit board is for specifying the operation setting of the inverter. For details, refer to 2-2-2 *Terminal Blocks* on page 2-8 in the User's Manual.
- *9. Safety function terminals SF1 and SF2 are disabled at SW9 (double-pole switch) on the printed circuit board before shipment from the factory. When using the SF1 and SF2 terminal functions, be sure to turn each SW9 switch OFF before connecting to these terminals.
- *10. Cut off the molded case circuit breaker (MCCB) or magnetic contactor (MC) at the auxiliary contact (manual reset) of the thermal relay.
- *11. $\square 0V$ and $\bigcirc 0V$ are separated and insulated.

2-3-2 Arrangement and Function of Main Circuit Terminal Block


The table below shows the arrangement of the main circuit terminal block and description of each terminal.

Main Circuit Terminal Block



The terminal arrangement shown on the left is an example for the inverters with a capacity of 0.75 kW or lower.

Terminal symbol		Terminal name	Description
L1/R	L1/L	Main power supply input terminal	Connect the AC input power supply. For single-phase 200-V type Inverters (3G3M1-AB□□-ECT), connect these to the L1/L and L2/N terminals, respectively.
L2/S			
L3/T	L2/N		

Terminal symbol	Terminal name	Description
U	Inverter output terminal	Connect a three-phase motor.
V		
W		
P1	DC reactor connection terminal	Remove the short-circuit bar between the terminals P1 and P(+), and connect a DC reactor.
P(+)		
P(+)	Braking resistor connection terminal	Connect a braking resistor (if a braking torque is required).
DB		
P(+)	Regenerative braking unit connection terminal	Connect regenerative braking units (if a braking torque is required and that produced by the built-in braking circuit is insufficient).
N(-)		
R0, T0	Control power supply auxiliary input	To hold a batch alarm signal when the protection function is activated even if the main power supply of the inverter is cut off or to display the data display on the front of the inverter, connect these terminals to the power supply (at a capacity of 1.85 kW or more, for details, refer to <i>2-3-4 Wiring for Main Circuit Terminals</i> on page 2-15).
G 	Ground terminal	This is the ground terminal. Connect this terminal to the ground. 200-V class should be connected under type-D grounding conditions; 400-V class should be connected under type-C grounding conditions.

2-3-3 Arrangement and Function of Control Circuit Terminal Block

The table below shows the arrangement of the control circuit terminal block, and description and specifications of each terminal.

Control Circuit Terminal Block

PTC	+10	AI1	AIC	DI1	DI2	DI3	DI4		
DO1	DOC	DI5	DI6	DI7	DIC				
ROA	ROB	ROC	PIA	PIB	PIZ	DIC	+24	+24	
						P24	0	SF1	SF2

Item		Terminal symbol	Terminal name	Description	Specifications
Analog	Input	+10	Power supply for analog input	This is a 10 VDC power supply for the AI1 terminal.	Maximum allowable current: 10 mA
		AI1	Analog voltage input	This is a -10 to 10 VDC analog voltage input.	Input impedance: 22 k Ω Allowable input voltage range: -15 to 10 VDC
		AIC	Analog input common	Common terminal for the analog input.	
		PTC	External thermistor input	Connect an external thermistor between the PTC and the AIC, and when an abnormal temperature is reached, an inverter trip is generated. (Set the inverter trip level at object 3008Hex-1CHex.)	PTC type

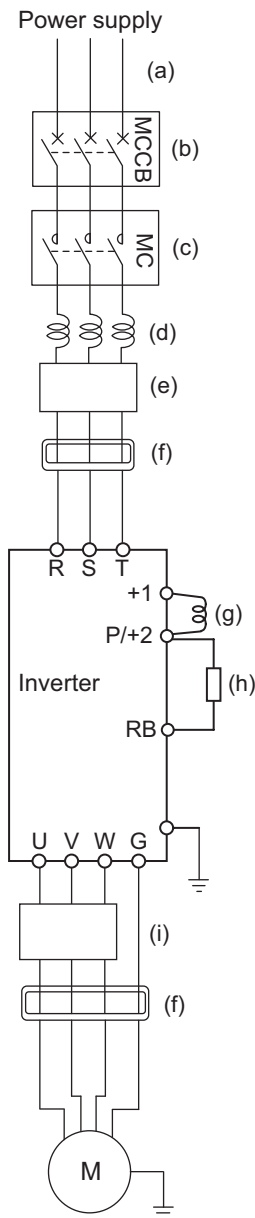
Item		Terminal symbol	Terminal name	Description	Specifications	
Digital	Power supply	DIC	Input signal common	Common terminal for the digital input.		
	Input	Contact	D11 D12 D13 D14 D15 D16 D17	Multifunction input terminal	Select functions and allocate them to terminals D11 to D17. These terminals support both the sink logic and the source logic. For details on the connection, refer to <i>Multifunction Input Terminals and Programmable Controller Connection</i> on page 2-61.	Voltage between each input terminal and the terminal DIC ON voltage: 20 V min. OFF voltage: 2 V max. Allowable voltage: 27 VDC max. Load current (D11, D12): 2.5 to 16 mA (at 27 V) Load current (D13 to D17): 2.5 to 5 mA (at 27 V) Internal resistance: 5.4 kΩ
			SF1 SF2	Safety input	Turn ON the Safety Function Selector Switch to enable this terminal. SF1 (Safety input 1) SF2 (Safety input 2)	Voltage between each input terminal and the terminal DIC ON voltage: 20 V min. OFF voltage: 2 V max. Allowable voltage: 27 VDC max. Load current: 2.5 to 5 mA (at 27 V) Internal resistance: 6.6 kΩ
			Pulse	PIA PIB PIZ	Pulse input	This is pulse input for frequency setting. This terminal accepts 5 to 24 VDC input signals.

Item			Terminal symbol	Terminal name	Description	Specifications
Digital	Output	Open collector	+24	Power supply terminal for output signal	This is a 24 VDC power supply for the output signal.	Allowable current: 100mA max.
			DOC	Output signal common	Common terminal for multifunction output terminal DO1.	Allowable current: 100 mA max.
			DO1	Multifunction output terminal	Select functions and allocate them to the DO1 terminal. These terminals support both the sink logic and the source logic. For details on the connection, refer to <i>Multifunction Output Terminals and Programmable Controller Connection</i> on page 2-62.	Open collector output Across DO1-DOC Allowable voltage: 48 VDC max. Allowable current: 50mA max. Voltage drop at power-on: 4 V max.
Multi-function relay output			ROA ROB ROC	Relay output terminal Relay output common	Select the desired function and allocate it to these terminals. This is SPDT contact output. Factory default values are NO contact between ROA-ROC and NC contact between ROB-ROC.	250 VAC, 0.3 A, $\cos\phi=0.3/48$ VDC, 0.5 A
24 VDC input			P24 0	Auxiliary power supply input terminal	Backup power supply for control circuit/communication function. The P24 terminal is insulated from the +24 terminal. The protection function, motor operation, FSoE (STO), each I/O terminal, fan, braking transistor and inrush current protection circuit do not operate.	24 VDC (22 to 26 V) 500 mA max.

2-3-4 Wiring for Main Circuit Terminals

Main Circuit Configuration Diagram

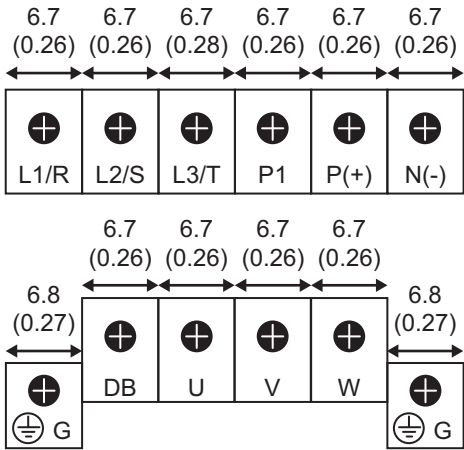
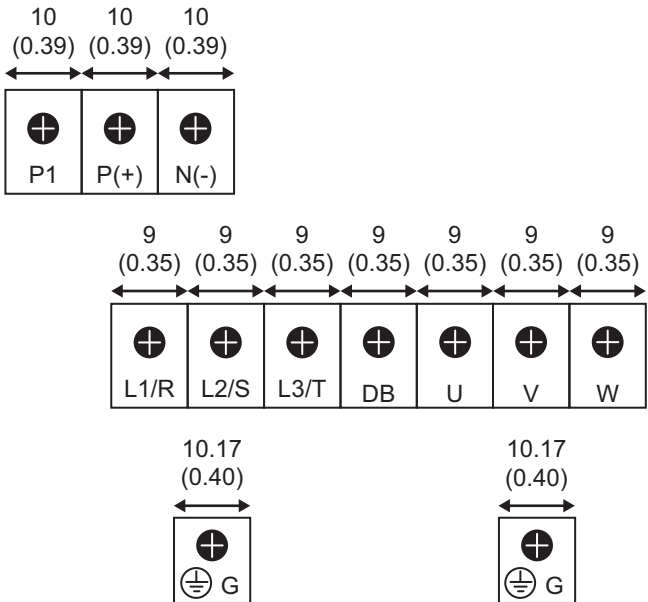
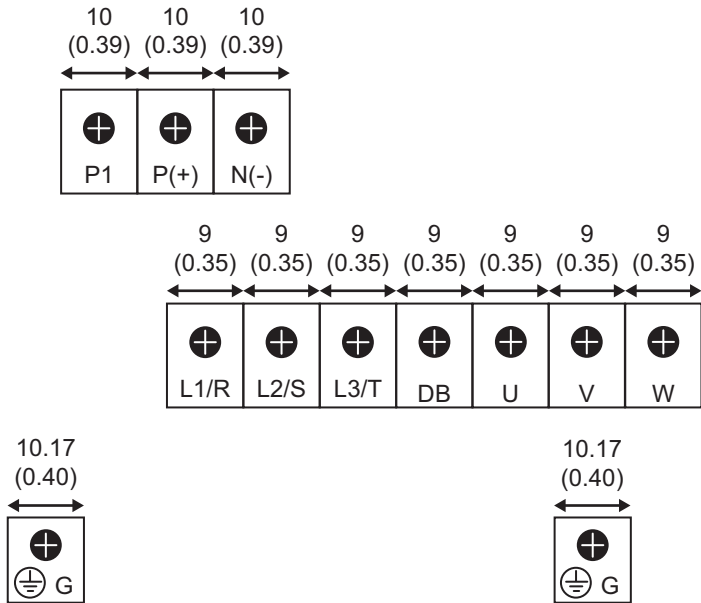
The diagram below shows the configuration of the inverter main circuit. The function of each peripheral component is also described.



Name	Function
(a) (b) (c)	Refer to <i>Recommended Cable Size, Wiring Device, and Crimp Terminal</i> on page 2-18.
(d) AC reactor	This is used as a harmonic suppression measure. It also helps improve the power factor. The AC reactor is used when the power supply voltage unbalance factor is 3% or more, the inverter capacity is 500 kVA or more, or rapid change in the power supply voltage occurs to reduce its effect.
(e) Input noise filter	This filter reduces the conductive noise generated in the inverter and transmitted via wires. Connect it to the primary side (input side) of the inverter.
(f) Radio noise filter	The inverter in operation may cause noise through the power supply wiring etc., which could affect radio receivers or other equipment nearby. This filter reduces such noise (radiated noise).
(g) DC reactor	This reactor helps suppress harmonics generated by the inverter.
(h) Braking resistor	These increase the amount of regenerative energy absorption when the inverter applies motor braking and are used to decrease the speed of an elevator or load with a large moment of inertia. All models of the 3G3M1 Series Inverter have built-in regenerative braking processing circuit. The regenerative braking unit is necessary only if a large braking torque is required and the built-in regenerative braking processing circuit cannot allow it.
(j) Output noise filter	This filter is installed between the inverter and the motor to reduce the radiated noise emitted from cables. It is used to reduce radio and television interference and prevent meter and sensor malfunction.

Arrangement of Main Circuit Terminals

The arrangement of terminals on the inverter main circuit terminal block is shown below.

Applicable model	Terminal arrangement
3G3M1-AB001/ AB002/AB004/AB007- ECT 3G3M1-A2001/ A2002/A2004/A2007-ECT	 <p>(For single-phase class, connect L1/L to L1/R and L2/N to L3/T.)</p>
3G3M1-AB015-ECT 3G3M1-A2015/A2022- ECT 3G3M1-A4004/ A4007/A4015/A4022-ECT	 <p>(For single-phase class, connect L1/L to L1/R and L2/N to L3/T.)</p>
3G3M1-AB022-ECT 3G3M1-A2037-ECT 3G3M1-A4030/A4040- ECT	 <p>(For single-phase class, connect L1/L to L1/R and L2/N to L3/T.)</p>

Applicable model	Terminal arrangement
3G3M1-AB037-ECT 3G3M1-A2055/A2075-ECT 3G3M1-A4055/A4075-ECT	<p>(For single-phase class, connect L1/L to L1/R and L2/N to L3/T.)</p>
3G3M1-A2110/A2150-ECT 3G3M1-A4110/A4150-ECT	
3G3M1-A2185-ECT 3G3M1-A4185/A4220-ECT	

Recommended Cable Size, Wiring Device, and Crimp Terminal

For inverter wiring, crimp terminal, and terminal screw tightening torque, refer to the table below.

- Each table shows an example of connecting the standard three-phase motor with four poles to an inverter.
- For the molded case circuit breaker (MCCB), select an appropriate product in consideration of the breaking capacity.

- For compliance with the UL standard requirements, be sure to perform wiring according to *2-4-2 UL/cUL Standards Cautions* on page 2-83, which includes the use of UL-compliant specified fuses and specified wiring materials.
- Tighten the terminal block screws with the specified torque. Weak tightening may result in a short-circuiting accident or fire. Conversely, overtightening these screws may cause damage to the terminal block or the inverter.

● **Three-phase 200-V class (Panel internal temperature 50°C or less)**

Model		Maximum applicable motor capacity [kW]	Recommended wire size [mm ²]							
			Main power supply input (L1/R, L2/S, L3/T)							
When DC reactor (DCR) is used				Without DC reactor						
HHD mode	HND mode		Allowable temperature (Note 1)			Current value [A]	Allowable temperature (Note 1)			Current value [A]
		60°C	75°C	90°C	60°C		75°C	90°C		
3G3M1-A2001-ECT	-	0.1	2.0	2.0	2.0	0.6	2.0	2.0	2.0	1.1
3G3M1-A2002-ECT	3G3M1-A2001-ECT	0.2	2.0	2.0	2.0	0.9	2.0	2.0	2.0	1.8
-	3G3M1-A2002-ECT	0.4	2.0	2.0	2.0	1.6	2.0	2.0	2.0	2.6
3G3M1-A2004-ECT	-		2.0	2.0	2.0	1.6	2.0	2.0	2.0	3.1
-	3G3M1-A2004-ECT	0.75	2.0	2.0	2.0	3.0	2.0	2.0	2.0	4.9
3G3M1-A2007-ECT	-		2.0	2.0	2.0	3.0	2.0	2.0	2.0	5.3
-	3G3M1-A2007-ECT	1.1	2.0	2.0	2.0	4.3	2.0	2.0	2.0	6.7
3G3M1-A2015-ECT	-	1.5	2.0	2.0	2.0	5.7	2.0	2.0	2.0	9.5
-	3G3M1-A2015-ECT	2.2	2.0	2.0	2.0	8.3	2.0	2.0	2.0	12.8
3G3M1-A2022-ECT	-		2.0	2.0	2.0	8.3	2.0	2.0	2.0	13.2
-	3G3M1-A2022-ECT	3	2.0	2.0	2.0	11.7	3.5	2.0	2.0	17.9
3G3M1-A2037-ECT	-	3.7	2.0	2.0	2.0	14.0	5.5	2.0	2.0	22.2
-	3G3M1-A2037-ECT	5.5	3.5	2.0	2.0	19.9	8.0	3.5	2.0	28.5
3G3M1-A2055-ECT	-		5.5	2.0	2.0	21.1	8.0	3.5	3.5	31.5
3G3M1-A2075-ECT	3G3M1-A2055-ECT	7.5	8.0	3.5	2.0	28.8	14.0	5.5	5.5	42.7
3G3M1-A2110-ECT	3G3M1-A2075-ECT	11	14.0	5.5	5.5	42.2	22.1	14.0	8.0	60.7
3G3M1-A2150-ECT	3G3M1-A2110-ECT	15	22.0	14.0	8.0	57.6	38.0	14.0	14.0	80.0

Model		Maximum applicable motor capacity [kW]	Recommended wire size [mm ²]							
			Main power supply input (L1/R, L2/S, L3/T)							
When DC reactor (DCR) is used				Without DC reactor						
HHD mode	HND mode		Allowable temperature (Note 1)			Current value [A]	Allowable temperature (Note 1)			Current value [A]
		60°C	75°C	90°C	60°C		75°C	90°C		
3G3M1-A2220-ECT	3G3M1-A2150-ECT	18.5	38.0*1	14.0	14.0	71.0	60.0*2	22.0	14.0	97.0
-	3G3M1-A2220-ECT	22	38.0*1	22.0	14.0	84.4	60.0*2	38.0*1	22.0	112.0

Model		Maximum applicable motor capacity [kW]	Recommended wire size [mm ²]							
			Inverter output (U, V, W)							
HHD mode				HND mode						
HHD mode	HND mode		Allowable temperature (Note 1)			Current value [A]	Allowable temperature (Note 1)			Current value [A]
		60°C	75°C	90°C	60°C		75°C	90°C		
3G3M1-A2001-ECT	-	0.1	2.0	2.0	2.0	1.0	-	-	-	-
3G3M1-A2002-ECT	3G3M1-A2001-ECT	0.2	2.0	2.0	2.0	1.6	2.0	2.0	2.0	1.3
-	3G3M1-A2002-ECT	0.4	-	-	-	-	2.0	2.0	2.0	2.0
3G3M1-A2004-ECT	-		2.0	2.0	2.0	3.0	-	-	-	-
-	3G3M1-A2004-ECT	0.75	-	-	-	-	2.0	2.0	2.0	3.5
3G3M1-A2007-ECT	-		2.0	2.0	2.0	5.0	-	-	-	-
-	3G3M1-A2007-ECT	1.1	-	-	-	-	2.0	2.0	2.0	6.0
3G3M1-A2015-ECT	-	1.5	2.0	2.0	2.0	8.0	-	-	-	-
-	3G3M1-A2015-ECT	2.2	-	-	-	-	2.0	2.0	2.0	9.6
3G3M1-A2022-ECT	-		2.0	2.0	2.0	11.0	-	-	-	-
-	3G3M1-A2022-ECT	3	-	-	-	-	2.0	2.0	2.0	12.0
3G3M1-A2037-ECT	-	3.7	3.5	2.0	2.0	17.5	-	-	-	-
-	3G3M1-A2037-ECT	5.5	-	-	-	-	3.5	2.0	2.0	19.6
3G3M1-A2055-ECT	-		5.5	3.5	2.0	25.0	-	-	-	-

Model		Maximum applicable motor capacity [kW]	Recommended wire size [mm ²]							
			Inverter output (U, V, W)							
HHD mode	HND mode		HHD mode				HND mode			
			Allowable temperature (Note 1)			Current value [A]	Allowable temperature (Note 1)			Current value [A]
60°C	75°C	90°C	60°C	75°C	90°C					
3G3M1-A2075-ECT	3G3M1-A2055-ECT	7.5	8.0	3.5	3.5	33.0	8.0	3.5	2.0	30.0
3G3M1-A2110-ECT	3G3M1-A2075-ECT	11	14.0	8.0	5.5	47.0	14.0	5.5	3.5	40.0
3G3M1-A2150-ECT	3G3M1-A2110-ECT	15	22.0	14.0	8.0	60.0	22.0	14.0	5.5	56.0
3G3M1-A2220-ECT	3G3M1-A2150-ECT	18.5	38.0 ^{*1}	14.0	14.0	76.0	38.0 ^{*1}	14.0	8.0	69.0
-	3G3M1-A2220-ECT	22	-	-	-	-	38.0 ^{*1}	22.0	14.0	88.0

Model		Maximum applicable motor capacity [kW]	Recommended wire size [mm ²]				
			DC reactor connection (P1, P(+))				
HHD mode	HND mode		Allowable temperature (Note 1)			Current value [A]	
			60°C	75°C	90°C		
3G3M1-A2001-ECT	-	0.1	2.0	2.0	2.0	0.7	
3G3M1-A2002-ECT	3G3M1-A2001-ECT	0.2	2.0	2.0	2.0	1.1	
-	3G3M1-A2002-ECT	0.4	2.0	2.0	2.0	2.0	
3G3M1-A2004-ECT	-	0.75	2.0	2.0	2.0	2.0	
-	3G3M1-A2004-ECT		2.0	2.0	2.0	3.7	
3G3M1-A2007-ECT	-		2.0	2.0	2.0	3.7	
-	3G3M1-A2007-ECT	1.1	2.0	2.0	2.0	5.3	
3G3M1-A2015-ECT	-	1.5	2.0	2.0	2.0	7.0	
-	3G3M1-A2015-ECT	2.2	2.0	2.0	2.0	10.2	
3G3M1-A2022-ECT	-	3	2.0	2.0	2.0	10.2	
-	3G3M1-A2022-ECT		2.0	2.0	2.0	14.3	
3G3M1-A2037-ECT	-		3.7	3.5	2.0	2.0	17.1
-	3G3M1-A2037-ECT	5.5	5.5	3.5	2.0	24.4	
3G3M1-A2055-ECT	-	7.5	5.5	3.5	2.0	25.8	
3G3M1-A2075-ECT	3G3M1-A2055-ECT		14.0	5.5	3.5	35.3	
3G3M1-A2110-ECT	3G3M1-A2075-ECT		11	22.0	8.0	5.5	51.7
3G3M1-A2150-ECT	3G3M1-A2110-ECT	15	38.0	14.0	14.0	70.5	
3G3M1-A2220-ECT	3G3M1-A2150-ECT	18.5	38.0 ^{*1}	22.0	14.0	87.0	
-	3G3M1-A2220-ECT	22	60.0 ^{*2}	22.0	22.0	103.4	

Model		Maximum applicable motor capacity [kW]	Recommended wire size [mm ²]							
			Brake resistance connection (P(+), DB)							
HHD mode	HND mode		HHD mode				HND mode			
			Allowable temperature (Note 1)			Current value [A]	Allowable temperature (Note 1)			Current value [A]
		60°C	75°C	90°C	60°C		75°C	90°C		
3G3M1-A2001-ECT	-	0.1	2.0	2.0	2.0	0.3	-	-	-	-
3G3M1-A2002-ECT	3G3M1-A2001-ECT	0.2	2.0	2.0	2.0	0.4	2.0	2.0	2.0	0.3
-	3G3M1-A2002-ECT	0.4	-	-	-	-	2.0	2.0	2.0	0.4
3G3M1-A2004-ECT	-		2.0	2.0	2.0	0.5	-	-	-	-
-	3G3M1-A2004-ECT	0.75	-	-	-	-	2.0	2.0	2.0	0.6
3G3M1-A2007-ECT	-		2.0	2.0	2.0	0.7	-	-	-	-
-	3G3M1-A2007-ECT	1.1	-	-	-	-	2.0	2.0	2.0	0.8
3G3M1-A2015-ECT	-	1.5	2.0	2.0	2.0	1.4	-	-	-	-
-	3G3M1-A2015-ECT	2.2	-	-	-	-	2.0	2.0	2.0	1.5
3G3M1-A2022-ECT	-		2.0	2.0	2.0	1.7	-	-	-	-
-	3G3M1-A2022-ECT	3	-	-	-	-	2.0	2.0	2.0	1.7
3G3M1-A2037-ECT	-	3.7	2.0	2.0	2.0	2.4	-	-	-	-
-	3G3M1-A2037-ECT	5.5	-	-	-	-	2.0	2.0	2.0	2.5
3G3M1-A2055-ECT	-		2.0	2.0	2.0	3.8	-	-	-	-
3G3M1-A2075-ECT	3G3M1-A2055-ECT	7.5	2.0	2.0	2.0	5.0	2.0	2.0	2.0	3.8
3G3M1-A2110-ECT	3G3M1-A2075-ECT	11	2.0	2.0	2.0	7.5	2.0	2.0	2.0	5.3
3G3M1-A2150-ECT	3G3M1-A2110-ECT	15	2.0	2.0	2.0	9.4	2.0	2.0	2.0	7.5
3G3M1-A2220-ECT	3G3M1-A2150-ECT	18.5	2.0	2.0	2.0	12.7	2.0	2.0	2.0	9.0
-	3G3M1-A2220-ECT	22	2.0	2.0	2.0	13.8	-	-	-	-

Model		Maximum applicable motor capacity [kW]	Recommended wire size [mm ²]		
			Inverter ground (G)		
HHD mode	HND mode		Allowable temperature (Note 1)		
			60°C	75°C	90°C
3G3M1-A2001-ECT	-	0.1	2.0	2.0	2.0
3G3M1-A2002-ECT	3G3M1-A2001-ECT	0.2	2.0	2.0	2.0
-	3G3M1-A2002-ECT	0.4	2.0	2.0	2.0
3G3M1-A2004-ECT	-	0.75	2.0	2.0	2.0
-	3G3M1-A2004-ECT		2.0	2.0	2.0
3G3M1-A2007-ECT	-	1.1	2.0	2.0	2.0
-	3G3M1-A2007-ECT		2.0	2.0	2.0
3G3M1-A2015-ECT	-	1.5	2.0	2.0	2.0
-	3G3M1-A2015-ECT	2.2	2.0	2.0	2.0
3G3M1-A2022-ECT	-		2.0	2.0	2.0
-	3G3M1-A2022-ECT	3	2.0	2.0	2.0
3G3M1-A2037-ECT	-	3.7	2.0	2.0	2.0
-	3G3M1-A2037-ECT	5.5	3.5	3.5	3.5
3G3M1-A2055-ECT	-		3.5	3.5	3.5
3G3M1-A2075-ECT	3G3M1-A2055-ECT	7.5	5.5	5.5	5.5
3G3M1-A2110-ECT	3G3M1-A2075-ECT	11	5.5	5.5	5.5
3G3M1-A2150-ECT	3G3M1-A2110-ECT	15	5.5	5.5	5.5
3G3M1-A2220-ECT	3G3M1-A2150-ECT	18.5	8.0	8.0	8.0
-	3G3M1-A2220-ECT	22	8.0	8.0	8.0

● Three-phase 400-V class (Panel internal temperature 50°C or less)

Model		Maximum applicable motor capacity [kW]	Recommended wire size [mm ²]							
			Main power supply input (L1/R, L2/S, L3/T)							
HHD mode	HND mode		When DC reactor (DCR) is used				Without DC reactor (DCR)			
			Allowable temperature (Note 1)			Current value [A]	Allowable temperature (Note 1)			Current value [A]
60°C	75°C	90°C	60°C	75°C	90°C					
3G3M1-A4004-ECT	-	0.4	2.0	2.0	2.0	0.9	2.0	2.0	2.0	1.7
-	3G3M1-A4004-ECT	0.75	2.0	2.0	2.0	1.5	2.0	2.0	2.0	2.7
3G3M1-A4007-ECT	-		2.0	2.0	2.0	1.6	2.0	2.0	2.0	3.1
-	3G3M1-A4007-ECT	1.1	2.0	2.0	2.0	2.1	2.0	2.0	2.0	3.9
3G3M1-A4015-ECT	-	1.5	2.0	2.0	2.0	3.0	2.0	2.0	2.0	5.9

Model		Maximum applicable motor capacity [kW]	Recommended wire size [mm ²]							
			Main power supply input (L1/R, L2/S, L3/T)							
When DC reactor (DCR) is used				Without DC reactor (DCR)						
Allowable temperature (Note 1)			Current value [A]	Allowable temperature (Note 1)			Current value [A]			
60°C	75°C			90°C	60°C	75°C		90°C		
HHD mode	HND mode									
-	3G3M1-A4015-ECT	2.2	2.0	2.0	2.0	4.2	2.0	2.0	2.0	7.3
3G3M1-A4022-ECT	-		2.0	2.0	2.0	4.4	2.0	2.0	2.0	8.2
-	3G3M1-A4022-ECT	3	2.0	2.0	2.0	5.8	2.0	2.0	2.0	11.3
3G3M1-A4030-ECT	-		2.0	2.0	2.0	7.3	2.0	2.0	2.0	13.0
-	3G3M1-A4030-ECT	3.7	2.0	2.0	2.0	7.3	2.0	2.0	2.0	13.0
3G3M1-A4040-ECT	-		2.0	2.0	2.0	10.1	3.5	2.0	2.0	16.8
-	3G3M1-A4040-ECT	5.5	2.0	2.0	2.0	10.1	3.5	2.0	2.0	16.8
3G3M1-A4055-ECT	-		2.0	2.0	2.0	10.6	3.5	2.0	2.0	17.3
3G3M1-A4075-ECT	3G3M1-A4055-ECT	7.5	2.0	2.0	2.0	14.4	5.5	2.0	2.0	23.2
3G3M1-A4110-ECT	3G3M1-A4075-ECT	11	5.5	2.0	2.0	21.1	8.0	3.5	3.5	33.0
3G3M1-A4150-ECT	3G3M1-A4110-ECT	15	8.0	3.5	2.0	28.8	14.0	5.5	5.5	43.8
3G3M1-A4185-ECT	3G3M1-A4150-ECT	18.5	14.0	5.5	3.5	35.5	22.0	8.0	5.5	52.3
3G3M1-A4220-ECT	3G3M1-A4185-ECT	22	14.0	5.5	5.5	42.2	22.0	14.0	8.0	60.6
-	3G3M1-A4220-ECT	30	22.0	14.0	8.0	57.0	38.0*1	14.0	14.0	77.9

Model		Maximum applicable motor capacity [kW]	Recommended wire size [mm ²]							
			Inverter output (U, V, W)							
HHD mode				HND mode						
Allowable temperature (Note 1)			Current value [A]	Allowable temperature (Note 1)			Current value [A]			
60°C	75°C			90°C	60°C	75°C		90°C		
HHD mode	HND mode									
3G3M1-A4004-ECT	-	0.4	2.0	2.0	2.0	1.8	-	-	-	-

Model		Maximum applicable motor capacity [kW]	Recommended wire size [mm ²]							
			Inverter output (U, V, W)							
HHD mode	HND mode		HHD mode				HND mode			
			Allowable temperature (Note 1)			Current value [A]	Allowable temperature (Note 1)			Current value [A]
		60°C	75°C	90°C	60°C		75°C	90°C		
-	3G3M1-A4004-ECT	0.75	-	-	-	-	2.0	2.0	2.0	2.1
3G3M1-A4007-ECT	-		2.0	2.0	2.0	3.4	-	-	-	-
-	3G3M1-A4007-ECT	1.1	-	-	-	-	2.0	2.0	2.0	4.1
3G3M1-A4015-ECT	-	1.5	2.0	2.0	2.0	4.8	-	-	-	-
-	3G3M1-A4015-ECT	2.2	-	-	-	-	2.0	2.0	2.0	5.5
3G3M1-A4022-ECT	-		2.0	2.0	2.0	5.5	-	-	-	-
-	3G3M1-A4022-ECT	3	-	-	-	-	2.0	2.0	2.0	6.9
3G3M1-A4030-ECT	-		-	-	-	-	-	-	-	-
-	3G3M1-A4030-ECT	3.7	2.0	2.0	2.0	9.2	-	-	-	-
3G3M1-A4040-ECT	-		-	-	-	-	-	-	-	-
-	3G3M1-A4040-ECT	5.5	-	-	-	-	2.0	2.0	2.0	11.1
3G3M1-A4055-ECT	-		2.0	2.0	2.0	14.8	-	-	-	-
3G3M1-A4075-ECT	3G3M1-A4055-ECT	7.5	3.5	2.0	2.0	18.0	3.5	2.0	2.0	17.5
3G3M1-A4110-ECT	3G3M1-A4075-ECT	11	5.5	2.0	2.0	24.0	5.5	2.0	2.0	23.0
3G3M1-A4150-ECT	3G3M1-A4110-ECT	15	8.0	3.5	2.0	31.0	8.0	5.5	3.5	31.0
3G3M1-A4185-ECT	3G3M1-A4150-ECT	18.5	14.0	5.5	3.5	39.0	14.0	5.5	3.5	38.0
3G3M1-A4220-ECT	3G3M1-A4185-ECT	22	14.0	8.0	5.5	45.0	14.0	8.0	5.5	45.0
-	3G3M1-A4220-ECT	30	-	-	-	-	22.0	14.0	8.0	60.0

Model		Maximum applicable motor capacity [kW]	Recommended wire size [mm ²]			
			DC reactor connection (P1, P(+))			
HHD mode	HND mode		Allowable temperature (Note 1)			Current value [A]
		60°C	75°C	90°C		
3G3M1-A4004-ECT	-	0.4	2.0	2.0	2.0	1.0
-	3G3M1-A4004-ECT	0.75	2.0	2.0	2.0	1.8
3G3M1-A4007-ECT	-		2.0	2.0	2.0	2.0
-	3G3M1-A4007-ECT	1.1	2.0	2.0	2.0	2.6
3G3M1-A4015-ECT	-	1.5	2.0	2.0	2.0	3.7
-	3G3M1-A4015-ECT	2.2	2.0	2.0	2.0	5.1
3G3M1-A4022-ECT	-		2.0	2.0	2.0	5.4
-	3G3M1-A4022-ECT	3	2.0	2.0	2.0	7.1
3G3M1-A4030-ECT	-					
-	3G3M1-A4030-ECT	3.7	2.0	2.0	2.0	8.9
3G3M1-A4040-ECT	-					
-	3G3M1-A4040-ECT	5.5	2.0	2.0	2.0	12.4
3G3M1-A4055-ECT	-		2.0	2.0	2.0	13.0
3G3M1-A4075-ECT	3G3M1-A4055-ECT	7.5	3.5	2.0	2.0	17.6
3G3M1-A4110-ECT	3G3M1-A4075-ECT	11	5.5	3.5	2.0	25.8
3G3M1-A4150-ECT	3G3M1-A4110-ECT	15	14.0	5.5	3.5	35.3
3G3M1-A4185-ECT	3G3M1-A4150-ECT	18.5	14.0	5.5	5.5	43.5
3G3M1-A4220-ECT	3G3M1-A4185-ECT	22	22.0	8.0	5.5	51.7
-	3G3M1-A4220-ECT	30	38.0*1	14.0	8.0	69.8

Model		Maximum applicable motor capacity [kW]	Recommended wire size [mm ²]							
			Brake resistance connection (P(+), DB)							
HHD mode	HND mode		HHD mode			HND mode				
		Allowable temperature (Note 1)			Current value [A]	Allowable temperature (Note 1)			Current value [A]	
		60°C	75°C	90°C		60°C	75°C	90°C		
3G3M1-A4004-ECT	-	0.4	2.0	2.0	2.0	0.4	-	-	-	-
-	3G3M1-A4004-ECT	0.75	-	-	-	-	2.0	2.0	2.0	0.4
3G3M1-A4007-ECT	-		2.0	2.0	2.0	0.5	-	-	-	-
-	3G3M1-A4007-ECT	1.1	-	-	-	-	2.0	2.0	2.0	0.6
3G3M1-A4015-ECT	-	1.5	2.0	2.0	2.0	0.7	-	-	-	-

Model		Maximum applicable motor capacity [kW]	Recommended wire size [mm ²]							
			Brake resistance connection (P(+), DB)							
HHD mode	HND mode		HHD mode				HND mode			
			Allowable temperature (Note 1)			Current value [A]	Allowable temperature (Note 1)			Current value [A]
60°C	75°C	90°C	60°C	75°C	90°C					
-	3G3M1-A4015-ECT	2.2	-	-	-	-	2.0	2.0	2.0	0.8
3G3M1-A4022-ECT	-		2.0	2.0	2.0	0.9	-	-	-	-
-	3G3M1-A4022-ECT	3	-	-	-	-	2.0	2.0	2.0	0.9
3G3M1-A4030-ECT	-		-	-	-	-	-	-	-	-
-	3G3M1-A4030-ECT	3.7	2.0	2.0	2.0	1.2	-	-	-	-
3G3M1-A4040-ECT	-		2.0	2.0	2.0	1.9	-	-	-	-
-	3G3M1-A4040-ECT	5.5	-	-	-	-	2.0	2.0	2.0	1.3
3G3M1-A4055-ECT	-		2.0	2.0	2.0	1.9	-	-	-	-
3G3M1-A4075-ECT	3G3M1-A4055-ECT	7.5	2.0	2.0	2.0	2.5	2.0	2.0	2.0	1.9
3G3M1-A4110-ECT	3G3M1-A4075-ECT	11	2.0	2.0	2.0	3.8	2.0	2.0	2.0	2.7
3G3M1-A4150-ECT	3G3M1-A4110-ECT	15	2.0	2.0	2.0	4.7	2.0	2.0	2.0	3.8
3G3M1-A4185-ECT	3G3M1-A4150-ECT	18.5	2.0	2.0	2.0	6.5	2.0	2.0	2.0	4.5
3G3M1-A4220-ECT	3G3M1-A4185-ECT	22	2.0	2.0	2.0	7.1	2.0	2.0	2.0	6.2
-	3G3M1-A4220-ECT	30	-	-	-	-	2.0	2.0	2.0	7.2

Model		Maximum applicable motor capacity [kW]	Recommended wire size [mm ²]		
			Inverter ground (G)		
HHD mode	HND mode		Allowable temperature (Note 1)		
			60°C	75°C	90°C
3G3M1-A4004-ECT	-	0.4	2.0	2.0	2.0
-	3G3M1-A4004-ECT	0.75	2.0	2.0	2.0
3G3M1-A4007-ECT	-		2.0	2.0	2.0
-	3G3M1-A4007-ECT	1.1	2.0	2.0	2.0
3G3M1-A4015-ECT	-	1.5	2.0	2.0	2.0

Model		Maximum applicable motor capacity [kW]	Recommended wire size [mm ²]		
HHD mode	HND mode		Inverter ground (G)		
			Allowable temperature (Note 1)		
			60°C	75°C	90°C
-	3G3M1-A4015-ECT	2.2	2.0	2.0	2.0
3G3M1-A4022-ECT	-		2.0	2.0	2.0
-	3G3M1-A4022-ECT	3	2.0	2.0	2.0
3G3M1-A4030-ECT	-				
-	3G3M1-A4030-ECT	3.7	2.0	2.0	2.0
3G3M1-A4040-ECT	-				
-	3G3M1-A4040-ECT	5.5	2.0	2.0	2.0
3G3M1-A4055-ECT	-		2.0	2.0	2.0
3G3M1-A4075-ECT	3G3M1-A4055-ECT	7.5	2.0	2.0	2.0
3G3M1-A4110-ECT	3G3M1-A4075-ECT	11	3.5	3.5	3.5
3G3M1-A4150-ECT	3G3M1-A4110-ECT	15	5.5	5.5	5.5
3G3M1-A4185-ECT	3G3M1-A4150-ECT	18.5	5.5	5.5	5.5
3G3M1-A4220-ECT	3G3M1-A4185-ECT	22	5.5	5.5	5.5
-	3G3M1-A4220-ECT	30	8.0	8.0	8.0

● **Single-phase 200-V class (Panel internal temperature 50°C or less)**

Model		Maximum applicable motor capacity [kW]	Recommended wire size [mm ²]							
HHD mode	HND mode		Main power supply input (L1/R, L2/S, L3/T)							
			When DC reactor (DCR) is used				Without DC reactor (DCR)			
			Allowable temperature (Note 1)			Current value [A]	Allowable temperature (Note 1)			Current value [A]
60°C	75°C	90°C	60°C	75°C	90°C					
3G3M1-AB001-ECT	-	0.1	2.0	2.0	2.0	1.1	2.0	2.0	2.0	1.8
-	3G3M1-AB001-ECT	0.2	2.0	2.0	2.0	2.7	2.0	2.0	2.0	2.0
3G3M1-AB002-ECT	-		2.0	2.0	2.0	2.0	2.0	2.0	2.0	3.3
-	3G3M1-AB002-ECT	0.4	2.0	2.0	2.0	3.7	2.0	2.0	2.0	3.6
3G3M1-AB004-ECT	-		2.0	2.0	2.0	3.5	2.0	2.0	2.0	5.4
-	3G3M1-AB004-ECT	0.55	2.0	2.0	2.0	4.6	2.0	2.0	2.0	7.3
3G3M1-AB007-ECT	-	0.75	2.0	2.0	2.0	6.4	2.0	2.0	2.0	9.7
-	3G3M1-AB007-ECT	1.1	2.0	2.0	2.0	9.4	2.0	2.0	2.0	13.8

Model		Maximum applicable motor capacity [kW]	Recommended wire size [mm ²]							
			Main power supply input (L1/R, L2/S, L3/T)							
When DC reactor (DCR) is used				Without DC reactor (DCR)						
HHD mode	HND mode		Allowable temperature (Note 1)			Current value [A]	Allowable temperature (Note 1)			Current value [A]
		60°C	75°C	90°C	60°C		75°C	90°C		
3G3M1-AB015-ECT	-	1.5	2.0	2.0	2.0	11.6	3.5	2.0	2.0	16.4
-	3G3M1-AB015-ECT	2.2	3.5	2.0	2.0	17.9	3.5	2.0	2.0	20.2
3G3M1-AB022-ECT	-		3.5	2.0	2.0	17.5	5.5	2.0	2.0	22.0
-	3G3M1-AB022-ECT	3	5.5	3.5	2.0	25.0	5.5	2.0	2.0	24.0
3G3M1-AB037-ECT	-	3.7	8.0	3.5	3.5	31.8	14.0	8.0	5.5	45.4

Model		Maximum applicable motor capacity [kW]	Recommended wire size [mm ²]							
			Inverter output (U, V, W)							
HHD mode				HND mode						
HHD mode	HND mode		Allowable temperature (Note 1)			Current value [A]	Allowable temperature (Note 1)			Current value [A]
		60°C	75°C	90°C	60°C		75°C	90°C		
3G3M1-AB001-ECT	-	0.1	2.0	2.0	2.0	1.0	-	-	-	-
-	3G3M1-AB001-ECT	0.2	-	-	-	-	2.0	2.0	2.0	1.2
3G3M1-AB002-ECT	-		2.0	2.0	2.0	1.6	-	-	-	-
-	3G3M1-AB002-ECT	0.4	-	-	-	-	2.0	2.0	2.0	1.9
3G3M1-AB004-ECT	-		2.0	2.0	2.0	3.0	-	-	-	-
-	3G3M1-AB004-ECT	0.55	-	-	-	-	2.0	2.0	2.0	3.5
3G3M1-AB007-ECT	-	0.75	2.0	2.0	2.0	5.0	-	-	-	-
-	3G3M1-AB007-ECT	1.1	-	-	-	-	2.0	2.0	2.0	6.0
3G3M1-AB015-ECT	-	1.5	2.0	2.0	2.0	8.0	-	-	-	-
-	3G3M1-AB015-ECT	2.2	-	-	-	-	2.0	2.0	2.0	9.6
3G3M1-AB022-ECT	-		2.0	2.0	2.0	11.0	-	-	-	-

Model		Maximum applicable motor capacity [kW]	Recommended wire size [mm ²]							
			Inverter output (U, V, W)							
HHD mode	HND mode		HHD mode				HND mode			
			Allowable temperature (Note 1)			Current value [A]	Allowable temperature (Note 1)			Current value [A]
		60°C	75°C	90°C	60°C		75°C	90°C		
-	3G3M1-AB022-ECT	3	-	-	-	-	2.0	2.0	2.0	12.0
3G3M1-AB037-ECT	-	3.7	3.5	2.0	2.0	17.5	-	-	-	-

Model		Maximum applicable motor capacity [kW]	Recommended wire size [mm ²]				
			DC reactor connection (P1, P(+))				
HHD mode	HND mode		Allowable temperature (Note 1)			Current value [A]	
			60°C	75°C	90°C		
3G3M1-AB001-ECT	-	0.1	2.0	2.0	2.0	1.3	
-	3G3M1-AB001-ECT	0.2	2.0	2.0	2.0	2.7	
3G3M1-AB002-ECT	-		2.0	2.0	2.0	2.4	
-	3G3M1-AB002-ECT	0.4	2.0	2.0	2.0	4.5	
3G3M1-AB004-ECT	-		2.0	2.0	2.0	4.3	
-	3G3M1-AB004-ECT	0.55	2.0	2.0	2.0	5.6	
3G3M1-AB007-ECT	-	0.75	2.0	2.0	2.0	7.8	
-	3G3M1-AB007-ECT	1.1	2.0	2.0	2.0	11.5	
3G3M1-AB015-ECT	-	1.5	2.0	2.0	2.0	14.2	
-	3G3M1-AB015-ECT	2.2	5.5	2.0	2.0	21.9	
3G3M1-AB022-ECT	-		3.5	2.0	2.0	21	
-	3G3M1-AB022-ECT	3	8.0	3.5	2.0	30.6	
3G3M1-AB037-ECT	-	3.7	14.0	5.5	3.5	38.9	

Model		Maximum applicable motor capacity [kW]	Recommended wire size [mm ²]							
			Brake resistance connection (P(+), DB)							
HHD mode	HND mode		HHD mode				HND mode			
			Allowable temperature (Note 1)			Current value [A]	Allowable temperature (Note 1)			Current value [A]
		60°C	75°C	90°C	60°C		75°C	90°C		
3G3M1-AB001-ECT	-	0.1	2.0	2.0	2.0	0.3	-	-	-	-
-	3G3M1-AB001-ECT	0.2	-	-	-	-	2.0	2.0	2.0	0.3
3G3M1-AB002-ECT	-		2.0	2.0	2.0	0.4	-	-	-	-

Model		Maximum applicable motor capacity [kW]	Recommended wire size [mm ²]							
			Brake resistance connection (P(+), DB)							
HHD mode	HND mode		HHD mode				HND mode			
			Allowable temperature (Note 1)			Current value [A]	Allowable temperature (Note 1)			Current value [A]
60°C	75°C	90°C	60°C	75°C	90°C					
-	3G3M1-AB002-ECT	0.4	-	-	-	-	2.0	2.0	2.0	0.4
3G3M1-AB004-ECT	-		2.0	2.0	2.0	0.5	-	-	-	-
-	3G3M1-AB004-ECT	0.55	-	-	-	-	2.0	2.0	2.0	0.6
3G3M1-AB007-ECT	-	0.75	2.0	2.0	2.0	0.7	-	-	-	-
-	3G3M1-AB007-ECT	1.1	-	-	-	-	2.0	2.0	2.0	1.1
3G3M1-AB015-ECT	-	1.5	2.0	2.0	2.0	1.4	-	-	-	-
-	3G3M1-AB015-ECT	2.2	-	-	-	-	2.0	2.0	2.0	1.5
3G3M1-AB022-ECT	-		2.0	2.0	2.0	1.7	-	-	-	-
-	3G3M1-AB022-ECT	3	-	-	-	-	2.0	2.0	2.0	1.9
3G3M1-AB037-ECT	-	3.7	2.0	2.0	2.0	2.4	-	-	-	-

Model		Maximum applicable motor capacity [kW]	Recommended wire size [mm ²]		
			Inverter ground (G)		
HHD mode	HND mode		Allowable temperature (Note 1)		
			60°C	75°C	90°C
3G3M1-AB001-ECT	-	0.1	2.0	2.0	2.0
-	3G3M1-AB001-ECT	0.2	2.0	2.0	2.0
3G3M1-AB002-ECT	-		2.0	2.0	2.0
-	3G3M1-AB002-ECT	0.4	2.0	2.0	2.0
3G3M1-AB004-ECT	-		2.0	2.0	2.0
-	3G3M1-AB004-ECT	0.55	2.0	2.0	2.0
3G3M1-AB007-ECT	-	0.75	2.0	2.0	2.0
-	3G3M1-AB007-ECT	1.1	2.0	2.0	2.0
3G3M1-AB015-ECT	-	1.5	2.0	2.0	2.0
-	3G3M1-AB015-ECT	2.2	2.0	2.0	2.0
3G3M1-AB022-ECT	-		2.0	2.0	2.0
-	3G3M1-AB022-ECT	3	2.0	2.0	2.0

Model		Maximum applicable motor capacity [kW]	Recommended wire size [mm ²]		
			Inverter ground (G)		
HHD mode	HND mode		Allowable temperature (Note 1)		
			60°C	75°C	90°C
3G3M1-AB037-ECT	-	3.7	3.5	3.5	3.5

● Three-phase 200-V class (Panel internal temperature 40°C or less)

Model		Maximum applicable motor capacity [kW]	Recommended wire size [mm ²]							
			Main power supply input (L1/R, L2/S, L3/T)							
HHD mode	HND mode		When DC reactor (DCR) is used				Without DC reactor			
			Allowable temperature (Note 1)			Current value [A]	Allowable temperature (Note 1)			Current value [A]
60°C	75°C	90°C	60°C	75°C	90°C					
3G3M1-A2001-ECT	-	0.1	2.0	2.0	2.0	0.6	2.0	2.0	2.0	1.1
3G3M1-A2002-ECT	3G3M1-A2001-ECT	0.2	2.0	2.0	2.0	0.9	2.0	2.0	2.0	1.8
-	3G3M1-A2002-ECT	0.4	2.0	2.0	2.0	1.6	2.0	2.0	2.0	2.6
3G3M1-A2004-ECT	-		2.0	2.0	2.0	1.6	2.0	2.0	2.0	3.1
-	3G3M1-A2004-ECT	0.75	2.0	2.0	2.0	3.0	2.0	2.0	2.0	4.9
3G3M1-A2007-ECT	-		2.0	2.0	2.0	3.0	2.0	2.0	2.0	5.3
-	3G3M1-A2007-ECT	1.1	2.0	2.0	2.0	4.3	2.0	2.0	2.0	6.7
3G3M1-A2015-ECT	-	1.5	2.0	2.0	2.0	5.7	2.0	2.0	2.0	9.5
-	3G3M1-A2015-ECT	2.2	2.0	2.0	2.0	8.3	2.0	2.0	2.0	12.8
3G3M1-A2022-ECT	-		2.0	2.0	2.0	8.3	2.0	2.0	2.0	13.2
-	3G3M1-A2022-ECT	3	2.0	2.0	2.0	11.7	2.0	2.0	2.0	17.9
3G3M1-A2037-ECT	-	3.7	2.0	2.0	2.0	14.0	3.5	2.0	2.0	22.2
-	3G3M1-A2037-ECT	5.5	2.0	2.0	2.0	19.9	3.5	2.0	2.0	28.5
3G3M1-A2055-ECT	-		2.0	2.0	2.0	21.1	5.5	3.5	2.0	31.5
3G3M1-A2075-ECT	3G3M1-A2055-ECT	7.5	3.5	2.0	2.0	28.8	8.0	5.5	3.5	42.7

Model		Maximum applicable motor capacity [kW]	Recommended wire size [mm ²]							
			Main power supply input (L1/R, L2/S, L3/T)							
When DC reactor (DCR) is used				Without DC reactor						
HHD mode	HND mode		Allowable temperature (Note 1)			Current value [A]	Allowable temperature (Note 1)			Current value [A]
		60°C	75°C	90°C	60°C		75°C	90°C		
3G3M1-A2110-ECT	3G3M1-A2075-ECT	11	8.0	5.5	3.5	42.2	14.0	8.0	5.5	60.7
3G3M1-A2150-ECT	3G3M1-A2110-ECT	15	14.0	8.0	5.5	57.6	22.0	14.0	14.0	80.0
3G3M1-A2185-ECT	3G3M1-A2150-ECT	18.5	14.0	14.0	8.0	71.0	38.0*1	22.0	14.0	97.0
-	3G3M1-A2185-ECT	22	22.0	14.0	14.0	84.4	38.0*1	22.0	14.0	112.0

Model		Maximum applicable motor capacity [kW]	Recommended wire size [mm ²]							
			Inverter output (U, V, W)							
HHD mode				HND mode						
HHD mode	HND mode		Allowable temperature (Note 1)			Current value [A]	Allowable temperature (Note 1)			Current value [A]
		60°C	75°C	90°C	60°C		75°C	90°C		
3G3M1-A2001-ECT	-	0.1	2.0	2.0	2.0	1.0	-	-	-	-
3G3M1-A2002-ECT	3G3M1-A2001-ECT	0.2	2.0	2.0	2.0	1.6	2.0	2.0	2.0	1.3
-	3G3M1-A2002-ECT	0.4	-	-	-	-	2.0	2.0	2.0	2.0
3G3M1-A2004-ECT	-		2.0	2.0	2.0	3.0	-	-	-	-
-	3G3M1-A2004-ECT	0.75	-	-	-	-	2.0	2.0	2.0	3.5
3G3M1-A2007-ECT	-		2.0	2.0	2.0	5.0	-	-	-	-
-	3G3M1-A2007-ECT	1.1	-	-	-	-	2.0	2.0	2.0	6.0
3G3M1-A2015-ECT	-	1.5	2.0	2.0	2.0	8.0	-	-	-	-
-	3G3M1-A2015-ECT	2.2	-	-	-	-	2.0	2.0	2.0	9.6
3G3M1-A2022-ECT	-		2.0	2.0	2.0	11.0	-	-	-	-
-	3G3M1-A2022-ECT	3	-	-	-	-	2.0	2.0	2.0	12.0
3G3M1-A2037-ECT	-	3.7	2.0	2.0	2.0	17.5	-	-	-	-

Model		Maximum applicable motor capacity [kW]	Recommended wire size [mm ²]							
			Inverter output (U, V, W)							
HHD mode	HND mode		HHD mode				HND mode			
			Allowable temperature (Note 1)			Current value [A]	Allowable temperature (Note 1)			Current value [A]
		60°C	75°C	90°C	60°C		75°C	90°C		
-	3G3M1-A2037-ECT	5.5	-	-	-	-	2.0	2.0	2.0	19.6
3G3M1-A2055-ECT	-		3.5	2.0	2.0	25.0	-	-	-	-
3G3M1-A2075-ECT	3G3M1-A2055-ECT	7.5	5.5	3.5	2.0	33.0	3.5	3.5	2.0	30.0
3G3M1-A2110-ECT	3G3M1-A2075-ECT	11	8.0	5.5	3.5	47.0	5.5	5.5	3.5	40.0
3G3M1-A2150-ECT	3G3M1-A2110-ECT	15	14.0	8.0	5.5	60.0	14.0	8.0	5.5	56.0
3G3M1-A2185-ECT	3G3M1-A2150-ECT	18.5	22.0	14.0	8.0	76.0	14.0	14.0	8.0	69.0
-	3G3M1-A2185-ECT	22	22.0	14.0	14.0	90.0	22.0	14.0	14.0	88.0

Model		Maximum applicable motor capacity [kW]	Recommended wire size [mm ²]				
			DC reactor connection (P1, P(+))				
HHD mode	HND mode		Allowable temperature (Note 1)			Current value [A]	
			60°C	75°C	90°C		
3G3M1-A2001-ECT	-	0.1	2.0	2.0	2.0	0.7	
3G3M1-A2002-ECT	3G3M1-A2001-ECT	0.2	2.0	2.0	2.0	1.1	
-	3G3M1-A2002-ECT	0.4	2.0	2.0	2.0	2.0	
3G3M1-A2004-ECT	-		2.0	2.0	2.0	2.0	
-	3G3M1-A2004-ECT	0.75	2.0	2.0	2.0	3.7	
3G3M1-A2007-ECT	-		2.0	2.0	2.0	3.7	
-	3G3M1-A2007-ECT	1.1	2.0	2.0	2.0	5.3	
3G3M1-A2015-ECT	-	1.5	2.0	2.0	2.0	7.0	
-	3G3M1-A2015-ECT	2.2	2.0	2.0	2.0	10.2	
3G3M1-A2022-ECT	-		2.0	2.0	2.0	10.2	
-	3G3M1-A2022-ECT	3	2.0	2.0	2.0	14.3	
3G3M1-A2037-ECT	-	3.7	2.0	2.0	2.0	17.1	
-	3G3M1-A2037-ECT	5.5	3.5	2.0	2.0	24.4	
3G3M1-A2055-ECT	-		3.5	2.0	2.0	25.8	
3G3M1-A2075-ECT	3G3M1-A2055-ECT	7.5	5.5	3.5	3.5	35.3	
3G3M1-A2110-ECT	3G3M1-A2075-ECT	11	14.0	5.5	5.5	51.7	
3G3M1-A2150-ECT	3G3M1-A2110-ECT	15	14.0	14.0	8.0	70.5	
3G3M1-A2185-ECT	3G3M1-A2150-ECT	18.5	22.0	14.0	14.0	87.0	

Model		Maximum applicable motor capacity [kW]	Recommended wire size [mm ²]			
			DC reactor connection (P1, P(+))			
HHD mode	HND mode		Allowable temperature (Note 1)			Current value [A]
		60°C	75°C	90°C		
-	3G3M1-A2185-ECT	22	38.0*1	22.0	14.0	103.4

Model		Maximum applicable motor capacity [kW]	Recommended wire size [mm ²]							
			Brake resistance connection (P(+), DB)							
HHD mode	HND mode		HHD mode				HND mode			
		Allowable temperature (Note 1)			Current value [A]	Allowable temperature (Note 1)			Current value [A]	
		60°C	75°C	90°C		60°C	75°C	90°C		
3G3M1-A2001-ECT	-	0.1	2.0	2.0	2.0	0.3	-	-	-	-
3G3M1-A2002-ECT	3G3M1-A2001-ECT	0.2	2.0	2.0	2.0	0.4	2.0	2.0	2.0	0.3
-	3G3M1-A2002-ECT	0.4	-	-	-	-	2.0	2.0	2.0	0.4
3G3M1-A2004-ECT	-		2.0	2.0	2.0	0.5	-	-	-	-
-	3G3M1-A2004-ECT	0.75	-	-	-	-	2.0	2.0	2.0	0.6
3G3M1-A2007-ECT	-		2.0	2.0	2.0	0.7	-	-	-	-
-	3G3M1-A2007-ECT	1.1	-	-	-	-	2.0	2.0	2.0	0.8
3G3M1-A2015-ECT	-	1.5	2.0	2.0	2.0	1.4	-	-	-	-
-	3G3M1-A2015-ECT	2.2	-	-	-	-	2.0	2.0	2.0	1.5
3G3M1-A2022-ECT	-		2.0	2.0	2.0	1.7	-	-	-	-
-	3G3M1-A2022-ECT	3	-	-	-	-	2.0	2.0	2.0	1.7
3G3M1-A2037-ECT	-	3.7	2.0	2.0	2.0	2.4	-	-	-	-
-	3G3M1-A2037-ECT	5.5	-	-	-	-	2.0	2.0	2.0	2.5
3G3M1-A2055-ECT	-		2.0	2.0	2.0	3.8	-	-	-	-
3G3M1-A2075-ECT	3G3M1-A2055-ECT	7.5	2.0	2.0	2.0	5.0	2.0	2.0	2.0	3.8
3G3M1-A2110-ECT	3G3M1-A2075-ECT	11	2.0	2.0	2.0	7.5	2.0	2.0	2.0	5.3

Model		Maximum applicable motor capacity [kW]	Recommended wire size [mm ²]							
			Brake resistance connection (P(+), DB)							
HHD mode	HND mode		HHD mode				HND mode			
			Allowable temperature (Note 1)			Current value [A]	Allowable temperature (Note 1)			Current value [A]
		60°C	75°C	90°C	60°C		75°C	90°C		
3G3M1-A2150-ECT	3G3M1-A2110-ECT	15	2.0	2.0	2.0	9.4	2.0	2.0	2.0	7.5
3G3M1-A2185-ECT	3G3M1-A2150-ECT	18.5	2.0	2.0	2.0	12.7	2.0	2.0	2.0	9.0
-	3G3M1-A2185-ECT	22	2.0	2.0	2.0	13.8	2.0	2.0	2.0	12.0

Model		Maximum applicable motor capacity [kW]	Recommended wire size [mm ²]		
			Inverter ground (G)		
HHD mode	HND mode		Allowable temperature (Note 1)		
			60°C	75°C	90°C
		3G3M1-A2001-ECT	-	0.1	2.0
3G3M1-A2002-ECT	3G3M1-A2001-ECT	0.2	2.0	2.0	2.0
-	3G3M1-A2002-ECT	0.4	2.0	2.0	2.0
3G3M1-A2004-ECT	-		2.0	2.0	2.0
-	3G3M1-A2004-ECT	0.75	2.0	2.0	2.0
3G3M1-A2007-ECT	-		2.0	2.0	2.0
-	3G3M1-A2007-ECT	1.1	2.0	2.0	2.0
3G3M1-A2015-ECT	-	1.5	2.0	2.0	2.0
-	3G3M1-A2015-ECT	2.2	2.0	2.0	2.0
3G3M1-A2022-ECT	-		2.0	2.0	2.0
-	3G3M1-A2022-ECT	3	2.0	2.0	2.0
3G3M1-A2037-ECT	-	3.7	2.0	2.0	2.0
-	3G3M1-A2037-ECT	5.5	3.5	3.5	3.5
3G3M1-A2055-ECT	-		3.5	3.5	3.5
3G3M1-A2075-ECT	3G3M1-A2055-ECT	7.5	5.5	5.5	5.5
3G3M1-A2110-ECT	3G3M1-A2075-ECT	11	5.5	5.5	5.5
3G3M1-A2150-ECT	3G3M1-A2110-ECT	15	5.5	5.5	5.5
3G3M1-A2220-ECT	3G3M1-A2150-ECT	18.5	8.0	8.0	8.0
-	3G3M1-A2185-ECT	22	8.0	8.0	8.0

● Three-phase 400-V class (Panel internal temperature 40°C or less)

Model		Maximum applicable motor capacity [kW]	Recommended wire size [mm ²]							
			Main power supply input (L1/R, L2/S, L3/T)							
When DC reactor (DCR) is used				Without DC reactor (DCR)						
HHD mode	HND mode		Allowable temperature (Note 1)			Current value [A]	Allowable temperature (Note 1)			Current value [A]
		60°C	75°C	90°C	60°C		75°C	90°C		
3G3M1-A4004-ECT	-	0.4	2.0	2.0	2.0	0.9	2.0	2.0	2.0	1.7
-	3G3M1-A4004-ECT	0.75	2.0	2.0	2.0	1.5	2.0	2.0	2.0	2.7
3G3M1-A4007-ECT	-		2.0	2.0	2.0	1.6	2.0	2.0	2.0	3.1
-	3G3M1-A4007-ECT	1.1	2.0	2.0	2.0	2.1	2.0	2.0	2.0	3.9
3G3M1-A4015-ECT	-	1.5	2.0	2.0	2.0	3.0	2.0	2.0	2.0	5.9
-	3G3M1-A4015-ECT	2.2	2.0	2.0	2.0	4.2	2.0	2.0	2.0	7.3
3G3M1-A4022-ECT	-		2.0	2.0	2.0	4.4	2.0	2.0	2.0	8.2
-	3G3M1-A4022-ECT	3	2.0	2.0	2.0	5.8	2.0	2.0	2.0	11.3
3G3M1-A4030-ECT	-									
-	3G3M1-A4030-ECT	3.7	2.0	2.0	2.0	7.3	2.0	2.0	2.0	13.0
3G3M1-A4040-ECT	-									
-	3G3M1-A4040-ECT	5.5	2.0	2.0	2.0	10.1	2.0	2.0	2.0	16.8
3G3M1-A4055-ECT	-		2.0	2.0	2.0	10.6	2.0	2.0	2.0	17.3
3G3M1-A4075-ECT	3G3M1-A4055-ECT	7.5	2.0	2.0	2.0	14.4	3.5	2.0	2.0	23.2
3G3M1-A4110-ECT	3G3M1-A4075-ECT	11	2.0	2.0	2.0	21.1	5.5	3.5	2.0	33.0
3G3M1-A4150-ECT	3G3M1-A4110-ECT	15	3.5	2.0	2.0	28.8	8.0	5.5	3.5	43.8
3G3M1-A4185-ECT	3G3M1-A4150-ECT	18.5	5.5	3.5	3.5	35.5	14.0	8.0	5.5	52.3
3G3M1-A4220-ECT	3G3M1-A4185-ECT	22	8.0	5.5	3.5	42.2	14.0	8.0	5.5	60.6
-	3G3M1-A4220-ECT	30	14.0	8.0	5.5	57.0	22.0	14.0	8.0	77.9

Model		Maximum applicable motor capacity [kW]	Recommended wire size [mm ²]							
			Inverter output (U, V, W)							
HHD mode	HND mode		HHD mode				HND mode			
			Allowable temperature (Note 1)			Current value [A]	Allowable temperature (Note 1)			Current value [A]
		60°C	75°C	90°C	60°C		75°C	90°C		
3G3M1-A4004-ECT	-	0.4	2.0	2.0	2.0	1.8	-	-	-	-
-	3G3M1-A4004-ECT	0.75	-	-	-	-	2.0	2.0	2.0	2.1
3G3M1-A4007-ECT	-		2.0	2.0	2.0	3.4	-	-	-	-
-	3G3M1-A4007-ECT	1.1	-	-	-	-	2.0	2.0	2.0	4.1
3G3M1-A4015-ECT	-	1.5	2.0	2.0	2.0	4.8	-	-	-	-
-	3G3M1-A4015-ECT	2.2	-	-	-	-	2.0	2.0	2.0	5.5
3G3M1-A4022-ECT	-		2.0	2.0	2.0	5.5	-	-	-	-
-	3G3M1-A4022-ECT	3	-	-	-	-	2.0	2.0	2.0	6.9
3G3M1-A4030-ECT	-		-	-	-	-	-	-	-	-
-	3G3M1-A4030-ECT	3.7	2.0	2.0	2.0	9.2	-	-	-	-
3G3M1-A4040-ECT	-		-	-	-	-	-	-	-	-
-	3G3M1-A4040-ECT	5.5	-	-	-	-	2.0	2.0	2.0	11.1
3G3M1-A4055-ECT	-		2.0	2.0	2.0	14.8	-	-	-	-
3G3M1-A4075-ECT	3G3M1-A4055-ECT	7.5	2.0	2.0	2.0	18.0	2.0	2.0	2.0	17.5
3G3M1-A4110-ECT	3G3M1-A4075-ECT	11	3.5	2.0	2.0	24.0	3.5	2.0	2.0	23.0
3G3M1-A4150-ECT	3G3M1-A4110-ECT	15	5.5	3.5	2.0	31.0	5.5	3.5	2.0	31.0
3G3M1-A4185-ECT	3G3M1-A4150-ECT	18.5	5.5	3.5	3.5	39.0	5.5	3.5	3.5	38.0
3G3M1-A4220-ECT	3G3M1-A4185-ECT	22	8.0	5.5	3.5	45.0	8.0	5.5	3.5	45.0
-	3G3M1-A4220-ECT	30	-	-	-	-	14.0	8.0	5.5	60.0

Model		Maximum applicable motor capacity [kW]	Recommended wire size [mm ²] Maximum applicable motor capacity [kW]							
			Main power supply input (L1/R, L2/S, L3/T)							
When DC reactor (DCR) is used				Without DC reactor (DCR)						
HD mode	ND mode		Allowable temperature (Note 1)			Current value [A]	Allowable temperature (Note 1)			Current value [A]
		60°C	75°C	90°C	60°C		75°C	90°C		
3G3M1-A4004-ECT	3G3M1-A4004-ECT	0.75	2.0	2.0	2.0	1.5	2.0	2.0	2.0	2.7
3G3M1-A4007-ECT	-	1.1	2.0	2.0	2.0	2.1	2.0	2.0	2.0	3.9
-	3G3M1-A4007-ECT	1.5	2.0	2.0	2.0	2.9	2.0	2.0	2.0	4.8
3G3M1-A4015-ECT	3G3M1-A4015-ECT	2.2	2.0	2.0	2.0	4.2	2.0	2.0	2.0	7.3
3G3M1-A4022-ECT	3G3M1-A4022-ECT	3	2.0	2.0	2.0	5.8	2.0	2.0	2.0	11.3
3G3M1-A4030-ECT	3G3M1-A4030-ECT	5.5	2.0	2.0	2.0	10.1	2.0	2.0	2.0	16.8
3G3M1-A4040-ECT	3G3M1-A4040-ECT									
3G3M1-A4055-ECT	-	7.5	2.0	2.0	2.0	14.4	3.5	2.0	2.0	23.2
3G3M1-A4075-ECT	3G3M1-A4075-ECT	11	2.0	2.0	2.0	21.1	5.5	3.5	2.0	33.0
3G3M1-A4110-ECT	3G3M1-A4075-ECT	15	3.5	2.0	2.0	28.8	8.0	5.5	3.5	43.8
3G3M1-A4150-ECT	3G3M1-A4110-ECT	18.5	5.5	3.5	3.5	35.5	14.0	8.0	5.5	52.3
3G3M1-A4185-ECT	3G3M1-A4150-ECT	22	8.0	5.5	3.5	42.2	14.0	8.0	5.5	60.6
3G3M1-A4220-ECT	3G3M1-A4185-ECT	30	14.0	8.0	5.5	57.0	22.0	14.0	8.0	77.9
-	3G3M1-A4220-ECT	37	14.0	14.0	8.0	68.5	38*1	14.0	14.0	94.3

Model		Maximum applicable motor capacity [kW]	Recommended wire size [mm ²]							
			Inverter output (U, V, W)							
HD mode				ND mode						
HD mode	ND mode		Allowable temperature (Note 1)			Current value [A]	Allowable temperature (Note 1)			Current value [A]
		60°C	75°C	90°C	60°C		75°C	90°C		
3G3M1-A4004-ECT	3G3M1-A4004-ECT	0.75	2.0	2.0	2.0	1.8	2.0	2.0	2.0	2.1
3G3M1-A4007-ECT	-	1.1	2.0	2.0	2.0	3.4	-	-	-	-

Model		Maximum applicable motor capacity [kW]	Recommended wire size [mm ²]							
			Inverter output (U, V, W)							
HD mode	ND mode		HD mode				ND mode			
			Allowable temperature (Note 1)			Current value [A]	Allowable temperature (Note 1)			Current value [A]
		60°C	75°C	90°C	60°C		75°C	90°C		
-	3G3M1-A4007-ECT	1.5	-	-	-	-	2.0	2.0	2.0	4.1
3G3M1-A4015-ECT	3G3M1-A4015-ECT	2.2	2.0	2.0	2.0	5.0	2.0	2.0	2.0	5.5
3G3M1-A4022-ECT	3G3M1-A4022-ECT	3	2.0	2.0	2.0	6.3	2.0	2.0	2.0	6.9
3G3M1-A4030-ECT	3G3M1-A4030-ECT	5.5	2.0	2.0	2.0	11.1	2.0	2.0	2.0	12.0
3G3M1-A4040-ECT	3G3M1-A4040-ECT									
3G3M1-A4055-ECT	-	7.5	2.0	2.0	2.0	17.5	-	-	-	-
3G3M1-A4075-ECT	3G3M1-A4055-ECT	11	3.5	2.0	2.0	23.0	2.0	2.0	2.0	21.5
3G3M1-A4110-ECT	3G3M1-A4075-ECT	15	5.5	3.5	2.0	31.0	3.5	2.0	2.0	28.5
3G3M1-A4150-ECT	3G3M1-A4110-ECT	18.5	5.5	3.5	3.5	38.0	5.5	3.5	3.5	37.0
3G3M1-A4185-ECT	3G3M1-A4150-ECT	22	8.0	5.5	3.5	45.0	8.0	5.5	3.5	44.0
3G3M1-A4220-ECT	3G3M1-A4185-ECT	30	14.0	8.0	5.5	60.0	14.0	8.0	5.5	59.0
-	3G3M1-A4220-ECT	37	-	-	-	-	22.0	14.0	8.0	72.0

Model		Maximum applicable motor capacity [kW]	Recommended wire size [mm ²]				
			DC reactor connection (P1, P(+))				
HHD mode	HND mode		Allowable temperature (Note 1)			Current value [A]	
			60°C	75°C	90°C		
3G3M1-A4004-ECT	-	0.4	2.0	2.0	2.0	1.0	
-	3G3M1-A4004-ECT	0.75	2.0	2.0	2.0	1.8	
3G3M1-A4007-ECT	-		2.0	2.0	2.0	2.0	
-	3G3M1-A4007-ECT	1.1	2.0	2.0	2.0	2.6	
3G3M1-A4015-ECT	-	1.5	2.0	2.0	2.0	3.7	
-	3G3M1-A4015-ECT	2.2	2.0	2.0	2.0	5.1	
3G3M1-A4022-ECT	-		2.0	2.0	2.0	5.4	
-	3G3M1-A4022-ECT	3	2.0	2.0	2.0	7.1	
3G3M1-A4030-ECT	-						

Model		Maximum applicable motor capacity [kW]	Recommended wire size [mm ²]			
			DC reactor connection (P1, P(+))			
HHD mode	HND mode		Allowable temperature (Note 1)			Current value [A]
		60°C	75°C	90°C		
-	3G3M1-A4030-ECT	3.7	2.0	2.0	2.0	8.9
3G3M1-A4040-ECT	-					
-	3G3M1-A4040-ECT	5.5	2.0	2.0	2.0	12.4
3G3M1-A4055-ECT	-		2.0	2.0	2.0	
3G3M1-A4075-ECT	3G3M1-A4055-ECT	7.5	2.0	2.0	2.0	17.6
3G3M1-A4110-ECT	3G3M1-A4075-ECT	11	3.5	2.0	2.0	25.8
3G3M1-A4150-ECT	3G3M1-A4110-ECT	15	5.5	3.5	3.5	35.3
3G3M1-A4185-ECT	3G3M1-A4150-ECT	18.5	8.0	5.5	3.5	43.5
3G3M1-A4220-ECT	3G3M1-A4185-ECT	22	14.0	5.5	5.5	51.7
-	3G3M1-A4220-ECT	30	14.0	14.0	8.0	69.8

Model		Maximum applicable motor capacity [kW]	Recommended wire size [mm ²]							
			Brake resistance connection (P(+), DB)							
HHD mode	HND mode		HHD mode				HND mode			
		Allowable temperature (Note 1)			Current value [A]	Allowable temperature (Note 1)			Current value [A]	
		60°C	75°C	90°C		60°C	75°C	90°C		
3G3M1-A4004-ECT	-	0.4	2.0	2.0	2.0	0.4	-	-	-	-
-	3G3M1-A4004-ECT	0.75	-	-	-	-	2.0	2.0	2.0	0.4
3G3M1-A4007-ECT	-		2.0	2.0	2.0	0.5	-	-	-	-
-	3G3M1-A4007-ECT	1.1	-	-	-	-	2.0	2.0	2.0	0.6
3G3M1-A4015-ECT	-	1.5	2.0	2.0	2.0	0.7	-	-	-	-
-	3G3M1-A4015-ECT	2.2	-	-	-	-	2.0	2.0	2.0	0.8
3G3M1-A4022-ECT	-		2.0	2.0	2.0	0.9	-	-	-	-
-	3G3M1-A4022-ECT	3	-	-	-	-	2.0	2.0	2.0	0.9
3G3M1-A4030-ECT	-									
-	3G3M1-A4030-ECT	3.7	2.0	2.0	2.0	1.2	-	-	-	-
3G3M1-A4040-ECT	-									

Model		Maximum applicable motor capacity [kW]	Recommended wire size [mm ²]							
			Brake resistance connection (P(+), DB)							
HHD mode	HND mode		HHD mode				HND mode			
			Allowable temperature (Note 1)			Current value [A]	Allowable temperature (Note 1)			Current value [A]
		60°C	75°C	90°C	60°C		75°C	90°C		
-	3G3M1-A4040-ECT	5.5	-	-	-	-	2.0	2.0	2.0	1.3
3G3M1-A4055-ECT	-		2.0	2.0	2.0	1.9	-	-	-	-
3G3M1-A4075-ECT	3G3M1-A4055-ECT	7.5	2.0	2.0	2.0	2.5	2.0	2.0	2.0	1.9
3G3M1-A4110-ECT	3G3M1-A4075-ECT	11	2.0	2.0	2.0	3.8	2.0	2.0	2.0	2.7
3G3M1-A4150-ECT	3G3M1-A4110-ECT	15	2.0	2.0	2.0	4.7	2.0	2.0	2.0	3.8
3G3M1-A4185-ECT	3G3M1-A4150-ECT	18.5	2.0	2.0	2.0	6.5	2.0	2.0	2.0	4.5
3G3M1-A4220-ECT	3G3M1-A4185-ECT	22	2.0	2.0	2.0	7.1	2.0	2.0	2.0	6.2
-	3G3M1-A4220-ECT	30	-	-	-	-	2.0	2.0	2.0	7.2

Model		Maximum applicable motor capacity [kW]	Recommended wire size [mm ²]		
			Inverter ground (G)		
HHD mode	HND mode		Allowable temperature (Note 1)		
			60°C	75°C	90°C
		3G3M1-A4004-ECT	-	0.4	2.0
-	3G3M1-A4004-ECT	0.75	2.0	2.0	2.0
3G3M1-A4007-ECT	-		2.0	2.0	2.0
-	3G3M1-A4007-ECT	1.1	2.0	2.0	2.0
3G3M1-A4015-ECT	-	1.5	2.0	2.0	2.0
-	3G3M1-A4015-ECT	2.2	2.0	2.0	2.0
3G3M1-A4022-ECT	-		2.0	2.0	2.0
-	3G3M1-A4022-ECT	3	2.0	2.0	2.0
3G3M1-A4030-ECT	-	3.7			
-	3G3M1-A4030-ECT		2.0	2.0	2.0
3G3M1-A4040-ECT	-				
-	3G3M1-A4040-ECT	5.5	2.0	2.0	2.0
3G3M1-A4055-ECT	-		2.0	2.0	2.0
3G3M1-A4075-ECT	3G3M1-A4055-ECT	7.5	2.0	2.0	2.0
3G3M1-A4110-ECT	3G3M1-A4075-ECT	11	3.5	3.5	3.5
3G3M1-A4150-ECT	3G3M1-A4110-ECT	15	5.5	5.5	5.5

Model		Maximum applicable motor capacity [kW]	Recommended wire size [mm ²]		
			Inverter ground (G)		
			Allowable temperature (Note 1)		
HHD mode	HND mode		60°C	75°C	90°C
3G3M1-A4185-ECT	3G3M1-A4150-ECT	18.5	5.5	5.5	5.5
3G3M1-A4220-ECT	3G3M1-A4185-ECT	22	5.5	5.5	5.5
-	3G3M1-A4220-ECT	30	8.0	8.0	8.0

Model		Maximum applicable motor capacity [kW]	Recommended wire size [mm ²]			
			DC reactor connection (P1, P(+))			
			Allowable temperature (Note 1)			Current value [A]
HD mode	ND mode		60°C	75°C	90°C	
3G3M1-A4004-ECT	3G3M1-A4004-ECT	0.75	2.0	2.0	2.0	1.8
3G3M1-A4007-ECT	-	1.1	2.0	2.0	2.0	2.6
-	3G3M1-A4007-ECT	1.5	2.0	2.0	2.0	3.6
3G3M1-A4015-ECT	3G3M1-A4015-ECT	2.2	2.0	2.0	2.0	5.1
3G3M1-A4022-ECT	3G3M1-A4022-ECT	3	2.0	2.0	2.0	7.1
3G3M1-A4030-ECT	3G3M1-A4030-ECT	5.5	2.0	2.0	2.0	12.4
3G3M1-A4040-ECT	3G3M1-A4040-ECT					
3G3M1-A4055-ECT	-	7.5	2.0	2.0	2.0	17.6
3G3M1-A4075-ECT	3G3M1-A4055-ECT	11	3.5	2.0	2.0	25.8
3G3M1-A4110-ECT	3G3M1-A4075-ECT	15	5.5	3.5	3.5	35.3
3G3M1-A4150-ECT	3G3M1-A4110-ECT	18.5	8.0	5.5	3.5	43.5
3G3M1-A4185-ECT	3G3M1-A4150-ECT	22	14.0	5.5	5.5	51.7
3G3M1-A4220-ECT	3G3M1-A4185-ECT	30	14.0	14.0	8.0	69.8
-	3G3M1-A4220-ECT	37	22.0	14.0	14.0	83.9

Model		Maximum applicable motor capacity [kW]	Recommended wire size [mm ²]							
			Brake resistance connection (P(+), DB)							
			HD mode				ND mode			
HD mode	ND mode		Allowable temperature (Note 1)			Current value [A]	Allowable temperature (Note 1)			Current value [A]
			60°C	75°C	90°C		60°C	75°C	90°C	
3G3M1-A4004-ECT	3G3M1-A4004-ECT	0.75	2.0	2.0	2.0	0.4	2.0	2.0	2.0	0.4
3G3M1-A4007-ECT	-	1.1	2.0	2.0	2.0	0.6	-	-	-	-
-	3G3M1-A4007-ECT	1.5	-	-	-	-	2.0	2.0	2.0	0.6

Model		Maximum applicable motor capacity [kW]	Recommended wire size [mm ²]							
			Brake resistance connection (P(+), DB)							
HD mode	ND mode		HD mode				ND mode			
			Allowable temperature (Note 1)			Current value [A]	Allowable temperature (Note 1)			Current value [A]
		60°C	75°C	90°C	60°C		75°C	90°C		
3G3M1-A4015-ECT	3G3M1-A4015-ECT	2.2	2.0	2.0	2.0	0.8	2.0	2.0	2.0	0.8
3G3M1-A4022-ECT	3G3M1-A4022-ECT	3	2.0	2.0	2.0	0.9	2.0	2.0	2.0	0.9
3G3M1-A4030-ECT	3G3M1-A4030-ECT	5.5	2.0	2.0	2.0	1.3	2.0	2.0	2.0	1.3
3G3M1-A4040-ECT	3G3M1-A4040-ECT									
3G3M1-A4055-ECT	-	7.5	2.0	2.0	2.0	1.9	-	-	-	-
3G3M1-A4075-ECT	3G3M1-A4075-ECT	11	2.0	2.0	2.0	2.7	2.0	2.0	2.0	2.3
3G3M1-A4110-ECT	3G3M1-A4075-ECT	15	2.0	2.0	2.0	3.8	2.0	2.0	2.0	3.1
3G3M1-A4150-ECT	3G3M1-A4110-ECT	18.5	2.0	2.0	2.0	4.5	2.0	2.0	2.0	4.2
3G3M1-A4185-ECT	3G3M1-A4150-ECT	22	2.0	2.0	2.0	6.2	2.0	2.0	2.0	4.9
3G3M1-A4220-ECT	3G3M1-A4185-ECT	30	2.0	2.0	2.0	7.2	2.0	2.0	2.0	7.2
-	3G3M1-A4220-ECT	37	-	-	-	-	2.0	2.0	2.0	8.0

Model		Maximum applicable motor capacity [kW]	Recommended wire size [mm ²]		
			Inverter ground (G)		
HD mode	ND mode		Allowable temperature (Note 1)		
			60°C	75°C	90°C
		60°C	75°C	90°C	
3G3M1-A4004-ECT	3G3M1-A4004-ECT	0.75	2.0	2.0	2.0
3G3M1-A4007-ECT	-	1.1	2.0	2.0	2.0
-	3G3M1-A4007-ECT	1.5	2.0	2.0	2.0
3G3M1-A4015-ECT	3G3M1-A4015-ECT	2.2	2.0	2.0	2.0
3G3M1-A4022-ECT	3G3M1-A4022-ECT	3	2.0	2.0	2.0
3G3M1-A4030-ECT	3G3M1-A4030-ECT	5.5	2.0	2.0	2.0
3G3M1-A4040-ECT	3G3M1-A4040-ECT				
3G3M1-A4055-ECT	-	7.5	2.0	2.0	2.0
3G3M1-A4075-ECT	3G3M1-A4055-ECT	11	3.5	3.5	3.5
3G3M1-A4110-ECT	3G3M1-A4075-ECT	15	5.5	5.5	5.5
3G3M1-A4150-ECT	3G3M1-A4110-ECT	18.5	5.5	5.5	5.5

Model		Maximum applicable motor capacity [kW]	Recommended wire size [mm ²]		
			Inverter ground (G)		
HD mode	ND mode		Allowable temperature (Note 1)		
			60°C	75°C	90°C
3G3M1-A4185-ECT	3G3M1-A4150-ECT	22	5.5	5.5	5.5
3G3M1-A4220-ECT	3G3M1-A4185-ECT	30	8.0	8.0	8.0
-	3G3M1-A4220-ECT	37	8.0	8.0	8.0

● Single-phase 200-V class (Panel internal temperature 40°C or less)

Model		Maximum applicable motor capacity [kW]	Recommended wire size [mm ²]							
			Main power supply input (L1/R, L2/S, L3/T)							
HHD mode	HND mode		When DC reactor (DCR) is used				Without DC reactor (DCR)			
			Allowable temperature (Note 1)			Current value [A]	Allowable temperature (Note 1)			Current value [A]
60°C	75°C	90°C	60°C	75°C	90°C					
3G3M1-AB001-ECT	-	0.1	2.0	2.0	2.0	1.1	2.0	2.0	2.0	1.8
-	3G3M1-AB001-ECT	0.2	2.0	2.0	2.0	2.2	2.0	2.0	2.0	3.3
3G3M1-AB002-ECT	-		2.0	2.0	2.0	2.0	2.0	2.0	2.0	3.3
-	3G3M1-AB002-ECT	0.4	2.0	2.0	2.0	3.7	2.0	2.0	2.0	4.9
3G3M1-AB004-ECT	-		2.0	2.0	2.0	3.5	2.0	2.0	2.0	5.4
-	3G3M1-AB004-ECT	0.55	2.0	2.0	2.0	4.6	2.0	2.0	2.0	7.3
3G3M1-AB007-ECT	-	0.75	2.0	2.0	2.0	6.4	2.0	2.0	2.0	9.7
-	3G3M1-AB007-ECT	1.1	2.0	2.0	2.0	9.4	2.0	2.0	2.0	13.8
3G3M1-AB015-ECT	-	1.5	2.0	2.0	2.0	11.6	2.0	2.0	2.0	16.4
-	3G3M1-AB015-ECT	2.2	2.0	2.0	2.0	17.9	2.0	2.0	2.0	20.2
3G3M1-AB022-ECT	-		2.0	2.0	2.0	17.5	2.0	2.0	2.0	22.0
-	3G3M1-AB022-ECT	3	3.5	2.0	2.0	25.0	3.5	2.0	2.0	26.0
3G3M1-AB037-ECT	-	3.7	5.5	3.5	2.0	31.8	8.0	5.5	3.5	45.4

Model		Maximum applicable motor capacity [kW]	Recommended wire size [mm ²]							
			Inverter output (U, V, W)							
HHD mode	HND mode		HHD mode				HND mode			
			Allowable temperature (Note 1)			Current value [A]	Allowable temperature (Note 1)			Current value [A]
		60°C	75°C	90°C	60°C		75°C	90°C		
3G3M1-AB001-ECT	-	0.1	2.0	2.0	2.0	1.0	-	-	-	-
-	3G3M1-AB001-ECT	0.2	-	-	-	-	2.0	2.0	2.0	1.2
3G3M1-AB002-ECT	-		2.0	2.0	2.0	1.6	-	-	-	-
-	3G3M1-AB002-ECT	0.4	-	-	-	-	2.0	2.0	2.0	1.9
3G3M1-AB004-ECT	-		2.0	2.0	2.0	3.0	-	-	-	-
-	3G3M1-AB004-ECT	0.55	-	-	-	-	2.0	2.0	2.0	3.5
3G3M1-AB007-ECT	-	0.75	2.0	2.0	2.0	5.0	-	-	-	-
-	3G3M1-AB007-ECT	1.1	-	-	-	-	2.0	2.0	2.0	6.0
3G3M1-AB015-ECT	-	1.5	2.0	2.0	2.0	8.0	-	-	-	-
-	3G3M1-AB015-ECT	2.2	-	-	-	-	2.0	2.0	2.0	9.6
3G3M1-AB022-ECT	-		2.0	2.0	2.0	11.0	-	-	-	-
-	3G3M1-AB022-ECT	3	-	-	-	-	2.0	2.0	2.0	12.0
3G3M1-AB037-ECT	-	3.7	2.0	2.0	2.0	17.5	-	-	-	-

Model		Maximum applicable motor capacity [kW]	Recommended wire size [mm ²]			
			DC reactor connection (P1, P(+))			
HHD mode	HND mode		Allowable temperature (Note 1)			Current value [A]
			60°C	75°C	90°C	
3G3M1-AB001-ECT	-	0.1	2.0	2.0	2.0	1.3
-	3G3M1-AB001-ECT	0.2	2.0	2.0	2.0	2.7
3G3M1-AB002-ECT	-		2.0	2.0	2.0	2.4
-	3G3M1-AB002-ECT	0.4	2.0	2.0	2.0	4.5
3G3M1-AB004-ECT	-		2.0	2.0	2.0	4.3
-	3G3M1-AB004-ECT	0.55	2.0	2.0	2.0	5.6
3G3M1-AB007-ECT	-	0.75	2.0	2.0	2.0	7.8

Model		Maximum applicable motor capacity [kW]	Recommended wire size [mm ²]			
			DC reactor connection (P1, P(+))			
HHD mode	HND mode		Allowable temperature (Note 1)			Current value [A]
		60°C	75°C	90°C		
-	3G3M1-AB007-ECT	1.1	2.0	2.0	2.0	11.5
3G3M1-AB015-ECT	-	1.5	2.0	2.0	2.0	14.2
-	3G3M1-AB015-ECT	2.2	2.0	2.0	2.0	21.9
3G3M1-AB022-ECT	-		2.0	2.0	2.0	21.4
-	3G3M1-AB022-ECT	3	2.0	2.0	2.0	30.6
3G3M1-AB037-ECT	-	3.7	5.5	3.5	3.5	38.9

Model		Maximum applicable motor capacity [kW]	Recommended wire size [mm ²]							
			Brake resistance connection (P(+), DB)							
HHD mode	HND mode		HHD mode				HND mode			
		Allowable temperature (Note 1)			Current value [A]	Allowable temperature (Note 1)			Current value [A]	
60°C	75°C	90°C	60°C	75°C		90°C				
3G3M1-AB001-ECT	-	0.1	2.0	2.0	2.0	0.3	-	-	-	-
-	3G3M1-AB001-ECT	0.2	-	-	-	-	2.0	2.0	2.0	0.2
3G3M1-AB002-ECT	-		2.0	2.0	2.0	0.4	-	-	-	-
-	3G3M1-AB002-ECT	0.4	-	-	-	-	2.0	2.0	2.0	0.4
3G3M1-AB004-ECT	-		2.0	2.0	2.0	0.5	-	-	-	-
-	3G3M1-AB004-ECT	0.55	-	-	-	-	2.0	2.0	2.0	0.6
3G3M1-AB007-ECT	-	0.75	2.0	2.0	2.0	0.7	-	-	-	-
-	3G3M1-AB007-ECT	1.1	-	-	-	-	2.0	2.0	2.0	1.1
3G3M1-AB015-ECT	-	1.5	2.0	2.0	2.0	1.4	-	-	-	-
-	3G3M1-AB015-ECT	2.2	-	-	-	-	2.0	2.0	2.0	1.5
3G3M1-AB022-ECT	-		2.0	2.0	2.0	1.7	-	-	-	-
-	3G3M1-AB022-ECT	3	-	-	-	-	2.0	2.0	2.0	1.9
3G3M1-AB037-ECT	-	3.7	2.0	2.0	2.0	2.4	-	-	-	-

Model		Maximum applicable motor capacity [kW]	Recommended wire size [mm ²]		
HHD mode	HND mode		Inverter ground (G)		
			Allowable temperature (Note 1)		
			60°C	75°C	90°C
3G3M1-AB001-ECT	-	0.1	2.0	2.0	2.0
-	3G3M1-AB001-ECT	0.2	2.0	2.0	2.0
3G3M1-AB002-ECT	-		2.0	2.0	2.0
-	3G3M1-AB002-ECT	0.4	2.0	2.0	2.0
3G3M1-AB004-ECT	-		2.0	2.0	2.0
-	3G3M1-AB004-ECT	0.55	2.0	2.0	2.0
3G3M1-AB007-ECT	-	0.75	2.0	2.0	2.0
-	3G3M1-AB007-ECT	1.1	2.0	2.0	2.0
3G3M1-AB015-ECT	-	1.5	2.0	2.0	2.0
-	3G3M1-AB015-ECT	2.2	2.0	2.0	2.0
3G3M1-AB022-ECT	-		2.0	2.0	2.0
-	3G3M1-AB022-ECT	3	2.0	2.0	2.0
3G3M1-AB037-ECT	-	3.7	3.5	3.5	3.5

Note 1: At an allowable temperature of 60°C, use 600 V IV insulated wire, at 75°C 600 V HIV insulated wire, and at 90°C 600 V crosslinked polyethylene insulated wire.

Note 2: When the recommended wire size is 38 mm², use crimped terminal model No. 38-6 made by J.S.T. Mfg. Co., Ltd. or an equivalent product (*1 in table).

Note 3: When the recommended wire size is 60mm², use crimped terminal model No. 60-6 made by J.S.T. Mfg. Co., Ltd. or an equivalent product (*2 in table).

● Tightening torque

Model		Screw specification					
		Main circuit		For ground		Control power supply auxiliary input (R0, T0)	
		Terminal screw size	Tightening torque [N·m]	Terminal screw size	Tightening torque [N·m]	Terminal screw size	Tightening torque [N·m]
Three-phase 200 V	3G3M1-A2001-ECT	M3.5	0.8	M3.5	1.2	-	-
	3G3M1-A2002-ECT						
	3G3M1-A2004-ECT						
	3G3M1-A2007-ECT						
	3G3M1-A2015-ECT	M4	1.2	M4	1.8	-	-
	3G3M1-A2022-ECT						
	3G3M1-A2037-ECT						
	3G3M1-A2055-ECT	M5	3	M5	3	-	-
	3G3M1-A2075-ECT						
	3G3M1-A2110-ECT	M6	3	M6	3	-	-
	3G3M1-A2150-ECT						
3G3M1-A2185-ECT	M6 (No. 3)	5.8	M6 (No. 3)	5.8	M3.5	1.2	
Three-phase 400 V	3G3M1-A4004-ECT	M4	1.2	M4	1.8	-	-
	3G3M1-A4007-ECT						
	3G3M1-A4015-ECT						
	3G3M1-A4022-ECT						
	3G3M1-A4030-ECT						
	3G3M1-A4040-ECT						
	3G3M1-A4055-ECT	M5	3	M5	3	-	-
	3G3M1-A4075-ECT						
	3G3M1-A4110-ECT	M6	3	M6	3	-	-
	3G3M1-A4150-ECT						
	3G3M1-A4185-ECT	M6 (No. 3)	5.8	M6 (No. 3)	5.8	M3.5	1.2
	3G3M1-A4220-ECT						
	Single-phase 200 V	3G3M1-AB001-ECT	M3.5	0.8	M3.5	1.2	-
3G3M1-AB002-ECT							
3G3M1-AB004-ECT							
3G3M1-AB007-ECT							
3G3M1-AB015-ECT		M4	1.2	M4	1.8	-	-
3G3M1-AB022-ECT							
3G3M1-AB037-ECT		M5	3	M5	3	-	-

Wiring for Main Power Supply Input Terminals (L1/R, L2/S, L3/T)

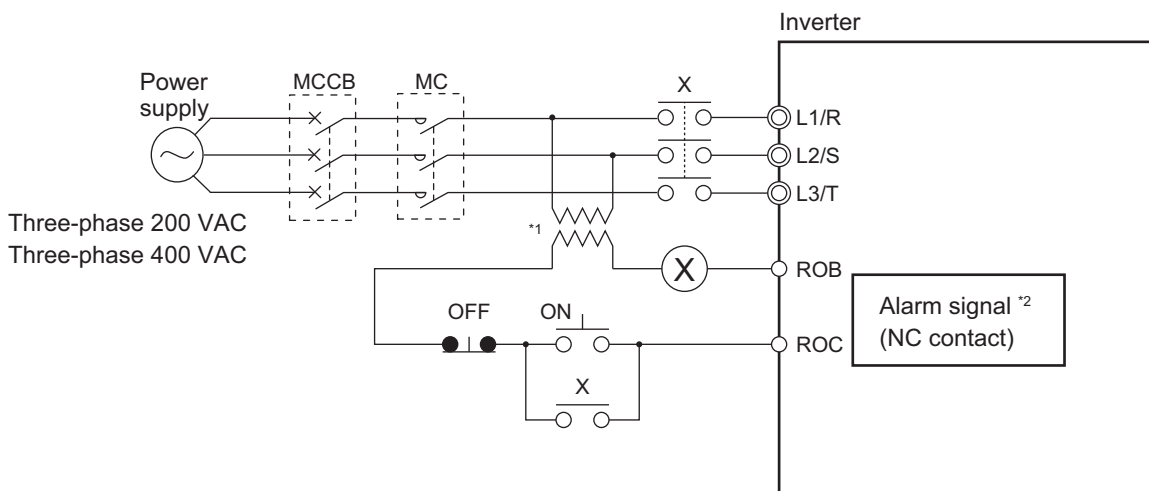
The following describes the wiring for the main power supply input terminals and for peripheral equipment.

● Installing molded case circuit breaker

If the inverter's protective function is activated, the inverter internal circuit may be damaged depending on the condition.

Be sure to connect the main power supply input terminals (L1/R, L2/S, L3/T) to the power supply via a molded case circuit breaker (MCCB) according to each inverter.

- When using multiple inverters, install one MCCB per inverter.
- Determine the capacity of the MCCB according to the molded case circuit breaker (MCCB) value shown in the previous table.
- Determine the time characteristic of the MCCB upon due consideration of the time characteristic of the inverter's overheat protection function (150% of the rated output current for one minute).
- If you must share one MCCB with multiple inverters or other equipment, construct a sequence that turns OFF the power supply via the alarm output signal, as shown in the figure below.



*1. For 400-V class, connect a 400/200-V transformer.

*2. Set the Output Terminal [ROA, ROB] Function Selection (3005Hex-1CHex) to "1099: AL (Alarm signal)."

● Installing earth leakage breaker

When selecting the earth leakage breaker to use between the power supply and the main power supply input terminals (L1/R, L2/S, L3/T), consider the following.

High-frequency leakage current from inverter

The inverter produces a high-frequency leakage current due to its high-speed output switching.

In general, a leakage current of approx. 100 mA will flow for the power cable length of 1 m per inverter. Moreover, an additional leakage current of approx. 5 mA will flow with the increasing length by 1 m.

Therefore, an earth leakage breaker to use in the power input section must be dedicated for the inverter, which removes high-frequency leakage current and detects only the leakage current in a frequency range that is dangerous to the human body.

- Select a special earth leakage breaker for the inverter with a sensitivity current rating of 10 mA or higher per inverter.
- If you use a general earth leakage breaker (which detects high-frequency leakage current), select one with a sensitivity current rating of 200 mA or higher per inverter and an operation time of 0.1 s or longer.

Leakage current from EMC noise filter

The EMC noise filter is designed to comply with European CE standards.

Specifically, it is designed to meet the neutral-point grounding requirement of the European power supply specifications. Therefore, using the EMC noise filter with the phase S grounding causes an increase of leakage current.

For use with the phase S grounding, it is recommended to use the Input Noise Filter.

- OMRON currently plans to support the EMC noise filters for the 3G3M1 Series.

● Installing magnetic contactor

To shut off the main circuit power supply with a sequence, you can use a magnetic contactor (MC) on the inverter side closer than a molded case circuit breaker (MCCB).

- Do not attempt to run/stop the inverter by turning ON/OFF a magnetic contactor. Instead, use the RUN command signal (FW/RV) via the control circuit terminal block of the inverter.
- Construct a sequence that turns OFF the power supply via the alarm output signal of the inverter.
- To use one or more braking resistors/regenerative braking units, construct a sequence that turns OFF a magnetic contactor via a thermal relay contact in each unit.

● Inrush current flow when the inverter power supply is turned ON

When the inverter power supply is turned ON, the charging current, which is called inrush current, flows in the main circuit board capacitor.

The table below shows the reference values at a power supply voltage of 200 V or 400 V when the power supply impedance is low. Take this into consideration when selecting the inverter power supply.

- With a low-speed no-fuse breaker, an inrush current 10 times the rated current can flow for 20 ms.
- To turn ON the power supply for multiple inverters simultaneously, select a no-fuse breaker whose 20-ms allowable current rating is greater than the total inrush current of the inverters.

Single-phase/Three-phase 200-V class	
3G3M1-□-ECT	Inrush current value (Ao-p)
A2001 to A2037 AB001 to AB022	12
A2055, A2075, AB037	126
A2110, A2150	251
A2185	145

Three-phase 400-V class	
3G3M1-□-ECT	Inrush current value (Ao-p)
A4004 to A4040	13
A4055, A4075	41
A4110, A4150	81
A4185, A4220	148

● Main power supply phase loss and single-phase input

To use a single-phase power supply, use a single-phase 200-V class inverter.

Using a single-phase power supply to supply power to a three-phase 200-V or three-phase 400-V class inverter may cause damage to the inverter.

Be sure to check that the three-phase power supply is wired properly before using the inverter.

● Power supply environment

In the following cases, the internal converter module (rectifier) may be damaged.

Take countermeasures such as installing an AC reactor on the main circuit input side of the inverter.

- The power supply voltage unbalance factor is 3% or more.

- The power supply capacity is at least 10 times larger than the inverter capacity and, at the same time, 500 kVA or more.
- Rapid change in the power supply voltage occurs.

Example) When the phase advance capacitor is turned ON/OFF, the inverter may detect an over-voltage or the rectifier may be damaged.

● Installing input surge absorber

When using an inductive load (such as a magnetic contactor, magnetic relay, magnetic valve, solenoid, or electromagnetic brake), use a surge absorber or diode together.

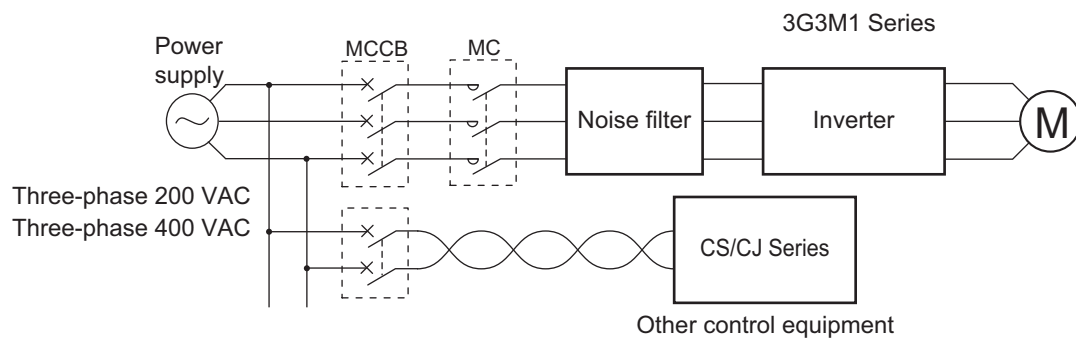
● Installing input noise filter

The inverter performs high-speed output switching, which may cause the noise flow from the inverter to power supply lines that negatively affects on peripheral equipment.

Therefore, it is recommended to use an input noise filter to reduce noise flowing out to power supply lines.

This also helps reduce noise that enters the inverter from power supply lines.

Input noise filter for inverter (for general use)



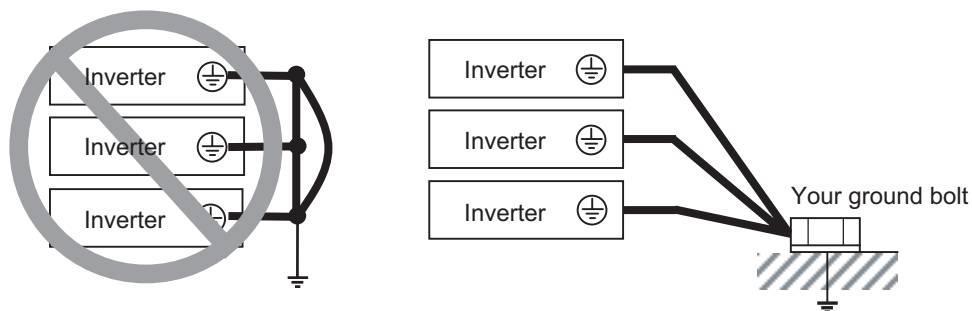
Wiring for Ground Terminal (G ⊕)

To prevent electric shock, be sure to ground the inverter and the motor.

The 200-V class should be connected to the ground terminal under type-D grounding conditions (conventional type 3 grounding conditions: 100 Ω or less ground resistance), the 400-V class should be connected to the ground terminal under type-C grounding conditions (conventional special type 3 grounding conditions: 10 Ω or less ground resistance).

For the ground cable, use the applicable cable or a cable with a larger diameter. Make the cable length as short as possible.

When several inverters are connected, the ground cable must not be connected across several inverters or looped. Otherwise, the inverters and peripheral control equipment may malfunction.



Harmonic Current Measures and DC/AC Reactor Wiring (P1, P(+))

In recent years, there is an increasing concern about harmonic currents generated from industrial machinery.

Harmonic measures must be implemented as *Guideline of Countermeasures Taken by Users against Higher Harmonics Received at High Voltages or Extremely High Voltages* was established by the Ministry of International Trade and Industry (current: Ministry of Economy, Trade and Industry) in September, 1994.

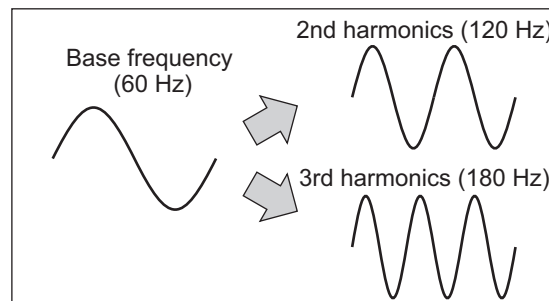
The following provides an overview of harmonics and measures against harmonics implemented in this inverter.

● Harmonics

The voltage or current whose frequency is an integral multiple of certain standard frequency (base frequency) is called a harmonic.

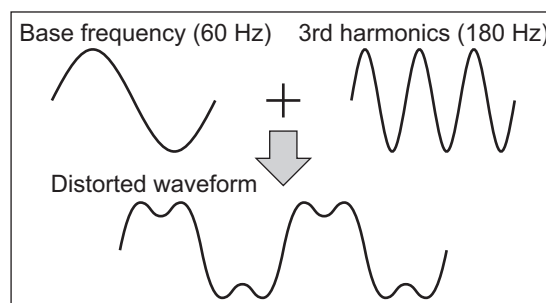
If a commercial power supply frequency of 60 Hz (50 Hz) is the reference frequency, the harmonics of that signal is:

- x2 = 120 Hz (100 Hz),
- x3 = 180 Hz (150 Hz),
- and so on.



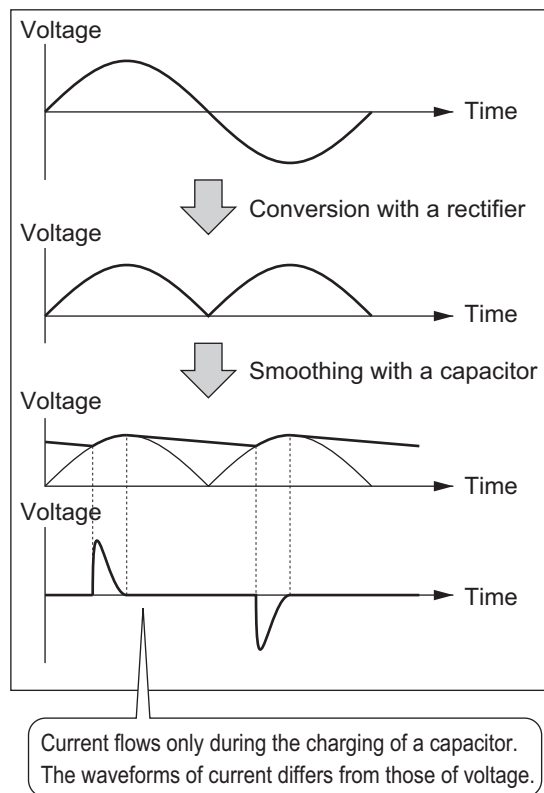
● Reason why harmonics cause problems

As the number of harmonics increases, the waveform of the commercial supply has more distortion. This distortion causes the malfunction of the connected equipment or leads to abnormal heat generation.



● Causes of harmonics

- General electrical equipment internally converts AC input power (commercial power) into DC power. At this time, harmonic currents occur because of the difference in the current flow direction between AC power and DC power.
- In an AC-to-DC power conversion, the rectifier converts the input power into a unidirectional voltage, which is then smoothed by the capacitor. As a result, the current charged into the capacitor has a waveform that contains harmonic components.
- This inverter also performs an AC-to-DC conversion as with other electrical equipment, which allows current with harmonic components to flow. In particular, the inverter has more current than other equipment, so the number of harmonic components in current is larger.



● DC/AC reactor

To suppress harmonic currents, use the DC (direct current) and AC (alternating current) reactors. The DC/AC reactor functions to suppress a steep change in the current.

The DC reactor has a higher harmonics suppression ability, so even higher suppression ability can be expected when used in conjunction with the AC reactor.

Suppressing harmonic currents also leads to the improvement in the power factor on the input or output side of the inverter.

● Before wiring

The DC reactor is connected to the DC power supply located inside the inverter.

Before wiring, be sure to turn OFF the power supply and make sure that the charge indicator is not lit.

Do not touch the interior of the inverter during inverter operation. Doing so may result in electric shock or burn injury.

By factory default, a short-circuit bar is connected between the terminals P1 and P(+). Before connecting the DC reactor, remove this short-circuit bar.

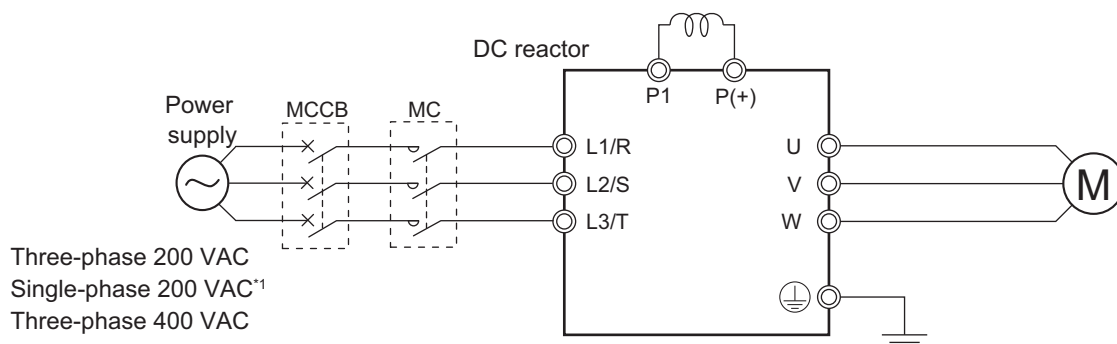
Note that the length of the DC reactor connection cable must be 10 m or shorter.

Remove the short-circuit bar only if you connect the DC reactor for use.

If you remove the short-circuit bar with the DC reactor unconnected, the inverter cannot operate because no power is supplied to its main circuit.

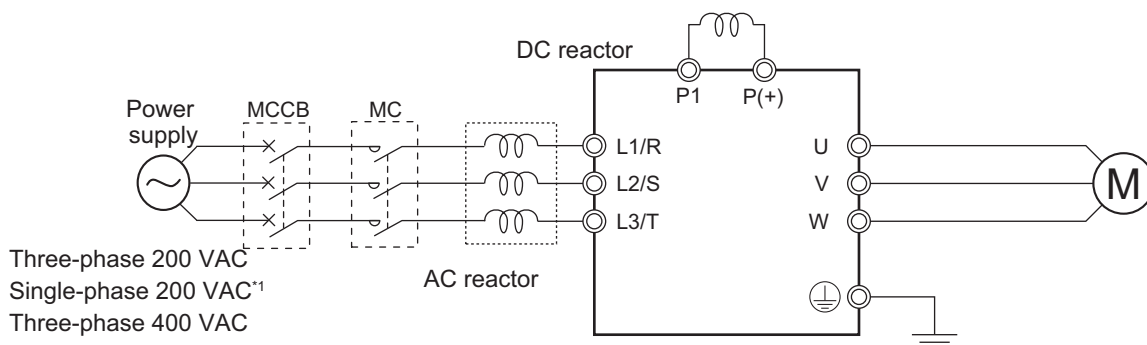
● Wiring method

With DC reactor



*1. Connect to the terminals L1/L and L2/N on the single-phase 200-VAC inverter.

With DC reactor and AC reactor



*1. Connect to the terminals L1/L and L2/N on the single-phase 200-VAC inverter.

● Effect of reactors

Through the use of the DC/AC reactor, the rate of harmonic current occurrences can be reduced as shown in the table of typical examples below.

Measure against harmonics	Harmonic current occurrence rate [%]							
	5th	7th	11th	13th	17th	19th	23th	25th
None (Inverter only)	65	41	8.5	7.7	4.3	3.1	2.6	1.8
AC reactor	38	14.5	7.4	3.4	3.2	1.9	1.7	1.3
DC reactor	30	13	8.4	5	4.7	3.2	3.0	2.2
With DC and AC reactors	28	9.1	7.2	4.1	3.2	2.4	1.6	1.4

● Guideline for reactor selection

When implementing measures against harmonics, first install a DC reactor and evaluate its effect. Then, if further reduction is required, add an AC reactor.

To implement harmonic countermeasures in consideration of the power supply environment (such as rapid change in the power supply voltage), first install an AC reactor and evaluate its effect. If further reduction is required, add a DC reactor.

If you have multiple inverters and use the AC reactor, use one AC reactor for each inverter. Using only one AC reactor for more than one inverter does not provide sufficient reduction

Wiring for Inverter Output Terminals (U, V, W)

The following describes the wiring for the inverter output terminals (U, V, W).

- **Never connect power supply to output terminals**

Never connect the power supply to the output terminals U, V, W.

The inverter is damaged internally if power supply voltage is applied to the output terminals.

- **Never short or ground output terminals**

Do not touch the output terminals with bare hand or contact the output wires with the inverter's case. Doing so may result in electric shock or ground fault.

Be careful not to short the output wires.

- **Do not use phase advance capacitors and noise filters for general-purpose power supplies or for the input side**

Never connect a phase advance capacitor or LC/RC noise filter for general-purpose power supplies to the output circuit.

Doing so may result in damage to the inverter or burnout of these parts.

- **Do not use magnetic switches**

Do not connect any magnetic switch or magnet contactor to the output circuit.

If a load is connected to the inverter when running, the inverter's overcurrent protection circuit is activated due to the inrush current.

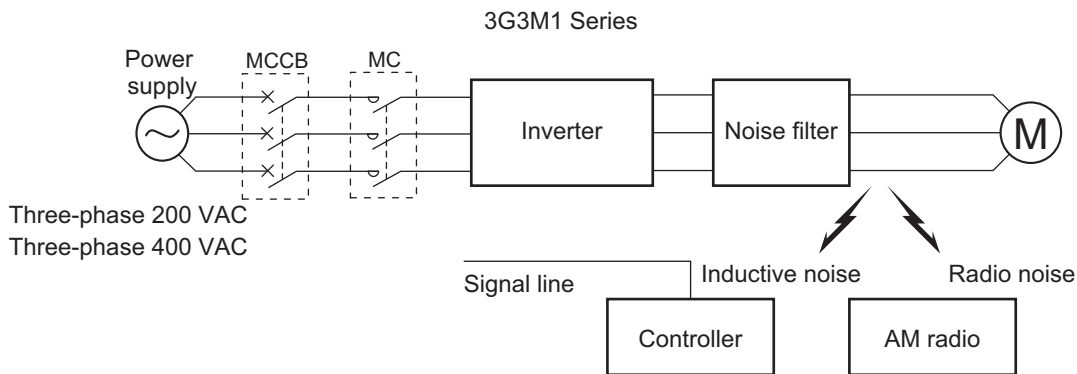
- **Precautions for connecting more than one motor to inverter's output terminals**

If connecting more than one motors to the output terminals of the inverter, note the following three points.

- Make sure that the rated current of the inverter is higher than the sum of the rated current values of the connected motors.
- The inverter cannot provide overload protection for individual motors, because it only detects a sum of the current values for all the connected motors.
Install a thermal relay for each motor. The RC value of each thermal relay must be 1.1 times larger than the rated current of the motor.
- Set the inverter to detect only overloading that occurred in it by setting the Electronic Thermal Level to the rated output current of the inverter.

- **Installing output noise filter**

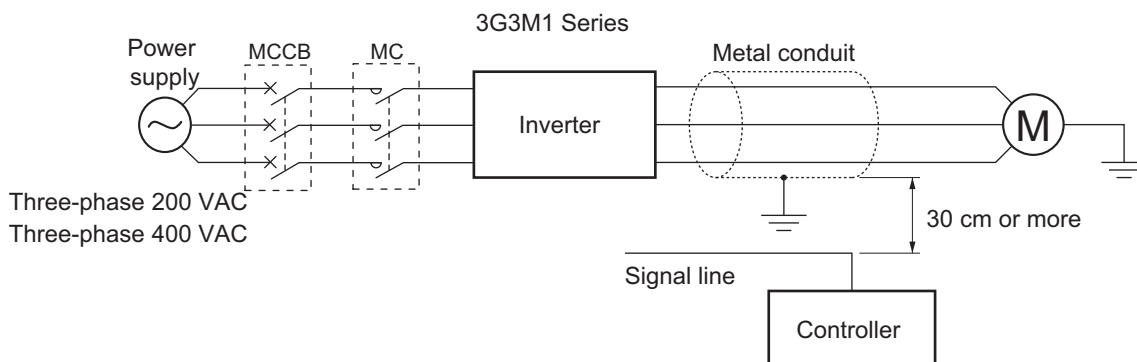
Connecting a noise filter to the output side of the inverter enables the reduction of radio noise and inductive noise.



Noise	Description
Inductive noise	Produced by electromagnetic induction, this noise causes malfunction of control equipment due to noise in signal lines.
Radio noise	The electromagnetic waves emitted from the inverter body or cables cause noise in radio receivers.

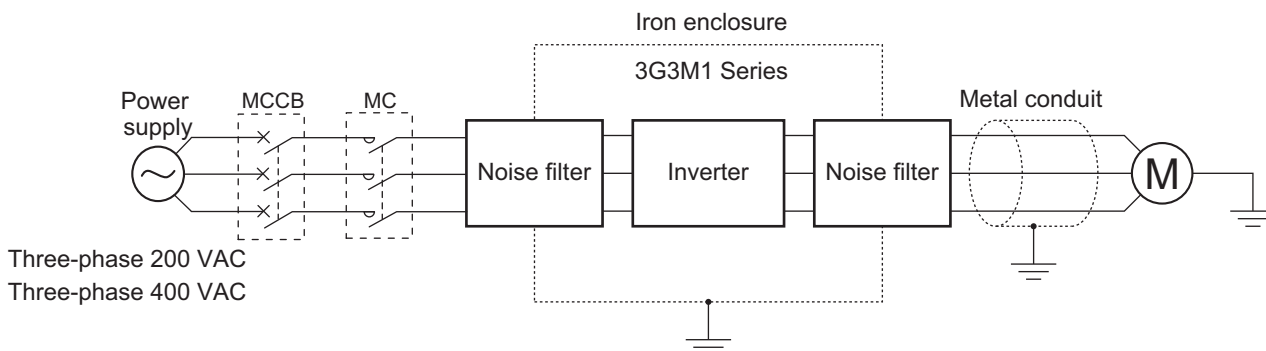
● **Measures against inductive noise**

In addition to the noise filter described above, you can suppress the inductive noise produced on the output side by connecting a bundle of wires through a grounded metal conduit. Moreover, moving the conduit 30 cm or more away from signal lines helps the reduction of inductive noise.



● **Measures against radio noise**

Besides the I/O wires, radio noise is radiated from the inverter itself. This radio noise can be reduced by installing noise filters on both the input and output sides of the inverter and by installing and shielding the inverter body in a grounded iron enclosure etc. Keep the cables between the inverter and the motor as short as possible.



● Cable length between inverter and motor

If the length of the cables between the inverter and the motor is long, consider how to address the following problems.

- Voltage drop in output cables

As the cable length between the inverter and the motor increases, the resistance in the cables becomes higher and accordingly the amount of voltage drop in the inverter output voltage becomes larger. This causes a decrease in the voltage that is applied to the motor, which results in a low output torque.

If the cables are long, take measures to reduce the resistance, for example, by selecting cables whose wire diameter is larger than specified.

- Surge in long cables

If the cable length exceeds 20 m, a surge voltage (approx. 1200 V max. for 400-V class) may be generated at the motor terminal depending on the stray capacitance or inductance of the cable, which may result in motor burnout.

In particular, when using a 400-V class inverter with a cable length of over 20 m, it is recommended to use a dedicated inverter motor. Dedicated inverter motors are designed to support the above surge voltage level.

- Leakage current from output cables

As the cable length between the inverter and the motor increases, stray capacitance increases between the inverter output and the ground. The increase in the stray capacitance on the output side of the inverter causes an increase of the high-frequency leakage current.

This high-frequency leakage current may negatively affect on the current detector in the inverter output section or peripheral equipment.

It is recommended to keep the wiring distance between the inverter and the motor at 100 m or shorter. If your system configuration requires the wiring distance of over 100 m, take measures to decrease the stray capacitance. The applicable measures are such as not wiring in a metal duct and using a separate cable for each phase.

In addition, set a carrier frequency appropriate for the wiring distance between the inverter and the motor according to the table below.

Capacity	Wiring distance between inverter and motor
3.7 kW max.	50 m max.
5.5 kW min.	100m max.

External Braking Resistor Connection Terminal (P(+), DB)

When driving a load with a large inertia or a vertical axis, regenerated energy is fed back to the inverter when it is decelerating or generating downward movement.

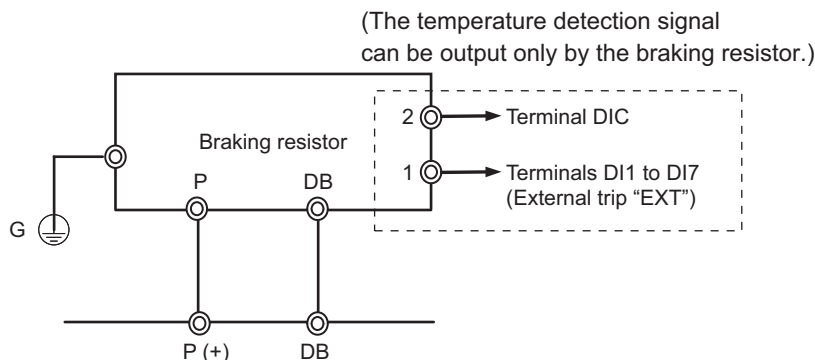
If the amount of regenerative energy exceeds the amount allowable for the inverter, an overvoltage is detected. Use braking resistors to prevent this.

● Using built-in regenerative braking circuit

All models of the 3G3M1 Series Inverter have built-in regenerative braking circuit.

To improve the braking capacity, connect the external braking resistor to these terminals (P(+), DB).

- Wiring diagram



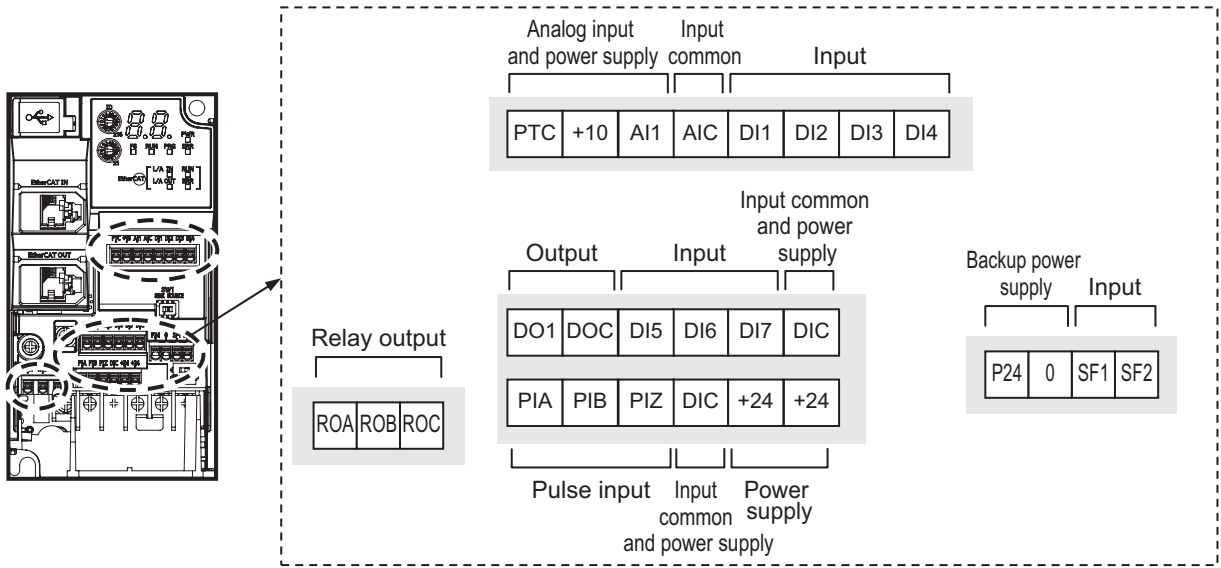
2-3-5 Wiring for Control Circuit Terminals

Wiring for Control Circuit Terminals

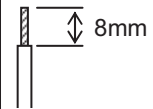
- The AIC terminal (common terminal of the analog input), DIC terminal (common terminal of the analog input) and DOC terminal (common terminal of the digital output) are mutually insulated from each other.
Do not short-circuit or ground these common terminals.
In addition, do not ground these common terminals via external equipment.
When finished wiring, check the external equipment ground conditions.
- For wiring to the control circuit terminals, use twisted-pair shielded cables (recommended diameter: 0.75 mm²). Connect the sheathed shielded cable to each common terminal. The cable length should be 20 m or shorter.
- Twist a cable connected to the terminal PTC (thermistor input) with a cable of the terminal AIC individually, and separate them from other AIC common cables. Since the current flowing through the thermistor is weak, separate the thermistor cable from main circuit cable (power cable). The thermistor connection cable should be 20 m or shorter.
- To use a relay for a multifunction output terminal, connect a surge-absorbing diode in parallel with the coil.
- The control circuit terminal block has three rows of terminals. Start wiring from the lower terminals. Wiring from the upper terminals makes it difficult to wire the lower terminals.

Arrangement of Control Circuit Terminal Blocks

The arrangement of terminals on the control circuit terminal block is shown below.



	Applicable wire		
	Solid wire mm ² (AWG)	Stranded wire mm ² (AWG)	Ferrule mm ² (AWG)
Other than below	0.2 to 1.5 (AWG24 to 16)	0.2 to 1.0 (AWG24 to 17)	0.25 to 0.75 (AWG24 to 18)
ROA/ROB/ROC SF1/SF2	0.2 to 1.5 (AWG24 to 16)	0.2 to 1.0 (AWG24 to 17)	0.25 to 0.75 (AWG24 to 18)

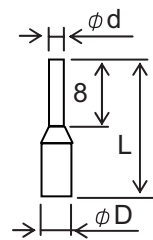


Sheath strip length should be approx. 8 mm for solid/stranded wire

Recommended Terminal

To improve ease of wiring and reliability in connection, it is recommended to use ferrules with the following specifications for signal wires.

Wire size mm ² (AWG)	Ferrule type*1	L [mm]	φd [mm]	φD [mm]
0.25 (24)	AI 0.25-8YE	12.5	0.8	2.0
0.34 (22)	AI 0.34-8TQ	12.5	0.8	2.0
0.5 (20)	AI 0.5-8WH	14	1.1	2.5
0.75 (18)	AI 0.75-8GY	14	1.3	2.8

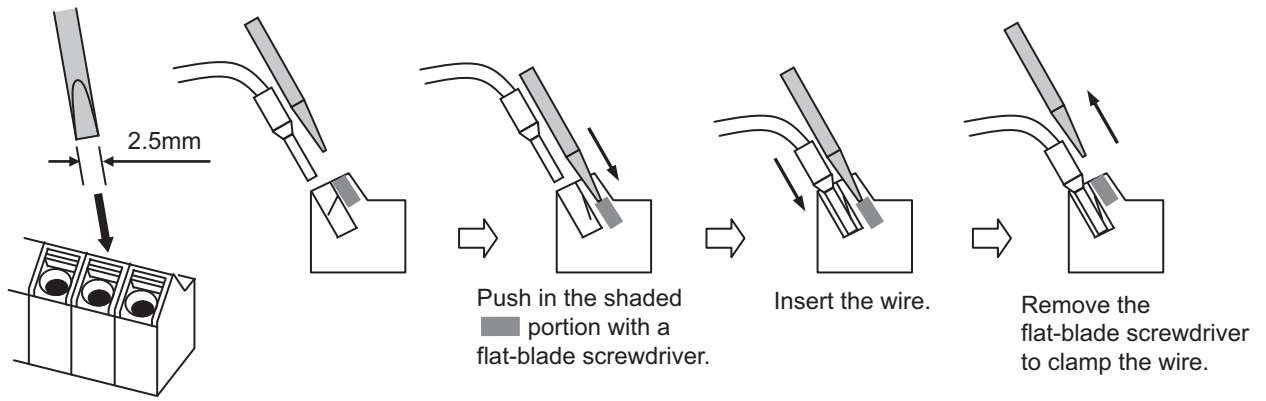


*1. Manufacturer: PHOENIX CONTACT
Crimping tool: CRIMPFOX 6

Wiring Method

- 1** Push in the orange colored portion of the control circuit terminal block with a flat-blade screwdriver (blade width: 2.5 mm max.) to open the wire insertion hole.
- 2** With the flat-blade screwdriver pushed in, insert the wire or ferrule into the wire insertion (round) hole.

3 Remove the flat-blade screwdriver to clamp the wire.



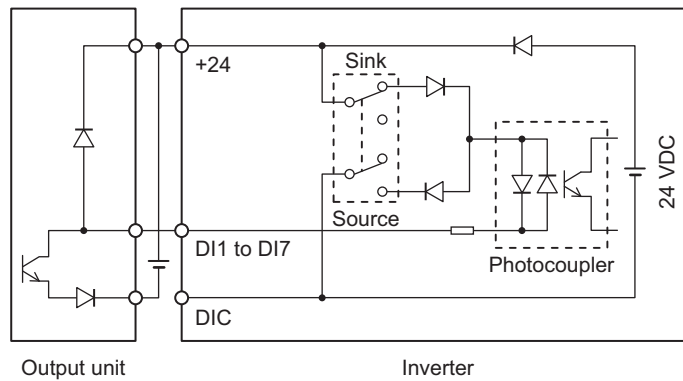
Note To disconnect, pull out the wire with the shaded (■) portion pushed in with a flat-blade screwdriver.

Selecting Input Control Logic

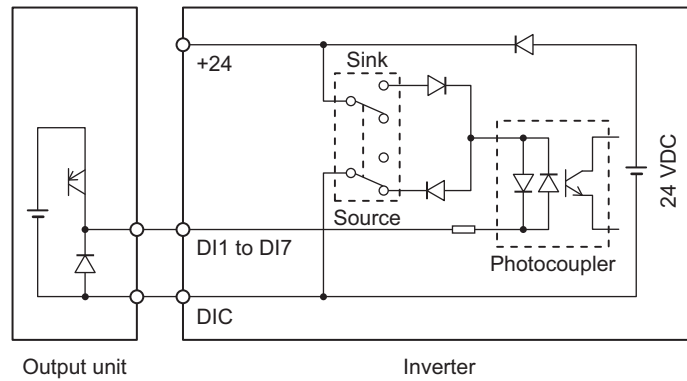
By factory default, the multifunction input terminals are set to sink logic (NPN). To change the input control logic to source logic (PNP), switch SW1 to the SOURCE side.

Multifunction Input Terminals and Programmable Controller Connection

● Sink logic

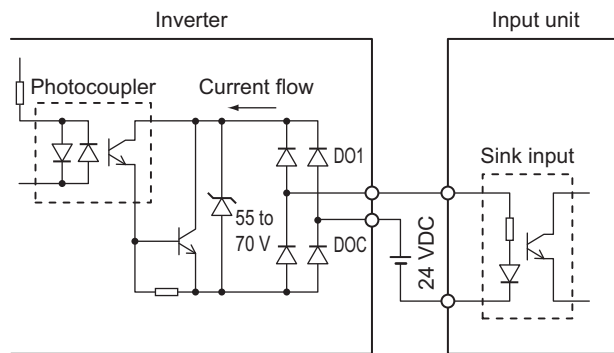


● Source logic

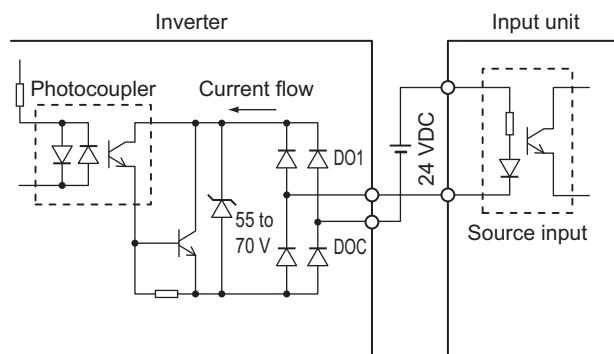


Multifunction Output Terminals and Programmable Controller Connection

● Sink logic



● Source logic



2-3-6 Recommended Encoder and Its Wiring

For the pulse train input function of the 3G3M1 Series inverter, be sure to use a complementary output type encoder.

In addition, for encoder cable connection, always use a shielded cable and connect it to the DIC terminal of the inverter's control circuit terminal block.

If an open collector output encoder is used, the inverter may not recognize the rotation in the forward or reverse direction. This is because, as the length of the encoder cable increases, its stray capacitance becomes larger, which causes the inverter to falsely recognize the crosstalk signal from the encoder.

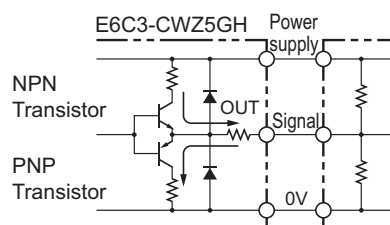
● Complementary output

Complementary output is a method of outputting via two transistors.

The wiring is connected to the 0 V side when output is ON and to the power supply side when output is OFF.

This design does not allow the wiring to be left open (at high impedance) as in the case of open collector output encoders.

Therefore, this provides a stable output from the encoder.



● Recommended product

E6C3-CWZ5GH (Manufacturer: OMRON)

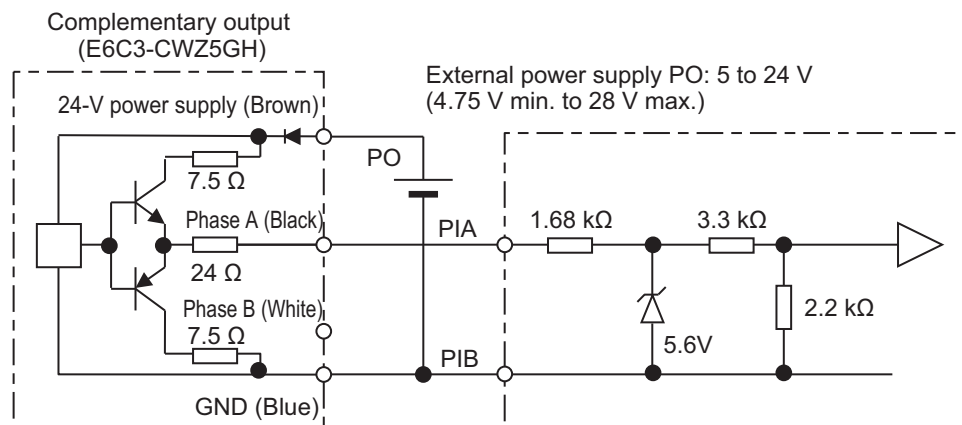
Encoder Input

For pulse train input, use the pulse train input PIA and PIB terminals of the control circuit terminals. Be sure to use a complementary output type encoder.

Wiring for Phase A and B 90° Phase Difference Pulse Train (3014Hex-0FHex = 2 or 3)

Connect the phase A and B 90° phase difference pulse train as shown in the diagram below.

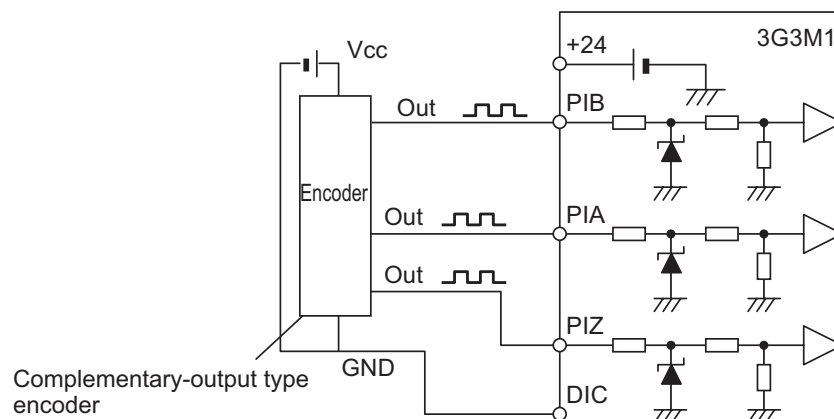
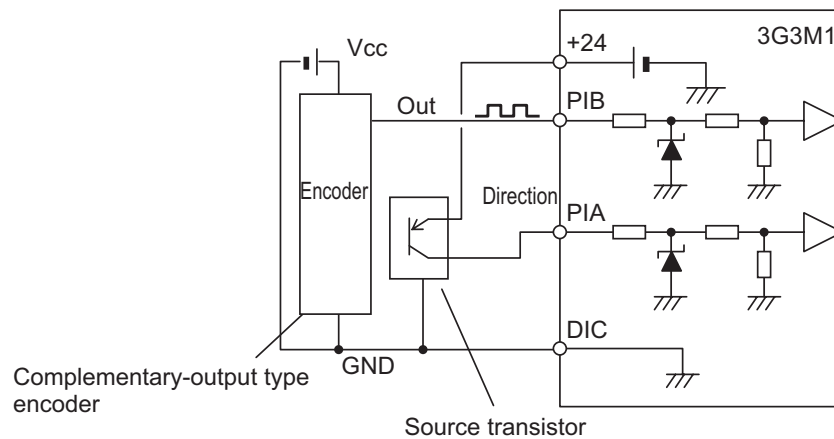
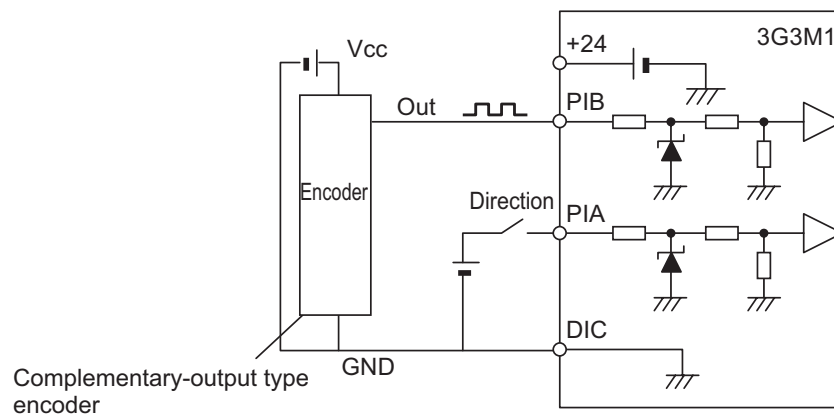
- Connect the phase A signal to the pulse input PIA terminal and the phase B signal to the pulse train input PIB terminal.
- The +24 V terminal of the inverter control circuit terminal block is for a 100 mA maximum 24 V power supply. This terminal can be used for the encoder power supply if the consumption current for the input terminals in use and the encoder power supply is allowable. However, note that this terminal must be isolated from any 24 V system power supply for other than the encoder and inverter.



Wiring for Single-phase Pulse Signal and Direction Signal (3014Hex-0FHex = 0)

Connect the single-phase pulse signal or single-phase pulse + direction signal as shown in the diagram below.

- Connect the direction signal to the pulse train input PIA terminal and the single-phase pulse to the pulse train input PIB terminal.
- The +24 V terminal of the inverter control circuit terminal block is for a 100 mA maximum 24 V power supply. This terminal can be used for the encoder power supply if the consumption current for the input terminals in use and the encoder power supply is allowable. However, note that this terminal must be isolated from any 24 V system power supply for other than the encoder and inverter.



Wiring for Forward Rotation Pulse/Reverse Rotation Pulse (3014Hex-0FHex = 1)

Connect the forward rotation pulse/reverse rotation pulse as shown in the diagram below.

- Connect the forward rotation pulse to the pulse train input PIA terminal and the reverse rotation pulse to the pulse train input PIB terminal.
- The +24 V terminal of the inverter control circuit terminal block is for a 100 mA maximum 24 V power supply. This terminal can be used for the encoder power supply if the consumption current for the input terminals in use and the encoder power supply is allowable. However, note that this terminal must be isolated from any 24 V system power supply for other than the encoder and inverter.

2-3-7 Safety Function

The safety function is designed so that the safety stop function of category 0 (uncontrolled stop) specified in IEC 60204-1 is used to meet the safety standards of PL-e under ISO 13849-1.

The safety input function allows the inverter output when current flows in both the terminals SF1 and SF2.

When the safety input function is activated, in compliance with the above standards, the output transistor operation of the inverter is stopped safely (by shutting off its output). As a result, the motor stops with free run.

For details, refer to *8-6 Safety Function* on page 8-61.

M1 supports the FSoE (Safety over EtherCAT) protocol for safe communications. Safe systems can be built by using the STO functions from a safety controller on the EtherCAT network.

Safety Function Settings

To use the safety function, it must be set beforehand. By default, the safety function is disabled.

Use of the safety function is enabled by turning SW9 OFF.

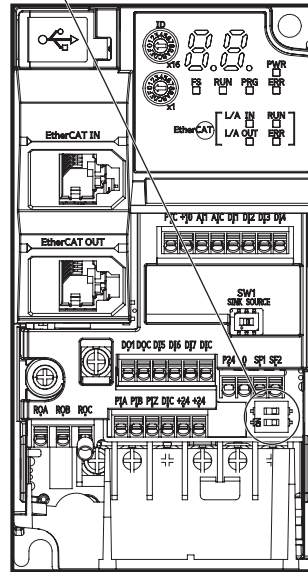
With the inverter power supply turned OFF, turn OFF the safety function selector switch SW9. When using EDM output (safety monitor output), set “102: EDM (safety monitor)” at the multifunction output terminal.

When the safety function is used → Both OFF

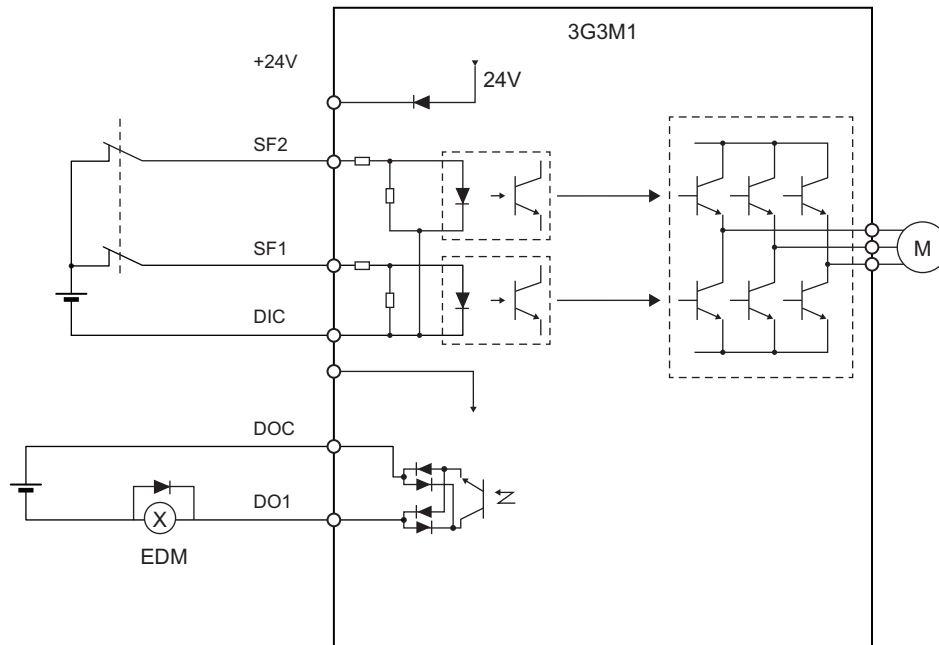
When the safety function is not used → Both ON

When only one is ON, the logic of the SF1 and SF2 signals no longer matches and this causes an ECF alarm.

Safety function selector switch



Wiring Example



In the factory default state, operation is always enabled by the short-circuit bars as shown in the figure above.

For details on connection with safety devices, refer to 8-6 *Safety Function* on page 8-61.

2-4 Others

2-4-1 Compliance with EU Directives and UKCA

This section provides conditions that must be met for compliance with European EU Directives. Take measures to meet the conditions shown here for the entire system as well as peripheral equipment.

For the system that incorporates this inverter, perform the final compliance verification separately on the whole system.

Directives and Legislation

EU Declaration of Conformity
OMRON declares that 3G3M1 Series conform with the requirements of the following EU Directive EMC Directive 2014/30/EU Machinery Directive 2006/42/EC
UKCA Declaration of Conformity
OMRON declares that 3G3M1 Series conform with the requirements of the following UK legislation (2016 No.1091) Electromagnetic Compatibility Regulations (2008 No.1597) Supply of Machinery (Safety) Regulations

Applicable Standards

The 3G3M1 Series complies with the following standards.

Standard	Applicable standard
EMC	EN 61800-3:2004/A1:2012
Electrical Safety (Machinery Directive/LVD)	EN 61800-5-1:2007/A1:2017
Functional Safety (Machinery Directive)	The safety functions in 3G3M1 Series are designed and manufactured in accordance with the following standards: <ul style="list-style-type: none"> • EN 61800-5-2: 2017 • EN ISO 13849-1: 2015, PL e / Safety category 3

- This product is designed for industrial environments.
If used in a residential environment, it may cause radio interference. In that case, it is necessary to take appropriate measures against radio interference.
- This product is not intended to be connected to a power grid that supplies residential facilities.

Concepts of Compliance

WARNING

There are conditions for compliance with the EU Low Voltage Directive and Machinery Directive. Strictly observe the conditions listed in the instruction manual or user's manual.
Not doing so may result in a serious injury due to an electric shock or fire.



● EMC

OMRON products are the electrical devices incorporated and used in various machines or manufacturing equipment. For this reason, OMRON makes efforts to manufacture products that meet the related EMC standards so that the machines or equipment in which they are incorporated can easily comply with the EMC standards.

The 3G3M1 Series Inverter complies with EN61800-3 when installed and wired to equipment according to the methods described below. However, the customer's machines and equipment vary in type, and in addition, EMC performance depends on the configuration and electrical characteristics of mechanical parts, and the configuration, wiring and location of the control panel. This does not allow OMRON to verify compliance under the customer's usage conditions.

Please perform the final verification on the EMC compliance of your machines or the entire system at your own responsibility.

● EMC noise filters

OMRON is currently preparing a line up of EMC noise filters.

● Wiring for power supply

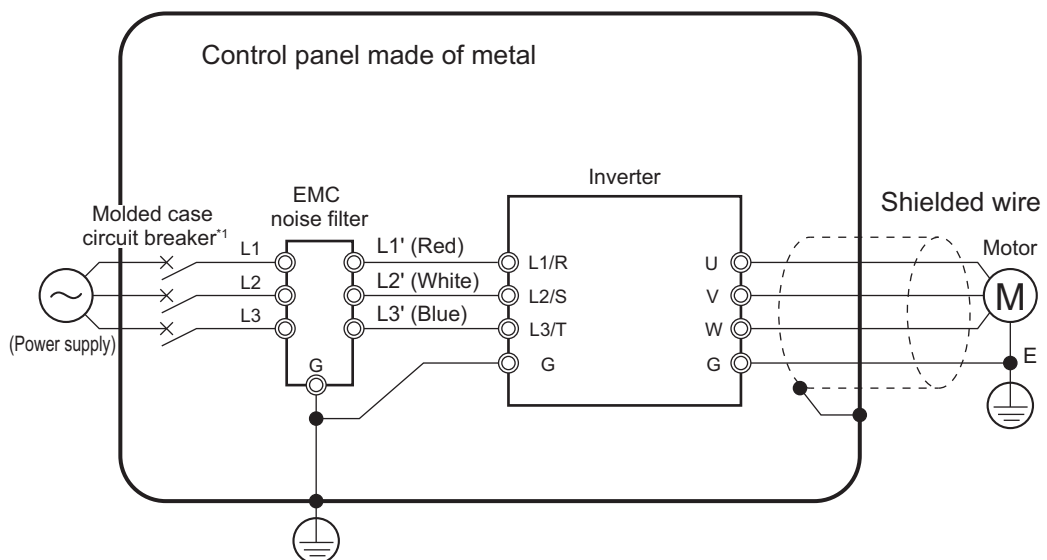
Keep the ground cable as short as possible.

Place the inverter and the noise filter on the same earth (ground) plate.

Always connect the power supply input terminals (L1/R, L2/S, L3/T) of the inverter to the power supply via an EMC noise filter.

Keep the cable between the inverter and the EMC noise filter as short as possible (40 cm maximum).

Connection Example



● Wiring between inverter and motor

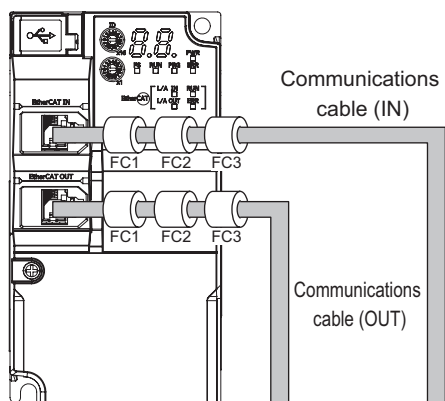
For cables between the inverter and motor, be sure to use shield braided cables.

Keep the cables as short as possible.

● Wiring of communications cables

Install the 3 ferrite cores shown below near the communications connectors of the communications cables that are connected to the communications connector (IN) and the communications connector (OUT). (When the communications cables are not connected to the OUT side, IN side only)

Symbol	Name	Manufacturer	Model
FC1, FC2, FC3	Ferrite core	NEC TOKIN	ESD-SR-160

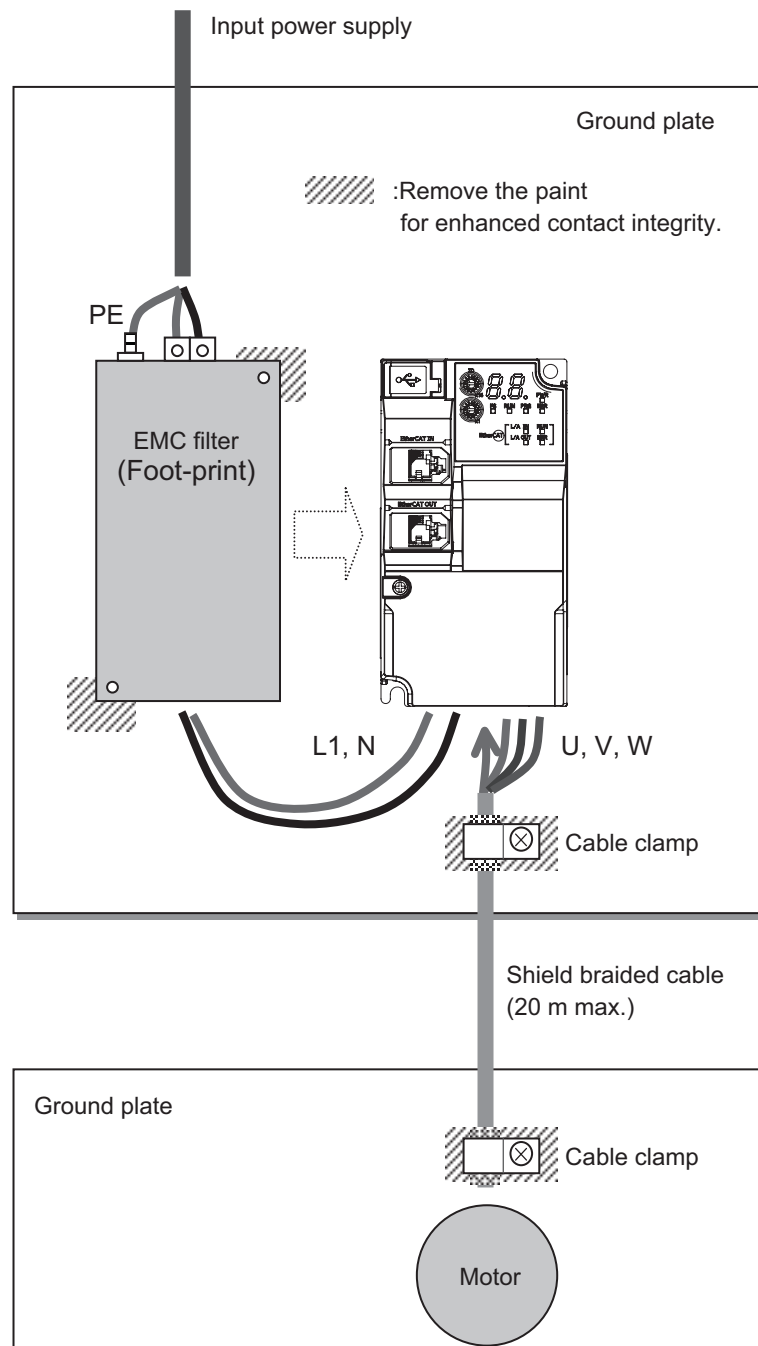


● Measures against noise for compliance with EMC Directive

- Keep the power cable of the inverter and the EMC noise filter wiring as short as possible. Use a shield braided cable.
- For the shield braided cable, use a tinned copper shielded cable with a shield factor of 85%.
- Be sure to connect the ground cable separately from the shielded cable. Use the ground cable as thick and short as possible to wire.
- Use shield braided cables for connection between the inverter and the motor. Keep the cables as short as possible at a length 20 m or less, with the cable shield grounded at each end. Installing a clamp filter near the inverter output terminals is an effective countermeasure.
- Ground the motor frame, the shield of the motor cable, and the terminal housing adequately. The motor terminal housing may not contact with the chassis due to the rubber bushing or the screw hole for motor ground terminal may be coated. Check the contact performance. If there is any problem, take measures to enhance contact performance.
- Use shielded cables for wiring to the control circuit terminal blocks and communications lines and ground the shield of each cable on the inverter side. Grounding the cables at each end may increase the effect.
- Connect the cable shield directly to a ground plate with a conductive cable clamp. At this time, keep the shield strip length as short as possible.
- Make the contact area between the EMC noise filter/inverter and the ground plate as large as possible to enhance contact performance. At this time, remove the paint etc. from the ground plate.
- For the control panel door, use a conductive gasket to improve the shielding effect.
- In the same control panel, do not install equipment that generates non-EMC-compliant electromagnetic waves.
- Avoid conductor loops that encompass large areas.
- As a measure against harmonic distortion, an AC/DC reactor or harmonic suppression equipment is required.

- Avoid placing noise-generating cables (such as power cables and motor cables of the inverter) in parallel with signal cables and allow a clearance of at least 25 cm between them. If you cannot avoid crossing two types of cables, keep them at right angles to each other.

● Wiring example for single-phase 200-V class




● Low-voltage directive (electrical safety)

The 3G3M1 Series Inverter complies with EN61800-5-1 when installed and wired to equipment according to the methods described below.

- The 3G3M1 Series Inverter is an open type device. Be sure to install it inside the control panel.
- The power supply and voltage (SELV) with reinforced or double insulation should be used for wiring to the control circuit terminals.

- To satisfy electrical safety requirements, the inverter must be protected with fuses or a molded case circuit breaker (MCCB) in case a short-circuiting accident occurs. Be sure to install fuses or a molded case circuit breaker (MCCB) on the power supply side of the inverter.
The fuses, if used, should be one of the UL-compliant Class-J product listed in *2-4-2 UL/cUL Standards Cautions* on page 2-83.
- Use one molded case circuit breaker (MCCB), or one set of fuses, per inverter.
- Use the crimp terminal with an insulation sleeve to connect to the main circuit terminals.

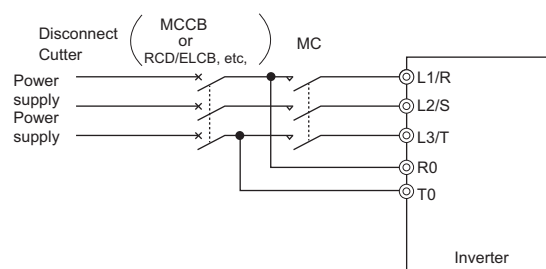
● Compliance with EU Low Voltage Directive

- Be sure to ground the ground terminal  G. Do not use only an earth leakage circuit breaker* (RCD: Residual-current-operated protective device/ELCB: Earth Leakage Circuit Breaker) as protection against electric shock. Also, use ground cable of the size of the power line or larger diameter.
*With overcurrent protection function
- To protect against high voltage that accompanies inverter damage and the risk of accidents, install a fuse having the rating specified in the table below on the power supply side.
 - Breaking capacity 10 kA or more, rated voltage 500 V or less

Power supply line	Standard applicable motor (kW)	Inverter model	Specifications	Fuse rating (A)
Three-phase 200 V	0.1	3G3M1-A2001-ECT	HHD	50 (IEC 60269-4)
	0.2		HND	
	0.4	3G3M1-A2002-ECT	HHD	50 (IEC 60269-4)
			HND	
	0.75	3G3M1-A2004-ECT	HHD	50 (IEC 60269-4)
			HND	
	1.1	3G3M1-A2007-ECT	HHD	50 (IEC 60269-4)
			HND	
	1.5	3G3M1-A2015-ECT	HHD	80 (IEC 60269-4)
			HND	
	2.2	3G3M1-A2022-ECT	HHD	125 (IEC 60269-4)
			HND	
	3	3G3M1-A2037-ECT	HHD	125 (IEC 60269-4)
			HND	
	5.5	3G3M1-A2055-ECT	HHD	160 (IEC 60269-4)
			HND	
	7.5	3G3M1-A2075-ECT	HHD	200 (IEC 60269-4)
			HND	
	11	3G3M1-A2110-ECT	HHD	200 (IEC 60269-4)
			HND	
15	3G3M1-A2150-ECT	HHD	250 (IEC 60269-4)	
		HND		
18.5	3G3M1-A2185-ECT	HHD	250 (IEC 60269-4)	
		HND		
22		HND		

Power supply line	Standard applicable motor (kW)	Inverter model	Specifications	Fuse rating (A)
Three-phase 400 V	0.4	3G3M1-A4004-ECT	HHD	50 (IEC 60269-4)
	0.75		HND	
			HD	
			ND	
	1.1	3G3M1-A4007-ECT	HHD	50 (IEC 60269-4)
			HND	
			HD	
	1.5	3G3M1-A4015-ECT	HHD	50 (IEC 60269-4)
			HND	
			ND	
	2.2	3G3M1-A4022-ECT	HHD	63 (IEC 60269-4)
			HND	
			HD	
			ND	
	3.0	3G3M1-A4030-ECT	HHD	63 (IEC 60269-4)
			HND	
			HD	
			ND	
	4.0	3G3M1-A4040-ECT	HHD	63 (IEC 60269-4)
			HND	
			HD	
			ND	
	5.5	3G3M1-A4055-ECT	HHD	100 (IEC 60269-4)
			HND	
HD				
ND				
7.5	3G3M1-A4075-ECT	HHD	100 (IEC 60269-4)	
		HND		
		HD		
11	3G3M1-A4055-ECT	ND	100 (IEC 60269-4)	
	3G3M1-A4075-ECT	HND	100 (IEC 60269-4)	
		HD		
15	3G3M1-A4110-ECT	HHD	125 (IEC 60269-4)	
	3G3M1-A4075-ECT	ND	100 (IEC 60269-4)	
		3G3M1-A4110-ECT	HND	125 (IEC 60269-4)
			HD	
3G3M1-A4150-ECT	HHD	160 (IEC 60269-4)		

Power supply line	Standard applicable motor (kW)	Inverter model	Specifications	Fuse rating (A)
Three-phase 400 V	18.5	3G3M1-A4110-ECT	ND	125 (IEC 60269-4)
		3G3M1-A4150-ECT	HND	160 (IEC 60269-4)
			HD	
	3G3M1-A4185-ECT	HHD	160 (IEC 60269-4)	
	22	3G3M1-A4150-ECT	ND	160 (IEC 60269-4)
			HND	
		3G3M1-A4185-ECT	HHD	200 (IEC 60269-4)
	30	3G3M1-A4185-ECT	ND	160 (IEC 60269-4)
			HND	
		3G3M1-A4220-ECT	HHD	200 (IEC 60269-4)
37		ND		
Single-phase 200 V	0.1	3G3M1-AB001-ECT	HHD	50 (IEC 60269-4)
	0.2		HND	
		3G3M1-AB002-ECT	HHD	50 (IEC 60269-4)
		HND		
	0.4	3G3M1-AB004-ECT	HHD	50 (IEC 60269-4)
	0.55		HND	
	0.75	3G3M1-AB007-ECT	HHD	50 (IEC 60269-4)
	1.1		HND	
	1.5	3G3M1-AB015-ECT	HHD	125 (IEC 60269-4)
	2.2		HND	
		3G3M1-AB022-ECT	HHD	125 (IEC 60269-4)
	HND			
3		HHD	160 (IEC 60269-4)	
3.7	3G3M1-AB037-ECT	HHD		



- Use a molded case circuit breaker (MCCB), residual current device (RCD) or earth leakage circuit breaker (ELCB), and magnetic contactor (MC) that are compliance with EN or IEC Standards.
- When using a residual current device (RCD) or earth leakage circuit breaker (ELCB) as protection against electric shock through direct or indirect contact with the power line or node, be sure to install a RCD or ELCB of type B (DC capable) model on the input side (primary side) of the inverter.

Power supply line	Standard applicable motor (kW)	Inverter model	Specifications	Molded case circuit breaker (MCCB) ^{*1}		Earth leakage circuit breaker (RCD/ELCB) ^{*1}			
				Rated current		Rated current		Sensitivity current ^{*2}	Max. fault loop impedance
				With DC reactor	Without DC reactor	With DC reactor	Without DC reactor		
Three-phase 200 V	0.1	3G3M1-A2001-ECT	HHD	5	5	5	5	30 mA	200 Ω
	0.2	3G3M1-A2002-ECT	HND						
	0.4	3G3M1-A2004-ECT	HHD	10	10	10	10		
		3G3M1-A2007-ECT	HND						
	0.75	3G3M1-A2015-ECT	HHD	10	15	10	15		
		3G3M1-A2022-ECT	HND						
	1.1	3G3M1-A2037-ECT	HHD	20	30	20	30		
		3G3M1-A2055-ECT	HND						
	1.5	3G3M1-A2075-ECT	HHD	30	40	30	40		
		3G3M1-A2110-ECT	HND						
	2.2	3G3M1-A2150-ECT	HHD	40	50	40	50		
		3G3M1-A2185-ECT	HND						
	3	3G3M1-A2185-ECT	HHD	40	75	40	75		
		3G3M1-A2150-ECT	HND						
	3.7	3G3M1-A2150-ECT	HHD	50	100	50	100		
		3G3M1-A2110-ECT	HND						
	5.5	3G3M1-A2150-ECT	HHD	75	125	75	125		
		3G3M1-A2185-ECT	HND						
7.5	3G3M1-A2150-ECT	HHD	100	150	100	150			
	3G3M1-A2185-ECT	HND							
11	3G3M1-A2150-ECT	HHD	100	175	100	175			
	3G3M1-A2185-ECT	HND							
15	3G3M1-A2150-ECT	HHD	100	175	100	175			
	3G3M1-A2185-ECT	HND							
18.5	3G3M1-A2150-ECT	HHD	100	175	100	175			
	3G3M1-A2185-ECT	HND							
22	3G3M1-A2185-ECT	HHD	100	175	100	175			

*1. The frame size and model of MCCB, RCD or ELCB (with overcurrent protection function) change according to the capacity of the power transformer. For details on selection method, refer to related technical data.

*2. The sensitivity current setting of the TT system differs according to each country. Follow the instructions of the relevant authority.

Power supply line	Standard applicable motor (kW)	Inverter model	Specifications	Molded case circuit breaker (MCCB)* ¹		Earth leakage circuit breaker (RCD/ELCB)* ¹			
				Rated current		Rated current		Sensitivity current* ²	Max. fault loop impedance
				With DC reactor	Without DC reactor	With DC reactor	Without DC reactor		
Three-phase 400 V	0.4 0.75	3G3M1-A4004-ECT	HHD	5	5	5	5	30 mA	20 Ω
			HND						
			HD						
			ND						
	1.1 1.5	3G3M1-A4007-ECT	HHD	5	5	5	5	30 mA	20 Ω
			HND						
			HD						
			ND						
	2.2	3G3M1-A4015-ECT	HHD	5	10	5	10	30 mA	20 Ω
			HND						
			HD						
			ND						
	3.0	3G3M1-A4022-ECT	HHD	10	15	10	15	30 mA	20 Ω
			HND						
			HD						
			ND						
	4.0	3G3M1-A4030-ECT	HHD	10	20	10	20	30 mA	20 Ω
			HND						
			HD						
			ND						
5.5	3G3M1-A4040-ECT	HHD	15	30	15	30	30 mA	20 Ω	
		HND							
		HD							
		ND							
7.5	3G3M1-A4055-ECT	HHD	20	40	20	40	30 mA	20 Ω	
		HND							
	3G3M1-A4075-ECT	HD							
		HHD							
11	3G3M1-A4055-ECT	ND	30	50	30	50	30 mA	20 Ω	
	3G3M1-A4075-ECT	HND							
		HD							
	3G3M1-A4110-ECT	HHD							

Power supply line	Standard applicable motor (kW)	Inverter model	Specifications	Molded case circuit breaker (MCCB) ^{*1}		Earth leakage circuit breaker (RCD/ELCB) ^{*1}			
				Rated current		Rated current		Sensitivity current ^{*2}	Max. fault loop impedance
				With DC reactor	Without DC reactor	With DC reactor	Without DC reactor		
Three-phase 400 V	15	3G3M1-A4075-ECT	ND	40	60	40	60	100mA	20 Ω
		3G3M1-A4110-ECT	HND HD						
		3G3M1-A4150-ECT	HHD						
	18.5	3G3M1-A4110-ECT	ND	50	75	50	100		
		3G3M1-A4150-ECT	HND HD						
		3G3M1-A4185-ECT	HHD						
	22	3G3M1-A4150-ECT	ND	75	125	75	125		
		3G3M1-A4185-ECT	HND HD						
		3G3M1-A4220-ECT	HHD						
	30	3G3M1-A4185-ECT	ND	100	100	75	125		
		3G3M1-A4220-ECT	HND HD						
		37	ND						

*1. The frame size and model of MCCB, RCD or ELCB (with overcurrent protection function) change according to the capacity of the power transformer. For details on selection method, refer to related technical data.

*2. The sensitivity current setting of the TT system differs according to each country. Follow the instructions of the relevant authority.

Power supply line	Standard applicable motor (kW)	Inverter model	Specifications	Molded case circuit breaker (MCCB) ^{*1}		Earth leakage circuit breaker (RCD/ELCB) ^{*1}			
				Rated current		Rated current		Sensitivity current ^{*2}	Max. fault loop impedance
				With DC reactor	Without DC reactor	With DC reactor	Without DC reactor		
Single-phase 200 V	0.1	3G3M1-AB001-ECT	HHD	5	5	5	5	30 mA	200 Ω
	0.2		HND						
	0.4	3G3M1-AB002-ECT	HHD						
		3G3M1-AB004-ECT	HHD						
	0.55	3G3M1-AB007-ECT	HND	10	10	15			
	0.75		HHD						
	1.1	HND	15	20	15	20			
	1.5	3G3M1-AB015-ECT					HHD		
	2.2	3G3M1-AB022-ECT	HND	30	30	30	30		
			HHD						
3	HND	40	40	40	40				
3.7	3G3M1-AB037-ECT					HHD	40	60	40

*1. The frame size and model of MCCB, RCD or ELCB (with overcurrent protection function) change according to the capacity of the power transformer. For details on selection method, refer to related technical data.

*2. The sensitivity current setting of the TT system differs according to each country. Follow the instructions of the relevant authority.

- Use the inverter in an environment that does not exceed pollution degree 2. In pollution degree 3 or 4 environments, install the inverter in a panel that satisfies IP rating IP54 or higher.
- To prevent operators from electric shock caused by live parts, install the inverter, AC reactor (ACR) or DC reactor (DCR), and input filter or output filter inside a panel with IP2X or higher. When an operator can easily touch the panel, ensure that the protection grade of the top surface of the panel is IP4X or higher.
- Do not directly connect copper wire to the ground terminal. Use tin-plated or equivalent-plated crimped terminals for connections.
- When the inverter is used at locations 2,000 m or higher above sea level, the insulation of the control circuit is the basic insulation. The inverter cannot be used at locations 3,000 m above sea level.
- Use wires stipulated in IEC60364-5-52.

Power supply line	Standard applicable motor (kW)	Inverter model	Specifications	Molded case circuit breaker (MCCB) or earth leakage circuit breaker (RCD/ELCB) rated current*1		Recommended wire size (mm ²)														
				With DC reactor	Without DC reactor	For main circuit														
						Main power supply input [L1/R, L2/S, L3/T]*2		Inverter ground [⊕]*2*3		Inverter output [U, V, W]*2	For DC reactor connection [P1, P(+)]	For braking resistor connection [P(+), DB]*2	For control circuit terminal	Control power supply auxiliary input R0, T0						
				With DC reactor	Without DC reactor	With DC reactor	Without DC reactor													
Three-phase 200 V	0.1	3G3M1-	HHD	5	5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	0.75	-						
	0.2	A2001-ECT	HND																	
	0.4	3G3M1-	HHD																	
		A2002-ECT	HND																	
	0.75	3G3M1-	HHD	10																
		A2004-ECT	HND																	
	1.1	3G3M1-	HHD	10	15															
	A2007-ECT	HND																		
	1.5	3G3M1-	HHD	20	30															
	2.2	A2015-ECT	HND																	
	3	3G3M1-	HHD																	
		A2022-ECT	HND																	
	3.7	3G3M1-	HHD	30	40										4	4	4	4		
	5.5	A2037-ECT	HND												6	6				
	7.5	3G3M1-	HHD	40	75										4	4	4	6	10	
		A2055-ECT	HND																	
	11	3G3M1-	HHD	50	100										10	16	10	16	10	16
		A2075-ECT	HND																	
15	3G3M1-	HHD	75	125	16	25	16	16	16	25										
	A2110-ECT	HND																		
18.5	3G3M1-	HHD	100	150	25	35	25	25	35	2.5										
	A2150-ECT	HND																		
22	3G3M1-	HHD	100	175	35	50	25	25	35											
A2185-ECT	HND																			

- *1. The frame size and model of MCCB, RCD or ELCB (with overcurrent protection function) change according to the capacity of the power transformer. For details on selection method, refer to related technical data.
- *2. The recommended size of wire to the main circuit terminal is the size when PVC wire having an allowable temperature of 70°C and a rated voltage of 600 V is used, and the ambient temperature is 40°C.
- *3. Only one wire of recommended size can be connected to the ground terminal.

Power supply line	Standard applicable motor (kW)	Inverter model	Specifications	Molded case circuit breaker (MCCB) or earth leakage circuit breaker (RCD/ELCB) rated current*1		Recommended wire size (mm ²)										
				With DC reactor	Without DC reactor	For main circuit						Inverter output [U, V, W]*2	For DC reactor connection [P1, P(+)]	For braking resistor connection [P(+), DB]*2	For control circuit terminal	Control power supply auxiliary input R0, T0
						Main power supply input [L1/R, L2/S, L3/T]*2		Inverter ground [⊕]*2*3		With DC reactor	Without DC reactor					
						With DC reactor	Without DC reactor	With DC reactor	Without DC reactor							
Three-phase 400 V	0.4	3G3M1-	HHD	5	5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	0.75	-		
	0.75	A4004-ECT	HND													
			HD													
			ND													
			1.1	3G3M1-	HHD										10	
	A4007-ECT	HND														
		HD														
		ND														
		1.5	3G3M1-	HHD	10										15	
	A4015-ECT			HND												
				HD												
				ND												
		2.2	3G3M1-	HHD	10										15	
	A4022-ECT			HND												
				HD												
				ND												
3.0		3G3M1-	HHD	10	15											
	A4030-ECT		HND													
			HD													
			ND													
4.0		3G3M1-	HHD	15	30											
	A4040-ECT		HND													
			HD													
			ND													
5.5		3G3M1-	HHD	15	30											
	A4055-ECT		HND													
			HD													
			ND													
7.5		3G3M1-	HHD	20	40											
	A4075-ECT		HND													
			HD													
			ND													

Power supply line	Standard applicable motor (kW)	Inverter model	Specifications	Molded case circuit breaker (MCCB) or earth leakage circuit breaker (RCD/ELCB) rated current*1		Recommended wire size (mm ²)									
						For main circuit						Inverter output [U, V, W]*2	For DC reactor connection [P1, P(+)]	For braking resistor connection [P(+), DB]*2	For control circuit terminal
				Main power supply input [L1/R, L2/S, L3/T]*2		Inverter ground [⊕]*2*3		Without DC reactor	Without DC reactor	Without DC reactor	Without DC reactor				
				With DC reactor	Without DC reactor	With DC reactor	Without DC reactor					With DC reactor	Without DC reactor		
Three-phase 400 V	11	3G3M1-A4055-ECT	ND	30	50	4	6	4	6	4	4	2.5	0.75	-	
		3G3M1-A4075-ECT	HND												
		3G3M1-A4110-ECT	HD												
	15	3G3M1-A4110-ECT	HHD	ND	40	69	6	10	6	10	6	10			
		3G3M1-A4075-ECT	HND												
		3G3M1-A4150-ECT	HD												
	18.5	3G3M1-A4110-ECT	HND	ND	75	10	16	10	16	10					2.5
		3G3M1-A4150-ECT	HD												
		3G3M1-A4185-ECT	HHD												
	22	3G3M1-A4075-ECT	HND	ND	50	100						16			-
		3G3M1-A4185-ECT	HD												
		3G3M1-A4220-ECT	HHD												
	30	3G3M1-A4185-ECT	HND	ND	75	125	16	25	16		16	25			
		3G3M1-A4220-ECT	HD												
		37	ND												

*1. The frame size and model of MCCB, RCD or ELCB (with overcurrent protection function) change according to the capacity of the power transformer. For details on selection method, refer to related technical data.

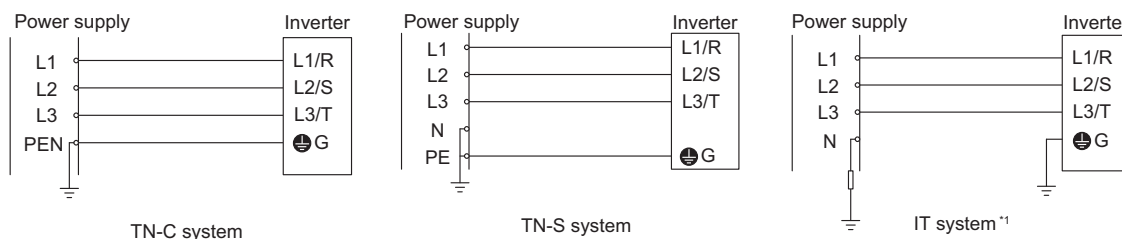
*2. The recommended size of wire to the main circuit terminal is the size when PVC wire having an allowable temperature of 70°C and a rated voltage of 600 V is used, and the ambient temperature is 40°C.

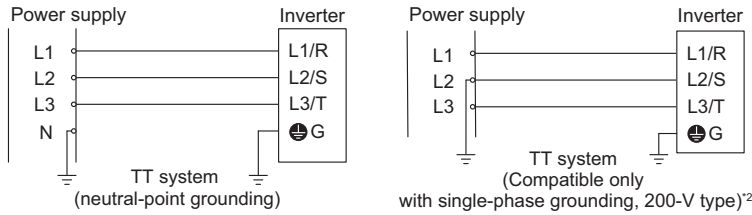
*3. Only one wire of recommended size can be connected to the ground terminal.

Power supply line	Standard applicable motor (kW)	Inverter model	Specifications	Molded case circuit breaker (MCCB) or earth leakage circuit breaker (RCD/ELCB) rated current*1		Recommended wire size (mm ²)													
				With DC reactor	Without DC reactor	For main circuit						Inverter output [U, V, W] ²	For DC reactor connection [P1, P(+)]	For braking resistor connection [P(+), DB] ²	For control circuit terminal	Control power supply auxiliary input R0, T0			
						Main power supply input [L1/R, L2/S, L3/T] ²		Inverter ground [⊕] ^{2*3}		With DC reactor	Without DC reactor						With DC reactor	Without DC reactor	
				With DC reactor	Without DC reactor	With DC reactor	Without DC reactor	With DC reactor	Without DC reactor										
Single-phase 200 V	0.1	3G3M1-AB001-ECT	HHD	5	5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	0.75	-					
	0.2	3G3M1-AB002-ECT	HND																
	0.4	3G3M1-AB004-ECT	HND												10				
	0.55	3G3M1-AB007-ECT	HND	10	15														
	0.75	3G3M1-AB015-ECT	HND	30	30										4	4			
	1.1	3G3M1-AB022-ECT	HND	30	40										4	4	6		
	1.5	3G3M1-AB037-ECT	HND	20	40										6	10	6	10	
	2.2	3G3M1-AB037-ECT	HND	30	60										6	10	6	10	10
	3.0	3G3M1-AB037-ECT	HND	30	60										6	10	6	10	10
	3.7	3G3M1-AB037-ECT	HND	40	60										6	10	6	10	10

- *1. The frame size and model of MCCB, RCD or ELCB (with overcurrent protection function) change according to the capacity of the power transformer. For details on selection method, refer to related technical data.
- *2. The recommended size of wire to the main circuit terminal is the size when PVC wire having an allowable temperature of 70°C and a rated voltage of 600 V is used, and the ambient temperature is 40°C.
- *3. Only one wire of recommended size can be connected to the ground terminal.

• Use this product on the following power supply system.





*1. The following IT system power supply is supported.

When the power supply system is not grounded at all	The insulation between the control interface and the main circuit of the inverter is the basic insulation. Accordingly, do not connect the SELV circuit directly from an external controller. (Connect using additional insulation.) Install a ground fault detector, and cut off the power supply within five seconds of a ground fault.
When the neutral point is grounded through an impedance	
When a single phase of the power supply is grounded through an impedance	Not supported.

*2. TT systems to which a single phase of a 400 V power supply is directly grounded are not supported.

- **A solid-state motor overload protection function (motor overload protection by electronic thermal relay) is mounted on each model. The protection level can be set at objects 3004Hex-0BHex to 3004Hex-0DHex**

Compliance with EMC Directive and Low Voltage Directive

(Manufacturer)

OMRON Corporation (Manufacturer)

Shiokoji Horikawa, Shimogyo-ku, Kyoto 600-8530 Japan

(Importer)

OMRON Europe B.V. (Importer in EU)

Wegalaan 67-69, 2132 JD Hoofddorp, The Netherlands

Cautions when exporting to Europe

- Not all OMRON products in Europe are imported through the above importer. When a different importer is exporting OMRON products to Europe, those importer is responsible to clarify their name and address as an importer and clearly indicate to the customer.

Compliance with UKCA

The UK legislation require clear indication of the name and address of the manufacturer and importer is compulsory. The importer must clearly indicate the importer name and address to the customer.

(Manufacturer)

OMRON Corporation (Manufacturer)

Shiokoji Horikawa, Shimogyo-ku, Kyoto 600-8530 Japan

(UKCA Contact)

Omron Electronics LTD.
Opal Drive, Fox Milne, MK15 0DG, Milton Keynes, United Kingdom

Ecodesign Directive

We provide the VSD efficiency information regarding to motor regulation.

For details, please visit the following website.

<https://industrial.omron.eu/en/company-info/environmental/ecodesign-directive>



2-4-2 UL/cUL Standards Cautions

Caution

UL and cUL compliance is subject to conditions. Strictly observe the conditions listed in the instruction manual or user's manual. Not doing so may result in fire or accidents.

The warnings and instructions in this section summarizes the procedures necessary to ensure an inverter installation complies with Underwriters Laboratories guidelines.

Applicable Standards: UL61800-5-1, C22.2 No.274-17

- Use UL certified 60/75°C Cu wire only.
- Use Class1 wire for control circuits.
- This inverter is suitable for use on circuits where the delivering current is limited to 100 kA or less when protected by external Semiconductor Fuse with UL recognition. See next section for details of fuses.
- This inverter should be installed in an environment of pollution degree 2 and an overvoltage class III.
- Maximum surrounding air temperature is as below.

Inverter Type	HHD/HND	HD/ND
3G3M1-A2001-ECT, 3G3M1-A2002-ECT, 3G3M1-A2004-ECT, 3G3M1-A2007-ECT, 3G3M1-A2015-ECT 3G3M1-A2055-ECT, 3G3M1-A2075-ECT, 3G3M1-A2110-ECT, 3G3M1-A2150-ECT, 3G3M1-A2185-ECT	50°C	-
3G3M1-A4004-ECT, 3G3M1-A4007-ECT, 3G3M1-A4015-ECT 3G3M1-A4055-ECT, 3G3M1-A4075-ECT, 3G3M1-A4110-ECT, 3G3M1-A4150-ECT, 3G3M1-A4185-ECT, 3G3M1-A4220-ECT, 3G3M1-AB001-ECT, 3G3M1-AB002-ECT	50°C	40°C
3G3M1-AB037-ECT	50°C	-

Inverter Type	HHD	HND/HD/ND
3G3M1-A2022-ECT, 3G3M1-A2037-ECT 3G3M1-A4022-ECT, 3G3M1-A4030-ECT, 3G3M1-A4040-ECT 3G3M1-AB004-ECT, 3G3M1-AB007-ECT, 3G3M1-AB015-ECT, 3G3M1- AB022-ECT	50°C	40°C

- Set motor (electronic thermal) protection levels using parameters 3004Hex-0BHex to 3004Hex-0DHex. (For details, refer to *6-3-3 Motor Electronic Thermal Function* on page 6-18.)
- Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the National Electric Code and any additional local codes.

The inverter does not have motor overheat protection built in.

Main Circuit Terminal Block Screw Sizes, Tightening Torque and Wire Sizes

Power supply system	Standard applicable motor (kW)	Inverter Model	HHD/HD/HND/ND modes	Tightening torque lb-in (N · m)			Wire size AWG (mm ²)							
				Main Terminal	Inverter's grounding	Control circuit auxiliary input	Main circuit copper wire						⊕ G	Control circuit auxiliary input
							L1/R, L2/S, L3/T			U, V, W				
							60°C Cu Wire	75°C Cu Wire	Remarks	60°C Cu Wire	75°C Cu Wire	Remarks	Inverter's grounding	
Three-phase 200 V	0.1	3G3M1-A2001-ECT	HHD	10.6 (1.2)	15.9 (1.8)	-	14 (2.1)	14 (2.1)	*3	14 (2.1)	14 (2.1)	*3	14 (2.1)	-
	0.2	3G3M1-A2001-ECT	HND											
		3G3M1-A2002-ECT	HHD											
	0.4	3G3M1-A2002-ECT	HND											
		3G3M1-A2004-ECT	HHD											
	0.75	3G3M1-A2004-ECT	HND											
		3G3M1-A2007-ECT	HHD											
	1.1	3G3M1-A2007-ECT	HND											
	1.5	3G3M1-A2015-ECT	HHD											
	2.2	3G3M1-A2015-ECT	HND										12 (3.3)	
		3G3M1-A2022-ECT	HHD											
	3	3G3M1-A2022-ECT	HND											

Power supply system	Standard applicable motor (kW)	Inverter Model	HHD/HD/HND/ND modes	Tightening torque lb-in (N · m)			Wire size AWG (mm ²)							
				Main Terminal	Inverter's grounding	Control circuit auxiliary input	Main circuit copper wire						Ⓜ G	Control circuit auxiliary input
							L1/R, L2/S, L3/T			U, V, W				
							60°C Cu Wire	75°C Cu Wire	Remarks	60°C Cu Wire	75°C Cu Wire	Remarks		
Three phase 200 V	3.7	3G3M1-A2037-ECT	HHD	10.6 (1.2)	15.9 (1.8)	-	14 (2.1)	14 (2.1)	*3	12 (3.3)	12 (3.3)	*3	10 (5.3)	-
	5.5	3G3M1-A2037-ECT	HND	27 (3)	27 (3)		10 (5.3)	10 (5.3)		10 (5.3)	10 (5.3)		8 (8.4)	
		3G3M1-A2055-ECT	HHD				8 (8.4)	8 (8.4)						
	7.5	3G3M1-A2055-ECT	HND	51.3 (5.8)	51.3 (5.8)		6 (13.3)			8 (8.4)	8 (8.4)		6 (13.3)	
		3G3M1-A2075-ECT	HHD				4 (21.2)	6 (13.3)		6 (13.3)				
	11	3G3M1-A2075-ECT	HND	3 (26.7)	4 (21.2)		3 (26.7)	4 (21.2)		4 (21.2)	6 (13.3)		14 (2.1)* 1*2	
		3G3M1-A2110-ECT	HHD				1 (42.4)	3 (26.7)		3 (26.7)	4 (21.2)			
	15	3G3M1-A2110-ECT	HND	10.6 (1.2)			1 (42.4)	3 (26.7)		3 (26.7)	4 (21.2)			
		3G3M1-A2150-ECT	HHD											
	18.5	3G3M1-A2150-ECT	HND											
3G3M1-A2185-ECT		HHD												
22	3G3M1-A2185-ECT	HND												

Power supply system	Standard applicable motor (kW)	Inverter Model	HHD/HD/HND/ND modes	Tightening torque lb-in (N · m)			Wire size AWG (mm ²)							
				Main Terminal	Inverter's grounding	Control circuit auxiliary input	Main circuit copper wire						Ⓜ G	Control circuit auxiliary input
							L1/R, L2/S, L3/T			U, V, W				
							60°C Cu Wire	75°C Cu Wire	Remarks	60°C Cu Wire	75°C Cu Wire	Remarks		
Three phase 400 V	0.4	3G3M1-A4004-ECT	HHD	10.6 (1.2)	15.9 (1.8)	-	14 (2.1)	14 (2.1)	*3	14 (2.1)	14 (2.1)	*3	14 (2.1)	-
	0.75	3G3M1-A4004-ECT	HD/HND											
		3G3M1-A4004-ECT	ND											
		3G3M1-A4007-ECT	HHD											
	1.1	3G3M1-A4007-ECT	HD/HND											
	1.5	3G3M1-A4007-ECT	ND											
		3G3M1-A4015-ECT	HHD											
	2.2	3G3M1-A4015-ECT	HD/HND										12 (3.3)	
		3G3M1-A4015-ECT	ND											
		3G3M1-A4022-ECT	HHD											
	3	3G3M1-A4022-ECT	ND											
		3G3M1-A4022-ECT	HD/HND											
		3G3M1-A4030-ECT	HHD											
	4	3G3M1-A4030-ECT	ND/HD/HND										10 (5.3)	
3G3M1-A4040-ECT		HHD												

Power supply system	Standard applicable motor (kW)	Inverter Model	HHD/HD/HND/ND modes	Tightening torque lb-in (N · m)			Wire size AWG (mm ²)							
				Main Terminal	Inverter's grounding	Control circuit auxiliary input	Main circuit copper wire						Ⓜ G	Control circuit auxiliary input
							L1/R, L2/S, L3/T			U, V, W				
							60°C Cu Wire	75°C Cu Wire	Remarks	60°C Cu Wire	75°C Cu Wire	Remarks	Inverter's grounding	
Three-phase 400 V	5.5	3G3M1-A4040-ECT	ND	10.6 (1.2)	15.9 (1.8)	-	12 (3.3)	12 (3.3)	*3	14 (2.1)	14 (2.1)	*3	10 (5.3)	-
		3G3M1-A4040-ECT	HD/HND											
		3G3M1-A4055-ECT	HHD	27 (3)	27 (3)									
	7.5	3G3M1-A4055-ECT	HD/HND	27 (3)	27 (3)	-	10 (5.3)	10 (5.3)	*3	12 (3.3)	12 (3.3)	*3	10 (5.3)	-
		3G3M1-A4075-ECT	HHD											
	11	3G3M1-A4055-ECT	ND				8 (8.4)	8 (8.4)		10 (5.3)	10 (5.3)		8 (8.4)	
		3G3M1-A4075-ECT	HD/HND											
		3G3M1-A4110-ECT	HHD	51.3 (5.8)	51.3 (5.8)									
	15	3G3M1-A4075-ECT	ND	27 (3)	27 (3)		6 (13.3)							
		3G3M1-A4110-ECT	HD/HND	51.3 (5.8)	51.3 (5.8)					8 (8.4)	8 (8.4)			
		3G3M1-A4150-ECT	HHD											
	18.5	3G3M1-A4110-ECT	ND					6 (13.3)		6 (13.3)			6 (13.3)	14 (2.1)* 1*2
		3G3M1-A4150-ECT	HD/HND											
		3G3M1-A4185-ECT	HHD			10.6 (1.2)					6 (13.3)			

Power supply system	Standard applicable motor (kW)	Inverter Model	HHD/HND/HND/ND modes	Tightening torque lb-in (N · m)			Wire size AWG (mm ²)								
				Main Terminal	Inverter's grounding	Control circuit auxiliary input	Main circuit copper wire						⊕ G	Control circuit auxiliary input	
							L1/R, L2/S, L3/T			U, V, W					
							60°C Cu Wire	75°C Cu Wire	Remarks	60°C Cu Wire	75°C Cu Wire	Remarks	Inverter's grounding		
Three-phase 400 V	22	3G3M1-A4150-ECT	ND	51.3 (5.8)	51.3 (5.8)	10.6 (1.2)	4 (21.2)	6 (13.3)	*3	6 (13.3)	6 (13.3)	*3	6 (13.3)	14 (2.1)* 1*2	
		3G3M1-A4185-ECT	HD/HND												
		3G3M1-A4220-ECT	HHD												
	30	3G3M1-A4185-ECT	ND	3 (26.7)	4 (21.2)	4 (21.2)									
		3G3M1-A4220-ECT	HD/HND												
	37	3G3M1-A4220-ECT	ND	2 (33.6)	3 (26.7)	3 (26.7)	4 (21.2)								
	Single-phase 200 V	0.1	3G3M1-AB001-ECT	HHD	7.1 (0.8)	10.6 (1.2)	-	14 (2.1)	14 (2.1)	*3	14 (2.1)	14 (2.1)	*3		14 (2.1)
			3G3M1-AB001-ECT	HND											
		3G3M1-AB002-ECT	HHD												
0.4		3G3M1-AB002-ECT	HND												
		3G3M1-AB004-ECT	HHD												
0.75		3G3M1-AB004-ECT	HND	12 (3.3)											
		3G3M1-AB007-ECT	HHD												
1.1		3G3M1-AB007-ECT	HND	10 (5.3)											

Power supply system	Standard applicable motor (kW)	Inverter Model	HHD/HD/HND/ND modes	Tightening torque lb-in (N · m)			Wire size AWG (mm ²)							
				Main Terminal	Inverter's grounding	Control circuit auxiliary input	Main circuit copper wire						Ⓜ G	Control circuit auxiliary input
							L1/R, L2/S, L3/T			U, V, W				
							60°C Cu Wire	75°C Cu Wire	Remarks	60°C Cu Wire	75°C Cu Wire	Remarks		
Single-phase 200 V	1.5	3G3M1-AB015-ECT	HHD	10.6 (1.2)	15.9 (1.8)	-	12 (3.3)	12 (3.3)	*3	14 (2.1)	14 (2.1)	*3	10 (5.3)	-
	2.2	3G3M1-AB015-ECT	HND				10 (5.3)	10 (5.3)						
		3G3M1-AB022-ECT	HHD											
	3	3G3M1-AB022-ECT	HND											
	3.7	3G3M1-AB037-ECT	HHD	27 (3)	27 (3)		6 (13.3)	8 (8.4)		12 (3.3)	12 (3.3)		8 (8.4)	

*1. Wires can be connected without any terminal treatment.

*2. Only 75°C (167°F) Cu wiring can be used.

*3. Shows common wiring sizes for UL Open Type and Enclosed Type. Please contact us separately if dedicated UL Open Type wiring sizes are required.

Fuse Size

Power supply voltage	Standard applicable motor (kW)	Inverter model	HHD/HD/HND/ND mode	Semiconductor protection fuse product number, manufacturer: Mersen / Bussmann (Eaton)
Three-phase 200 V	0.1	3G3M1-A2001-ECT	HHD	PC30UD69V50□/170M3458
	0.2	3G3M1-A2001-ECT	HND	
		3G3M1-A2002-ECT	HHD	PC30UD69V50□/170M3458
	0.4	3G3M1-A2002-ECT	HND	
		3G3M1-A2004-ECT	HHD	PC30UD69V50□/170M3458
	0.75	3G3M1-A2004-ECT	HND	
		3G3M1-A2007-ECT	HHD	PC30UD69V50□/170M3460
	1.1	3G3M1-A2007-ECT	HND	
	1.5	3G3M1-A2015-ECT	HHD	PC30UD69V80□/170M3462
	2.2	3G3M1-A2015-ECT	HND	
		3G3M1-A2022-ECT	HHD	PC30UD69V125□/170M3462
	3	3G3M1-A2022-ECT	HND	
	3.7	3G3M1-A2037-ECT	HHD	PC30UD69V125□/170M3463
	5.5	3G3M1-A2037-ECT	HND	
		3G3M1-A2055-ECT	HHD	PC30UD69V160□/170M3464
	7.5	3G3M1-A2055-ECT	HND	
		3G3M1-A2075-ECT	HHD	PC30UD69V200□/170M3465
	11	3G3M1-A2075-ECT	HND	
		3G3M1-A2110-ECT	HHD	PC30UD69V200□/170M3465
	15	3G3M1-A2110-ECT	HND	
3G3M1-A2150-ECT		HHD	PC30UD69V250□/170M3466	
18.5	3G3M1-A2150-ECT	HND		
	3G3M1-A2185-ECT	HHD	PC30UD69V250□/170M3466	
22	3G3M1-A2185-ECT	HND		

Power supply voltage	Standard applicable motor (kW)	Inverter model	HHD/HD/HND/ND mode	Semiconductor protection fuse product number, manufacturer: Mersen / Bussmann (Eaton)
Three-phase 400V	0.4	3G3M1-A4004-ECT	HHD	PC30UD69V50□/170M3458
	0.75	3G3M1-A4004-ECT	HD/HND	
		3G3M1-A4004-ECT	ND	
	1.1	3G3M1-A4007-ECT	HHD	PC30UD69V50□/170M3458
		3G3M1-A4007-ECT	HD/HND	
	1.5	3G3M1-A4007-ECT	ND	PC30UD69V50□/170M3459
		3G3M1-A4015-ECT	HHD	
	2.2	3G3M1-A4015-ECT	HD/HND	PC30UD69V63□/170M3460
		3G3M1-A4015-ECT	ND	
		3G3M1-A4022-ECT	HHD	
	3	3G3M1-A4022-ECT	HD/HND	PC30UD69V63□/170M3461
		3G3M1-A4022-ECT	ND	
	3.7	3G3M1-A4040-ECT	HHD	PC30UD69V100□/170M3462
	5.5	3G3M1-A4040-ECT	HD/HND	
		3G3M1-A4055-ECT	HHD	
	7.5	3G3M1-A4055-ECT	HD/HND	PC30UD69V100□/170M3462
		3G3M1-A4075-ECT	HHD	
	11	3G3M1-A4075-ECT	ND	PC30UD69V100□/170M3462
		3G3M1-A4075-ECT	HD/HND	PC30UD69V100□/170M3462
		3G3M1-A4110-ECT	HHD	PC30UD69V125□/170M3463
	15	3G3M1-A4075-ECT	ND	PC30UD69V100□/170M3462
		3G3M1-A4110-ECT	HD/HND	PC30UD69V125□/170M3463
		3G3M1-A4150-ECT	HHD	PC30UD69V160□/170M3464
18.5	3G3M1-A4110-ECT	ND	PC30UD69V125□/170M3463	
	3G3M1-A4150-ECT	HD/HND	PC30UD69V160□/170M3464	
	3G3M1-A4185-ECT	HHD	PC30UD69V160□/170M3464	
22	3G3M1-A4150-ECT	ND	PC30UD69V160□/170M3464	
	3G3M1-A4185-ECT	HD/HND	PC30UD69V160□/170M3464	
	3G3M1-A4220-ECT	HHD	PC30UD69V200□/170M3465	
30	3G3M1-A4185-ECT	ND	PC30UD69V160□/170M3464	
	3G3M1-A4220-ECT	HD/HND	PC30UD69V200□/170M3465	
37	3G3M1-A4220-ECT	ND		

Power supply voltage	Standard applicable motor (kW)	Inverter model	HHD/HD/HND/ND mode	Semiconductor protection fuse product number, manufacturer: Mersen / Busmann (Eaton)
Single-phase 200 V	0.1	3G3M1-AB001-ECT	HHD	PC30UD69V50□/170M3458
	0.2	3G3M1-AB001-ECT	HND	
		3G3M1-AB002-ECT	HHD	PC30UD69V50□/170M3458
	0.4	3G3M1-AB002-ECT	HND	PC30UD69V50□/170M3458
		3G3M1-AB004-ECT	HHD	
	0.75	3G3M1-AB004-ECT	HND	PC30UD69V50□/170M3460
		3G3M1-AB007-ECT	HHD	
	1.1	3G3M1-AB007-ECT	HND	PC30UD69V125□/170M3462
	1.5	3G3M1-AB015-ECT	HHD	
	2.2	3G3M1-AB015-ECT	HND	PC30UD69V125□/170M3463
3G3M1-AB022-ECT		HHD		
3	3G3M1-AB022-ECT	HND	PC30UD69V160□/170M3464	
3.7	3G3M1-AB037-ECT	HHD		

3

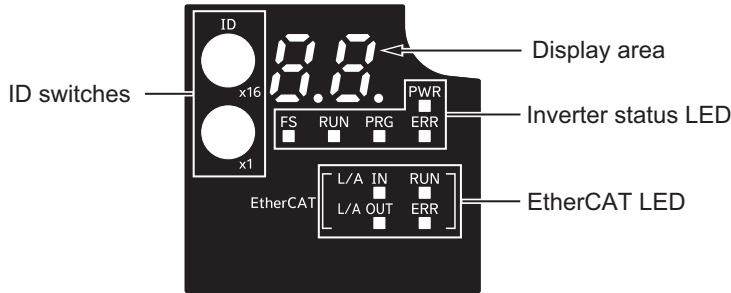
EtherCAT Communications

This section explains EtherCAT communications under the assumption that the inverter is connected to a Machine Automation Controller NJ/NX-series CPU Unit.

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3-1 Display Area and Settings

This section explains the indicators and switches located on the front of the inverter.



3-1-1 Node Address Setting

Use the ID switches located in the display area to set the EtherCAT node address.

ID switch setting	Description
	Connection to NJ/NX-series CPU Unit
00	The controller sets the node address.
01 to FF	The ID switches set the node address.



Additional Information

- The ID switch setting is read only once when the Unit power supply is turned ON. Although the setting is changed after the Unit power supply is ON, it is not reflected in the control. It is enabled the next time the Unit power supply is turned ON.
- EtherCAT Slave Information File**
Information on EtherCAT slave settings is stored in the ESI (EtherCAT Slave Information) file. The master uses the information in this file to configure the network and set communications parameters. This information is in an XML file.

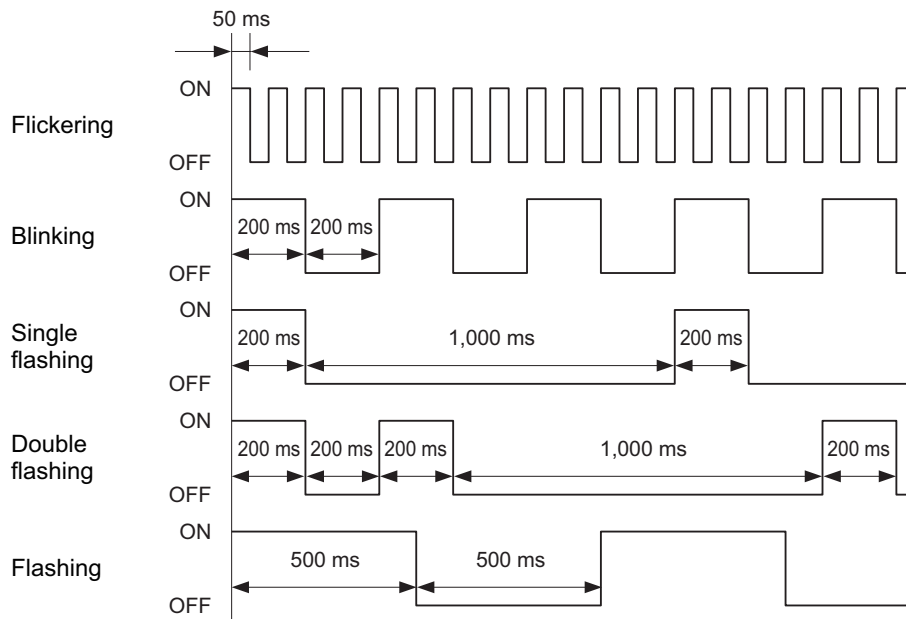
3-1-2 Name of Each Status Indicator

The following table shows the status indicators and their meaning.

Name	Function	Color	Status	Description
Power indicator	Indicates the status of control power supply.	Green	OFF	Control power supply OFF
			ON	Control power supply ON
FS indicator	Indicates FSoE communications status.	Green	ON	FSoE slave connection established
			Flashing	FSoE slave connection establishment in progress
		Red	Flashing	Safety Parameter Error, Safety Communications Timeout, or other errors
		---	OFF	STO via FSoE is disabled, the power is not supplied, or a fatal error including Self-diagnosis Error
RUN (Operation) indicator	Indicates that the inverter is running.	Green	OFF	Stopped
			ON	Running

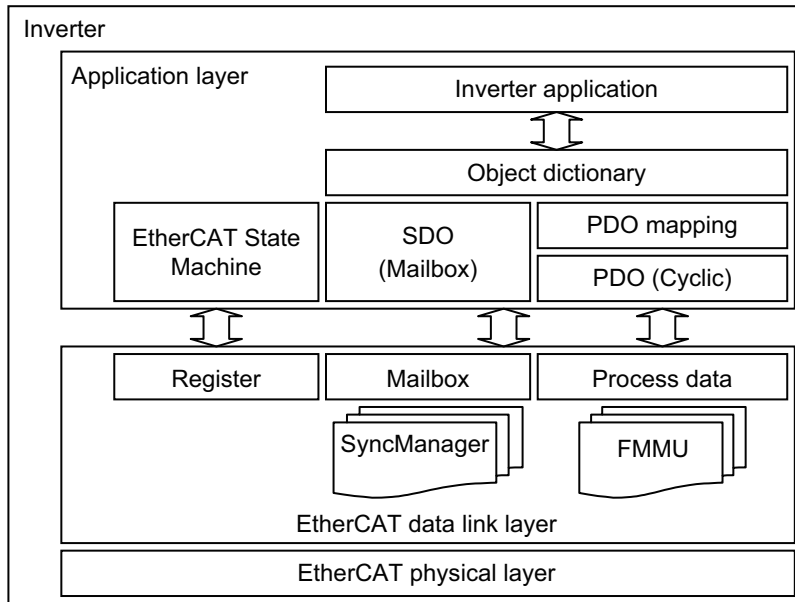
Name	Function	Color	Status	Description
Program indicator	Indicates the PDO mapping error status.	Green	OFF	No PDO mapping error
			Flashing	PDO mapping error
Error indicator	Indicates that an error has occurred in the Unit.	Red	OFF	No error
			ON	Error
			Flashing	Warning
EtherCAT L/A IN indicator	Indicates link status in EtherCAT physical layer.	Green	OFF	Link not established in physical layer
			ON	Link established in physical layer
			Flickering	In operation after link was established
EtherCAT L/A OUT indicator	Indicates link status in EtherCAT physical layer.	Green	OFF	Link not established in physical layer
			ON	Link established in physical layer
			Flickering	In operation after link was established
EtherCAT RUN indicator	Indicates the status of ESM.	Green	OFF	Init state or power OFF state
			Blinking	Pre-Operational state
			Single flash	Safe-Operational state
			ON	Operational state
EtherCAT error indicator	Indicates EtherCAT communications error status.	Red	OFF	No error
			Blinking	Communications setting error
			Single flash	Synchronization error or communications data error
			Double flash	Application WDT timeout (Sync Manager WDT Error)
			Flickering	Boot error
			ON	A fatal error such as WDT timeout

See the following diagram for the status of the indicators.



3-2 Structure of the CAN Application Protocol over EtherCAT

This section explains the structure of the CAN application protocol over EtherCAT (CoE) for an M1-series Inverters with Built-in EtherCAT Communications.



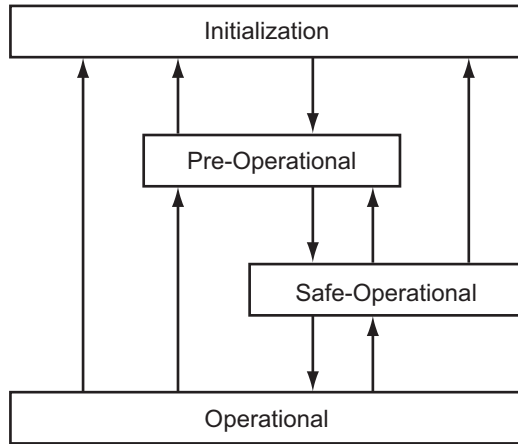
Normally, EtherCAT can transmit different protocols. M1-series Inverters with Built-in EtherCAT Communications use the IEC 61800-7 (CiA 402) drive profile.

The object dictionary in the application layer contains parameters and application data as well as information on the PDO mapping between the process data servo interface and Servo Drive application. The process data object (PDO) consists of the object dictionary that can be used for PDO mapping. The contents of the process data are defined by the PDO mapping.

Process data communications cyclically reads and writes the PDO. Mailbox communications (SDO) uses asynchronous message communications where all objects in the object dictionary can be read and written.

3-3 Communications Status Transitions

The EtherCAT State Machine (ESM) of the EtherCAT slave is controlled by the EtherCAT master.

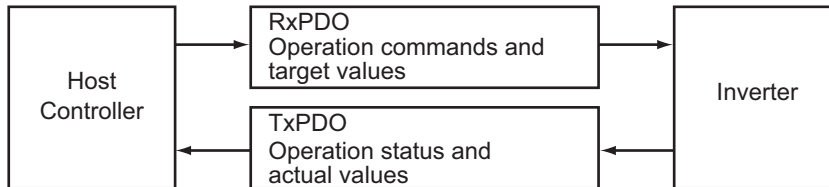


State	SDO communications	PDO reception	PDO transmission	Description
Init	Not possible	Not possible	Not possible	Communication initialization is in progress. Communications are not possible.
Pre-Operational	Possible	Not possible	Not possible	Only SDO communications are possible in this state. This state is entered after initialization is completed. In this state, the network settings are initialized.
Safe-Operational	Possible	Not possible	Possible	In this state, PDO transmissions are possible in addition to SDO communications. PDO transmissions can be used to send information such as status from the inverter.
Operational	Possible	Possible	Possible	This is a normal operating state. PDO communications can be used to control the Servomotor.

Note The Bootstrap mode is not supported.

3-4 Process Data Objects (PDOs)

The process data objects (PDOs) are used for real-time data transfer during cyclic communications. PDOs can be RxPDOs, which receive data from the controller, or TxPDOs, which send status from the inverter to the host controller.



The EtherCAT application layer can hold multiple objects to enable transferring inverter process data. The contents of the process data are described in the PDO mapping objects and the Sync Manager PDO Assignment objects.

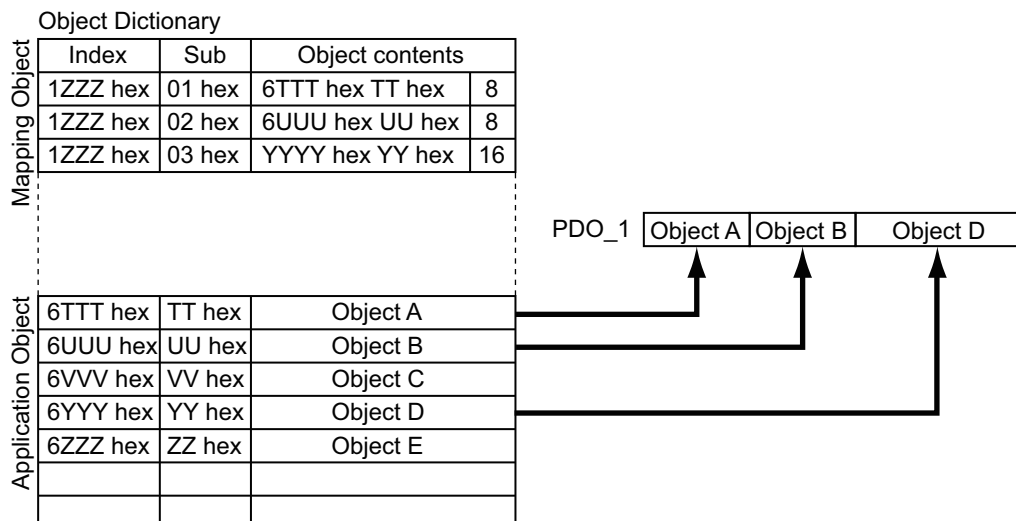
3-4-1 PDO Mapping Settings

The PDO mapping objects provide mapping for the application objects (real-time process data) between the object dictionary and PDOs.

The number of mapped objects is shown in subindex *00 hex* in the mapping table. In this mapping table, *1600 to 17FF hex* are for RxPDOs and *1A00 to 1BFF hex* are for TxPDOs.

M1-series Inverters use *1600 hex*, *1700 hex*, *1701 hex*, and *1710 hex* for an RxPDO, and *1A00 hex*, *1B00 hex*, *1B01 hex*, *1B10 hex*, and *1BFF hex* for a TxPDO.

The following table is an example of PDO mapping.

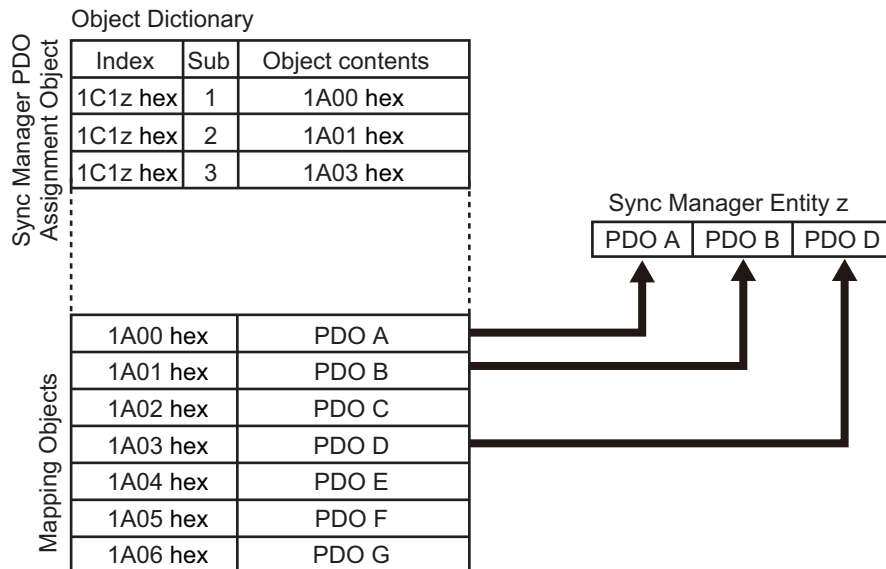


3-4-2 Sync Manager PDO Assignment Settings

A Sync Manager channel consists of several PDOs. The Sync Manager PDO Assignment objects describe relationships between these PDOs and the Sync Manager.

The number of PDOs is shown in subindex *00 hex* in the Sync Manager PDO Assignment table. M1-series Inverters use *1C12 hex* for an RxPDO, and *1C13 hex* for a TxPDO.

The following table is an example of Sync Manager PDO mapping.



3-4-3 Fixed PDO Mapping

This section describes the contents of fixed PDO mapping for M1-series Inverters. You cannot change these contents.

PDO Mapping 1 (Velocity Control)

RxPDO: 258th receive PDO Mapping (1701 hex)	Command (5000 hex) and Frequency Reference (5010 hex)
TxPDO: 258th transmit PDO Mapping (1B01 hex)	Status (5100 hex) and Frequency Reference Monitor (5110 hex)

PDO Mapping 2 (Velocity Control)

This is the mapping for applications that use the Velocity mode of the CiA402 drive profile.

RxPDO: 257th receive PDO Mapping (1700 hex)	Controlword (6040 hex) and vl target velocity (6042 hex)
TxPDO: 257th transmit PDO Mapping (1B00 hex)	Statusword (6041 hex) and vl velocity demand (6043 hex)

PDO Mapping 3 (Safety Function)

This is the mapping for using the safety function through EtherCAT communications.

RxPDO: 273th receive PDO Mapping (1710 hex)	FSoE Master CMD (E700-01 hex), STO command (6640 hex), Error Acknowledge (6632 hex), FSoE Master CRC_0 (E700-03 hex), and FSoE Master Conn_ID (E700-02 hex)
TxPDO: 273th transmit PDO Mapping (1B10 hex)	FSoE Slave CMD (E600-01 hex), STO command (6640 hex), Error Acknowledge (6632 hex), Safety Connection Status (E601-01 hex), FSoE Slave CRC_0 (E600-03 hex), and FSoE Slave Conn_ID (E600-02 hex)

3-4-4 Variable PDO Mapping

M1-series Inverters allow you to change some mapped objects.

The PDO mapping objects for which you can change the setting are the **1st receive PDO Mapping** (1600 hex) and the **1st transmit PDO Mapping** (1A00 hex).

These objects can be changed only when the EtherCAT communications state is Pre-Operational.

Since the mapping you changed is not saved in non-volatile memory, set the EtherCAT master so that the settings can be configured each time you turn ON the power supply in order to use the mapping other than the default setting.

Default Setting

RxPDO: 1st receive PDO Mapping (1600 hex)	No variable PDO mapping
TxPDO: 1st transmit PDO Mapping (1A00 hex)	No variable PDO mapping

Maximum Number of Objects and Maximum Total Size Allowed in a PDO Mapping

PDO mapping object	Max. number of objects	Max. total size of objects
RxPDO	10 ^{*1}	32 bytes ^{*2}
TxPDO	10 ^{*1}	38 bytes ^{*2}

*1. Total excluding the FsoE protocol

*2. Including the FsoE protocol



Additional Information

For information on the objects you can map, refer to *A-2-5 PDO Mapping Objects* on page A-15.

3-4-5 Sync Manager PDO Mapping Assignment Settings

M1-series Inverters use **Sync Manager 2 to 3 PDO Assignment**.

You can assign PDO mapping objects to each Sync Manager as shown in the following table.

Sync Manager	Assigned object	Supported PDO	Assigned PDO mapping object	Max. No. of assigned objects
Sync Manager 2	1C12 hex	RxPDO	1600 hex, 1700 hex, 1701 hex, and 1710 hex	3 ^{*1}

Sync Manager	Assigned object	Supported PDO	Assigned PDO mapping object	Max. No. of assigned objects
Sync Manager 3	1C13 hex	TxPDO	1A00 hex, 1B00 hex, 1B01 hex, 1B10 hex, and 1BFF hex	3*2

*1. The maximum object size assigned to **Sync Manager 2 PDO Assignment** is 32 bytes.

*2. The maximum object size assigned to **Sync Manager 3 PDO Assignment** is 38 bytes.

Objects are mapped in the order of subindex setting *01 hex*, *02 hex*, and *03 hex*.

These objects can be changed only when the EtherCAT communications state is Pre-Operational. Since the mapping you changed is not saved in non-volatile memory, set the EtherCAT master so that the settings can be configured each time you turn ON the power supply in order to use the mapping other than the default setting.

Default Setting

Sync Manager 2 (1C12 hex)	1701 hex
Sync Manager 3 (1C13 hex)	1B01 hex



Additional Information

If any of the following operation is attempted, as a PDO Setting Error, the 7-segment display will display *Et* and the error code object (603F hex) will display 6341 hex.

- If mapped objects exceed the maximum total size
- If the safety function objects 1710 hex and 1B10 hex are not added to the end of PDO mapping
- If the FSoE-related objects 6632 hex, 6640 hex, E600 hex, E601 hex, and E700 hex are assigned to other PDO mapping objects than 1710 hex and 1B10 hex
- If, with Controlword (6040 hex) or vl target velocity (6042 hex) assigned to mapping, Command (5000 hex) and Frequency Reference (5010 hex) are also assigned to mapping

3-5 Service Data Objects (SDOs)

M1-series Inverters support SDO communications. SDO communications are used for setting objects and monitoring the status of inverters. The host controller performs object setting and status monitoring by reading and writing data to entries in the object dictionary.

The following table lists the abort codes (ABORT) for when an SDO communications error occurs.

Code (hex)	Meaning
05030000	Toggle bit not changed
05040000	SDO protocol timeout
05040001	Client/Server command specifier not valid or unknown
05040005	Out of memory
06010000	Unsupported access to an object
06010001	Attempt to read to a write only object
06010002	Attempt to write to a read only object
06010003	Subindex 00 hex is not set to 0, so data cannot be written
06020000	The object does not exist in the object directory
06040041	The object can not be mapped into the PDO
06040042	The number and length of the objects to be mapped would exceed the PDO length
06040043	General parameter incompatibility reason
06040047	General internal incompatibility in the device
06060000	Access failed due to a hardware error
06070010	Data type does not match, length of service parameter does not match
06070012	Data type does not match, length of service parameter too high
06070013	Data type does not match, length of service parameter too low
06090011	Subindex does not exist
06090030	Value range of parameter exceeded (only for write access)
06090031	Value of parameter written too high
06090032	Value of parameter written too low
06090036	Maximum value is less than minimum value
08000000	General error
08000020	Data cannot be transferred or stored to the application
08000021	Data cannot be transferred or stored to the application because of local control ^{*1}
08000022	Data cannot be transferred or stored to the application because of the present device state
08000023	Object dictionary dynamic generation fails or no object dictionary is present

*1. In this state, the slave operates locally and cannot be controlled from the EtherCAT master.

3-6 Synchronization Mode and Communications Cycle

M1-series Inverters support the following synchronization modes.

- Free-Run Mode

Note SM Event Mode is not supported.

3-6-1 Free-Run Mode

You can use the Free-Run Mode when synchronization such as the DC Mode is not required.

In Free-Run Mode, slaves perform I/O processing, i.e. refresh I/O data asynchronously with the communications cycle of the master.

Communications Cycle

The communications cycle is determined by the cycle time of the master.

Setting range: 125 μ s to 100 ms

3-7 Emergency Messages

When an error or warning occurs in an M1-series Inverter, an emergency message is sent to the master through SDO communications. An emergency message is not sent for a communications error.

You can select whether or not to send emergency messages in **Diagnosis History** (10F3 hex).

When the power supply is turned ON, **Diagnosis History – Flags** (10F3-05 hex) is set to 0 (not notify).

To send emergency messages, set the least significant bit of **Diagnosis History – Flags** (10F3-05 hex) to 1 every time the power is turned ON.

An emergency message consists of 8-byte data.

Byte	0	1	2	3	4	5	6	7
Contents	Emergency Error Code*1		Error Register (object 1001 hex)	Manufacturer-specific Error Field*2				

*1. Error codes (FF00 to FFFF hex) in the manufacturer-specific area are used. Byte 0 is fixed to *FF hex*, and byte 1 shows the main code of an error number or warning number.

*2. Byte 3 is not used. An error code is shown in bytes 4 to 7. For details on error event codes, refer to *A-5 Sysmac Error Status Codes* on page A-206.

Note For details on errors and warnings of the inverter, refer to *Section 9 Troubleshooting* on page 9-1.

3-8 Sysmac Device Features

Sysmac Device refers to the control device product designed according to standardized communications and user interface specifications for OMRON control devices. And the features that are available with such a device are called Sysmac Device Features.

This section describes the features that the inverter provides when it is combined with a Machine Automation Controller such as NJ/NX series and automation software.

Sysmac Error Status

Because, in Sysmac Devices, errors that may occur in slaves are systematized, you can check the causes and remedies for errors with a common procedure.

The status of an error can be monitored in the **Sysmac Error Status** (2002-01 hex). To display the error detected by the inverter in Sysmac Studio, the **Sysmac Error Status** (2002-01 hex) must be mapped to the PDO. Sysmac Studio, by default, uses the **512th transmit PDO Mapping** (1BFF hex) assignment to map the **Sysmac Error Status** (2002-01 hex) automatically to the PDO.



Additional Information

- For the **Sysmac Error Status** (2002-01 hex), refer to *A-2-7 Manufacturer Specific Objects 1* on page A-24.
- For errors displayed in Sysmac Studio, refer to *A-5 Sysmac Error Status Codes* on page A-206.

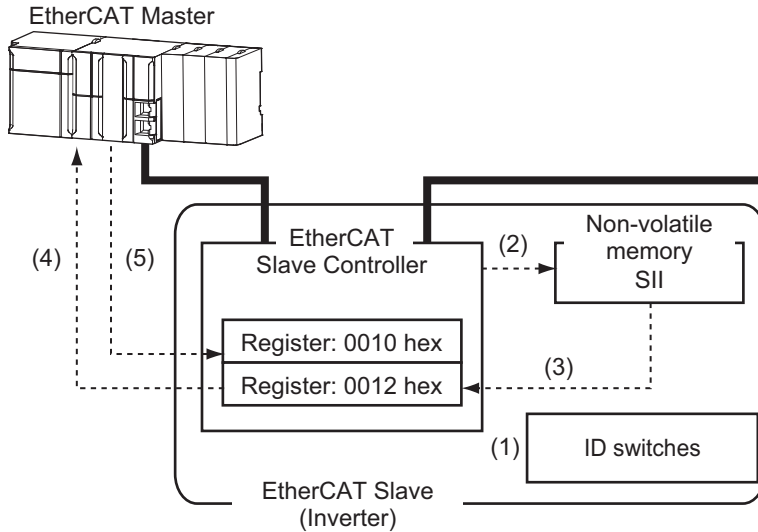
Saving the Node Address Setting

When the ID switches are set to 00, the value of the node address you set in Sysmac Studio is used. (Software setting)

When Software setting is enabled, in Sysmac Studio, execute **Slave Node Address Writing** on the **EtherCAT** tab page to save the slave node address setting in the non-volatile memory of the inverter.

● Software Setting

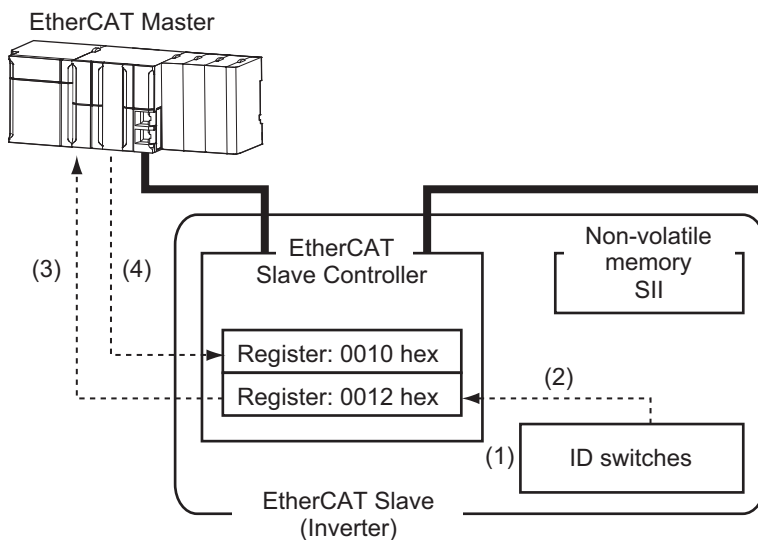
The set value saved as Slave Information Interface (SII) information in the non-volatile memory of the slave is used as the node address.



1. Set the ID switches to 00 during power OFF.
2. Write a node address value to Slave SII from the master.
3. When the slave power is turned ON, the node address value is applied to Register: 0012 hex by the software.
4. The EtherCAT master reads the value that is set in Register: 0012 hex.
5. The EtherCAT master writes the value of 0012 hex to 0010 hex of the EtherCAT slave as the node address.

● Switch Setting

The value of the ID switches of the slave is used as the node address.



1. Set the ID switches during power OFF.
2. When the slave power is turned ON, the value of the ID switches is applied to the register: 0012 hex.
3. The EtherCAT master reads the value that is set in Register: 0012 hex.
4. The EtherCAT master writes the value of 0012 hex to 0010 hex as the node address.

Serial Number Display

The serial number saved in the non-volatile memory of the inverter is displayed in the **Serial Number** (1018-04 hex). Controllers that support Sysmac Device Features can use this serial number to check the network configuration.

To enable this check, in Sysmac Studio, set **Serial Number Check Method** to **Setting = Actual Device** on the **EtherCAT** tab page.

If the specified condition is not met, a Network Configuration Verification Error will occur.



Additional Information

This network configuration check can detect the replacement of slave devices, which prevents you from forgetting to set parameters on those slaves.

SII Data Check

The Slave Information Interface (SII) contains EtherCAT slave configuration information that is written to the non-volatile memory of an EtherCAT slave.

Sysmac Device EtherCAT slaves check the SII information from the slave side.

If one of these slaves finds that SII information with which it cannot operate was written, it generates an SII Verification Error (Error No. 88.03) or ESC Initialization Error (Error No. 88.01). If this error is not cleared after the power cycle, there is a possibility of an inverter failure. Replace the inverter.

3-9 Cable Redundancy Function

Configuring a ring topology on the EtherCAT system enables communications to continue even if an EtherCAT physical layer link is disconnected in the ring topology.

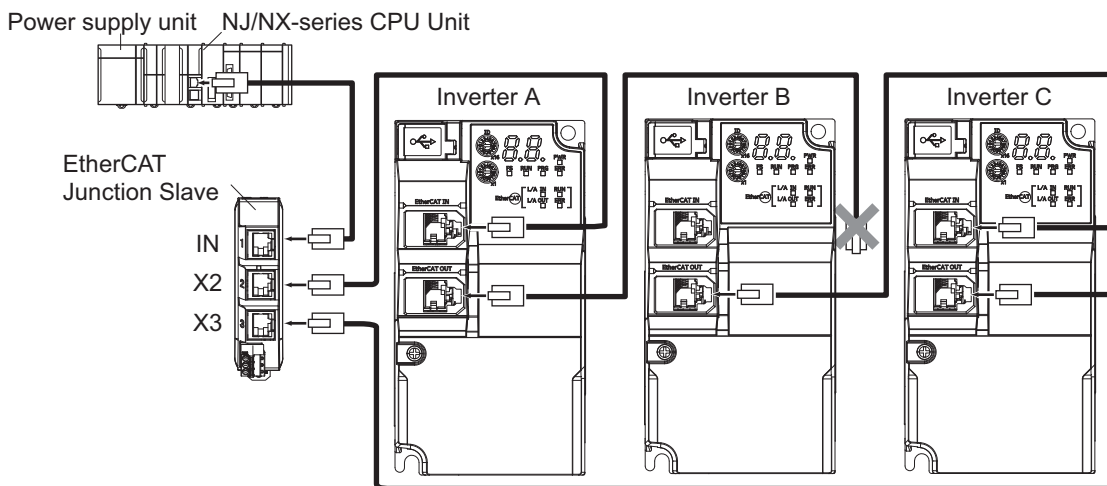
Possible causes for the ring disconnection status in which an EtherCAT physical layer link is disconnected are as follows:

- An EtherCAT communications cable is disconnected, loose, broken, or short-circuited.
- Failure in the EtherCAT physical layer of an EtherCAT inverter

3-9-1 Description of Operation

This function enables communications to continue even if a cable is disconnected or broken in a ring topology and the ring disconnection status results.

Even when the cable is disconnected from the ECAT IN connector on the EtherCAT inverter B and the ring disconnection status results as in the figure below, all EtherCAT inverters can continue communications. If an EtherCAT communications cable is disconnected, protect the conductor so that the disconnected connector does not touch the control panel or other equipment.



The ring disconnection status may have resulted from a broken or short-circuited communications cable or an inverter failure, instead of EtherCAT communications cable disconnection. If the ring disconnection status occurs, immediately perform inspection and take appropriate measures. Refer to *10-1-8 Method for Ring Disconnection Maintenance and Inspection* on page 10-9 for details on the inspection method.

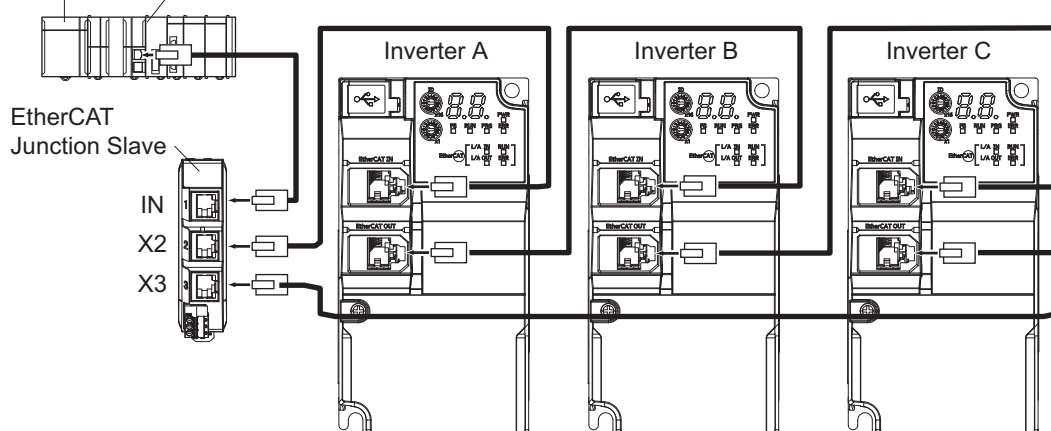
If the ring disconnection status occurs due to a broken or short-circuited communications cable or an inverter failure, continuing to use the devices as they are may stop the entire communications system.

3-9-2 Wiring

This example shows how to connect an NJ/NX-series CPU Unit to inverters via an OMRON GX-JC03 EtherCAT Junction Slave by the use of EtherCAT Communications Cables. Connect the NJ/NX-series CPU unit to the IN connector on the EtherCAT Junction Slave. Connect the X2 connector (start port of the ring) on the EtherCAT Junction Slave to the ECAT IN connector on the first inverter. Connect the ECAT OUT connector on the first inverter to the ECAT IN connector on the next inverter. Connect the

ECAT OUT connector on the last inverter to the X3 connector (end port of the ring) on the EtherCAT Junction Slave.

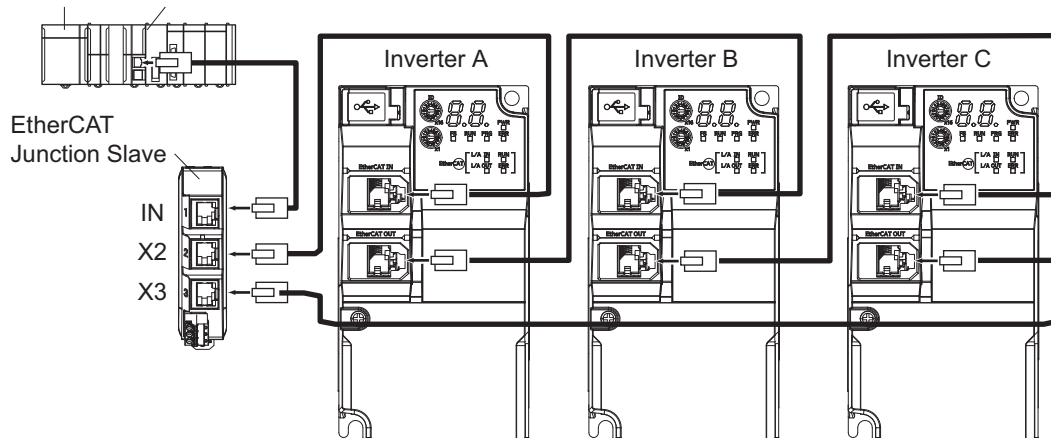
Power supply unit NJ/NX-series CPU Unit



3-9-3 Procedure of Checking Operation

This section takes the following configuration example and describes how to check that the cable redundancy function operates correctly.

Power supply unit NJ/NX-series CPU Unit



- 1** Check that the devices start up in the normal status.
 - Connect the EtherCAT communications cables correctly, and turn ON the power supply to the EtherCAT master and to the slaves.
 - Check that there is no problem with the EtherCAT master and the slaves.
 - Check that the L/A IN indicators and the L/A OUT indicators of all slaves blink.
 - Turn OFF the power supply to the EtherCAT master and to the slaves.
- 2** With a cable disconnected from a connector, check that the communications continue in the ring disconnection status.
 - Disconnect the cable from the ECAT IN connector on "Inverter B", and protect the disconnected cable connector.
 - Turn ON the power supply to the EtherCAT master and to the slaves.
 - Check that there is no problem with the EtherCAT master and the slaves.

- 3** Check the location where the ring is disconnected.
 - Check that the L/A OUT indicator of "Inverter A" and the L/A IN indicator of "Inverter B" are OFF.
 - Check that the other the L/A IN indicators and the L/A OUT indicators blink.
 - Stop operation and turn OFF the power supply to the EtherCAT master and to the slaves.
 - Connect the disconnected cable to the ECAT IN connector on "Inverter B".

- 4** With a cable disconnected from another connector, check that the communications continue in the ring disconnection status.
 - Disconnect the cable from the ECAT OUT connector on "Inverter B", and protect the disconnected cable connector.
 - Turn ON the power supply to the EtherCAT master and to the slaves.
 - Check that there is no problem with the EtherCAT master and the slaves.

- 5** Check the location where the ring is disconnected.
 - Check that the L/A OUT indicator of "Inverter B" and the L/A IN indicator of "Inverter C" are OFF.
 - Check that the other the L/A IN indicators and the L/A OUT indicators blink.
 - Stop operation and turn OFF the power supply to the EtherCAT master and to the slaves.
 - Connect the disconnected cable to the ECAT OUT connector on "Inverter B".

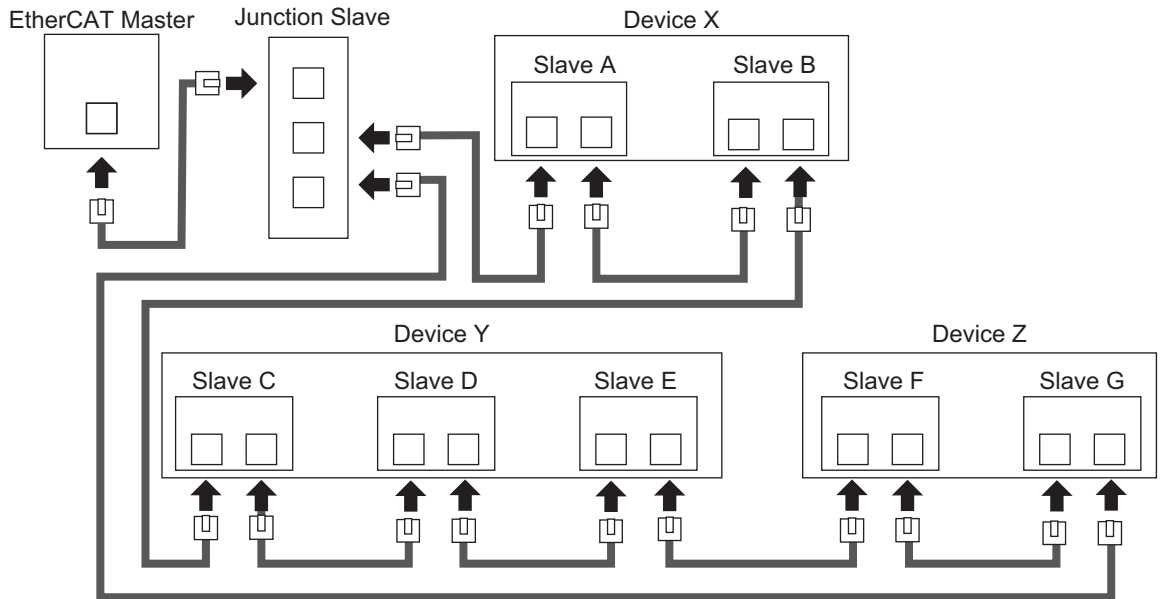
Now you are done with checking operation.

3-9-4 Slave Communications Statuses When Cable Redundancy Function Is Used

This section takes the following example in which the cable redundancy function is used and a ring topology is configured, and describes communications statuses during normal operation and in the ring disconnection status. The configuration example contains three devices in the ring topology.

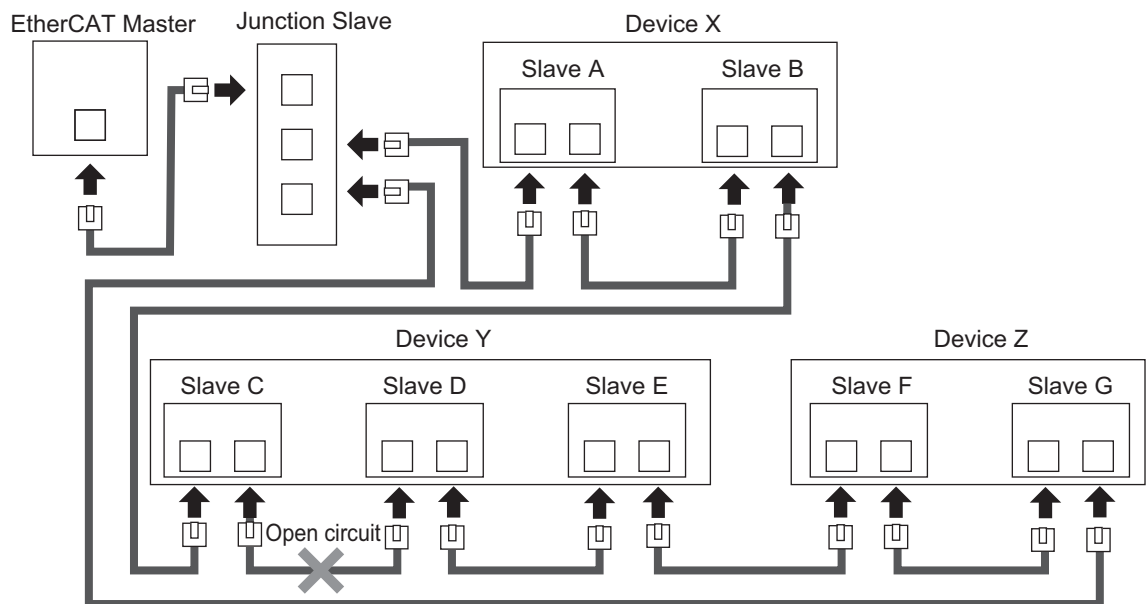
● Normal Status

All slaves are in communication.



● Ring Disconnection Status

Although the ring is disconnected between Slave C and D, all slaves continue communications.



Stop Device X to Z and then turn OFF the power supply to the EtherCAT master. Fix the ring disconnection status by replacing the cable, and then turn ON the power supply to the EtherCAT master and to the devices, which returns the system to the normal communications status.

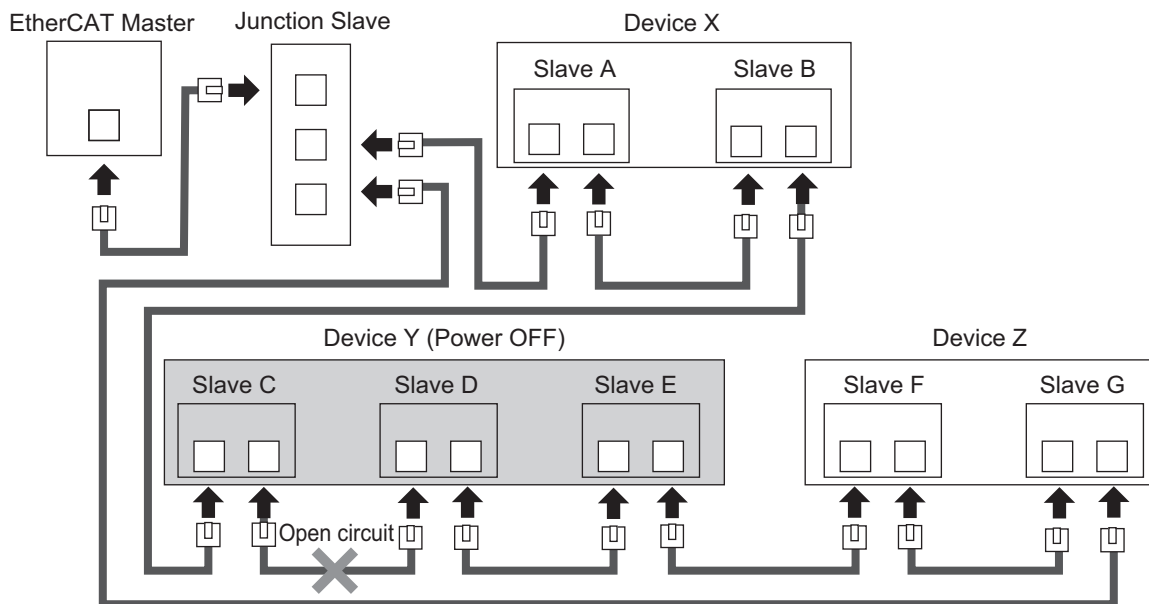
3-9-5 Relation between the Network Configuration Information and the Actual Configuration

The following table shows the relation between the network configuration information downloaded in an NJ/NX-series CPU Unit supporting the cable redundancy function and the actual configuration.

No.	Network Configuration Information	Actual Configuration	EtherCAT Communications Status	Communications Status with a Cable Disconnected or Broken
1	Daisy chain and branching topology only	Daisy chain and branching topology only (same as the network configuration information)	Normal status	The communications status changes to the minor fault status in which part of the slaves can continue communications. *1
2		Contains the ring topology	Minor fault	All slaves can continue communications. Removing a cable added to the network configuration information and resetting the error returns the communications status to the status of No. 1.
3	Contains the ring topology	Daisy chain and branching topology only	Ring Disconnection Status	The communications status changes to the minor fault status in which part of the slaves can continue communications. *1
4		Contains the ring topology (same as the network configuration information)	Normal status	The communications status changes to the ring disconnection status in which all slaves can continue communications. If a cable is disconnected or broken in this status, the status changes to the minor fault status in which part of the slaves can continue communications. *1

*1. If a minor fault occurs, slaves not separated from the EtherCAT master operate according to "Fail-soft Operation Setting" of the CPU Unit. Slaves separated from the EtherCAT master cannot continue communications. Refer to the *NJ/NX-series CPU Unit Built-in EtherCAT® Port User's Manual (Cat. No. W505)* for details on Fail-soft Operation Setting.

The following example shows a case of No. 4. In this example, the communications status changes from the normal status to the ring disconnection status, and then the power supply to Device Y is turned OFF, which turns OFF the power supply to Slave C to E and causes a minor fault. Slave A, B, F, and G continue communications even after the minor fault occurs.



4

Inverter Control

This section describes the profiles that are used to control inverters.

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4-1-1	Function Object Selection	4-2
4-1-2	Function Object Mapping	4-3
4-2	Control with the Independent Profile	4-5
4-2-1	Inverter Setting	4-5
4-2-2	Profile Allocation.....	4-5
4-3	Control with the CiA402 Profile	4-7
4-3-1	Inverter Setting	4-7
4-3-2	Profile Allocation.....	4-7
4-4	Control with the PDO Free Format	4-9
4-4-1	Inverter Setting	4-9
4-4-2	Object Mapping	4-9
4-4-3	Objects Allocation in Sysmac Studio	4-9
4-4-4	Restrictions.....	4-10

4-1 Outline

This section describes how to use the EtherCAT communications to control the inverter.

4-1-1 Function Object Selection

Inverter control is performed by allocating a function object to a PDO.

Various inverter functions can be utilized by allocating a function object to a PDO.

However, some function object allocations may be fixed due to the restrictions at the Master Unit, and PDO mapping of some function objects are not supported.

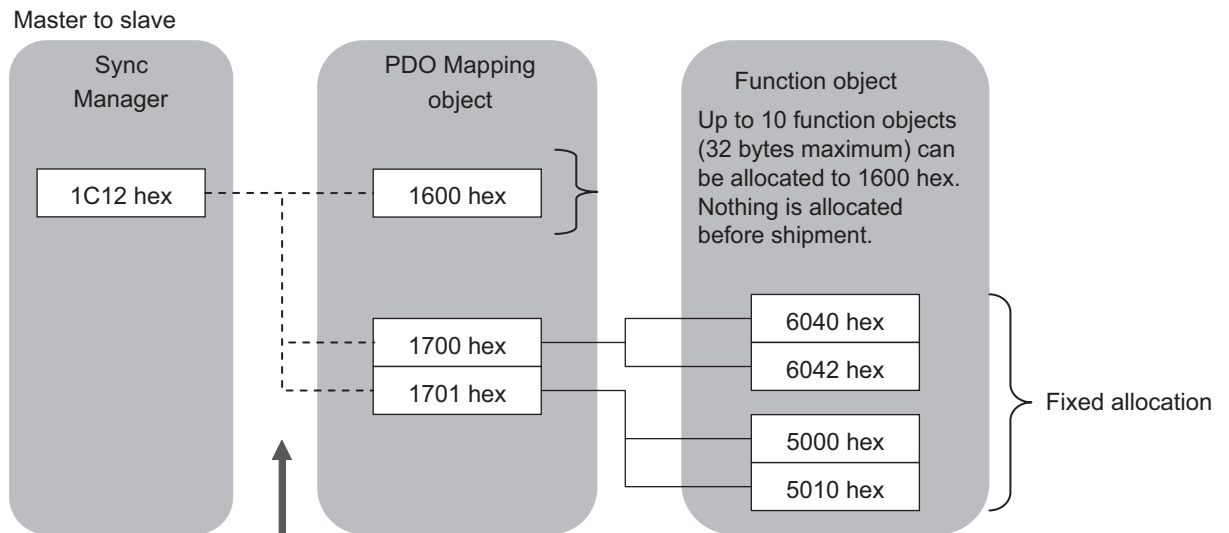
Type	Details
Independent profile	OMRON's independently-developed function object. Enables easy control of the inverter.
CiA402 drive profile	A function object that conforms to the CiA402 drive profile.
PDO free format	Objects can be freely allocated, including the above objects.

Note 1. When using a Master Unit from another manufacturer, check yourself whether it supports the above functions.

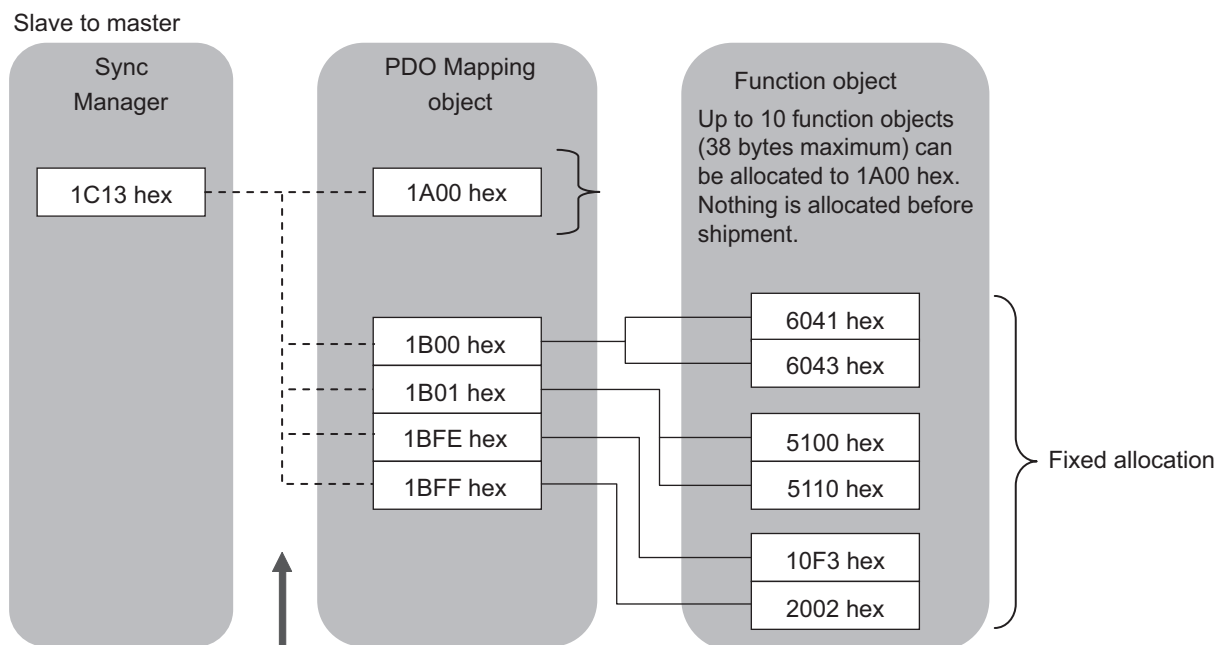
Note 2. If you are using your Machine Automation Controller NJ/NX-series CPU Unit as the master, refer to the explanation on allocation in PDO free format.

4-1-2 Function Object Mapping

Allocation of function objects is realized through the hierarchical structure shown in the figure below. Allocation is performed using a tool that is compatible with the Master Unit.



Up to three PDO Mapping objects can be allocated.



Up to three PDO Mapping objects can be allocated.

PDO Mapping Object

● RxPDO (Master to Slave)

Object index (name)	Details
1600 hex (1st receive PDO Mapping)	Objects can be freely allocated. Up to 10 objects (maximum size of 32 bytes) can be allocated to PDO.
1700 hex (257th receive PDO Mapping)	The fixed allocation that conforms to the CiA402 drive profile.
1701 hex (258th receive PDO Mapping)	The fixed allocation of the independent profile.

● TxPDO (Slave to Master)

Object index (name)	Details
1A00 hex (1st transmit PDO Mapping)	Objects can be freely allocated. Up to 10 objects (maximum size of 38 bytes) can be allocated to PDO.
1B00 hex (257th transmit PDO Mapping)	The fixed allocation that conforms to the CiA402 drive profile.
1B01 hex (258th transmit PDO Mapping)	The fixed allocation of the independent profile.
1BFE hex (511th transmit PDO Mapping)	By default, Sysmac Studio allocates 10F3-04 hex: New Messages Available.
1BFF hex (512th transmit PDO Mapping)	By default, Sysmac Studio allocates 2002 hex: Sysmac error status.

Sync Manager Object

Sync Manager PDO assignment	Details
1C12 hex	Allocate RxPDO (master to slave). Up to 3 RxPDOs can be allocated.
1C13 hex	Allocate TxPDO (slave to master). Up to 3 TxPDOs can be allocated.

4-2 Control with the Independent Profile

This section describes how to use the OMRON profile to control the inverter.

4-2-1 Inverter Setting

The inverter parameters must be set to match the profile.

With the independent profile, set as follows.

Index-Subindex	Parameter	Description
3004-02 hex	1st Frequency Reference Selection	15: EtherCAT (Default setting)
3004-03 hex	1st RUN Command Selection	5: EtherCAT (Default setting)

4-2-2 Profile Allocation

Assign the PDOs of the independent profile to Sync Manager.

Sync Manager PDO assignment	Description
1C12 hex	1701 hex (Fixed allocation of the independent profile)
1C13 hex	1B01 hex (Fixed allocation of the independent profile)

The values below are the fixed mapping for the PDOs.

PDO	Description
1701 hex	5000 hex (Command) 5010 hex (Frequency Reference)
1B01 hex	5100 hex (Status) 5110 hex (Output Frequency Monitor)

Bit and Data Information

● Command

-	-	-	-	-	-	-	-	7	-	-	-	-	-	1	0
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Bit	Name	Meaning
0	Forward/stop	0: Stop 1: Forward command
1	Reverse/stop	0: Stop 1: Reverse command
7	Fault reset	↑: Resets an error or trip for the inverter.
-	Reserved	Set 0.

● Frequency Reference

Name	Meaning
Frequency Reference	Specify the frequency reference in increments of 0.01 Hz. When a value is set that exceeds the maximum frequency, operation is performed at the maximum frequency. Setting range: 0 to maximum frequency

● Status

The 16-bit data is as shown below.

15	-	-	12	-	-	9	-	7	-	-	-	3	-	1	0
----	---	---	----	---	---	---	---	---	---	---	---	---	---	---	---

Bit	Name	Meaning
0	During forward operation	0: Stopped/during reverse operation 1: During forward operation
1	During reverse operation	0: Stopped/during forward operation 1: During reverse operation
3	Fault	0: No alarm (9-1-2 Alarm Code List on page 9-3) occurred for the inverter 1: Alarm occurred for the inverter
7	Warning	0: No warning (9-1-3 Minor Fault Code List on page 9-25) occurred for the inverter 1: Warning occurred for the inverter
9	Remote	0: Local (Operations from EtherCAT are disabled) 1: Remote (Operations from EtherCAT are enabled)
12	Frequency matching	0: During acceleration/deceleration or stopped 1: Frequency matched
15	Connection error between EtherCAT communications CPU and inverter CPU	0: Normal 1: Error (Cannot update data between EtherCAT CPU and inverter CPU. To restore, turn the power supply OFF and then ON again.)
-	Reserved	Set 0.

● Output Frequency Monitor

Name	Meaning
Output Frequency Monitor	Displays the output frequency in increments of 0.01 Hz.

4-3 Control with the CiA402 Profile

This section describes how to use the Velocity mode of the CiA402 drive profile to control the inverter.

4-3-1 Inverter Setting

The inverter parameters must be set to match the profile.

With the CiA402 profile, set as follows.

Index-Subindex	Parameter	Description
3004-02 hex	1st Frequency Reference Selection	15: EtherCAT (Default setting)
3004-03 hex	1st RUN Command Selection	5: EtherCAT (Default setting)
3007-02 hex	1st Motor Pole Number	2 to 128 (Default setting: 4) (Set to match the system.)

4-3-2 Profile Allocation

Assign the PDOs of the CiA402 profile to Sync Manager.

Sync Manager PDO assignment	Description
1C12 hex	1700 hex (Fixed allocation conforming to the CiA402 drive profile)
1C13 hex	1B00 hex (Fixed allocation conforming to the CiA402 drive profile)

The values below are the fixed mapping for the PDOs.

PDO	Description
1700 hex	6040 hex (Controlword) 6042 hex (vI target velocity)
1B00 hex	6041 hex (Statusword) 6043 hex (vI velocity demand)

Bit and Data Information

● Controlword

The 16-bit data is as shown below.

-	-	-	-	-	-	-	-	7	-	-	-	3	2	1	0
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Bit	Name	Meaning
0	Switch on	The state is controlled by these bits. For details, refer to <i>State Control Commands</i> on page A-4.
1	Enable voltage	
2	Quick stop	
3	Enable operation	
7	Fault reset	Faults and warnings are cleared when this bit turns ON.
-	Reserved	Set 0.

● vl target velocity

Name	Meaning
vl target velocity	Set the command speed in r/min. Setting range: -maximum speed to +maximum speed Set the operation direction with a symbol (-/+). When a value is set that exceeds the maximum frequency, operation is performed at the maximum frequency.

● Statusword

The 16-bit data is as shown below.

-	-	-	-	-	-	9	-	7	6	5	4	3	2	1	0
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Bit	Name	Meaning
0	Ready to switch on	These bits indicate the state. For details, refer to <i>State Coding</i> on page A-5.
1	Switched on	
2	Operation enabled	
3	Fault	
4	Voltage enabled	
5	Quick stop	
6	Switch on disabled	
7	Warning	1: Warning (<i>9-1-3 Minor Fault Code List</i> on page 9-25) occurring 0: Warning not occurred.
9	Remote	0: Control from Controlword is disabled. 1: Control from Controlword is enabled.
-	Reserved	Not used.

● vl velocity demand

Name	Meaning
vl velocity demand	Displays the operation speed in r/min. The operation direction is expressed with a symbol (-/+).

4-4 Control with the PDO Free Format

Objects can be freely allocated to PDOs to create an independent profile.

If you use in combination with the OMRON independent profile or the CiA402 drive profile, you can perform advanced control and monitoring.

To use your OMRON NJ501-1□00 as the master, allocate desired objects by referring to this section.

4-4-1 Inverter Setting

When using the OMRON independent profile, set **1st Frequency Reference Selection** (3004-02 hex) and **1st RUN Command Selection** (3004-03 hex).

When using the CiA402 drive profile, set **1st Frequency Reference Selection** (3004-02 hex), **1st RUN Command Selection** (3004-03 hex), and **1st Motor Pole Number** (3007-02 hex).

For details, refer to *4-3-1 Inverter Setting* on page 4-7.

4-4-2 Object Mapping

Allocate the objects that you want to use to PDOs.

Setting Example

Set as follows to allocate the acceleration time and deceleration time to RxPDO and the current monitor to TxPDO, based on the OMRON independent profile.

● PDO Mapping

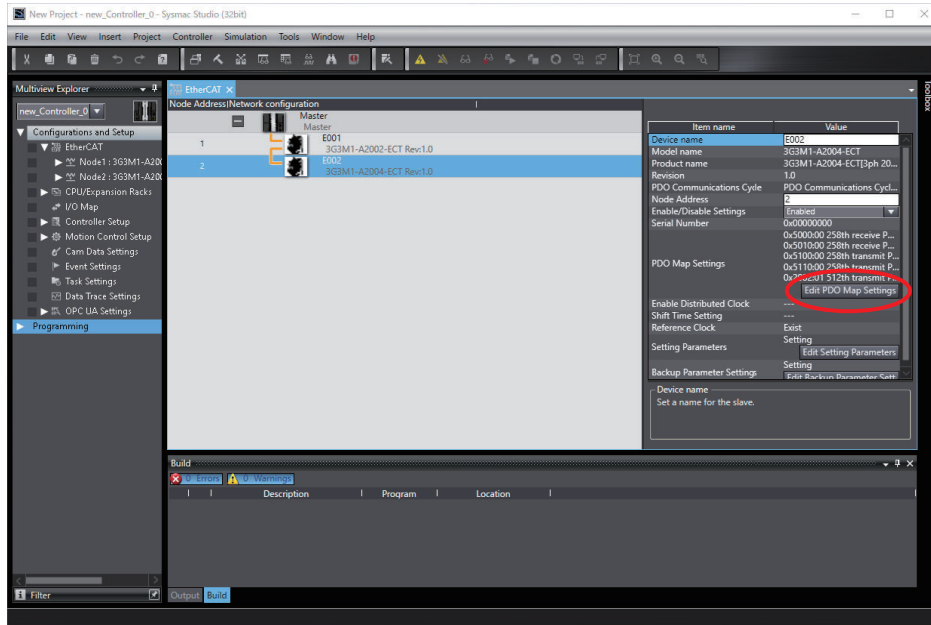
PDO	Description
1600 hex (1st receive PDO Mapping)	3004-08 hex (F07 1st Acceleration Time 1)
	3004-09 hex (F08 1st Deceleration Time 1)
1A00 hex (1st transmit PDO Mapping)	3003-0C hex (M11 Output Current Monitor)

● Sync Manager Assignment

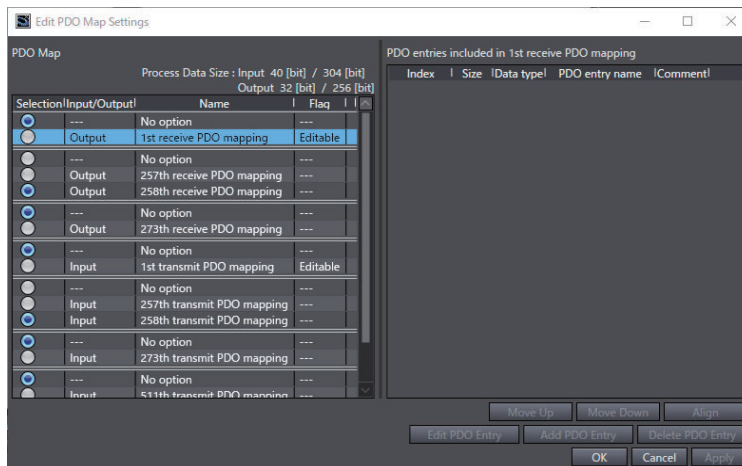
Sync Manager PDO assignment	Description
1C12 hex	1701 hex (Fixed allocation of the independent profile)
	1600 hex (Setting as above)
1C13 hex	1B01 hex (Fixed allocation of the independent profile)
	1A00 hex (Setting as above)

4-4-3 Objects Allocation in Sysmac Studio

In Sysmac Studio, you can edit the PDO map settings for each slave.



Click **Edit PDO Map Settings** in the **Configurations and Setup** of the EtherCAT slave to open the **Edit PDO Map Settings** pane.



To allocate an object to a PDO in Sysmac Studio, select **Output** (or **Input**) for one of **1st Receive PDO Mapping** (or **1st Transmit PDO Mapping**), right-click **Add PDO Entry** on the right side of the screen, and then select a desired object from the list.

Note that up to 10 PDOs can be selected each for the target of **Output** (or **Input**).

4-4-4 Restrictions

The PDO free format has the restrictions that are described below.

- Up to 10 objects can be allocated to the PDO mapping of **1st receive PDO Mapping** (or **1st transmit PDO Mapping**). Keep the total size of the allocated objects to within 32 (or 38) bytes.
- An object from 5000 hex to 5FFF hex cannot be allocated to RxPDO (master to slave) together with an object from 6000 hex to 6FFF hex.
- If the inverter parameters (objects 3000 hex to 3FFF hex) that cannot be changed during operation are allocated to RxPDO (master to slave), the values of those parameters will not be updated during operation.

- The greater the number of RxPDOs or TxPDOs is, the longer the data updating cycle becomes.

5

Operation and Test Run

This section describes the operation method of this product and the test run procedure.

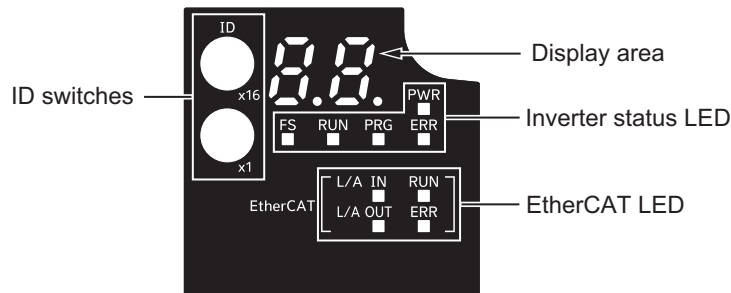
5-1	Part Names	5-2
5-1-1	Part Names and Descriptions.....	5-2
5-2	Connecting Sysmac Studio.....	5-4
5-3	Flow of Test Run.....	5-5
5-4	Operation Items for Test Run.....	5-7












5-1 Part Names



The following shows the names and descriptions of the data display and LEDs.

5-1-1 Part Names and Descriptions

The table below shows the name and function of each part.



Display	Name	Description
	Power LED	The control power supply status is displayed.
	FS LED	The safety communication status is displayed.
	RUN LED	Lights (green) when the inverter is running (during output to the motor). Lights during deceleration after RUN command OFF. Goes out while the RUN command is ON at Frequency Reference 0 Hz as there is no output (excluding Zero Speed Control).
	Program LED	Lights when there is an error in PDO mapping.
	Error LED	Lights (red) when the inverter trips. For how to reset a trip error state, refer to <i>How to Reset a Trip State</i> on page 9-2.
	 L/A IN EtherCAT L/A IN LED	Lights or flashes by linking of the EtherCAT physical layer.
	 L/A OUT EtherCAT L/A OUT LED	
	 RUN EtherCAT RUN LED	The EtherCAT communication status is displayed.
	 ERR EtherCAT Error LED	
	Data display	Error display No., inverter status, etc. is displayed by a two-digit seven-segment LED.

	Display	Name	Description
ID		ID switch for node address setting (×16)	Use the two rotary switches for 0 to F (hexadecimal) to set the EtherCAT node address.
		ID switch for node address setting (×1)	

5-2 Connecting Sysmac Studio

Inverter parameters can be edited, data can be monitored and other operations are possible in the automation software Sysmac Studio.

This section describes how to connect the inverter to Sysmac Studio.

1. Connect the USB cable to the USB connector, and connect the inverter to the PC.
2. Start up Sysmac Studio, and select new project.
Select “Drive” at Category, specify the inverter to connect to the device, and click “Create.”
3. Right-click on the target inverter in the tree, and select “Communication Settings.”
Check that “Connect directly by USB” is set, and select the USB port to which the cable is connected at Select Port.
4. Right-click on the target inverter in the tree, and select “Online.”

For details on how to connect Sysmac Studio and its function, refer to *Related Manuals* on page 30.

5-3 Flow of Test Run

Perform a test run of the inverter according to the following flow.

Item	Description	Reference
Installation	Install the inverter according to the installation conditions.	2-1-1 <i>Inverter Installation</i> on page 2-2
↓		
Wiring and connections	Connect the inverter to the power supply and peripheral equipment.	2-3 <i>Wiring</i> on page 2-10
↓		
Configuration of Ether-CAT Slave/Units	Sysmac Studio is used to create new projects and slave/units configuration off-line or on-line.	<i>Sysmac Studio Version 1 Operation Manual (Cat. No. W504)</i>
↓		
Node Address Setting	Set the node address.	3-1-1 <i>Node Address Setting</i> on page 3-2
↓		
Power-on	Check the points mentioned in the next page before turning the power supply ON.	5-4 <i>Operation Items for Test Run</i> on page 5-7
↓		
Display status checks	Check that no error is occurring on the inverter.	<i>Section 9 Troubleshooting</i> on page 9-1
↓		
Parameter Initialization	Initialize inverter parameters.	6-1 <i>Data Initialization</i> on page 6-3
↓		
Parameter setting	Set the parameters required for the test run.	6-3 <i>Motor Parameter Settings</i> on page 6-17 6-4 <i>RUN command</i> on page 6-22
↓		
No-load run	Run the motor in a no-load state.	<i>Section 6 Basic Settings</i> on page 6-1
↓		

Item	Description	Reference
Load run	Run the inverter with the mechanical system connected.	<i>Section 6 Basic Settings</i> on page 6-1
↓		
Operation	Operation via EtherCAT communication	<i>Section 4 Inverter Control</i> on page 4-1
	Basic settings (operation by the basic settings required to operate and stop the inverter)	<i>Section 6 Basic Settings</i> on page 6-1
	Vector control (operation using vector control and other functions)	<i>Section 7 Vector Control and Applied Functions</i> on page 7-1

5-4 Operation Items for Test Run

The following describes the operation items for the test run.

Installation

Check that the inverter meets the installation conditions.

For details on installing the inverter, refer to *2-1 Installation* on page 2-2.

Wiring and Connections

Select peripheral equipment according to the specifications and wire the cables securely.

For details on wiring the inverter, refer to *2-3 Wiring* on page 2-10.

Configuration of EtherCAT Slave/Units

Sysmac Studio is used to create new projects and slave/units configuration off-line or on-line. Refer to the *Sysmac Studio Version 1 Operation Manual (Cat. No. W504)* for details.

Node Address Setting

Set the node address matched to the EtherCAT configuration.

For details on the node address setting, refer to *3-1-1 Node Address Setting* on page 3-2.

Power-on

● Points to be checked before turning ON the power

Check that the power supply voltage is appropriate and that the power supply input terminals (L1/R, L2/S, L3/T) are securely wired.

The rated input voltage of the 3G3M1 Series Inverter is as follows.

Model	Power supply voltage
3G3M1-A2□	Three-phase 200 to 240 VAC
3G3M1-A4□	Three-phase 380 to 480 VAC
3G3M1-AB□	Single-phase 200 to 240 VAC

Check that the motor is securely connected to the motor output terminals (W, V, U).

Check that the controller is securely wired to the control circuit terminals. In addition, turn OFF all control terminals.

Set the motor in a no-load state (not connected to the mechanical system).

● Power-on

If no problem is found in the above checks, turn the power supply ON.

Display Status Checks

Name	Display status
PWR (Power LED)	ON
FS (FS LED)	OFF
RUN (RUN LED)	OFF
PRG (Program LED)	OFF
ERR (Error LED)	OFF
EtherCAT L/A IN	ON
EtherCAT L/A OUT	OFF
EtherCAT RUN	ON
EtherCAT ERR	OFF

When the display status is other than shown above, refer to *3-1-2 Name of Each Status Indicator* on page 3-2 and *Section 9 Troubleshooting* on page 9-1 for countermeasures.

Seven-segment LED Indicator

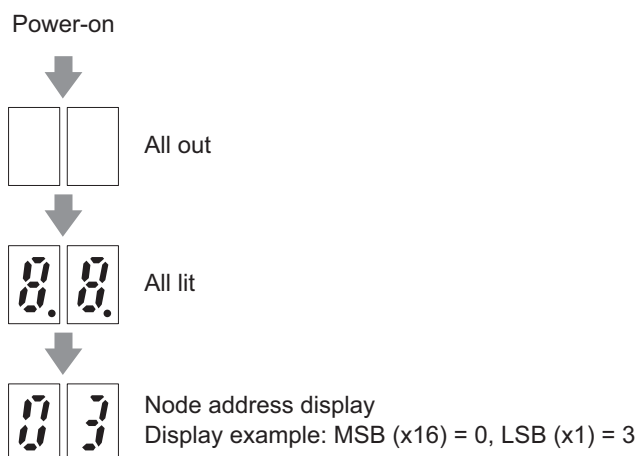
The figure below shows the seven-segment LED indicator on the data display.

When the power is turned ON, the node address value set by the ID switch is displayed, and then the display changes according to the value set at 7SEG Monitor Item Selection (3052Hex-52Hex).

When an alarm occurs, the alarm code is displayed, and when a light alarm occurs, the light alarm code is displayed.

Parameter No.	Function name	Data	Default data	Unit
3052Hex-52Hex	7SEG monitor (Item selection)	100 to 400	0: Display drive status 1: ID by rotary switch	-

● Transition of seven-segment LED indicator during power ON



● 7SEG Monitor Item Selection (3052Hex-52Hex) = 0: Display drive status

↓ One second elapses



- Operation enabled status

The display is as follows when “Control Word” (6040Hex) is enabled.



- FW = ON status

The display is as follows when “Command” (5000Hex) is enabled and the direction of rotation is forward.



- RV = ON status

The display is as follows when “Command” (5000Hex) is enabled and the direction of rotation is reverse.

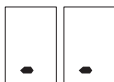


● Alarm, light alarm occurred



For details on the LED display after an error has occurred, refer to *9-1-1 Alarm Display* on page 9-2.

● Measuring capacitor life



● Functional safety state Error detected



● PDO setting error, EtherCAT communication EEPROM error



Parameter Initialization

The set values of parameters can be initialized and returned to their factory default settings. The fault monitor can also be cleared.

The following figure shows the steps of parameter initialization.

Initialization is executed when “1: Initialize all parameters” is set at Data Initialization (3008Hex-04Hex).

For details on parameter initialization, refer to *6-1 Data Initialization* on page 6-3.

Parameter Setting

To operate the inverter, two commands are required: the RUN command and the frequency reference. Set 1st RUN Command Selection (3004Hex-03Hex) and 1st Frequency Reference Selection (3004Hex-02Hex).

Next, set the 1st Motor Pole Number (3007Hex-02Hex) and 1st Motor Capacity (3007Hex-03Hex) for the applicable motor. These values will be used as the reference values for the automatic torque boost, motor protection and torque limit functions.

Then set the rated current value of the motor at 1st Motor Electronic Thermal Level (3004Hex-0CHex). Set the value correctly according to the motor in use.

Parameter No.	Function name	Set value	Default data	Unit
3004Hex-02Hex	1st Frequency Reference Selection	1 to 15 1: Analog voltage input (terminal AI1) 7: UP/DOWN control 10: Pattern operation 12: Pulse train input 13: Calculation result 15: EtherCAT	15	-
3004Hex-03Hex	1st RUN Command Selection	1 to 5 1: Terminal command FW or RV 5: EtherCAT	5	-
3007Hex-02Hex	1st Motor Pole Number	2 to 128 poles	4	Pole
3007Hex-03Hex	1st Motor Capacity	0.01 to 1000 kW	Dependent on capacity	kW

No-Load Run

In a motor no-load state (not connected to the mechanical system), rotate the motor.

5000 hex (Command) and 5010 hex (Frequency Reference) are used. (For details, refer to *4-2 Control with the Independent Profile* on page 4-5.)

Load Run

If no problem is found during a no-load run, connect the mechanical system and run the inverter with a load.

● Connecting the mechanical system

Before connecting the mechanical system, make sure that the motor has stopped completely. Then, connect the mechanical system to the motor securely to prevent the mounting screws from loosening.

In case of unexpected abnormal inverter operation, be prepared to stop the motor immediately. In the same way as during a no-load run, operate the machine at low speed and then decelerate.

● RUN mode checks

After checking that the machine moves in the correct direction and smoothly at low speed, set a larger output frequency.

Check that there is no mechanical vibration and noise by altering the forward and reverse rotation directions.

- Check that the output current is up to 150% of the motor rated current.
Output Current Monitor (3003Hex-0CHex)
- Check that the thermal load rate is sufficiently low to reach 100%.
Motor Electronic Thermal Monitor (3003Hex-3CHex)
- Check that the Main Circuit DC Voltage for the 200-V class and the 400-V class is sufficiently low to reach 390 VDC and 780 VDC, respectively.
Main Circuit DC Voltage (3003Hex-16Hex)

Operation

For a detailed description of operations via EtherCAT communication, refer to *Section 4 Inverter Control* on page 4-1.

To operate the inverter by only basic parameters, refer to *Section 6 Basic Settings* on page 6-1.

To use applied functions such as Vector control without sensor, V/f control with speed sensor, torque control and position control, in addition to *Section 6 Basic Settings* on page 6-1, refer to *Section 7 Vector Control and Applied Functions* on page 7-1.

6

Basic Settings

This section describes the basic functions such as the RUN command.

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6-1 Data Initialization

6-1-1 Data Initialization

- The parameter initialization function restores changed parameters to the factory default settings.
- It can also clear the fault monitor data.
- When the inverter is newly set after restoring parameters to the factory default settings, execute parameter initialization with “1: Initialize all parameters” set to Data Initialization (3008Hex-04Hex).
- Note that previous settings cannot be reverted to once Data Initialization (3008Hex-04Hex) is set to a value other than “0” to execute parameter initialization. After initialization ends, Data Initialization (3008Hex-04Hex) returns to “0.”

Parameter No.	Function name	Data	Default data	Unit
3008Hex-04Hex	Data Initialization	0: Disable 1: Initialize all parameters 2: Initialize motor 1 parameters 3: Initialize motor 2 parameters 4: Restore user defined data 5: Initialize all parameters (except I/O and communications) 6: Reserved 7: Clear alarm history 8: Clear selection of favorite function code	0	-

- During operation, initialization is not possible. Perform initialization after stopping inverter operation. Also, do not enter a RUN command as the inverter might operate unintentionally during initialization.

Parameter Initialization (3008Hex-04Hex = 1)

- When “1: Initialize all parameters” is set to Data Initialization (3008Hex-04Hex), all parameters excluding the following are set to their default data (values at the time of shipment from the factory).

Main Circuit Capacitor Service Life Coefficient (Measurement Value) (3008Hex-2BHex)

Main Circuit Capacitor Service Life Coefficient (Initial Value) (3008Hex-30Hex)

Service Life of Main Circuit Capacitor Remaining Time (3008Hex-4EHex)

Cumulative Run Time of Cooling Fan (3008Hex-2CHex)

Cumulative Run Time of Capacitors on Printed Circuit Boards (3008Hex-31Hex)

1st Startup Count for Motor (3008Hex-2DHex)

2nd Startup Counter for Motor (3009Hex-35Hex)

1st Cumulative Motor Run Time (3008Hex-5FHex)

2nd Cumulative Motor Run Time (3009Hex-34Hex)

User Preference Dataset Protection Function Selection (3020Hex-5FHex)

Monitor Exclusive Parameters (M, W Parameters)

- Parameters are initialized even if they are protected by a password, and both passwords 1 and 2 are canceled. (Refer to 8-7-2 *Password Function* on page 8-66.)

- User preference dataset saved by User Preference Dataset Registration (3020Hex-5EHex) are not initialized. (Refer to 6-1-2 *User Preference Dataset (Registration/Protection)* on page 6-6.)

Initialize motor 1 parameters (3008Hex-04Hex= 2)

- When “2: Initialize motor 1 parameters” is set to Data Initialization (3008Hex-04Hex), the following parameters are set to their default data (values at the time of shipment from the factory).
 - 1st Manual Torque Boost Voltage (3004Hex-0AHex)
 - 1st Motor Electronic Thermal Level (3004Hex-0CHex)
 - 1st Motor Pole Number (3007Hex-02Hex)
 - 1st Motor Rated Current (3007Hex-04Hex)
 - 1st Motor Armature Resistance (3007Hex-07Hex)
 - 1st Motor Parameter %R1 (3007Hex-08Hex)
 - 1st Motor Parameter %X (3007Hex-09Hex)
 - 1st Slip Compensation Gain for Braking (3007Hex-0CHex)
 - 1st Rated Slip Frequency (3007Hex-0DHex)
 - 1st Iron Loss Factor 1 (3007Hex-0EHex)
 - 1st Magnetic Saturation Factor 1 (3007Hex-11Hex)
 - 1st Magnetic Saturation Factor 2 (3007Hex-12Hex)
 - 1st Magnetic Saturation Factor 3 (3007Hex-13Hex)
 - 1st Magnetic Saturation Factor 4 (3007Hex-14Hex)
 - 1st Magnetic Saturation Factor 5 (3007Hex-15Hex)
 - 1st PM Motor Starting Method (3007Hex-1FHex)
 - 1st Motor Torque Current under Vector Control (3007Hex-38Hex)
 - 1st Induced Voltage Factor under Vector Control (3007Hex-39Hex)
 - 1st PM Motor Armature Resistance (3007Hex-3DHex)
 - 1st PM Motor d-axis Inductance (3007Hex-3EHex)
 - 1st PM Motor q-axis Inductance (3007Hex-3FHex)
 - 1st PM Motor Induced Voltage Ke (3007Hex-40Hex)
 - 1st PM Motor Iron Loss (3007Hex-41Hex)
 - 1st PM Motor Reference Current for Magnetic Pole Detection (3007Hex-58Hex)
 - 1st PM Motor Overcurrent Protection Level (3007Hex-5BHex)
 - Auto Search Delay Time 2 for Starting Mode (3008Hex-2FHex)
 - Magnetic Flux Level during Deceleration (3014Hex-5BHex)

Initialize Motor 2 Parameters (3008Hex-04Hex= 3)

- When “3: Initialize motor 2 parameters” is set to Data Initialization (3008Hex-04Hex), the following parameters are set to their default data (values at the time of shipment from the factory).
 - 2nd Manual Torque Boost Voltage (3009Hex-06Hex)
 - 2nd Motor Electronic Thermal Level (3009Hex-08Hex)
 - 2nd Motor Pole Number (3009Hex-10Hex)
 - 2nd Motor Rated Current (3009Hex-12Hex)
 - 2nd Motor Armature Resistance (3009Hex-15Hex)
 - 2nd Motor Motor Constant %R1 (3009Hex-16Hex)
 - 2nd Motor Motor Constant %X (3009Hex-17Hex)

2nd Slip Compensation Gain for Braking (3009Hex-1AHex)
 2nd Rated Slip Frequency (3009Hex-1BHex)
 2nd Iron Loss Factor 1 (3009Hex-1CHex)
 2nd Magnetic Saturation Factor 1 (3009Hex-1FHex)
 2nd Magnetic Saturation Factor 2 (3009Hex-20Hex)
 2nd Magnetic Saturation Factor 3 (3009Hex-21Hex)
 2nd Magnetic Saturation Factor 4 (3009Hex-22Hex)
 2nd Magnetic Saturation Factor 5 (3009Hex-23Hex)
 Torque Current for 2nd Vector Control (3009Hex-38Hex)
 Induced Voltage Factor for 2nd Vector Control (3009Hex-39Hex)

Restore User Defined Data (3008Hex-04Hex= 4)

- When “4: Restore user defined data” is set to Data Initialization (3008Hex-04Hex), parameters are initialized using the user preference dataset saved at User Preference Dataset Registration (3020Hex-5EHex). When there are no user preference dataset, parameters are initialized using factory defaults. (Same operation as when Data Initialization (3008Hex-04Hex) is set to 1).
- User preference dataset saved by User Preference Dataset Registration (3020Hex-5EHex) are not initialized. (Refer to 6-1-2 *User Preference Dataset (Registration/Protection)* on page 6-6.)
- The following parameters are not initialized.

Main Circuit Capacitor Service Life Coefficient (Measurement Value) (3008Hex-2BHex)
 Main Circuit Capacitor Service Life Coefficient (Initial Value) (3008Hex-30Hex)
 Service Life of Main Circuit Capacitor Remaining Time (3008Hex-4EHex)
 Cumulative Run Time of Cooling Fan (3008Hex-2CHex)
 Cumulative Run Time of Capacitors on Printed Circuit Boards (3008Hex-31Hex)
 1st Startup Count for Motor (3008Hex-2DHex)
 2nd Startup Counter for Motor (3009Hex-35Hex)
 1st Cumulative Motor Run Time (3008Hex-5FHex)
 2nd Cumulative Motor Run Time (3009Hex-34Hex)
 User Preference Dataset Protection Function Selection (3020Hex-5FHex)
 Monitor Exclusive Parameters (M, W Parameters)

Initialize All Parameters (Except I/O and Communications) (3008Hex-04Hex = 5)

- When “5: Initialize all parameters (except I/O and communications)” is set to Data Initialization (3008Hex-04Hex), the following parameters excluding I/O and communications are initialized to their factory defaults.

Input Terminal [DI1] to [DI7] Function Selection (3005Hex-02Hex to 3005Hex-06Hex,
 3005Hex-63Hex, 3005Hex-64Hex)
 Output Terminal [DO1] Function Selection (3005Hex-15Hex)
 Output Terminal [ROA, ROB] Function Selection (3005Hex-1CHex)

Also, the following parameters are not initialized.

Main Circuit Capacitor Service Life Coefficient (Measurement Value) (3008Hex-2BHex)
 Main Circuit Capacitor Service Life Coefficient (Initial Value) (3008Hex-30Hex)
 Service Life of Main Circuit Capacitor Remaining Time (3008Hex-4EHex)
 Cumulative Run Time of Cooling Fan (3008Hex-2CHex)
 Cumulative Run Time of Capacitors on Printed Circuit Boards (3008Hex-31Hex)
 1st Startup Count for Motor (3008Hex-2DHex)
 2nd Startup Counter for Motor (3009Hex-35Hex)
 1st Cumulative Motor Run Time (3008Hex-5FHex)
 2nd Cumulative Motor Run Time (3009Hex-34Hex)
 User Preference Dataset Protection Function Selection (3020Hex-5FHex)
 Monitor Exclusive Parameters (M, W Parameters)

Clear Alarm History (3008Hex-04Hex = 7)

- When “7: Clear alarm history” is set to Data Initialization (3008Hex-04Hex), the alarm history and various information at the time of the alarm are cleared to set to an alarm non-occurring state.
- The alarm information of parameters (refer to 8-1-4 *Alarm information* on page 8-16) is initialized.

6-1-2 User Preference Dataset (Registration/Protection)

Set User Preference Dataset Registration/Protection by the following parameters. When “4: Restore user defined data” is set to Data Initialization (3008Hex-04Hex), parameters are initialized using the saved user preference datasets.

Parameter No.	Function name	Data	Default data	Unit
3020Hex-5EHex	User Preference Dataset Registration	0: Disable 1: Store	0	-
3020Hex-5FHex	User Preference Dataset Protection Function Selection	0: Unprotected 1: Protected	0	-
Related function		Data Initialization (3008Hex-04Hex)		

- The set values of parameters that have been changed from the factory defaults can be saved (registered) as user preference dataset. For parameters also that have not been changed from the factory defaults, factory defaults can be saved (registered) as user preference dataset. Note, however, that the following parameters are not targeted for saving as user preference datasets.

Main Circuit Capacitor Service Life Coefficient (Measurement Value) (3008Hex-2BHex)
 Main Circuit Capacitor Service Life Coefficient (Initial Value) (3008Hex-30Hex)
 Service Life of Main Circuit Capacitor Remaining Time (3008Hex-4EHex)
 Cumulative Run Time of Cooling Fan (3008Hex-2CHex)
 Cumulative Run Time of Capacitors on Printed Circuit Boards (3008Hex-31Hex)
 1st Startup Count for Motor (3008Hex-2DHex)
 2nd Startup Counter for Motor (3009Hex-35Hex)
 1st Cumulative Motor Run Time (3008Hex-5FHex)
 2nd Cumulative Motor Run Time (3009Hex-34Hex)
 User Preference Dataset Protection Function Selection (3020Hex-5FHex)
 Monitor Exclusive Parameters (M, W Parameters)

- Save user preference dataset by the following procedure.
 - Step 1: Set “0: Unprotected” (default value) to User Preference Dataset Protection Function Selection (3020Hex-60Hex).
 - Step 2: When User Preference Dataset Registration (3020Hex-5FHex) is set to “1: Protected,” registration of the user preference dataset is started.
 - Step 3: To protect the user preference dataset, set “1: Protected (save prohibited)” to User Preference Dataset Protection Function Selection (3020Hex-60Hex).
- To set all user preference datasets to the factory defaults, initialize parameters by Data Initialization (3008Hex-04Hex) “1: Initialize all parameters,” and then register the datasets by User Preference Dataset Registration (3020Hex-5FHex).

6-2 Setting V/f Control

6-2-1 Motor Control Method (V/f Characteristics)

- V/f control is a method of controlling a motor by setting the output voltage and frequency of the inverter as V/f characteristics. This is effective for using the inverter easily.
- Set 0 and 3 at Drive Control Selection and select the V/f characteristics (output voltage and output frequency).

Parameter No.	Function name	Data	Default data	Unit
3004Hex-2BHex/ 3009Hex-0FHex	1st Drive Control Selection/2nd Drive Control Selection*1	0: IM V/f control 3: IM V/f control with speed sensor	0	-
3004Hex-26Hex/ 3009Hex-0EHex	1st V/f Characteristics Selection/2nd V/f Characteristics Selection	0: Variable torque load 1: Constant torque load	1	-

*1. To enable switching to the 1st and 2nd control, allocate "12: SET (2nd control)" to either of input terminal [DI1] to [DI7].

V/f Control (Induction Motor) (3004Hex-2BHex/3009Hex-0FHex = 0)

V/f control outputs the voltage and frequency according to a preset V/f pattern to operate the motor. Also, slip compensation function enabled/disabled can be switched by Slip compensation Function Selection (3052Hex-2BHex). For details on slip compensation, refer to 6-2-3 *Slip Compensation* on page 6-14.

V/f Control with Speed Sensor (Induction Motor) (3004Hex-2BHex/3009Hex-0FHex = 3)

When a load is applied to an induction motor, slip occurs according to characteristics of the motor and this results in a drop in motor rotation speed.

With V/f control with speed sensor, the motor rotation speed is detected by an encoder mounted on the motor shaft, and the slip frequency is compensated by PI control so that the motor rotation speed matches the speed equivalent to the instructed speed. As a result, the speed control accuracy of the motor is improved.

Constant Torque Characteristics (3004Hex-26Hex/3009Hex-0EHex = 1)

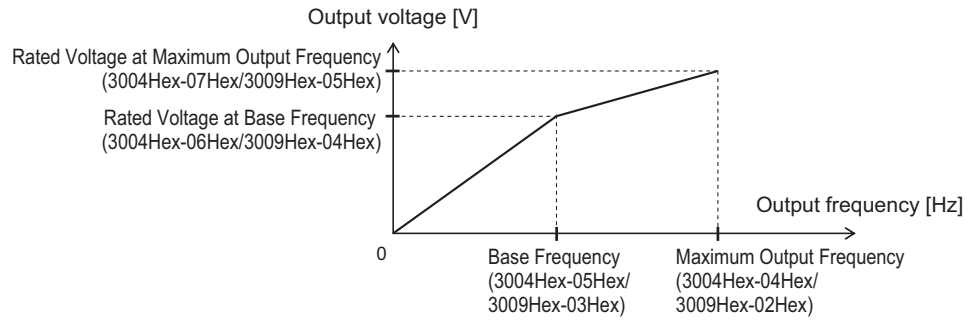
This setting is suitable for cart, conveyor, overhead traveling crane, and other applications where a torque is required, independent of the motor rotation speed.

It enables the output of a constant torque based on the frequency, according to the V/f characteristics that represent the proportional relationship between the output frequency and the output voltage.

For the base frequency, set the rated frequency of the motor.

For the maximum frequency, set the highest frequency at which control is performed on the inverter.

Note that this must be within the maximum frequency of the motor.

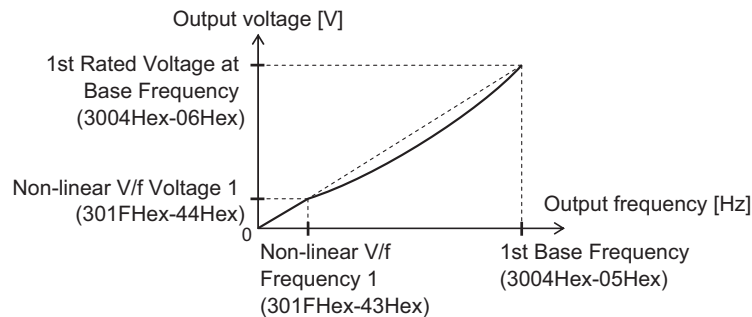


Reducing Torque Characteristics (3004Hex-26Hex/3009Hex-0EHex = 0)

This setting is suitable for fan, pump, and other applications that do not require large torque at low speeds.

It provides high efficiency, reduced noise and vibration as the output voltage is reduced in the low speed range.

By using the non-linear V/f function, a sufficient startup torque can also be secured as constant torque characteristics up to specified speeds.



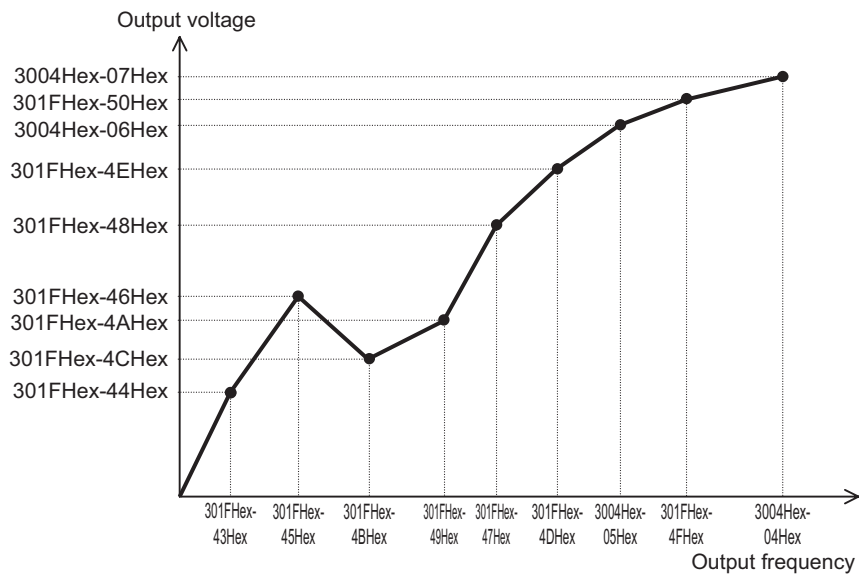
Reducing torque characteristics using non-linear V/f

Reducing torque characteristics are characteristics to the power of two.

Broken Line V/f Function

- With the non-linear V/f function, V/f characteristics at a total of nine points can be configured as desired by setting the voltage and frequency of seven points in addition to base voltage/frequency and maximum voltage/frequency. When the non-linear V/f function is not used, set "0.0" to the non-linear V/f frequency 1 to 7 that is not to be used.
- Frequency is not in parameter No. order but in order of the size of the set value. (Refer to the figure below.)
- The non-linear V/f function can be jointly used with torque boost, reducing torque characteristics and automatic energy saving operation.

Parameter No.	Function name	Data	Description	Default data	Unit
301FHex-43Hex	Non-linear V/f Frequency 1	0.0: Disable 0.1 to 590.0	Sets the frequency at each break point.	0.0	Hz
301FHex-45Hex	Non-linear V/f Frequency 2				
301FHex-47Hex	Non-linear V/f Frequency 3				
301FHex-49Hex	Non-linear V/f Frequency 4				
301FHex-4BHex	Non-linear V/f Frequency 5				
301FHex-4DHex	Non-linear V/f Frequency 6				
301FHex-4FHex	Non-linear V/f Frequency 7				
301FHex-44Hex	Non-linear V/f Voltage 1	0 to 240 (for 200 V class series) 0 to 500 (for 400 V class series)	Sets the voltage at each break point.	0	V
301FHex-46Hex	Non-linear V/f Voltage 2				
301FHex-48Hex	Non-linear V/f Voltage 3				
301FHex-4AHex	Non-linear V/f Voltage 4				
301FHex-4CHex	Non-linear V/f Voltage 5				
301FHex-4EHex	Non-linear V/f Voltage 6				
301FHex-50Hex	Non-linear V/f Voltage 7				



6-2-2 Load Mode Selection

Select either of the heavy load mode (HHD/HD) or the light load mode (HND/ND) according to the application.

Parameter No.	Function name	Data	Default data	Unit
3004Hex-51Hex	Load Mode Selection	0: HHD 1: HND 3: HD (only for 400 V) 4: ND (only for 400 V)	0	-

Parameter No.	Function name	Data	Default data	Unit
Related function		1st Drive Control Selection (3004Hex-2BHex) 2nd Drive Control Selection (3009Hex-0FHex) 1st Manual Torque Boost Voltage (3004Hex-0AHex) 2nd Manual Torque Boost Voltage (3009Hex-06Hex) 1st Overload Protect Level (3004Hex-2DHex) 2nd Overload Protect Level (301FHex-30Hex) Carrier Frequency (3004Hex-1BHex) 1st DC Injection Braking Level (3004Hex-16Hex) 2nd DC Injection Braking Level (3009Hex-0BHex)		

- Load modes that can be selected differ depending on the voltage specifications and capacity of the inverter.

Power supply specifications	Load Mode Selection (3004Hex-51Hex)			
	0: HHD	1: HND	3: HD	4: ND
Three-phase 200 V full capacity	OK	OK	-	-
Three-phase 400V full capacity	OK	OK	OK	OK
Single-phase 200 V (2.2 k or less)	OK	OK	-	-
Single-phase 200 V (3.7 kW)	OK	-	-	-

- For loads (such as fans and pumps) that do not require frequent use of the inverter above the rated torque, the light load mode can be selected. The rated current of the inverter increases above that of the heavy load mode, which enables the inverter to drive a motor one size larger. For details on rated current specifications, refer to *1-3-1 Standard Specifications* on page 1-10. The overload capacity differs as shown in the following table on each specification type.

3004Hex-51Hex data	Specification type		Continuous rated current level	Ambient temperature	Overload capacity
0	Heavy load mode	HHD	Motor of same capacity as inverter capacity can be driven	Up to 50°C	150% 1min, 200% 0.5 s
3 (only for 400 V)		HD	Motor of capacity one size larger than the inverter capacity can be driven	Up to 40°C	150% 1 min
1	Light load mode	HND	Motor of capacity one size larger than the inverter capacity can be driven	Up to 50°C	120% 1 min
4 (only for 400 V)		HD	Motor of capacity one to two sizes larger than the inverter capacity can be driven	Up to 40°C	120% 1 min

Related Parameters

- Some parameters are restricted by changing the setting of Load Mode Selection (3004Hex-51Hex).
- **When Drive Control Selection (3004Hex-2BHex/3009Hex-0FHex) = 0 to 6 (induction motor)**
 - The set values of the following parameters are overwritten with the following values according to the new settings after changing Load Mode Selection (3004Hex-51Hex).
Manual Torque Boost Voltage (3004Hex-0AHex/3009Hex-06Hex)

Overload Protect Level (3004Hex-2DHex/301FHex-30Hex)

- The upper limit values of the following parameters change according to the new settings after changing Load Mode Selection (3004Hex-51Hex). When the set values exceed the upper limit, they are overwritten with the upper limit.

Carrier Frequency (3004Hex-1BHex)

DC Injection Braking Level (3004Hex-16Hex/3009Hex-0BHex)

Power supply	Model	Capacity [kW]	Manual Torque Boost Voltage (3004Hex-0AHex/ 3009Hex-06Hex)				Overload Protect Level (3004Hex-2DHex/ 301FHex-30Hex)				Carrier Frequency (3004Hex-1BHex)				DC Injection Braking Level (3004Hex-16Hex/ 3009Hex-0BHex)			
			Set value				Set value				Maximum value (*1)				Maximum value (*1)			
			Load Mode Selection (3004Hex-51Hex)				Load Mode Selection (3004Hex-51Hex)				Load Mode Selection (3004Hex-51Hex)				Load Mode Selection (3004Hex-51Hex)			
			0: HH D	1: HN D	3: HD	4: ND	0: HH D	1: HN D	3: HD	4: ND	0: HH D	1: HN D	3: HD	4: ND	0: HH D	1: HN D	3: HD	4: ND
Three-phase 200V	3G3M1-A2001	0.1	8.4	6.7	-	-	180	130	-	-	16	16	-	-	100	80	-	-
	3G3M1-A2002	0.2	8.4	6.7	-	-	180	130	-	-	16	16	-	-	100	80	-	-
	3G3M1-A2004	0.4	7.1	4.0	-	-	180	130	-	-	16	16	-	-	100	80	-	-
	3G3M1-A2007	0.75	3.8	2.6	-	-	180	130	-	-	16	16	-	-	100	80	-	-
	3G3M1-A2015	1.5	3.0	2.4	-	-	180	130	-	-	16	16	-	-	100	80	-	-
	3G3M1-A2022	2.2	2.5	2.1	-	-	180	130	-	-	16	10	-	-	100	80	-	-
	3G3M1-A2037	3.7	2.4	2.0	-	-	180	130	-	-	16	10	-	-	100	80	-	-
	3G3M1-A2055	5.5	1.9	1.9	-	-	180	130	-	-	16	16	-	-	100	80	-	-
	3G3M1-A2075	7.5	1.8	1.8	-	-	180	130	-	-	16	16	-	-	100	80	-	-
	3G3M1-A2110	11	1.3	1.3	-	-	180	130	-	-	16	16	-	-	100	80	-	-
	3G3M1-A2150	15	1.2	1.2	-	-	180	130	-	-	16	16	-	-	100	80	-	-
	3G3M1-A2185	18.5	0.9	0.9	-	-	160	130	-	-	16	16	-	-	100	80	-	-

Power supply	Model	Capacity [kW]	Manual Torque Boost Voltage (3004Hex-0AHex/ 3009Hex-06Hex)				Overload Protect Level (3004Hex-2DHex/ 301FHex-30Hex)				Carrier Frequency (3004Hex-1BHex)				DC Injection Braking Level (3004Hex-16Hex/ 3009Hex-0BHex)			
			Set value				Set value				Maximum value (*1)				Maximum value (*1)			
			Load Mode Selection (3004Hex-51Hex)				Load Mode Selection (3004Hex-51Hex)				Load Mode Selection (3004Hex-51Hex)				Load Mode Selection (3004Hex-51Hex)			
			0: HH D	1: HN D	3: HD	4: ND	0: HH D	1: HN D	3: HD	4: ND	0: HH D	1: HN D	3: HD	4: ND	0: HH D	1: HN D	3: HD	4: ND
Three-phase 400 V	3G3M1-A4004	0.4	7.1	4.0	7.1	4.0	180	130	160	130	16	16	16	10	100	80	80	60
	3G3M1-A4007	0.75	3.8	2.6	3.8	2.6	180	130	160	130	16	16	16	10	100	80	80	60
	3G3M1-A4015	1.5	3.0	2.4	3.0	2.4	180	130	160	130	16	16	16	10	100	80	80	60
	3G3M1-A4022	2.2	2.5	2.1	2.5	2.1	180	130	160	130	16	16	16	10	100	80	80	60
	3G3M1-A4030	3.0	2.5	2.1	2.5	2.1	180	130	160	130	16	16	16	10	100	80	80	60
	3G3M1-A4040	4.0	2.4	2.0	2.4	2.0	180	130	160	130	16	16	16	10	100	80	80	60
	3G3M1-A4055	5.5	1.9	1.9	1.9	1.9	180	130	160	130	16	16	16	10	100	80	80	60
	3G3M1-A4075	7.5	1.8	1.8	1.8	1.8	180	130	160	130	16	16	16	10	100	80	80	60
	3G3M1-A4110	11	1.3	1.3	1.3	1.3	180	130	160	130	16	16	16	10	100	80	80	60
	3G3M1-A4150	15	1.2	1.2	1.2	1.2	180	130	160	130	16	16	16	10	100	80	80	60
	3G3M1-A4185	18.5	0.9	0.9	0.9	0.9	160	130	160	130	16	16	16	10	100	80	80	60
3G3M1-A4220	22	0.9	0.9	0.9	0.9	160	130	160	130	16	10	10	6	100	80	80	60	
Single-phase 200 V	3G3M1-AB001	0.1	8.4	6.7	-	-	180	130	-	-	16	10	-	-	100	80	-	-
	3G3M1-AB002	0.2	8.4	6.7	-	-	180	130	-	-	16	10	-	-	100	80	-	-
	3G3M1-AB004	0.4	7.1	4.0	-	-	180	130	-	-	16	10	-	-	100	80	-	-
	3G3M1-AB007	0.75	3.8	2.6	-	-	180	130	-	-	16	10	-	-	100	80	-	-
	3G3M1-AB015	1.5	3.0	2.4	-	-	180	130	-	-	16	10	-	-	100	80	-	-
	3G3M1-AB022	2.2	2.5	2.1	-	-	180	130	-	-	16	10	-	-	100	80	-	-
	3G3M1-AB037	3.7	2.4	-	-	-	180	-	-	-	16	-	-	-	100	-	-	-

● **When Drive Control Selection (3004Hex-2BHex/3009Hex-0FHex) = 15, 16 (synchronous motor)**

- The set values of the following parameters are overwritten with the following values according to the new settings after changing Load Mode Selection (3004Hex-51Hex).
Manual Torque Boost Voltage (3004Hex-0AHex)

Power supply	Model	Capacity [kW]	Manual Torque Boost Voltage (3004Hex-0AHex)			
			Set value			
			Load Mode Selection (3004Hex-51Hex)			
			0: HHD	1: HND	3: HD	4: ND
Three-phase 200 V	3G3M1-A2001	0.1	8.4	6.7	-	-
	3G3M1-A2002	0.2	8.4	6.7	-	-
	3G3M1-A2004	0.4	7.1	4.0	-	-
	3G3M1-A2007	0.75	6.8	3.5	-	-
	3G3M1-A2015	1.5	6.8	4.9	-	-
	3G3M1-A2022	2.2	6.8	4.5	-	-
	3G3M1-A2037	3.7	5.5	4.1	-	-
	3G3M1-A2055	5.5	4.9	3.4	-	-
	3G3M1-A2075	7.5	4.4	2.7	-	-
	3G3M1-A2110	11	3.5	2.1	-	-
	3G3M1-A2150	15	2.8	1.6	-	-
	3G3M1-A2185	18.5	2.2	1.3	-	-
Three-phase 400V	3G3M1-A4004	0.4	7.1	4.0	7.1	4.0
	3G3M1-A4007	0.75	6.8	3.5	6.8	3.5
	3G3M1-A4015	1.5	6.8	4.9	6.8	4.9
	3G3M1-A4022	2.2	6.8	4.5	6.8	4.5
	3G3M1-A4030	3.0	6.8	4.5	6.8	4.5
	3G3M1-A4040	4.0	5.5	4.1	5.5	4.1
	3G3M1-A4055	5.5	4.9	3.4	4.9	3.4
	3G3M1-A4075	7.5	4.4	2.7	4.4	2.7
	3G3M1-A4110	11	3.5	2.1	3.5	2.1
	3G3M1-A4150	15	2.8	1.6	2.8	1.6
	3G3M1-A4185	18.5	2.2	1.3	2.2	1.3
	3G3M1-A4220	22	2.2	1.1	2.2	1.1
Single-phase 200 V	3G3M1-AB001	0.1	8.4	6.7	-	-
	3G3M1-AB002	0.2	8.4	6.7	-	-
	3G3M1-AB004	0.4	7.1	4.0	-	-
	3G3M1-AB007	0.75	6.8	3.5	-	-
	3G3M1-AB015	1.5	6.8	4.9	-	-
	3G3M1-AB022	2.2	6.8	4.5	-	-
	3G3M1-AB037	3.7	5.5	-	-	-

6-2-3 Slip Compensation

The slip compensation function calculates the torque generated by the motor to infer the slip amount. As a result of this calculation, the drop in motor rotation speed can be compensated for to suppress the drop in motor rotation speed. This is useful for improving the speed control accuracy of the motor.

To enable the slip compensation function, select “0: V/f control” or “3: V/f control with speed sensor” at Drive Control Selection (3004Hex-2BHex/3009Hex-0FHex), then set 1 at Slip compensation Function Selection (3052Hex-2BHex), and set the conditions for enabling the slip compensation function to Slip Compensation Operating Conditions Selection (3008Hex-45Hex/3009Hex-29Hex).

Parameter No.	Function name	Data	Default data	Unit
3052Hex-2BHex	Slip compensation Function Selection	0: Disable 1: Enable	0	-
3008Hex-45Hex/ 3009Hex-29Hex	1st Slip Compensation Operating Conditions Selection/2nd Slip Compensation Operating Conditions Selection* ¹	0: Enable during acceleration/deceleration, enable at base frequency or higher 1: Disable during acceleration/deceleration, enable at base frequency or higher 2: Enable during acceleration/deceleration, disable at base frequency or higher 3: Disable during acceleration/deceleration, at base frequency or higher	0	-
3007Hex-0AHex/ 3009Hex-18Hex* ²	1st Slip Compensation Gain for Driving/2nd Slip Compensation Gain for Driving* ¹	0.0 to 200.0	100.0	%
3007Hex-0BHex/ 3009Hex-19Hex	1st Slip Compensation Response Time/2nd Slip Compensation Response Time* ¹	0.01 to 10.00	0.12	s
3007Hex-0CHex/ 3009Hex-1AHex* ²	1st Slip Compensation Gain for Braking/2nd Slip Compensation Gain for Braking* ¹	0.0 to 200.0	100.0	%
3007Hex-0DHex/ 3009Hex-1BHex* ²	1st Rated Slip Frequency/2nd Rated Slip Frequency* ¹	0.00 to 15.00	Dependent on capacity	Hz

*1. To enable switching to the 1st and 2nd control, allocate “12: SET (2nd control)” to either of input terminal [DI1] to [DI7].

*2. When 0.0% or 0.00 Hz is set to one of 3007Hex-0AHex/3009Hex-18Hex, 3007Hex-0CHex/3009Hex-1AHex and 3007Hex-0DHex/3009Hex-1BHex, slip compensation is disabled.

Details of 1st Slip Compensation Operating Conditions Selection (3008Hex-45Hex) and 2nd Slip Compensation Operating Conditions Selection (3009Hex-29Hex) are as shown in the table below.

3008Hex-45Hex/ 3009Hex-29Hex Data	Motor operation state		Frequency range	
	At acceleration/ deceleration	At constant speed	Base frequency or less	Base frequency or more
0	Enable	Enable	Enable	Enable
1	Disable	Enable	Enable	Enable
2	Enable	Enable	Enable	Disable
3	Disable	Enable	Enable	Disable

- For Slip Compensation Gain for Driving (3007Hex-0AHex/3009Hex-18Hex)/Slip Compensation Response Time (3007Hex-0BHex/3009Hex-19Hex)/Slip Compensation Gain for Braking (3007Hex-0CHex/3009Hex-1AHex), adjust the compensation amount for when slip compensation is

performed and the slip amount in the internal calculation. These can be set individually in the driving mode and the braking mode. The rated slip frequency is archived when set to 100%. When over-compensation (100% or higher) is set in slip compensation, hunting sometimes occurs. So, check this on an actual inverter.

The slip compensation response time determines the response when slip compensation is performed. Basically, there is no need to change the setting.

- Rated slip frequency (3007Hex-0DHex/3009Hex-1BHex)

Set the rated slip frequency of the motor. This is also automatically set by executing auto-tuning.

$$\text{Rated slip frequency (Hz)} = \frac{\text{Synchronous speed} - \text{Rated speed}}{\text{Synchronous speed}} \times \text{Base frequency}$$

6-3 Motor Parameter Settings

6-3-1 Induction Motor Basic Settings

When running an induction motor, set the following parameters to match the rated value of the motor used and the design values of the machinery.

Parameter No.	Function name	Data	Default data	Unit
3004Hex-05Hex/ 3009Hex-03Hex	1st Base Frequency/2nd Base Frequency* ¹	5.0 to 590.0	50.0	Hz
3004Hex-06Hex/ 3009Hex-04Hex	1st Rated Voltage at Base Frequency/2nd Rated Voltage at Base Frequency* ¹	80 to 240: (200 V class series) 160 to 500: (400 V class series)	Dependent on capacity	V
3004Hex-04Hex/ 3009Hex-02Hex	1st Maximum Output Frequency/2nd Maximum Output Frequency* ¹	5.0 to 590.0	60.0	Hz

*1. To enable switching to the 1st and 2nd control, allocate "12: SET (2nd control)" to either of input terminal [DI1] to [DI7].

6-3-2 Base Frequency and Maximum Frequency of Motor

To configure the V/f control characteristics output to the motor, set the base frequency and maximum frequency of your motor.

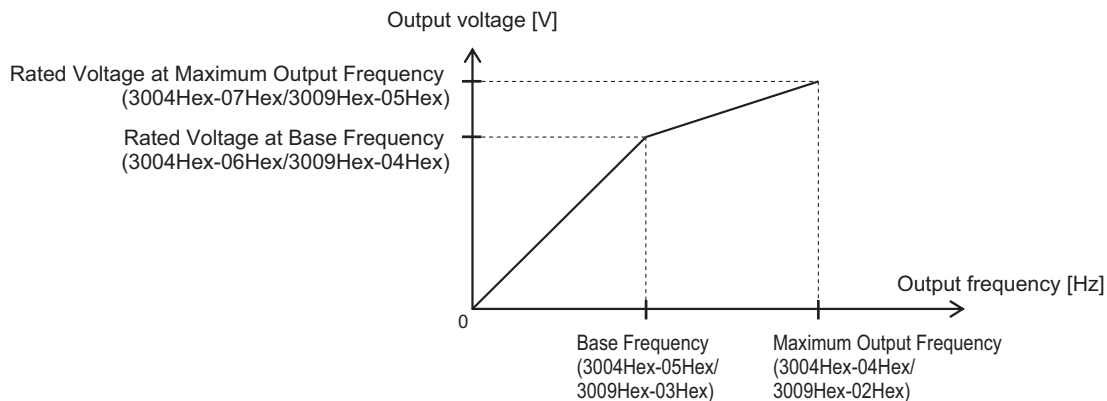
For the base frequency, set the rated frequency of the motor (the frequency listed on the motor rating nameplate).

For the maximum frequency, set the highest frequency required for your application. However, do not exceed the maximum rotation speed of the motor.

Then, set the motor rated voltage to 1st Rated Voltage at Maximum Output Frequency (3004Hex-07Hex)/2nd Rated Voltage at Maximum Output Frequency (3009Hex-05Hex).

Parameter No.	Function name	Data	Default data	Unit
3004Hex-05Hex/ 3009Hex-03Hex	1st Base Frequency/2nd Base Frequency* ¹	5.0 to 590.0	50.0	Hz
3004Hex-04Hex/ 3009Hex-02Hex	1st Maximum Output Frequency/2nd Maximum Output Frequency* ¹	5.0 to 590.0	60.0	Hz
3004Hex-06Hex/ 3009Hex-04Hex	1st Rated Voltage at Base Frequency/2nd Rated Voltage at Base Frequency* ¹	80 to 240: (200 V class series) 160 to 500: (400 V class series)	Dependent on capacity	V
3004Hex-07Hex/ 3009Hex-05Hex	1st Rated Voltage at Maximum Output Frequency/2nd Rated Voltage at Maximum Output Frequency* ¹	80 to 240: (200 V class series) 160 to 500: (400 V class series)	Dependent on capacity	V

*1. To enable switching to the 1st and 2nd control, allocate "12: SET (2nd control)" to either of input terminal [DI1] to [DI7].



- For these motors, check the rated motor current and select an appropriate inverter based on the rated current of the inverter.
- Do not set the base frequency to lower than the motor rated frequency. Doing so may cause overload or motor burnout.
- Do not select a motor incoming voltage higher than the motor rated voltage. Doing so may cause an overload or motor burnout.

6-3-3 Motor Electronic Thermal Function

The motor electronic thermal function prevents the motor from overloading and burning. In addition, M1 has a braking resistor electronic thermal function. (Refer to 6-12-2 *Braking Resistor Electronic Thermal Function* on page 6-67.)

- The motor electronic thermal function calculates the electronic thermal calculated value for motor protection based on the output current of the inverter. The status of the electronic thermal function can be checked by the monitor of electronic thermal overload protection for motor (3003Hex-3CHex). When 100% is reached in the percentage display, motor overload (alarm codes: 17, 18) is detected.
- The motor electronic thermal function sets Motor Electronic Thermal Level (3004Hex-0CHex/3009Hex-08Hex), Motor Electronic Thermal Characteristic Selection (3004Hex-0BHex/3009Hex-07Hex) and Motor Electronic Thermal Time Constant (3004Hex-0DHex/3009Hex-09Hex).
- When Motor Electronic Thermal Overload Protection Data Retention (3008Hex-5AHex) is set to 1, the electronic thermal cumulative value and thermal cumulative value of the overload early warning are saved in the EEPROM when an insufficient voltage state has occurred, and, when the power is next turned ON, EEPROM saved values are used as the defaults for cumulative values.

Parameter No.	Function name	Data	Default data	Unit
3004Hex-0BHex/ 3009Hex-07Hex	1st Motor Electronic Thermal Characteristic Selection/2nd Motor Electronic Thermal Characteristic Selection*1	1: For a general-purpose motor with shaft-driven cooling fan 2: For an inverter-driven motor non-ventilated motor or motor with separately powered cooling fan	1	-
3004Hex-0CHex/ 3009Hex-08Hex	1st Motor Electronic Thermal Level/2nd Motor Electronic Thermal Level*1	0.00: Disable 0.01 to 118.8 # Setting range from 1% (HHD) to 135% (ND) of the rated inverter current.	22.5	A

Parameter No.	Function name	Data	Default data	Unit
3004Hex-0DHex/ 3009Hex-09Hex	1st Motor Electronic Thermal Time Constant/2nd Motor Electronic Thermal Time Constant*1	0.5 to 75.0	5.0	min
3003Hex-3CHex	Motor Electronic Thermal Monitor	0 to 100	0	%
3008Hex-5AHex	Motor Electronic Thermal Overload Protection Data Retention	0: Disable 1: Enable	0	-
Related function		Motor overload (alarm codes: 17, 18)		

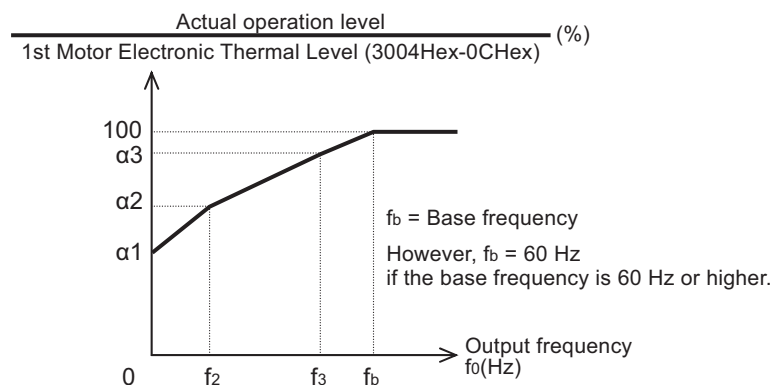
*1. To enable switching to the 1st and 2nd control, allocate "12: SET (2nd control)" to either of input terminal [DI1] to [DI7].

Motor Electronic Thermal Level (3004Hex-0CHex/3009Hex-08Hex)

- Set the operation level of the electronic thermal for motor protection. To not use this function, set 0.00.
- Normally, set to the motor continuous allowable current (generally, about 1.0 to 1.1 times the motor rated current) when the motor is run at base frequency.

Motor Electronic Thermal Characteristic Selection (3004Hex-0BHex/3009Hex-07Hex)

- Select the characteristics of the motor cooling system.
- **When Motor Electronic Thermal Characteristic Selection (3004Hex-0BHex/3009Hex-07Hex) = 1: For a general-purpose motor with shaft-driven cooling fan**
 - The figure below shows the electronic thermal operation characteristics. Characterization factors $\alpha 1$ to $\alpha 3$ and their switching frequencies f_2 and f_3 differ according to the characteristics of the motor.



- The following shows each factor that is set according to the motor characteristics selected by motor capacity and motor type (induction motor/PM motor).

Induction motor (IM)

Motor capacity	Thermal time constant t (factory default)	Thermal time constant setting reference current value I _{max}	Characterization factor switching frequency		Characterization factor			
			f ₂	f ₃	α1	α2	α3	
0.4, 0.75 kW	5 min	Continuous allowable current value × 150%	5 Hz	7 Hz	75%	85%	100%	
1.5 to 3.7 kW					85%	85%	100%	
5.5 to 11 kW					6 Hz	90%	95%	100%
15 kW					7 Hz	85%	85%	100%
18.5, 22 kW					5 Hz	92%	100%	100%
30 to 45 kW	10 min		Continuous allowable current value × 150%	Base Frequency × 33%	Base Frequency × 83%	54%	85%	95%
55 to 90 kW						51%	95%	95%
110 kW min.						53%	85%	90%

Synchronous motor (PM)

Motor capacity	Thermal time constant t (factory default)	Thermal time constant setting reference current value I _{max}	Characterization factor switching frequency		Characterization factor			
			f ₂	f ₃	α1	α2	α3	
0.2 to 22 kW	5 min	Continuous allowable current value × 150%	Base Frequency × 33%	Base Frequency × 33%	69%	90%	90%	
30 to 45 kW	10 min				Base Frequency × 83%	54%	85%	95%
55 to 90 kW						51%	95%	95%
110 kW min.						53%	85%	90%

● **When Motor Electronic Thermal Characteristic Selection (3004Hex-0BHex/3009Hex-07Hex) = 2: For an inverter-driven motor non-ventilated motor or motor with separately powered cooling fan**

- The operation level is a constant value without decrease that is set at Motor Electronic Thermal Level (3004Hex-0CHex/3009Hex-08Hex) as there is no drop in the cooling effectiveness by output frequency.

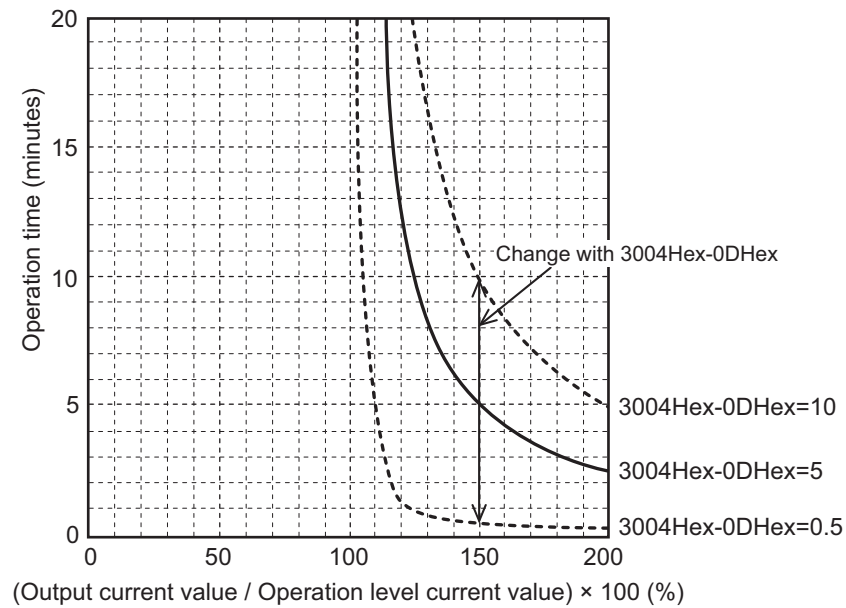
Motor Electronic Thermal Time Constant (3004Hex-0DHex/3009Hex-09Hex)

- Set the thermal time constant of the motor. Set the electronic thermal operating time for when a current of 150% of the operation level set at Motor Electronic Thermal Level (3004Hex-0CHex/3009Hex-08Hex) flows continuously. The thermal time constant of a general motor is 5 minutes for 22kW or less (factory default).

(Example) When the data of Motor Electronic Thermal Time Constant (3004Hex-0DHex/3009Hex-09Hex) is set to "5" (5 minutes)

When a current 150% of the overload detection level set as shown in the figure below flows for 5 minutes, the motor overload (alarm codes: 17, 18) protection function operates. Also, for 120%, the motor overload protection function operates after approx. 12.5 minutes.

The time that an alarm actually is generated is shorter than the set data as the time from when the continuous allowable current (100%) is exceeded up to when the 150% level is reached also is taken into consideration.



Motor Electronic Thermal Warning

Use this function to output a warning signal before the motor electronic thermal function executes an overload protection. The electronic thermal warning operates at or above the current value set in the Overload early warning 2 Level (OL2) (3005Hex-23Hex). Generally, set to around 80% to 90% of the current value of the Motor Electronic Thermal Level (3004Hex-0CHex/3009Hex-08Hex). The temperature characteristics of the motor are set in Motor Electronic Thermal Characteristic Selection (3004Hex-0BHex/3009Hex-07Hex) or Motor Electronic Thermal Time Constant (3004Hex-0DHex/3009Hex-09Hex).

Parameter No.	Function name	Data	Default data	Unit
3005Hex-15Hex/ 3005Hex-1CHex	Output Terminal [DO1] Function Selection/Output Terminal [ROA, ROB] Function Selection	7: THM (Electronic thermal warning)	-	-
3005Hex-23Hex	Overload early warning 2 Level (OL2)	0.00: Disable 0.01 to 176.0 # Setting range from 1% (HHD) to 200% (ND) of the rated inverter current.	21.0	A

6-4 RUN command

6-4-1 RUN command selection

Select the input method for the RUN command.

Parameter No.	Function name	Data	Default data	Unit
3004Hex-03Hex/ 301FHex-03Hex	1st RUN Command Selection 2nd RUN Command Selection*1	1: Terminal command FW or RV 5: EtherCAT	5	-
Related function		Input Terminal [DI6] Function Selection (3005Hex-63Hex) Input Terminal [DI7] Function Selection (3005Hex-64Hex) Operation command (3002Hex-07Hex)		

*1. To enable switching to the 1st and 2nd control, allocate "12: SET (2nd control)" to either of input terminal [DI1] to [DI7].

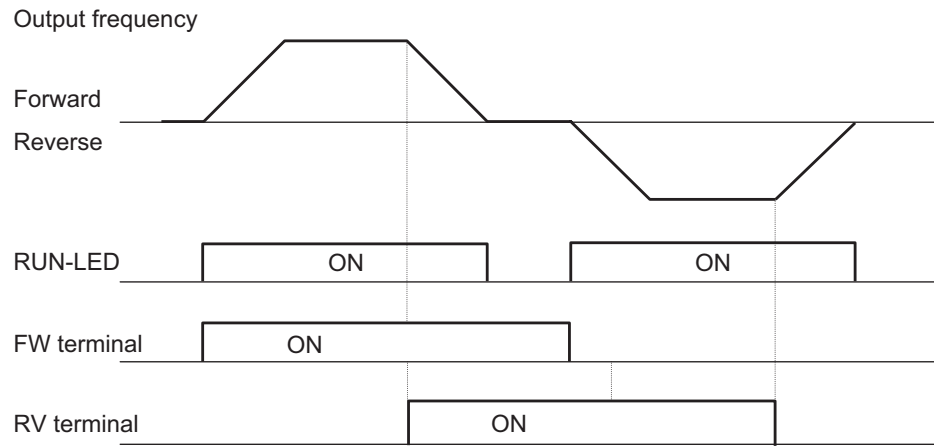
The operation method for data selected at 1st RUN Command Selection (3004Hex-03Hex)/2nd RUN Command Selection (301FHex-03Hex) is as follows.

Data	Operation method
1	Forward rotation is performed when the FW terminal turns ON. Reverse rotation is performed when the RV terminal turns ON. Operation stops when both the FW and RV terminals are OFF or both are ON.
5	When using an unique profile, operation is instructed by 5000 hex (Reference) and when using a CiA402 profile, it is instructed by 6040 hex (Control Word). For details, refer to <i>Section 4 Inverter Control</i> on page 4-1.

- When "1: External signal (Digital input)" is selected at RUN Command Selection (3004Hex-03Hex/301FHex-03Hex), allocate "98: FW (forward rotation)" and "99: RV (reverse rotation)" to each of Input Terminal [DI6] Function Selection (3005Hex-63Hex) and Input Terminal [DI7] Function Selection (3005Hex-64Hex). Operation stops when both the FW and RV terminals are ON or both are OFF.
- When "1: External signal (Digital input)" is selected at RUN Command Selection (3004Hex-03Hex/301FHex-03Hex), 3-wire input is possible. Refer to *3-wire Input Function (FW, STP, F/R)* on page 6-50.
- The RUN command from an input terminal can be forcibly enabled via input terminals. Refer to *8-6-3 STO Function by Safety Input Signal* on page 8-62.
- When the inverter is outputting to the motor, operation is in progress and the RUN-LED lights. Lights during deceleration after RUN command OFF. Goes out while the RUN command is ON at frequency reference 0 Hz as there is no output. When zero speed control is being executed, this lights as the inverter outputs even when the frequency reference is 0 Hz.

● Operation example

- The following shows an example of operation by forward command FW input and reverse command RV input when "1: External signal (Digital input)" is selected at RUN Command Selection (3004Hex-03Hex/301FHex-03Hex).



6-5 Frequency Reference

6-5-1 Frequency Reference Selection

- Select the input method for the frequency reference.

Parameter No.	Function name	Data	Default data	Unit
3004Hex-02Hex/ 3006Hex-1FHex	1st Frequency Reference Selection/2nd Frequency Reference Selection*1	1: Analog Voltage Input (Input Terminal[A11]) 7: UP/DOWN control 10: Pattern operation 12: Pulse train input 13: Calculation result 15: EtherCAT	15	-
3002Hex-07Hex	Operation command	Bit1: REV Bit0: FWD	0	-
Related function		Input Terminal [DI1] to [DI7] Function Selection (3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex)		

*1. To enable switching to the 1st and 2nd control, allocate "12: SET (2nd control)" to either of input terminal [DI1] to [DI7].

The frequency reference method for data selected at 1st Frequency Reference Selection (3004Hex-02Hex) and 2nd Frequency Reference Selection (3006Hex-1FHex) is as follows.

Data	Frequency reference method
1	Sets the frequency reference via the analog voltage input (input terminal [A11]).
7	Sets the frequency reference via the UP and DOWN terminals.
10	Sets the frequency reference via Pattern Operation Function Selection.
12	Sets the frequency reference via pulse train input.
13	The result of calculation of the frequency calculation function is set as the frequency reference.
14	Sets the frequency reference via EtherCAT communication.

- The forced terminal block function are given priority over the frequency reference selected at Frequency Reference Selection (3004Hex-02Hex/3006Hex-1FHex). For details, refer to 8-6-3 *STO Function by Safety Input Signal* on page 8-62.

Command Using Analog Voltage Input (Frequency Reference Selection (3004Hex-02Hex/3006Hex-1FHex) = "1")

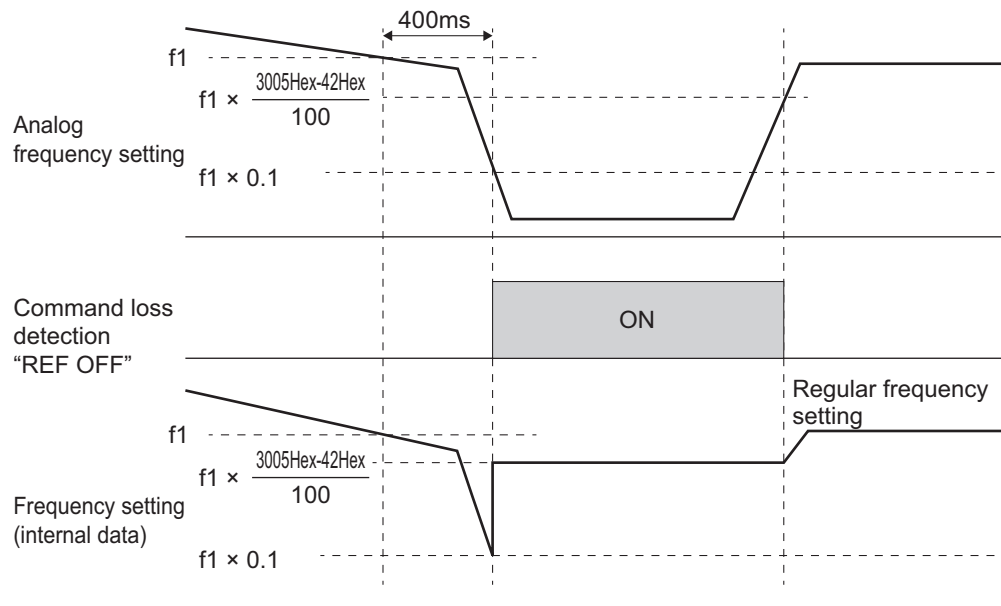
- Analog input can adjust the input signal by gain and bias. (Refer to 8-3-2 *Analog Input Adjustment Function* on page 8-34.)
- Behavior when the analog signal is disconnected can be set at analog reference loss detection.

● Analog Reference Loss Detection

When the analog frequency reference falls to 10% or lower of the frequency reference for 400 ms, the wiring of the analog frequency reference is judged to have become disconnected, operation is

continued at the frequency of the ratio set at Reference Loss Detection Operation Selection (3005Hex-42Hex) for the frequency setting value, and the REF OFF terminal is turned ON. When the frequency setting value returns to the value set at Reference Loss Detection Operation Selection (3005Hex-42Hex) or higher, it is judged that the disconnection has been restored, and operation is performed at the legitimate frequency setting.

Parameter No.	Function name	Data	Default data	Unit
3005Hex-42Hex	Reference Loss Detection Operation Selection	0: Decelerate to stop 20 to 120: Continuous operation frequency ratio 999: Disable	999	%
3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex	Input Terminal [DI1] to [DI7] Function Selection	33: REF OFF (Reference loss detection)	-	-



- With the frequency reference via analog input, select only linear acceleration/deceleration.

UP/DOWN Control (Frequency Reference Selection (3004Hex-02Hex/3006Hex-1FHex) = "7")

- Refer to 8-9-10 *UP/DOWN control* on page 8-105.

Pattern Operation (Frequency Reference Selection (3004Hex-02Hex/3006Hex-1FHex) = "10")

- Refer to 6-5-3 *Pattern Operation Function Selection* on page 6-28.

Command Based on Pulse Train Input (Frequency Reference Selection (3004Hex-02Hex/3006Hex-1FHex) = “12”)

- Refer to *8-9-17 Pulse Train Frequency Input* on page 8-129.

Command via Calculation Result of Frequency Calculation Function (Frequency Reference Selection (3004Hex-02Hex/3006Hex-1FHex) = “13”)

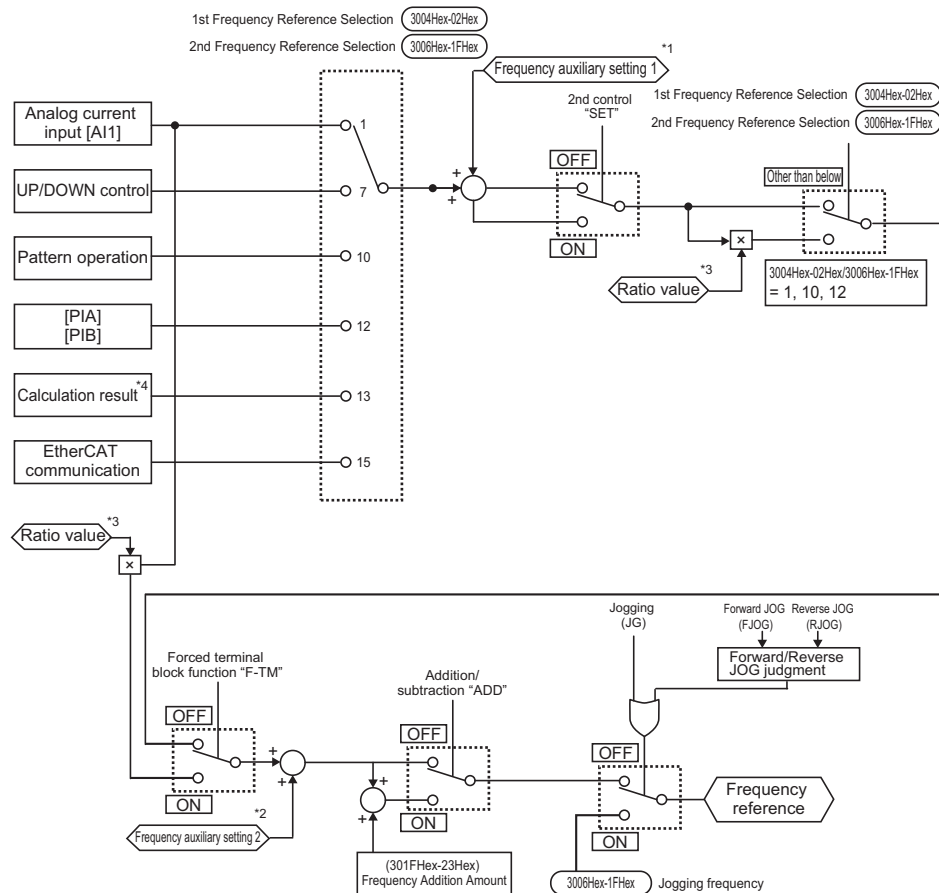
- Refer to *8-9-8 Frequency Calculation Function* on page 8-104.

Command Based on Communication (Frequency Reference Selection (3004Hex-02Hex/3006Hex-1FHex) = “15”)

- When using an unique profile, frequency reference is instructed by 5010 hex (Frequency Reference) and when using a CiA402 profile, it is instructed by 6042 hex (Speed Command). For details, refer to *Section 4 Inverter Control* on page 4-1.

Frequency Reference Correlation Chart

- Set the frequency reference at 1st Frequency Reference Selection (3004Hex-02Hex) and 2nd Frequency Reference Selection (3006Hex-1FHex).
Alternatively, the frequency reference can be switched via multifunction input. Below shows a chart showing the correlation between priority, related parameters, and related multifunction input terminals when the frequency reference is switched.



The presence/absence of the pulse train command depends on the combination of the following parameter settings.

3004Hex-02Hex	3006Hex-1FHex	301FHex-20Hex	301FHex-21Hex	301FHex-14Hex	Pulse train command
Any one is 12	Ignore				Set frequency
Any one is 13	Any one is 5		45		PID feedback
Other than the above				3	Without
Other than the above					Without

- *1. Auxiliary frequency setting 1 is set by setting 1 to Extended function (3005Hex-3EHex).
- *2. Auxiliary frequency setting 2 is set by setting 2 to Extended function (3005Hex-3EHex).
- *3. Ratio value is set by setting 6 to Extended function (3005Hex-3EHex).
- *4. For details on the result of logical operation, refer to 8-9-8 *Frequency Calculation Function* on page 8-104.

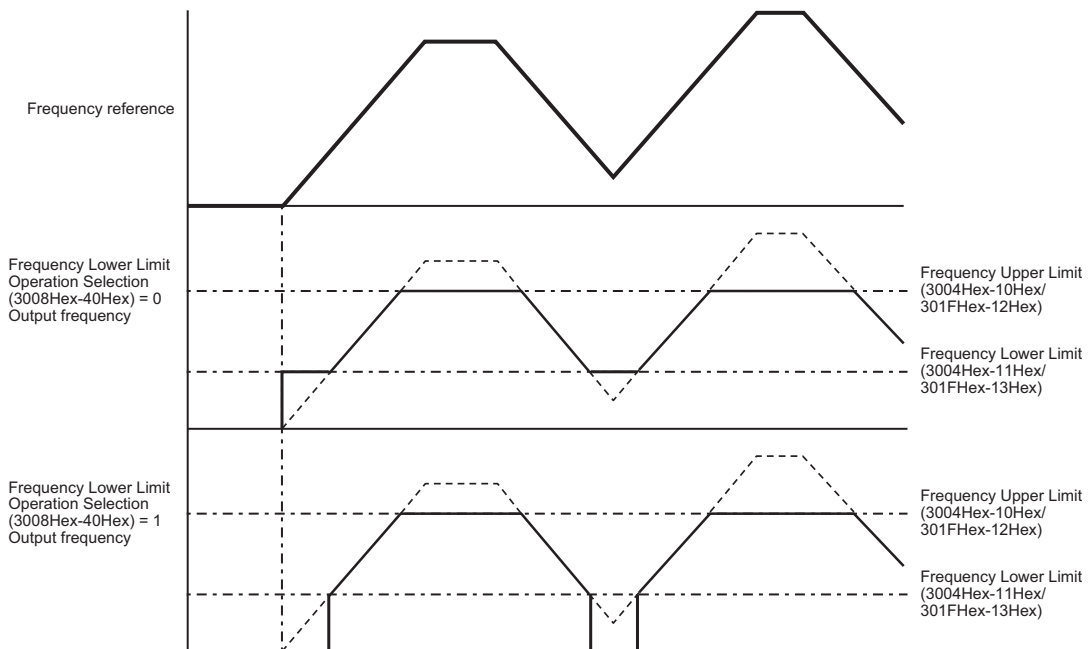
6-5-2 Frequency Limit

- Use this function to set the upper and lower limits of the output frequency. The set limits will be applied if the input frequency reference is beyond the upper/lower limit(s).
- Be sure to set so that the upper limit (3004Hex-10Hex/301FHex-12Hex) is greater than the lower limit (3004Hex-11Hex/301FHex-13Hex).
- Set the lower limit so that it does not reach or exceed Maximum Output Frequency (3004Hex-04Hex/3009Hex-02Hex).
- When 0 Hz is set to the upper limit, operation is limited to 0 Hz and disabled.
- Processing when the set frequency is less than the Frequency Lower Limit (3008Hex-40Hex) can be selected at Frequency Lower Limit Operation Selection (3004Hex-11Hex/301FHex-13Hex).

Parameter No.	Function name	Data	Default data	Unit
3004Hex-10Hex/ 301FHex-12Hex	1st Frequency Upper Limit/2nd Frequency Upper Limit*1	0.00 to 590.00	70.0	Hz
3004Hex-11Hex/ 301FHex-13Hex	1st Frequency Lower Limit/2nd Frequency Lower Limit*1	0.00 to 590.00	0.0	Hz
3008Hex-40Hex	Frequency Lower Limit Oper- ation Selection	0: Frequency Command is the Frequency Lower Limit. 1: Frequency Command is 0Hz	0	-

*1. To enable switching to the 1st and 2nd control, allocate "12: SET (2nd control)" to either of input terminal [DI1] to [DI7].

- When "0: Frequency Command is the Frequency Lower Limit" is selected at Frequency Lower Limit Operation Selection (3008Hex-40Hex), the output frequency becomes the frequency set at Frequency Lower Limit (3004Hex-11Hex/301FHex-13Hex) even if the frequency reference is set to less than Frequency Lower Limit (3004Hex-11Hex/301FHex-13Hex). Even if 0 Hz is set to the frequency reference, priority is given to the lower limit. For this reason, turn the RUN command OFF to stop output.



6-5-3 Pattern Operation Function Selection

- To perform pattern operation, set Frequency Reference Selection (3004Hex-02Hex/3006Hex-1FHex) = "10."
- The pattern operation function operates according to seven preset patterns.
- Operation time, rotation direction, acceleration/deceleration time, and the frequency reference are set to patterns.
- Three pattern operations can be selected: one cycle operation, repetition operation and constant speed operation after 1 cycle operation,
- The status of pattern operation can be output to output terminals [DO1] and [ROA, ROB].

Parameter No.	Function name	Data	Default data	Unit
3006Hex-16Hex	Pattern Operation Function Selection	0: 1 cycle operation (Pattern operation)*1 1: Repetition operation (Pattern operation) 2: Constant speed operation (Pattern operation) after 1 cycle operation*2	0	-
3006Hex-17Hex to 3006Hex-1DHex	Pattern Operation Stage 1 to 7 Operation Setting	Bit 15: 0 = Forward 1 = Reverse Bit 14: Fixed to 0 (Not used) Bit 13 to 12: Acceleration/Deceleration time selection 0: 1st Acceleration Time 1 (3004Hex-08Hex)/1st Deceleration Time 1 (3004Hex-09Hex) 1: 2nd Acceleration Time 1 (3005Hex-0BHex)/2nd Deceleration Time 1 (3005Hex-0CHex) 2: 1st Acceleration Time 2 (3005Hex-0DHex)/1st Deceleration Time 2 (3005Hex-0EHex) 3: 2nd Acceleration Time 2 (3005Hex-0FHex)/2nd Deceleration Time 2 (3005Hex-10Hex) Bit 11 to 10: Minimum unit of operation time 0: 0.01 1: 0.1 2: 1 3: 10 Bit 9 to 0: Data part of operation time 0000 to 03E7 hex (0.00 to 9.99) if Minimum unit is 0: 0.01 0064 to 03E7 hex (10.0 to 99.9) if Minimum unit is 1: 0.1 #1 0064 to 03E7 hex (100 to 999) if Minimum unit is 2: 1 #1 0064 to 0258 hex (1000 to 6000) if Minimum unit is 3: 10 #2 #1. 0000 to 0063 hex and 03E8 to 03FF hex cannot be set. #2. 0000 to 0063 hex and 0259 to 03FF hex cannot be set.	0	-
3006Hex-06Hex to 3006Hex-0CHex	Multi-step Frequency Reference 1 to 7	0.0 to 590.00	0.0	Hz
3005Hex-15Hex/ 3005Hex-1CHex	Output Terminal [DO1] Function Selection/Output Terminal [ROA, ROB] Function Selection	16: TU (transition to pattern operation stage) 17: TO (pattern operation cycle operation completion)	-	-

*1. With the deceleration time after end of one cycle, a deceleration stop is performed according to the setting value of 1st Deceleration Time 1 (3004Hex-09Hex).

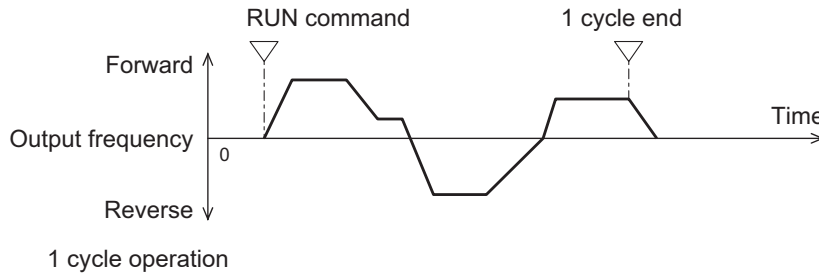
*2. With constant speed operation after end of one cycle, constant speed operation is performed according to the last set frequency in pattern operation.

● Pattern Operation Function Selection

- Operation is as follows when “0” to “2” is set at Pattern Operation Function Selection (3006Hex-16Hex).

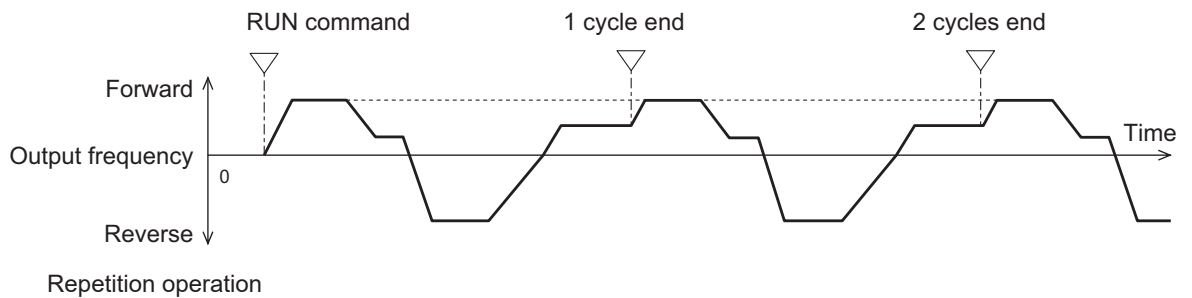
1. Pattern Operation Function Selection (3006Hex-16Hex) = “0: 1 cycle operation”

A deceleration stop is performed after one cycle operation by the preset pattern.



2. Pattern Operation Function Selection (3006Hex-16Hex) = “1: Repetition operation”

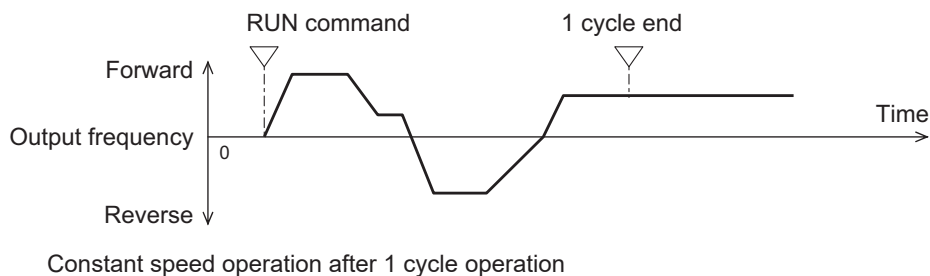
Operation by the preset pattern is repeated.



3. Pattern Operation Function Selection (3006Hex-16Hex) = “2: Constant speed operation after 1 cycle operation”

After one cycle operation by the preset pattern, constant speed operation is performed in accordance with the last set frequency of pattern operation.

To stop constant speed operation, turn the RUN command OFF.



● Pattern Operation Setting

- To set the patterns in pattern operation, set the operation time, rotation direction and acceleration/deceleration time to Pattern Operation Stage 1 to 7 Operation Setting (3006Hex-17Hex to 3006Hex-1DHex). The following describes the method for setting stages in Operator and in Sysmac Studio.

<Setting stages in Sysmac Studio>

Pattern Operation Stage 1 Operation Setting (3006Hex-17Hex to 3006Hex-1DHex)

Example: In case of (reverse rotation, 2nd deceleration time, 10.0 s)

Rotation direction Reverse: 8000 hex

Acceleration/deceleration time 2nd acceleration/deceleration time: 1000 hex

Operation time 10.0 s = 0.1 × 100: 0400 hex + 0064 hex

Accordingly, the set value becomes 8000 hex + 1000 hex + 0400 hex + 0064 hex = 9464 hex

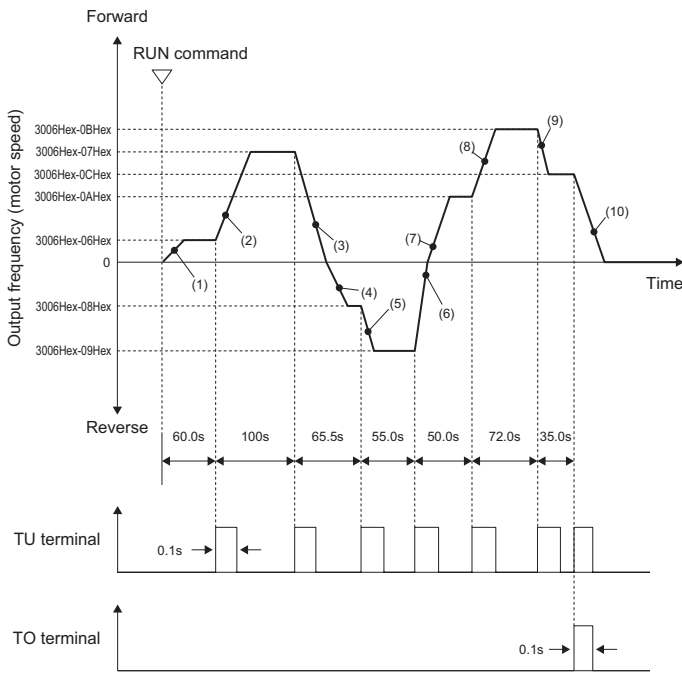
- Stages set with an operation time of 0.0 are disabled and are ignored.
- Each of Multi-step Frequency Reference 1 to 7 (3006Hex-06Hex to 3006Hex-0CHex) is applied to the frequency setting of stages 1 to 7.
- The signal can be output at completion of cycle operation when the pattern operation stage is transitioned to by allocating “16: Pattern operation stage transition (TU)” and “17: Pattern operation cycle completed (TO)” to output terminals [DO1] and [ROA, ROB]. For details, refer to the operation example figure below.
- When Pattern Operation Function Selection (3006Hex-16Hex) = 0 is set and pattern operation is started by input via the FW/RV terminals turning ON, the motor stops when the final stage ends even if the FW/RV terminals stay ON.

At this time, when the value of Frequency Reference Selection (3004Hex-02Hex/3006Hex-1FHex) is changed without turning the FW/RV terminals OFF, operation is immediately started according to the set frequency after the value is changed.

● Pattern operation setting examples

Pattern Operation Function Selection (3006Hex-16Hex)	Stage No.	Operation time	Rotation direction	Acceleration/deceleration time	Operation (reference) frequency
		Set value	Set value	Set value	
0	Stage 1	60.0	0	2	Multi-step Frequency Reference 1 (3006Hex-06Hex)
	Stage 2	100.0	0	1	Multi-step Frequency Reference 2 (3006Hex-07Hex)
	Stage 3	65.5	1	4	Multi-step Frequency Reference 3 (3006Hex-08Hex)
	Stage 4	55.0	1	3	Multi-step Frequency Reference 4 (3006Hex-09Hex)
	Stage 5	50.0	0	2	Multi-step Frequency Reference 5 (3006Hex-0AHex)
	Stage 6	72.0	0	4	Multi-step Frequency Reference 6 (3006Hex-0BHex)
	Stage 7	35.0	0	2	Multi-step Frequency Reference 7 (3006Hex-0CHex)

This is illustrated as follows.



With the deceleration time after end of one cycle, a deceleration stop is performed by the setting value of 1st Deceleration Time 1 (3004Hex-09Hex).

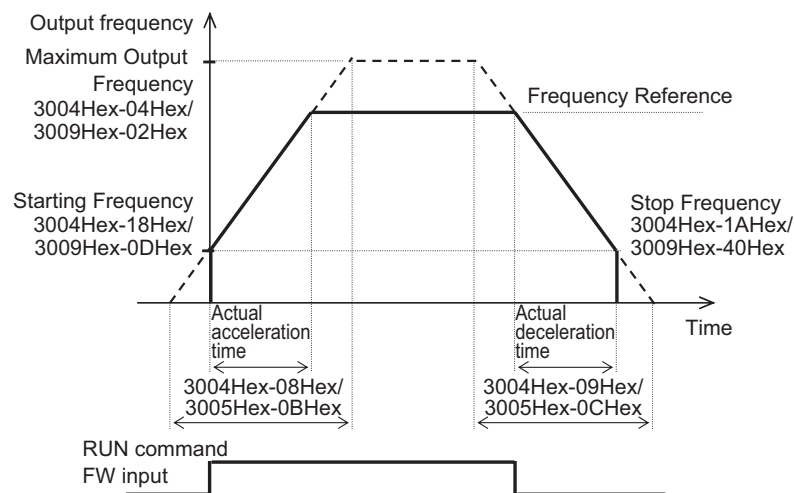
Acceleration times or deceleration times set at (1) to (10)

(1)	Acceleration time: 3005Hex-0BHex
(2)	Acceleration time: 3004Hex-08Hex
(3)	Deceleration time:3005Hex-10Hex
(4)	Acceleration time: 3005Hex-0FHex
(5)	Acceleration time: 3005Hex-0DHex
(6)	Deceleration time: 3005Hex-0CHex
(7)	Acceleration time: 3005Hex-0BHex
(8)	Acceleration time: 3005Hex-0FHex
(9)	Deceleration time: 3005Hex-0CHex
(10)	Deceleration time:3004Hex-09Hex

6-6 Acceleration/Deceleration Time Settings

6-6-1 Acceleration/Deceleration Time Setting

- Set the motor acceleration/deceleration time.
- The set time here is the acceleration/deceleration time from 0 Hz to the maximum output frequency. The actual acceleration/deceleration time varies depending on the frequency reference value.
- This parameter is for setting the time constant of the primary delay filter with respect to the output frequency during acceleration/deceleration when V/f control (3004Hex-2BHex/3009Hex-0FHex = 0 to 3) is selected. Set this parameter when an overshoot or undershoot occurs when the frequency arrives at the target frequency or the rotation of the motor stops and this causes mechanical problems. Setting a large value stabilizes the output frequency but worsens response.



Parameter No.	Function name	Data	Default data	Unit
3004Hex-08Hex/ 3005Hex-0BHex	1st Acceleration Time 1 / 2nd Acceleration Time 1* ¹	0.00 to 6000	6.00	s
3004Hex-09Hex/ 3005Hex-0CHex	1st Deceleration Time 1 / 2nd Deceleration Time 1* ¹	0.00 to 6000	6.00	s
3014Hex-57Hex	Acc/Dec Output Frequency Filter	0.000 to 5.000	0.000	s

*1. To enable switching to the 1st and 2nd control, allocate "12: SET (2nd control)" to either of input terminal [DI1] to [DI7].

When a short deceleration time is set, the regenerative amount that is fed back at deceleration increases. When the regenerative amount exceeds the allowable capacity of the inverter, either the deceleration time is extended by the setting of Anti-regenerative Control Function Selection (3008Hex-46Hex), or overvoltage (alarm code: 7) is detected. To shorten the deceleration time, use the regenerative braking function. For details on the regenerative braking function, refer to 6-12-1 *Regenerative Braking Function* on page 6-67.

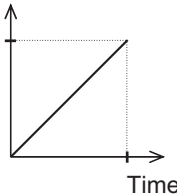
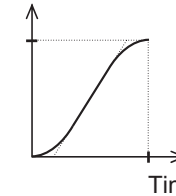
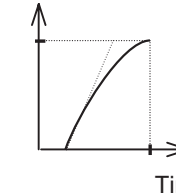
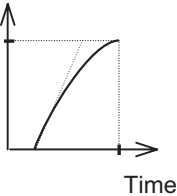
6-6-2 Acceleration/Deceleration Pattern

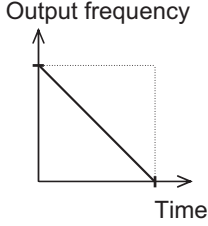
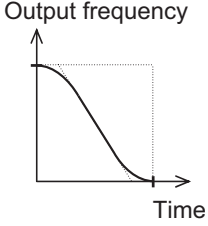
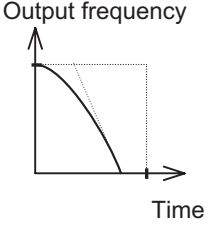
- Use this function to set the acceleration/deceleration pattern.
- Select the acceleration/deceleration pattern at Acceleration/Deceleration Pattern Selection (3008Hex-08Hex).
- These acceleration/deceleration patterns are enabled also for frequency reference input via analog input terminals.

Parameter No.	Function name	Data	Default data	Unit
3008Hex-08Hex	Acceleration/Deceleration Pattern Selection	0: Disable (Linear acceleration/deceleration) 1: S-curve acceleration/deceleration 2: S-curve acceleration/deceleration (Arbitrary: According to 3008Hex-3AHex to 3008Hex-3DHex) 3: Curve acceleration/deceleration	0	-
3008Hex-3AHex	S-curve Acceleration Range Frequency at Starting	0 to 100	10	%
3008Hex-3BHex	S-curve Acceleration Range Frequency at End			
3008Hex-3CHex	S-curve Deceleration Range Frequency at Starting			
3008Hex-3DHex	S-curve Deceleration Range Frequency at End			

Pattern Selection

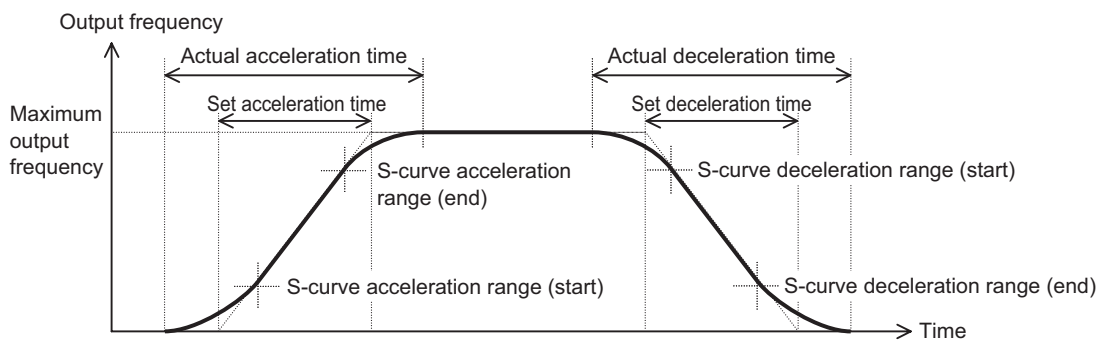
- Set Acceleration/Deceleration Pattern Selection (3008Hex-08Hex) according to the following table.

3008Hex-08Hex (Acceleration/Deceleration Pattern Selection)	Set value			
	0	1	2	3
	Disable (Linear acceleration/deceleration)	S-curve acceleration/deceleration	S-curve acceleration/deceleration (Arbitrary)	Curve acceleration/deceleration
At acceleration	Output frequency  Time	Output frequency  Time	Output frequency  Time	Output frequency  Time

3008Hex-08Hex (Acceleration/Deceleration Pattern Selection)	Set value			
	0	1	2	3
	Disable (Linear acceleration/deceleration)	S-curve acceleration/deceleration	S-curve acceleration/deceleration (Arbitrary)	Curve acceleration/deceleration
At deceleration				

S-curve Acceleration/Deceleration Range

- When “2: S-curve acceleration/deceleration (Arbitrary)” is selected at Acceleration/Deceleration Pattern Selection (3008Hex-08Hex), set S-curve Acceleration Range Frequency at Starting (3008Hex-3AHex)/S-curve Acceleration Range Frequency at End (3008Hex-3BHex) and S-curve Deceleration Range Frequency at Start (3008Hex-3CHex)/S-curve Deceleration Range Frequency at End (3008Hex-3DHex). When “1: S-curve acceleration/deceleration” is set at Acceleration/Deceleration Pattern Selection (3008Hex-08Hex), each are fixed at 5%.
- The larger the values of S-curve Acceleration Range Frequency at Starting (3008Hex-3AHex), S-curve Acceleration Range Frequency at End (3008Hex-3BHex), S-curve Deceleration Range Frequency at Start (3008Hex-3CHex) and S-curve Deceleration Range Frequency at End (3008Hex-3DHex) are, the gentler acceleration/deceleration is performed. For this reason, the actual acceleration/deceleration time is longer than the set acceleration/deceleration time.



	S-curve acceleration range (start)	S-curve acceleration range (end)	S-curve deceleration range (start)	S-curve deceleration range (end)
S-curve acceleration/deceleration	5% (fixed)	5% (fixed)	5% (fixed)	5% (fixed)
S-curve acceleration/deceleration (Arbitrary)	0 to 100% S-curve Acceleration Range Frequency at Starting (3008Hex-3AHex)	0 to 100% S-curve Acceleration Range Frequency at End (3008Hex-3BHex)	0 to 100% S-curve Deceleration Range Frequency at Starting (3008Hex-3CHex)	0 to 100% S-curve Deceleration Range Frequency at End (3008Hex-3DHex)

6-6-3 Acceleration/Deceleration Stop Function

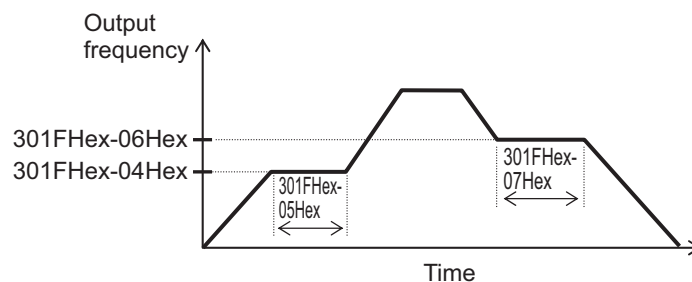
- This function causes the inverter stop accelerating/decelerating temporarily and start running at a constant speed at the frequency output at that time.
- There are two acceleration/deceleration stop methods as follows, which can be used in conjunction with each other.
 - When the output frequency reaches the set frequency, acceleration/deceleration stops for the set stop time.
 - Stop the acceleration/deceleration operation while the HLD terminal is ON.

Parameter No.	Function name	Data	Default data	Unit
301FHex-04Hex	Acceleration Stop Frequency	0.00: Disable 0.01 to 590.00	0.00	Hz
301FHex-05Hex	Acceleration Stop Time	0.0: Disable 0.1 to 60.0	0.0	s
301FHex-06Hex	Deceleration Stop Frequency	0.00: Disable 0.01 to 590.00	0.00	Hz
301FHex-07Hex	Deceleration Stop Time	0.0: Disable 0.1 to 60.0	0.0	s
3005Hex-02Hex to 3005-06Hex, 3005Hex-63Hex, 3005Hex-64Hex	Input Terminal [DI1] to [DI7] Function Selection	163: HLD (Acceleration/ deceleration stop)	-	-

- If the HLD terminal is ON, acceleration/deceleration operation stops regardless of the stop time. Until the set stop time elapses, acceleration/deceleration stops continuously even if the HLD terminal is turned OFF during the set stop frequency.

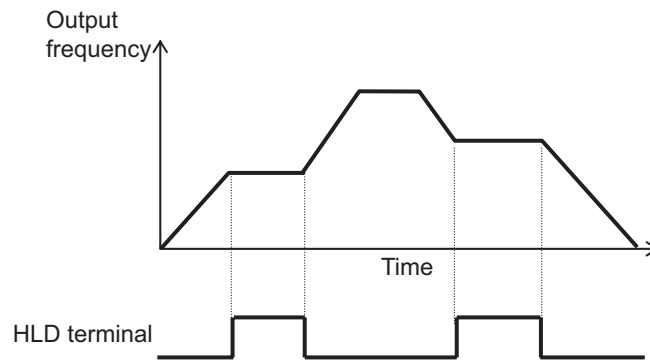
Stopping when the specified frequency/stop time is reached

- Set the frequency at which acceleration operation is stopped to Acceleration Stop Frequency (301FHex-04Hex), and set the time that acceleration operation is stopped to Acceleration Stop Time (301FHex-05Hex). To not stop acceleration operation, set Acceleration Stop Time (301FHex-05Hex) to 0.0.
- Set the frequency at which deceleration operation is stopped to Deceleration Stop Frequency (301FHex-06Hex), and set the time that deceleration operation is stopped to Deceleration Stop Time (301FHex-07Hex). To not stop deceleration operation, set Deceleration Stop Time (301FHex-07Hex) to 0.0.



Stopping via input to a multifunction input terminal

- When the HLD terminal is turned ON during acceleration, acceleration is stopped, and when it is turned OFF, acceleration is resumed.
- When the HLD terminal is turned ON during deceleration, deceleration is stopped, and when it is turned OFF, deceleration is resumed.



6-6-4 2-step Acceleration/Deceleration Function

- Use the 2-step acceleration/deceleration function to control two acceleration/deceleration time.
- The acceleration/deceleration time switching method can be selected from the following four.
 - 2-step Acceleration/Deceleration Switching Condition Selection (301F-1AHex/301F-1BHex) = "0: Switching by 2CH terminal" (Example 1)
 - 2-step Acceleration/Deceleration Switching Condition Selection (301F-1AHex/301F-1BHex) = "1: Switching by setting" (Example 2)
 - 2-step Acceleration/Deceleration Switching Condition Selection (301F-1AHex/301F-1BHex) = "2: Forward and reverse" (Example 3)
 - 2-step Acceleration/Deceleration Switching Condition Selection (301F-1AHex/301F-1BHex) = "3: Switching by RT1, RT2 terminals" (Example 4)
- For Acceleration Time 2 (3005Hex-0DHex/3005Hex-0FHex) and Deceleration Time 2 (3005Hex-0EHex/3005Hex-10Hex), set the time from frequency 0 Hz up to the maximum output frequency in the same way as Acceleration Time 1 (3004Hex-08Hex/3005Hex-0BHex) and Deceleration Time 1 (3004Hex-09Hex/3005Hex-0CHex).
- Acceleration/deceleration pattern and acceleration/deceleration operation stop also can be used.

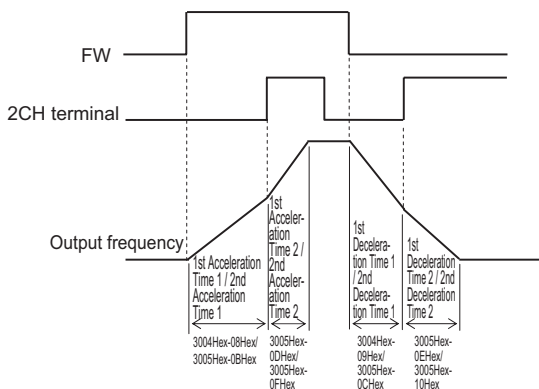
Parameter No.	Function name	Data	Default data	Unit
3004Hex-08Hex	1st Acceleration Time 1	0.00 to 6000	6.00	s
3004Hex-09Hex	1st Deceleration Time 1			
3005Hex-0BHex	2nd Acceleration Time 1*1			
3005Hex-0CHex	2nd Deceleration Time 1*1			
3005Hex-0DHex	1st Acceleration Time 2			
3005Hex-0EHex	1st Deceleration Time 2			
3005Hex-0FHex	2nd Acceleration Time 2*1			
3005Hex-10Hex	2nd Deceleration Time 2*1			

Parameter No.	Function name	Data	Default data	Unit
301FHex-1AHex/ 301FHex-1BHex	1st 2-step Acceleration/ Deceleration switching Condition Selection/2nd 2-step Acceleration/ Deceleration Switching Condition Selection ^{*1}	0: Switching by 2CH terminal 1: Switching by setting 2: Forward and reverse 3: Switching by RT1, RT2 terminals	0	-
301FHex-1CHex/ 301FHex-1DHex	1st 2-step Acceleration Switching Frequency/2nd 2-step Acceleration Switching Frequency ^{*1}	0.00 to 590.0	0.00	Hz
301FHex-1EHex/ 301FHex-1FHex	1st 2-step Deceleration Switching Frequency/2nd 2-step Deceleration Switching Frequency ^{*1}			
3014Hex-57Hex	Acc/Dec Output Frequency Filter	0.000 to 5.000	0.000	s
3005Hex-02Hex to 3005-06Hex, 3005Hex-63Hex, 3005Hex-64Hex	Input Terminal [DI1] to [DI7] Function Selection	159: 2CH (2-step acceleration/ deceleration) 4: RT1 (Acceleration/deceleration selection(2-step)) 5: RT2(Acceleration/deceleration selection(4-step))	-	-

*1. To enable switching to the 1st and 2nd control, allocate "12: SET (2nd control)" to either of input terminal [DI1] to [DI7].

2-step Acceleration/Deceleration Switching Condition Selection (301FHex-1AHex/301FHex-1BHex) = "0: Switching by 2CH terminal" (Example 1)

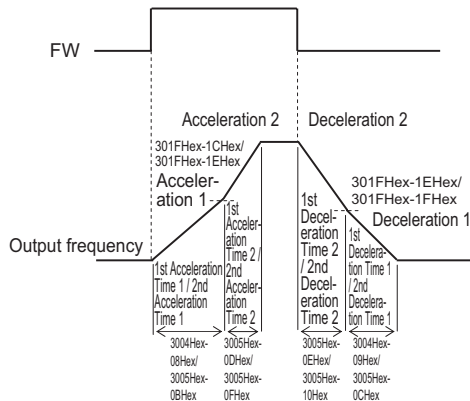
- When 2CH terminal is ON, acceleration/deceleration is performed at acceleration time 2 (3005Hex-0DHex/3005Hex-0FHex) or deceleration time 2 (3005Hex-0EHex/3005Hex-10Hex). When the terminal is OFF, acceleration/deceleration is performed at acceleration time 1 (3004Hex-08Hex/3005Hex-0BHex) or deceleration time 1 (3004Hex-09Hex/3005Hex-0CHex).



2-step Acceleration/Deceleration Switching Condition Selection (301FHex-1AHex/301FHex-1BHex) = "1: Switching by setting" (Example 2)

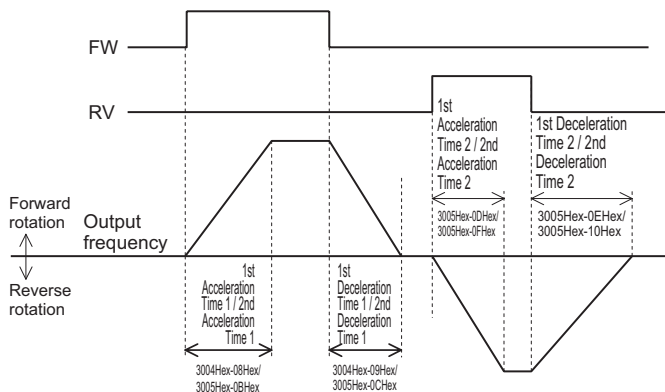
- During forward rotation, acceleration is performed at acceleration time 1 (301FHex-1CHex/301FHex-1EHex) from output frequency 0 Hz up to 2-step Acceleration Switching Frequency

- (3004Hex-08Hex/3005Hex-0BHex). Acceleration is performed at acceleration time 2 (301FHex-1CHex/301FHex-1EHex) from 2-step Acceleration Switching Frequency (3005Hex-0DHex/3005Hex-0FHex) up to the maximum output frequency.
- During reverse rotation, deceleration is performed at deceleration time 1 (301FHex-1DHex/301FHex-1FHex) from output frequency 0 Hz up to 2-step Deceleration Switching Frequency (3004Hex-09Hex/3005Hex-0CHex). Deceleration is performed at deceleration time 2 (3005Hex-0EHex/3005Hex-0FHex) from 2-step Deceleration Frequency (301FHex-1EHex/301FHex-1FHex) up to the maximum output frequency.



2-step Acceleration/Deceleration Switching Condition Selection (301FHex-1AHex/301FHex-1BHex = “2: Forward and reverse” (Example 3))

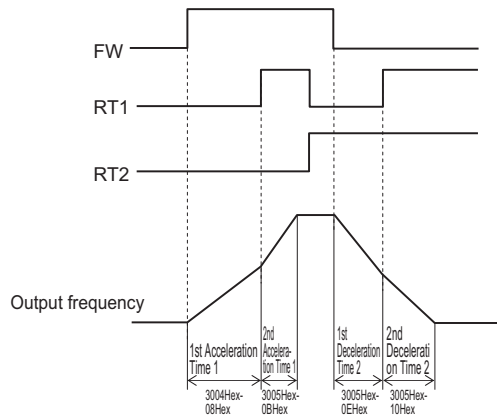
- During forward rotation, acceleration/deceleration is performed at acceleration time 1 (3004Hex-08Hex/3005Hex-0BHex) or deceleration time 1 (3004Hex-09Hex/3005Hex-0CHex). During reverse rotation, acceleration/deceleration is performed at acceleration time 2 (3005Hex-0DHex/3005Hex-0FHex) or deceleration time 2 (3005Hex-0EHex/3005Hex-10Hex).



2-step Acceleration/Deceleration Switching Condition Selection (301FHex-1AHex/301FHex-1BHex) = “3: Switching by RT1, RT2 terminals” (Example 4)

- With RT1 terminal and RT2 terminal combined, select the acceleration/deceleration time during which acceleration/deceleration is performed.

RT2 terminal	RT1 terminal	Selected acceleration/deceleration time
OFF	OFF	1st Acceleration Time 1 (3004Hex-08Hex), 1st Deceleration Time 1 (3004Hex-09Hex)
OFF	ON	2nd Acceleration Time 1 (3005Hex-0BHex), 2nd Deceleration Time 1 (3005Hex-0CHex)
ON	OFF	1st Acceleration Time 2 (3005Hex-0DHex), 1st Deceleration Time 2 (3005Hex-0EHex)
ON	ON	2nd Acceleration Time 2 (3005Hex-0FHex), 2nd Deceleration Time 2 (3005Hex-10Hex)



6-7 Stop Method Settings

The stop operation methods are as follows.

- Stop by RUN command

Trigger	Stop operation	Reference page
FW terminal/RV terminal or 3-wire operation stop	Select stop by Deceleration Time (3004Hex-09Hex) or free-run stop at Stop Selection (3008Hex-0CHex).	page 6-50
Operation stop via EtherCAT		page 6-22
Jogging operation stop		page 6-53

- Stop from external input terminal

Trigger	Stop operation	Reference page
Forced stop (30: STOP) terminal	Deceleration Time for Forced Stop (3008Hex-39Hex)	page 8-137
External trip (9: EXT) terminal	Free-run stop	page 8-76
Free-run stop (7: FRS) terminal	Free-run stop	page 8-52

- Stop by error occurrence

Trigger	Stop operation	Reference page
Trip by error occurrence	Free-run stop	page 9-3
Overvoltage/overcurrent occurrence	Select trip or restart at Overvoltage/Overcurrent Restart Function Selection (301FHex-28Hex).	page 8-50
Momentary power failure	Select whether to perform a free-run by trip or perform continuous running or a restart at a momentary power failure at Power Interruption Restart Mode Selection (3004Hex-0FHex).	page 8-41

6-7-1 Stop Selection

- Select whether you want the motor to make a deceleration stop according to the deceleration time setting or a free-run stop, when the stop command is input via the Control Circuit Terminal Block.
- Set the operation when the RUN command selected at RUN Command Selection (3004Hex-03Hex/301FHex-03Hex) turns OFF to Stop Selection (3008Hex-0CHex).
- In position control, a deceleration stop is performed regardless of the setting of Stop Selection (3008Hex-0CHex).

Parameter No.	Function name	Data	Default data	Unit
3008Hex-0CHex	Stop Selection	0: Normal deceleration 1: Free run stop	0	-
3008Hex-61Hex	Start Check Function	0: Disable start check function 1: Do not use. 2: Enable start check function 3: Do not use.	0	-
Related function		RUN Command Selection (3004Hex-03Hex/301FHex-03Hex) Input Terminal [DI1] to [DI7] Function Selection (3005Hex-02Hex to 3005-06Hex, 3005Hex-63Hex, 3005Hex-64Hex) Acceleration Time (3004Hex-08Hex/3005Hex-0BHex) Deceleration Time (3004Hex-09Hex/3005Hex-0CHex)		

When Normal Deceleration Stop Is Selected (Stop Selection (3008Hex-0CHex) = “0”)

- Deceleration stop according to the selected deceleration hold time. For details, refer to *6-6-1 Acceleration/Deceleration Time Setting* on page 6-33.

When Free Run Stop Is Selected (Stop Selection (3008Hex-0CHex) = “1”)

- By the free run stop function, power to the motor is cut off to stop the motor.
- To use external braking, select free-run stop. Using external braking midway during a deceleration stop may cause an overload or overcurrent.
- If operation is started again during free run operation, the inverter will restart according to Free Run Stop Restart Operation Selection (3052Hex-2AHex).

6-8 Reset

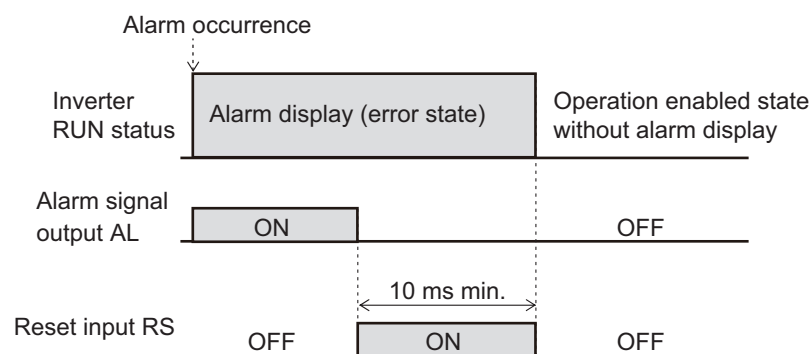
6-8-1 Reset Function

- Use the reset function to reset the trip status (output shutoff status caused by occurrence of error) of the inverter.
- The reset function is executed by input terminal “8: RS (Reset)” terminal, Operation command (3002Hex-07Hex bit 15: RST) via EtherCAT communication or the Alarm Reset Command (3002Hex-0FHex).
- When a reset is performed with the RUN command ON, the inverter may abruptly start depending on the setting of the Start Check Function (3008Hex-61Hex). When performing a reset operation, ensure that the RUN command is OFF. For details, refer to *Start Check Function (3008Hex-61Hex = “2,” “4”)* on page 8-69.

Parameter No.	Function name	Data	Default data	Unit
3005Hex-02Hex to 3005-06Hex, 3005Hex-63Hex, 3005Hex-64Hex	Input Terminal [DI1] to [DI7] Function Selection	8: RS (Reset)	-	-
3002Hex-0FHex	Alarm Reset Command	0: Disable 1: Alarm reset	0	-
3002Hex-07Hex	Operation command	Bit 15: RST	0	-
Related function		Output Terminal [DO1], [ROA, ROB] Function Selection (3005Hex-15Hex, 3005Hex-1CHex) = [99 (AL: Alarm signal)]		

Reset from Terminal

When the state of the RS (reset) terminal is changed from OFF to ON, the alarm is reset and AL (alarm output) output allocated to the multifunction output terminal is set to OFF. When it is next changed from ON to OFF, the alarm display is erased and the error state is cleared. Ensure at least 10 ms as the time for turning the RS (reset) terminal ON. During normal operation, keep the terminal set to OFF.



Resetting via EtherCAT Communication

- The alarm can be reset by one of the following operations via EtherCAT communication.

- Set 1 to Alarm Reset Command (3002Hex-0FHex). (After a reset, this command automatically returns to 0.)
- The state of bit 15 of Operation command (3002Hex-07Hex) is changed from 0 to 1, then returns to 0. (It does not automatically return to 0.)
- Be sure to confirm that the RUN command is turned OFF before resetting the alarm because the machine may abruptly start depending on the setting of Start Check Function (3008Hex-61Hex).

6-9 Multi-function Input

6-9-1 Multifunction Input Selection

Functions can be operated via input terminals by allocating the functions to input terminals [DI1] to [DI7]. This section describes primary functions. For details on other functions, refer to *8-2 Multifunction Input/Output Functions List* on page 8-23.

- Set selection of functions to Input Terminal [DI1] to [DI7] Function Selection (3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex).

Parameter No.	Function name	Data	Default data	Unit
3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex	Input Terminal [DI1] to [DI7] Function Selection	Table below or, refer to <i>8-2 Multifunction Input/Output Functions List</i> on page 8-23.	-	-
3051Hex-19Hex to 3051Hex-1FHex	Input Terminal [DI1] to [DI7] Response Time	1 to 400	1	ms

- By setting data in which 1000 is added to the set data, it is possible to switch from an NO contact input to an NC contact input. However, for a function whose input is an NC contact as standard, the contact can be changed to an NO contact by setting data in which 1000 is added. (Refer to *8-2-1 Multifunction Input Selection* on page 8-23.)

Example 1) SET terminal (2nd control)

To use the function for an NO contact, set 12. To use the function for an NC contact, set 1012.

Example 2) STP terminal (3-wire stopping: NC contact)

To use the function for an NC contact, set 6. To use the function for an NO contact, set 1006.

- If the same function is allocated to the input terminals, and if any one of the input terminals to which the function is allocated, except for the exceptions below, turns ON, the function is handled as ON. If all terminals to which “98: FW (forward rotation)” and “99: RV (reverse rotation)” is allocated are ON, the function is handled as ON.
- Set the response time for each input terminal [DI1] to [DI7] independently. This function is effective for removing noise caused by chattering, etc. Inputs are set when the status matches twice after checking the statuses of the input terminals at each individual set response time. For example, when 400 ms is set, up to 800 ms is required until an input is set.

Fig. 1: Example of response time matching twice and recognition of inverter ON

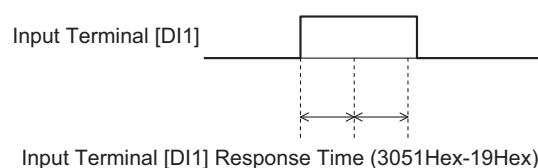
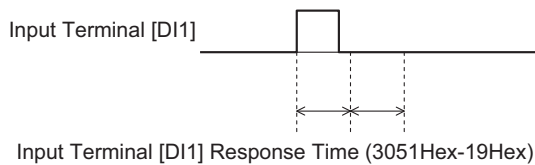


Fig. 2: Example of response time matching less than twice and non-recognition of inverter ON



Parameter No.	Set data	Function name	Reference item	Reference page
3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex	6	SET (2nd control)	2nd control	page 6-49
	98	FW (forward rotation)*1	Forward run command	
	99	RV (reverse rotation)*1	Reverse run command	
	6	STP (3-wire stopping: NC contact)	3-wire input function	page 6-50
	97	F/R (3-wire forward/reverse rotation)		
	0	CF1 (Multi-step speed setting binary 1)	Multi-step speed operation function	page 6-51
	1	CF2 (Multi-step speed setting binary 2)		
	2	CF3 (Multi-step speed setting binary 3)		
	3	CF4 (Multi-step speed setting binary 4)		
	173	SF1 (Multi-step speed setting bit 1)		
	174	SF2 (Multi-step speed setting bit 2)		
	175	SF3 (Multi-step speed setting bit 3)		
	176	SF4 (Multi-step speed setting bit 4)		
	177	SF5 (Multi-step speed setting bit 5)		
	178	SF6 (Multi-step speed setting bit 6)		
	179	SF1 (Multi-step speed setting bit 7)		
	10	JG (Jogging)	Jogging	page 6-53
	159	2CH (2-step acceleration/deceleration)	2-step acceleration/deceleration	page 6-59
	8	RS (Reset)	Reset	page 6-59

*1. "98: FW (forward rotation)" and "99: RV (reverse rotation)" can be allocated to only Input Terminal [DI6] Function Selection (3005Hex-63Hex) or Input Terminal [DI7] Function Selection (3005Hex-64Hex). When one function has been allocated to two terminals, the state is considered to be ON by both terminals turning ON.

2nd Control Switch Function (SET)

The M1 Series provides two controls that can be switched as required. There are three types of parameters: shared parameters, parameters for 1st control and parameters for 2nd control. Parameters for 1st control and parameters for 2nd control are switched for to use.

- To enable switching to the 1st and 2nd control, allocate "12: SET (2nd control)" to either of input terminal [DI1] to [DI7]. (OFF: 1st control, ON: 2nd control)
- The status of the selected control can be checked via external output terminals by allocating "49: SETM (2nd control under selection)" to Output Terminal [DO1] Function Selection (3005Hex-15Hex)

and Output Terminal [ROA, ROB] Function Selection (3005Hex-1CHex). When the SET terminal is turned ON, 2nd control is selected, and 2nd control under selection (49: SETM) turns ON.

Parameter No.	Function name	Data	Default data	Unit
3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex	Input Terminal [DI1] to [DI7] Function Selection	12: SET (2nd control)	-	-
Related function		Output Terminal [DO1], [ROA, ROB] Function Selection (3005Hex-15Hex, 3005Hex-1CHex) = [49 (SETM: 2nd control selection signal)]		

- 1st control and 2nd control cannot be switched when operation is stopped. During operation, the SET terminal does not operate even if it is turned ON.
- The functions that can be switched by the SET terminal are as shown below.

Parameter No.		Parameter name
1st control motor	2nd control motor	
3004Hex-2BHex	3009Hex-0FHex	Drive control selection
3004Hex-26Hex	3009Hex-0EHex	V/f characteristics selection
3004Hex-03Hex	301FHex-03Hex	RUN command selection
3004Hex-02Hex	3006Hex-1FHex	Frequency Reference Selection
3004Hex-04Hex	3009Hex-02Hex	Maximum output frequency
3004Hex-05Hex	3009Hex-03Hex	Base Frequency
3004Hex-06Hex	3009Hex-04Hex	Rated Voltage at Base Frequency
3004Hex-07Hex	3009Hex-05Hex	Rated Voltage at Maximum Output Frequency
3004Hex-08Hex	3005Hex-0BHex	Acceleration time 1
3004Hex-09Hex	3005Hex-0CHex	Deceleration time 1
3005Hex-0DHex	3005Hex-0FHex	Acceleration time 2
3005Hex-0EHex	3005Hex-10Hex	Deceleration time 2
301FHex-1AHex	301FHex-1DHex	2-step Acceleration/Deceleration Switching Condition Selection
301FHex-1CHex	301FHex-1BHex	2-step Acceleration Switching Frequency
301FHex-1EHex	301FHex-1FHex	2-step Deceleration Frequency
3004Hex-0BHex	3009Hex-07Hex	Motor Electronic Thermal Characteristic Selection
3004Hex-0CHex	3009Hex-08Hex	Motor Electronic Thermal Level
3004Hex-0DHex	3009Hex-09Hex	Motor Electronic Thermal Time Constant
3004Hex-10Hex	301FHex-12Hex	Frequency Upper Limit
3004Hex-11Hex	301FHex-13Hex	Frequency Lower Limit
3004Hex-15Hex	3009Hex-0AHex	DC Injection Braking Start Frequency
3004Hex-16Hex	3009Hex-0BHex	DC Injection Braking Level
3004Hex-17Hex	3009Hex-0CHex	DC Injection Braking Time
3004Hex-18Hex	3009Hex-0DHex	Starting frequency
3004Hex-19Hex	3009Hex-3FHex	Starting Frequency Holding Time
3004Hex-1AHex	3009Hex-40Hex	Stop Frequency
3004Hex-27Hex	3009Hex-41Hex	Stop Frequency Detection Method Selection
3004Hex-28Hex	3009Hex-42Hex	Stop Frequency Holding Time
3008Hex-45Hex	3009Hex-29Hex	Slip Compensation Operating Conditions Selection
3008Hex-51Hex	3009Hex-2AHex	Output current fluctuation damping gain for motor

Parameter No.		Parameter name
1st control motor	2nd control motor	
3004Hex-2CHex	301FHex-2FHex	Overload Protect Function Selection
3004Hex-2DHex	301FHex-30Hex	Overload Protect Level
3005Hex-26Hex	3005Hex-39Hex	Overload Early Warning Detection Level
3005Hex-27Hex	3005Hex-38Hex	Overload Early Warning Detection Timer
3005Hex-28Hex	3009Hex-3EHex	Display Coefficient 1 for Transport Time / Auxiliary Display Coefficient 1 for Speed Monitor
3005Hex-33Hex	3009Hex-3DHex	Display coefficient for speed monitor
301FHex-0DHex	301FHex-0EHex	Torque Boost Function Selection
3004Hex-0AHex	3009Hex-06Hex	Manual Torque Boost Voltage
301FHex-17Hex	301FHex-18Hex	AVR Function Selection
3006Hex-36Hex	3006Hex-37Hex	Input Terminal [AI1, AI2] Normal/Inverse Operation for 1st Frequency Command
3007Hex-02Hex	3009Hex-10Hex	Pole Number
3007Hex-03Hex	3009Hex-11Hex	Motor capacity
3007Hex-04Hex	3009Hex-12Hex	Motor Rated Current
3007Hex-05Hex	3009Hex-13Hex	Auto Tuning Function Selection
3007Hex-06Hex	3009Hex-14Hex	Online tuning Function Selection
3007Hex-07Hex	3009Hex-15Hex	Motor Armature Resistance
3007Hex-08Hex	3009Hex-16Hex	Motor Parameter %R1
3007Hex-09Hex	3009Hex-17Hex	Motor Parameter %X
3007Hex-36Hex	3009Hex-36Hex	Motor %X Correction Factor
3007Hex-0AHex	3009Hex-18Hex	Slip Compensation Gain for Driving
3007Hex-0BHex	3009Hex-19Hex	Slip Compensation Response Time
3007Hex-0CHex	3009Hex-1AHex	Slip Compensation Gain for Braking
3007Hex-0DHex	3009Hex-1BHex	Rated Slip Frequency
3007Hex-0EHex	3009Hex-1CHex	Iron Loss Factor 1
3007Hex-11Hex	3009Hex-1FHex	Magnetic Saturation Factor 1
3007Hex-12Hex	3009Hex-20Hex	Magnetic Saturation Factor 2
3007Hex-13Hex	3009Hex-21Hex	Magnetic Saturation Factor 3
3007Hex-14Hex	3009Hex-22Hex	Magnetic Saturation Factor 4
3007Hex-15Hex	3009Hex-23Hex	Magnetic Saturation Factor 5
3007Hex-38Hex	3009Hex-38Hex	Torque Current for Vector Control
3007Hex-39Hex	3009Hex-39Hex	Induced Voltage Factor for Vector Control

- The following parameters are enabled only when 1st control is selected. When 2nd control is selected, this control operates by setting the following parameters.

Parameter No.	Parameter name
3004Hex-13Hex	Input Terminal [AI1, AI2] Bias for 1st Frequency Command
3006Hex-33Hex	Input Terminal [AI1, AI2] Bias Analog Input for 1st Frequency Command
3020Hex-60Hex	DC Injection Braking Startup Time
3008Hex-4FHex	1st Motor Maintenance Interval
3008Hex-50Hex	1st Preset Startup Count for Motor Maintenance
3003Hex-52Hex	1st Remaining Time before the Next Motor Maintenance
3003Hex-56Hex	1st Remaining Startup Times before the Next Motor Maintenance
3007Hex-1FHex	1st PM Motor Starting Method
3007Hex-3DHex	1st PM Motor Armature Resistance

Parameter No.	Parameter name
3007Hex-3EHex	1st PM Motor d-axis Inductance
3007Hex-3FHex	1st PM Motor q-axis Inductance
3007Hex-40Hex	1st PM Motor Induced Voltage Ke
3007Hex-41Hex	1st PM Motor Iron Loss
3007Hex-42Hex	1st PM Motor d-axis Inductance Magnetic Saturation Correction
3007Hex-4BHex	1st PM Motor Reference Current at Starting
3007Hex-56Hex	1st PM Motor Flux Limitation Value
3007Hex-58Hex	1st PM Motor Reference Current for Magnetic Pole Detection
3007Hex-5BHex	1st PM Motor Overcurrent Protection Level
3007Hex-60Hex	1st PM Motor Magnetic Pole position Offset
3014Hex-51Hex	1st PM Motor Magnetic Pole Position Pull-in Frequency

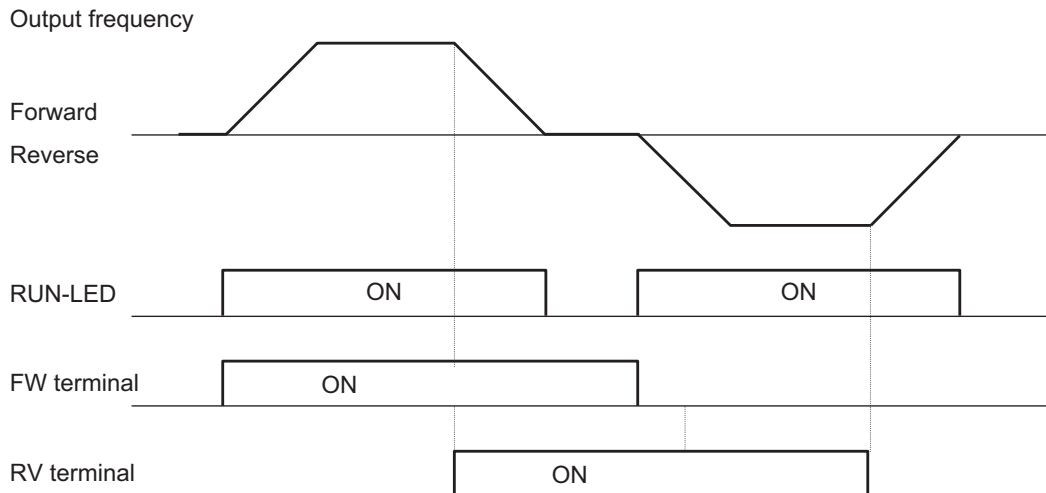
Forward RUN Command (FW) and Reverse RUN Command (RV)

- To input the forward RUN and reverse RUN commands via the control circuit terminals, allocate “98: FW” and “99: RV” to Input Terminal [DI6] Function Selection (3005Hex-63Hex) and Input Terminal [DI7] Function Selection (3005Hex-64Hex). FW (forward rotation) and RV (reverse rotation) can be set to only Input Terminal [DI6] Function Selection (3005Hex-63Hex) and Input Terminal [DI7] Function Selection (3005Hex-64Hex).
- Set “1: External signal (Digital input)” to 1st RUN Command Selection (3004Hex-03Hex) and 2nd RUN Command Selection (301FHex-03Hex).
- When the same RUN command (FW or RV) is assigned to input terminals [DI6] and [DI7], the function is handled as ON when all assigned terminals are ON.

Parameter No.	Function name	Data	Default data	Unit
3004Hex-03Hex/ 301FHex-03Hex	1st RUN Command Selection/2nd RUN Command Selection*1	1: Terminal command FW or RV	5	-
3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex	Input Terminal [DI1] to [DI7] Function Selection	98: FW (Forward rotation) 99: RV (Reverse rotation)	-	-

*1. To enable switching to the 1st and 2nd control, allocate “12: SET (2nd control)” to either of input terminal [DI1] to [DI7].

- When both FW and RV turn ON, operation is the same as when they are both OFF.



3-wire Input Function (FW, STP, F/R)

- To select 3-wire input, allocate the three parameters “98: FW (forward rotation),” “6: STP (3-wire stopping)” and “97: F/R (3-wire forward/reverse rotation)” to Input Terminal [DI1] to [DI7] Function Selection (3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex).
- Set “1: External signal (Digital input)” to 1st RUN Command Selection (3004Hex-03Hex) and 2nd RUN Command Selection (301FHex-03Hex).

Parameter No.	Function name	Data	Default data	Unit
3004Hex-03Hex/ 301FHex-03Hex	1st RUN Command Selection/2nd RUN Command Selection*1	1: Terminal command FW or RV	5	-
3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex	Input Terminal [DI1] to [DI7] Function Selection	98:FW (Forward rotation)*2 6: STP (3-wire stopping) 97: F/R (3-wire forward/reverse rotation)	-	-

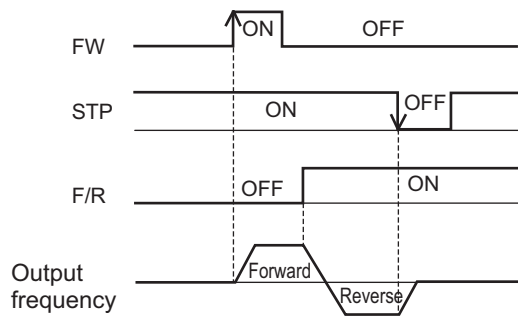
*1. To enable switching to the 1st and 2nd control, allocate “12: SET (2nd control)” to either of input terminal [DI1] to [DI7].

*2. “98: FW (forward rotation)” can be allocated to either Input Terminal [DI6] Function Selection (3005Hex-63Hex) or Input Terminal [DI7] Function Selection (3005Hex-64Hex). Also, 3-wire operation cannot be started up by “99: RV (reverse rotation).”

Data	Symbol	Function name	State	Description
98	FW	Forward rotation (3-wire starting up)	ON	3-wire operation by rising edge
			OFF	Independent of motor operation
6	STP	3-wire stopping: NC contact	ON	Motor operation enabled
			OFF	3-wire operation stopped by falling edge
97	F/R	3-wire forward/reverse	ON	Reverse rotation
			OFF	Forward rotation

- To reliably ascertain ON/OFF, continue ON or OFF for the time twice the set value of Input Terminal Response Time (3051Hex-19Hex to 3051Hex-1FHex). When Input Terminal Response Time is the default value, continue for 2 ms.
- When the STP terminal signal is disconnected, the input signal turns OFF and the status changes to the stop status. Even if the FW terminal is turned ON in this state, the output frequency is not output.

- The operation timing is as follows.



Multi-step Frequency Reference

- Use this function to switch the frequency reference set to 16 frequencies or frequency reference set to 8 frequencies based on the combination of selected input terminals.

Parameter No.	Function name	Data	Default data	Unit
3004Hex-02Hex/ 3006Hex-1FHex	1st Frequency Reference Selection/2nd Frequency Reference Selection*1	1: Voltage input to terminal [AI1] 7: Terminal command UP / DWN control 10: Pattern operation 12: Pulse train input 13: Calculation result 15: EtherCAT	15	-
301FHex-08Hex	Multi-step Frequency Selection	0: Binary (CF1 to CF4) 1: Bit (SF1 to SF7)	0	-
3006Hex-06Hex to 3006Hex-14Hex	Multi-step Frequency Reference 1 to 15	0.00 to 590.0	0.00	Hz
3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex	Input Terminal [DI1] to [DI7] Function Selection	0 to 3: CF1 to 4 (Multi speed setting binary 1 to 4) 173 to 179: SF1 to 7 (Multi speed setting bit 1 to 7)	-	-

*1. To enable switching to the 1st and 2nd control, allocate "12: SET (2nd control)" to either of input terminal [DI1] to [DI7].

- Select the setting method for 1st Multi-step Frequency Reference 0 or 2nd Multi-step Frequency Reference 0 at 1st Frequency Reference Selection (3004Hex-02Hex) and 2nd Frequency Reference Selection (3006Hex-1FHex).
- For the set frequency, Multi-step Frequency Reference 1 to 15 are common in 1st control and 2nd control.
- To switch between Bit (8-step selection with 7 terminals) and Binary (16-step selection with 4 terminals), select "0: Binary (16-step selection with 4 terminals)" or "1: Bit (8-step selection with 7 terminals)" at Multi-step Frequency Selection (301FHex-08Hex).
- To switch the frequency reference, allocate "173 to 179: SF1 to 7 (Multi-step frequency reference setting bits 1 to 7)" to Input Terminal [DI1] to [DI7] Function Selection (3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex) in the case of "binary (16-step selection with 4 terminals)." In the case of "8-step selection with 7 terminals," select "0 to 3: CF1 to 4 (Multi-step frequency reference setting binary 1 to 4)."
- The rotation direction becomes the direction specified by the RUN command.

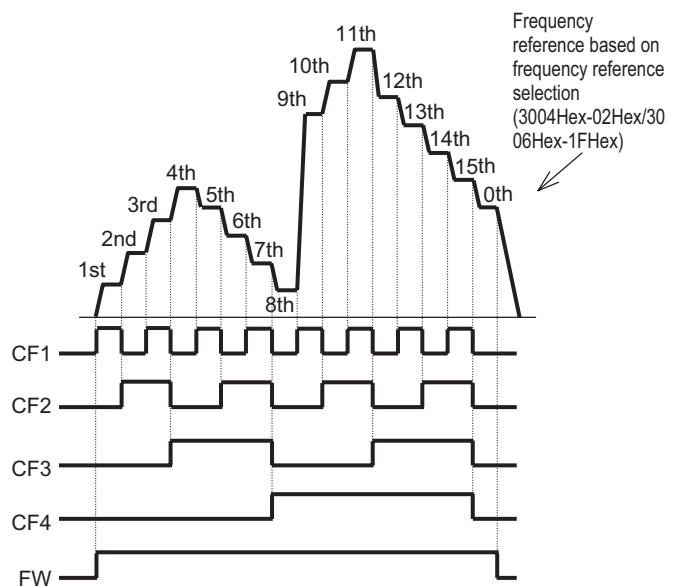
- With switching of frequency selection in multi-step function, an unintended frequency reference is sometimes selected depending on the deviation of timing of input terminals [DI1] to [DI7].

● Binary Operation

Setting “0: CF1” to “3: CF4” to Input Terminal [DI1] to [DI7] Function Selection (3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex) enables selection of multi-step speeds 0 to 15.

- Use the Multi-step Frequency Reference 1 to 15 (3006Hex-06Hex to 3006Hex-14Hex) to set the frequency reference for the multi-step speed 1 to 15.
- When CF1 to CF4 are all OFF, 1st Frequency Reference Selection (3004Hex-02Hex) and 2nd Frequency Reference Selection (3006Hex-1FHex) are selected.

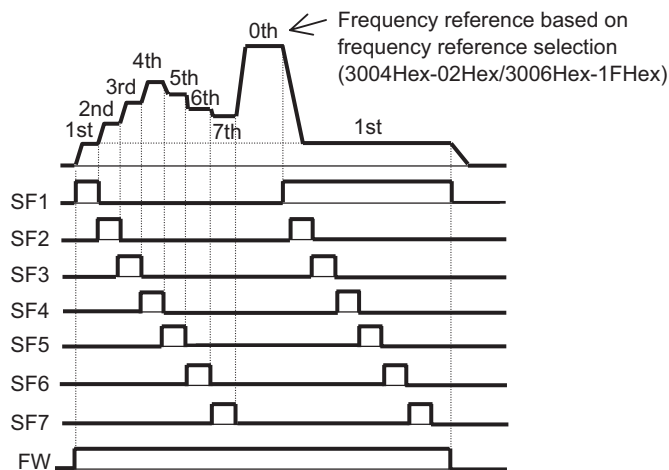
Multi-step Frequency Reference	CF4	CF3	CF2	CF1
0th	OFF	OFF	OFF	OFF
1st			ON	
2nd			OFF	
3rd			ON	
4th	ON	ON	OFF	OFF
5th			ON	
6th			OFF	
7th			ON	
8th	OFF	OFF	OFF	OFF
9th			ON	
10th			OFF	
11th			ON	
12th	ON	ON	OFF	OFF
13th			ON	
14th			OFF	
15th			ON	



● Bit Operation

- Multi-step frequency references 0 to 7 can be selected by input terminals when “173: SF1” to “179: SF7” are set to Input Terminal [DI1] to [DI7] Function Selection (3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex).
- Set the frequency reference of SF1 to SF7 to Multi-step Frequency Reference 1 to 7 (3006Hex-06Hex to 3006Hex-0CHex).
- When SF1 to SF7 are all OFF, 1st Frequency Reference Selection (3004Hex-02Hex) and 2nd Frequency Reference Selection (3006Hex-1FHex) are selected.
- When multiple terminals are turned ON simultaneously, priority is given to the terminal with the smallest number among SF1 to SF7. (“Disabled” in the following table indicates that speed is selected regardless of the ON/OFF status.)

Multi-step Frequency Reference	SF7	SF6	SF5	SF4	SF3	SF2	SF1
0th	OFF	OFF	OFF	OFF	OFF	OFF	OFF
1st	Disabled	Disabled	Disabled	Disabled	Disabled	Disabled	ON
2nd	Disabled	Disabled	Disabled	Disabled	Disabled	ON	OFF
3rd	Disabled	Disabled	Disabled	Disabled	ON	OFF	OFF
4th	Disabled	Disabled	Disabled	ON	OFF	OFF	OFF
5th	Disabled	Disabled	ON	OFF	OFF	OFF	OFF
6th	Disabled	ON	OFF	OFF	OFF	OFF	OFF
7th	ON	OFF	OFF	OFF	OFF	OFF	OFF



- A smaller number is sometimes selected for the frequency reference depending on the timing of switching.

Jogging (JG)

The jogging function operates according to the jogging terminal (10: JG) and RUN command (FW or RV terminal), forward rotation jogging terminal (94: FJOG) and reverse rotation jogging terminal (95: RJOG), and command arriving via communication.

- Jogging terminal (10: JG) and RUN command (FW or RV terminal)
- Forward rotation jogging terminal (94: FJOG) and reverse rotation jogging terminal (95: RJOG)
- Jogging execution via communication
- Jogging frequency (3006Hex-15Hex), acceleration time (3008Hex-37Hex) and deceleration time (3008Hex-38Hex) of jogging operation can be set. Select jogging operation at start and stop of jogging at Jogging Operation Selection (301FHex-0CHex).
- During position control, jogging operation is disabled.
- Speed control during jogging operation can be adjusted by filter, gain, etc.

Parameter No.	Function name	Data	Default data	Unit
3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex	Input Terminal [DI1] to [DI7] Function Selection	10: JG (Jogging) 94: FJOG (Forward rotation jogging) 95: RJOG (Reverse rotation jogging)	-	-

Parameter No.	Function name	Data	Default data	Unit
301FHex-0CHex	Jogging Operation Selection	0: Free run stop on jogging stop, disabled in operation 1: Deceleration stop on jogging stop, disabled in operation 2: DC injection braking on jogging stop, disabled in operation* ¹ 3: Free run stop on jogging stop, enabled in operation 4: Deceleration stop on jogging stop, enabled in operation 5: DC injection braking on jogging stop, enabled in operation* ¹	4	-
3006Hex-15Hex	Jogging Frequency	0.00 to 590.00	0.00	Hz
3008Hex-37Hex	Jogging Acceleration Time	0.00 to 6000	6.00	s
3008Hex-38Hex	Jogging Deceleration Time	0.00 to 6000	6.00	s
3014Hex-64Hex	Extension Function 1	Bit 3: Jogging Enable via communications Do not use other bits	0008 hex	-
3014Hex-0AHex	Speed Control Jogging Speed Command Filter	0.000 to 5.000	0.02	s
3014Hex-0BHex	Speed Control Jogging Speed Detection Filter	0.000 to 0.100	0.005	s
3014Hex-0CHex	Speed Control Jogging P Proportional Gain	0.1 to 200.0	10.0	-
3014Hex-0DHex	Speed Control Jogging I Integral Time	0.001 to 9.999 999: Cancel integral term	0.1	s
3020Hex-30Hex	Speed Control Jogging Feed Forward Gain	0.00 to 99.99	0.00	s
3014Hex-0EHex	Speed Control Jogging Output Filter	0.000 to 0.100	0.002	s
Related function		DC Injection Braking Selection (301FHex-0FHex)		

*1. When the Jogging Operation Selection (301FHex-0CHex) setting is "2: DC injection braking on jogging stop, disabled in operation" or "5: DC injection braking on jogging stop, enabled in operation," DC Injection Braking Selection (301FHex-0FHex) must be set. Refer to 8-5-1 DC Injection Braking (DB) on page 8-55.

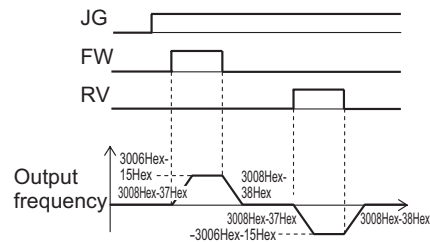
● Switching by JG terminal

- Jogging is executed by turning the JG terminal ON and then turning the FW and RV terminals ON.
- Set the jogging operation stop method and whether to enable or disable the jogging function during operation at Jogging Operation Selection (301FHex-0CHex).
- For 100 ms after the RUN command turns ON, jogging operation can be switched to by the JG (Jogging) terminal regardless of the setting of Jogging Operation Selection (301FHex-0CHex).
- Set the frequency for jogging operation at Jogging Frequency (3006Hex-15Hex).
- Set the acceleration time and deceleration time during jogging operation at Jogging Acceleration Time (3008Hex-37Hex) and Jogging Deceleration Time (3008Hex-38Hex).

● Disabled in operation (when Jogging Operation Selection (301FHex-0CHex) = "0," "1," "2")

- Turn the JG terminal ON and then turn the FW or RV terminal ON.

- During operation (FW terminal is ON, RV terminal is ON), the jogging function is disabled. Note, however, that the function is enabled within 100 ms of starting operation. During operation, the jogging operation is enabled, and jogging operation is started.



- Jogging operation is not performed if the JG terminal turns ON after the FW terminal turns ON first and 100 ms or more elapses. To perform jogging operation, turn the JG terminal ON and then turn the FW or RV terminal ON.

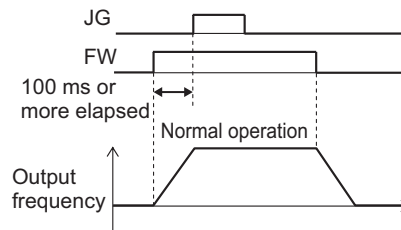


Fig.: Operation of setting when disabled while inverter is running

● Enabled in operation (when Jogging Operation Selection (301FHex-0CHex) = "3," "4," "5")

- Jogging is performed even if the FW terminal turns ON first.

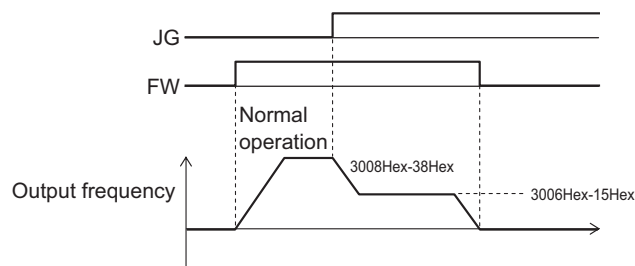


Fig.: Jogging operation switching while inverter is running

However, if the JG terminal turns OFF first, the motor comes to a free-run state.

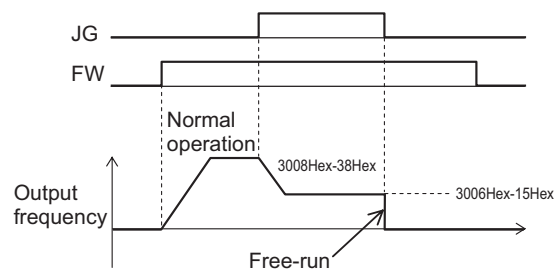


Fig.: Operation when jogging is canceled

If the JG terminal is turned ON again with the motor in a free-run state (JG terminal OFF and FW terminal ON), jogging operation is started again.

If the FW terminal is turned OFF with the motor in a free-run state (JG terminal OFF and FW terminal ON), and the FW terminal is turned ON again, normal operation is performed.

● Relationship with DC braking

When the jogging function is used to perform inching, the inverter sometimes does not come to an exact stop in applications such as turntables and rotates an extra bit more before it comes to a stop.

In vector control, the braking torque just before the stop can be adjusted so that the inverter comes to an exact stop by adjusting the speed adjuster (ASR). However, in V/f control, sufficient braking torque sometimes cannot be ensured simply by adjusting the torque boost.

In cases like these, jogging operation and the DC braking function are used in combination to adjust inching.

For details on DC braking, refer to *8-5-1 DC Injection Braking (DB)* on page 8-55.

Operation when the RUN command is turned OFF during jog operation with the DB (DC braking) terminal turned ON is as follows.

(Example: When External DC Injection Braking Edge/Level Selection (301FHex-10Hex) = "1: Level operation")

- When Jogging Operation Selection (301FHex-0CHex) = 0, 3, operation immediately becomes free run when the RUN command turns OFF, and immediately DC braking by the DB terminal operates.
- When Jogging Operation Selection (301FHex-0CHex) = 1, 2, 4, 5, DC braking by the DB terminal operates immediately when the RUN command turns OFF.

● Forward Rotation Jogging/Reverse Rotation Jogging

- When the FJOG (Forward rotation jogging) terminal or RJOG (Reverse rotation jogging) terminal is turned ON when the RUN command is OFF, forward rotation or reverse rotation jogging operation can be performed. Deceleration stop is performed according to the acceleration/deceleration time regardless of Jogging Operation Selection (301FHex-0CHex).

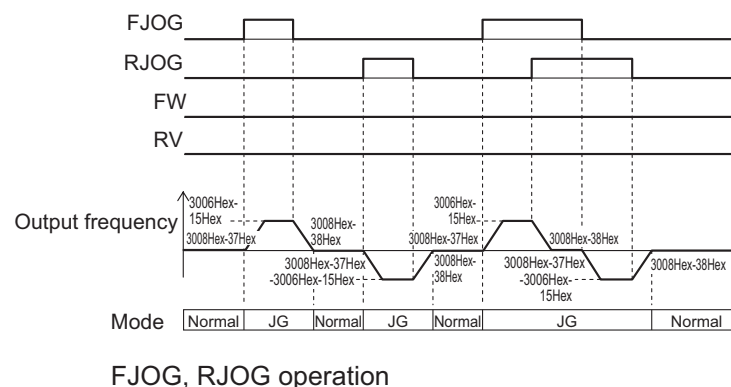
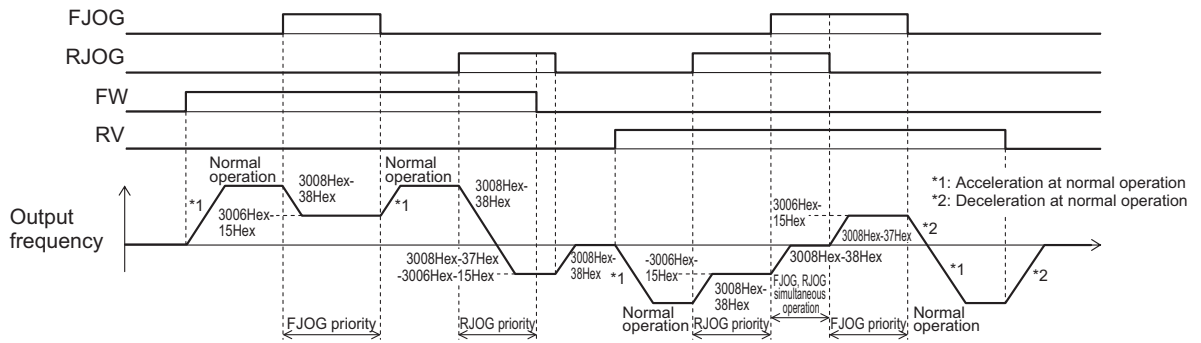


Fig.: Jogging operation by FJOG and RJOG terminals during an operation stop



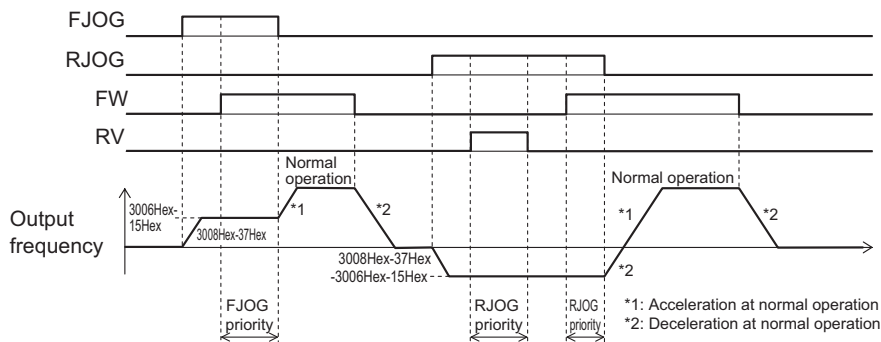
FJOG, RJOG ON while FW, RV are ON

Fig.: Jogging operation by FJOG and RJOG terminals while inverter is running

- When the FJOG (Forward rotation jogging) terminal and RJOG (Reverse rotation jogging) terminal are both ON, operation is the same as when they are both OFF.
- Operation during a stop follows the setting of Jogging Operation Selection (301FHex-0CHex), though the enabled/disabled during operation settings are not affected.
- FJOG (Forward rotation jogging) terminal and RJOG (Reverse rotation jogging) terminal are given priority over jogging operation by the FW terminal/RV terminal and the JG terminal.

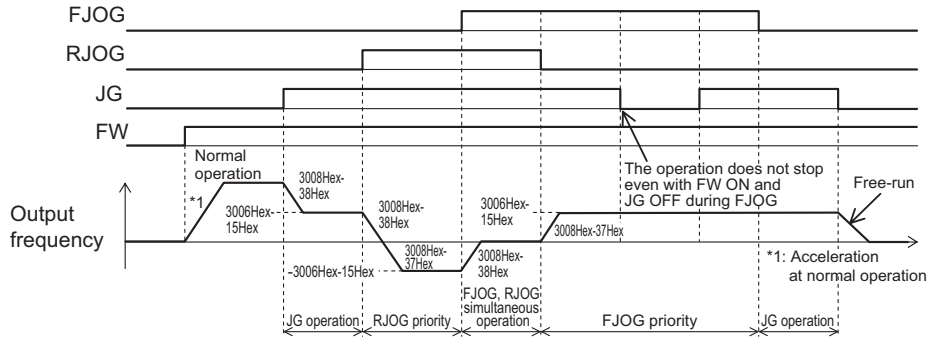
Parameter No.	Function name	Data	Default data	Unit
3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex	Input Terminal [DI1] to [DI7] Function Selection	94: FJOG (Forward rotation jogging) 95: RJOG (Reverse rotation jogging)	-	-

- Operation when the FW and RV terminals turn ON while the FJOG and RJOG terminals are ON is as follows.



FW, RV ON while FJOG, RJOG are ON

- Combinations of the JG terminal and FJOG terminal, RJOG terminal while jogging during operation is enabled act as follows.



Combinations of JG and FJOG, RJOG while jogging during operation is enabled

● Jogging function via communication

- When Extension Function 1 (3014Hex-64Hex) bit 3 is “0: Jogging Disable via communications,” this function is enabled only when 1st RUN Command Selection (3004Hex-03Hex) is “1: External signal (Digital input).”
- When Extension Function 1 (3014Hex-64Hex) bit 3 is “1: Jogging Enable via communications,” forward rotation jogging or reverse rotation jogging operations are possible by the command arriving via communication regardless of the value of Extension Function 1 (3014Hex-64Hex) bit 3. When commands via communication are enabled, input terminal is disabled.

Parameter No.	Function name	Data	Default data	Unit
3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex	Input Terminal [DI1] to [DI7] Function Selection	10: JG (Jogging) 94: FJOG (Forward rotation jogging) 95: RJOG (Reverse rotation jogging)	-	-
3002Hex-07Hex	Operation command	Bit15: RST Bit14: DI7 Bit13: DI6 Bit12: - Bit11: - Bit10: - Bit9: - Bit8: - Bit7: - Bit6: DI5 Bit5: DI4 Bit4: DI3 Bit3: DI2 Bit2: DI1 Bit1: REV Bit0: FWD	0	-

- Allocate this function to “10: JG (Jogging),” “94: FJOG (Forward rotation jogging)” and “95: RJOG (Reverse rotation jogging)” input terminals in Input Terminal [DI1] to [DI7] Function Selection, and operate Operation command (3002Hex-07Hex) via communication to perform jogging.

● Adjustment of jogging operation

- This function is for adjusting the speed control during jogging operation. As this speed control parameter is used only in jogging operation, jogging operation with a speed response faster than during normal operation can be performed.
- For details on parameters, refer to the parameters (3014Hex-02Hex to 3014Hex-07Hex) for speed control during normal operation that are applicable in 7-5-1 *Speed Control Settings* on page 7-26. There are no parameters relating to the notch filter for jogging.

2-step acceleration/deceleration

- For details on the 2-step acceleration/deceleration function, refer to 6-6-4 *2-step Acceleration/Deceleration Function* on page 6-37.

Reset

- For details on a reset, refer to 6-8-1 *Reset Function* on page 6-43.

6-10 Multi-function output

6-10-1 Multifunction Output Selection

- Inverter status can be output from output terminals by allocating functions to output terminals [DO1] and [ROA, ROB]. This section describes seven types of primary functions. For details on other functions, refer to 8-2 *Multifunction Input/Output Functions List* on page 8-23.

Parameter No.	Function name	Data	Default data	Unit
3005Hex-15Hex/ 3005Hex-1CHex	Output Terminal [DO1] Function Selection/Output Terminal [ROA, ROB] Function Selection	Table below or, refer to 8-2 <i>Multifunction Input/Output Functions List</i> on page 8-23.	-	-
3051Hex-0AHex	Output Terminal [DO1] ON Delay Time	0.0 to 100.0	0.0	s
3051Hex-0EHex	Output Terminal [ROA, ROB] ON Delay Time			
3051Hex-0BHex	Output Terminal [DO1] OFF Delay Time	0.0 to 100.0	0.0	s
3051Hex-0FHex	Output Terminal [ROA, ROB] OFF Delay Time			

- Set this at Output Terminal [DO1] Function Selection (3005Hex-15Hex) and Output Terminal [ROA, ROB] Function Selection (3005Hex-1CHex).
- An NO contact output can be changed to an NC contact output by setting data in which 1000 is added to the set data, and, as a result, the operations of set signals are reversed.
- Each multifunction output terminal can be allocated with the ON/OFF delay time independently.
- The output terminal [DO1] is open collector output, and the output terminal [ROA, ROB] is relay output.
- The following functions have an OFF delay time of 0.1 s even if the OFF delay time is not set. When these functions are allocated to output terminals, the OFF delay becomes the time obtained by adding 0.1 s to Output Terminal [DO1] OFF Delay Time (3051Hex-0BHex) and Output Terminal [ROA, ROB] OFF Delay Time (3051Hex-0FHex).

Inverter output limited (5: IOL) terminal, Electronic thermal warning (7: THM) terminal, Overload prevention control in progress (36: OLP) terminal, Overload early warning 2 (37: OL2) terminal, Overload early warning (38: OL) terminal, Low current signal (41: LOC) terminal, PID deviation excessive (42: OD) terminal, PID wakeup timer stopped (44: PID-STP) terminal, Overtorque (46: OTQ) terminal, Thermistor detection (56: MOH) terminal

Parameter No.	Data	Function name	Reference item	Reference page
3005Hex-15Hex, 3005Hex-1CHex	0	RUN (Signal during run)	Signal during run	page 6-61
	1	FAR1 (Frequency arrival 1 (constant speed))	Constant speed arrival signal	page 6-62
	99	AL (Alarm signal)	Alarm signal	page 6-63
	70	ZS (0 Hz detection signal)	0 Hz detection signal	page 6-63
	10	IRDY (Operation ready completion)	Operation ready completion	page 6-61
	52	FWR (Forward run signal)	Forward run signal	page 6-62
	53	RVR (Reverse run signal)	Reverse run signal	page 6-62

Operation Ready Completion Signal (IRDY)

- This signal is output when the inverter becomes ready to operate (ready to accept the RUN command).

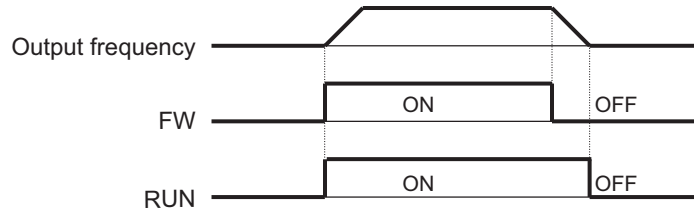
Parameter No.	Function name	Data	Default data	Unit
3005Hex-15Hex/ 3005Hex-1CHex	Output Terminal [DO1] Function Selection/ Output Terminal [ROA, ROB] Function Selection	10: IRDY (Operation ready completion)	-	-

- When this signal is not output, the inverter does not operate even if the RUN command is input.
- If this signal is not output, check if the input power supply voltage (L1/R, L2/S, L3/T) is within the specification range.

Signal during RUN (RUN), Inverter Output Signal (RUN2)

- This signal is output while the inverter is running (RUN command ON).
- The signal during RUN (RUN) and inverter output signal (RUN2) are output also when the inverter is decelerating after the RUN command turns OFF.
- When in a free-run state (output shutoff status), the signal during RUN (RUN) and inverter output signal (RUN2) are not output even if the RUN command is turned ON. (Note that on the Operator, the RUN LED is lit when the RUN command is ON.)
- The signal during RUN (RUN) is not output while DC braking is operating, during tuning of motor parameters while stopped, and during pre-excitation by the EXITE terminal. The inverter output signal (RUN2) is output.

Parameter No.	Function name	Data	Default data	Unit
3005Hex-15Hex/ 3005Hex-1CHex	Output Terminal [DO1] Function Selection/ Output Terminal [ROA, ROB] Function Selection	0: RUN (Signal during run) 35: RUN2 (Inverter output in progress)	-	-



- The signal is not output when at stop frequency and starting frequency or below

Forward Run Signal (FWR)

- This signal is output while the inverter performs forward operation.

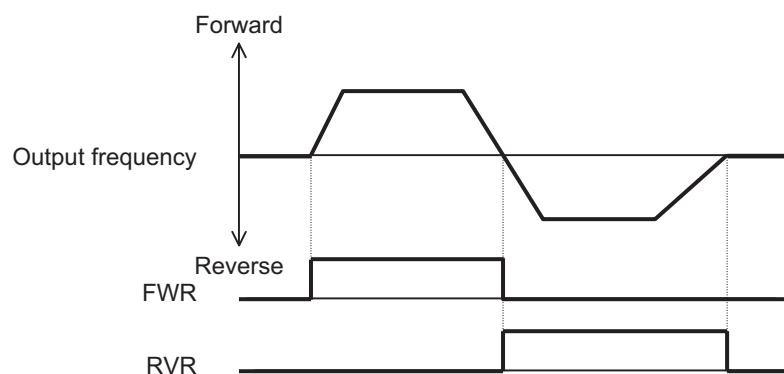
Parameter No.	Function name	Data	Default data	Unit
3005Hex-15Hex/ 3005Hex-1CHex	Output Terminal [DO1] Function Selection/Output Terminal [ROA, ROB] Function Selection	52: FWR (Forward run signal)	-	-

- This signal is not output while the inverter performs reverse operation, when it is stopped or during free-run. Note, however, that during control methods with speed sensor, judgment is performed based on the speed detection value to output the signal even in free-run status.

Reverse Run Signal (RVR)

- This signal is output while the inverter performs reverse operation.

Parameter No.	Function name	Data	Default data	Unit
3005Hex-15Hex/ 3005Hex-1CHex	Output Terminal [DO1] Function Selection/Output Terminal [ROA, ROB] Function Selection	53: RVR (Reverse run signal)	-	-



- This signal is not output while the inverter performs forward operation, when it is stopped or during free-run. Note, however, that during control methods with speed sensor, judgment is performed based on the speed detection value to output the signal even in free-run status.

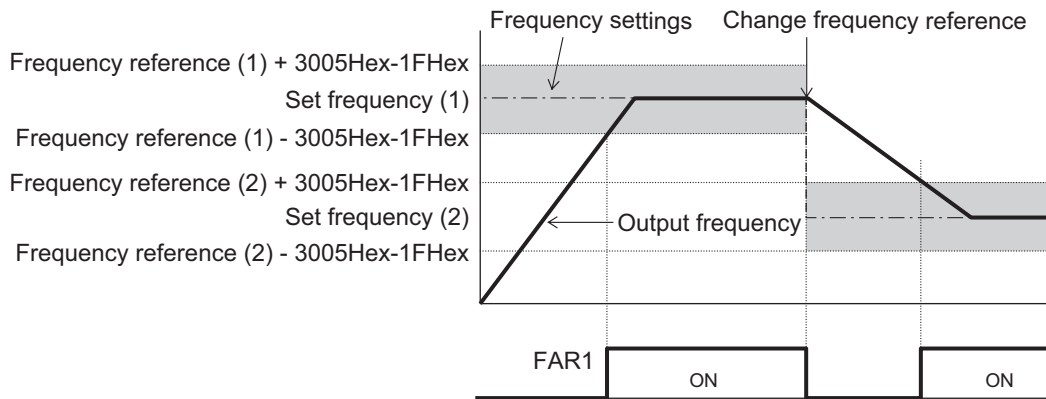
Frequency Arrival 1 (Constant Speed) (FAR1)

- This signal is output when the output frequency arrives at the frequency reference.

- The detection width of the frequency arrival signal is set at Frequency Arrival Detection Width (FAR1/FAR2/FAR3/FDT3/FDT4) (3005Hex-1FHex).

Parameter No.	Function name	Data	Default data	Unit
3005Hex-15Hex/ 3005Hex-1CHex	Output Terminal [DO1] Function Selection/Output Terminal [ROA, ROB] Function Selection	1: FAR1 (Constant speed arrival signal)	-	-
3005Hex-1FHex	Frequency Arrival Detection Width (FAR1/FAR2/FAR3/FDT3/FDT4)	0.0 to 10.0	2.5	Hz

- When the output frequency is within the range of \pm Frequency Arrival Detection Width (FAR1/FAR2/FAR3/FDT3/FDT4) (3005Hex-1FHex) centering around the frequency reference, ON is output, and when it is outside the range, this signal turns OFF.
- During free-run or when the set frequency is less than the stop frequency, the RUN command turns OFF, and turns OFF during a deceleration stop.
- The figure below shows an example of changing the frequency reference from frequency reference (1) to frequency reference (2).



Alarm Signal (AL)

- The inverter detects an overcurrent, overvoltage, or some other abnormality, and outputs an alarm signal (AL).
- The alarm signal is the default data of Output Terminal [ROA, ROB] Function Selection (3005Hex-1CHex).
- A trip state can be canceled by resetting the inverter, by which the alarm signal is also turned OFF.
- For details on a reset, refer to 6-8-1 *Reset Function* on page 6-43.

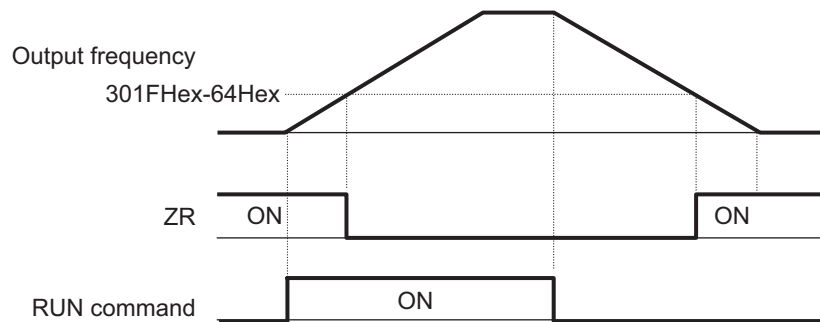
Parameter No.	Function name	Data	Default data	Unit
3005Hex-15Hex/ 3005Hex-1CHex	Output Terminal [DO1] Function Selection/Output Terminal [ROA, ROB] Function Selection	99: AL (Alarm signal)	-	-

0 Hz Detection Signal (ZS)

- This signal is output when the output frequency of the inverter falls below the 0Hz Detection Output Detection Level (ZS) (301FHex-64Hex).

Parameter No.	Function name	Data	Default data	Unit
3005Hex-15Hex/ 3005Hex-1CHex	Output Terminal [DO1] Function Selection/ Output Terminal [ROA, ROB] Function Selection	70: ZS (0 Hz detection signal)	-	-
301FHex-64Hex	0Hz Detection Output Detection Level (ZS)	0.00 to 100.00	0.00	Hz

- This signal is output when the output frequency of the inverter falls below the 0Hz Detection Output Detection Level (ZS) (301FHex-64Hex) also when the RUN command is OFF.
- This signal turns ON if the speed command value (output frequency) or the speed detection value is less than the 0Hz Detection Output Detection Level (ZS) (301FHex-64Hex), and turns OFF if it is at 0Hz Detection Output Detection Level (ZS) (301FHex-64Hex) or higher regardless of the alarm status or free-run after the power is turned ON.



6-11 Torque Boost Function Settings

6-11-1 Torque boost

- The torque boost function is for increasing the output torque if it is not sufficient at lower speeds.
- This inverter provides two torque boost options: Manual torque boost for manual torque adjustment and Automatic torque boost for automatic torque adjustment.
- Automatic torque boost is enabled when “0: IM V/f control,” “1: IM Dynamic torque vector control without speed sensor,” “3: IM V/f control with speed sensor” or “4: IM Dynamic torque vector control with speed sensor” is selected at Drive Control Selection (3004Hex-2BHex/3009Hex-0FHex).
- Manual torque boost is enabled when “0: IM V/f control” or “3: IM V/f control with speed sensor” is selected at Drive Control Selection (3004Hex-2BHex/3009Hex-0FHex).
- The default is automatic torque boost set to enabled. (Torque Boost Function Selection (301FHex-0DHex/301FHex-0EHex) = 1)

Parameter No.	Function name	Data	Default data	Unit
3004Hex-2BHex/ 3009Hex-0FHex	1st Drive Control Selection/2nd Drive Control Selection	0: IM V/f control 1: IM Dynamic torque vector control 3: IM V/f control with speed sensor 4: IM Dynamic torque vector control with speed sensor	0	-
301FHex-0DHex/ 301FHex-0EHex	1st Torque Boost Function Selection/2nd Torque Boost Function Selection	0: Manual torque boost 1: Automatic torque boost	1	-
3004Hex-0AHex/ 3009Hex-06Hex	1st Manual Torque Boost Voltage/2nd Manual Torque Boost Voltage	0.0 to 20.0% Percentage of Rated Voltage at Base Frequency (3004Hex-06Hex/3009Hex-04Hex)	1.9	%
Related function		Base Frequency (3004Hex-05Hex/3009Hex-03Hex) Rated Voltage at Base Frequency (3004Hex-06Hex/3009Hex-04Hex) Motor Parameter (3007Hex-02Hex/3009Hex-10Hex to 3007Hex-04Hex/3009Hex-12Hex, 3007Hex-07Hex/3009Hex-15Hex to 3007Hex-15Hex/3009Hex-23Hex)		

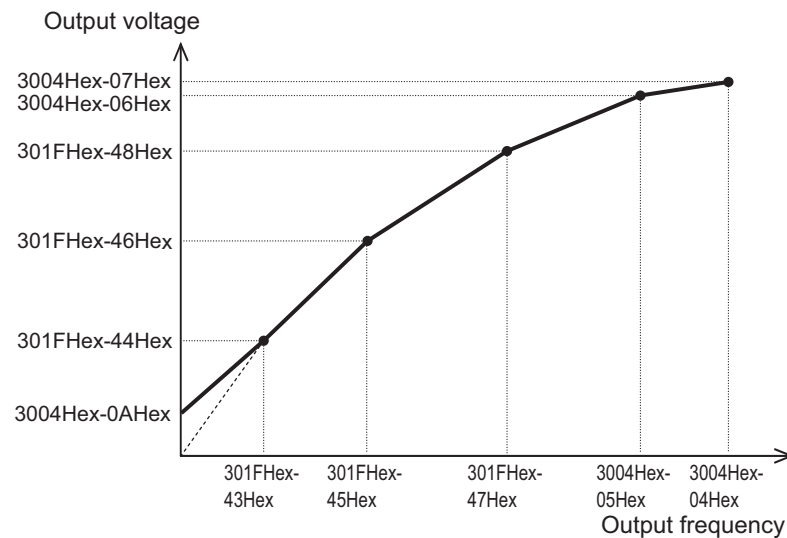
Automatic Torque Boost (301FHex-0DHex/301FHex-0EHex = 1)

- With this setting, the inverter increases the output voltage automatically depending on the load condition.
- When automatic torque boost function is enabled, the non-linear V/f function is disabled.
- To use automatic torque boost, either set 1st Base Frequency (3004Hex-05Hex), 1st Rated Voltage at Base Frequency (3004Hex-06Hex), and motor parameters (3007Hex-02Hex/3009Hex-10Hex to 3007Hex-04Hex/3009Hex-12Hex and 3007Hex-07Hex/3009Hex-15Hex to 3007Hex-15Hex/3009Hex-23Hex) to match the motor capacity or motor characteristics, or execute auto-tuning (3007Hex-05Hex).

- To use automatic torque boost, set “1: Constant torque load” to V/f Characteristics Selection (3004Hex-26Hex/3009Hex-0EHex). When “0: Variable torque load” is set, manual torque boost is selected regardless of the setting of Torque Boost Function Selection (301FHex-0DHex/301FHex-0EHex).
- Automatic torque boost controls to match the motor characteristics. To use the automatic torque boost function effectively, either set Base Frequency (3004Hex-05Hex/3009Hex-03Hex), Rated Voltage at Base Frequency (3004Hex-06Hex/3009Hex-04Hex), and motor parameters (3007Hex-02Hex/3009Hex-10Hex to 3007Hex-04Hex/3009Hex-12Hex and 3007Hex-07Hex/3009Hex-15Hex to 3007Hex-15Hex/3009Hex-23Hex) to match the motor capacity or motor characteristics, or execute auto-tuning.

Manual Torque Boost Voltage (301FHex-0DHex/301FHex-0EHex = 0)

- With the torque boost by Manual Torque Boost Voltage (3004Hex-0AHex/3009Hex-06Hex), a constant voltage is added to the V/f characteristics before output regardless of the load. The optimum voltage suited to the motor and load are manually adjusted by the Manual Torque Boost Voltage (3004Hex-0AHex/3009Hex-06Hex) to ensure starting torque. Adjust the voltage to a level at which startup is possible and overexcitation does not occur in a no-load state or light load state.
- When the non-linear V/f function is used in combination with the manual torque boost function, the torque boost is enabled at the lowest non-linear V/f frequency or less.



- When Manual Torque Boost Voltage (3004Hex-0AHex/3009Hex-06Hex) is set to 0.0%, manual torque boost is disabled.

6-12 Measures Against Overvoltage

6-12-1 Regenerative Braking Function

- During motor deceleration and elevator descent, regenerative energy sometimes is returned to the inverter and an overvoltage is detected due to an excessive regenerative amount.
- The regenerative braking function uses the built-in or an external regenerative braking resistor to decrease the internal Main Circuit DC Voltage of the inverter by converting the regenerated energy from the motor into heat via external braking resistors.
- The 3G3M1 Series has a built-in regenerative braking circuit and a regenerative braking function operates at all times regardless of whether the inverter is running or has stopped.

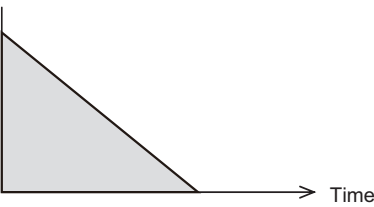
6-12-2 Braking Resistor Electronic Thermal Function

- Either use a braking resistor with thermal contact or use the braking resistor electronic thermal function for overheat protection of the external braking resistor.
- Use the braking resistor electronic thermal function by setting each of Electronic Thermal for Braking Resistor Discharging Capacity (3004Hex-33Hex), Electronic Thermal for Braking Resistor Allowable Average Loss (3004Hex-34Hex) and Braking Resistor Resistance (3004Hex-35Hex). These values are determined by inverter model and type of braking resistor.
- To use the regenerative braking function, set Anti-regenerative Control Function Selection (3008Hex-46Hex) to "0: Disable."

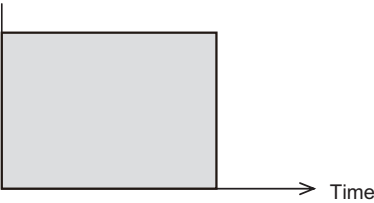
Parameter No.	Function name	Data	Default data	Unit
3004Hex-33Hex	Electronic Thermal for Braking Resistor Discharging Capacity	1 to 9000 32767: Disable	32767	kWs
3004Hex-34Hex	Electronic Thermal for Braking Resistor Allowable Average Loss	0.001 to 99.99	0.001	kW
3004Hex-35Hex	Braking Resistor Resistance	0.01 to 999	0.01	Ω
3017Hex-3EHex	Braking Resistor Thermal Monitor	0.0 to 100.0	0.0	%
Related function		Anti-regenerative Control Function Selection (3008Hex-46Hex)		

- Set the Electronic Thermal for Braking Resistor Discharging Capacity (3004Hex-33Hex) and Electronic Thermal for Braking Resistor Allowable Average Loss (3004Hex-34Hex) by the following formula depending on how the braking load is applied.

● When braking load during deceleration decreases with time

How to apply a braking load	Allowable average loss	Thermal braking resistance value
<p>Braking load (kW)</p>  <p>Time</p>	<p>Electronic Thermal for Braking Resistor Discharging Capacity (3004Hex-33Hex) =</p> $\frac{\text{Braking time (s)} \times \text{Motor capacity (kW)}}{2}$	<p>Electronic Thermal for Braking Resistor Allowable Average Loss (3004Hex-34Hex) =</p> $\frac{\frac{\%ED(\%)^{*1}}{100} \times \text{Motor capacity (kW)}}{2}$

● When braking load at deceleration is a constant speed

How to apply a braking load	Allowable average loss	Thermal braking resistance value
<p>Braking load (kW)</p>  <p>Time</p>	<p>Electronic Thermal for Braking Resistor Discharging Capacity (3004Hex-33Hex) =</p> $\text{Braking time (s)} \times \text{Motor capacity (kW)}$	<p>Electronic Thermal for Braking Resistor Allowable Average Loss (3004Hex-34Hex) =</p> $\frac{\%ED(\%)^{*1}}{100} \times \text{Motor capacity (kW)}$

*1. %ED indicates the usage rate. It is the percentage of the time under braking in the interval where the brake is applied. (Reference: A-10-3 Overview of Braking Resistor Selection on page A-299)

- When a braking resistor capable of outputting a temperature detection signal is applied, allocate “9: EXT (external trip)” to one of input terminals [DI1] to [DI7], and connect the temperature detection signal of the braking resistor.
- Even if there is actually little temperature rise, the electronic thermal sometimes is activated and the overheating protection (alarm code: 16 hex) is generated depending on the braking resistor specifications. Check the specifications of the braking resistor and set its parameter.

7

Vector Control and Applied Functions

This section describes the vector control and applied functions characteristic of this inverter.

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7-1 Details of Motor Control Methods

Select the control method best suited to type of motor to be driven and application. Set the control method to be used in 1st Drive Control Selection (3004Hex-2BHex)/2nd Drive Control Selection (3009Hex-0FHex).

Available control methods differ according to the type of motor.

Vector control without speed sensor and vector control with speed sensor can be set only to 1st motor control.

7-1-1 Motor Control Methods

Dynamic Torque Vector Control (IM: Induction Motor)

To make full use of motor torque, torque corresponding to load is calculated, and the voltage/current vector is optimally controlled according to that calculated value. When dynamic torque vector control is selected, automatic torque boost and slip compensation are automatically enabled. This function is useful for enhancing response to load fluctuation or other external disturbances and improving the speed control accuracy of the motor. Note, however, that this control is open loop V/f control and does not control current like in vector control. For this reason, response to sudden load external disturbances may not be possible, though it does have advantages such as a maximum torque larger than that of vector control.

Dynamic Torque Vector Control with Speed Sensor (IM: Induction motor)

With regard to V/f control with speed sensor, to make full use of motor torque, torque corresponding to load is calculated, and the voltage/current vector is optimally controlled according to that calculated value. This control is useful for enhancing response to load fluctuation or other external disturbances and improving the speed control accuracy of the motor.

Vector Control without Speed Sensor

Speed control is performed based on the motor speed inferred from voltage and current, motor current is further divided into excitation current and torque current, and vector control for controlling each of these currents is performed. The required response can be achieved by adjusting the control constants (PI constants) with speed control (PI controller).

With vector control, a certain degree of difference (voltage margin) between the induction voltage of the motor and voltage that can be output from the inverter is required as motor current is controlled. Generally, the voltage of a general-purpose motor is matched to the commercial power supply. However, due to the necessity for this voltage margin, the terminal voltage of the motor must be kept low when performing control. When the terminal voltage of the motor is kept low when performing control, the rated torque of the motor cannot be output even if the rated current of the motor according to specification is applied. To ensure the rated torque, the rated current must be increased (the same applies in vector control with speed sensor).

Vector Control with Speed Sensor (IM: Induction motor)

Speed control is performed based on the motor rotation position and speed detected according to the feedback signal from the motor's PG, motor current is further divided into excitation current and torque current, and vector control for controlling each of these currents is performed. The required response can be achieved by adjusting the control constants (PI constants) with speed control (PI controller). Compared with speed sensorless vector control, vector control with speed sensor affords speed control with even higher accuracy and faster response.

Vector Control without Speed Sensor (PM: Synchronous Motor)

Speed control is performed based on the motor speed inferred from voltage and current, motor current is further divided into excitation current and torque current, and vector control for controlling each of these currents is performed. The required response can be achieved by adjusting the control constants (PI constants) of speed control (PI controller).

Vector Control with Speed Sensor (PM: Synchronous Motor)

Speed control is performed based on the motor rotation speed and magnetic pole position detected according to the feedback signal from the motor's speed/magnetic pole position sensor, motor current is further divided into excitation current and torque current, and vector control for controlling each of these currents is performed. The required response can be achieved by adjusting the control constants (PI constants) of speed control (PI controller). Compared with sensorless vector control, vector control with sensor affords a wider speed control range and speed control with higher response.

7-1-2 Basic Motor Parameter Settings

Set the basic parameters for motor control and protection.

Setting the correct motor parameters to the inverter is effective in stabilizing motor behavior as appropriate values are obtained for the control result.

- Match the base frequency to the rated frequency stipulated for the motor. Setting the base frequency lower than the rated frequency might result in motor burnout.
- The rated frequency of a general induction motor is designed to be within the range 50 to 60 Hz. When setting the maximum frequency to 60 Hz or higher, check the maximum allowable frequency in the motor specifications. Setting a maximum frequency and rated voltage exceeding the motor specifications might result in motor burnout.

Basic Parameter Settings

Item	Inverter parameter		Setting range	Description	Default value
Capacity	3007Hex-0 3Hex/ 3009Hex-1 1Hex	1st Motor Capacity/2nd Motor Capacity	0.01 to 1000 kW	Sets the motor capacity.	Dependent on capacity
Number of poles	3007Hex-0 2Hex/ 3009Hex-1 0Hex	1st Motor Pole Number/2nd Motor Pole Number	2 to 128 poles	Sets the number of poles of the motor.	4
Frequency	3004Hex-0 5Hex/ 3009Hex-0 3Hex	1st Base Frequency/2nd Base Frequency	5.0 to 590.0 Hz	Sets the base frequency of the motor.	50.0
	3004Hex-0 4Hex/ 3009Hex-0 2Hex	1st Maximum Output Frequency/2nd Maximum Output Frequency	5.0 to 590.0 Hz	Sets the maximum frequency of the motor.	60.0
Voltage	3004Hex-0 6Hex/ 3009Hex-0 4Hex	1st Rated Voltage at Base Frequency/2nd Rated Voltage at Base Frequency	80 to 240 V: AVR operation (200 V class series) 160 to 500 V: AVR operation (400 V class series)	Sets the base voltage of the motor.	Dependent on capacity
	3004Hex-0 7Hex/ 3009Hex-0 5Hex	1st Rated Voltage at Maximum Output Frequency/2nd Rated Voltage at Maximum Output Frequency	80 to 240 V: AVR operation (200 V class series) 160 to 500 V: AVR operation (400 V class series)	Sets the maximum voltage of the motor.	Dependent on capacity
Current	3007Hex-0 4Hex/ 3009Hex-1 2Hex	1st Motor Rated Current/2nd Motor Rated Current	0.00 to 500.0 A	Set the rated current of the motor.	Dependent on capacity

Capacity and Number of Poles

Set the capacity and number of poles of the motor.

Note that when the capacity is changed, specific parameters on the inverter are initialized to their factory defaults.

After setting the capacity, either perform auto-tuning or manual input the motor constants that have been prepared.

When the correct motor constants are set, operation is optimized so it becomes stable.

Cleared default values are for auto-tuning, and action may not be as expected if the values deviate from actual motor constants. For this reason, ensure that the motor constants are set correctly.

Base Frequency/Base Voltage

Match 1st Base Frequency (3004Hex-05Hex)/2nd Base Frequency (3009Hex-03Hex) and 1st Rated Voltage at Base Frequency (3004Hex-06Hex)/2nd Rated Voltage at Base Frequency (3009Hex-04Hex) to the rated frequency and rated voltage of the motor.

The base frequency is found as follows from the rated rotation speed (min-1) of the motor and the number of poles.

- Base frequency (Hz) = Rated rotation speed (min-1) × number of poles/120

Maximum Frequency/Maximum Output Voltage

Set the maximum frequency and maximum output voltage of the motor.

Rated Current

Set the motor rated current matched to the motor specifications. Motor protection sometimes does not function properly if the motor rated current is not set properly.

Also, motor control sometimes becomes unstable if the motor rated current is not set properly.

7-1-3 Motor Parameter Settings

When motor parameters are correctly set matched to the motor control method, control is compensated and motor behavior is stabilized.

Note that when the capacity is changed, specific parameters on the inverter are initialized to their factory defaults.

After setting the capacity, either perform auto-tuning or manual input the motor constants that have been prepared.

For details on auto-tuning, refer to *7-8-1 Motor Off-line Auto-tuning* on page 7-65.

Save the set parameter values as a user preference dataset so that motor constants can be recovered if they are initialized unintentionally.

For details on the user preference dataset, refer to *6-1-1 Data Initialization* on page 6-3.

Set the following constants according to the settings of 1st Drive Control Selection (3004Hex-2BHex)/2nd Drive Control Selection (3009Hex-0FHex).

Dynamic Torque Vector Control (With/without Speed Sensor) (Induction Motor)

Parameter No.	Function name	Set data	Default data
3004Hex-2BHex/ 3009Hex-0FHex	1st Drive Control Selection/2nd Drive Control Selection	1: IM Dynamic torque vector control	0
3004Hex-05Hex/ 3009Hex-03Hex	1st Base Frequency/2nd Base Frequency	Motor rated value	50.0Hz
3004Hex-06Hex/ 3009Hex-04Hex	1st Rated Voltage at Base Frequency/2nd Rated Voltage at Base Frequency		Dependent on capacity
3007Hex-03Hex/ 3009Hex-11Hex	1st Motor Capacity/2nd Motor Capacity		Dependent on capacity
3007Hex-04Hex/ 3009Hex-12Hex	1st Motor Rated Current/2nd Motor Rated Current		Dependent on capacity
3007Hex-07Hex/ 3009Hex-15Hex	1st Motor Armature Resistance/2nd Motor Armature Resistance	When rotation tuning can be performed, this does not need to be set. When rotation tuning is not possible, either set the values given in the test report for the motor, or set the value calculated by the following formula. $\sqrt{(3007Hex-04Hex)^2 - (3007Hex-38Hex)^2}$	Dependent on capacity
3004Hex-04Hex/ 3009Hex-02Hex	1st Maximum Output Frequency/2nd Maximum Output Frequency	Design specification value	60.0Hz
3004Hex-08Hex	1st Acceleration Time 1		6.0 s
3004Hex-09Hex	1st Deceleration Time 1		6.0 s

Vector Control (With/without Speed Sensor) (IM: Induction Motor)

Parameter No.	Function name	Set data	Default data
3004Hex-2BHex/ 3009Hex-0FH ex	1st Drive Control Selection/2nd Drive Control Selection	4: IM Dynamic torque vector control with speed sensor 6: IM Vector control with speed sensor	0
3004Hex-05H ex/ 3009Hex-03H ex	1st Base Frequency/2nd Base Frequency	Motor rated value	50.0Hz
3004Hex-06H ex/ 3009Hex-04H ex	1st Rated Voltage at Base Frequency/2nd Rated Voltage at Base Frequency		Dependent on capacity
3007Hex-02H ex/ 3009Hex-10H ex	1st Motor Pole Number/2nd Motor Pole Number		4
3007Hex-03H ex/ 3009Hex-11H ex	1st Motor Capacity/2nd Motor Capacity		Dependent on capacity
3007Hex-04H ex/ 3009Hex-12H ex	1st Motor Rated Current/2nd Motor Rated Current		Dependent on capacity
3007Hex-07H ex/ 3009Hex-15H ex	1st Motor Armature Resistance/2nd Motor Armature Resistance	When rotation tuning can be performed, this does not need to be set. When rotation tuning is not possible, either set the values given in the test report for the motor, or set the value calculated by the following formula. $\sqrt{(3007Hex-04Hex)^2 - (3007Hex-38Hex)^2}$	Dependent on capacity
3004Hex-04H ex/ 3009Hex-02H ex	1st Maximum Output Frequency/2nd Maximum Output Frequency	Design specification value	60.0Hz
3004Hex-08H ex	1st Acceleration Time 1		6.0 s
3004Hex-09H ex	1st Deceleration Time 1		6.0 s

Vector Control (With/without Speed Sensor) (PM: Synchronous Motor)

Parameter No.	Function name	Set data	Default data
3004Hex-2BH ex	1st Drive Control Selection	15: PM Vector control without speed and pole position sensor 16: PM Vector control with speed and pole position sensor	0
3004Hex-1BH ex	Carrier Frequency	Motor specification	2kHz
3004Hex-05H ex	1st Base Frequency	Motor rated value	50.0Hz
3004Hex-06H ex	1st Rated Voltage at Base Frequency		Dependent on capacity
3007Hex-02H ex	1st Motor Pole Number		4
3007Hex-03H ex	1st Motor Capacity		Dependent on capacity
3007Hex-04H ex	1st Motor Rated Current		Dependent on capacity
3007Hex-1FH ex	1st PM Motor Starting Method		0: Pull-in by current 1: For IPM type 1(Interior permanent magnet synchronous motor) 2: For SPM type (Surface permanent magnet synchronous motor) 3: Pull-in by current for IPM type 4: For IPM type 2(Interior permanent magnet synchronous motor)
3007Hex-40H ex	1st PM Motor Induced Voltage Ke	When unknown, perform rotation tuning.	Dependent on capacity
3007Hex-41H ex	1st PM Motor Iron Loss	When unknown, set 0%.	Dependent on capacity
3007Hex-5BH ex	1st PM Motor Overcurrent Protection Level	When unknown, set 2x the rated current.	Dependent on capacity
3004Hex-04H ex	1st Maximum Output Frequency	Design specification value	60.0Hz
3004Hex-10H ex	1st Frequency Upper Limit		70.0Hz
3004Hex-08H ex	1st Acceleration Time 1		6.0 s
3004Hex-09H ex	1st Deceleration Time 1		6.0 s

When Control with Speed Sensor Is Selected as Control Method

When a control with speed sensor is selected as the control method, the following parameters matched to the encoder specifications are required.

Parameter No.	Function name	Set data	Default data
3014Hex-0FHex	Input Terminal [PIA][PIB] Pulse Input Format Selection	2: Quadrature A/B signal (B phase lead) 3: Quadrature A/B signal (A phase lead)	2
3014Hex-10Hex	Input Terminal [PIA][PIB] Encoder Pulse Resolution	Number of pulses of motor encoder to be controlled 0400 (hexadecimal display) / 1024 P/R	0400 (hexadecimal display)
3014Hex-11Hex	Input Terminal [PIA][PIB] Pulse Scaling Factor Denominator	Set the speed reduction ratio of the motor and encoder.	1
3014Hex-12Hex	Input Terminal [PIA][PIB] Pulse Scaling Factor Numerator	When the encoder is directly coupled to the motor, this does not need to be set. (Default value = 1) Motor speed = Encoder speed × (3014Hex-12Hex)/(3014Hex-11Hex)	1

Parameters That Do Not Require Setting

The following table shows parameters whose values are determined by other parameters or parameters that do not need to be changed from their factory default values.

Parameter No.	Function name	Data	Default data	Unit
3007Hex-0EHex/ 3009Hex-1CHex	1st Iron Loss Factor 1/2nd Iron Loss Factor 1	0.00 to 20.00%	Dependent on capacity	%
3007Hex-38Hex/ 3009Hex-38Hex	1st Motor Torque Current under Vector Control/Torque Current for 2nd Vector Control	0.00 to 2000A	Dependent on capacity	A
3007Hex-39Hex/ 3009Hex-39Hex	1st Induced Voltage Factor under Vector Control/Induced Voltage Factor for 2nd Vector Control	50 to 100%	Dependent on capacity	%
3007Hex-42Hex	1st PM Motor d-axis Inductance Magnetic Saturation Correction	0.0 to 100% (100.0%=No magnetic saturation) 999 (Factory default)	999	%
3007Hex-4BHex	1st PM Motor Reference Current at Starting	10 to 200% (Based on the rated current of the motor)	80	%
3007Hex-56Hex	1st PM Motor Flux Limitation Value	50.0 to 150.0% 999 (Factory default)	999	%
3007Hex-58Hex	1st PM Motor Reference Current for Magnetic Pole Detection	0 to 200% (Based on the rated current of the motor)	0	%

7-2 V/f control with speed feedback

The 3G3M1 Series Inverter can perform V/f control with speed feedback by using the pulse train input function mounted as standard.

This control enables highly accurate and stable speed control based on the feedback of the pulse generator (PG) signal or the phase A/B signals from the encoder.

This section describes the settings and functions of V/f control with speed feedback.

7-2-1 Settings of V/f Control with Speed Feedback

In this control mode, the inverter can perform highly accurate and stable speed control as V/f control, based on the speed feedback data.

- To use this function, set “3: IM V/f control with speed sensor” at 1st Drive Control Selection (3004Hex-2BHex)/2nd Drive Control Selection (3009Hex-0FHex).
- Set the type of the pulse train signal to input in Input Terminal [PIA][PIB] Pulse Input Format Selection (3014Hex-0FHex), and the number of pulses per one rotation of the motor ($\times 1$ multiplication) in Input Terminal [PIA][PIB] Encoder Pulse Resolution (3014Hex-10Hex).
- Set values in Input Terminal [PIA][PIB] Pulse Scaling Factor Denominator (3014Hex-11Hex) and Input Terminal [PIA][PIB] Pulse Scaling Factor Numerator (3014Hex-12Hex) according to the speed reduction ratio of the motor and encoder.

Parameter No.	Function name	Data	Default data	Unit
3004Hex-2BHex/ 3009Hex-0FHex	1st Drive Control Selection/ 2nd Drive Control Selection	3: IM V/f control with speed sensor	0	-
3014Hex-0FHex	Input Terminal [PIA][PIB] Pulse Input Format Selection	0: Pulse train signing/pulse train input 1: Forward/reverse rotation pulse 2: Quadrature A/B signal (B phase lead) 3: Quadrature A/B signal (A phase lead)	2	-
3014Hex-10Hex	Input Terminal [PIA][PIB] Encoder Pulse Resolution	20 to 60000	1024	Pulse
3014Hex-11Hex	Input Terminal [PIA][PIB] Pulse Scaling Factor Denominator	1 to 32767	1	-
3014Hex-12Hex	Input Terminal [PIA][PIB] Pulse Scaling Factor Numerator	1 to 32767	1	-

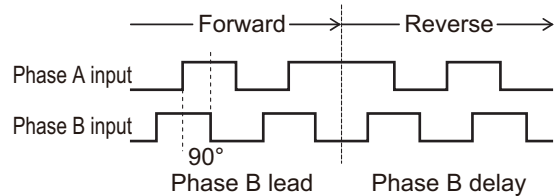
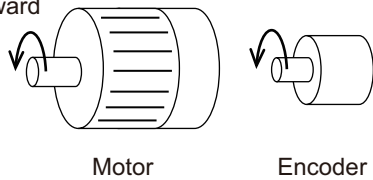
● Details of Input Terminal [PIA][PIB] Pulse Input Format Selection (3014Hex-0FHex)

The Input Terminal [PIA][PIB] Pulse Input Format Selection (3014Hex-0FHex) setting causes the inverter to recognize the feedback rotation direction as shown below.

3014Hex-0FHex data	Pulse input method	Remarks
2	Quadrature A/B signal (B phase lead)	
3	Quadrature A/B signal (A phase lead)	When 3014Hex-0FHex = 2, reverse rotation (A phase lead becomes forward rotation).

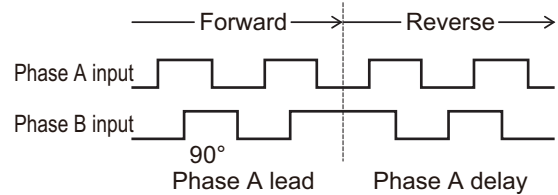
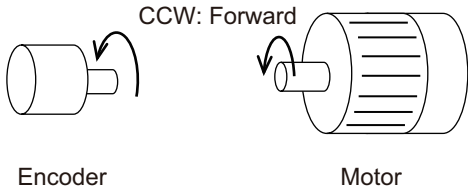
The counterclockwise direction (CCW) as viewed from the shaft side is taken as the forward rotation direction of the motors. At this time, if the output pulse of the encoder is B phase lead, set “2: Quadrature A/B signal (B phase lead)” at Input Terminal [PIA][PIB] Pulse Input Format Selection (3014Hex-0FHex).

CCW: Forward



If the output pulse of the encoder is A phase lead, set “3: Quadrature A/B signal (A phase lead)” at Input Terminal [PIA][PIB] Pulse Input Format Selection (3014Hex-0FHex).

CCW: Forward



Additional Information

In the case of a motor that complies with the IEC Standards, forward rotation causes the motor to rotate clockwise (CW).

Either connect the output pulse of the encoder during forward (CW) rotation so that it becomes B phase lead, or set Input Terminal [PIA][PIB] Pulse Input Format Selection (3014Hex-0FHex) to match the output pulse of the encoder.

7-2-2 Protective Detection under V/f Control with Speed Feedback

In V/f control with speed feedback, the following protective detection functions can be used. Use these functions according to your application.

Parameter No.	Function name	Data	Default data	Unit
3014Hex-16Hex	Speed Agreement / Speed Deviation Error Hysteresis Width	0.0 to 50.0	10.0	%
3014Hex-17Hex	Speed Agreement / Speed Deviation Error Detection Timer	0.00 to 10.00	0.50	s

Parameter No.	Function name	Data	Default data	Unit
3014Hex-18Hex	Speed Deviation Error Processing Selection	0: Continue to run 1 1: Stop with alarm 1 2: Stop with alarm 2 3: Continue to run 2 4: Stop with alarm 3 5: Stop with alarm 4	2	-
3014Hex-21Hex	Speed Limit 1 in Forward	0 to 110	100	%
3014Hex-22Hex	Speed Limit 2 in Reverse	0 to 110	100	%
3014Hex-24Hex	Over Speed Detection Level	0 to 120, 999: Depend on 3014Hex-21Hex, 3014Hex-22Hex	999	%
3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex	Input Terminal [DI1] to [DI7] Function Selection	71: DSAG (Speed agreement) 76: DSE (Excessive speed deviation)	-	-

● Overspeed error detection

If the output frequency exceeds the overspeed protection level, the inverter detects the overspeed protection alarm (alarm code: 1B) and shuts off (trips) inverter output.

- Conditions that cause an overspeed protection alarm
Over Speed Detection Level (3014Hex-24Hex) = 999

<Forward rotation side> Overspeed protection level = 1st Maximum Output Frequency (3004Hex-04Hex)/2nd Maximum Output Frequency (3009Hex-02Hex) × Speed Limit 1 in Forward (3014Hex-21Hex) (%) × 120 (%)

<Reverse rotation side> Overspeed protection level = 1st Maximum Output Frequency (3004Hex-04Hex)/2nd Maximum Output Frequency (3009Hex-02Hex) × Speed Limit 2 in Reverse (3014Hex-22Hex) (%) × 120 (%)

Over Speed Detection Level (3014Hex-24Hex) = Other than 999

Overspeed protection level = 1st Maximum Output Frequency (3004Hex-04Hex)/2nd Maximum Output Frequency (3009Hex-02Hex) × Over Speed Detection Level (3014Hex-24Hex) (%)

● Speed mismatch/excessive speed deviation

If the state where the difference between the frequency reference and the actual frequency exceeds the set value of Speed Agreement / Speed Deviation Error Hysteresis Width (3014Hex-16Hex) continues for Speed Agreement / Speed Deviation Error Detection Timer (3014Hex-17Hex), this state is judged to be a speed mismatch/excessive speed deviation, post-detection processing is performed according to the setting of Speed Deviation Error Processing Selection (3014Hex-18Hex).

3014Hex-18Hex data	Function	Detection condition	Post-detection processing	Error detection width when speed command > 3004Hex-05Hex
0	Continue to run 1	When the speed command (after software start processing) cannot be followed due to a heavy overload, for example, and the detection speed drops compared with the speed command, a PG error is not judged.	The excessive speed deviation "DSE" signal is output and the inverter continues to operate.	Even at 1st Base Frequency (3004Hex-05Hex) or higher, constant at "detection width = 3014Hex-16Hex × maximum frequency."
1	Stop with alarm 1		Inverter free-run at speed mismatch/excessive speed deviation (alarm code: 2F)	
2	Stop with alarm 2			
3	Continue to run 2	When the speed command (after software start processing) cannot be followed due to a heavy overload, for example, and the detection speed drops compared with the speed command, a PG error is not judged.	The excessive speed deviation "DSE" signal is output and the inverter continues to operate.	At 1st Base Frequency (3004Hex-05Hex) or lower, constant at "detection width = 3014Hex-16Hex × maximum frequency." At 1st Base Frequency (3004Hex-05Hex) or higher, "detection width = 3014Hex-16Hex × speed command × maximum frequency / base frequency."
4	Stop with alarm 3		Inverter free-run at speed mismatch/excessive speed deviation (alarm code: 2F)	
5	Stop with alarm 4			

When Continue to run (0 or 3) is set in Speed Deviation Error Processing Selection (3014Hex-18Hex), inverter output is not shut off (tripped). For this reason, allocate "76: DSE (excessive speed deviation)" to Output Terminal [DO1] Function Selection (3005Hex-15Hex) and Output Terminal [ROA, ROB] Function Selection (3005Hex-1CHex), and configure a sequence that, for example, stops control.

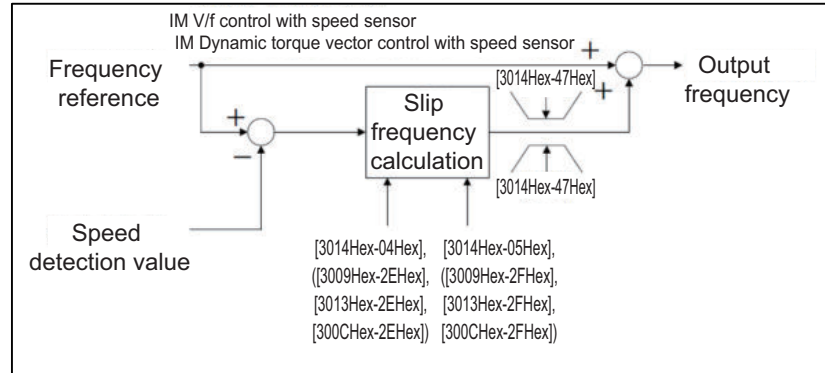
To judge that the speed deviation is within the setting range, allocate "71: DSAG (speed agreement)."

7-2-3 Adjustments for V/f Control with Speed Feedback

You can adjust the V/f control with speed feedback function with the gain settings shown below. However, the function cannot be adjusted when using a motor that causes an extremely large slip (10% of the rated rotation speed or higher) or in applications where such a large load that causes the motor to stall (or step out) is applied. If so, set the type and capacity of the motor again.

Parameter No.	Function name	Data	Default data	Unit
3014Hex-04Hex	Speed Control 1 P Proportional Gain	0.1 to 200.0	10.0	time
3014Hex-05Hex	Speed Control 1 I Integral Time	0.001 to 9.999 999: Disable	0.100	s

Parameter No.	Function name	Data	Default data	Unit
3014Hex-47Hex	Speed Control Slip Frequency Limit	0.00 to 100.00	100.00	%



● V/f control with speed feedback slip compensation proportional gain

At first, adjust the proportional gain for speed feedback control.

- Check and gradually increase the set value of PG feedback value (3017Hex-11Hex).
- While checking the PG feedback value (3017Hex-11Hex), increase the value within the range where the motor speed is stable.
- If the motor speed fluctuates or the motor vibrates wildly, decrease the set value until it becomes stable.
- When adjusting the response if the load is actually activated, increase the set value to improve response, or decrease the set value to make it stable.

● V/f control with speed feedback slip compensation integral time

Next, adjust the integral time for speed feedback control.

- Check and gradually decrease the set value of PG feedback value (3017Hex-11Hex).
- Decrease the value in the PG feedback value (3017Hex-11Hex) until it matches the reference frequency.
- If the motor speed fluctuates or the motor vibrates wildly, increase the set value until it becomes stable.
- When adjusting the response if the load is actually activated, decrease the set value to improve response, or increase the set value to make it stable.

● Speed control limiter

Speed Control Slip Frequency Limit (3014Hex-47Hex) is the limiter for the slip frequency that is added to the frequency reference. The maximum frequency is taken to be 100%. Ordinarily, leaving this setting at 100% causes no problems.

7-3 Sensorless Vector Control

A characteristic of an induction motor is that its rotation speed drops when output torque increases. When sensorless vector control is selected, the relationship between the output torque and rotation speed of an induction motor can be improved and high torque can be output even at low speeds. Sensorless vector control enables a high starting torque of 200% to be output at 0.5 Hz. An auto-tuning function (rotation method, stop method) that automatically sets motor constants also is mounted on the inverter.

7-3-1 Sensorless Vector Control Parameter Settings

- Set the 1st Drive Control Selection (3004Hex-2BHex)/2nd Drive Control Selection (3009Hex-0FHex) to “5: IM Vector control without speed sensor.”
- Set 1st Motor Capacity (3007Hex-03Hex)/2nd Motor Capacity (3009Hex-11Hex), 1st Motor Pole Number (3007Hex-02Hex)/2nd Manual Torque Boost Voltage (3009Hex-06Hex), 1st Motor Rated Current (3007Hex-04Hex)/2nd Motor Rated Current (3009Hex-12Hex) according to the motor in use.
- When rotation tuning is not possible, set 1st Motor Armature Resistance (3007Hex-07Hex)/2nd Motor Armature Resistance (3009Hex-15Hex) by the formula below. When rotation tuning is possible, setting is not required.

$$\sqrt{(3007\text{Hex-}04\text{Hex})^2 - (3007\text{Hex-}38\text{Hex})^2}$$

- Set the rated frequency of the motor to 1st Base Frequency (3004Hex-05Hex)/2nd Base Frequency (3009Hex-03Hex), and set the motor rated voltage to 1st Rated Voltage at Base Frequency (3004Hex-06Hex)/2nd Rated Voltage at Base Frequency (3009Hex-04Hex). If the motor synchronous speed can be confirmed, set the value calculated by the formula below to 3004Hex-05Hex/3009Hex-03Hex.

$$\frac{\text{Synchronous speed}}{120} \times \text{Number of poles}$$

- To use this function, set the motor constants of the motor in use according to 7-8-1 *Motor Off-line Auto-tuning* on page 7-65 and 7-3-2 *Motor Parameter Settings* on page 7-17.
- Motor magnetic flux is controlled according to the instructed torque by setting “1: Enable” in Magnetic Flux Weakening Control Function Selection (3014Hex-53Hex). When the instructed torque is small, motor magnetic flux is weakened and stability of control is improved with Magnetic Flux Weakening Lower Limit (3014Hex-54Hex) as the lower limit.
- Set the magnetic flux weakening lower limit value in % units in Magnetic Flux Weakening Lower Limit (3014Hex-54Hex). If the lower limit value is set to too low, there is the risk of the problems of hunting and speed delay.
Use the lower limit value at its factory default (40%) as far as feasibly possible.

Parameter No.	Function name	Data	Default data	Unit
3004Hex-2BHex	1st Drive Control Selection	0 : IM V/f control 1 : IM Dynamic torque vector control 5 : IM Vector control without speed sensor	0	-
3009Hex-0FHex	2nd Drive Control Selection <i>7-3-1 Sensorless Vector Control Parameter Settings</i> on page 7-16	0: IM V/f control 1: IM Dynamic torque vector control without speed sensor 5: IM Vector control without speed sensor		
3007Hex-03Hex/ 3009Hex-11Hex	1st Motor Capacity/2nd Motor Capacity	0.01 to 1000 kW	Dependent on capacity	kW
3007Hex-02Hex/ 3009Hex-06Hex	1st Motor Pole Number/2nd Manual Torque Boost Voltage	2 to 128 poles	4	Pole
3007Hex-04Hex/ 3009Hex-12Hex	1st Motor Rated Current/2nd Motor Rated Current	0.00 to 500.0 A	21	A
3007Hex-07Hex/ 3009Hex-15Hex	1st Motor Armature Resistance/2nd Motor Armature Resistance	0.00 to 500.0 A	10.55	A
3004Hex-05Hex/ 3009Hex-03Hex	1st Base Frequency/2nd Base Frequency	5.0 to 590.0	50.0	Hz
3004Hex-06Hex/ 3009Hex-04Hex	1st Rated Voltage at Base Frequency/2nd Rated Voltage at Base Frequency	80 to 240 V: AVR operation (200 V class series) 160 to 500 V: AVR operation (400 V class series)	200	V
3014Hex-53Hex	Magnetic Flux Weakening Control Function Selection	0: Disable 1: Enable	0	-
3014Hex-54Hex	Magnetic Flux Weakening Lower Limit	10 to 70%	40	%

*1. To enable switching to the 1st and 2nd control, allocate "12: SET (2nd control)" to either of input terminal [DI1] to [DI7].

7-3-2 Motor Parameter Settings

- Ordinarily, offline auto-tuning is performed to set motor parameters. However, if offline auto-tuning ends in error, for example, when the inverter does not reach 50% of its rated current during auto-tuning, set the motor parameters manually.
- To increase the performance of vector control, set each parameter value again according to the motor in use.
- Obtain the motor's datasheet from the motor manufacturer and set each motor parameter. For the following set values, set the data for one phase in a Y-connection after conversion in 1st Base Frequency (3004Hex-05Hex)/2nd Base Frequency (3009Hex-03Hex).

1st Motor Armature Resistance (3007Hex-07Hex)/2nd Motor Armature Resistance (3009Hex-15Hex) : Set the no-load current of the motor, or set the current value measured when the motor is in isolated no-load operation in 1st Base Frequency (3004Hex-05Hex)/2nd Base Frequency (3009Hex-03Hex).

1st Motor Parameter %R1 (3007Hex-08Hex)/2nd Motor Motor Constant %R1 (3009Hex-16Hex) : Set the wiring resistance value on the primary side of the motor for one phase in a Y-connection as a percentage Ohmic drop. Calculate by the following formula.

$$\%R1 = \frac{R1 + \text{Cable } R1}{V/(\sqrt{3} \times I)} \times 100 (\%)$$

R1: Motor primary resistance (Ω)

Cable R1: Resistance value c of output side cable

V: Motor rated voltage (V)

I: Motor rated current (A)

1st Motor Parameter %X (3007Hex-09Hex)/2nd Motor Motor Constant %X (3009Hex-17Hex) : Set the leakage inductance for one phase in a Y-connection motor as a percentage reactance drop. Calculate by the following formula.

$$\%X = \frac{X1 + X2 \times XM/(X2+XM) + \text{Cable } X}{V/(\sqrt{3} \times I)} \times 100 (\%)$$

X1: Motor primary leakage reactance (Ω)

X2: Motor secondary leakage reactance (primary converted value)

XM: Motor excitation reactance (Ω)

Cable X: Reactance of output side cable (Ω)

V: Motor rated voltage (V)

I: Motor rated current (A)

1st Rated Slip Frequency (3007Hex-0DHex)/2nd Rated Slip Frequency (3009Hex-1BHex) : Set the rated slip frequency in a Y-connection motor as Hz.

- After setting each motor parameter, adjust the parameters according to *7-3-3 Adjustments for Sensorless Vector Control* on page 7-18.
- To increase response, increase the setting of Speed Control 1 P Proportional Gain (3014Hex-04Hex)/Speed Control 2 P Proportional Gain (3009Hex-2EHex), and decrease the setting if motor hunting occurs.

Parameter No.	Function name	Data	Default data	Unit
3007Hex-07Hex/ 3009Hex-15Hex	1st Motor Armature Resistance/2nd Motor Armature Resistance	0.00 to 500.0 A	10.55	A
3007Hex-08Hex/ 3009Hex-16Hex	1st Motor Parameter %R1/2nd Motor Motor Constant %R1	0.00 to 50.00 %	3.17	%
3007Hex-09Hex/ 3009Hex-17Hex	1st Motor Parameter %X/2nd Motor Motor Constant %X	0.00 to 50.00 %	11.47	%
3007Hex-0DHex/ 3009Hex-1BHex	1st Rated Slip Frequency/2nd Rated Slip Frequency	0.00 to 15.00 Hz	1.00	Hz

7-3-3 Adjustments for Sensorless Vector Control

- To use sensorless vector control, perform offline auto-tuning. If offline auto-tuning cannot be performed, set the parameters of the motor in use according to *7-3-2 Motor Parameter Settings* on page 7-17.

- The inverter may not provide sufficient performance characteristics if the motor is two or more sizes smaller than the maximum applicable motor capacity. This is because the inverter requires a current accuracy of at least 50% of the rated current.
- If sensorless vector control does not provide the intended performance characteristics, adjust the motor parameters depending on the phenomenon, as shown in the following table.

Operation status	Phenomenon	Description of adjustment	Adjustment item
Power running	Actual motor speed is lower than target speed.	Increase the slip compensation gain (drive) or rated slip gradually.	3007Hex-0AHex/ 3009Hex-18Hex 3007Hex-0DHex/ 3009Hex-1BHex
	Actual motor speed is higher than target speed.		
Regeneration	Torque is insufficient at low frequencies (a few Hz).	Increase %R1 and no-load current gradually.	3007Hex-08Hex/ 3009Hex-16Hex 3007Hex-07Hex/ 3009Hex-15Hex
During startup	Shock occurs during startup.	Adjust the speed control P gain.	3014Hex-04Hex/ 3009Hex-2EHex
	Motor rotates momentarily in opposite direction to instructed rotational direction.	Set rotational direction limitation.	3008Hex-09Hex
At deceleration	Motor is hunting.	Adjust the speed control P gain.	3014Hex-04Hex/ 3009Hex-2EHex
Torque limiting	Torque becomes insufficient at low frequencies when torque limit is enabled.	Decrease the torque limit.	3004Hex-29Hex 3004Hex-2AHex 3005Hex-11Hex 3005Hex-12Hex
Low frequency operation	Rotation is unstable.	Adjust the speed control P gain.	3014Hex-04Hex/ 3009Hex-2EHex

Output Torque Monitor Function

To monitor the output torque, reference the torque calculation value (3010Hex-08Hex).

Parameter No.	Function name	Data	Default data	Unit
3010Hex-08Hex	Actual torque value/ Torque command value	-999 to 999	0	%

7-4 PM Motor

The 3G3M1 Series provides the PM motor mode.

Synchronous motors (PM motors) that are more efficient than induction motors (IM motors) can be controlled.

This section describes the PM motor mode.

7-4-1 PM Motor and PM Motor Control

PM Motor

A PM motor (abbreviation for “Permanent Magnet motor”) is a motor that uses permanent magnets for the motor rotor.

Generally, it is also called a synchronous motor. Compared with induction motors that are used conventionally for the inverter, PM motors allow no current flow on the rotor side, which results in highly efficient operation due to reduced loss.

In terms of the internal construction, there are various types of PM motors: IPM motors (interior permanent magnet type), SPM motors (surface permanent magnet type), and so on.

PM motors have the control characteristics as shown below.

When using the PM motor mode of the 3G3M1 Series Inverter, understand the following characteristics before selecting the inverter type and function settings.

- The applied AC power must be synchronized with the rotor permanent magnets.
 - Although the motor allows a large current to flow, it cannot output a sufficient torque if the AC power is not synchronized.
- The permanent magnets used for the rotor are subject to demagnetization if a large current flows in the PM motor.
 - Once a rotor is demagnetized, the motor cannot output a sufficient torque and must be replaced.

PM Motor Control

PM motor control with speed feedback can be selected on the 3G3M1 Series.

As large startup torque cannot be output, PM motor control without speed feedback is suitable for applications with reduced torque characteristics (which do not require torque at low speeds) such as fans and pumps.

For applications with constant torque characteristics such as general transfer equipment and elevating axes (which require a torque exceeding the rated torque also at low speeds), select PM motor control with speed feedback.

In PM motor control without speed feedback, use control with startup torque at 50% or less of the motor rated torque to keep the PM motor in a synchronized state.

Follow the steps below to use PM motor control.

1. Switch to the PM motor mode (*7-4-2 Switching to PM Motor Mode* on page 7-21)
2. Execute offline auto-tuning for PM motor parameters (*7-8-1 Motor Off-line Auto-tuning* on page 7-65)
3. Set PM motor parameters (*7-3-2 Motor Parameter Settings* on page 7-17)

Refer to this section if offline auto-tuning fails.

- Adjust the PM motor mode (7-4-4 Adjustment of PM Motor Mode Settings on page 7-22)

Parameters with Changed Default Data

Changing the control method switches the default data for the following parameters.

Parameter No.	Function name	3004Hex-2BHex set value	
		Changed from 15, 16 to other than 15, 16	Changed from other than 15, 16 to 15, 16
3004Hex-04Hex	1st Maximum Output Frequency	60	90
3004Hex-05Hex	1st Base Frequency	50	90
3004Hex-06Hex	1st Rated Voltage at Base Frequency	200/400	Individual capacity values for PMSM
3004Hex-07Hex	1st Rated Voltage at Maximum Output Frequency	200/400	Individual capacity values for PMSM
3004Hex-0CHex	1st Motor Electronic Thermal Level	Individual capacity values for IM	Individual capacity values for PMSM
3004Hex-0DHex	1st Motor Electronic Thermal Time Constant	5 minutes	Less than 18.5 kW: 2 minutes 18.5 kW or more: 5 minutes
3004Hex-10Hex	1st Frequency Upper Limit	70	90
3004Hex-18Hex	1st Starting Frequency	0.5	1
3004Hex-1BHex	Carrier Frequency	2	4
3005Hex-33Hex	1st Frequency Conversion Coefficient	30	20
3007Hex-02Hex	1st Motor Pole Number	4	6
3007Hex-04Hex	1st Motor Rated Current	Individual capacity values for IM	Individual capacity values for PMSM
3014Hex-02Hex	Speed Control 1 Speed Command Filter	0.02	0.2
3014Hex-03Hex	Speed Control 1 Speed Detection Filter	0.005	0.025
3014Hex-04Hex	Speed Control 1 P Proportional Gain	10	2
3014Hex-05Hex	Speed Control 1 I Integral Time	0.1	0.6
3014Hex-07Hex	Speed Control 1 Output Filter	0.002	0

Parameter No.	Function name	3004Hex-2BHex set value	
		Changed from 15 to other than 15	Changed from other than 15 to 15
3014Hex-44Hex	Motor Starting Mode Auto Search in Speed Sensor Vector Control	1	2

7-4-2 Switching to PM Motor Mode

To switch to the PM motor control mode, set “15: PM Vector control without speed and pole position sensor” or “16: PM Vector control with speed and pole position sensor” to 1st Drive Control Selection (3004Hex-2BHex), and switch to the PM motor mode.

The PM motor can be connected only in drive control selection 1.

Parameter No.	Function name	Data	Default data	Unit
3004Hex-2BHex	1st Drive Control Selection	15 : PM Vector control without speed and pole position sensor 16 : PM Vector control with speed and pole position sensor	0	-

7-4-3 Offline Auto-tuning for PM Motor Parameters

For details on auto-tuning a PM motor, refer to *7-8-1 Motor Off-line Auto-tuning* on page 7-65.

7-4-4 Adjustment of PM Motor Mode Settings

PM Motor Adjustment Parameters

For the adjustment of PM motor control, this inverter provides parameters for the control method during startup, parameters for stableness and responsiveness, and initial pole position estimation functions. The following table summarizes the parameters.

For details on how to adjust these parameters, refer to the next section onwards.

Parameter No.	Function name	Data	Default data	Unit
3004Hex-19Hex	1st Starting Frequency 1 Holding Time	0.00 to 10.00	0.00	s
3004Hex-1BHex	Carrier Frequency	0: 0.75 kHz 1 to 16	2	kHz
3014Hex-04Hex	Speed Control 1 P Proportional Gain	0.1 to 200.0	10.0	time
3014Hex-05Hex	Speed Control 1 I Integral Time	0.001 to 9.999 999: Disable	0.100	s
3007Hex-1FHex	1st PM Motor Starting Method	0: Pull-in by current 1: For IPM type 1 (Interior permanent magnet synchronous motor) 2: For SPM type (Surface permanent magnet synchronous motor) 3: Pull-in by current for IPM type 4: For IPM type 2 (Interior permanent magnet synchronous motor)	1	-
3007Hex-3EHex	1st PM Motor d-axis Inductance	0.00 to 500.00	4.77	mH
3007Hex-3FHex	1st PM Motor q-axis Inductance	0.00 to 500.00	10.70	mH
3007Hex-4BHex	1st PM Motor Reference Current at Starting	10 to 200 (Based on the rated current of the motor)	80	%
3007Hex-5AHex	{P89Motor 1 (PM motor control switching level)}	0 to 100	0	%

PM Motor Adjustment

Adjust the PM motor as shown in the table below depending on its operation status and the phenomenon.

Operation status	Phenomenon	Description of adjustment	Adjustment item
During startup	Motor rotates in reverse or rotates slightly.	The motor may rotate slightly in magnetic pole alignment during startup. Set 1st PM Motor Starting Method 3007Hex-1FHex to 1 to suppress the rotation amount during startup. When operation is performed with 3007Hex-1FHex set to 0 or 3, reverse rotation becomes difficult by lowering 3007Hex-4BHex.	3007Hex-1FHex x 3007Hex-4BHex
	Motor stalls or causes an overcurrent trip.	If the motor stalls during startup, a large current may flow, which causes an overcurrent trip. Increase the PM motor starting current value. Increasing the PM motor starting current value improves the magnetic pole alignment during startup, which results in an increase in the startup torque. However, setting this parameter to an excessively large value may cause detection of an overload. Check the value in the monitor of electronic thermal overload protection for motor (monitor mode: 5_62).	3007Hex-4BHex
		Increase the PM motor starting time value. This increases the time during which the starting current flows to improve magnetic pole alignment during startup, which results in an increase in the startup torque.	3004Hex-19Hex x
	Motor starting time is too long.	Set 3007Hex-1FHex correctly according to the motor in use.	3007Hex-1FHex x

Operation status	Phenomenon	Description of adjustment	Adjustment item
Motor rotating	Rotation is unstable.	If the motor rotation is unstable during startup, increase the motor starting current. However, setting this parameter to an excessively large value may cause detection of an overload. Check the value in the monitor of electronic thermal overload protection for motor (monitor mode: 5_62).	3007Hex-4BHex
	A shock or overcurrent trip occurs.	Adjust the speed control gain to a larger value and the integral time to a smaller value.	3014Hex-04Hex, 3014Hex-05Hex
	Motor is hunting or vibrating.	Adjust the speed control gain to a smaller value and the integral time to a larger value.	3014Hex-04Hex, 3014Hex-05Hex
		Increase the carrier frequency if it is low.	3004Hex-1BHex
		Gradually increase the PM motor d-axis inductance. Gradually increase the PM motor q-axis inductance.	3007Hex-3EHex 3007Hex-3FHex

Overcurrent protection

PM motors must set with an allowable current value for preventing the permanent magnet from becoming demagnetized. If a current exceeding this allowable current value is allowed to pass, the magnetic force of the permanent magnet weakens and the desired motor characteristics can no longer be obtained.

When a current of current value set in 1st PM Motor Overcurrent Protection Level (3007Hex-5BHex) or higher flows, overcurrent protection alarms (alarm code: 01, 02, 03) are output to protect the motor.

Parameter No.	Function name	Data	Default data	Unit
3007Hex-5BHex	1st PM Motor Overcurrent Protection Level	0.00 to 4000A (0.00: No active)	50.00	A

High-efficiency Control

In the operation of PM motors, motor parameters are used to perform high-efficiency control. Operation of a PM motor with the motor parameters unknown or in a state where rotation tuning cannot be performed is sometimes possible by disabling high-efficiency control.

To disable high-efficiency control, set PM Motor High-efficiency Control Selection (3014Hex-5AHex) to 0.

Parameter No.	Function name	Data	Default data	Unit
3014Hex-5AHex	PM Motor High-efficiency Control Selection	0: Disable 1: Enable	1	-

Magnetic Position Detection Completed Signal (PTD)

The ON signal is output when the magnetic pole position is detected at PM motor startup. This parameter is enabled when 3007Hex-1FHex is set to other than 0.

Parameter No.	Function name	Data	Default data	Unit
3005Hex-15Hex, 3005Hex-1CHex	Output Terminal [DO1] Function Selection, Output Terminal [ROA, ROB] Function Selection	89: PTD (magnetic position detection completed signal)	-	-

Synchronous Motor Magnetic Pole Position Pull-in Frequency

When using an encoder having A, B and Z phase outputs in PM Vector control with speed and pole position sensor, pull-in operation at the magnetic pole position is performed at the frequency set at 3014Hex-51Hex during the period up to detection of the Z phase immediately after power is turned ON as the magnetic pole position is unknown. After detection of the Z phase, the magnetic pole position referenced to the magnetic pole position sensor offset set to 3007Hex-60Hex is established, and regular operation is switched to.

Generally, there is no need for adjustment.

Parameter No.	Function name	Data	Default data	Unit
3014Hex-51Hex	1st PM Motor Magnetic Pole Position Pull-in Frequency	0.1 to 10.0	1.0	Hz

7-5 Speed Control

The 3G3M1 Series is provided with speed control.

This section describes the speed control settings and functions.

7-5-1 Speed Control Settings

Speed control parameters can be selected from four types by combining speed control signals. Speed control is enabled in vector control with speed sensor, V/f control with speed sensor and vector control without speed sensor (permanent magnet synchronous motor). Speed control parameters can be adjusted to perform optimum speed control.

Parameter No.	Function name	Data	Default data	Unit
3014Hex-02Hex/ 3009Hex-2CHex/ 3013Hex-2CHex/ 300CHex-2CHex	Speed Control 1 Speed Command Filter/Speed Control 2 Speed Command Filter/Speed Control 3 Speed Command Filter/Speed Control 4 Speed Command Filter	0.000 to 5.000	0.02	s
3014Hex-03Hex/ 3009Hex-2DHex/ 3013Hex-2DHex/ 300CHex-2DHex	Speed Control 1 Speed Detection Filter/Speed Control 2 Speed Detection Filter/Speed Control 3 Speed Detection Filter/Speed Control 4 Speed Detection Filter	0.000 to 0.100	0.005	s
3014Hex-04Hex/ 3009Hex-2EHex/ 3013Hex-2EHex/ 300CHex-2EHex	Speed Control 1 P Proportional Gain/Speed Control 2 P Proportional Gain/Speed Control 3 P Proportional Gain/Speed Control 4 P Proportional Gain	0.1 to 200.0	10	-
3014Hex-05Hex/ 3009Hex-2FHex/ 3013Hex-2FHex/ 300CHex-2FHex	Speed Control 1 I Integral Time/Speed Control 2 I Integral Time/Speed Control 3 I Integral Time/Speed Control 4 I Integral Time	0.001 to 9.999 999: Disable	0.1	s
3014Hex-06Hex/ 3009Hex-30Hex/ 3013Hex-30Hex/ 300CHex-30Hex	Speed Control 1 FF Gain/Speed Control 2 FF Gain/Speed Control 3 FF Gain/Speed Control 4 FF Gain	0.00 to 99.99	0	s
3014Hex-07Hex/ 3009Hex-31Hex/ 3013Hex-31Hex/ 300CHex-31Hex	Speed Control 1 Output Filter/Speed Control 2 Output Filter/Speed Control 3 Output Filter/Speed Control 4 Output Filter	0.000 to 0.100	0.002	s
3014Hex-08Hex/ 3009Hex-32Hex/ 3013Hex-32Hex/ 300CHex-32Hex	Speed Control 1 Notch Filter Resonance Frequency/Speed Control 2 Notch Filter Resonance Frequency/Speed Control 3 Notch Filter Resonance Frequency/Speed Control 4 Notch Filter Resonance Frequency	1 to 500	200	Hz

Parameter No.	Function name	Data	Default data	Unit
3014Hex-09Hex/ 3009Hex-33Hex/ 3013Hex-33Hex/ 300CHex-33Hex	Speed Control 1 Notch Filter Attenuation Level/Speed Control 2 Notch Filter Attenuation Level/ Speed Control 3 Notch Filter Attenuation Level/Speed Control 4 Notch Filter Attenuation Level	0 to 40	0	dB
3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex	Input Terminal [DI1] to [DI7] Function Selection	78: Speed control parameter selection 1 79: Speed control parameter selection 2	-	-

Switching Speed Control Constants

In readiness for cases where speed control constants must be changed according to changes in load or machine conditions, the 3G3M1 has four speed control constants. These can be switched by speed control parameter selection 1 terminal input "MPRM1" and speed control parameter selection 2 "MPRM2." Speed control constants 1 and 2 can also be switched by the "SET (2nd control)" terminal.

Input signal		Switching speed control constants
MPRM2	MPRM1	
OFF	OFF	Speed control constant 1: 3014Hex-02Hex to 3014Hex-09Hex
OFF	ON	Speed control constant 2: 3009Hex-2CHex to 3009Hex-33Hex
ON	OFF	Speed control constant 3: 3013Hex-2CHex to 3013Hex-33Hex
ON	ON	Speed control constant 4: 300CHex-2CHex to 300CHex-33Hex

Input signal SET	Switching speed control constants
OFF	Speed control constant 1: 3014Hex-02Hex to 3014Hex-09Hex
ON	Speed control constant 2: 3009Hex-2CHex to 3009Hex-33Hex

Speed Command Filter (3014Hex-02Hex/3009Hex-2CHex/3013Hex-2CHex/300CHex-2CHex)

This parameter is for setting the time constant of the primary lag filter for the speed set value. Adjust this parameter, for example, when overshooting in response to changes in the speed command is large.

Setting a large filter time constant stabilizes the output and reduces overshoot in response to changes in the speed setting though the speed response becomes slower.

Speed Detection Filter (3014Hex-03Hex/3009Hex-2DHex/ 3013Hex-2DHex/300CHex-2DHex)

This parameter is for setting the time constant of the primary lag filter with respect to the speed detection value. This is a filter for feedback. Set it when the mechanical system vibrates.

Adjust this parameter, for example, when ripple (vibration component) is carried on the speed detection signal as a result of the control target (mechanical system) such as belt deflection, and hunting caused by that vibration component prevents gain, etc. of the PI controller from being sufficiently increased (response is slow). Also, set this parameter when there are few pulses from the encoder which results in a speed that causes vibration.

When the filter time constant is increased, the speed detection value is stabilized, and the gain of the PI controller can be increased even if ripple is carried on the speed detection signal. Note, however, that as speed detection itself is delayed, speed response slows down, overshooting increases and sometimes results in hunting.

P (Gain) (3014Hex-04Hex/3009Hex-2EHex/3013Hex-2EHex/ 300CHex-2EHex), I (Integral Time) (3014Hex-05Hex/3009Hex-2FHex/ 3013Hex-2FHex/300CHex-2FHex)

These parameters are for setting the gain and integral time of the speed controller (ASR).

By setting 3014Hex-05Hex = 999, the integral operation can be disabled.

- P (gain)

Definition of P gain = 1.0 is a torque command of 100% (100% torque output at each capacity) when the speed deviation (speed command - actual speed) is 100% (equivalent to the maximum speed setting).

Adjust the P gain according to the moment of inertia of the machine connected to the motor shaft. When the moment of inertia increases, P gain also must be increased to ensure the same response. When P gain is increased, control response becomes faster, however, the motor speed sometimes overshoots and the motor hunts. Also, machine resonance and excessive noise amplitude causes the machine or motor to generate abnormal noise.

If this happens, the resonance amplitude can be decreased by lowering P gain. However, excessively decreasing P gain causes control response to slow down, low-frequency speed fluctuations to occur, and stabilization of the motor speed to take longer.

- I (integral time)

When the integral time is set to a small value, response is fast as the correction time for deviation is short. To allow overshooting to enable the target speed to be reached quickly, decrease the set value, and when overshooting cannot be allowed, increase the set value.

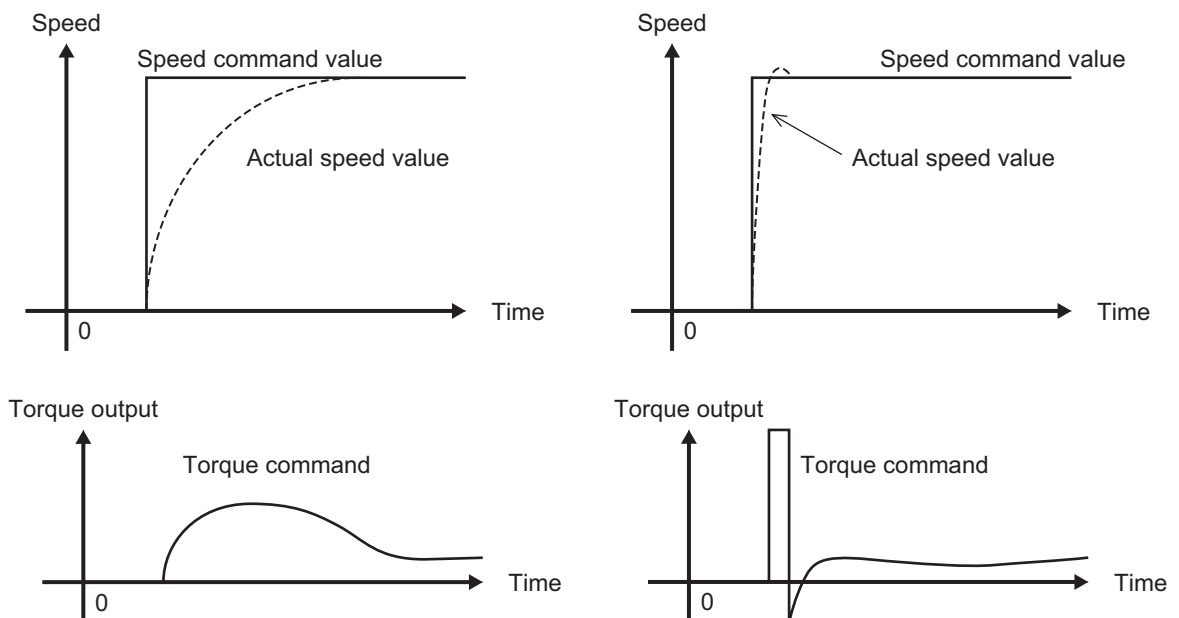
In cases where machine resonance occurs and abnormal machine noise is emitted from the motor and gears, the resonance point can be moved to the low frequency side to suppress resonance in the high frequency region by increasing the integral time.

FF (Gain) (3014Hex-06Hex/3009Hex-30Hex/3013Hex-30Hex/ 300CHex-30Hex)

This parameter performs feedforward control for adding the torque that is determined from the amount of change in the speed command directly to the torque command.

PI control of the speed controller is feedback control whereby corrective action (following the speed command) is performed according to the result (actual speed value) of the control target. Accordingly, with this control, correction also is effective on external disturbances that cannot be measured and causes that cannot be directly measured such as the uncertainty of control target characteristics. However, changes also in known command amounts are corrected after they appear in deviation (speed command - actual speed value) later on. As the control value (torque command) is required in advance for known causes, faster-response control can be expected by adding that control value directly to the torque command. This parameter is for performing this kind of control. Feedforward control adds the torque that is determined from the amount of change in the speed command directly to the torque command.

This is effective when the load inertia is already known. As shown conceptually in the figure below, the speed of the actual value following the command amount when feedforward control is disabled and when it is enabled is completely different. Note, however, that, in order to obtain maximum effect, the PI constants of feedback control should be adjusted to balance well with this set value.



Although the above effect can be obtained by setting the P gain of the speed controller to a higher value, increasing gain is counterproductive as it also increases system response and produces machine resonance and vibration sound.

Notch Filter Resonance Frequency (3014Hex-08Hex/ 3009Hex-32Hex/3013Hex-32Hex/300CHex-32Hex) and Notch Filter Attenuation Level (3014Hex-09Hex/3009Hex-33Hex/3013Hex-33Hex/ 300CHex-33Hex)

The speed loop gain at only near a preset resonance point can be lowered to suppress machine resonance. The notch filter can be used only when “vector control with speed sensor” is selected. Setting a higher speed loop gain to increase speed response may result in machine resonance being generated.

To suppress machine resonance, the speed loop gain must be lowered to lower the overall speed response. If the notch filter is used at this time, the speed loop gain at only near the preset resonance point can be lowered, and the speed loop gain at other than the resonance point can be set higher. As a result, the overall speed response can be increased.

When “0” (dB) is set to “attenuation level,” the notch filter is disabled.

Speed Control Speed Loop Switching Time at Parameter Change (3014Hex-1AHex)

Parameters can be switched even when the inverter is operating. The parameters that can be switched include the P gain and I integral time of the speed control system. When these parameters are switched while the inverter is operating, in some load operating conditions, sudden torque fluctuations may occur and cause mechanical shock which may be problematic.

To alleviate this kind of shock, suppress sudden fluctuations in torque by setting the ramp function in Speed Control Speed Loop Switching Time at Parameter Change (3014Hex-1AHex) when switching parameters.

Parameter No.	Function name	Data	Default data	Unit
3014Hex-1AHex	Speed Control Speed Loop Switching Time at Parameter Change	0.000 to 1.000	0.000	s

Slip Frequency Limit (3014Hex-47Hex)

A limiter can be set to PI calculation output of speed control systems by V/f control with speed sensor and dynamic torque vector control with speed sensor. This is enabled only when “3: IM V/f control with speed sensor” or “4: IM Dynamic torque vector control with speed sensor” is selected at Drive Control Selection (3004Hex-2BHex/3009Hex-0FHex).

In a normal control state, PI calculation output is within “slip frequency × maximum torque %.”

When an abnormal state, for example, a temporary excessive load, occurs, PI calculation output deviates considerably and it sometimes takes time to return to a normal state. For this reason, abnormal operation can be suppressed by limiting PI calculation output.

7-6 Torque control

The 3G3M1 Series provides the torque control mode.

This section describes the torque control settings and functions.

7-6-1 Torque Control Settings

The inverter provides torque control that controls the output torque of the motor.

- This function is enabled when “5: IM Vector control without speed sensor,” “6: IM Vector control with speed sensor” and “16: PM Vector control with speed and pole position sensor” are set in 1st Drive Control Selection (3004Hex-2BHex)/2nd Drive Control Selection (3009Hex-0FHex).
- Torque control can be switched between enabled and disabled by the setting of parameter 3008Hex-13Hex. Torque control can be switched to speed control by turning “23: ATR (torque control cancel)” allocated to Input Terminal [DI1] to [DI7] Function Selection (3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex) to ON with the torque reference enabled.
- Select torque command input in Torque Reference Selection (3051Hex-21Hex). One of Torque Reference (3051Hex-22Hex), analog input and fieldbus (option) can be selected.

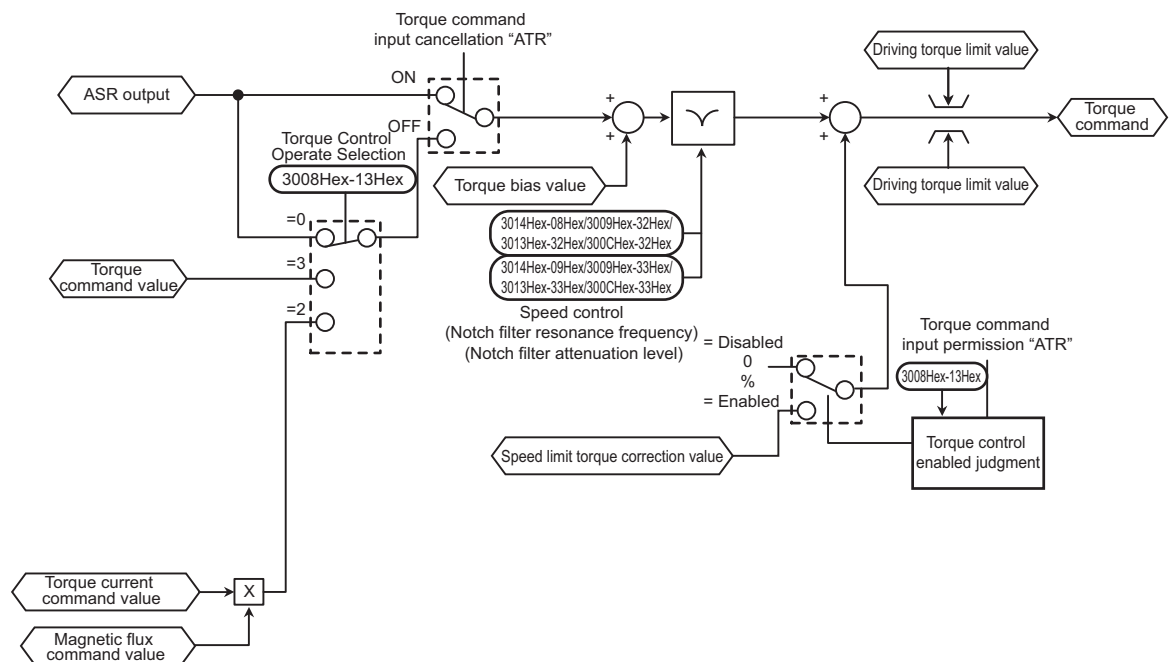
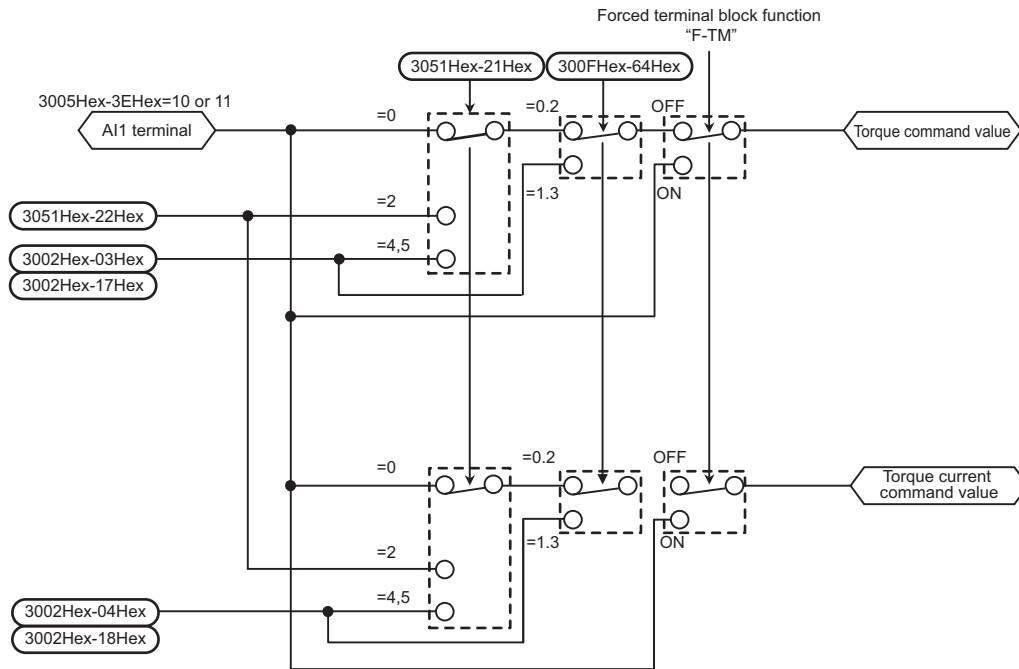
When instructing the torque command by analog input, torque becomes 0% to 200% at 0 to 10 V.

- Because, under torque control, the speed of the inverter is determined by the balance between torque and load, to prevent the inverter from going out of control, set the speed limit/acceleration level as a percentage of the maximum frequency in 3014Hex-21Hex (for forward rotation) and 3014Hex-22Hex (for reverse rotation).
- The torque command value of this torque control function takes the motor rated torque to be 100%.
- When “4: B/D (torque polarity detection)” is allocated to a multifunction output terminal, the signal for distinguishing drive torque or braking torque is output. The OFF signal is output when the torque is drive torque, and the ON signal is output when the torque is braking torque.

Parameter No.	Function name	Data	Default data	Unit
3008Hex-13Hex	Torque Control Operate Selection	0: Disable (Speed control) 2: Torque current command input 3: Torque command input	0	-
3051Hex-21Hex	Torque Reference Selection	0: Analog input 2: Operator (H333) 4: RS-485 communication 5: Fieldbus (Reserved)	0	-
3051Hex-22Hex	Torque Reference	0 to 200 %	0	%
3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex	Input Terminal [DI1] to [DI7] Function Selection	23: ATR (torque control cancel)	-	-

Parameter No.	Function name	Data	Default data	Unit
3005Hex-15Hex, 3005Hex-1CHex	Output Terminal [DO1] Function Selection, Output Terminal [ROA, ROB] Function Selection	4: B/D (torque polarity detection)	-	-
3005Hex-3EHex	Input Terminal [AI1] Function Selection	10: Torque command 11: Torque current command	-	-
300FHex-64Hex	Support Tool Link Function Selection	0: Numerical setting and terminal command (including operation command) by related parameter settings 1: Numerical setting uses communications command (support tools) 2: Terminal setting uses communications command (support tools) 3: Both numerical setting and terminal command use communications command (support tools) Numerical setting means Frequency reference, torque command, or torque bias command.	0	-
3002Hex-03Hex	Torque Reference	-327.68 to 327.67 ^{*1}	0.00	%
3002Hex-04Hex	Torque Current Command	-327.68 to 327.67 ^{*1}	0.00	%
3002Hex-17Hex	Torque Reference via Communication	-327 to 327 ^{*1}	0	%
3002Hex-18Hex	Torque Current Command via Communication	-327 to 327 ^{*1}	0	%

*1. The upper and lower limits of the torque command via communications are $\pm 200.00\%$. When the command contains a value exceeding the $\pm 200.00\%$ range, the torque command is limited internally to $\pm 200.00\%$.



7-6-2 Torque Bias Function Settings

This function is for applying bias to the torque command in torque control.

- This function is enabled when "5: IM Vector control without speed sensor," "6: IM Vector control with speed sensor" and "16: PM Vector control with speed and pole position sensor" are set in 1st Drive Control Selection (3004Hex-2BHex)/2nd Drive Control Selection (3009Hex-0FHex).
- Select the command source of torque bias in Torque Bias Function Selection (3020Hex-37Hex).
 - "0: Torque bias invalid"
Disables torque bias.
 - "1: Torque bias (Level 1 to 3)"

Switches the torque bias level according to “TB1” and “TB2” allocated to multifunction input terminals.

Input signal		Torque bias value selection
TB1	TB2	
OFF	OFF	No torque bias
OFF	ON	3020Hex-38Hex: Torque bias level 1
ON	OFF	3020Hex-39Hex: Torque bias level 2
ON	ON	3020Hex-3AHex: Torque bias level 3

“2: Analog torque bias”

Set Input Terminal [AI1] Function Selection (3005Hex-3EHex) to “9: torque bias,” and determine the torque bias value by analog voltage input.

When “62: H-TB (Torque bias hold)” is allocated to Input Terminal [DI1] to [DI7] Function Selection (3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex) and the terminal is turned ON, the torque bias level currently entered to that input is held.

“5: Fieldbus”

Set Torque Bias Value via Communication (3002Hex-10Hex)/Torque Bias Value (3002Hex-19Hex) via the fieldbus.

- The torque command value of this torque control function takes the motor rated torque to be 100%.
- Set the polarity of the instructed torque bias value in Torque Bias Polarity Selection (3051Hex-23Hex).

“0: Signed”

The forward torque increases when the torque bias value is positive (+) and the reverse torque increases when the torque bias value is negative (-), independent of the operation direction.

“1: Depends on the run direction”

The direction in which torque bias works depends on the RUN command direction.

Forward command	:	Forward torque increases when torque bias value is positive (+). Reverse torque increases when torque bias value is negative (-).
Reverse command	:	Reverse torque increases when torque bias value is positive (+). Forward torque increases when torque bias value is negative (-).

- Set Torque Bias Mechanical Loss Compensation (3020Hex-3BHex) to compensate for mechanical loss.
- Shock is sometimes large when the torque bias is simply added. Startup with little shock is possible by setting a timer in Torque Bias Startup Timer (3020Hex-3CHex). Set the timer as the time for adding 100% torque. When 0 is set, all the torque bias value is added instantaneously.
- Torque bias can be gradually excluded in the same way as the startup timer by setting Torque Bias Shutdown Timer (3020Hex-3EHex). Set the timer as the time for subtracting 100% torque. When 0 is set, all the torque bias value is subtracted.
- The maximum torque bias value can be limited by setting Torque Bias Limit (3020Hex-3FHex).

Parameter No.	Function name	Data	Default data	Unit
3020Hex-37Hex	Torque Bias Function Selection	0: Invalid 1: Parameter ""torque bias 1 to 3"" (H155 to H157) 2: Analog input 5: EtherCAT	0	-
3020Hex-38Hex/ 3020Hex-39Hex/ 3020Hex-3AHex	Torque Bias Level 1 Torque Bias Level 2 Torque Bias Level 3	-300 to +300 %	0	%
3020Hex-3BHex	Torque Bias Mechanical Loss Compensation	0 to 300	0	%
3020Hex-3CHex	Torque Bias Startup Timer	0.00 to 1.00	0.00	s
3020Hex-3EHex	Torque Bias Shutdown Timer	0.00 to 1.00	0.00	s
3020Hex-3FHex	Torque Bias Limit	0 to 300	200	%
3051Hex-23Hex	Torque Bias Polarity Selection	0: Signed 1: Depends on the run direction	0	-
3002Hex-10Hex	Torque Bias Value via Communication	-327.68 to 327.67	0.00	%
3002Hex-19Hex	Torque Bias Value	-327 to +327 (Truncate to 3002Hex-10Hex set value)	0	%
3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex	Input Terminal [DI1] to [DI7] Function Selection	60: TB1 (Torque bias command 1) 61: TB2 (Torque bias command 2) 62: H-TB (Torque bias hold)	-	-

7-7 Position Control

On the 3G3M1 Series, the PG feedback signal can be used to perform position control.

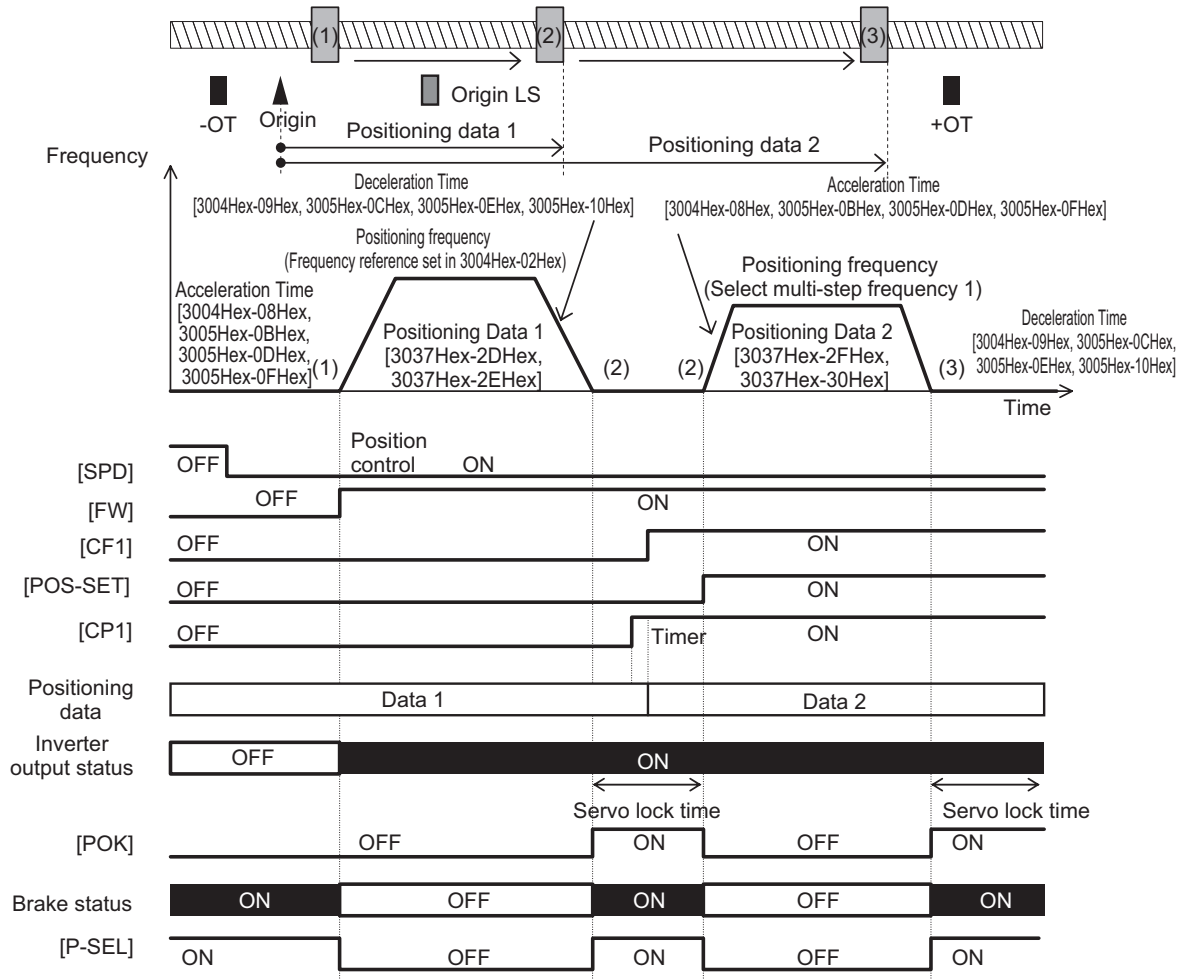
The pulses of the feedback signal are counted internally by the inverter, and operation is performed so that moving amount is to the specified position data.

In vector control with speed sensor or V/f control with speed sensor, the speed and position are calculated based on the feedback signal. In vector control without speed sensor or V/f control without speed sensor, only position is calculated based on the feedback signal. The inverter is also mounted with an orientation function as an applied function for position control.

The position control function can be used in 1st and 2nd control. However, note that only one set of position control related parameters is provided for the position control function.

7-7-1 Basic Operation

Positioning control is enabled by turning digital input “SPD” OFF during a stop. After that, operation is started by input of the RUN command, acceleration is performed up to the set frequency, and a deceleration and stop are performed so that movement is made up to the position data. When movement stops, the servo lock is activated. Eight types of positioning data can be selected by combinations of “CP1,” “CP2” and “CP3.” Movement is resumed by a change made to the position data (target position changed) by “POS-SET” turning ON. When the target position is reached and the servo lock is activated, digital output “POK” turns ON. If “P-SEL” is turned ON when the mechanical brake is applied during a servo lock, the electric angle is fixed so that the mechanical brake can be input.



7-7 Position Control

7

7-7-1 Basic Operation

List of input terminal functions		
Data	Terminal function	Description
42	ORL: Origin search limit signal	The return-to-origin operation is as follows: After "ORL" is turned ON during return-to-origin operation, movement is made by the homing offset from the initial Z phase of the PG, and movement is stopped.
119	P-SEL: ASR integral term cancellation	When "P-SEL" is turned ON, the integral term of the speed controller is canceled and P operation is performed. When the mechanical brake is applied during position control, the motor cannot rotate even if there exists position error. For this reason, the integral term accumulates which sometimes causes an overload trip to occur. In such a case, use this function.
135	INC/ABS: Increment/absolute position switching	When "INC/ABS" turns ON, the positioning data is taken as the absolute position from the current position. When "INC/ABS" turns OFF, the positioning data is taken as the absolute position from the origin.
136	ORT: Orientation command	Orientation operation is started when "ORT" is turned ON.

List of input terminal functions		
Data	Terminal function	Description
137	SPD: Speed/position switching	The mode changes to the position control mode when "SPD" is turned OFF. The mode changes to the speed control mode when turned ON. This function can be operated during operation. After positioning by position control, the state changes to a servo lock state (in vector control) or to a DC braking state (in V/f control).
138	ORG: Return-to-origin start up signal	The mode changes to the return-to-origin mode when "ORG" is turned ON.
139	FOT: Forward rotation drive prohibited	The overtravel detection signal in the positive direction is input when "FOT" is turned OFF. Use this for emergency stop and return-to-origin.
140	ROT: Reverse rotation driving prohibited	The overtravel detection signal in the negative direction is input when "ROT" is turned OFF. Use this for emergency stop and return-to-origin.
141	PCLR: Current position clear	The current position is cleared to zero when "PCLR" is turned ON.
142	PSET: Current position preset	When "PSET" is turned ON, the current position is taken as Preset Position (MSB) (3037Hex-29Hex) and Preset Position (LSB) (3037Hex-2AHex).
144	POS-SET: Position change command	When "POS-SET" is turned ON, the target position is changed, and movement to the new target position is started.
145 146 147	CP1: Position command selection 1 CP2: Position command selection 2 CP3: Position command selection 3	Select Positioning Data 1 to 8 (3037Hex-2DHex to 3037Hex-3CHex) as a combination of these.

List of output terminal functions		
Data	Terminal function	Description
82	POK: Positioning completed	This turns ON at completion of positioning (position deviation is Positioning Completed Range (3037Hex-28Hex) or less).
151	OT-OUT: Overtravel detection	This turns ON when the software overtravel was detected or the overtravel detection signal was accepted.
152	STOP-OUT: Forced stop detection	This turns ON when a forced deceleration stop is made by a multifunction input function "STOP" or detection of an overtravel.

7-7-2 Position Control Gain

Position control generates the torque command and speed command to drive the inverter based on the deviation between the current position and command position according to operation patterns that are generated from position data (target position). Basically, position control assumes that speed control has already been adjusted under a real load and that acceleration and deceleration are possible without any problem. Position control gain adjusts the response of position control. To increase response, set larger values in Position Loop Gain 1 (3037Hex-04Hex) and Position Loop Gain 2 (3037Hex-05Hex). Setting too large a value causes hunting or overshooting. To switch the gain at low speed and high speed, set the switching frequency in Position Loop Gain Switch Frequency

(3037Hex-06Hex). If the system starts to vibrate when system rigidity is weak and gain is increased, set a large value in Position Control Feed Forward Gain (3037Hex-02Hex).

Parameter No.	Function name	Data	Default data	Unit
3037Hex-02Hex	Position Control Feed Forward Gain	0.00: Cancel 0.01 to 1.50	0.00	-
3037Hex-03Hex	Position Control Feed Forward Filter	0.000 to 5.000	0.500	s
3037Hex-04Hex	Position Loop Gain 1 (low speed side)	0.1 to 300.0	1.0	-
3037Hex-05Hex	Position Loop Gain 2 (high speed side)	0.1 to 300.0	1.0	-
3037Hex-06Hex	Position Loop Gain Switch Frequency	0.0 to 590.0	0.0	Hz

7-7-3 Electronic Gear

With position control, the moving amount is basically managed by the number of pulses of the PG. However, it is more convenient to manage moving amounts referenced to physical numeric values (user values). The conversion ratio of user values to number of PG pulses can be set as an electronic gear.

Parameter No.	Function name	Data	Default data	Unit
3037Hex-07Hex	Electronic Gear Denominator	1 to 65535	1	-
3037Hex-08Hex	Electronic Gear Numerator	1 to 65535	1	-

● How to calculate the electronic gear

Electronic gear numerator/electronic gear denominator ratio can be calculated based on the moving amount per user values unit (position resolution) [mm/user preference], moving amount per single rotation of the motor [mm/rev] and number of PG pulses per single rotation of the motor [pulse/rev].

$$\frac{\text{Electronic gear numerator}}{\text{Electronic gear denominator}} = \frac{\text{Moving amount per user value [mm/user value]}}{\text{Moving amount per 1 PG pulse [mm/pulse]}}$$

$$= \frac{\text{Moving amount per user value [mm/user value]}}{\frac{\text{Moving amount per motor rotation [mm/rev]}}{\text{Number of pulses per motor rotation [pulse/rev]}}}$$

Set the electronic gear reduced so that each of the electronic gear numerator/electronic gear denominator reduced become integers of 65535 or less.

Ex- When the moving amount per user values unit is 0.1 [mm/user preference], machine speed at motor speed of 1,800 [r/min] is 150 [m/min] and the number of PG pulses is 1,000 [pulse/rev] (Example)

$$\frac{\text{Electronic gear numerator}}{\text{Electronic gear denominator}} = \frac{0.1 \text{ [mm/user value]}}{150 \times 1000 / 1800 \text{ [mm/rev]}} = \frac{180}{150} = \frac{12}{10}$$

7-7-4 Acceleration/Deceleration Time Selection

The normal acceleration/deceleration time is selected during position control. Even if the acceleration/deceleration time selection is switched or parameter values are changed during position control operation, the new selection or parameter values are not reflected in operation. These are reflected when the next position control operation is started.

The following table summarizes acceleration/deceleration time selections.

SET terminal	301FHex-1AHex 301FHex-1BHex	2CH terminal	Output frequency	Forward/reverse	RT2 terminal	RT1 terminal	Acceleration time	Deceleration time	
1st control	0: 2CH	OFF	-	-	-	-	3004Hex-08Hex 1st Acceleration Time 1	3004Hex-09Hex 1st Deceleration Time 1	
		ON	-	-	-	-	3005Hex-0DHex 1st Acceleration Time 2	3005Hex-0EHex 1st Deceleration Time 2	
	1: Switch frequency	-	Disable	-	-	-	3004Hex-08Hex 1st Acceleration Time 1	3004Hex-09Hex 1st Deceleration Time 1	
	2: Switching normal/reverse rotation	-	-	Disable	-	-	3004Hex-08Hex 1st Acceleration Time 1	3004Hex-09Hex 1st Deceleration Time 1	
	3: RT1/2	-	-	-	-	OFF	OFF	3004Hex-08Hex 1st Acceleration Time 1	3004Hex-09Hex 1st Deceleration Time 1
		-	-	-	-	OFF	ON	3005Hex-0BHex 2nd Acceleration Time 1	3005Hex-0CHex 2nd Deceleration Time 1
		-	-	-	-	ON	OFF	3005Hex-0DHex 1st Acceleration Time 2	3005Hex-0EHex 1st Deceleration Time 2
		-	-	-	-	ON	ON	3005Hex-0FHex 2nd Acceleration Time 2	3005Hex-10Hex 2nd Deceleration Time 2

SET terminal	301FHex-1AHex 301FHex-1BHex	2CH terminal	Output frequency	Forward/reverse	RT2 terminal	RT1 terminal	Acceleration time	Deceleration time
2nd control	0: 2CH	OFF	-	-	-	-	3005Hex-0BHex 2nd Acceleration Time 1	3005Hex-0CHex 2nd Deceleration Time 1
		ON	-	-	-	-	3005Hex-0FHex 2nd Acceleration Time 2	3005Hex-10Hex 2nd Deceleration Time 2
	1: Switch frequency	-	Disable	-	-	-	3005Hex-0BHex 2nd Acceleration Time 1	3005Hex-0CHex 2nd Deceleration Time 1
	2: Switching normal/reverse rotation	-	-	Disable	-	-	3005Hex-0BHex 2nd Acceleration Time 1	3005Hex-0CHex 2nd Deceleration Time 1
	3: RT1/2	-	-	-	OFF	OFF	3004Hex-08Hex 1st Acceleration Time 1	3004Hex-09Hex 1st Deceleration Time 1
		-	-	-	OFF	ON	3005Hex-0BHex 2nd Acceleration Time 1	3005Hex-0CHex 2nd Deceleration Time 1
		-	-	-	ON	OFF	3005Hex-0DHex 1st Acceleration Time 2	3005Hex-0EHex 1st Deceleration Time 2
		-	-	-	ON	ON	3005Hex-0FHex 2nd Acceleration Time 2	3005Hex-10Hex 2nd Deceleration Time 2

Acceleration/deceleration time selection during position control is basically the same as in speed control, with the exception of limits being applied to the following:

- LAC terminal disabled
- The function for switching the acceleration/deceleration time according to the output frequency when “1: Switch frequency” is set to 1st 2-step Acceleration/ Deceleration switching Condition Selection (301FHex-1AHex)/2nd 2-step Acceleration/Deceleration Switching Condition Selection (301FHex-1BHex) is disabled. Ordinarily, the acceleration/deceleration time is used when the output frequency is the threshold or less.
- The function for switching the acceleration/deceleration time according to the forward rotation/ reverse rotation when “2: Forward/reverse” is set to 1st 2-step Acceleration/ Deceleration switching Condition Selection (301FHex-1AHex)/2nd 2-step Acceleration/Deceleration Switching Condition Selection (301FHex-1BHex) is disabled. Ordinarily, the acceleration/deceleration time on the forward rotation side is used.

Deceleration Time for Forced Stop (3008Hex-39Hex) is selected for the acceleration/deceleration time in the following cases:

- When the RUN command (FWD, REV) is shut off and deceleration is performed during position control
- When an emergency stop is performed by detection of an overtravel (OT) or input of the “STOP” signal

7-7-5 Positioning data

Positioning data for up to eight points can be set in user value units. Positioning data is selected in combinations of position command selection signals “CP1” “CP2” and “CP3” via digital input. To prevent chattering at contacts, selection is switched when a position command selection signal has not changed state until the Position Data Determination Time (3037Hex-27Hex) elapses. Positioning data can be changed during position control. To reflect a newly changed position, turn the position change command “POS-SET” ON. When positioning data is changed during a stop, operation by position change command “POS-SET” is not required.

“CP3”	“CP2”	“CP1”	Parameter	Data	Range (user value unit)
OFF	OFF	OFF	3037Hex-2DHex, 3037Hex-2EHex	Positioning data 1	±268435455 (F000 0001 hex to 0FFF FFFF hex)
OFF	OFF	ON	3037Hex-2FHex, 3037Hex-30Hex	Positioning data 2	±268435455
OFF	ON	OFF	3037Hex-31Hex, 3037Hex-32Hex	Positioning data 3	±268435455
OFF	ON	ON	3037Hex-33Hex, 3037Hex-34Hex	Positioning data 4	±268435455
ON	OFF	OFF	3037Hex-35Hex 3037Hex-36Hex	Positioning data 5	±268435455
ON	OFF	ON	3037Hex-37Hex, 3037Hex-38Hex	Positioning data 6	±268435455
ON	ON	OFF	3037Hex-39Hex, 3037Hex-3AHex	Positioning data 7	±268435455
ON	ON	ON	3037Hex-3BHex, 3037Hex-3CHex	Positioning data 8	±268435455

Parameter No.	Function name	Data	Default data	Unit
3005Hex-02Hex to 3005Hex-06Hex 3005Hex-63Hex 3005Hex-64Hex	Input Terminal [DI1] to [DI7] Function Selection	135 (1135): Increment/absolute position switching “INC/ABS” 144 (1144): Position change command “POS-SET” 145 (1145): Position command selection 1 “CP1” 146 (1146): Position command selection 2 “CP2” 147 (1147): Position command selection 3 “CP3”	-	-
3037Hex-26Hex	Positioning Data Type	0: Absolute position (ABS) 1: Relative position (INC)	0	-
3037Hex-27Hex	Position Data Determination Time	0.000 to 0.100 s	0.000	s

Parameter No.	Function name	Data	Default data	Unit
3037Hex-4EHex	Positioning Data Setting Selection via communication	0: Disable Communications Positioning Data (S20, S21) 1: Enable Communications Positioning Data (S20, S21)	0	-
3002Hex-15Hex	Positioning Data via Communication (MSB)	-268435455 to 268435455 (MSB: -4096 to 4095)	0	-
3002Hex-16Hex	Positioning Data via Communication (LSB)	(LSB: 0 to 65535)		

● Positioning Data Type (3037Hex-26Hex)

Handling of the positioning data set to positioning data 1 to 8 can be switched between handling as absolute positions or as moving amounts.

To switch handling when necessary, use increment/absolute position switching “INC/ABS” (data = 135) in the multifunction input terminal function.

When “INC/ABS” is allocated to multifunction input terminals, the 3037Hex-26Hex setting is disabled.

● Position Data Determination Time (3037Hex-27Hex)

When position command selection 1 “CP1” to position command selection 3 “CP3” is switched, chattering may cause the selected positioning data to change. In cases like these, set the time up to settling of the positioning data to 3037Hex-27Hex.

● Positioning Data Setting Selection via communication (3037Hex-4EHex)

Positioning data can also be assigned via communication. To assign positioning data via communication, set 1 to 3037Hex-4EHex. The upper four digits and lower four digits of the positioning data are assigned to Positioning Data via Communication (MSB) (3002Hex-15Hex) and Positioning Data via Communication (LSB) (3002Hex-16Hex), respectively.

To reflect positioning data, turn the position change command “POS-SET” ON.

While commands via communication are enabled, Positioning Data 1 (MSB) (3037Hex-2DHex) and Positioning Data 1 (LSB) (3037Hex-2EHex) are switched to 3002Hex-15Hex and 3002Hex-16Hex. These parameters can also be switched to positioning data 2 to 8 by position command selection 1 “CP1” to position command selection 3 “CP1.”

7-7-6 Overtravel (OT)

When a movement limit point is passed through, there is the risk of mechanical failure or accident. For this reason, the movement limit point can be detected by the hardware and input digitally as an overtravel (OT) signal. OT detection causes a deceleration stop for the time set in Deceleration Time for Forced Stop (3008Hex-39Hex) and then servos change to a locked state. When Over Travel Forced Stop Operation Selection (3037Hex-51Hex) = 1, a deceleration stop is performed and then the operation error (alarm code: 24) is generated. Plus side overtravel “FOT” and minus side overtravel “ROT” can be allocated independently. The overtravel signal is enabled (NC contact is made) when it is OFF, for safety reasons. When an overtravel is detected, overtravel detection signal “OT-OUT” is output as a digital output.

Parameter No.	Function name	Data	Default data	Unit
3005Hex-02Hex to 3005Hex-06Hex	Input Terminal [DI1] to [DI7] Function Selection	139 (1139): Forward rotation driving prohibited "FOT"	-	-
3005Hex-63Hex		140 (1140): Reverse rotation driving prohibited "ROT"		
3005Hex-64Hex				
3037Hex-51Hex	Over Travel Forced Stop Operation Selection	0: Servo lock after deceleration stop 1: Operation error (alarm code: 24) after a deceleration stop	0	-

7-7-7 Software OT

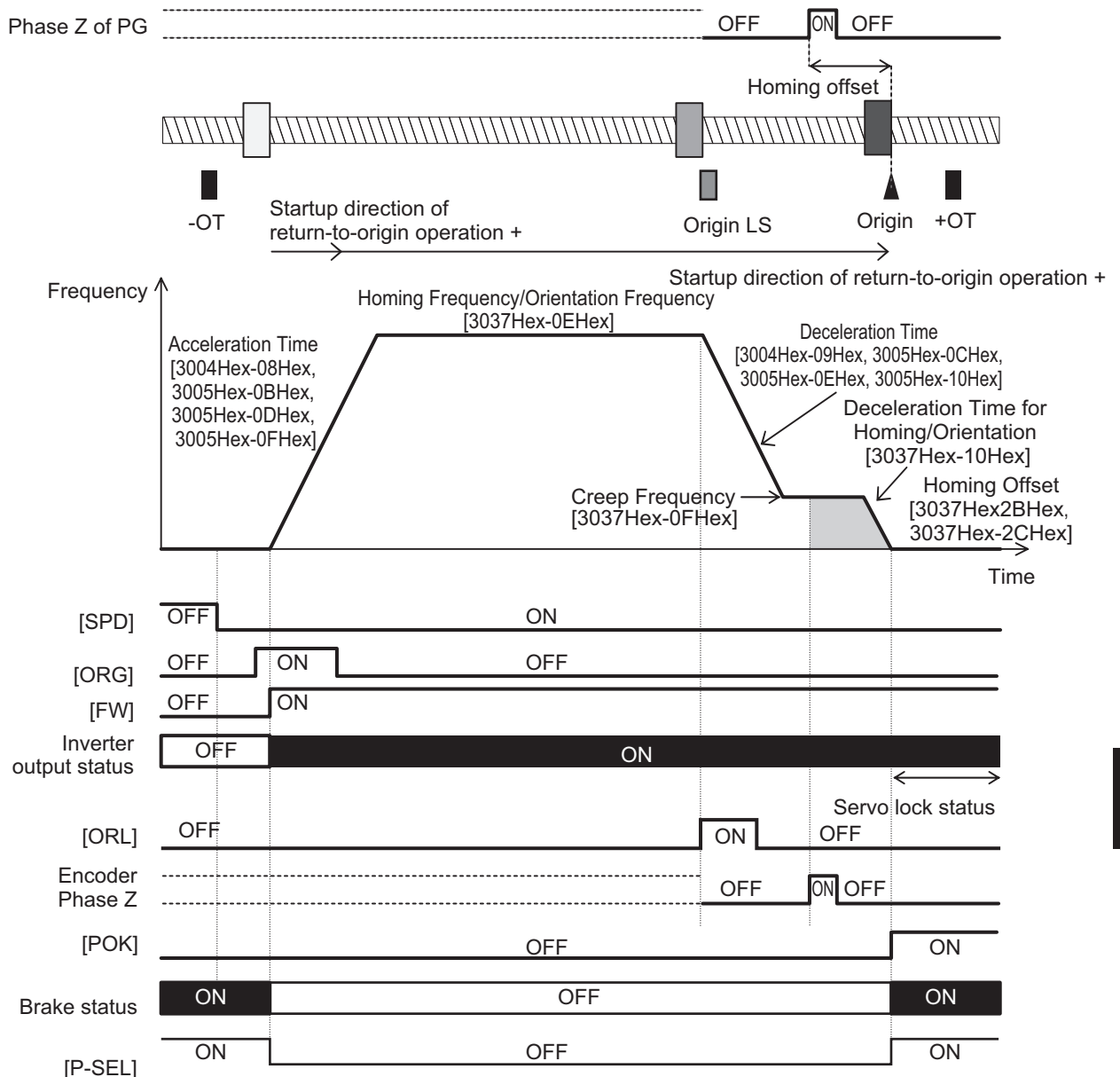
With overtravel (OT), the movement limit point is basically detected by the hardware. However, the limit point position can be set by number of pulses as a software OT. The limit point position can be set in two directions independently by + software OT and - software OT. Operation when a software OT is detected can be selected in Overtravel Function Selection (3037Hex-17Hex). When an OT limit point does not exist, for example, on a rotating body, leave parameter 3037Hex-17Hex at its default value (= 0).

Parameter No.	Function name	Data	Default data	Unit
3037Hex-17Hex	Overtravel Function Selection	0: Invalid/Infinite rotation 1: Valid (Positioning at OT position at over traveling), normal PTP 2: Valid (Immediately stopped at over traveling), normal PTP	0	-
3037Hex-1AHex	Software Overtravel Detection Position in the Positive Direction (MSB)	-268435455 to 268435455 (MSB: -4,096 to 4,095, LSB: 0 to 65,535)	268435455	-
3037Hex-1BHex	Software Overtravel Detection Position in the Positive Direction (LSB)			
3037Hex-1CHex	Software Overtravel Detection Position in the Negative Direction (MSB)	-268435455 to 268435455 (MSB: -4,096 to 4,095, LSB: 0 to 65,535)	-268435455	-
3037Hex-1DHex	Software Overtravel Detection Position in the Negative Direction (LSB)			

7-7-8 Basic Return-to-origin Operation

The return-to-origin operation is started when the RUN command is input with multifunction input terminal "SPD" set to OFF and terminal "ORG" set to ON. Specify the operation direction in Homing Operation Selection (3037Hex-0AHex). The return-to-origin operation is as follows. Acceleration is performed to the frequency set in Homing Frequency/Orientation Frequency (3037Hex-0EHex), and, after the moving body has turned origin search limit signal "ORL" ON, movement is performed from the initial Z phase signal (reference signal for homing offset) by the amounts set in the homing offsets

(Homing Offset (MSB) (3037Hex-2BHex) and Homing Offset (LSB) (3037Hex-2CHex)), and movement is stopped. The positioning completed signal “POK” also is output. When overtravel turns ON before the origin limit switch, reverse rotation operation is performed to search for the origin limit switch.



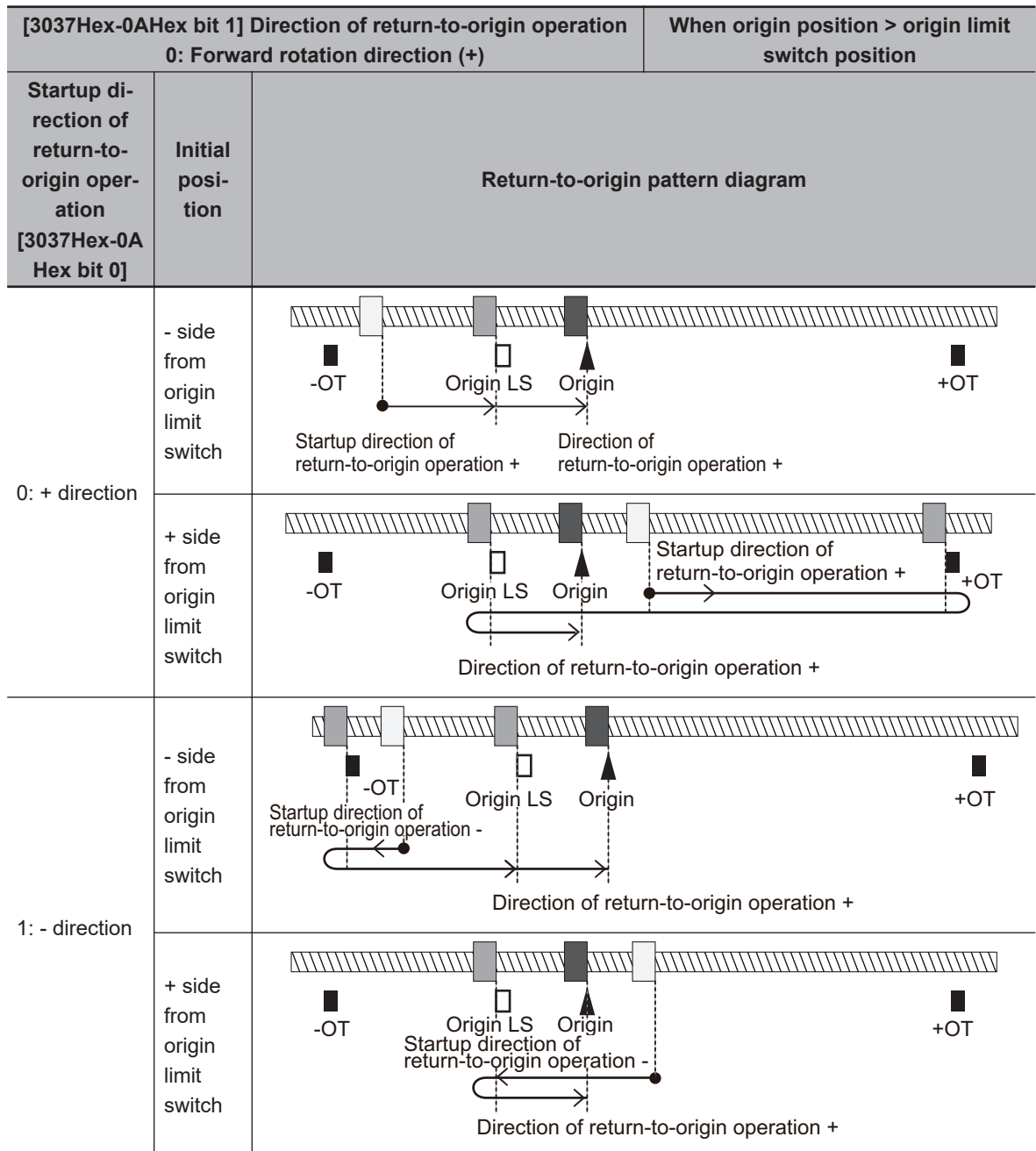
● Homing Operation Selection (3037Hex-0AHex)

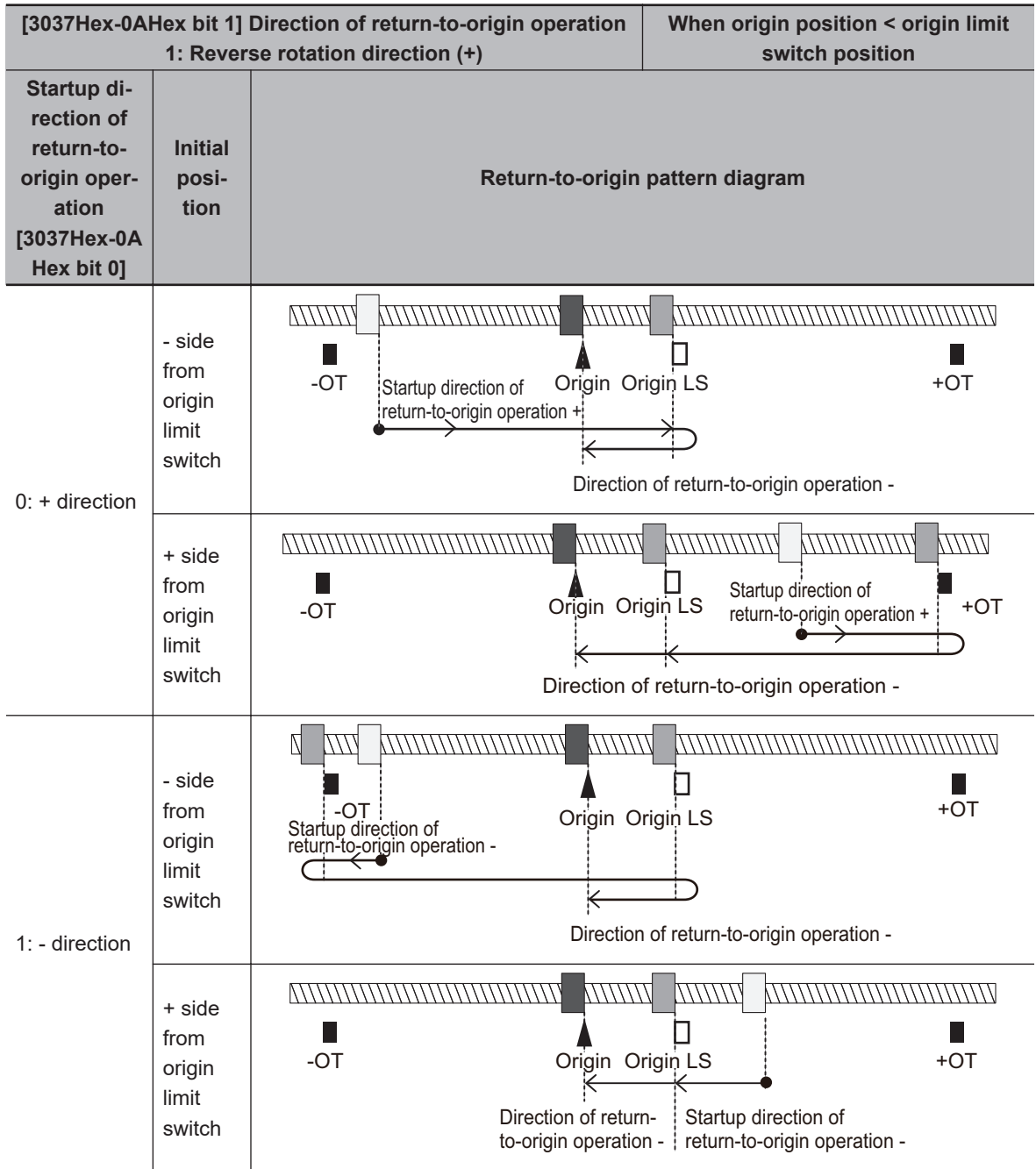
This parameter defines the startup direction of return-to-origin operation, moving direction of return-to-origin operation, operation at detection of an overtravel, and limit switch detection timing.

- bit 0 : Startup direction of return-to-origin operation 0: Forward rotation direction, 1: Reverse rotation direction
Return-to-origin operation starts in the direction defined by this bit regardless of the direction specified in the RUN command from the inverter.
- bit 1 : Direction of return-to-origin operation 0: Forward rotation direction, 1: Reverse rotation direction.
This bit defines the direction of movement of the return-to-origin operation. When the reverse of the startup direction is set, ORL (origin search limit signal) is detected, then operation is paused and is reversed.

- bit 2 : Return-to-origin operation overtravel operation selection 0: Reversal by overtravel detection, 1: Stop by overtravel detection
This bit defines whether to stop or reverse operation when an overtravel is detected before ORL (origin search limit signal) is detected.
- bit 3 : Origin limit switch timing selection 0: ON edge detection, 1: OFF edge detection
This bit defines whether or not to detect the limit switch at its ON edge or OFF edge.

The figure below shows action according to the setting of the 3037Hex-0AHex parameter. In the figure, it is assumed that bit 2 = 0 and reverse operation is performed at detection of an overtravel.





● **Homing Reference Signal Selection (3037Hex-0CHex), Reference Signal for Homing Offset (3037Hex-0DHex)**

The reference signal for homing is to switch from the homing frequency to the homing creep frequency. The reference signal for homing starts incrementing of the homing offset. Ordinarily, the signal of the origin limit switch is taken as the reference signal for homing and the Z phase signal is taken as the reference signal for homing offset (factory default). When return-to-origin is configured using other signals, select the reference signal for homing and reference signal for homing offset according to the table below. When Reference Signal for Homing Offset (3037Hex-0DHex) is set to other than “0: Z pulse of position encoder”, the reference signal for homing is not included in the configuration, and so the Homing Reference Signal Selection (3037Hex-0CHex) setting is disabled.

Parameter No.	Function name	Data	Default data	Unit
3037Hex-0CHex	Homing Reference Signal Selection	0: Z phase 1: Origin limit input (ORL) 2: Overtravel input in the positive direction (FOT) 3: Overtravel input in the negative direction (ROT)	1	-
3037Hex-0DHex	Reference Signal for Homing Offset	0: Z phase 1: Origin limit input (ORL) 2: Overtravel input in the positive direction (FOT) 3: Overtravel input in the negative direction (ROT) 4: Stopper (Hit and stop)	0	-
3037Hex-0FHex	Creep Frequency	0.1 to 590.0 Hz	0.5	Hz

3037Hex-0CHex: Reference signal for homing	3037Hex-0DHex: Reference signal for homing offset	Frequency at start of homing offset	Operation
0: Z phase	0: Z phase (factory default)	Creep frequency	Homing offset is started at the first detection of the Z phase after startup at the creep frequency
1: Origin limit switch (factory default)		Homing frequency to homing creep frequency	
2: Overtravel switch in the positive direction		Homing frequency to homing creep frequency	Deceleration to creep frequency at reverse operation by detection of overtravel
3: Overtravel switch in the negative direction			
Disable	1: Origin limit switch	Homing frequency	
	2: Overtravel switch in the positive direction	Homing frequency to homing creep frequency	Deceleration to creep frequency at reverse operation by detection of overtravel
	3: Overtravel switch in the negative direction		
	4: Stopper	Homing frequency to homing creep frequency	Operation is instantaneously reversed after judgment of collision with the stopper by generation of the torque limit, and homing offset is performed at the creep frequency

7-7-9 Clearing of position

The current position is cleared to zero by digital input “PCLR” turning ON. The current position can be cleared to zero in either position control and speed control. Either of the ON edge and ON level can be selected as the timing to clear the current position.

When “PCLR” is turned ON during position control operation, the current position is cleared to zero and movement to the target position is performed. When “PCLR” is turned ON after position control stop, the current position is cleared to zero, however, movement to the target position is not started. To perform movement, either turn the RUN command OFF then back ON again, or turn “POS-SET” ON.

Parameter No.	Function name	Data	Default data	Unit
3005Hex-02Hex to 3005Hex-06Hex 3005Hex-63Hex 3005Hex-64Hex	Input Terminal [DI1] Function Selection to Input Terminal [DI7] Function Selection	141 (1141): Current position clear “PCLR”	-	-
3037Hex-16Hex	Current Position Clear Signal Operation Selection	0: Clear at edge detection 1: Clear at level detection	0	-

7-7-10 Position preset

The current position can be overwritten by the setting of Preset Position (MSB) (3037Hex-29Hex) and Preset Position (LSB) (3037Hex-2AHex) at the ON edge of digital input “PSET.” The current position can be preset in either position control and speed control.

When “PSET” is turned ON during position control operation, the current position is overwritten by the preset position and movement to the target position is performed. When “PSET” is turned ON after position control stop, the current position is overwritten, however, movement to the target position is not started. To perform movement, either turn the RUN command OFF then back ON again, or turn “POS-SET” ON.

Parameter No.	Function name	Data	Default data	Unit
3005Hex-02Hex to 3005Hex-06Hex 3005Hex-63Hex 3005Hex-64Hex	Input Terminal [DI1] Function Selection to Input Terminal [DI7] Function Selection	142 (1142): Current position preset “PSET”	-	-
3037Hex-29Hex	Preset Position (MSB)	-268435455 to 268435455 (MSB: -4,096 to 4,095, LSB: 0 to 65,535)	0	-
3037Hex-2AHex	Preset Position (LSB)			

● Position control by pulse train input

Position control can be performed with pulse train input used as the pulse position command.

When digital input “SPD” is turned OFF with “12: Pulse train input” set to 1st Frequency Reference Selection (3004Hex-02Hex)/2nd Frequency Reference Selection (3006Hex-1FHex), position control is made to operate by taking the pulses according to the pulse train input as the position command pulse.

For details on the pulse train input method, refer to *8-9-17 Pulse Train Frequency Input* on page 8-129.

7-7-11 Orientation

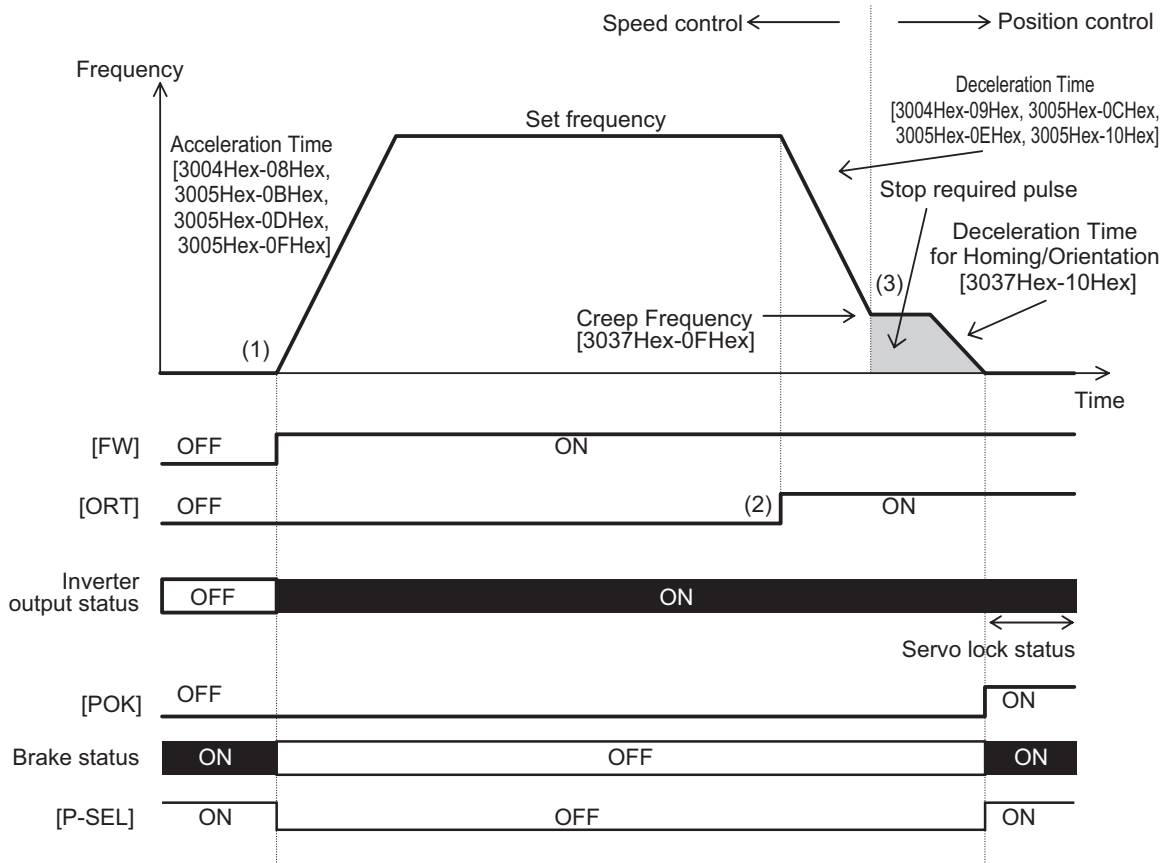
The orientation function can be used as an applied function for position control. In speed control, orientation can be performed during operation or while operation is stopped.

● Orientation during speed control

With speed control, a motor in rotation can be stopped at a desired mechanical position. When digital input “ORT” is turned ON (2) during operation in speed control, deceleration is performed up to

the frequency set in Homing Frequency/Orientation Frequency (3037Hex-0EHex) for the currently selected deceleration time, control transitions to the position control mode (3), the rotation amount that allows a deceleration stop at the setting in Deceleration Time for Homing/Orientation (3037Hex-10Hex) up to the position of the currently selected positioning data is calculated from the current position, and the motor rotates for that calculated rotation amount and stops.

The positioning data can be selected from Positioning Data 1 to 8 (3037Hex-2DHex to 3037Hex-3CHex) by digital input position command selection signals “CP1,” “CP2” and “CP3”. When assigning positioning data as factory default absolute positions (ABS), the absolute positions are referenced to the Z phase of the encoder. To assign positioning data as absolute positions referenced not to the Z phase of the encoder but to the machine origin position, Positioning Data 1 to 8 (3037Hex-2DHex to 3037Hex-3CHex) can be handled as it is as the positioning data of the machine origin reference by setting the position offset of the “encoder Z phase - machine origin position” to Homing Offset (MSB) (3037Hex-2BHex) and Homing Offset (LSB) (3037Hex-2CHex).

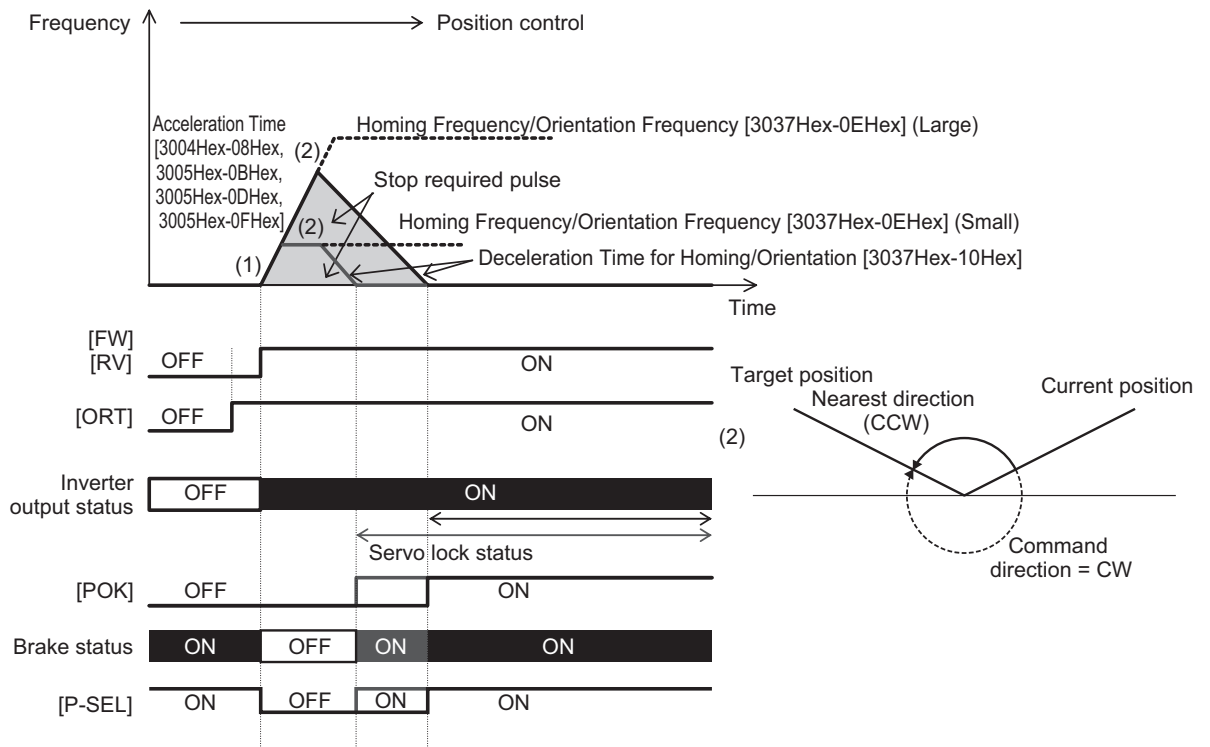


● Orientation from a stopped state

When the control mode is vector control with speed sensor, servo lock operation is performed when positioning by orientation is completed, and digital output “POK” is output if positional deviation is within Positioning Completed Range (3037Hex-28Hex). When the positioning position is changed from this state and orientation is performed again with “POS-SET” set to ON, control changes to position control and positioning is performed within one rotation. At this time, either of “Nearest direction” operation which performs positioning by the shortest distance or “Command direction” operation which follows the direction instructed in the RUN command can be selected at Orientation Selection (3037Hex-09Hex) regardless of the operation direction. In V/f control with speed sensor, the control mode changes to DC braking and the inverter maintains output. In orientation from a

stopped state, rotation is never performed beyond one rotation even if a value exceeding one rotation is programmed in the positioning data.

If the RUN command turns ON after the orientation command "ORT" is turned ON during an inverter output stop, orientation operation is performed immediately without operating up to the set frequency by speed control. Note, however, that when operation is performed after the orientation command "ORT" is turned ON from a stopped state immediately after the power is turned ON, operation by speed control is always performed for one rotation or more to detect the Z phase and the orientation operation is performed.



When using the orientation function, vector control with speed sensor, by which speed feedback control is performed by a machine shaft encoder, can be selected as the control mode when the motor to machine shaft transmission gear ratio (speed reduction ratio) is (as a guideline) approx. 5x. In the case of vector control with speed sensor, servo lock operation is performed after a positioning stop, and, if external force is applied after the stop, resistance torque is generated in an attempt to hold the stop position.

On the other hand, when the machine shaft to motor shaft transmission gear ratio (speed reduction ratio) is large, it will be difficult to detect the motor speed at low-speed rotation, and machine performance sometimes can no longer be sufficiently demonstrated unless an encoder with a large number of pulses is used. On machines to which an encoder with a large number of pulses cannot be attached or that have a large transmission gear ratio, use V/f control with speed sensor and not vector control with speed sensor that performs speed feedback control from a machine shaft encoder. Servo lock operation is not possible in V/f control with speed sensor. When an external force is applied after a stop, use a mechanical brake. Also, in V/f control with speed sensor, torque boost sometimes must be adjusted or automatic torque boost sometimes must be set to generate torque at ultra low speeds immediately before a stop.

Parameter No.	Function name	Data	Default data	Unit
3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex	Input Terminal [DI1] to [DI7] Function Selection	78(1078): Speed control parameter selection 1 "MPRM1" 79(1079): Speed control parameter selection 2 "MPRM2" 135(1135): Increment/absolute position switching "INC/ABS" 136(1136): Orientation command "ORT" 137(1137): Speed/position switching "SPD" 141(1141): Current position clear "PCLR" 142(1142): Current position preset "PSET" 143(1143): Teaching command "TEACH" 144(1144): Position change command "POS-SET" 145(1145): Position command selection 1 "CP1" 146(1146): Position command selection 2 "CP2" 147(1147): Position command selection 3 "CP3"	-	-
3005Hex-15Hex 3005Hex-1CHex	Output Terminal [DO1] Function Selection, Output Terminal [ROA, ROB] Function Selection	82(1082): Positioning completed "POK"	-	-
3014Hex-04Hex, 3009Hex-2EHex, 3013Hex-2EHex, 300CHex-2EHex	Speed Control 1 P Proportional Gain, Speed Control 2 P Proportional Gain, Speed Control 3 P Proportional Gain, Speed Control 4 P Proportional Gain	0.1 to 200.0	10.00	time
3014Hex-05Hex	Speed Control 1 I Integral Time	0.001 to 9.999 s 999: Cancel integral term	0.100	s
3009Hex-2FHex	Speed Control 2 I Integral Time	0.001 to 9.999 s 999: Cancel integral term		
3013Hex-2FHex	Speed Control 3 I Integral Time	0.001 to 9.999 s 999: Disable		
300CHex-2FHex	Speed Control 4 I Integral Time	0.001 to 9.999 s 999: Disable		
3037Hex-02Hex	Position Control Feed Forward Gain	0.00: Disable feed-forward 0.01 to 1.50	0.00	-
3037Hex-03Hex	Position Control Feed Forward Filter	0.000 to 5.000 s	0.500	s
3037Hex-04Hex	Position Loop Gain 1	0.1 to 300.0	1.0	time
3037Hex-05Hex	Position Loop Gain 2	0.1 to 300.0	1.0	time

Parameter No.	Function name	Data	Default data	Unit
3037Hex-06Hex	Position Loop Gain Switch Frequency	0.0 to 590.0 Hz	0.0	Hz
3037Hex-07Hex	Electronic Gear Denominator	1 to 65535	1	-
3037Hex-08Hex	Electronic Gear Numerator	1 to 65535	1	-
3037Hex-09Hex	Orientation Selection	0: Nearest direction (Valid for reverse rotation) 1: Command direction (Direction of operation command source)	1	-
3037Hex-0AHex	Homing Operation Selection	Bit 7: Z phase correction 0: Disable 1: Enable Bit 4 to 6: Reserved Bit 3: Detection timing of homing limit switch 0: By rising edge 1: By falling edge Bit 2: OT detected operation selection 0: Return at FOT/ROT detection 1: Stop at OT detection (Cancel homing) Bit 1: Homing Start direction 0: Forward direction 1: Reverse direction Bit 0: Homing shaft direction 0: Forward direction 1: Reverse direction	0	-
3037Hex-0EHex	Homing Frequency/Orientation Frequency	0.1 to 590.0 Hz	5.0	Hz
3037Hex-10Hex	Deceleration Time for Homing/Orientation	0.00 to 6000 s	6.00	s
3037Hex-16Hex	Current Position Clear Signal Operation Selection	0: Edge 1: Level	0	-
3037Hex-26Hex	Positioning Data Type	0: Absolute position (ABS) 1: Relative position (INC)	0	-
3037Hex-27Hex	Position Data Determination Time	0.000 to 0.100 s	0.000	s
3037Hex-28Hex	Positioning Completed Range	0 to 9999	1	-
3037Hex-29Hex	Preset Position (MSB)	-268435455 to 268435455 (MSB: -4,096 to 4,095, LSB: 0 to 65,535)	0	-
3037Hex-2AHex	Preset Position (LSB)			
3037Hex-2BHex	Homing Offset (MSB)	-268435455 to 268435455 (MSB: -4,096 to 4,095, LSB: 0 to 65,535)	0	-
3037Hex-2CHex	Homing Offset (LSB)			
3037Hex-2DHex	Positioning Data 1 (MSB)	-268435455 to 268435455 (MSB: -4,096 to 4,095, LSB: 0 to 65,535)	0	-
3037Hex-2EHex	Positioning Data 1 (LSB)			

Parameter No.	Function name	Data	Default data	Unit
3037Hex-2FHex	Positioning Data 2 (MSB)	-268435455 to 268435455 (MSB: -4,096 to 4,095, LSB: 0 to 65,535)	0	-
3037Hex-30Hex	Positioning Data 2 (LSB)			
3037Hex-31Hex	Positioning Data 3 (MSB)	-268435455 to 268435455 (MSB: -4,096 to 4,095, LSB: 0 to 65,535)	0	-
3037Hex-32Hex	Positioning Data 3 (LSB)			
3037Hex-33Hex	Positioning Data 4 (MSB)	-268435455 to 268435455 (MSB: -4,096 to 4,095, LSB: 0 to 65,535)	0	-
3037Hex-34Hex	Positioning Data 4 (LSB)			
3037Hex-35Hex	Positioning Data 5 (MSB)	-268435455 to 268435455 (MSB: -4,096 to 4,095, LSB: 0 to 65,535)	0	-
3037Hex-36Hex	Positioning Data 5 (LSB)			
3037Hex-37Hex	Positioning Data 6 (MSB)	-268435455 to 268435455 (MSB: -4,096 to 4,095, LSB: 0 to 65,535)	0	-
3037Hex-38Hex	Positioning Data 6 (LSB)			
3037Hex-39Hex	Positioning Data 7 (MSB)	-268435455 to 268435455 (MSB: -4,096 to 4,095, LSB: 0 to 65,535)	0	-
3037Hex-3AHex	Positioning Data 7 (LSB)			
3037Hex-3BHex	Positioning Data 8 (MSB)	-268435455 to 268435455 (MSB: -4,096 to 4,095, LSB: 0 to 65,535)	0	-
3037Hex-3CHex	Positioning Data 8 (LSB)			
3037Hex-4EHex	Positioning Data Setting Selection via communication	0: Disable Communications Positioning Data (S20, S21) 1: Enable Communications Positioning Data (S20, S21)	0	-

- **Position Loop Gain 1 (low speed side) (3037Hex-04Hex), Position Loop Gain 2 (high speed side) (3037Hex-05Hex)**
- **Position Loop Gain Switch Frequency (3037Hex-06Hex)**
- **Speed control P (gain) (3014Hex-04Hex, 3009Hex-2EHex, 3013Hex-2EHex, 300CHex-2EHex)**
- **Speed control I (integral time) (3014Hex-05Hex, 3009Hex-2FHex, 3013Hex-2FHex, 300CHex-2FHex)**

In orientation operation, the response of position control can be switched during deceleration and during a stop.

The larger the set value, the more improved response becomes, the shorter the settling time becomes and the more holding performance can be improved during a servo lock stop. However, setting too large a value causes hunting. Adjust this parameter so that hunting does not occur. Also, when increasing the gain of the position controller, also adjust the speed adjuster (ASR). To switch speed control P (gain) and speed control I (integral time), use parameter selection 1 and 2 "MPRM1" and "MPRM2."

- **Electronic Gear Denominator (3037Hex-07Hex), Electronic Gear Numerator (3037Hex-08Hex)**

Positioning data in orientation can be handled as an angle, number of pulses or other user value.

Example) When the PG of number of pulses 1024 [pulse/rev] is used and the moving amount per user value is 1 [pulse/user value] for the equivalent number of pulses 4x the PG pulses

$$\frac{\text{Electronic gear numerator}}{\text{Electronic gear denominator}} = \frac{\text{Moving amount per user value}}{\text{Moving amount per 1 PG pulse}} = \frac{\frac{1}{4 \times 1024} [\text{rev/user value}]}{\frac{1}{1024} [\text{rev/pulse}]} = \frac{1}{4} [\text{pulse/user value}]$$

Example) When the moving amount per user value is 0.01 [°/user value], the moving amount per single motor rotation is 360.00 [°/rev], and the number of PG pulses per single motor rotation is 4096 (1024 × 4x) [pulse/rev]

$$\frac{\text{Electronic gear numerator}}{\text{Electronic gear denominator}} = \frac{\text{Moving amount per user value}}{\text{Moving amount per 1 PG pulse}} = \frac{0.01 [\text{°/user value}]}{\frac{360.00 [\text{°/rev}]}{4096 [\text{pulse/rev}]}} = \frac{4096}{36000} [\text{pulse/user value}]$$

● Orientation Selection (3037Hex-09Hex)

When Orientation Selection (3037Hex-09Hex) is set to “0: Nearest direction (Valid for reverse rotation),” the moving amount to the positioning data instructed from the current position rotates in the smaller direction (nearest direction) regardless of the direction instructed in the RUN command. Note, however, that when operation has not been performed even once after the power is turned ON, operation starts in the direction instructed in the RUN command and orientation is performed as the near direction is unknown. Then, positioning is performed by the nearest direction. When Orientation Selection (3037Hex-09Hex) is set to “1: Command direction (Direction of operation command source),” operation starts in the direction instructed in the RUN command at all times and orientation is performed.

● Homing Operation Selection (3037Hex-0AHex)

In a pulse encoder, variance sometimes occurs between the output timing of the A, B phase pulses and Z phase pulse. If a position error of one pulse occurs on the machine side when positioning is performed to the same position during forward rotation and reverse rotation, set 1 to “bit 7: Z phase correction” in Homing Operation Selection (3037Hex-0AHex). Occurrence of position error caused by the rotational direction can be suppressed by enabling this correction.

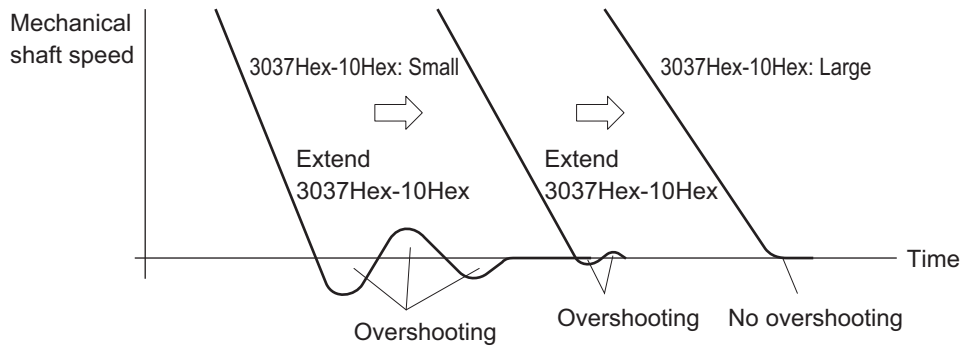
● Homing Frequency/Orientation Frequency (3037Hex-0EHex)

This is the frequency when speed control is switched to position control by the orientation command “ORT” during speed control. If the preset frequency is high, the time up to completion of positioning increases, and when torque limit deceleration is performed, the position deviation over alarm (alarm code: 38) sometimes occurs. To perform torque limit deceleration, set the frequency when switching from speed control to position control to as low a frequency as possible.

In V/f control with speed sensor, when the preset frequency is low, it becomes difficult to position to the instructed positioning position unless torque boost is adjusted or automatic torque boost is used. Adjust all of Deceleration Time for Homing/Orientation(3037Hex-10Hex), Position Loop Gain 1 (low speed side) (3037Hex-04Hex) and Position Loop Gain 2 (high speed side) (3037Hex-05Hex) so that the desired settling time is reached in keeping with the control method.

● Deceleration Time for Homing/Orientation (3037Hex-10Hex)

Set the deceleration time from Homing Frequency/Orientation Frequency (3037Hex-0EHex). This deceleration time can be adjusted to adjust the set time when overtravel or overshooting occurs on the instructed position.

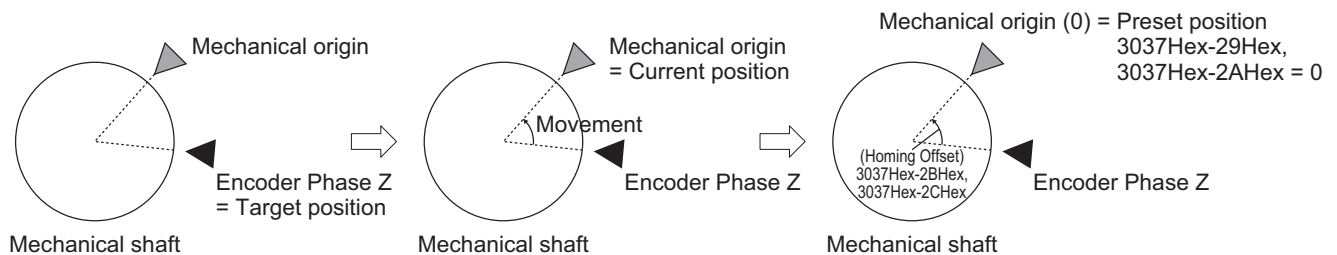


● Preset Position (MSB) (3037Hex-29Hex), Preset Position (LSB) (3037Hex-2AHex)

The current reference position and current feedback position can be set to any position referenced to the machine origin. In orientation, ordinarily, the position offset between the machine origin and the Z phase of the encoder is handled as the homing offset. For this reason, set Preset Position (MSB) (3037Hex-29Hex) and Preset Position (LSB) (3037Hex-2AHex) as "0."

● Homing Offset (MSB) (3037Hex-2BHex), Homing Offset (LSB) (3037Hex-2CHex)

The homing offset in orientation is equivalent to the position offset between the machine origin and the Z phase of the encoder. Adjust the homing offset by the following procedure.



- 1) When the orientation command is turned ON with the target position set as 0, perform positioning with the Z phase position of the encoder as the origin.
- 2) Then, operate the motor, and move the machine shaft to the machine origin position and stop movement there. Set the Current Feedback Position Monitor (MSB) (3037Hex-63Hex) and Current Feedback Position Monitor (LSB) (3037Hex-64Hex) at this time to Homing Offset (MSB) (3037Hex-2BHex) and Homing Offset (LSB) (3037Hex-2CHex). Then, when the current position preset "PSET" is turned ON with Preset Position (MSB) (3037Hex-29Hex) and Preset Position (LSB) (3037Hex-2AHex) set to "0," "0" is set to Current Feedback Position Monitor (MSB) (3037Hex-63Hex) and Current Feedback Position Monitor (LSB) (3037Hex-64Hex).
- 3) For confirmation, perform orientation again. Perform orientation with the current position as "0" (origin), and check that orientation to the machine origin position is possible.

● Positioning Data 1 to 8 (3037Hex-2DHex to 3037Hex-3CHex) and Position Data Determination Time (3037Hex-27Hex)

This parameter is for setting the positioning position referenced to the machine origin in orientation. Up to eight points can be set, and multipoint positioning can be performed continuously by using position command selection 1 to 3 "CP1 to CP3." To prevent malfunction caused by chattering when the position command selection signal is used to switch positioning data, set a time for chattering to settle or longer in Position Data Determination Time (3037Hex-27Hex). To enable changes to the positioning data with the RUN command ON, be sure to turn the position change command

“POS-SET” ON. As changes to the positioning data while the RUN command is OFF are reset when operation is started, operation by position change command “POS-SET” is not required. Orientation operation differs from position control in that, even when a value greater than one rotation is set to positioning data, the value is automatically corrected to a position within one rotation when the operation is actually performed.

To assign positioning data as an incremental amount of movement relative to the current position, set movement in Positioning Data Type (3037Hex-26Hex). To switch handling when necessary, use increment/absolute position switching “INC/ABS” (data = 135) in the multifunction input terminal function. When this function is allocated, the 3037Hex-26Hex setting is disabled.

● Positioning Data Setting Selection via communication (3037Hex-4EHex)

In orientation, to use Positioning Data via Communication (MSB) (3002Hex-15Hex) and Positioning Data via Communication (LSB) (3002Hex-16Hex) via communication to perform positioning, set “1” to Positioning Data Setting Selection via communication (3037Hex-4EHex) to enable positioning commands via communication, just as in position control.

7-7-12 Functions That Are Disabled in Position Control

When speed/position switching is set to “SPD” OFF and the RUN command is ON, the following functions are disabled.

Jogging operation, PID control, starting frequency hold, stop frequency hold, DC braking, Zero Speed Control, restart after momentary power failure, retry, offline tuning, anti-regenerative control, overload prevention, Stop Selection (3008Hex-0CHex), pickup, torque control, 1st/2nd control.

7-7-13 Position Monitor

Use this function to monitor the feedback current position and instructed current position. The feedback current position is the value obtained by totaling the number of feedback pulses and converting them to user values. The instructed current position is not the target position but the momentary instructed position based on the position instruction pattern, and is the same as the feedback current position during a stop.

Parameter No.	Function name	Data	Default data	Unit
3037Hex-61Hex	Current Reference Position Monitor (MSB)	-268435455 to 268435455 (MSB: -4096 to 4095, LSB: 0 to 65535)	-	-
3037Hex-62Hex	Current Reference Position Monitor (LSB)		-	
3037Hex-63Hex	Current Feedback Position Monitor (MSB)	-268435455 to 268435455 (MSB: -4096 to 4095, LSB: 0 to 65535)	-	-
3037Hex-64Hex	Current Feedback Position Monitor (LSB)		-	

7-7-14 Restarting Positioning

If the motor moves out of the Restarting Positioning Range Setting (3037Hex-4FHex) while operation is still ON after positioning is performed by position control, the inverter automatically starts repositioning the motor again. When the motor is in the Positioning Completed Range (3037Hex-28Hex) even if outside of the position restarting range, the motor does not operate.

When the motor current position moves out of the range $\pm 3037\text{Hex}-4\text{FHex}$ from the target value, it moves to the target position.

The restarting positioning function is useful in V/f control. In vector control, servo lock operation is performed after completion of position control operation, so processing to stop at the target position functions at all times.

When the current position is overwritten during a stop, the restarting positioning function is disabled.

Parameter No.	Function name	Data	Default data	Unit
3037Hex-28Hex	Positioning Completed Range	0 to 9999	1	-
3037Hex-4FHex	Restarting Positioning Range Setting	0: Disable 1 to 9999	9999	-

7-7-15 Brake Control during Position Control

The output state of the brake signal during a position control stop can be set at bit 6 of Brake Control Operation Selection (300EHex-61Hex).

At Brake Release

In V/f control, with the RUN command ON, when the output current is at the current set in Brake Control Brake-release Current (300EHex-45Hex) or higher, the frequency reference is at the frequency set in Brake Control Brake-release Frequency (300EHex-46Hex) or higher, and the time set in 300EHex-47Hex elapses, "BRK" is turned ON regardless of the setting of 300EHex-61Hex bit 6.

In vector control, when 300EHex-61Hex bit 6 = 0, the RUN command is ON, the output current is at the current set in Brake Control Brake-release Current (300EHex-45Hex) or higher, the torque command is at the torque set in Brake control Brake-release Torque (300EHex-60Hex) or higher, and the time set in 300EHex-47Hex elapses, "BRK" is turned ON.

In vector control, if the output current is at the current set in Brake Control Brake-release Current (300EHex-45Hex) or higher, the torque command is at the torque set in Brake control Brake-release Torque (300EHex-60Hex) or higher, and the time set in Brake Control Brake-release Timer (300EHex-47Hex) elapses when 300EHex-61Hex bit 6 = 1 and the servo lock state is entered by the servo lock terminal turning ON, the brake release signal "BRK" is turned ON even if the RUN command is OFF.

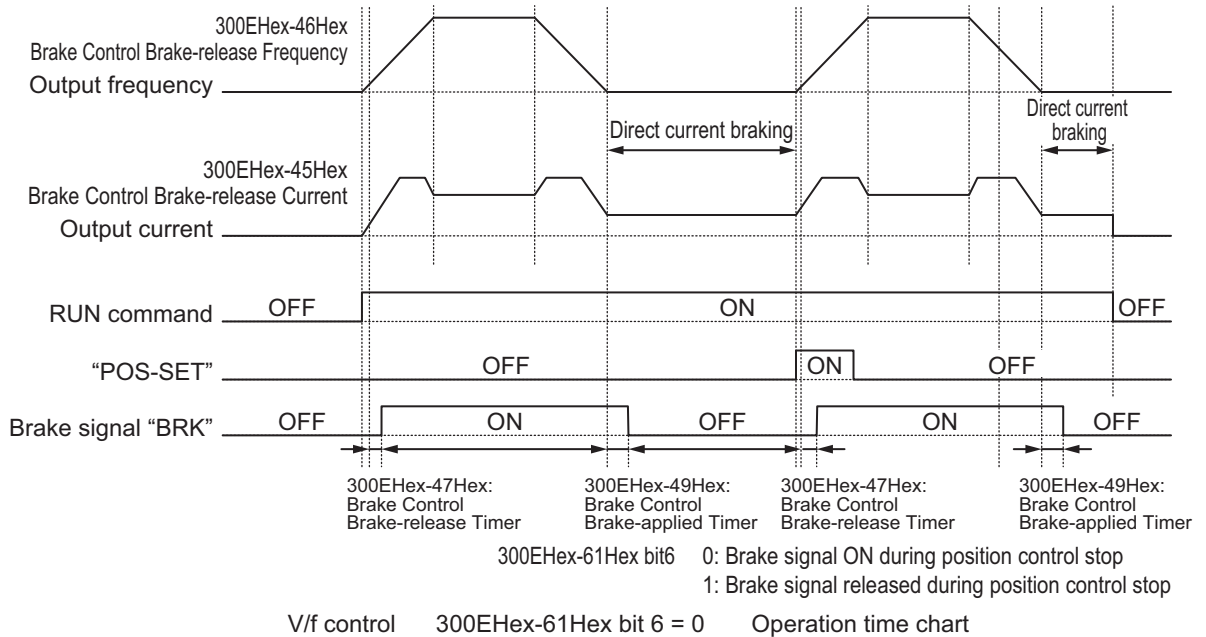
At Application of Brake

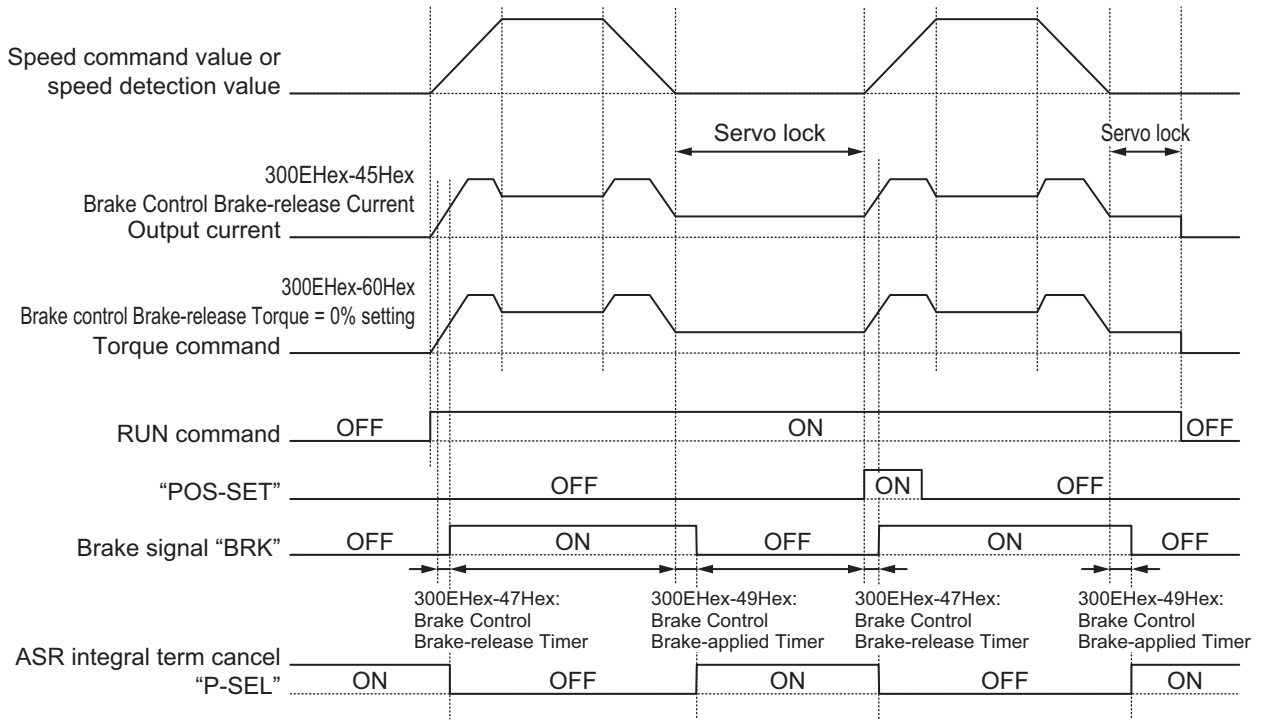
When a stop is made at the target position with 300EHex-61Hex bit 6 = 0, the brake release signal "BRK" is turned ON when the time set at Brake Control Brake-applied Timer (300EHex-49Hex) elapses even if the RUN command is ON.

When a stop is made at the target position with 300EHex-61Hex bit 6 = 1, the brake release signal "BRK" is not turned ON even if the time set at Brake Control Brake-applied Timer (300EHex-49Hex) elapses if the RUN command is ON.

When the brake is applied during position control, the motor cannot rotate even if there exists position error. For this reason, the integral term accumulates which sometimes causes an overload trip to occur. When ASR integral term cancel “P-SEL” allocated to a multifunction input terminal is turned ON, the integral term of the speed controller is canceled and P operation is performed.

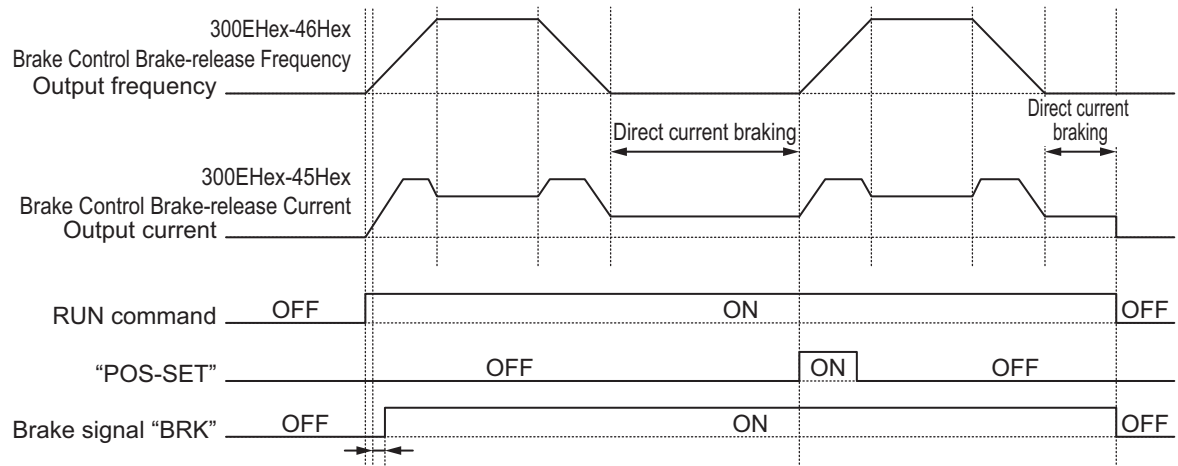
Parameter No.	Function name	Data
300EHex-6 1Hex	Brake Control Operation Selection	bit 6 = 0: Position control stopped, brake signal OFF (brake applied) bit 6 = 1: Position control stopped, brake signal ON (brake released)
3005Hex-0 2Hex to 3005Hex-0 6Hex, 3005Hex-6 3Hex, 3005Hex-6 4Hex	Input Terminal [DI1] to [DI7] Function Selection	119: P-SEL (ASR integral term cancellation)





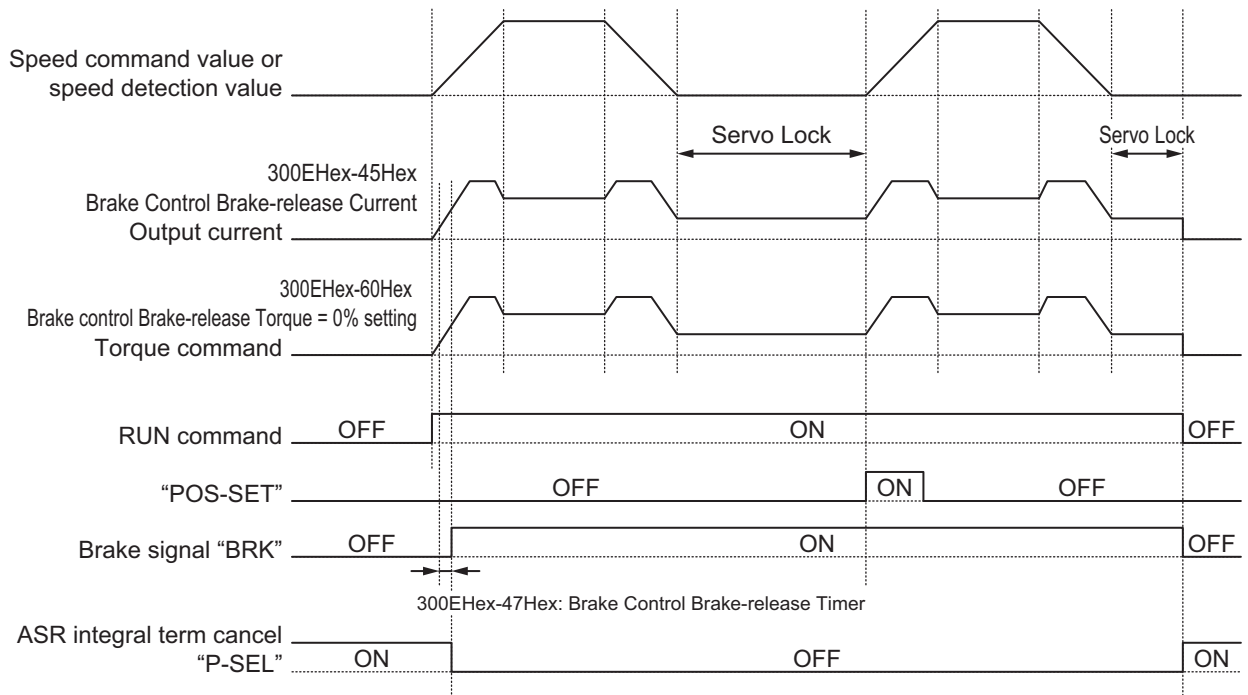
300EHex-61Hex bit6 0: Brake signal ON during position control stop
1: Brake signal released during position control stop

Vector control 300EHex-61Hex bit 6 = 0 Operation time chart



300EHex-61Hex bit6 0: Brake signal ON during position control stop
1: Brake signal released during position control stop

V/f control 300EHex-61Hex bit 6 = 1 Operation time chart



300EHex-61Hex bit6 0: Brake signal ON during position control stop
1: Brake signal released during position control stop

Vector control 300EHex-61Hex bit 6 = 1 Operation time chart

7-7-16 Position Store Selection at Power OFF

When 3037Hex-15Hex is set to "1: Store at low voltage status," the data of the current feedback position (3037Hex-63Hex, 3037Hex-64Hex) is stored to EEPROM when an insufficient voltage state occurs, and is restored at the next power ON. When "0: Invalid" is set, the data is cleared to zero at the next power ON.

Even if store to EEPROM is enabled when an insufficient voltage state occurs, when the motor rotates with the power supply shut off, the rotation amount cannot be detected and this causes position error. When this function is used, use of the mechanical brake is recommended.

Parameter No.	Function name	Data	Default data	Unit
3037Hex-15Hex	Position Feedback Store Selection at Power Off	0: Disable 1: Store at low voltage status	0	-

7-7-17 Excessive Positional Deviation

Excessive positional deviation is judged when the deviation between the current reference position and current feedback position exceeds the detection level of excessive positioning deviation (3037Hex-18Hex, 3037Hex-19Hex).

When excessive positional deviation occurs, the excessive positional deviation alarm (d0) is immediately output and the motor runs freely.

In position control, the current reference position is overwritten with the current feedback position when inverter output turns OFF, and the positional deviation of APR is cleared. For this reason, the

excessive positional deviation alarm (d0) can be reset when the alarm stops and inverter output turns OFF.

Positional deviation is closely related to positioning frequency and position command gain. When a certain frequency reference is output at a certain position reference gain, a constant positional deviation is always required. Due to this fact, positional deviation can be improved by either increasing the detection level of excessive positioning deviation (3037Hex-18Hex, 3037Hex-19Hex) or by increasing the position control gain (3037Hex-04Hex and 3037Hex-05Hex) when the excessive positional deviation alarm (d0) occurs.

Parameter No.	Function name	Data	Default data	Unit
3037Hex-18Hex x	Detection Level of Excessive Positioning Deviation (MSB)	0: Disable (MSB: 0, LSB: 0)	0	-
3037Hex-19Hex x	Detection Level of Excessive Positioning Deviation (LSB)	1 to 268435455 (MSB: 0 to 4,095, LSB: 0 to 65,535)	0	-

7-7-18 Touch Probe (Latch) Function

This is a function that latches the feedback position when the external latch input signal or the encoder Z-phase is started.

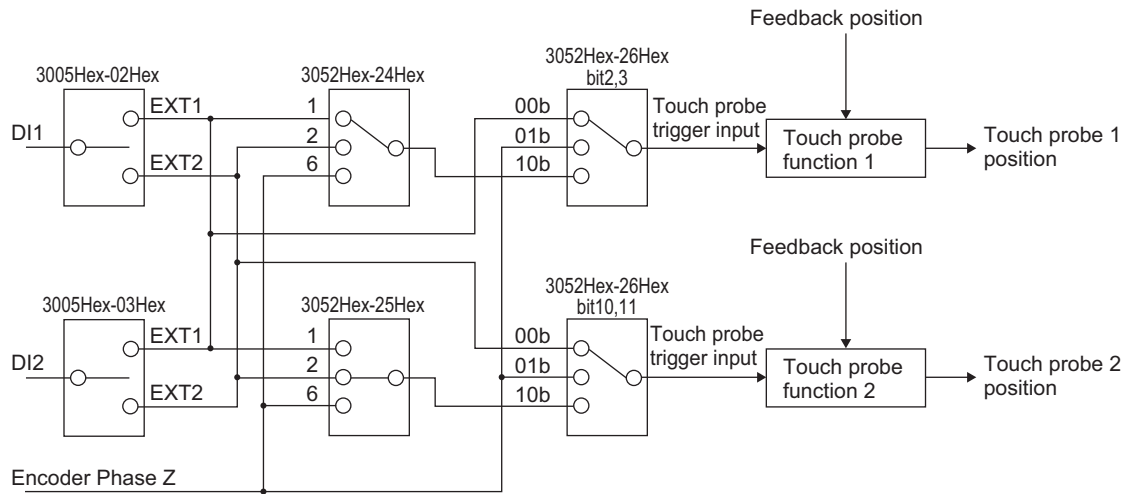
This function is disabled if neither of “187: EXT1 (External latch input 1)” and “188: EXT2 (External latch input 2)” is allocated to Input Terminal [DI1] Function Selection (3005Hex-02Hex) and Input Terminal [DI2] Function Selection (3005Hex-03Hex), and if the selection trigger is not encoder Z-phase. This function is also disabled when bit 0 (Latch function 1) and bit 8 (Latch function 2) of Touch Probe Function (3052Hex-26Hex) are 0.

Parameter No.	Function name	Data	Default data	Unit
3052Hex-24Hex	Touch Probe 1 Source	1: External Latch Input 1 (EXT1) 2: External Latch Input 2 (EXT2) 6: Encoder Phase Z	1	-
3052Hex-25Hex	Touch Probe 2 Source	1: External Latch Input 1 (EXT1) 2: External Latch Input 2 (EXT2) 6: Encoder Phase Z	1	-
3052Hex-26Hex	Touch Probe Function	0000 to FFFF hex	0	-
3017Hex-31Hex	Touch Probe 1 Positive Edge (MSB)	-4096 to 4095	0	-
3017Hex-32Hex	Touch Probe 1 Positive Edge (LSB)	0 to 65535	0	-
3017Hex-33Hex	Touch Probe 2 Positive Edge (MSB)	-4096 to 4095	0	-
3017Hex-34Hex	Touch Probe 2 Positive Edge (LSB)	0 to 65535	0	-
3017Hex-35Hex	Touch Probe Status	0000 to FFFF hex	0	-
3005Hex-02Hex, 3005Hex-03Hex	Input Terminal [DI1] Function Selection, In- put Terminal [DI2] Function Selection	187: EXT1 (External latch input 1)*1 188: EXT2 (External latch input 2)*1	-	-

*1. External latch cannot be allocated to other than multifunction input DI1 and DI2.

Setting the Trigger Signal

The trigger of the touch probe function can be selected as shown in the figure below.



Explanation of Bits of Touch Probe Function (3052Hex-26Hex)

Each bit of the touch probe function is as shown below.

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0	0	0	EPs	TriSel	Cont	Ena	0	0	0	EPs	TriSel	Cont	Ena		
Touch probe function 2							Touch probe function 1								

Ena: Touch probe function disabled (0) or enabled (1)

Cont: Touch probe operation Trigger First Event Mode(0) / Continuous Mode(1)

TriSel: Touch probe trigger input switching

bit 3(11)	bit 2(10)	Select trigger input
0	0	EXT1
0	1	Z-phase
1	0	According to the touch probe trigger selection 3052Hex-24Hex and 3052Hex-25Hex
1	1	The trigger signal input is considered to be "0."

EPs: Latch operation enabled (1) or disabled (0) during Active edge

Explanation of Bits of Touch Probe Status (3017Hex-35Hex)

Each bit of the touch probe status is as shown below.

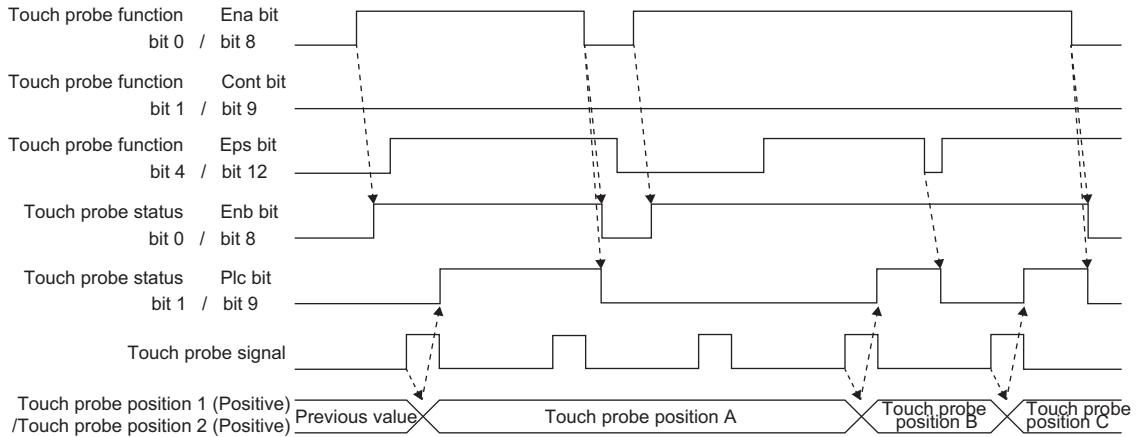
b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0	0	0	0	0	0	PLc	Enb	0	0	0	0	0	0	PLc	Enb
Touch probe function 2							Touch probe function 1								

Enb: Touch probe function disabled (0) or enabled (1)

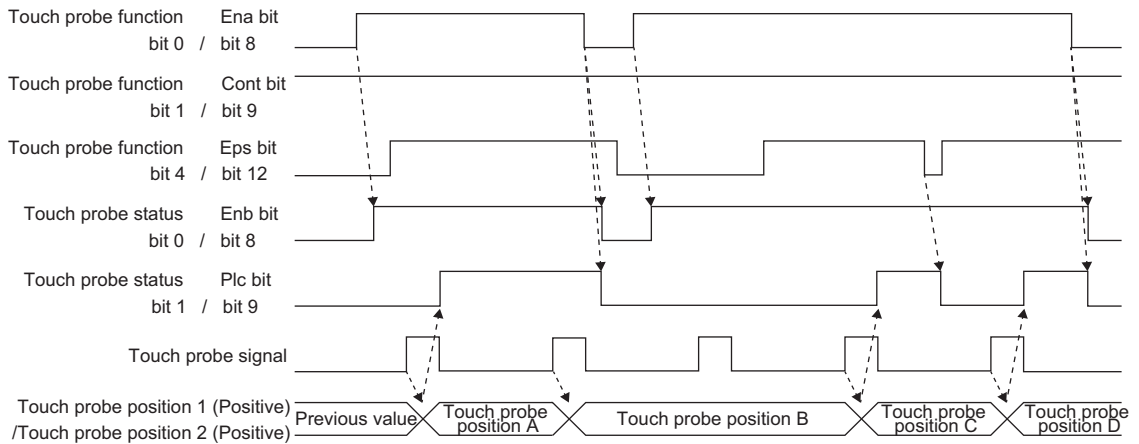
PLc: With (0) or without (1) Latch positive data

Operation Sequence

● For Cont = 0: Trigger First Event Mode (First Trigger)



● For Cont = 1: Continuous Mode (Continuous)



7-8 Motor tuning

7-8-1 Motor Off-line Auto-tuning

To perform auto-tuning of the motor, perform the settings according to the control method in 7-1-3 *Motor Parameter Settings* on page 7-6, and then perform according to the following procedure.

Offline Auto-tuning of Induction Motor (IM Motor)

Offline auto-tuning consists of the following five steps:

- Presetting of parameters
- Selection of motor rotation during auto-tuning
- Execution of auto-tuning
- Processing after auto-tuning
- Corrective action in case of an error

1 Presetting of parameters

- 1) Set one of "0: IM V/f control," "1: IM Dynamic torque vector control," "3: IM V/f control with speed sensor," "4: IM Dynamic torque vector control with speed sensor," "5: IM Vector control without speed sensor" or "6: IM Vector control with speed sensor" to 1st Drive Control Selection (3004Hex-2BHex)/2nd Drive Control Selection (3009Hex-0FHex).
- 2) Referring to 7-1-3 *Motor Parameter Settings* on page 7-6, set parameters matched to the control method.

2 Tuning method

Check the machine status, and select either "2: Tune the motor parameters while rotating" or "1: Tune the motor parameters while stopped" in 1st Auto Tuning Function Selection (3007Hex-05Hex)/2nd Auto-tuning Selection Function Selection (3009Hex-13Hex). When the wiring length has changed after rotation tuning is performed, tuning can be performed by "5: Tune the motor %R1 and %X while stopped."

3007Hex-05Hex/ 3009Hex-13Hex data	Data to be tuned	Tuning	Supplementary explanation
1 Tune the motor parameters while stopped	Primary resistance %R1 (3007Hex-08Hex/ 3009Hex-16Hex) Leakage reactance %X (3007Hex-09Hex/ 3009Hex-17Hex) Rated slip (3007Hex-0DHex/ 3009Hex-1BHex) %X correction factor (3007Hex-36Hex/ 3009Hex-36Hex)	Tuning is performed in a stop state.	When the motor cannot be rotated.

3007Hex-05Hex/ 3009Hex-13Hex data		Data to be tuned	Tuning	Supplementary explanation
2	Tune the motor parameters while rotating	No-load current (3007Hex-07Hex/ 3009Hex-15Hex) Primary resistance %R1 (3007Hex-08Hex/ 3009Hex-16Hex) Leakage reactance %X (3007Hex-09Hex/ 3009Hex-17Hex) Rated slip (3007Hex-0DHex/ 3009Hex-1BHex) Magnetic saturation factor 1 to 5 (3007Hex-11Hex/ 3009Hex-15Hex) %X correction factor (3007Hex-36Hex/ 3009Hex-36Hex)	Tuning is performed in the following order. <ul style="list-style-type: none"> • %R1, %X in motor stopped state • No-load current and magnetic saturation factor in motor rotating state (50% of base frequency) • Rated slip in motor stopped state again 	When the motor can be rotated safely.
5	Tune the motor %R1 and %X while stopped	Primary resistance %R1 (3007Hex-08Hex/ 3009Hex-16Hex) Leakage reactance %X (3007Hex-09Hex/ 3009Hex-17Hex) %X correction factor (3007Hex-36Hex/ 3009Hex-36Hex)	Tuning is performed in a stop state.	When the motor cannot be rotated. (Applied only when rotation tuning has been performed and the wiring length has been changed)

The tuning result is automatically written to the relevant parameter.

3 Preparing the mechanical system

As preparation for performing rotation tuning, remove machine couplings, and disable safety interlocks.

4 Execution of auto-tuning

- 1) Set the tuning method to the data part of object 3007Hex-05Hex and the rotation direction to bits 8 and 9.

The value of each bit is as follows.

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0	0	0	0	0	0	RE V	FW D	Data part							

Select one of the following to the data part.

Data part	Tuning method
01	Tune the motor parameters while stopped
02	Tune the motor parameters while rotating
05	Tune the motor %R1 and %X while stopped

- 2) Tuning is started when a value is written to object 3007Hex-05Hex. The time required for auto-tuning is approx. 5 to 40 seconds.
To input the RUN command via the FW or RV terminals, change the setting of 3004Hex-03Hex, and set only the data part in (1) above.
- 3) After (2) above is completed when the data part of 3007Hex-05Hex is 02Hex, acceleration is performed up to 50% of the rated speed and rotation tuning is started. When rotation tuning is completed, a deceleration stop is performed. The time required for this operation is approx. 10 seconds excluding the acceleration/deceleration time.
- 4) When the RUN command via the FW and RV terminals is selected according to the 3004Hex-03Hex = 1 setting, completion of tuning can be checked by the Tuning Progress (3017Hex-51Hex) (completion at 100%).
After tuning is completed, turn the RUN command via the FW and RV terminals OFF.
For details on how to execute auto-tuning by Sysmac Studio, refer to *Sysmac Studio Version 1 Drive Functions Operation Manual (Cat. No. I589)*.

5 Corrective action in case of an error

As unwanted tuning might cause hunting or other malfunctions or worsen operational accuracy, the inverter generates a tuning error (alarm code: 25 Hex) and discards tuning values when an abnormality is found in the tuning result.

When tuning ends in a tuning error (alarm code: 25 Hex), check the following.

- Is inverter output wiring open?
- Has the mechanical brake operated?
- Has the free-run command "FRS" turned ON?
- Are parameter settings correct?

For details on the tuning error (alarm code: 25 Hex), refer to *Tuning Error* on page 7-69.

Offline Auto-tuning of Synchronous Motor (PM Motor)

Offline auto-tuning consists of the following five steps:

- Presetting of parameters
- Selection of tuning method
- Preparing the mechanical system
- Execution of auto-tuning
- Corrective action in case of an error

1 Presetting of parameters

- 1) Set "15: PM Vector control without speed and pole position sensor" or "16: PM Vector control with speed and pole position sensor" to 1st Drive Control Selection (3004Hex-2BHex).
- 2) Referring to 7-1-3 *Motor Parameter Settings* on page 7-6, set parameters matched to the control method.

2 Selection of tuning method

Check the machine status, and select either "2: Tune the motor parameters while rotating" or "1: Tune the motor parameters while stopped" in 1st Auto Tuning Function Selection (3007Hex-05Hex). When performing only offset adjustment of the magnetic pole position sensor, select "4: Tune the PM motor magnetic pole position offset while rotating." After tuning is

finished, adjust the acceleration time and deceleration time, and conformity between the rotational direction of the motor and rotational direction of the machine.

3007Hex-05Hex data		Data to be tuned	Tuning	Supplementary explanation
1	Tune the motor parameters while stopped	1st PM Motor Armature Resistance (3007Hex-3DHex) 1st PM Motor d-axis Inductance (3007Hex-3EHex) 1st PM Motor q-axis Inductance (3007Hex-3FHex)	Tuning is performed in a stop state.	When the motor cannot be rotated. For example, when the load cannot be removed. 3007Hex-1FHex = 1 or 2
2	Tune the motor parameters while rotating	1st PM Motor Armature Resistance (3007Hex-3DHex) 1st PM Motor d-axis Inductance (3007Hex-3EHex) 1st PM Motor q-axis Inductance (3007Hex-3FHex) 1st PM Motor Induced Voltage Ke (3007Hex-40Hex)	The armature resistance, d-axis inductance and q-axis inductance are tuned in a motor stop state. After this, rotation is performed up to 50% of the rated frequency to tune the induced voltage.	When the motor can be rotated safely.
		1st PM Motor Magnetic Pole position Offset (3007Hex-60Hex)	The magnetic pole position sensor offset is tuned in a motor rotating state (speed according to 3014Hex-51Hex)	This is implemented only on the case of PM Vector control with speed and pole position sensor (PM) (synchronous motor) (3004Hex-2BHex = 16) using an A, B phase + U, V, W phase magnetic pole position detection type (3014Hex-0FHex = 4) encoder.
4	Tune the PM motor magnetic pole position offset while rotating	1st PM Motor Magnetic Pole position Offset (3007Hex-60Hex)	The magnetic pole position sensor offset is tuned in a motor rotating state (speed according to 3014Hex-51Hex)	This is performed when performing tuning of only the magnetic pole position sensor. Select PM Vector control with speed and pole position sensor (3004Hex-2BHex = 16)

The tuning result is automatically written to the relevant parameter.

3 Preparing the mechanical system

As preparation for performing rotation tuning, remove machine couplings, and disable safety interlocks.

4 Execution of auto-tuning

- 1) Set the tuning method to the data part of object 3007Hex-05Hex and the rotation direction to bits 8 and 9.

The value of each bit is as follows.

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0	0	0	0	0	0	RE V	FW D	Data part							

Select one of the following to the data part.

Data part	Tuning method
01	Tune the motor parameters while stopped
02	Tune the motor parameters while rotating
05	Tune the motor %R1 and %X while stopped

- 2) Tuning is started when a value is written to object 3007Hex-05Hex. The time required for auto-tuning is approx. 5 to 40 seconds.
To input the RUN command via the FW or RV terminals, change the setting of 3004Hex-03Hex, and set only the data part in (1) above.
- 3) After (2) above is completed when the data part of 3007Hex-05Hex is 02Hex, acceleration is performed up to 50% of the rated speed and rotation tuning is started. When rotation tuning is completed, a deceleration stop is performed. The time required for this operation is approx. 10 seconds excluding the acceleration/deceleration time.
- 4) When the RUN command via the FW and RV terminals is selected according to the 3004Hex-03Hex = 1 setting, completion of tuning can be checked by the Tuning Progress (3017Hex-51Hex) (completion at 100%).

After tuning is completed, turn the RUN command via the FW and RV terminals OFF.

For details on how to execute auto-tuning by Sysmac Studio, refer to *Sysmac Studio Version 1 Drive Functions Operation Manual (Cat. No. I589)*.

5 Corrective action in case of an error

As unwanted tuning might cause hunting or other malfunctions or worsen operational accuracy, the inverter generates a tuning error (alarm code: 25 Hex) and discards tuning values when an abnormality is found in the tuning result.

When tuning ends in a tuning error (alarm code: 25 Hex), check the following.

- Is inverter output wiring open?
- Has the mechanical brake operated?
- Has the free-run command "FRS" turned ON?
- Are parameter settings correct?

For details on the tuning error (alarm code: 25 Hex), refer to *Tuning Error* on page 7-69.

Tuning Error

The following table summarizes the causes of tuning errors.

Sub codes can be checked by the error sub code (3011Hex-04Hex). Individual alarms occur in addition to the following alarms when regular alarm detection is activated.

Cause of tuning error	Alarm code: 25 Hex Error sub code	Cause and countermeasure
Sequence abnormality	0007 Hex 0008 Hex 0009 Hex	When RUN command OFF, forced stop "STOP" and free-run stop "FRS," etc. are input during tuning →Do not turn the RUN command OFF during tuning.
Overcurrent abnormality	0006 Hex 000A Hex	When an abnormally large current flows during tuning →Check the state of the mechanical brake. Also, check if the motor can be mechanically rotated.
Tuning result abnormality	0001 Hex 0002 Hex 0003 Hex 0004 Hex	When unbalance between phases or an output phase loss is detected, or when an open output, etc. causes the tuning result to be an abnormally large or small value →Check the wiring.
Tuning frequency abnormality (Only when 3007Hex-05Hex = 2)	000D Hex	When various limit operations occur during tuning, or when a limit is applied at the maximum output frequency or frequency limiter (upper limit) →Change so that the limit value becomes 50% or higher of the base frequency.
Error occurrence	000F Hex	When an insufficient voltage state has occurred or an alarm has occurred →For details on countermeasures for individual alarms, refer to <i>9-1 Alarm Display and Remedies</i> on page 9-2.
Acceleration time exceeded (Only when 3007Hex-05Hex = 2)	0012 Hex	When 3x the set value of acceleration time in 3004Hex-08Hex is exceeded for the output frequency to reach 50% of the base frequency →Increase the value of 3004Hex-08Hex.
Control method error	0015 Hex	Although the motor is rotated for magnetic pole position tuning when 3007Hex-1FHex = 0 or 3, when 3007Hex-05Hex = 1: Tune the motor parameters while stopped is performed at this setting When 3007Hex-05Hex = 5: Tune the motor parameters while stopped is performed when 3004Hex-2BHex = 15 →Set to the correct combination.
Parameter Setting error	138B Hex	When the rated impedance or rated inductance is outside the effective range →Check setting of 3004Hex-05Hex, 3004Hex-06Hex and 3007Hex-04Hex.
Inability to calculate magnetic pole position	138D Hex	When 3007Hex-1FHex = 1 or 3 is set: When the salient pole ratio of the motor inductance is small When 3007Hex-1FHex = 2 is set: When there is no magnetic saturation characteristic of the motor →When 3007Hex-1FHex = 1, change 3007Hex-58Hex to a small value. Note, however, that in the case of motors that are difficult to magnetically saturate, tuning is sometimes impossible. →When 3007Hex-1FHex = 2 or 3, set 3007Hex-1FHex = 0, and adjust while increasing 3004Hex-19Hex in stages in increments between about 0.5 to 5.0 s until rotation tuning no longer fails.

Cause of tuning error	Alarm code: 25 Hex Error sub code	Cause and countermeasure
Insufficient magnetic saturation	13C0 Hex	When the magnetic saturation characteristic of the motor is small and the magnetic pole position cannot be distinguished →Increase the value of 3007Hex-58Hex in stages taking about 120% as the upper limit. When there is no apparent effect, set 3007Hex-1FHex = 0 or 3, and set to about 3004Hex-19Hex = 0.5 to 5.0 s.
Excessive magnetic saturation	13C1 Hex	When the magnetic saturation characteristic of the motor is large, and a large current flows for distinguishing the magnetic pole position, which is dangerous →Set 3007Hex-58Hex to a small value.
Tuning result abnormality	13C3 Hex 5065 Hex	When unbalance between phases or a phase loss is detected, or when an open output or short-circuit causes the tuning result to be abnormally small or large →Check that there is no error occurring in the wiring between the inverter and motor. →When there is an electromagnetic contactor (MC) between the inverter and motor, check to see if the contact is open.

7-8-2 Online Tuning

When dynamic torque vector control or slip compensation control is adopted and operation is performed for a long time, motor constants change according to the rise in motor temperature. When motor constants change, the speed compensation amount of the motor changes, and this sometimes results in the motor speed deviating from the initial motor rotation speed. By enabling online tuning, the motor constants corresponding to the change in motor temperature are identified and fluctuation in motor speed is reduced.

Online tuning can be used in either of the following cases after having performed rotation tuning by auto-tuning.

- When 1st Drive Control Selection (3004Hex-2BHex)/2nd Drive Control Selection (3009Hex-0FHex) is set to "1: IM Dynamic torque vector control"
- When 1st Drive Control Selection (3004Hex-2BHex)/2nd Drive Control Selection (3009Hex-0FHex) is set to "0: IM V/f control," and Slip compensation Function Selection (3052Hex-2BHex) is set to "1: Enable" and 1st Torque Boost Function Selection (301FHex-0DHex)/2nd Torque Boost Function Selection (301FHex-0EHex) is set to "1: Automatic torque boost"

Parameter No.	Function name	Data	Default data	Unit
3007Hex-06Hex/ 3009Hex-14Hex	1st Online Tuning Function Selection/2nd Online tuning Function Selection	0: Disable 1: Enable	0	-

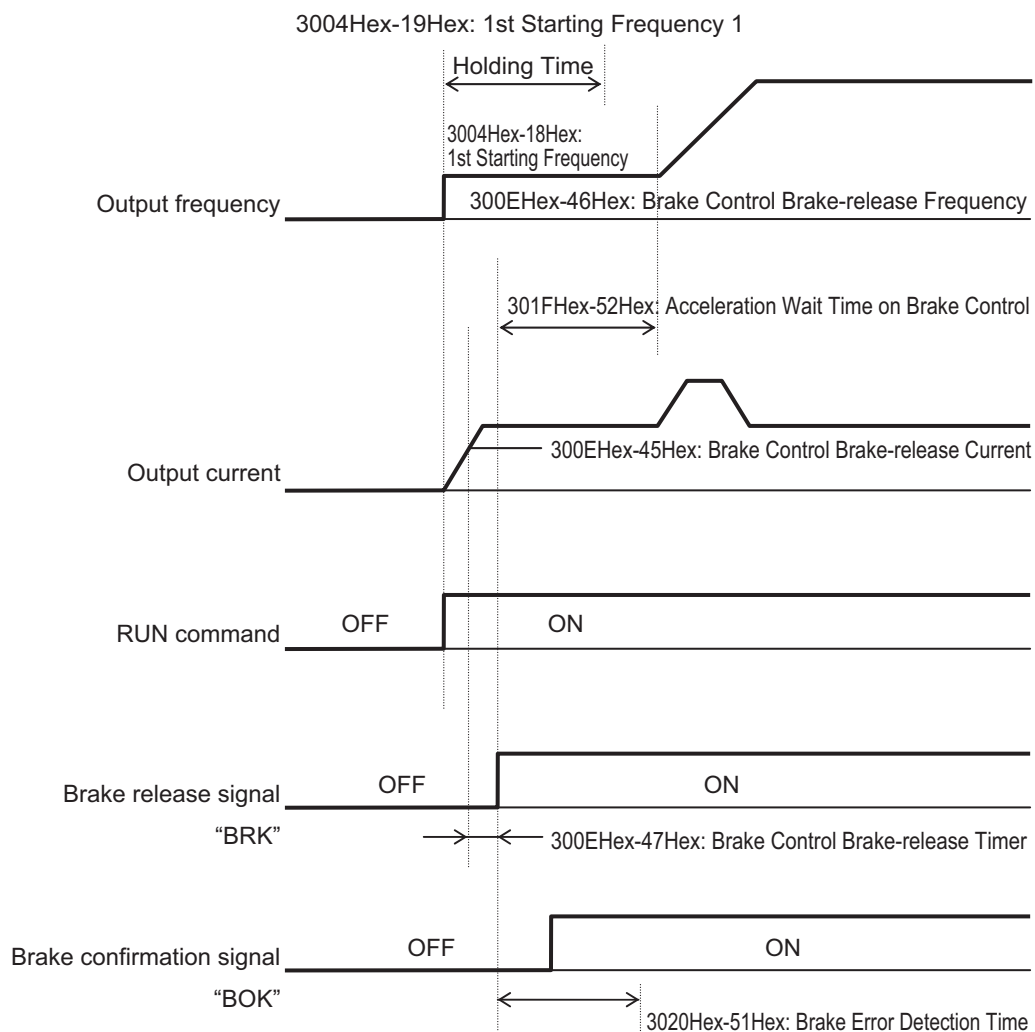
7-9 Brake control function

The 3G3M1 Series Inverter has a built-in brake control function for an elevating system, for example. Use this function to control the external brake used in an elevating system, for example, from the inverter.

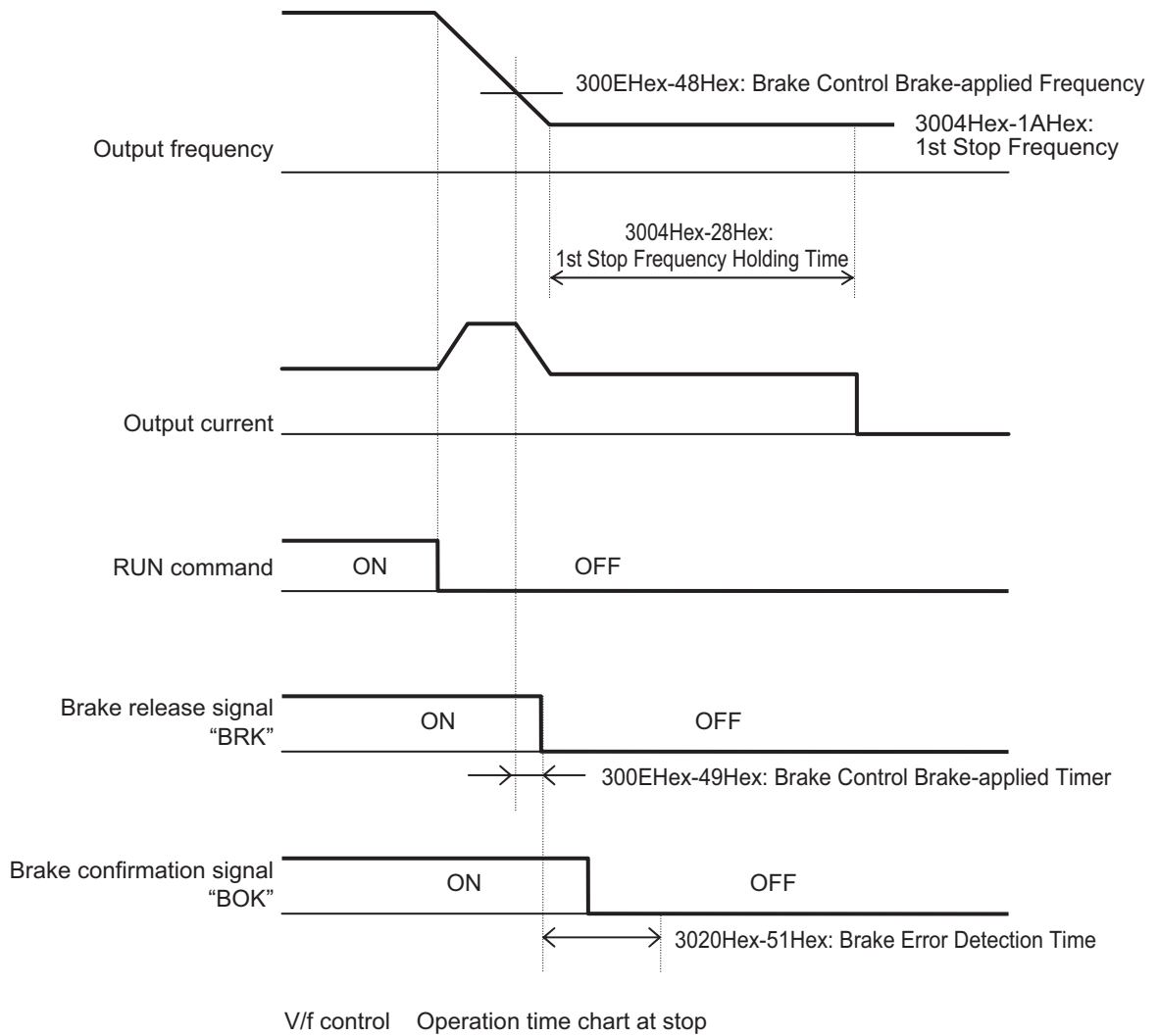
The brake control function can be used independently of the 1st Drive Control Selection (3004Hex-2BHex)/2nd Drive Control Selection (3009Hex-0FHex) setting.

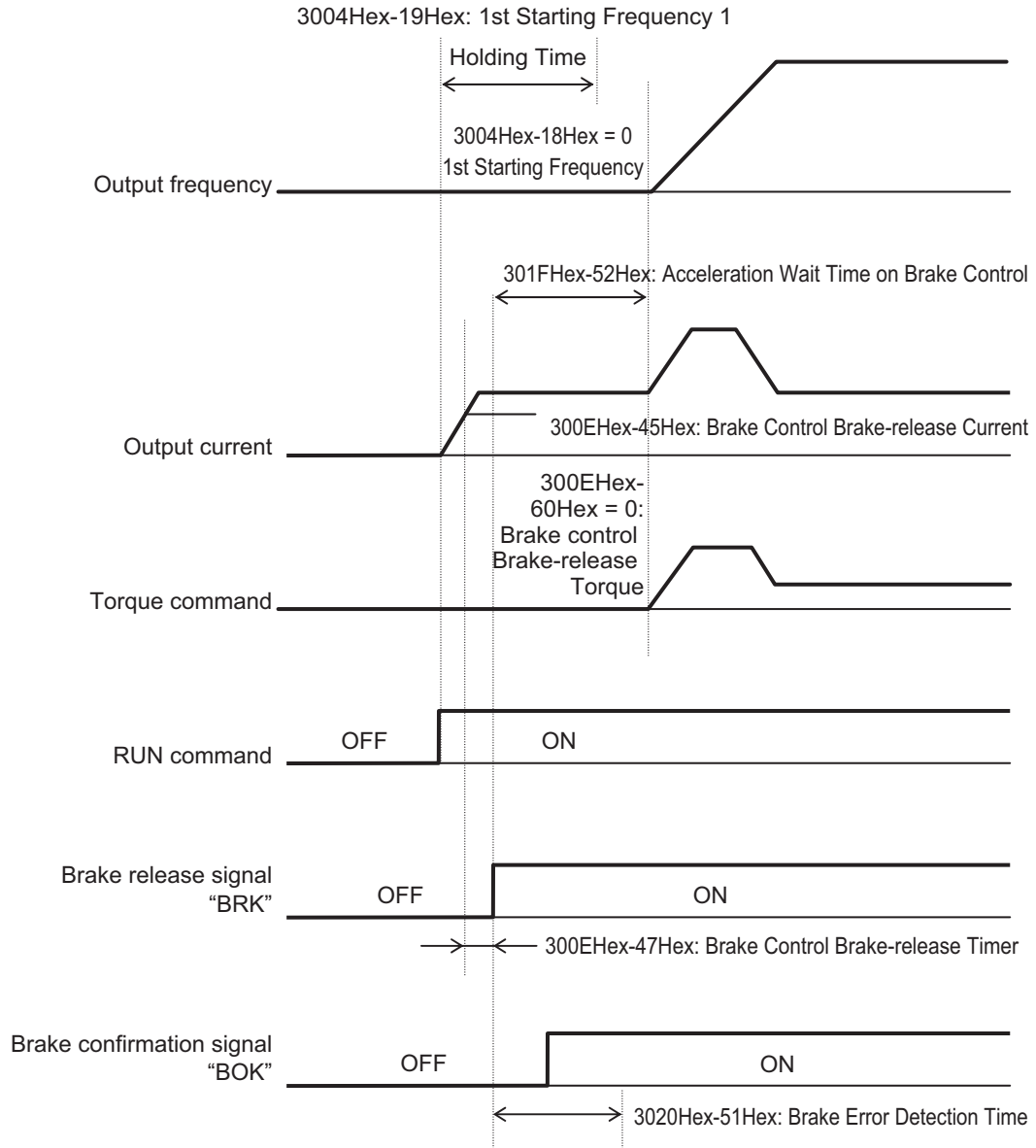
7-9-1 Operation Sequence of Brake Control Function

The description of operation sequence of brake control function is shown below.

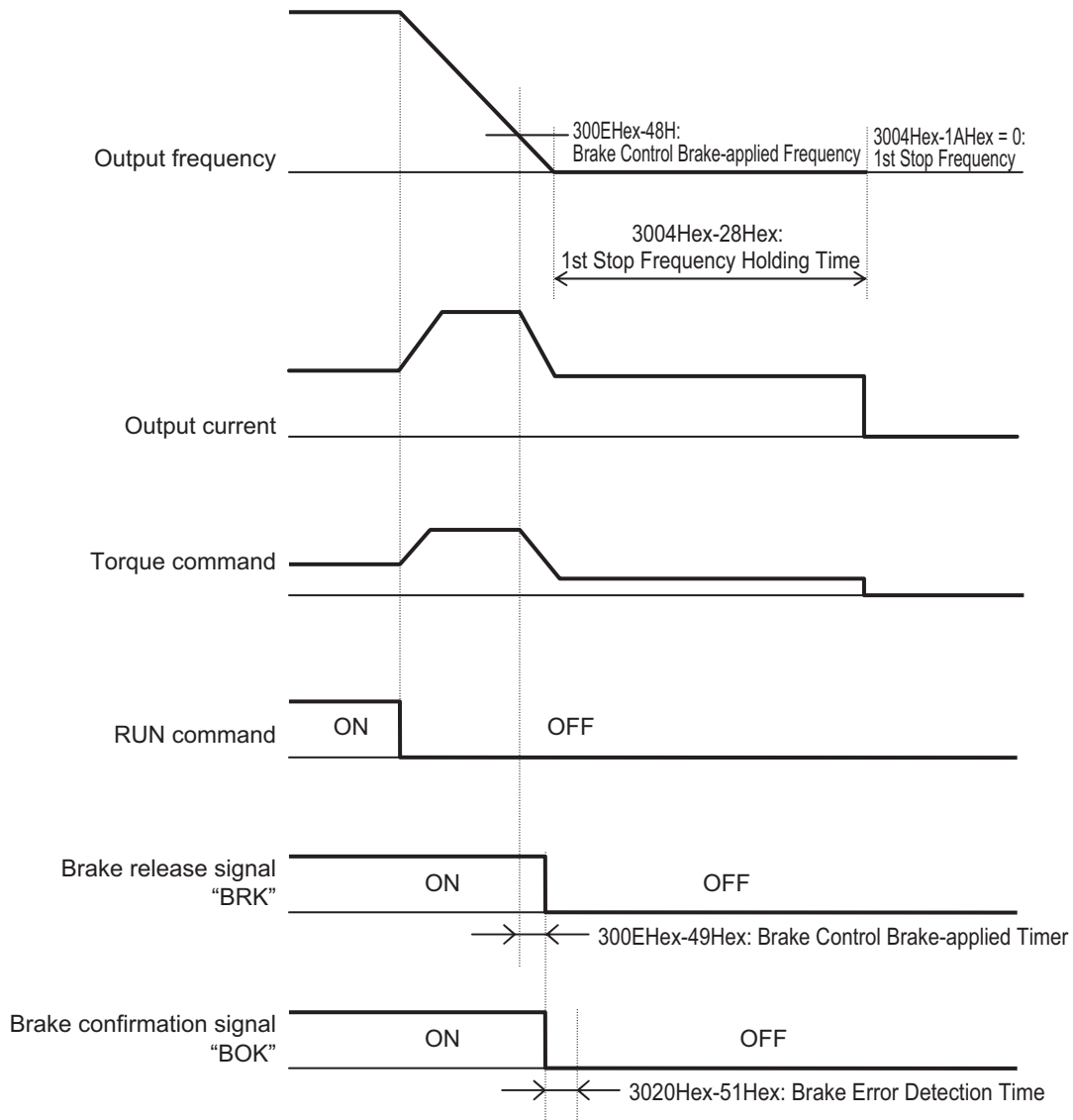


V/f control Operation time chart at startup





Vector control Operation time chart at startup



Vector control Operation time chart at stop

Note The above sequence chart shows an example where one of Input Terminal [DI1] to [DI7] Function Selection (3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex) is set to “65: BOK (brake confirmation signal).”

● At acceleration

1. When the RUN command is input, the inverter starts output.
2. When both the output current and output frequency (in V/f control) and the output current and torque command (in vector control) reach the brake signal release level (300EHex-45Hex, 300EHex-46Hex, 300EHex-60Hex), the inverter waits for the time set at Brake Control Brake-release Timer (300EHex-47Hex) and then outputs the brake release signal (3005Hex-15Hex, 3005Hex-1CHex = 57: BRK).
3. After the brake release signal is output, the inverter waits for input of the brake confirmation signal (3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex = 65: BOK) for the time set at Brake Error Detection Time (3020Hex-51Hex).

If the brake confirmation signal is not input within the time set at 3020Hex-51Hex, the inverter sets the output terminal and outputs the brake error signal (3005Hex-15Hex, 3005Hex-1CHex = 182: BER) and detects the brake error (alarm code: 24).

4. After the brake release signal is input (brake is released), the inverter waits for the time set at Acceleration Wait Time on Brake Control (301FHex-52Hex), and performs acceleration again up to the set frequency.

● At deceleration

1. When the RUN command turns OFF, the inverter decelerates to the Brake Control Brake-applied Frequency (300EHex-48Hex), waits for the time set at Brake Control Brake-applied Timer (300EHex-49Hex), and turns OFF the brake release signal (3005Hex-15Hex, 3005Hex-1CHex = 57: BRK).
2. After the brake release signal is turned OFF, the inverter waits for the brake confirmation signal (3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex = 65: BOK) for the time set at Brake Error Detection Time (3020Hex-51Hex) to turn OFF.
If the brake confirmation signal does not turn OFF within the time set at 3020Hex-51Hex, the inverter outputs the brake error signal (3005Hex-15Hex, 3005Hex-1CHex = 182: BER) and detects the brake error (alarm code: 24).
3. After the brake confirmation signal turns OFF (after applying the brake), when the inverter arrives at the stop frequency, it waits for the time set at 1st Stop Frequency Holding Time (3004Hex-28Hex) and decelerates again to an output frequency of 0 Hz.

7-9-2 Brake Control Function Settings

To enable the brake control function, allocate “57: BRK (brake release)” to the multifunction output terminal.

The brake control function can be used independently of the 1st Drive Control Selection (3004Hex-2BHex)/2nd Drive Control Selection (3009Hex-0FHex) setting.

In the 3G3M1 Series, you can combine this function with the position control.

For details on how to combine this function with position control, refer to *7-7-15 Brake Control during Position Control* on page 7-58.

- Allocate the following output to Output Terminal [DO1] Function Selection (3005Hex-15Hex) or Output Terminal [ROA, ROB] Function Selection (3005Hex-1CHex).

Brake control output : “57: BRK (brake release)”

Brake error output : “182: BER (brake error)”

- As required, allocate “65: BOK (brake confirmation)” to Input Terminal [DI1] to [DI7] Function Selection (3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex) to use this function.
- According to your system, set the parameters used for the operation sequence.
- To generate high torque at startup, it is recommended to use the torque bias function. For details on the torque bias function, refer to *7-6-2 Torque Bias Function Settings* on page 7-33.
- Set a frequency higher than Brake Control Brake-release Frequency (300EHex-46Hex). If the set frequency is equal to or lower than the 300EHex-46Hex value, the inverter will detect an overload because the brake cannot be released.

Parameter No.	Function name	Data	Default data	Unit
300EHex-47 Hex	Brake Control Brake-release Timer	0.000 to 5.000	1.000	s
301FHex-52 Hex	Acceleration Wait Time on Brake Control	0.00 to 5.00	0.00	s
3004Hex-28 Hex	1st Stop Frequency Holding Time	0.00 to 10.00	0.00	s
3020Hex-51 Hex	Brake Error Detection Time	0.00 to 10.00	1.00	s
300EHex-46 Hex	Brake Control Brake-release Frequency* ¹	0.0 to 25.0	1.0	Hz
300EHex-45 Hex	Brake Control Brake-release Current* ²	0.00 to 300.00 Set the motor rated torque as 100%.	100.00	%
300EHex-48 Hex	Brake Control Brake-applied Frequency* ¹	0.0 to 25.0	1.0	Hz
300EHex-49 Hex	Brake Control Brake-applied Timer	0.000 to 5.000	1.000	Hz
300EHex-60 Hex	Brake control Brake-release Torque	0.00 to 300.00 Set the motor rated torque as 100%.	100.00	%
300EHex-61 Hex	Brake Control Operation Se- lection	0 to 31 (Decimal) (Enabled only in vector control with speed sensor)	0	-
	bit 0: Target operation speed	0: Speed detection value	0	-
		1: Speed command value Selection of speed information used for braking judgment		
	bit 4: Braking condition selec- tion	0: RUN command OFF disabled	0	-
		1: RUN command OFF enabled		
bit 6: Operation selection dur- ing position control stop	0: BRK OFF	0	-	
	1: BRK ON			
3005Hex-02 Hex to 3005Hex-06 Hex, 3005Hex-63 Hex, 3005Hex-64 Hex	Input Terminal [DI1] to [DI7] Function Selection	65: BOK (brake confirmation)	-	-
3005Hex-15 Hex	Output Terminal [DO1] Func- tion Selection	57: BRK (brake release)	-	-
3005Hex-1C Hex	Output Terminal [ROA, ROB] Function Selection	182: BER (brake error)		

*1. Set this to a value larger than 1st Starting Frequency (3004Hex-18Hex).

*2. Note that, if the set value is too low, the inverter may not output a sufficient torque when the brake is released.

7-10 Peripheral speed constant control

In winding systems such as wire drawing machines and spinning machines, the outer diameter of the wind-up roll increases due to the amount of material being wound onto the roll and the actual wind-up speed increases when winding is continued at a constant shaft speed. To maintain the wind-up speed at the outer periphery at a constant speed, a speed sensor is used to detect the wind-up speed, and the speed of the motor shaft is controlled so that the wind-up speed is kept constant.

7-10-1 Line Speed Control Settings

Set enable/disable status for line speed control.

Parameter No.	Function name	Data	Default data	Unit
3014Hex-2AHex	Special Control Selection	1: Line speed control with speed sensor	0	-
3014Hex-10Hex	Input Terminal [PIA][PIB] Encoder Pulse Resolution	20 to 60000	1024	Pulse
3014Hex-11Hex	Input Terminal [PIA][PIB] Pulse Scaling Factor Denominator	1 to 32767	1	-
3014Hex-12Hex	Input Terminal [PIA][PIB] Pulse Scaling Factor Numerator	1 to 32767	1	-
3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex	Input Terminal [DI1] to [DI7] Function Selection	70: Line speed control cancellation 71: Line speed control frequency memory	-	-

Machine Configuration and Settings

The following parameters must be set when the mechanical system of a winder is configured as shown in the figure below.

LSC-HLD	Function
OFF	Disabled (save operation not performed)
ON	Enabled (frequency reference after thick winding compensation is saved)

Digital Setting

Set as follows to set the peripheral speed (feed speed) digitally in m/min.

Parameter No.	Function name	Description
{E48}	{E48LED monitor (Speed monitor item)}	5: Feed speed
3005Hex-33Hex	1st Frequency Conversion Coefficient	$K_s = \frac{240\pi \times a \times r_1}{p \times b}$ <p> K_s: 1st Frequency Conversion Coefficient (3005Hex-33Hex) p: Number of motor poles a, b: Motor shaft - Winding shaft speed reduction ratio (Rotation of winding shaft a occurs when the motor shaft b rotates) r_1: Radius of winding system (Initial value before winding) (m) </p>

Analog Setting

To set the peripheral speed (feed speed) by analog input, set analog input (0% to 100%) by the following formula.

$$\text{Analog input (\%)} = \frac{p \times b \times 100}{240\pi \times r_1 \times a \times f_{\max}} \times V$$

V: Peripheral speed (line speed) (m/min), f_{\max} : 1st Maximum Output Frequency (3004Hex-04Hex)

Adjustment

Just like regular speed control, the speed command filter, speed detection filter, P gain, integral time, and other parameters of the speed control system that controls peripheral speed to a constant speed must be adjusted.

Parameter No.	Function name	Description
3014Hex-02Hex	Speed Control 1 Speed Command Filter	Increase the filter constant when overshooting in response to changes in the speed command is large.
3014Hex-03Hex	Speed Control 1 Speed Detection Filter	Set a large filter constant to increase gain when the speed detection signal contains ripple and the gain of speed control cannot be raised.
3014Hex-04Hex	Speed Control 1 P Proportional Gain	When running a motor at a speed in which hunting occurs, lower the gain. When response is slow, increase the gain.

Parameter No.	Function name	Description
3014Hex-05Hex	Speed Control 1 I Integral Time	When response is slow, shorten the integral time.

7-11 Torque limit function

7-11-1 Torque Limit Function Settings

The torque limit function is for limiting the output torque of the motor.

- With the torque limit function, the following torque limit values are applied according to torque limit switching 1 and 2, analog voltage and operation state allocated to 1st Drive Control Selection (3004Hex-2BHex)/2nd Drive Control Selection (3009Hex-0FHex), Torque Limit Operation Selection (3008Hex-4CHex) and multifunction input.

Control Method	Torque Limit Operation Selection 3008Hex-4CHex	Multi-function Input		Analog input	Operation state	Torque limit value to be applied	
		TRQ1	TRQ2				
V/f control	-	OFF	-	Available*1	Power running*2	Analog input	
					Regeneration*2		
				Not available	Power running	3004Hex-29Hex	
		Regeneration			3004Hex-2AHex		
		-		ON	Power running	3005Hex-11Hex	
					Regeneration	3005Hex-12Hex	
Vector control	0: Four quadrants independent	-	-	Available	1st quadrant	Analog input	
				Not available		3004Hex-29Hex	
				-	2nd quadrant	3004Hex-2AHex	
					3rd quadrant	3005Hex-11Hex	
					4th quadrant	3005Hex-12Hex	
				1: Four quadrants identical	OFF	OFF	Available
	Not available		3004Hex-29Hex				
	ON	OFF	-				3004Hex-2AHex
	OFF	ON	-				3005Hex-11Hex
		ON	ON	-		3005Hex-12Hex	

*1. To enable analog input, set "7: Analog torque limiter" to Input Terminal [AI1] Function Selection (3005Hex-3EHex).

*2. Power running indicates the 1st and 3rd quadrants, and regeneration indicates the 2nd and 4th quadrants.

- Setting "184: TL (torque limit enabled)" to Input Terminal [DI1] to [DI7] Function Selection (3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex) enables the torque limit function only when the TL is input.

When this terminal is reset, the torque limit setting is disabled and the inverter uses the maximum value (300%) as the torque limit value.

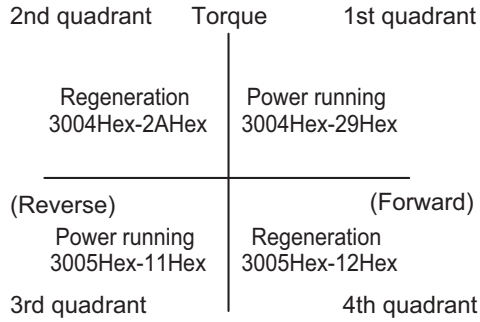
When the torque limit enabled (TL) function is not allocated to a multifunction input terminal, the torque limit function is enabled at all times.

- The torque limit function regards the motor rated torque as 100%.
- When “132: TRQ (Torque limited)” is set to Output Terminal [DO1] Function Selection (3005Hex-15Hex) or Output Terminal [ROA, ROB] Function Selection (3005Hex-1CHex), the torque limit function can be checked to see if it is activated by the status of the torque limited signal.
- To enable the torque limit value by analog voltage, set “7: Analog torque limiter” to Input Terminal [AI1] Function Selection (3005Hex-3EHex). Analog inputs 0 to 10 V are equivalent to torque limit values 0% to 300%. The torque limit value set by analog input is enabled in all operation modes.

Parameter No.	Function name	Data	Default data	Unit
3004Hex-29Hex	Torque Limit 1 (power running)	0 to 300 (In four quadrants, forward driving)	300	%
3004Hex-2AHex	Torque Limit 2 (regeneration)	0 to 300 (In four quadrants, reverse regeneration)		
3005Hex-11Hex	Torque Limit 3 (power running)	0 to 300 (In four quadrants, reverse driving)		
3005Hex-12Hex	Torque Limit 4 (regeneration)	0 to 300 (In four quadrants, forward regeneration)		
3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex	Input Terminal [DI1] to [DI7] Function Selection	14: TRQ1 (Torque limit switching 1) 184: TL (Torque control enabled) 185: TRQ2 (Torque limit switching 2)	-	-
3005Hex-15Hex	Output Terminal [DO1] Function Selection	132: TRQ (Torque limited)	-	-
3005Hex-1CHex	Output Terminal [ROA, ROB] Function Selection			
3005Hex-3EHex	Input Terminal [AI1] Function Selection	7: Analog torque limiter	-	-
3008Hex-4BHex	Torque Limit Function Selection	0: Torque limit 1: Torque current limit	1	-
3008Hex-4CHex	Torque Limit Operation Selection	0: Four quadrants independent	0	-
		1: Four quadrants identical		
3008Hex-4DHex	Frequency Rising Limit for Torque Limit	0.0 to 590.0	5.0	Hz

● Details of Four Quadrant Independent (3008Hex-4CHex = 0)

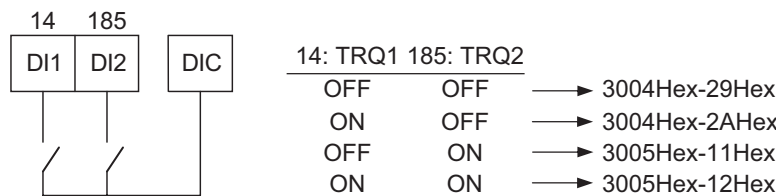
The torque limit (3004Hex-29Hex, 3004Hex-2AHex, 3005Hex-11Hex, 3005Hex-12Hex) when “0: Four quadrant independent” is selected at Torque Limit Operation Selection (3008Hex-4CHex) is as shown in the figure below.



● **Details of Four Quadrant Identical (3008Hex-4CHex = 1)**

When “1: Four quadrants identical” is selected at Torque Limit Operation Selection (3008Hex-4CHex), the torque limit value (3004Hex-29Hex, 3004Hex-2AHex, 3005Hex-11Hex, 3005Hex-12Hex) that is switched by torque limit switching 1 and 2 allocated to multifunction input terminals is set as shown in the figure below.

Exam- ple) When torque limit switching 1 (14: TRQ1) is allocated to multifunction input terminal DI1 and torque limit switching 2 (185: TRQ2) is allocated to multifunction input terminal DI2



● **Details of Torque Limiter (3008Hex-4BHex = 0)**

This parameter limits the torque to a fixed value.

● **Details of Frequency Rising Limit for Torque Limit (3008Hex-4DHex)**

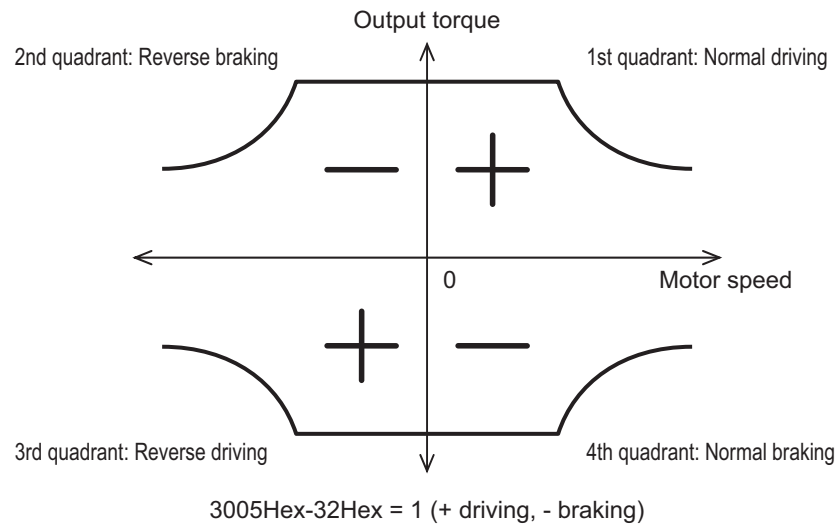
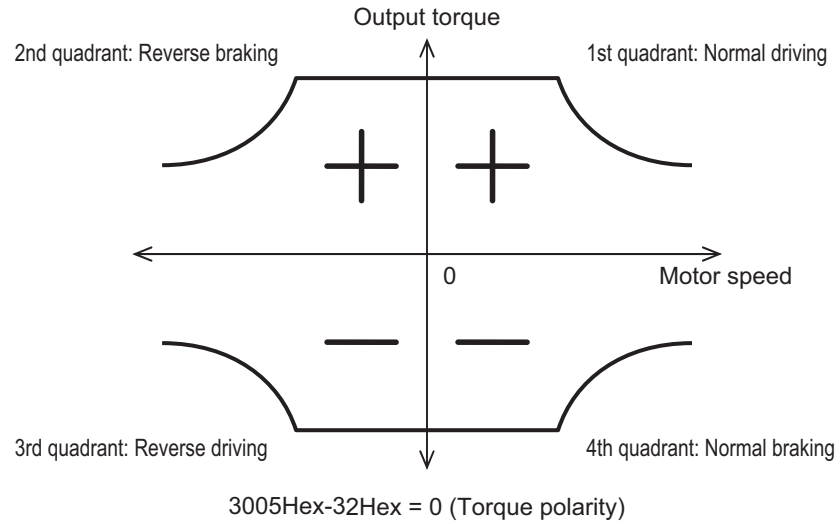
When a load is applied on the regeneration side, the actual speed of the motor is pulled to the load side to become faster than the output frequency of the inverter. When this state continues, the voltage at both ends of the main circuit capacity rises, and an overvoltage is detected and results in the inverter tripping. To avoid a trip, the overvoltage is averted by increasing the output frequency to more than the actual frequency reference. However, at this time, this torque limiter functions to apply a limit to how far the frequency rises.

7-11-2 Torque Monitor

In the torque calculation value of V/f control and the torque command value in vector control, the torque polarity is generally + for drive and - for braking. When the rotational direction changes from forward rotation to reverse rotation in elevator loads or similar applications, the polarity also is reversed as torque changes from drive to braking.

When Sysmac Studio is connected to trace torque data, continuous data can no longer be acquired as the polarity of the torque command value also changes interlocked with the speed polarity. The continuity of torque data can be ensured as forward drive and reverse braking is handled as + polarity and forward braking and reverse drive is handled as - polarity by setting 0 to Torque Command Monitor Polarity Selection (3005Hex-32Hex).

Parameter No.	Function name	Data	Default data	Unit
3005Hex-32Hex	Torque Command Monitor Polarity Selection	0: Torque polarity 1: Plus for driving Minus for braking	1	-



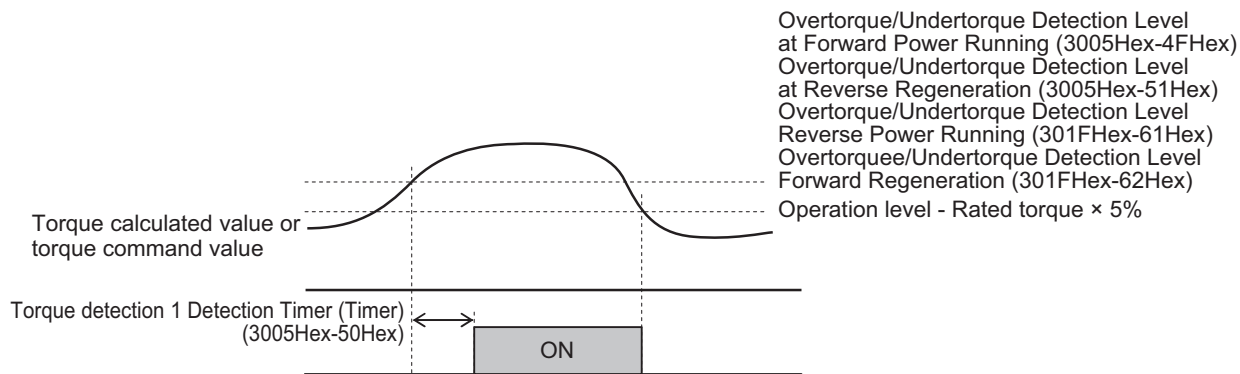
7-12 Overtorque/Undertorque Function

7-12-1 Overtorque/Undertorque Function Settings

Use this function to detect that the estimated motor output torque value exceeded the set level and output the overtorque signal.

- To enable detection of the overtorque state, allocated “46: OTQ (Over/under torque signal) (NO contact)” to Output Terminal [DO1] Function Selection (3005Hex-15Hex) or Output Terminal [ROA, ROB] Function Selection (3005Hex-1CHex). Detection of the undertorque state also can be enabled by allocating “1046: OTQ (Over/under torque signal) (NC contact).”
- The overtorque/undertorque ON signal is output when the torque value calculated by the inverter or the torque command value is at the set level of torque detection (operation level) or higher, and continues for the set time of torque command detection (timer time) or longer. The overtorque/undertorque signal is turned OFF when the torque calculation value becomes “operation level - 5% of the motor rated torque or lower.”
- The operation level can be set separately to each of the four quadrants, and the state at acceleration/deceleration and constant speed also can be selected.
- For calculating the overtorque and undertorque levels in this function, the motor rated torque is taken to be 100%.
- Use this function to detect the brake release signal of an elevator, or if the load applied to the load machine is abnormally high.

Parameter No.	Function name	Data	Default data	Unit
3005Hex-15Hex	Output Terminal [DO1] Function Selection	46: OTQ (Overtorque) 1046: OTQ (Undertorque)	-	-
3005Hex-1CHex	Output Terminal [ROA, ROB] Function Selection			
3005Hex-4FHex	Overtorque/Undertorque Detection Level at Forward Power Running	0 to 300	100	%
3005Hex-51Hex	Overtorque/Undertorque Detection Level at Reverse Regeneration	0 to 300	100	%
301FHex-61Hex	Overtorque/Undertorque Detection Level Reverse Power Running	0 to 300	100	%
301FHex-62Hex	Overtorque/Undertorque Detection Level Forward Regeneration	0 to 300	100	%
3005Hex-50Hex	Torque detection 1 Detection Timer	0.01 to 600.00	10.00	s
301FHex-63Hex	Overtorque/Undertorque Detection Condition Selection	0: Output during acceleration/deceleration and constant-speed operation 1: Output only during constant-speed operation	1	s



8

Other Functions

This section describes the details of functions not described in Section 6 or Section 7.

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8-1 Status Monitors

This section describes the output frequency, fault monitor during trip, and other monitor functions of the inverter.

8-1-1 Operation Monitor

Parameter No.	Item	Range	Display item
3010Hex-04Hex	Output Frequency Monitor before Slip Compensation	0.00 to 590.00 [Hz]	Output frequency 1 (before slip compensation) is displayed in increments of 0.01 Hz.
3017Hex-10Hex	Output Frequency After Slip Compensation	0.00 to 590.00 [Hz]	Output frequency 2 (after slip compensation) is displayed in increments of 0.01 Hz.
3010Hex-06Hex	Output Current Monitor	0.00 to 655.3 [A]	Output current effective value is displayed in increments of 0.01 A. A current value of 100 A or higher is displayed in increments of 0.1 A.
3010Hex-07Hex	Output Voltage Monitor	0.0 to 999.0 [V]	The output voltage command value is displayed in increments of 0.1 V. However, the display value changes in increments of 1.0 V.
3010Hex-08Hex	Output Torque Monitor	-400 to 400 [%]	The torque calculated value, torque command value and torque current command value are displayed in increments of 1%. <ul style="list-style-type: none"> Rated motor torque ratio of torque calculated value in the case of V/f control and dynamic torque vector control Speed control mode of vector control: Rated motor torque ratio of speed control output (after torque bias) When the torque command is used in the torque control mode of vector control: Rated motor torque ratio of torque command value When the torque current command is used in the torque control mode of vector control: Rated motor current ratio of torque current command value
3010Hex-03Hex	Frequency Reference Monitor	0.00 to 590.00 [Hz]	Displays the set frequency in increments of 0.01 Hz.

Parameter No.	Item	Range	Display item
3010Hex-02Hex	Running Status 1 Monitor	0000Hex to FFFFHex	<p>The operation status is displayed by a four-digit hexadecimal. 0000 to FFFF hex</p> <p>Bit 15: BUSY (During function code data writing) Bit14: - Bit13: - Bit12: RL (Communications effective) Bit11: ALM (Alarm relay) Bit10: DEC (During deceleration) Bit9: ACC (During acceleration) Bit8: IL (During current limiting) Bit7: VL (During voltage limiting) Bit6: TL (Torque limiting) bit 5: NUV; Main circuit DC voltage established Bit4: BRK (During braking) Bit3: INT (Inverter shut down) bit 2: EXT; During DC braking or during pre-exciting Bit1: REV (During reverse operation) Bit0: FWD (During forward operation)</p>
3017Hex-0BHex	Motor Speed	0.00 to 99990 [r/min]	<p>The rotation speed is displayed as "output frequency (Hz) × 120/Number of motor poles".</p> <ul style="list-style-type: none"> Value converted from the V/f control and frequency before dynamic torque vector control slip compensation based on the number of poles V/f with speed sensor, vector with speed sensor: Motor speed detection value Vector without speed sensor: Motor rotation speed estimated value
3017Hex-0CHex	Load Shaft Speed	0.00 to 99990 [m/min]	<p>The load speed is calculated by multiplying the output frequency by (1st Frequency Conversion Coefficient (3005Hex-33Hex) / Display Coefficient 1 for Transport Time / Auxiliary Display Coefficient 1 for Speed Monitor (3005Hex-28Hex)) and displayed. Load speed = Output frequency × (3005Hex-33Hex / 3005Hex-28Hex)</p>
3010Hex-0CHex	PID Process Command (After Scale Transformation)	-999 to 9990	<p>The PID command value is converted using PID Control Maximum Scale (3024Hex-07Hex) and PID Control Minimum Scale (3024Hex-08Hex) and displayed. Display value = (PID process command (%)/100) × (Display maximum value - Display minimum value) + Display minimum value</p>

Parameter No.	Item	Range	Display item
3010Hex-0DHex	PID Feedback Value Monitor	-999 to 9990	The PID feedback value is converted using PID Control Maximum Scale (3024Hex-07Hex) and PID Control Minimum Scale (3024Hex-08Hex) and displayed. Display value = (PID feedback value (%) / 100) × (Display maximum value - Display minimum value) + Display minimum value Even when the PID function is disabled, 3010Hex-0DHex displays the input PID feedback value.
3010Hex-0EHex	Torque Limit Value A Monitor	-300 to 300 [%]	The selected torque limit set value of the rated motor torque ratio is displayed in increments of 1%. During V/f control, the power running torque limit is displayed in A and the regenerative torque limit is displayed in B. During vector control and four quadrants independent (3008Hex-4CHex = 0), the 1st/3rd quadrant torque limit is displayed in A and the 2nd/4th quadrant torque limit is displayed in B. 1st and 3rd, and 2nd and 4th are switched depending on forward rotation or reverse rotation. During vector control and four quadrants identical (3008Hex-4CHex = 1), the same value is displayed in A and B. The torque limit is selected by the torque limit function. (Reference: 7-11 Torque limit function on page 7-82)
3010Hex-0FHex	Torque Limit Value B Monitor		
3010Hex-10Hex	Ratio value Monitor	0.00 to 200.0 [%]	A ratio set value of 1.00 time selected via analog input is displayed as 100%. 3010Hex-10Hex displays the input ratio set value even when no ratio set value is selected for analog input.
3010Hex-0BHex	Feed Speed	0.00 to 99990 [m/min]	The feed speed is calculated by multiplying the output frequency by (1st Frequency Conversion Coefficient (3005Hex-33Hex) / Display Coefficient 1 for Transport Time / Auxiliary Display Coefficient 1 for Speed Monitor (3005Hex-28Hex)) and displayed. Feed speed = Output frequency × (3005Hex-33Hex / 3005Hex-28Hex)

Parameter No.	Item	Range	Display item
3017Hex-2DHex, 3017Hex-2EHex	Target Position Monitor (MSB), Target Position Monitor (LSB)	F000 0000 hex to	The target stop position user value (hexadecimal) is displayed in upper bytes/lower bytes.
3017Hex-2BHex, 3017Hex-2CHex	Feedback Current Position Monitor (MSB), Feedback Current Position Monitor (LSB)	0FFF FFFF hex (Hexadecimal) (Equivalent to -268435456 to 268435455)	The current position is displayed in upper bytes/lower bytes.
3017Hex-2FHex, 3017Hex-30Hex	Position Deviation Monitor (MSB), Position Deviation Monitor (LSB)		The position deviation is displayed in upper bytes/lower bytes.
3017Hex-35Hex	Touch Probe Status	0000 hex to FFFF hex (Hexadecimal)	bit 0: Touch probe 1 Enb bit 1: Touch probe 1 PLc bit 8: Touch probe 2 Enb bit 9: Touch probe 2 PLc Other than the above: Reserved
3010Hex-21Hex	PID Output Monitor	-150 to 150.0 [%]	The PID output value is displayed in increments of 0.01%. (The maximum frequency is 100%.) If PID control is disabled, 3010Hex-21Hex displays 0.
3010Hex-1BHex	Magnetic Flux Command Value	0 to 999 [%]	The flux command value is displayed in increments of 1%. The magnetic flux command calculated by vector control is displayed. 0 is displayed for other than vector control. In the case of an induction motor (IM), the magnetic flux that is generated when a current equivalent to the no-load current flows is displayed on the monitor as 100%. In the case of a synchronous motor (PM), the magnetic flux equivalent to the PM Motor Induced Voltage (3007Hex-40Hex) is displayed on the monitor as 100%.

Parameter No.	Item	Range	Display item
3003Hex-4BHex	Running Status 2 Monitor	0000Hex to FFFFHex	The operation status is displayed by a four-digit hexadecimal. 0000 to FFFF hex Bit 15: Motor type (1: PM motor / 0: Induction motor) Bit14: During EN circuit diagnosis Bit7: During speed control (1 during control) Bit5 Bit4: Select motor 00: 1st motor 01: 2nd motor 10: Reserved 11: Reserved Bit 3 to Bit 0: Control method 0000: V/f control without slip compensation 0001: Dynamic torque vector control 0010: V/f control with slip compensation 0011: V/f control with speed sensor 0100: Dynamic torque vector control with speed sensor 0101: Vector control without speed sensor 0110: Vector control with speed sensor 0111: Torque control (Vector control without speed sensor) 1000: Torque control (Vector control with speed sensor)
3017Hex-11Hex	PG Feedback Value	0.00 to 590.0 [Hz]	The value obtained by converting the PG feedback value to frequency is displayed in Hz.
3017Hex-13Hex	Torque Bias Monitor	-999 to 999	Displays the torque bias command value selected by Torque Bias Function Selection (3020Hex-37Hex), Select torque bias 1 (60: TB1) terminal or Select torque bias 2 (61: TB2) terminal. (Displayed in % with respect to the rated motor torque)
3017Hex-36Hex	Pulse Input Rate for A/B Phase of Reference Side	-327.68 to 327.67 [p/s]	The pulse rate entered in the AB phase of the PG used as the input function selection command (reference) side is displayed. (in increments of 0.01 [kp/s])
3017Hex-37Hex	Pulse Input Rate for Z Phase of Reference Side	0 to 16000 [p/s]	The pulse rate entered in the Z phase of the PG used as the input function selection command (reference) side is displayed.
3017Hex-38Hex	Pulse Input Rate for A/B Phase of Feedback Side	-327.68 to 327.67 [p/s]	The pulse rate entered in the AB phase of the PG used as the return (follower) side is displayed. (in increments of 0.01 [kp/s])
3017Hex-39Hex	Pulse Input Rate for Z Phase of Feedback Side	0 to 16000 [p/s]	The pulse rate entered in the Z phase of the PG used as the return (follower) side is displayed.

Operation Status 1 Monitor [3003Hex-0FHex]

The operation status displays the status allocated to each bit by a four-digit hexadecimal. The allocation for 0 to 15 bits of the operation status is described in the table below.

Bit	Symbol	Description
15	BUSY	During parameter code data writing
14	WR	Fixed to 0
13		Fixed to 0
12	RL	Communications effective (the condition when the RUN command is issued from communication, or when the set frequency is referenced)
11	ALM	Alarm occurrence
10	DEC	During deceleration
9	ACC	During acceleration
8	IL	During current limiting
7	VL	During voltage limiting
6	TL	Torque limiting
5	NUV	Main Circuit DC Voltage > Undervoltage level
4	BRK	During braking
3	INT	Inverter output is being intercepted
2	EXT	Direct DC braking
1	REV	During reverse operation
0	FWD	During forward operation

Running Status 2 Monitor [3003Hex-4BHex]

The operation status 2 displays the status allocated to each bit by a four-digit hexadecimal. The allocation for 0 to 15 bits of the operation status is described in the table below.

Bit	Symbol	Description
15	-	Synchronous motor drive
14	-	During EN circuit diagnosis
13	-	Not used
12	-	
11	-	
10	-	
9	-	
8	-	
7	-	
6	-	Not used
5	-	Motor selection
4	-	00: 1st motor 01: 2nd motor

Bit	Symbol	Description
3	-	Control Method
2	-	0000: V/f control without slip compensation
1	-	0001: Dynamic torque vector control
0	-	0010: V/f control with slip compensation
		0011: V/f control with speed sensor
		0100: Dynamic torque vector control with speed sensor
		0101: Vector control without speed sensor
		0110: Vector control with speed sensor
		1011: Torque control (vector control with speed sensor)

8-1-2 I/O check

Parameter No.	Item	Range	Display item
3010Hex-29Hex, 3010Hex-2AHex	Input Terminal Monitor, Output Signal Monitor	0000 hex to FFFF hex	Displays the ON/OFF status of the input terminals [DI1] to [DI7], output terminals [DO1], [ROA, ROB] and the [EN1] and [EN2] terminals.
3010Hex-2BHex, 3010Hex-2CHex	Communications Input Signal Monitor, Commu- nications Control Output Signal Monitor	0000Hex to FFFFHex	Displays the ON/OFF status of the input terminals [DI1] to [DI7], [EN1], [EN2], RST (reset command), REV (reverse command), FWD (forward command) and the output terminals [DO1], [ROA, ROB] instructed via communication based on RS-485.
3010Hex-2DHex	Input Terminal [AI1] Input Voltage Monitor	0.0 to 12.0 [V]	The input voltage of the analog input terminal [AI1] is displayed in increments of 0.1 V.
3010Hex-38Hex	Pulse Input (A/B Phase [PIA][PIB])	-327.68 to 327.67 [p/s]	The pulse rate entered in the pulse input terminal [PIA] [PIB] is displayed. (in increments of 0.01 [kp/s]) Displayed without quad edge evaluation regardless of the pulse format.
3010Hex-39Hex	Pulse Input (Z Phase [PIZ])	0 to 16000 [p/s]	The pulse rate entered in the pulse input terminal [PIZ] is displayed.
3011Hex-62Hex	Input Input Terminal [PTC] Input Voltage	-12.0 to 12.0 [V]	The thermistor input terminal [PTC] input voltage is displayed in increments of 0.1 V. *Since this item is shared with other terminal functions, "999" is displayed when it is disabled due to switching by the hardware SW.

Digital Input/Output Terminal Monitor [3010Hex-29Hex, 3010Hex-2AHex]

The status of I/O allocated to each bit for the digital input/output terminal monitor is indicated by a four-digit hexadecimal.

The allocation for 0 to 15 bits of the terminal I/O status is described in the table below.

Input Terminal Monitor [3010Hex-29Hex]

Bit	Symbol	Description
15	-	Not used
14	-	
13	-	
12	EN2	1 by input
11	EN1	
10	-	Not used
9	-	
8	-	
7	-	
6	DI5	1 by input
5	DI4	
4	DI3	
3	DI2	
2	DI1	
1	DI7	
0	DI6	

Output Signal Monitor [3010Hex-2AHex]

Bit	Symbol	Description
15	-	Not used
14	-	
13	-	
12	-	
11	-	
10	-	
9	ROA, ROB	1 by output
8	-	Not used
7	-	
6	-	
5	-	
4	-	
3	-	
2	-	
1	-	1 by output
0	DO1	

Communications Control Signal (Input/Output) Monitor [3010Hex-2BHex, 3010Hex-2CHex]

The status of I/O by communication allocated to each bit for the communications control signal (input/output) monitor is indicated by a four-digit hexadecimal.

The allocation for 0 to 15 bits of the terminal I/O status is described in the table below.

Communications Input Signal Monitor [3010Hex-2BHex]

Bit	Symbol	Description
15	RST	1 by input
14	DI7	
13	DI6	
12		Not used
11		
10		
9		
8		
7		1 by input
6	DI5	
5	DI4	
4	DI3	
3	DI2	
2	DI1	
1	REV	
0	FWD	

Communications Control Output Signal Monitor (3010Hex-2CHex)

Bit	Symbol	Description
15	-	Not used
14	-	
13	-	
12	-	
11	-	
10	-	
9	ROA, ROB	1 by output
8	-	Not used
7	-	
6	-	
5	-	
4	-	
3	-	
2	-	
1	-	
0	DO1	1 by output

8-1-3 Maintenance Information

Parameter No.	Item	Range	Display item
3010Hex-47Hex	Total Power ON Time Monitor	0 to 655350 hours	The cumulative operation time (the time when the main power supply is ON) of the inverter is displayed. Measurement range: 0 to 655350 hours If 655350 hours is exceeded, the accumulation operation stops.

Parameter No.	Item	Range	Display item
3010Hex-48Hex	Main circuit DC voltage Monitor	0.0 to 999.0 [V]	Although the Main Circuit DC Voltage of the inverter is displayed in increments of 0.1 V, the data changes in increments of 1 V.
3010Hex-49Hex	Internal Air Highest Temperature	20 to 125 [°C]	The maximum value of the internal air temperature for each hour is displayed in increments of 1 degree. Display unit: °C (for 20°C and below, 20°C is displayed.) Since there is no internal air temperature sensor in 15 kW and lower models, 3010Hex-49Hex displays 0.
3010Hex-4AHex	Heat Sink Maximum Temperature	20 to 125 [°C]	The maximum value of the cooling fin temperature for each hour is displayed. Display unit: °C (for 20°C and below, 20°C is displayed.)
3010Hex-4BHex	Maximum Effective Current Value	0.00 to 999.9 [A]	The maximum effective current value for each hour is displayed.
3010Hex-4CHex	Main Circuit Capacitor's Capacitor Monitor	0.0 to 100.0 [%]	The factory default value of the current main circuit capacitor's capacitor is displayed as 100.0%.
3010Hex-44Hex	Cumulative Run Time of Capacitors on Printed Circuit Boards	0 to 9999 [x10h]	The time obtained by multiplying the coefficient based on the ambient temperature conditions with the cumulative time during which voltage is applied to the electrolytic capacitors on printed circuit boards is displayed as the cumulative operation time. Measurement range: 0 to 99990 hours If 99990 hours is exceeded, the accumulation operation stops. For details, refer to <i>8-8-10 Capacitor Life Warning Signal (WAC)</i> on page 8-85.
3010Hex-45Hex	Cumulative Run Time of Cooling Fan	0 to 9999 [x10h]	The cumulative time when the cooling fan was operating is displayed. Counting is not performed when the Cooling Fan Function Selection (Object 3008Hex-07Hex) is enabled and the cooling fan has stopped. Measurement range: 0 to 99990 hours If 99990 hours is exceeded, the accumulation operation stops.
3010Hex-4FHex	Number of Startups	0 to 65530	The number of operations of the 1st motor (number of times the RUN command for the inverter is turned ON) is calculated and displayed. If 65530 operations is exceeded, the value returns to 0 and the calculation continues.

Parameter No.	Item	Range	Display item
3010Hex-52Hex	Integrated Power Monitor	0.000 to 9999 [100kWh]	The integrating electric power consumption is displayed. 0.1 kWh to 999,900 kWh is displayed for 0.001 to 9999, with 1 = 100 kWh. The value returns to 0 at 1,000,000 kWh. The integrated electric power consumption and the integrated electric power data can be reset by setting Display Coefficient for Integrated Power (3005Hex-34Hex) to "0.000." If 999,900 kWh is exceeded, the value returns to 0. Integration is not performed when 0.000 is still set.
3010Hex-53Hex	Data Used Integrating Electric Power	0.001 to 9999	The integrated electric power consumption (1.000 = 100 kWh) × Display Coefficient for Integrated Power (3005Hex-34Hex) is displayed as the integrated electric power data. The setting range of Display Coefficient for Integrated Power (3005Hex-34Hex) is 0.000 to 9999. Display unit: None If 9999 is exceeded, the accumulation operation stops. The decimal point position moves depending on the size of the integrated electric power data, and the display resolution changes. The integrated electric power data can be reset by setting 3005Hex-34Hex to "0.000." Integration is not performed when 0.000 is still set.
3010Hex-58Hex	Inverter ROM Version 1 Main	0 to 59999	The version of the inverter ROM1 is displayed.
3010Hex-59Hex	Inverter ROM Version 2 Sub	0 to 59999	The version of the inverter ROM2 is displayed.
3012Hex-29Hex	1st Cumulative Run Time	0 to 9999 [x10h]	The cumulative time of the 1st motor run time is displayed. Measurement range: 0 to 99990 hours If 99990 hours is exceeded, the value returns to 0 and the calculation continues.
3003Hex-3EHex	Inverter Internal Air Temperature Monitor (Real-time value)	20.0 to 125.0 [°C]	The current internal temperature of the inverter is displayed. Although the display is in increments of 0.1°C, the data changes in increments of 1°C. Display unit: °C Since there is no internal air temperature sensor in 15 kW and lower models, "-----" is displayed. 0 is displayed in 3003Hex-3EHex.

Parameter No.	Item	Range	Display item
3003Hex-3FHex	Fin Temperature Monitor (Real-time value)	20.0 to 125.0 [°C]	The current temperature of the cooling fin inside the inverter is displayed. Although the display is in increments of 0.1°C, the data changes in increments of 1°C. Display unit: °C
3003Hex-4DHex	Service Life of Main Circuit Capacitor Elapsed Time	0 to 6553 [10h]	The time during which voltage is applied to the electrolytic capacitor of the main circuit is displayed as the cumulative elapsed time. The capacity of the electrolytic capacitor of the main circuit is measured when the main power supply is OFF, and the elapsed time is corrected. Measurement range: 0 to 65530 hours If 65530 hours is exceeded, the accumulation operation stops.
3003Hex-4EHex	Service Life of Main Circuit Capacitor Remaining Time	0 to 6553 [10h]	The time remaining until the service life of the electrolytic capacitor of the main circuit is displayed.
3012Hex-2AHex	2nd Cumulative Run Time of motor	0 to 9999 [x10h]	The cumulative time of the 2nd motor run time is displayed.
3003Hex-52Hex	1st Remaining Time before the Next Motor Maintenance	0 to 9999 [x10h]	The time until the next maintenance is displayed. The value obtained by subtracting the cumulative motor run time from 1st Motor Maintenance Interval (3008Hex-4FHex) is displayed. (This function is available only for the 1st motor) Display: 0 to 99990
3012Hex-2DHex	2nd Number of Startups	0 to 65530	The number of operations of the 2nd motor (number of times the RUN command for the inverter is turned ON) is accumulated.
3003Hex-56Hex	1st Remaining Startup Times before the Next Motor Maintenance	0 to 65530	The number of startups until the next maintenance is displayed. The value obtained by subtracting the number of startups from 1st Preset Startup Count for Motor Maintenance (3008Hex-50Hex) is displayed. (This function is available only for the 1st motor)

Parameter No.	Item	Range	Display item
3003Hex-57Hex	Latest Light Alarm Factor	00 hex to FF hex	<p>The contents of the minor alarm that occurred recently, the last to third last time are displayed by a code.</p> <p>0 to 254 (00 hex to FE hex)</p> <p>0(0x00): No alarm</p> <p>17(0x11): OH1; Heat sink overheat</p> <p>18(0x12): OH2; External alarm input</p> <p>19(0x13): OH3; Inverter internal overheat</p> <p>22(0x16): dBH; Braking resistor overheat</p> <p>23(0x17): OL1; Motor 1 overload (electronic thermal overload relay)</p> <p>24(0x18): OL2; Motor 2 overload (electronic thermal overload relay)</p> <p>34(0x22): Er4; Option card communications error</p> <p>35(0x23): Er5; Option card error</p> <p>47(0x2F): ErE; Following error (excessive speed deviation)</p> <p>53(0x35): ErP; RS-485 communications error (Option card)</p> <p>56(0x38): Ero; Position control error</p> <p>58(0x3A): CoF PID feedback disconnection detected</p> <p>100(0x64): FAL; Detect DC fan lock</p> <p>101(0x65): OL; Motor overload early warning</p> <p>102(0x66): OH; Heat sink overheat early warning</p> <p>103(0x67): LiF; Lifetime alarm</p> <p>104(0x68): rEF; Reference loss</p> <p>105(0x69): Pid; PID alarm</p> <p>106(0x6A): UTL; Low output torque detection</p> <p>107(0x6B): PTC PTC thermistor activated</p> <p>108(0x6C): rTE; Inverter life (Cumulative run time)</p> <p>109(0x6D): CnT; Inverter life (Number of startups)</p>
3003Hex-58Hex	Light Alarm Factor Last		
3003Hex-59Hex	Light Alarm Factor 2nd Last		
3003Hex-5AHex	Light Alarm Factor 3rd Last		
3017Hex-3EHex	Braking Resistor Thermal Monitor	0.0 to 100.0%	<p>The percentage of the electronic thermal calculated value for motor protection at the current moment is displayed. If the percentage reaches 100.0%, the dBH alarm occurs.</p>
3003Hex-3CHex	Motor Electronic Thermal Monitor	0.0 to 100.0%	<p>The percentage of the electronic thermal calculated value for motor protection at the current moment is displayed. If the percentage reaches 100.0%, the OL1 (1st motor overload) or OL2 (2nd motor overload) (depending on whether the 1st control or 2nd control is selected) occurs.</p>

Parameter No.	Item	Range	Display item
3017Hex-50Hex	Total RUN Time Monitor	0 to 655350 hours	The cumulative time of the inverter RUN state is displayed. Measurement range: 0 to 655350 hours If 655350 hours is exceeded, the accumulation operation stops.

8-1-4 Alarm information

Parameter No.	Item	Range	Display item
1 Latest alarm			
3011Hex-15Hex	Latest Alarm Info. Output Frequency	0.00 to 99.99, 100.0 to 590.0 [Hz]	The output frequency before slip compensation is displayed in increments of 0.01 Hz. A value of 100.0 Hz or higher is displayed in increments of 0.1 Hz.
3011Hex-16Hex	Latest Alarm Info. Output Current	0.00 to 99.99, 100.0 to 655.3 [A]	The output current is displayed. A current value of 100.0A or higher is displayed in increments of 0.1 A. Display unit: A (Ampere)
3011Hex-17Hex	Latest Alarm Info. Output Voltage	0 to 999 [V]	The output voltage is displayed. Display unit: V (Volt)
3011Hex-18Hex	Latest Alarm Info. Torque Monitor	-400 to 400 [%]	The torque calculated value is displayed.
3011Hex-19Hex	Latest Alarm Info. Frequency Command	0.00 to 99.99, 100.0 to 590.0 [Hz]	The set frequency is displayed.
3011Hex-1AHex	Latest Alarm Info. Running Status 1	0000Hex to FFFFHex	The operation status is displayed by a four-digit hexadecimal. 0000 to FFFF hex Bit 15: BUSY (During function code data writing) Bit14: - Bit13: - Bit12: RL (Communications effective) Bit11: ALM (Alarm relay) Bit10: DEC (During deceleration) Bit9: ACC (During acceleration) Bit8: IL (During current limiting) Bit7: VL (During voltage limiting) Bit6: TL (Torque limiting) bit5: NUV (Main circuit DC voltage established) Bit4: BRK (During braking) Bit3: INT (Inverter shut down) Bit2: EXT; During DC braking or during pre-exciting Bit1: REV (During reverse operation) Bit0: FWD (During forward operation)
3011Hex-1BHex	Latest Alarm Info. Cumulative Ope. time	0 to 655,350 hours	The cumulative inverter run time (the time when the main power supply is ON) when an error occurs is displayed.

Parameter No.	Item	Range	Display item
3011Hex-1CHex	Latest Alarm Info. Number of Startups	0 to 65530	The number of operations of the motor selected when an alarm occurred (number of times the RUN command for the inverter is turned ON) is accumulated.
3011Hex-1DHex	Latest Alarm Info. Main Circuit DC Voltage	0.0 to 999.0 [V]	The Main Circuit DC Voltage of the inverter is displayed.
3011Hex-1EHex	Latest Alarm Info. Internal Air Temperature	20 to 125 [°C]	The internal air temperature during the occurrence of an alarm is recorded and displayed. For 20°C and below, 20°C is displayed. Display unit: °C
3011Hex-1FHex	Latest Alarm Info. Heat Sink Temperature	20 to 125 [°C]	The heat sink temperature during the occurrence of an alarm is recorded and displayed. For 20°C and below, 20°C is displayed. Display unit: °C
3011Hex-20Hex	Latest Alarm Info. Input Terminal (Hexadecimal display)	0000Hex to FFFFHex	The final command value of the terminal block input signal when an alarm occurs is displayed by a four-digit hexadecimal. The display format is the same as the expression of I/O check. (Refer to 8-1-2 I/O check on page 8-9.)
3011Hex-21Hex	Latest Alarm Info. Output Terminal (Hexadecimal display)	0000Hex to FFFFHex	The final command value of the terminal block output signal when an alarm occurs is displayed by a four-digit hexadecimal. The display format is the same as the expression of I/O check. (Refer to 8-1-2 I/O check on page 8-9.)
3011Hex-02Hex	Latest Multiple Alarm1	Alarm code display	Simultaneously occurring alarm code (1st) when a main alarm occurred or while it is occurring
3011Hex-03Hex	Latest Multiple Alarm2	Alarm code display	Simultaneously occurring alarm code (2nd) when a main alarm occurred or while it is occurring
3011Hex-22Hex	Latest Alarm Info. Input Terminal via Communication (Hexadecimal display)	0000Hex to FFFFHex	The final command value of the communication input signal when an alarm occurs is displayed by a four-digit hexadecimal.
3011Hex-23Hex	Latest Alarm Info. Output Terminal via Communication (Hexadecimal display)	0000Hex to FFFFHex	The final command value of the communication output signal when an alarm occurs is displayed by a four-digit hexadecimal.
3011Hex-04Hex	Latest Alarm Sub Code 1	0 to 9999	An auxiliary code for the alarm factors is displayed.

Parameter No.	Item	Range	Display item
3011Hex-25Hex	Latest Alarm Info. Running Status 2	0000Hex to FFFFHex	<p>The running status 2 is displayed by a four-digit hexadecimal. 0000 to FFFF hex</p> <p>Bit15: Motor type (1: PM motor / 0: Induction motor)</p> <p>Bit14: During EN circuit diagnosis</p> <p>Bit7: During speed control (1 during control)</p> <p>Bit5 Bit4: Select motor 00: 1st motor 01: 2nd motor 10: Reserved 11: Reserved</p> <p>Bit3 to Bit0: Control method 0000: V/F control without slip compensation 0001: Dynamic torque vector control 0010: V/F control with slip compensation 0011: V/F control with speed sensor 0100: Dynamic torque vector control with speed sensor 0101: Vector control without speed sensor 0110: Vector control with speed sensor 0111: Torque control (Vector control without speed sensor) 1000: Torque control (Vector control with speed sensor)</p>
3011Hex-26Hex	Latest Alarm Info. Speed Detection	B1E0(-fmax) to 4E20(fmax)	<p>The speed detection value is displayed. The speed detection value with \pmmaximum frequency = ± 20000 expressed in hexadecimal is displayed in increments of ± 0.01 Hz.</p>

Parameter No.	Item	Range	Display item
3011Hex-27Hex	Latest Alarm Info. Running Status 3	0000Hex to FFFFHex	The running status 3 is displayed by a four-digit hexadecimal. 0000 to FFFF hex Bit15: --- Bit14: OL (Overload warning) Bit13: LOC (Light load detection signal) Bit12: OL2 (Overload warning 2) Bit11: OLP (Overload prevention controlling) Bit10: LIFE (Lifetime alarm) Bit9: OHF (Fin Overheat warning) Bit8: TRY (During retry) Bit7: FAN (Fan operation signal) Bit6: REF (RUN command source) Bit5: THM (Thermal warning) Bit4: IPF (During restart after instantaneous power failure) Bit3: SETM (2nd motor selection) Bit2: IRDY (Operation ready signal) Bit1: FDT1 (Over set frequency arrival signal 1) Bit0: FAR1 (Frequency arrival signal 1 (constant speed))
3011Hex-05Hex	Latest Multiple Alarm Sub Code 2	0 to 9999	The sub code when multiple alarms occurred is displayed.
301AHex-09Hex	Latest Alarm Info. Cumulative Running Time	0 to 655,350 hours	The cumulative time of the inverter RUN state is displayed.
3011Hex-32Hex	Fault Counter	0 to 65535	The number of times the inverter trips is displayed. The number of times is saved in the EEPROM when the power is turned OFF. Counting is performed from 0 to 65535, and if 65535 times is exceeded, the accumulation operation stops. By setting "7: Clear alarm history" to Data Initialization (3008Hex-04Hex), the value is cleared to 0.
2 The last alarm			
3011Hex-3DHex	Last Info. Alarm Info. Output Frequency	0.00 to 99.99, 100.0 to 590.0 [Hz]	The output frequency before slip compensation is displayed in increments of 0.01 Hz. A value of 100.0 Hz or higher is displayed in increments of 0.1 Hz.
3011Hex-3EHex	Last Alarm Info. Output Current	0.00 to 99.99, 100.0 to 655.3 [A]	The output current is displayed. A current value of 100.0A or higher is displayed in increments of 0.1 A. Display unit: A (Ampere)
3011Hex-42Hex	Last Alarm Info. Running Status	0000Hex to FFFFHex	The operation status is displayed by a four-digit hexadecimal.
3011Hex-43Hex	Last Alarm Info. Cumulative Ope. Time	0 to 655,350 hours	The number of operations of the motor (number of times the RUN command for the inverter is turned ON) is calculated and displayed.

Parameter No.	Item	Range	Display item
3011Hex-45Hex	Last Alarm Info. Main Circuit DC Voltage	0.0 to 999.0 [V]	The Main Circuit DC Voltage of the inverter is displayed.
301AHex-13Hex	Last Alarm Info. Cumulative Running Time	0 to 655,350 hours	The cumulative time of the inverter RUN state is displayed.
3 Second last alarm			
3012Hex-01Hex	Second Last Alarm Info. Output Frequency	0.00 to 99.99, 100.0 to 590.0 [Hz]	The output frequency before slip compensation is displayed in increments of 0.01 Hz. A value of 100.0 Hz or higher is displayed in increments of 0.1 Hz.
3012Hex-02Hex	Second Last Alarm Info. Output Current	0.00 to 99.99, 100.0 to 655.3 [A]	The output current is displayed. A current value of 100.0A or higher is displayed in increments of 0.1 A. Display unit: A (Ampere)
3012Hex-06Hex	Second Last Alarm Info. Running Status	0000Hex to FFFFHex	The operation status is displayed by a four-digit hexadecimal.
3012Hex-07Hex	Second Last Alarm Info. Cumulative Ope. Time	0 to 655,350 hours	The number of operations of the motor (number of times the RUN command for the inverter is turned ON) is calculated and displayed.
3012Hex-09Hex	Second Last Alarm Info. Main Circuit DC Voltage	0.0 to 999.0 [V]	The Main Circuit DC Voltage of the inverter is displayed.
301AHex-1DHex	Second last Alarm Info. Cumulative Running Time	0 to 655,350 hours	The cumulative time of the inverter RUN state is displayed.
4 Third last alarm			
3012Hex-33Hex	Third Last Alarm Info. Output Frequency	0.00 to 99.99, 100.0 to 590.0 [Hz]	The output frequency before slip compensation is displayed in increments of 0.01 Hz. A value of 100.0 Hz or higher is displayed in increments of 0.1 Hz.
3012Hex-34Hex	Third Last Alarm Info. Output Current	0.00 to 99.99, 100.0 to 655.3 [A]	The output current is displayed. A current value of 100.0A or higher is displayed in increments of 0.1 A. Display unit: A (Ampere)
3012Hex-38Hex	Third Last Alarm Info. Running Status	0000Hex to FFFFHex	The operation status is displayed by a four-digit hexadecimal.
3012Hex-39Hex	Third Last Alarm Info. Cumulative Ope. Time	0 to 655,350 hours	The number of operations of the motor (number of times the RUN command for the inverter is turned ON) is calculated and displayed.
3012Hex-3BHex	Third Last Alarm Info. Main Circuit DC Voltage	0.0 to 999.0 [V]	The Main Circuit DC Voltage of the inverter is displayed.
301AHex-27Hex	Third last Alarm Info. Cumulative Running Time	0 to 655,350 hours	The cumulative time of the inverter RUN state is displayed.
5 Fourth last alarm			
301AHex-2AHex	Fourth last Alarm Info. Output Frequency	0.00 to 99.99, 100.0 to 590.0 [Hz]	The output frequency before slip compensation is displayed in increments of 0.01 Hz. A value of 100.0 Hz or higher is displayed in increments of 0.1 Hz.
301AHex-2BHex	Fourth last Alarm Info. Output Current	0.00 to 99.99, 100.0 to 655.3 [A]	The output current is displayed. A current value of 100.0A or higher is displayed in increments of 0.1 A. Display unit: A (Ampere)

Parameter No.	Item	Range	Display item
301AHex-32Hex	Fourth Last Alarm Info. Running Status	0000Hex to FFFFHex	The operation status is displayed by a four-digit hexadecimal.
301AHex-2CHex	Fourth Last Alarm Info. Cumulative Ope. time	0 to 655,350 hours	The number of operations of the motor (number of times the RUN command for the inverter is turned ON) is calculated and displayed.
301AHex-2DHex	Fourth Last Alarm Info. Main Circuit DC Voltage	0.0 to 999.0 [V]	The Main Circuit DC Voltage of the inverter is displayed.
301AHex-31Hex	Fourth Last Alarm Info. Cumulative Running Time	0 to 655,350 hours	The cumulative time of the inverter RUN state is displayed.
6 Fifth last alarm			
301AHex-34Hex	Fifth Last Alarm Info. Output Frequency	0.00 to 99.99, 100.0 to 590.0 [Hz]	The output frequency before slip compensation is displayed in increments of 0.01 Hz. A value of 100.0 Hz or higher is displayed in increments of 0.1 Hz.
301AHex-35Hex	Fifth Last Alarm Info. Output Current	0.00 to 99.99, 100.0 to 655.3 [A]	The output current is displayed. A current value of 100.0A or higher is displayed in increments of 0.1 A. Display unit: A (Ampere)
301AHex-3CHex	Fifth Last Alarm Info. Running Status	0000Hex to FFFFHex	The operation status is displayed by a four-digit hexadecimal.
301AHex-36Hex	Fifth Last Alarm Info. Cumulative Ope. Time	0 to 655,350 hours	The number of operations of the motor (number of times the RUN command for the inverter is turned ON) is calculated and displayed.
301AHex-37Hex	Fifth last Alarm Info. Main Circuit DC Voltage	0.0 to 999.0 [V]	The Main Circuit DC Voltage of the inverter is displayed.
301AHex-3BHex	Fifth last Alarm Info. Cumulative Running time	0 to 655,350 hours	The cumulative time of the inverter RUN state is displayed.

Running Status 3 Monitor [3003Hex-47Hex]

The operation status 3 displays the status allocated to each bit by a four-digit hexadecimal. The allocation for 0 to 15 bits of the operation status is described in the table below.

Bit	Symbol	Description
15	-	Fixed to 0
14	ID2	Current detection 2
13	IDL	Low current detection
12	ID	Current detection
11	OLP	Overload prevention controlling
10	LIFE	Lifetime alarm
9	OH	Heat sink overheat early warning
8	TRY	During retry
7	FAN	Fan operation signal
6	KP	During touch panel operation
5	OL	Motor overload early warning
4	IPF	During restart after instantaneous power failure
3	SWM2	Motor 2 selection

Bit	Symbol	Description
2	RDY	During operation preparation
1	FDT	Frequency detection
0	FAR	Frequency arrival

8-2 Multifunction Input/Output Functions List

This section describes the input/output signals of the inverter.

8-2-1 Multifunction Input Selection

By allocating the following functions to Input Terminal [DI1] to [DI7] Function Selection (3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex), the set function can be operated. However, “98: FW (Forward Run/Stop)” and “99: RV (Reverse Run/Stop)” can be allocated to only Input Terminal [DI6] Function Selection (3005Hex-63Hex) or Input Terminal [DI7] Function Selection (3005Hex-64Hex).

By setting data in which 1000 is added to the set data of the following functions that are to be used, it is possible to switch the input terminals [DI1] to [DI7] from an NO contact input to an NC contact input. However, as a standard, “6: STP (3-wire stop),” “9: EXT (External trip),” “23: ATR (Torque command input permission)” and “30: STOP (Force to stop)” are set to an NC contact, and change to an NO contact by setting data in which 1000 is added.

If the same function is allocated to the multifunction input terminals, and if any one of the multifunction input terminals to which the function is allocated, except for the exceptions below, turns ON, the function is handled as ON.

Exception: If all terminals to which “9: EXT (External trip),” “30: STOP (Force to stop),” “38: ROK (Permission of Run command),” “98: FW (Forward Run/Stop)” or “99: RV (Reverse Run/Stop)” is allocated are ON, the function is handled as ON.

Input terminals or output terminals can be forcibly manipulated via communication by setting Support Tool Link Function Selection (300FHex-64Hex).

When operation via communication is set to enabled (300FHex-64Hex = 2, 3), the function allocated to the input terminal can be operated via communication. Handling of commands via communication and commands via terminal blocks differs according to each individual function that is allocated.

For the behavior when operation via communication is enabled (300FHex-64Hex = 2, 3), refer to the symbols in the “Communication function” column in the table below. The following shows the meanings of the symbols.

- E: Signals wired to the input terminal are disabled and operation follows commands instructed by Operation command (3002Hex-07Hex).
- O: Handled as ON when whichever of signals wired to the input terminal or commands instructed by Operation command (3002Hex-07Hex) are ON.
- A: Handled as ON when both signals wired to the input terminal and commands instructed by Operation command (3002Hex-07Hex) are ON.
- : Changes cannot be made by the communications function

Parameter No.	Data	Description	Communication function	Reference item	Page
3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex	0	CF1: Multi-step frequency setting binary 1	E	Multi-step speed operation function	page 6-51
	1	CF2: Multi-step frequency setting binary 2	E		
	2	CF3: Multi-step frequency setting binary 3	E		
	3	CF4: Multi-step frequency setting binary 4	E		
	4	RT1: Select ACC/DEC time (2 steps)	E	2-step acceleration/ deceleration function	page 6-37
	5	RT2: Select ACC/DEC time (4 steps)	E	2-step acceleration/ deceleration	page 6-59
	6	STP: 3-wire stop: NC contact	-	3-wire input function	page 6-50
	7	FRS: Free-run stop	O	Free-run stop	page 8-52
	8	RS: Reset	O	Reset Reset (RS)	page 6-43 page 6-59
	9	EXT: External trip: NC contact	-	External trip	page 8-76
	10	JG: Jogging	O	Jogging	page 6-53
	12	SET: Set 2nd control	O	2nd control function	page 6-46
	13	DB: External DC injection braking	E	Direct current braking	page 8-55
	14	TRQ1: Torque limit switching 1	E	Torque limit function	page 7-82
	15	CS: Commercial switch	E	Commercial switch	page 8-125
	16	SW60: Commercial switch (60Hz)	E		
	17	UP: UP/DWN function accelerated	-	Remote operation function	page 8-105
	18	DWN: UP/DWN function decelerated	-		
	19	Do not set.	O	-	-
	20	PID: PID enabled/disabled	E	PID function	page 8-108
	21	IVS: Switch normal/inverse operation	E		

Parameter No.	Data	Description	Communication function	Reference item	Page
3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex	22	IL: Interlock	-	Restart after Momentary Power Failure	page 8-41
	23	ATR: Torque command input permission: NC contact	E	Torque control	page 7-31
	25	U-DI: Universal DI	-	Universal Terminal	page 8-140
	26	STM: Enable auto search for idling motor speed at starting	O	Restart after Momentary Power Failure	page 8-41
	30	STOP: Force to stop: NC contact	A	Forced Stop	page 8-137
	32	EXITE: Pre-excite	E	Pre-excite	page 8-135
	33	PIDC: PID integral reset	E	PID function	page 8-108
	34	PID-HLD: Hold PID integral component	E		
	35	Do not set.	-	-	-
	38	ROK: Permission of Run command	E	Permission of RUN Command	page 8-103
	42	ORL: Zero return limit signal	O	Position control	page 7-36
	44	Do not set.	O	-	-
	46	OLS: Enable overload stop	E	Overload Stop Function	page 8-137
	47	LOCK: Servo lock command	E	Servo Lock	page 8-133
	58	UDC: UP/DWN function data clear	O	Remote operation function	page 8-105
	59	BATRY: Enable battery-driven operation	E	Battery Operation Enable Command (BATRY)	page 8-139
	60	TB1: Select torque bias 1	E	Torque bias function	page 7-33
	61	TB2: Select torque bias 2	E		
	62	H-TB: Hold torque bias	E		
	65	BOK: Brake confirmation	-	Brake control function	page 7-72
70	Hz/LSC: Cancel line speed control	E	Cancel line speed control	page 7-79	

Parameter No.	Data	Description	Communication function	Reference item	Page
3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex	71	LSC-HLD: Hold line speed control frequency in the memory	E	Hold line speed control frequency in the memory	page 7-79
	72	CRUN-M1: Count the run time of commercial power-driven motor 1	O	Commercial switch	page 8-125
	73	CRUN-M2: Count the run time of commercial power-driven motor 2	O		
	76	DROOP: Select droop control	E	Droop Control	page 8-134
	78	MPRM1: Select speed control parameter 1	E	Speed Control Settings	page 7-26
	79	MPRM2: Select speed control parameter 2	E		
	80	Do not set.	E	-	-
	81	Do not set.	E	-	-
	82	AR-CCL: Cancel anti-regenerative control	E	Overvoltage Suppression Function during Deceleration	page 8-74
	84	LAC: Acceleration and deceleration time cancel	E	Acceleration/deceleration time setting	page 8-132
	85	AHD: Analog command held	O	Retention of analog command function	page 8-39
	94	FJOG: Run forward with Jogging	E	Jogging (JG)	page 6-53
	95	RJOG: Run reverse with Jogging	E		
	97	F/R: 3-wire forward/reverse	O	3-wire input function	page 6-50
	98	FW: Forward Run/Stop* ¹	E	RUN command selection Forward RUN Command (FW) and Reverse RUN Command (RV)	page 6-22 page 6-49
99	RV: Reverse Run/Stop* ²	E			
119	P-SEL: Proportional operation of speed regulator	O	Position control	page 7-36	

Parameter No.	Data	Description	Communication function	Reference item	Page
3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex	121	Do not set.	O	-	-
	122	Do not set.	O	-	-
	123	Do not set.	O	-	-
	124	Do not set.	O	-	-
	125	Do not set.	O	-	-
	126	Do not set.	O	-	-
	127	Do not set.	O	-	-
	134	Do not set.	O	-	-
	135	ABS/INC: Relative / absolute position command	E	Positioning data	page 7-42
	136	ORT: Orientation command	E	Orientation	page 7-49
	137	SPD: Speed control/position control switching	E	Position control	page 7-36
	138	ORG: Zero return startup signal	E		
	139	FOT: Forward driving stop	-	Overtravel (OT)	page 7-43
	140	ROT: Reverse driving stop	-		
	141	PCLR: Position clear command	O	Clearing of position	page 7-48
	142	PSET: Position preset command	O	Position preset	page 7-49
	144	POS-SET: Target position update command	E	Positioning data	page 7-42
	145	CP1: Position command selection 1	E		
	146	CP2: Position command selection 2	E		
	147	CP3: Position command selection 3	E		
	159	2CH: 2-step acceleration/deceleration	E	2-step acceleration/deceleration function 2-step acceleration/deceleration	page 6-37 page 6-59
	160	Do not set.	E	-	-
	161	ADD: Frequency addition	E	Frequency Addition Function	page 8-104
	162	F-TM: Forced terminal block	-	Forced terminal block function	page 8-66

Parameter No.	Data	Description	Communication function	Reference item	Page
3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex	163	HLD: Retain output frequency	E	Acceleration/Deceleration Stop Function	page 6-36
	164	KHC: Integrated power clear	O	Integrated power clear (KHC)	page 8-98
	171	PID-SS1: PID control multistage command 1	E	PID function	page 8-108
	172	PID-SS2: PID control multistage command 2	E		
	173	SF1: Multi-step frequency setting bit 1	E	Multi-step speed operation function	page 6-51
	174	SF2: Multi-step frequency setting bit 2	E		
	175	SF3: Multi-step frequency setting bit 3	E		
	176	SF4: Multi-step frequency setting bit 4	E		
	177	SF5: Multi-step frequency setting bit 5	E		
	178	SF6: Multi-step frequency setting bit 6	E	Multi-step speed operation function	page 6-51
	179	SF7: Multi-step frequency setting bit 7	E		
	184	TL: Torque limit enabled	E	Torque limit function	page 7-82
	185	TRQ2: Torque limit switching 2	E		
	186	USP: Unattended start protection	-	Unattended start protection	page 8-51
	187	EXT1: External Latch Input 1 ^{*2}	-	Touch Probe (Latch) Function	page 7-62
	188	EXT2: External Latch Input 2 ^{*2}	-		

*1. Forward rotation and reverse rotation can be allocated only to the DI6 and DI7 terminals.

*2. External latch input 1 and external latch input 2 can be allocated only to DI1 and DI2.

8-2-2 Multifunction Output Selection

The following functions can be allocated to Output Terminal [DO1] Function Selection (3005Hex-15Hex) and Output Terminal [ROA, ROB] Function Selection (3005Hex-1CHex). The multifunction output terminal DO1 is open collector output, and the multifunction relay output terminals ROA/B/C are relay outputs.

By setting data in which 1000 is added to the set data of the following functions that are to be used, it is possible to switch the multifunction output terminals DO1 and ROA/B/C from an NO contact input to an NC contact input.

Parameter No.	Data	Description	Reference item	Page
3005Hex-15Hex, 3005Hex-1CHex	0	RUN: Run Signal	Run Signal	page 6-61
	1	FAR1: Frequency arrival signal 1 (constant speed)	Constant speed arrival signal	page 6-62
	2	FAR2: Over set frequency arrival signal 1	Frequency arrival signal	page 8-78
	3	UV: Signal during undervoltage	Restart after Momentary Power Failure	page 8-45
	4	B/D: Detected torque polarity	Torque control	page 7-31
	5	IOL: Inverter output limiting	Inverter output limiting	page 8-93
	6	IPF: Auto-restarting after momentary power failure	Restart after Momentary Power Failure	page 8-45
	7	THM: Thermal warning	Electronic Thermal Warning	page 6-21
	8	Do not set.	-	-
	10	IRDY: Operation ready signal	Operation ready completion signal	page 6-61
	15	AX: Switch MC on the input power lines (for inverter input-side electromagnetic contactor)	Switch MC on the input power lines	page 8-94
	16	TU: Pattern operation stage transition	Pattern Operation Function Selection	page 6-28
	17	TO: Pattern operation cycle completed	Pattern Operation Function Selection	
	18	Do not set.	Pattern Operation Function Selection	
	19	Do not set.	Pattern Operation Function Selection	
	20	Do not set.	Pattern Operation Function Selection	
	21	FAR2: Frequency arrival signal 2	Frequency arrival signal	page 8-78
	22	IOL2: Inverter output limiting with delay	Inverter output limiting	page 8-93
	25	FAN: Cooling fan in operation	Cooling FAN Control Method Selection	page 8-88
	26	TRY: Auto-resetting	Trip Retry Operation	page 8-50
	27	Reserved		page 8-140
	28	OHF: Fin overheat warning	Cooling fin overheat warning	page 8-90
	29	SY: Synchronization completed	Simultaneous Start Synchronized Run Operation	-
	30	LIFE: Lifetime alarm	Lifetime alarm (LIFE)	page 8-88
	31	FDT2: Over set frequency arrival signal 2	Frequency arrival signal	page 8-78
	33	REFOFF: Reference loss detected	Frequency Reference	page 6-24

Parameter No.	Data	Description	Reference item	Page
3005Hex-15Hex, 3005Hex-1CHex	35	RUN2: Inverter outputting	Run Signal	page 6-61
	36	OLP: Overload prevention controlling	Overload Limit/Overload Warning	page 8-71
	37	OL2: Overload warning 2		
	38	OL: Overload warning		
	41	LOC: Light load detection signal	Light load detection signal	page 8-90
	42	OD: Excessive PID deviation	PID function	page 8-108
	43	PID-CTL: Under PID control	PID function	
	44	PID-STP: Under sleep mode of PID control	PID function	
	46	OTQ: Overtorque	Overtorque/undertorque	page 7-86
	48	SWM1: 1st motor in operation	1st control under selection signal	page 8-92
	49	SETM: 2nd motor in operation	2nd control under selection signal	
	52	FWR: Forward run signal	Forward run signal	page 6-62
	53	RVR: Reverse run signal	Reverse run signal	page 6-62
	54	Do not set.	-	-
	56	MOH: Motor overheat detected by thermistor	Thermistor Trip Function	page 8-77
	57	BRK: Brake release	Brake control function	page 7-72
	59	AIIDc: Analog AI2 (All) disconnection detection	Window comparator	page 8-91
	70	ZS: 0 Hz signal	0 Hz detection function	page 6-63
	71	DSAG: Speed agreement	Motor control method with speed sensor	page 7-12
	72	FAR3: Frequency arrival signal 3	Frequency arrival signal	page 8-78
	76	DSE: Excessive speed deviation	Motor control method with speed sensor	page 7-12
	77	U-EDC: Low DC link bus voltage detection	Low DC link bus voltage detection	page 8-93
	79	IPF2: During decelerating at momentary power failure	Restart after Momentary Power Failure	page 8-48
	82	POK: Position ready	Position control	page 7-36
	84	MNT: Maintenance timer counted up	Maintenance monitor	page 8-82
	87	FAR1FDT 1: Frequency match detection	Frequency arrival signal	page 8-78
	89	PTD: Pole tuning done	Synchronous motor (PM)	page 7-25
	90	Do not set.	-	-
	91	Do not set.	-	-
	92	Do not set.	-	-
93	Do not set.	-	-	
95	Do not set.	-	-	
98	L-ALM: Minor alarm	Minor alarm list	page 8-95	
99	AL: Alarm output	Alarm list	page 6-63	

Parameter No.	Data	Description	Reference item	Page
3005Hex-15Hex, 3005Hex-1CHex	101	DECF: EN circuit failure detected	Safety function (Set by the EDM selector switch)	page 8-62
	102	EDM: STO (Safe Torque Off) Performance Monitor		
	105	DBAL: Braking transistor broken	Braking transistor broken (DBAL)	page 8-87
	111	Do not set.	-	-
	112	Do not set.	-	-
	113	Do not set.	-	-
	114	Do not set.	-	-
	115	Do not set.	-	-
	116	Do not set.	-	-
	117	Do not set.	-	-
	118	Do not set.	-	-
	119	Do not set.	-	-
	120	Do not set.	-	-
	132	TRQ: Torque limit	Torque limit function	page 7-82
	151	OT-OUT: Overtravel detection	Over-travel	page 7-43
	152	STOP-OUT: Forced stop detection	Forced Stop	page 8-137
	182	BER: Brake error	Brake control function	page 7-72
	183	FDT3: Set-frequency-only arrival signal	Frequency arrival signal	page 8-78
	185	FDT4: Set-frequency-only arrival signal 2		
	186	FBV: PID FB status output	PID function	page 8-108
	187	FR: Starting contact signal	Starting contact signal	page 8-90
	188	Do not set.	-	-
	206	LOG1: Logic operation output 1	Logical operation function	page 8-83
	207	LOG2: Logic operation output 2		
	208	LOG3: Logic operation output 3		
	209	Do not set.	-	-
	236	ONT: Power ON time over	RUN time/Power ON time over	page 8-81
	237	RNT: RUN time over		
	238	AI1Dc: Analog AI1 disconnection detection	Window comparator	page 8-91
	239	AIVDc: Analog AI2 (AIV) disconnection detection		
240	WAC: Capacitor life warning signal	Capacitor life warning signal	page 8-85	
241	WAF: Cooling fan life warning signal	Cooling fan life warning signal	page 8-88	

8-3 Analog I/O Settings

This section describes the analog I/O signal settings for this inverter.

8-3-1 Analog Input (Function Selection)

This inverter has an analog input terminal [AI1] with voltage input.

Analog input terminal [AI1] 0 to 10V, -10 to 10V

- For details on analog input adjustment, refer to *8-3-2 Analog Input Adjustment Function* on page 8-34.
- One function is allocated to the analog input terminal [AI1]. One input cannot be used simultaneously for another function.

Parameter No.	Function name	Data	Default data	Unit
3005Hex-3EHex	Input Terminal [AI1] Function Selection	0: Frequency command 1: Auxiliary frequency setting 1 2: Auxiliary frequency setting 2 3: PID command *1 5: PID feedback 6: Ratio setting 7: Analog torque limiter 9: Torque bias *1 10: Torque command *1 11: Torque current command *1 17: Speed limit for forward rotation 18: Speed limit for reverse rotation 20: Analog signal input monitor 21: PID feed forward	0	-
3006Hex-24Hex	Input Terminal [AI1] Polarity Selection	0: Bipolar 1: Unipolar	1	-

*1. When using PID process command 1, torque bias, torque reference value and torque current command value with analog input terminals, configure parameters for selecting commands of each function in addition to Input Terminal [AI1] Function Selection (3005Hex-3EHex). When both are set to analog input, analog input signal is treated as a command.

Analog Input Extended Function Selection (3005Hex-3EHex)

By setting Input Terminal [AI1] Function Selection (3005Hex-3EHex), the following functions can be allocated to each of the analog input terminals.

3005Hex-3E Hex data	Function	Description
0	None	-
1	Auxiliary frequency setting 1	An auxiliary frequency input added to 1st Frequency Reference Selection (3004Hex-02Hex). Not added to other than the 1st frequency reference (such as the 2nd frequency reference, multi-step frequency reference, etc.). 100%/Full scale

3005Hex-3E Hex data	Function	Description
2	Auxiliary frequency setting 2	An auxiliary frequency input added to all frequency settings. Added to frequency setting 1, frequency setting 2, multistep frequency, etc. 100%/Full scale
3	PID command	Enter the command source for the temperature, pressure, etc. in PID control. It is also necessary to set PID Control PID Command Selection (J02).
5	PID feedback	Enter the feedback for the temperature, pressure, etc. in PID control. Set "0: Analog input" at PID Control Feedback Selection (301FHex-14Hex). 100%/Full scale
6	Ratio setting	The ratio setting is used for the constant line speed control by diameter calculation of the winding machine and the ratio operation of multiple units, and is therefore calculated as percentage in the last frequency reference. 100%/Full scale
7	Analog torque limiter	Used when the analog input is used as torque limit instead of Torque Limit 1 (3004Hex-29Hex). 200%/Full scale
9	Torque bias	The analog input is used as the torque bias value. Set "2: Analog input" at Torque Bias Function Selection (3020Hex-37Hex). 200%/Full scale
10	Torque Reference	During torque control, the analog input is used as the torque command. Set "2: Torque current command input" or "3: Torque command input" at Torque Control Operate Selection (3008Hex-13Hex) and "0: Analog input" at Torque Reference Selection (3051Hex-21Hex).
11	Torque Current Command	During torque control, the analog input is used as the torque current command. Set "2: Torque current command input" or "3: Torque command input" at Torque Control Operate Selection (3008Hex-13Hex) and "0: Analog input" at Torque Reference Selection (3051Hex-21Hex).
17	Speed limit for forward rotation	The analog input is used as the output frequency limit value. Analog input 100% is equivalent to Maximum Output Frequency (3004Hex-04Hex/3009Hex-02Hex). When using this function, the concomitant use of Over Speed Detection Level (3014Hex-24Hex) is recommended.
18	Speed limit for reverse rotation	
20	Analog Input Monitor	By connecting analog signals to the inverter, the display coefficient can be used to convert and display analog signals as temperature, pressure and other physical quantities via communications. 100%/Full scale
21	PID feed forward	Enter the feedforward such as the temperature, pressure, etc. in PID control. Set "1: Input terminal [AI1]" to PID Control PID Feedforward Selection for Process Control (301FHex-16Hex). 100%/Full scale

Using an Analog Input in Command System Parameters

- When using analog input terminals by the following functions, configure parameters for selecting the commands of each function in addition to Input Terminal [AI1] Function Selection (3005Hex-3EHex). When both are set to analog input, analog input signal is treated as a command.

Function	Command setting	3005Hex-3EHex data	Reference
Frequency Reference	1st Frequency Reference Selection (3004Hex-02Hex)/2nd Frequency Reference Selection (3006Hex-1FHex) = "1: Analog voltage input (input terminal [AI1])"	0: Frequency reference	page 6-24
Torque Reference	Torque Control Operate Selection (3008Hex-13Hex) = "3: Torque command input" Torque Reference Selection (3051Hex-21Hex) = "0: Analog input"	10: Torque command	page 7-31
Torque Current Command	Torque Control Operate Selection (3008Hex-13Hex) = "2: Torque current command input" Torque Reference Selection (3051Hex-21Hex) = "0: Analog input"	11: Torque current command value	page 7-31
Torque bias	Torque Bias Function Selection (3020Hex-37Hex) = "2: Analog input"	9: Torque bias	page 7-33
PID command	PID Control PID Command Selection (300EHex-03Hex) = "1: Analog input"	3: PID command	page 8-108
PID feedback	PID Control Feedback Selection (301FHex-14Hex) = "0: Analog input"	5: PID feedback	page 8-108

8-3-2 Analog Input Adjustment Function

This function adjusts the offset, bias and gain of the analog input terminals [AI1].

- The analog input terminal [AI1] has a voltage input only.
- Select the polarity (3006Hex-24Hex) of the analog signal to input and set the input range of the analog signal.
- Add the value set at Offset (3006Hex-20Hex) to the analog input value, and adjust for shift of the offset.
- Set the bias (command) (3004Hex-13Hex/3006Hex-38Hex) and gain (command) (3006Hex-21Hex), and convert the analog signal to digital value and adjust the resulting signal. Adjust the base point of bias (command) and gain (command) at bias (analog input) (3006Hex-33Hex/3006Hex-39Hex) and gain (analog input) (3006Hex-23Hex).
- Filters (3006Hex-22Hex) can be set to remove noise.

Parameter No.	Function name	Data	Default data	Unit
3006Hex-24Hex	Input Terminal [AI1] Polarity Selection	0: Bipolar 1: Unipolar	1	-
3006Hex-20Hex	Input Terminal [AI1] Offset	-5.0 to 5.0	0.0	%
3006Hex-22Hex	Input Terminal [AI1] Filter	0.00 to 5.00	0.05	s
3006Hex-21Hex	Input Terminal [AI1] Gain (Command)	0.00 to 400.00	100.00	%
3006Hex-23Hex	Input Terminal [AI1] Gain (Analog Input)	0.00 to 100.00	100.00	%

Parameter No.	Function name	Data	Default data	Unit
Bias adjustment on 1st frequency reference				
3004Hex-13Hex	Input Terminal [AI1, AI2] Bias for 1st Frequency Command	-100.00 to 100.00	0.00	%
3006Hex-33Hex	Input Terminal [AI1, AI2] Bias Analog Input for 1st Frequency Command	0.00 to 100.00	0.00	%
Bias adjustment on 2nd frequency reference				
3006Hex-38Hex	Input Terminal [AI1] Bias (Command)	-200.00 to 200.00	0.00	%
3006Hex-39Hex	Input Terminal [AI1] Bias (Analog Input)	0.00 to 100.00	0.00	%

Polarity Selection (3006Hex-24Hex)

Set the input range of analog input voltage.

Input Terminal [AI1] Polarity Selection (3006Hex-24Hex) data	Function	Description
0	Bipolar (-10 to 10 V)	When analog signals are changed to digital values after application of bias, values less than 0% are enabled as minus values.
1	Unipolar (0 to 10 V)	When analog signals are changed to digital values after application of bias, values less than 0% are limited at 0%.

Offset (3006Hex-20Hex)

Set an offset with respect to the analog input voltage. It is also possible to correct the offset of signals from external equipment.

Filter (3006Hex-22Hex)

Set the filter time constant with respect to the analog input voltage. As response slows down when a large time constant is set, take the response speed of the equipment into consideration when determining the time constant. When noise causes the input voltage to fluctuate, increase the time constant.

Scaling of Analog Input Signal

The relationship between analog input signals and digital values for each individual analog input range is as follows.

Analog input range	Input value	Digital value (%)	Gain/bias setting value
0 to 10V	0 10V	0% 100%	Gain reference value 100% (factory default value) Gain 100% (factory default value) Bias reference value 100% (factory default value) Bias 0% (factory default value)
-10 to 10V	-10 0 +10V	-100% 0% 100%	Gain reference value 100% (factory default value) Gain 100% (factory default value) Bias reference value 100% (factory default value) Bias 0% (factory default value)

Analog input signals 0% to 100% are converted at the following full scale, and used by the corresponding functions.

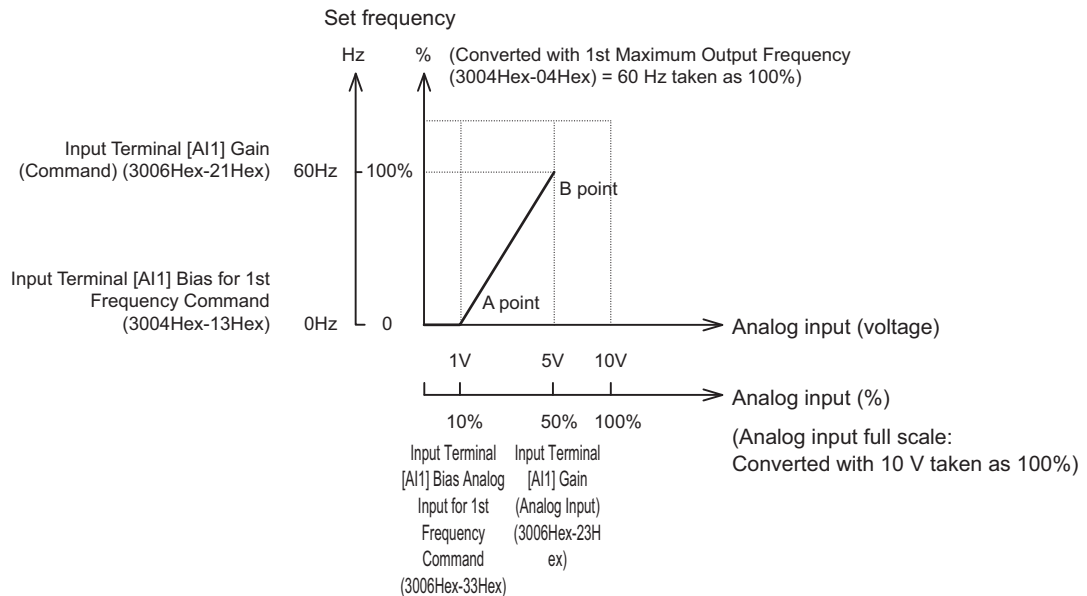
Input Terminal [AI1] Function Selection (3005Hex-3EHex) data	Function	Full scale
0	Frequency Reference	0 to maximum output frequency [Hz]
1	Auxiliary frequency setting 1	Same as above (same as "0: Frequency reference")
2	Auxiliary frequency setting 2	Same as above (same as "0: Frequency reference")
3	PID command	Input Terminal [AI1] Analog Input Adjustment Minimum Scale (3006Hex-3DHex) to Input Terminal [AI1] Analog Input Adjustment Maximum Scale (3006Hex-3CHex)
5	PID feedback	Same as above (same as "3: PID command")
6	Ratio setting	0 to 100%
7	Analog torque limiter	0 to 200%
9	Torque bias	Same as above (same as "7: Analog torque limiter")
10	Torque Reference	0 to 200%
11	Torque Current Command	Same as above (same as "10: Torque command")
17	Speed limit for forward rotation	0 to maximum output frequency [Hz]
18	Speed limit for reverse rotation	Same as above (same as "17: Speed limit for forward rotation")
20	For analog input display	(Same as "3: PID command")
21	PID feed forward	(Same as "3: PID command")

Gain/Bias

When setting gain and bias, take the maximum frequency required for your application to be 100%. When setting the bias base point and gain base point data, take full scale of analog input (10 V) to be 100%.

Even if an analog input is unipolar, the frequency setting can be set as bipolar by setting bias as a negative value.

Example) When setting the set frequency 0 to 60 Hz by analog input AI1 1 to 5 V (1st Maximum Output Frequency (3004Hex-04Hex) = 60 Hz)



(A point)

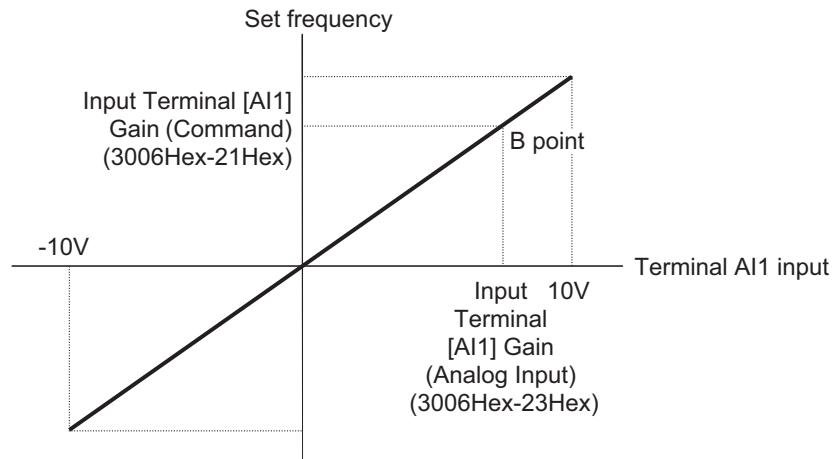
To take the frequency reference to be 0 Hz when the analog input is 1 V, set Input Terminal [AI1] Bias for 1st Frequency Command (3004Hex-13Hex) to 0%. At this time, as 1 V becomes the bias base point and 1 V is equivalent to 10% of full scale 10 V of terminal AI1, set Input Terminal [AI1, AI2] Bias Analog Input for 1st Frequency Command (3006Hex-33Hex) to 10%.

(B point)

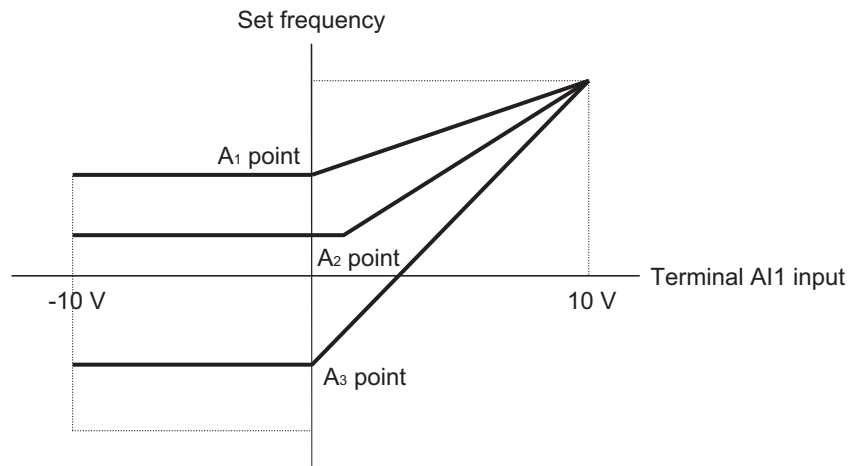
To take the frequency reference to be the maximum frequency when the analog input is 5 V, set Input Terminal [AI1] Gain (Command) (3006Hex-21Hex) to 100%. At this time, as 5 V becomes the gain base point and 5 V is equivalent to 50% of full scale 10 V of input terminal [AI1], set Input Terminal [AI1] Gain (Analog Input) (3006Hex-23Hex) to 50%.

Input terminal [AI1] can be used with bipolar inputs (-10 V to 10 V) by setting Input Terminal [AI1] Polarity Selection (3006Hex-24Hex) to "0."

When Input Terminal [AI1] Bias for 1st Frequency Command (3004Hex-13Hex) and Input Terminal [AI1] Bias Analog Input for 1st Frequency Command (3006Hex-33Hex) are both set to "0," the command becomes symmetrically inverted as shown in the figure below.



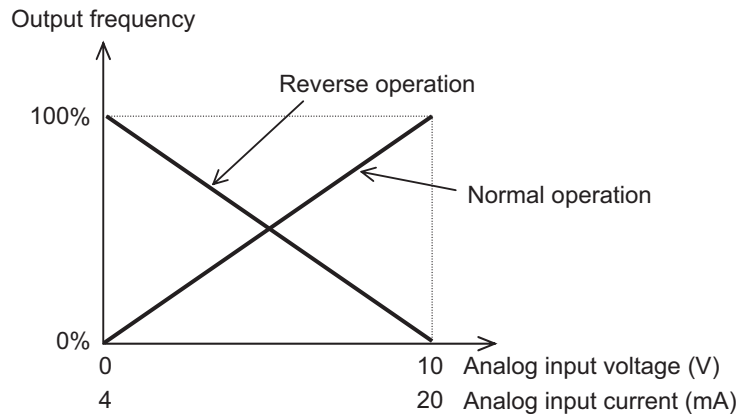
When Input Terminal [AI1] Bias for 1st Frequency Command (3004Hex-13Hex) and Input Terminal [AI1] Bias Analog Input for 1st Frequency Command (3006Hex-33Hex) are set to an arbitrary value (e.g. points A1, A2, A3), each of the values are limited by bias values as shown in the figure below.



Normal and Inverse Operations

Normal operation and inverse operation of the analog frequency reference can be switched by the IVS terminal

Parameter No.	Function name	Data	Default data	Unit
3006Hex-36Hex	Input Terminal [AI1, AI2] Normal/Inverse Operation for 1st Frequency Command	0: Normal 1: Inverse	0	-
3006Hex-37Hex	Input Terminal [AI1, AI2] Normal/Inverse Operation for 2nd Frequency Command	0: Normal 1: Inverse	0	-
3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex	Input Terminal [DI1] to [DI7] Function Selection	21: IVS (Switch normal/ inverse operation)	-	-



- Switching of Normal/Inverse is performed by the combination of Input Terminal [AI1] Normal/Inverse Operation for 1st Frequency Command (3006Hex-36Hex)/Input Terminal [AI1] Normal/Inverse Operation for 2nd Frequency Command (3006Hex-37Hex) and the Normal/Inverse switching “IVS” signal. Operation is as shown in the following table.

3006Hex-36Hex/3006Hex-37Hex data	Input signal “IVS”	Operation
0: Normal	OFF	Normal operation
0: Normal	ON	Reverse operation
1: Inverse	OFF	Reverse operation
1: Inverse	ON	Normal operation

Input Terminal [AI1] Normal/Inverse Operation for 1st Frequency Command (3006Hex-36Hex)/Input Terminal [AI1, AI2] Normal/Inverse Operation for 2nd Frequency Command (3006Hex-37Hex) are enabled when analog input is selected as the frequency reference at 1st Frequency Reference Selection (3004Hex-02Hex)/2nd Frequency Reference Selection (3006Hex-1FHex). In UP/DOWN control, normal/inverse operation cannot be selected.

8-3-3 Analog Input Filter

Use it to set an input filter for voltage or current input when using an external analog signal to input the frequency reference. The analog input filter is effective in removing noise from the analog input circuit.

Increasing the set value results in a slow response. This is the filter time constant for a sett value of 0.00 to 5.00 (s).

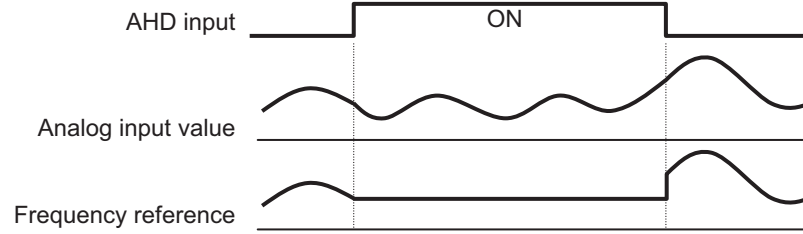
Parameter No.	Function name	Data	Default data	Unit
3006Hex-22Hex	Input Terminal [AI1] Filter	0.00 to 5.00 s	0.05	s

8-3-4 Analog Command Hold Function (AHD)

Use this function to hold the frequency reference, PID command, etc. instructed by analog input. While the AHD terminal is ON, the capture result of the analog input [AI1] terminal is held. Since the analog input value is held, this function can be used regardless of the usage purpose of the analog inputs.

If the power is turned ON, or if the reset terminal (8: RS) is turned from ON to OFF with the AHD terminal ON, the last held data is made available.

Parameter No.	Function name	Data	Default data	Unit
3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex	Input Terminal [DI1] to [DI7] Function Selection	85: AHD (Analog command held)	-	-



8-4 Restart Functions

This section describes the restart-related functions and their operations.

8-4-1 Restart Settings

- Whether or not to perform an auto search start during restart is determined based on the setting of Motor Starting Mode Auto Search Function Selection (3008Hex-0AHex). If auto search start is not to be performed, the inverter restarts from the starting frequency as in normal operation.
- If “0: Disable” is set at Motor Starting Mode Auto Search Function Selection (3008Hex-0AHex), then Power Interruption Restart Wait Time (3008Hex-0EHex) is ignored, and restart is performed from 0 Hz.
- If “2: Enable at normal start and restart after momentary power failure” is selected for Motor Starting Mode Auto Search Function Selection (3008Hex-0AHex), auto search restart is performed even when the power is turned ON again.
- Motor Starting Mode Auto Search Function Selection (3008Hex-0AHex) is a parameter that is used in V/f control (including dynamic torque vector control). Motor Starting Mode Auto Search in Speed Sensor less Vector Control (3014Hex-44Hex) is used during vector control without speed sensor.
- When vector control with speed sensor is used, restart is performed from the speed detected by the speed sensor regardless of Motor Starting Mode Auto Search Function Selection (3008Hex-0AHex).
- When using V/f control with speed sensor (including dynamic torque vector control with speed sensor), Motor Starting Mode Auto Search Function Selection (3008Hex-0AHex) is followed.

Parameter No.	Function name	Data	Default data	Unit
3008Hex-0AHex	Motor Starting Mode Auto Search Function Selection	0: Disable 1: Enable (Only at restart after momentary power failure)	0	-
3014Hex-44Hex	Motor Starting Mode Auto Search in Speed Sensor less Vector Control	2: Enable (At normal start and restart after momentary power failure)	1	

- The details of Starting Frequency Selection at Frequency Pull-in Restart (301FHex-35Hex) are as follows.

Set value	Description	Description
0	Frequency at which the power failure occurred	Pull-in from frequency when inverters output was shut off
1	Maximum frequency	Pull-in from maximum frequency
2	Set frequency	Pull-in from currently selected frequency reference
3	Starting frequency	Restart from starting frequency

8-4-2 Restart after Momentary Power Failure

This function is used to set operation selection during restart after a momentary power failure.

Parameter No.	Function name	Data	Default data	Unit
3004Hex-0FH ex	Power Interruption Re-start Mode Selection	0: Immediately trip (Free run stop) 1: Trip after a recovery from power failure (Free run stop) 2: Trip after decelerate-to-stop 3: Continue to run 4: Restart at the frequency selected by (301FHex-35Hex) 6: Decelerate-to-stop (w/o trip)	1	-
3005Hex-02H ex to 3005Hex-06H ex, 3005Hex-63H ex, 3005Hex-64H ex	Input Terminal [DI1] to [DI7] Function Selection	26: STM (Enable auto search for idling motor speed at starting) 22: IL (Interlock)	-	-
3008Hex-0AH ex	Motor Starting Mode Auto Search Function Selection	0: Disable 1: Enable only at restart after momentary power failure	0	-
3014Hex-44H ex	Motor Starting Mode Auto Search in Speed Sensor less Vector Control	2: Enable at normal start and restart after momentary power failure	1	-
3008Hex-11H ex	Allowable Time for Power Interruption Re-start	0.0 to 30.0 999: Auto judgment	32767	s
3008Hex-0EH ex	Power Interruption Re-start Wait Time	0.1 to 100.0	0.5	s
3008Hex-0FH ex	Deceleration Setting During Current Limit for Restart Mode after Power Interruption	0.00: Selected deceleration time 0.01 to 100.00 999: According to current limiter	32767	Hz/s
3008Hex-10H ex	Continuous Running Voltage Level	200 to 300 (200 V class series) 400 to 600 (400 V class series)	235	V
3008Hex-32H ex	Auto Search Delay Time 1 for Starting Characteristic	0.0 to 10.0	0	s
3008Hex-2FH ex	Auto Search Delay Time 2 for Starting Mode	0.1 to 100.0	1.0	s
3008Hex-5DH ex	Continuous Running at the Momentary Power Failure P Proportional Gain	0.000 to 10.000 999: Auto	32767	-
3008Hex-5EH ex	Continuous Running at the Momentary Power Failure Integral Time	0.010 to 10.000 999: Auto	32767	s

Parameter No.	Function name	Data	Default data	Unit
301FHex-35Hex	Starting Frequency Selection at Frequency Pull-in Restart	0: Frequency at which the power failure occurred 1: Maximum output frequency 2: Frequency reference 3: Starting frequency	3	-

Restart Mode after Power Interruption Operation Selection (3008Hex-0FHex)

3004Hex-0FHex data	Operation details	
	Without auto search	With auto search*1
0: Immediately trip	If a momentary power failure occurs while the inverter is operating and an undervoltage is detected in the Main Circuit DC Voltage of the inverter, the undervoltage alarm LU is output at that time, the inverter output is cut off and the motor enters the free-run state.	
1: Trip after a recovery from power failure	If a momentary power failure occurs while the inverter is operating and an undervoltage is detected in the Main Circuit DC Voltage of the inverter, the inverter output is cut off at that time and the motor enters the free-run state, but no undervoltage alarm is generated. During power restoration from a momentary power failure, an undervoltage alarm LU is output.	
2: Trip after decelerate-to-stop	If a momentary power failure occurs while the inverter is operating and the Main Circuit DC Voltage of the inverter falls below the continuous running level, the deceleration stop control is started. During deceleration stop control, the kinetic energy of the moment of inertia of the load is regenerated due to deceleration, and the deceleration operation continues. After the deceleration stop, the LU alarm is output.	
3: Continue to run	If the RUN command is input during power restoration, restart is performed from the pull-in frequency. Select the pull-in frequency at Starting Frequency Selection at Frequency Pull-in Restart (301FHex-35Hex).	If the RUN command is input during power restoration, auto search is performed, the motor speed is estimated, and restart is performed from the frequency.
	If a momentary power failure occurs while the inverter is operating and the Main Circuit DC Voltage of the inverter falls below the continuous running level, the operation continuation control is started. During continuous running control, the kinetic energy of the moment of inertia of the load is regenerated due to deceleration, and the operation continues and power restoration is awaited. If the energy to be regenerated is low and an undervoltage is detected, the inverter output is cut off, and the motor falls in a free-run state.	
4: Restart based on pull-in frequency	If a momentary power failure occurs while the inverter is operating and an undervoltage is detected in the Main Circuit DC Voltage of the inverter, the inverter output is cut off and the motor enters the free-run state.	
	If the RUN command is input during power restoration, restart is performed from the pull-in frequency. Select the pull-in frequency at Starting Frequency Selection at Frequency Pull-in Restart (301FHex-35Hex).	If the RUN command is input during power restoration, auto search is performed, the motor speed is estimated, and restart is performed from the frequency.

6: Decelerate-to-stop (w/o trip)	<p>If a momentary power failure occurs while the inverter is operating and the Main Circuit DC Voltage of the inverter falls below the continuous running level, the deceleration stop control is started. During deceleration stop control, the kinetic energy of the moment of inertia of the load is regenerated due to deceleration, and the deceleration operation continues. An alarm does not occur after a deceleration stop.</p> <p>If the RUN command turns OFF in the deceleration stop state, the deceleration stop state is canceled, and the operation can be performed when the RUN command turns ON the next time.</p>
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- *1. With auto search is selected when Enable auto search for idling motor speed at starting “STM” is ON, or Motor Starting Mode Auto Search Function Selection (3008Hex-0AHex/3014Hex-44Hex) = 1 or 2. When a motor control method with speed sensor is selected, restart is performed from the motor speed detected by the speed sensor. In the case of a motor control method without speed sensor, restart is performed from the estimated speed.



Additional Information

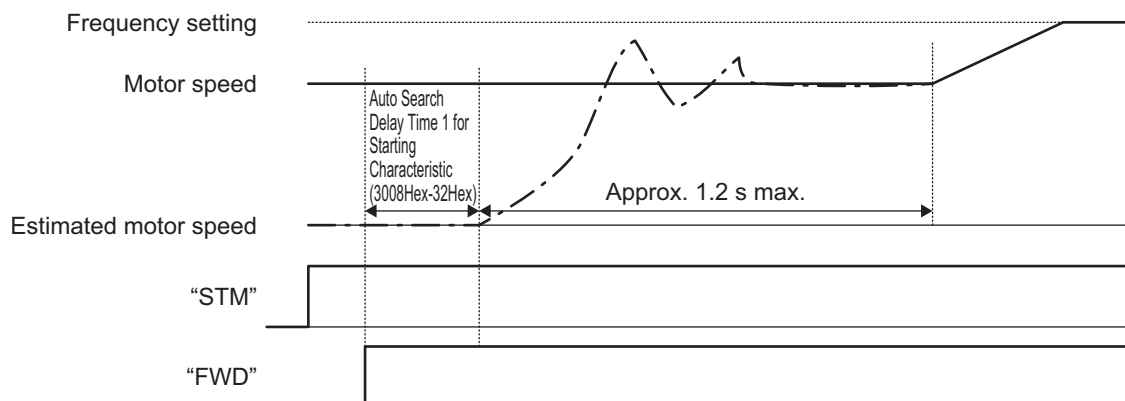
When using vector control without speed sensor, do not use restarting from the pull-in frequency (Starting Frequency Selection at Frequency Pull-in Restart (301FHex-35Hex)). If you select starting from pull-in frequency, normal start may not be performed, or the device may be damaged.

Startup characteristics selection STM

Allocate “26: STM (Enable auto search for idling motor speed at starting)” to Input Terminal [DI1] to [DI7] Function Selection (3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex). This function is used to select whether or not to perform the auto search operation (auto search without stopping the motor during idling) when the inverter is started by turning the STM terminal ON or OFF.

Startup characteristics selection STM	Operation
OFF	Auto search disabled
ON	Auto search enabled

By a startup with auto search enabled, the speed at startup will be searched (for a maximum of approx. 1.2 seconds) as an auto search without stopping the motor during idling is performed. After a speed search, acceleration is performed up to the set frequency in accordance with the set acceleration time.

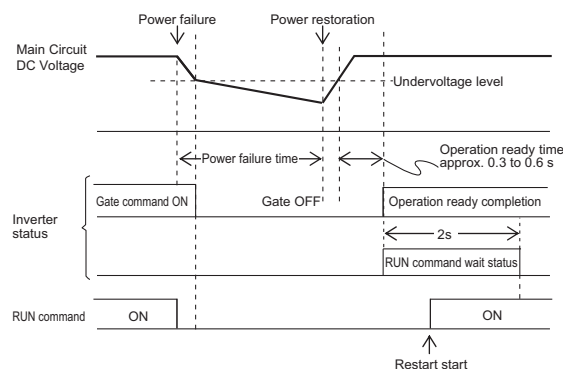


At a startup as a result of the RUN command turning ON, the auto search is started after a delay by the time set at Auto Search Delay Time 1 for Starting Characteristic (3008Hex-32Hex). When control of a motor is alternately switched between two inverters, and the motor is started by an auto search after a free run during switching, the RUN command does not need to be issued in a timely manner by setting Auto Search Delay Time 1 for Starting Characteristic (3008Hex-32Hex).

Restart Mode after Momentary Power Failure (Basic Operation: Without Auto Search Setting)

When the inverter detects that the Main Circuit DC Voltage has dropped below the undervoltage level during operation, it judges a momentary power failure.

After the restoration of power, the inverter is set to the operation ready completion state once the initial charging time has elapsed. During a momentary power failure, the power of the external circuit (such as a relay circuit) controlling the inverter also declines and the RUN command may also turn OFF. Therefore, when the operation ready state is complete, the inverter waits for two seconds for the RUN command to be input. If the input of the RUN command is confirmed within two seconds, the inverter starts restarting according to Power Interruption Restart Mode Selection (3008Hex-0FHex). If the RUN command is not input, the restart mode after momentary power failure is canceled, and startup is performed from the normal starting frequency.



During power restoration, the inverter waits for two seconds for the RUN command to be input, but if the time period set at Allowable Time for Power Interruption Restart (3008Hex-11Hex) elapses after power failure is judged, the two-second long RUN command input waiting state is canceled, and normal startup is performed.

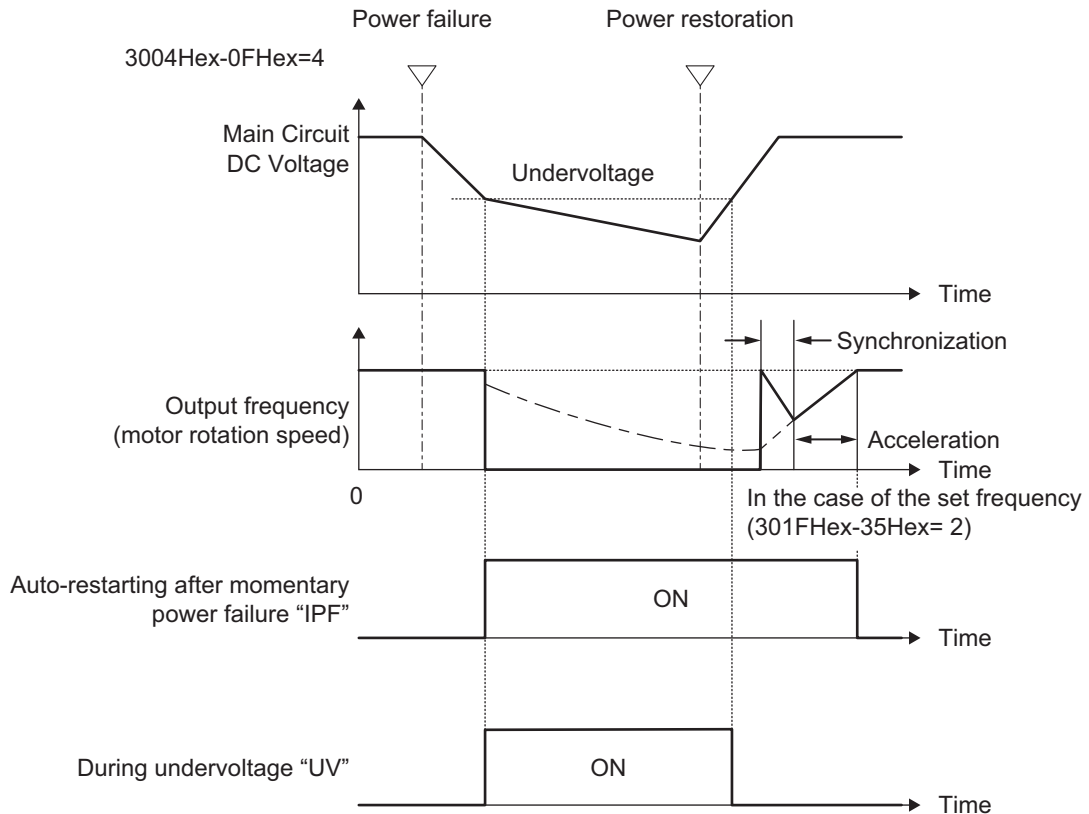
If the free-run command “FRS” is input during a power failure, Free Run Stop Restart Operation Selection (H441) is set, and when the RUN command is input, startup is performed from the normal starting frequency.

As a measure against difficulty in bringing down the Main Circuit DC Voltage during momentary power failure, if “22: IL (Interlock)” is allocated to Input Terminal [DI1] to [DI7] Function Selection (3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex), the momentary power failure can be detected accurately.

Input signal IL	Meaning
OFF	Momentary power failure not occurred
ON	Momentary power failure occurred (Restart after momentary power failure enabled)

When the motor speed drops during momentary power failure and startup is performed from the frequency prior to the momentary power failure after the power is restored, the current limitation function is activated, and the output frequency of the inverter declines automatically. When the output frequency and the motor rotation speed are synchronous, acceleration is performed up to the original output frequency.

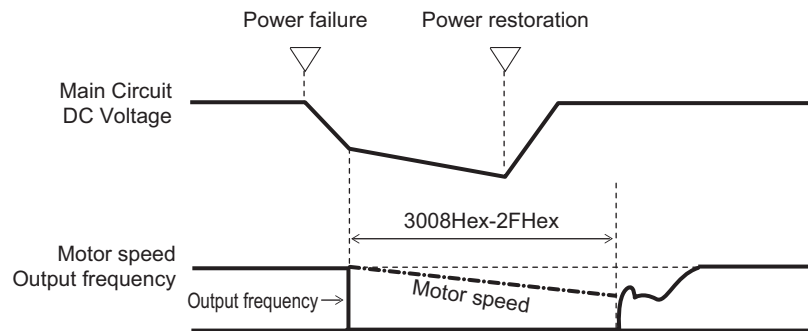
However, the momentary overcurrent limitation must be enabled (Instantaneous Overcurrent Limiting Function Selection (3008Hex-0DHex) = 1) for the synchronous pull-in of the motor.



Restart Mode after Momentary Power Failure (Basic Operation: With Auto Search Setting)

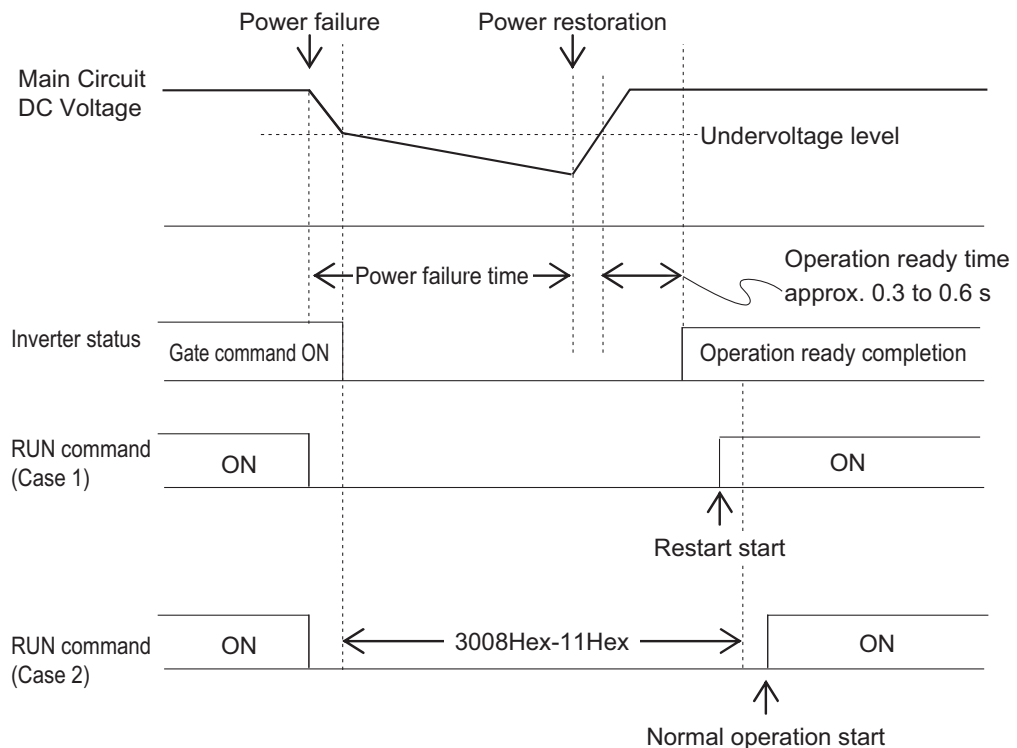
The auto search operation does not operate normally if residual voltage is remaining in the motor. Therefore, it is necessary to secure time for the residual voltage to dissipate.

The required time for restart after momentary power failure is secured by Auto Search Delay Time 2 for Starting Mode (3008Hex-2FHex).



Allowable Time for Power Interruption Restart (3008Hex-11Hex)

Set the maximum time from when a momentary power failure (undervoltage level) occurs until a restart is performed (setting range: 0.0 to 30.0 s). If the setting range is exceeded, the restart after momentary power failure is not performed, and operation is performed by turning ON the power again.



If Allowable Time for Power Interruption Restart (3008Hex-11Hex) is set to "999," restart after momentary power failure is performed until the Main Circuit DC Voltage drops down to the allowable voltage for restart after momentary power failure, and once it becomes equal to or below the allowable voltage for restart after momentary power failure, it is judged that the power supply is cut off, the restart after momentary power failure is not performed, and the operation is performed by turning the power ON again.

Power supply system	Allowable voltage for restart after momentary power failure
200 V	50 V

Power supply system	Allowable voltage for restart after momentary power failure
400 V	100 V

Power Interruption Restart Wait Time (3008Hex-0EHex)

Set the time from after the occurrence of momentary power failure until the inverter restarts (Auto Search Delay Time 2 for Starting Mode (3008Hex-2FHex) is used during auto search setting). If the inverter is started in a state when the residual voltage of the motor is high, the inrush current may increase, there may be a temporary regeneration, and an overvoltage alarm may occur. For safety, adjust Power Interruption Restart Wait Time (3008Hex-0EHex) so that restart is performed after the residual voltage becomes low to an extent.

Deceleration Setting During Current Limit for Restart Mode after Power Interruption (3008Hex-0FHex)

During restart after a momentary power failure, if the output frequency of the inverter and the rotation speed of the motor are not in sync, an overcurrent flows and current limitation is activated. If a current limitation is detected, the output frequency is automatically lowered to be in sync with the motor rotation speed. At Deceleration Setting During Current Limit for Restart Mode after Power Interruption (3008Hex-0FHex), set the gradient (frequency fall rate (Hz/s)) for lowering the output frequency.

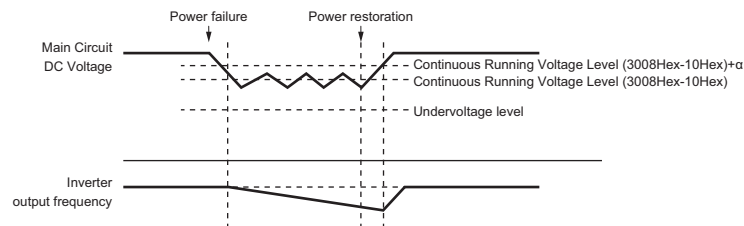
3008Hex-0FHex data	Output frequency lowering operation
0.00	Falls at the selected deceleration time.
0.01 to 100.00 Hz/s	Falls at the fall rate set at Deceleration Setting During Current Limit for Restart Mode after Power Interruption (3008Hex-0FHex).
999	Falls in accordance with the PI controller of the current limitation process (the PI constant is a fixed value inside the inverter).

Continuous Running Voltage Level (3008Hex-10Hex)

- Deceleration stop during momentary power failure
If “Trip after decelerate-to-stop (Power Interruption Restart Mode Selection (3008Hex-0FHex) = 2)” or “Decelerate-to-stop(w/o trip) (Deceleration Setting During Current Limit for Restart Mode after Power Interruption (3008Hex-0FHex) = 6)” is selected at the Power Interruption Restart (mode selection), then at the moment a momentary power failure occurs while the inverter is operating and the Main Circuit DC Voltage of the inverter falls below the continuous running level, the deceleration stop control is started.
Adjust the Main Circuit DC Voltage level at which to start the deceleration stop control at Continuous Running Voltage Level (3008Hex-10Hex). During deceleration stop control, deceleration is performed while controlling the Main Circuit DC Voltage at a constant level with a PI controller. The P (Proportional) and I (Integral) of the PI controller are adjusted by Continuous Running at the Momentary Power Failure P Proportional Gain (3008Hex-5DHex) and Continuous Running at the Momentary Power Failure Integral Time (3008Hex-5EHex), respectively.
- Continuous running

If “Continue to run (Deceleration Setting During Current Limit for Restart Mode after Power Interruption (3008Hex-0FHex) = 3)” is selected at the Power Interruption Restart (mode selection), then at the moment a momentary power failure occurs while the inverter is operating and the Main Circuit DC Voltage of the inverter falls below the continuous running level, the operation continuation control is started.

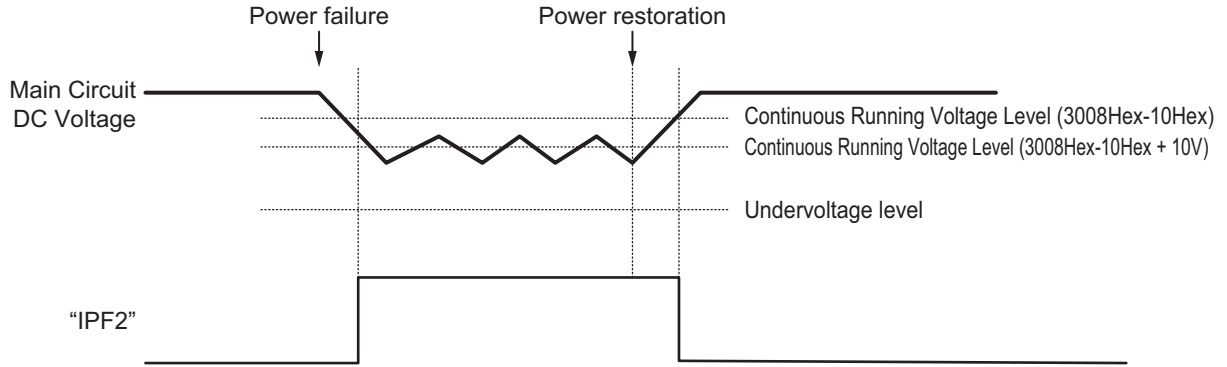
Adjust the continuous running level at which to start the continuous running control at Continuous Running Voltage Level (3008Hex-10Hex). During continuous running control, the operation is continued while controlling the Main Circuit DC Voltage at a constant level with a PI controller.



Power supply system	α	
	22 kW max.	30 kW min.
200 V	5 V	10 V
400 V	10V	20 V

- During decelerating at momentary power failure “IPF2”
This parameter turns ON when Deceleration Setting During Current Limit for Restart Mode after Power Interruption (3008Hex-0FHex) is 2 or 3, and the Main Circuit DC Voltage falls below Continuous Running Voltage Level (3008Hex-10Hex) and the continuous running state is established. This parameter turns OFF when power restores and the Main Circuit DC Voltage becomes “the voltage set at Continuous Running Voltage Level (3008Hex-10Hex) +10 V or higher.”
This parameter turns ON even when Deceleration Setting During Current Limit for Restart Mode after Power Interruption (3008Hex-0FHex) is 4 or 5 and the Main Circuit DC Voltage falls below the undervoltage level. This parameter turns OFF when the DC link bus voltage reaches “the undervoltage level +10 V or higher.”

Parameter No.	Function name	Data	Default data	Unit
3005Hex-15Hex/ 3005Hex-1CHex	Output Terminal [DO1] Function Selection/ Output Terminal [ROA, ROB] Function Selection	79: IPF2 (During decelerating at momentary power failure)	-	-



8-4-3 Trip Retry Operation

This function is used to set the operation selection to restart during overvoltage or overcurrent.

Parameter No.	Function name	Data	Default data	Unit
301FHex-28Hex	Overvoltage/Overcurrent Re-start Function Selection	0: Trip immediately 4: Restart at the frequency selected by 301FHex-35Hex	0	-
3008Hex-05Hex	Retry Count at Trip	0: Disable 1 to 20: Number of retries	0	-
3008Hex-06Hex	Retry Standby Time at Trip	0.5 to 20.0	5	s
3005Hex-15Hex/ 3005Hex-1CHex	Output Terminal [DO1] Function Selection/Output Terminal [ROA, ROB] Function Selection	26: TRY (Auto-resetting)	-	-

Overvoltage/Overcurrent Restart Function Selection (301FHex-28Hex)

301FHex-28Hex data	Operation details	
	Without auto search	With auto search*1
0: Trip	An alarm is output when an overvoltage or overcurrent is detected, the inverter output is cut off, and the motor falls in a free-run state.	
4: Restart based on pull-in frequency	If an overvoltage or overcurrent is detected, the inverter output is cut off, and the motor falls in a free-run state.	
	During recovery from overvoltage or overcurrent, restart is performed from the pull-in frequency. Select the pull-in frequency at Starting Frequency Selection at Frequency Pull-in Restart (301FHex-35Hex).	During recovery from overvoltage or overcurrent, auto search is performed, the motor speed is estimated, and restart is performed from the frequency.

*1. With auto search is Enable auto search for idling motor speed at starting "STM" is ON, or 3008Hex-0AHex(3014Hex-44Hex) = 1 or 2.
When a motor control method with speed sensor is selected, restart is performed from the motor speed detected by the speed sensor. In the case of a motor control method without speed sensor, restart is performed from the estimated speed.



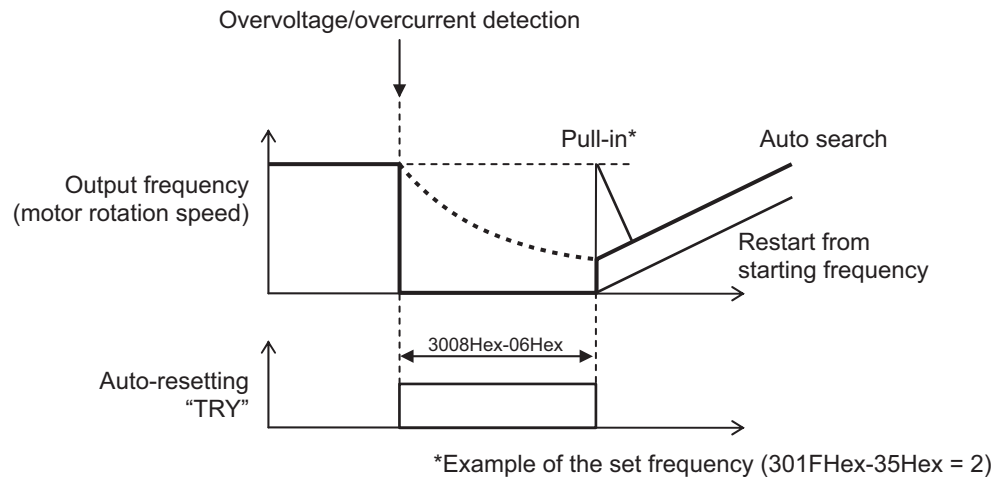
Additional Information

When using vector control without speed sensor, do not use restarting from the pull-in frequency (Starting Frequency Selection at Frequency Pull-in Restart (301FHex-35Hex)). If you select starting from pull-in frequency, normal start may not be performed, or the device may be damaged.

Use the retry function to recover from overvoltage or overcurrent.

(3008Hex-05Hex: Retry Count at Trip, 3008Hex-06Hex: Retry Standby Time at Trip)

As for the starting method, the settings in E139 is applied.



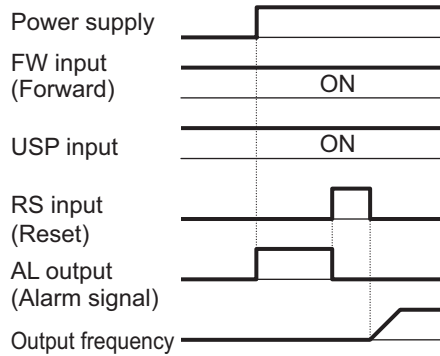
8-4-4 Unattended Start Protection (USP Terminal)

- Use this function to have the inverter trip if the power supply is turned ON with the RUN command ON in the inverter.
- When the RUN command is ON and multifunction input “USP” is ON when the power is ON, a run operation error (alarm code: 24, sub code: 30) is generated
- When the run operation error is reset with the RUN command still ON, operation is started regardless of the ON/OFF setting of “USP.” (Example 1)
- If the RUN command turns ON after the power supply is turned ON, the inverter operates normally. (Example 2)
- Allocate “186: USP (Unattended start protection)” to Input Terminal [DI1] to [DI7] Function Selection (3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex).
- Power recovery restart prevention based on USP input is enabled only for a RUN command from the terminal block.

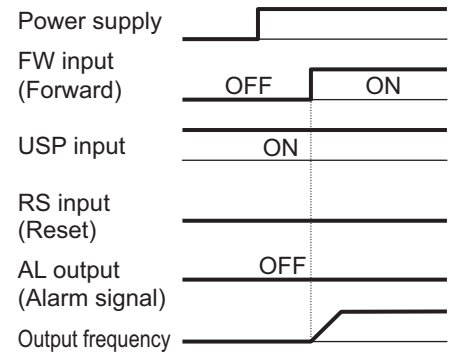
Parameter No.	Function name	Data	Default data	Unit
3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex	Input Terminal [DI1] to [DI7] Function Selection	186: USP (Unattended start protection)	-	-

The operation of the unattended start protection is shown below.

(Example 1) Power ON with RUN command ON
(Reset with Reset (RS))



(Example 2) RUN command after power ON (Normal operation)



Using the unattended start protection and the Start Check Function in Combination

- When used in combination with the start check function (3008Hex-61Hex = -61, 2), a run operation error (alarm code: 24, sub code: 5) is generated by the start check function, and this is given priority. For this reason, to cancel the run operation error, turn the RUN command OFF and then perform a reset operation.
- For details on the start check function, refer to *8-7-3 Start Check Function* on page 8-69.

8-4-5 Free Run Restart

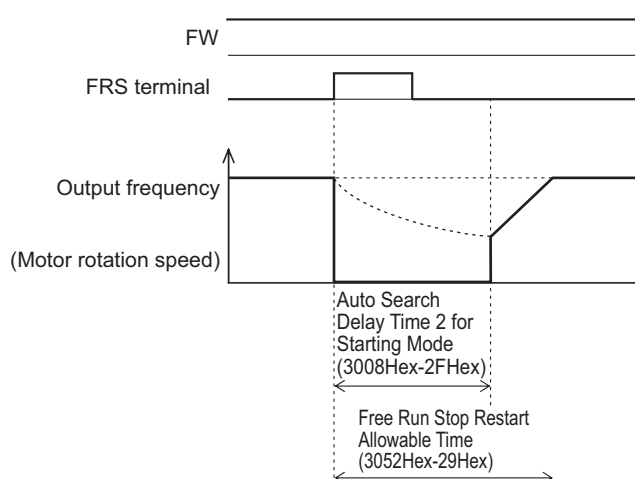
- A restart is performed when the operation state is returned to while in a free-run state.
- A free-run restart is performed by the restart operation selected at Free Run Stop Restart Operation Selection (3008Hex-0CHex) when “1: Free run stop” is selected at Stop Selection (3052Hex-2AHex) and the RUN command is turned ON while in a free-run state or when the free-run command (7: FRS) terminal is set to OFF and the free-run state is canceled.
- For details on a restart after a momentary power failure, refer to *8-4-2 Restart after Momentary Power Failure* on page 8-41.

Parameter No.	Function name	Data	Default data	Unit
3052Hex-2AHex	Free Run Stop Restart Operation Selection	1: Starting with matching frequency 2: Starting with active matching frequency	2	-
3008Hex-0EHex	Power Interruption Restart Wait Time	0.1 to 100.0	0.5	s
3008Hex-2FHex	Auto Search Delay Time 2 for Starting Mode	0.1 to 100.0	1.0	s
3004Hex-18Hex/ 3009Hex-0DHex	1st Starting Frequency/2nd Starting Frequency	0.0 to 60.0	0.5	Hz
3008Hex-0FHex	Deceleration Setting During Current Limit for Restart Mode after Power Interruption	0.00: Selected deceleration time 0.01 to 100.00 999: According to current limiter	32767	Hz/s

Parameter No.	Function name	Data	Default data	Unit
301FHex-35Hex	Starting Frequency Selection at Frequency Pull-in Restart	0: Frequency at which the power failure occurred 1: Maximum output frequency 2: Frequency reference 3: Starting frequency	3	-
3052Hex-29Hex	Free Run Stop Restart Allowable Time	0.0 to 30.0	30.0	s
3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex	Input Terminal [DI1] to [DI7] Function Selection	7: FRS (Free-run stop) 26: STM (Enable auto search for idling motor speed at starting)	-	-

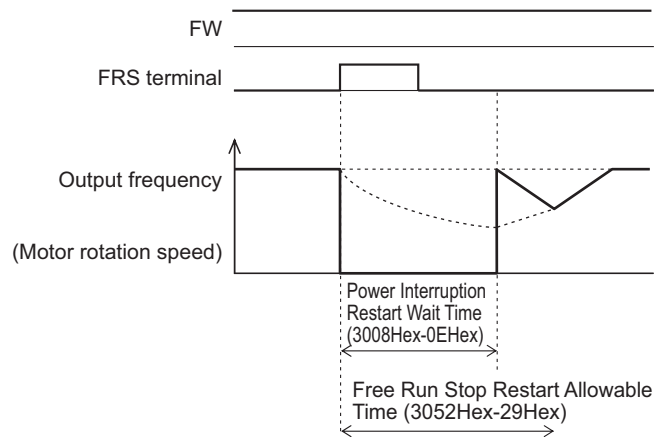
Auto Search Restart (3052Hex-2AHex = 1)

- Auto search restart causes the inverter to anticipate the frequency from the voltage between the motor terminals in a free-run state and restart matched to that frequency. If the anticipated frequency is not sufficient, the inverter restarts from 1st Starting Frequency (3004Hex-18Hex)/2nd Starting Frequency (3009Hex-0DHex).
- With the RUN command ON, when the free-run state is canceled after the Auto Search Delay Time 2 for Starting Mode (3008Hex-2FHex) has elapsed since the free-run state, the auto search restart is started.
- The restart is performed at the starting frequency when Free Run Stop Restart Allowable Time (3052Hex-29Hex) is set shorter than Auto Search Delay Time 2 for Starting Mode (3008Hex-2FHex).
- The examples below assume that the FRS terminal is used.
- When the anticipated frequency exceeds the Maximum Output Frequency (3004Hex-04Hex/3009Hex-02Hex) or the Frequency Upper Limit (3004Hex-10Hex/301FHex-12Hex), auto search restart is not performed, and the restart is performed using the maximum frequency or the Frequency Upper Limit (3004Hex-10Hex/301FHex-12Hex), whichever is lower.

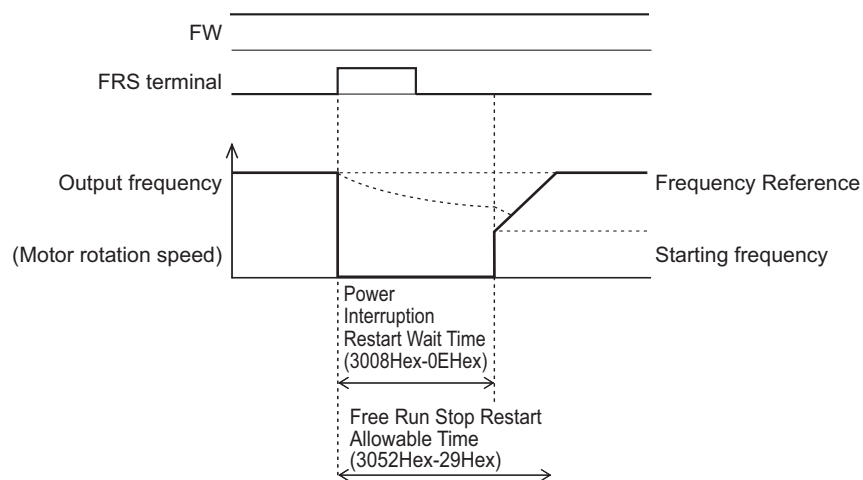


Frequency Pull-in Restart (3052Hex-2AHex = 2)

- A frequency pull-in restart refers to the method of performing acceleration again to restart when the frequency reference is output to the motor in a free-run state, and the frequency reference is decelerated by current limit until there is no longer a current limit. This enables a smooth restart independent of the voltage between motor terminals. Use this setting when the inverter is in free-run state for a long time due to a large load inertia.
- With the RUN command ON, when the free-run state is canceled after the Power Interruption Restart Wait Time (3008Hex-0EHex) has elapsed since the free-run state, the frequency selected by Starting Frequency Selection at Frequency Pull-in Restart (301FHex-35Hex) is output and the frequency pull-in restart is performed.
- The examples below assume that the FRS terminal is used.
Example) When Starting Frequency Selection at Frequency Pull-in Restart (301FHex-35Hex) = “0: Frequency at which the power failure occurred”



Example) When Starting Frequency Selection at Frequency Pull-in Restart (301FHex-35Hex) = “3: Starting frequency”



8-5 DC Injection Braking Function

This section describes the DC injection braking function.

8-5-1 DC Injection Braking (DB)

Use this function to have the motor apply DC injection braking according to the load.

For an induction motor, this function allows braking with no feedback of regenerated energy to the inverter. However, for a PM motor, consider to take measures against overvoltage because even the DC injection braking function allows regenerated energy to be fed back to the inverter.

DC injection braking can be controlled with one of the following three methods:

- Setting “13: DB (External DC injection braking)” to Input Terminal [DI1] to [DI7] Function Selection (3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex), and turning ON/OFF the terminal to which the external DC injection braking function is allocated.
- Setting DC Injection Braking Selection (301FHex-0FHex) and then setting appropriate function parameters.
- Setting DC Injection Braking Selection (301FHex-0FHex) and controlling the motor only by comparison via the frequency set in the DC Injection Braking Frequency parameter.

Note, however that the use of DC injection braking may not cause the motor to stop due to the moment of inertia of the motor load.

DC injection braking is disabled when the torque control, position control and servo lock is enabled.

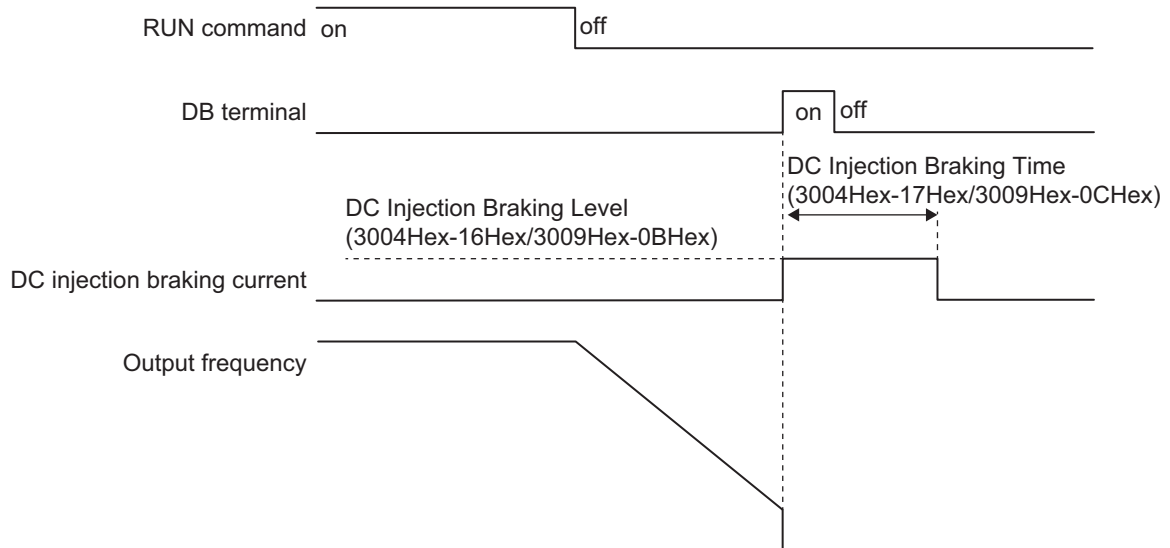
Parameter No.	Function name	Data	Default data	Unit
301FHex-0FHex	DC Injection Braking Selection	0: External DC injection braking 1: External DC injection braking/setting frequency 2: Setting frequency	0	-
3004Hex-15Hex/ 3009Hex-0AHex	1st DC Injection Braking Start Frequency/2nd DC Injection Braking Start Frequency	0.0 to 60.0	0.0	Hz
3004Hex-16Hex/ 3009Hex-0BHex	1st DC Injection Braking Level/2nd DC Injection Braking Level	0 to 100 (HHD mode) 0 to 80 (HND/HD mode) 0 to 60 (ND mode) Based on inverter rated current	0	%
3004Hex-17Hex/ 3009Hex-0CHex	1st DC Injection Braking Time/2nd DC Injection Braking Time	0.00: Disable 0.01 to 30.00	0.00	s
3008Hex-60Hex	DC Injection Braking Start Characteristic Selection	0: Slow response 1: Quick response	1	-
301FHex-10Hex	External DC Injection Braking Edge/Level Selection	0: Edge operation 1: Level operation	1	-
3020Hex-60Hex	DC Injection Braking Startup Time	0.00: Disable 0.01 to 30.00 Only motor 1 is effective	0	s

Parameter No.	Function name	Data	Default data	Unit
3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex	Input Terminal [DI1] to [DI7] Function Selection	13: DB (External DC injection braking)	-	-

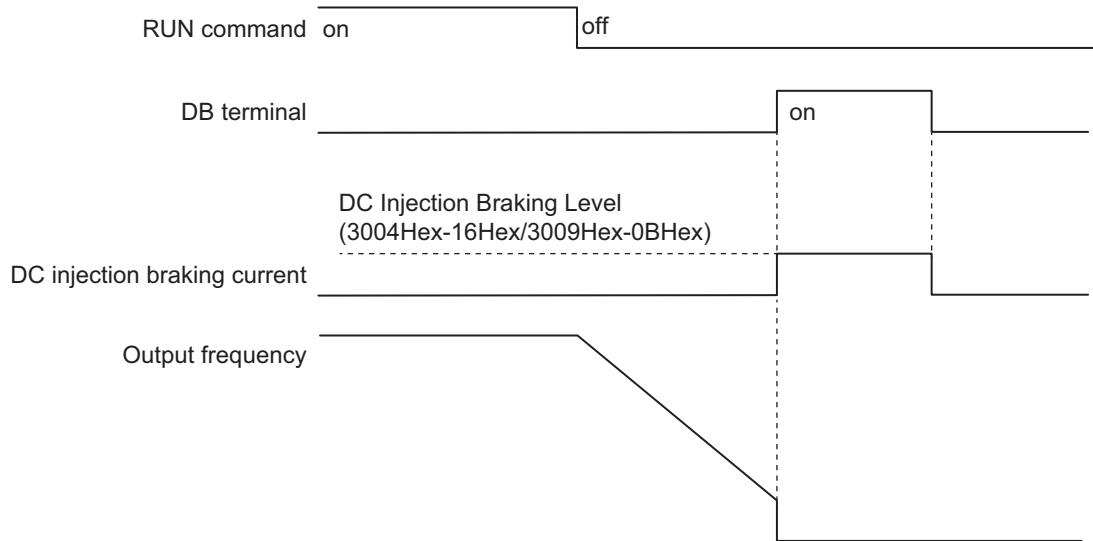
- When operation is started, DC injection braking operation is canceled and normal operation is started.
- If the RUN command is turned ON during DC injection braking, DC injection braking is canceled and normal operation is started.

DC Injection Braking by DB Terminal (301FHex-0FHex= “0: External Terminal,” “1: External DC Injection Braking/Setting Frequency”)

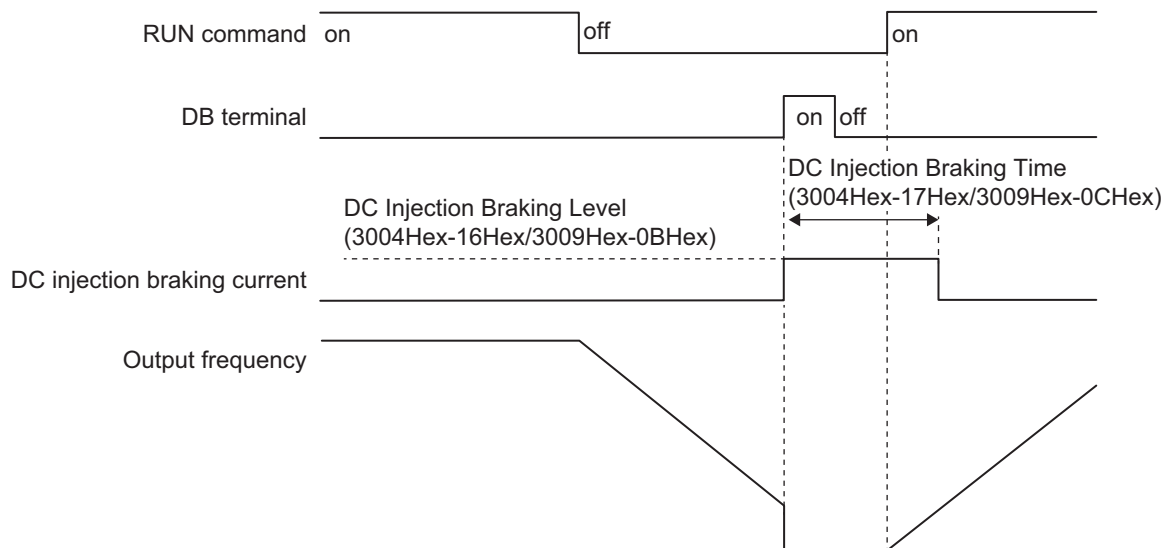
- DC injection braking can be applied by the DB terminal (13: External DC injection braking). Set “13: DB (External DC injection braking)” to Input Terminal [DI1] to [DI7] Function Selection (3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex).
- When “2: Setting frequency” is selected for DC Injection Braking Selection (301FHex-0FHex), DC injection braking by DB terminal (13: External DC injection braking) is disabled.
- When “1: External DC injection braking/setting frequency” is selected for DC Injection Braking Selection (301FHex-0FHex), this setting is given priority over DC injection braking by DC Injection Braking Start Frequency (3004Hex-15Hex/3009Hex-0AHex).
- When “0: Edge operation” is selected for External DC Injection Braking Edge/Level Selection (301FHex-10Hex), DC injection braking operates only for the time period set in the DC Injection Braking Time (3004Hex-17Hex/3009Hex-0CHex) from the rising edge of the DB terminal.



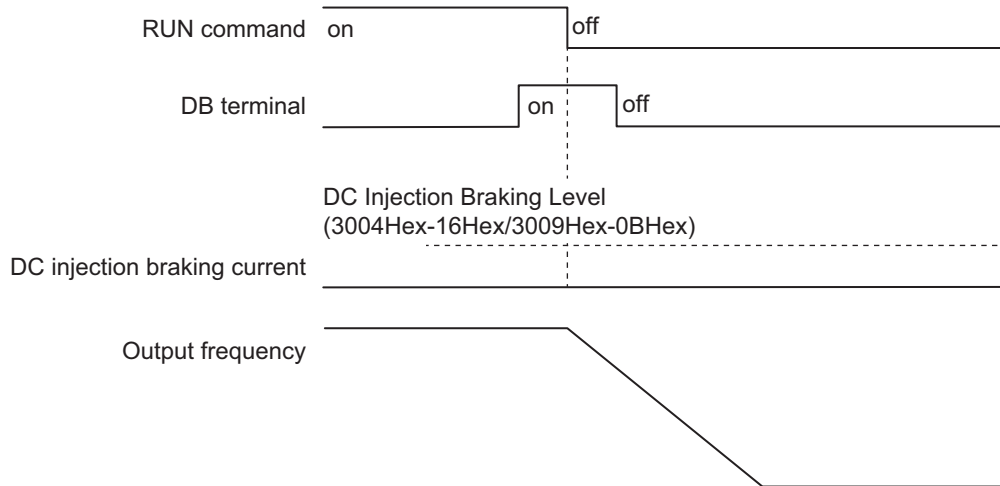
- When “1: Level operation” is selected for External DC Injection Braking Edge/Level Selection (301FHex-10Hex), DC injection braking operates while the DB terminal (13: External DC injection braking) is ON.



- When the RUN command is ON, run operation is given priority. Even if the DB terminal is turned ON while the RUN command is ON, DC injection braking is not started. If the RUN command is turned ON during DC injection braking, DC injection braking is stopped and operation is started.

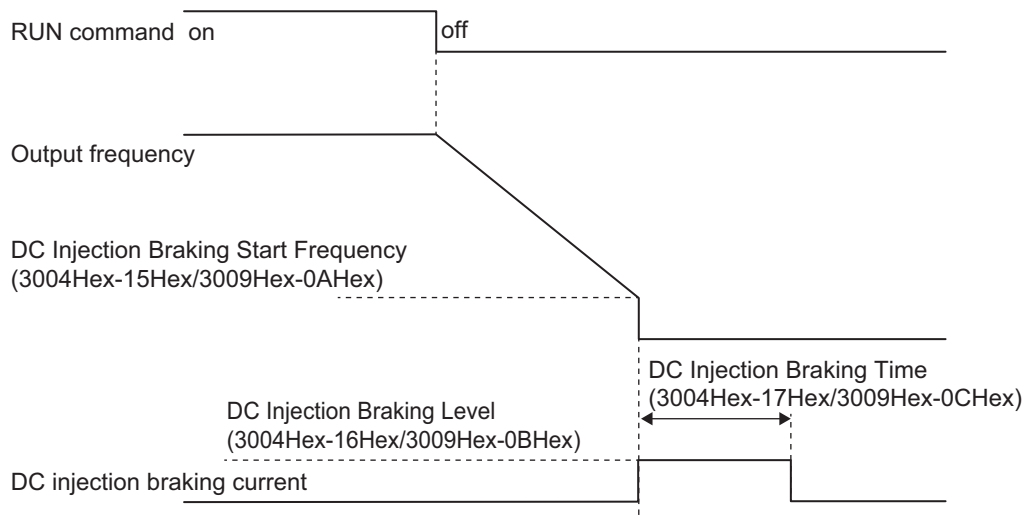


Also, the DB terminal turns ON while the RUN command is ON, thereafter, even if the RUN command turns OFF, the DC injection braking does not start.



DC Injection Braking Start at Output Frequency (301FHex-0FHex = "1: External DC Injection Braking/Setting Frequency")

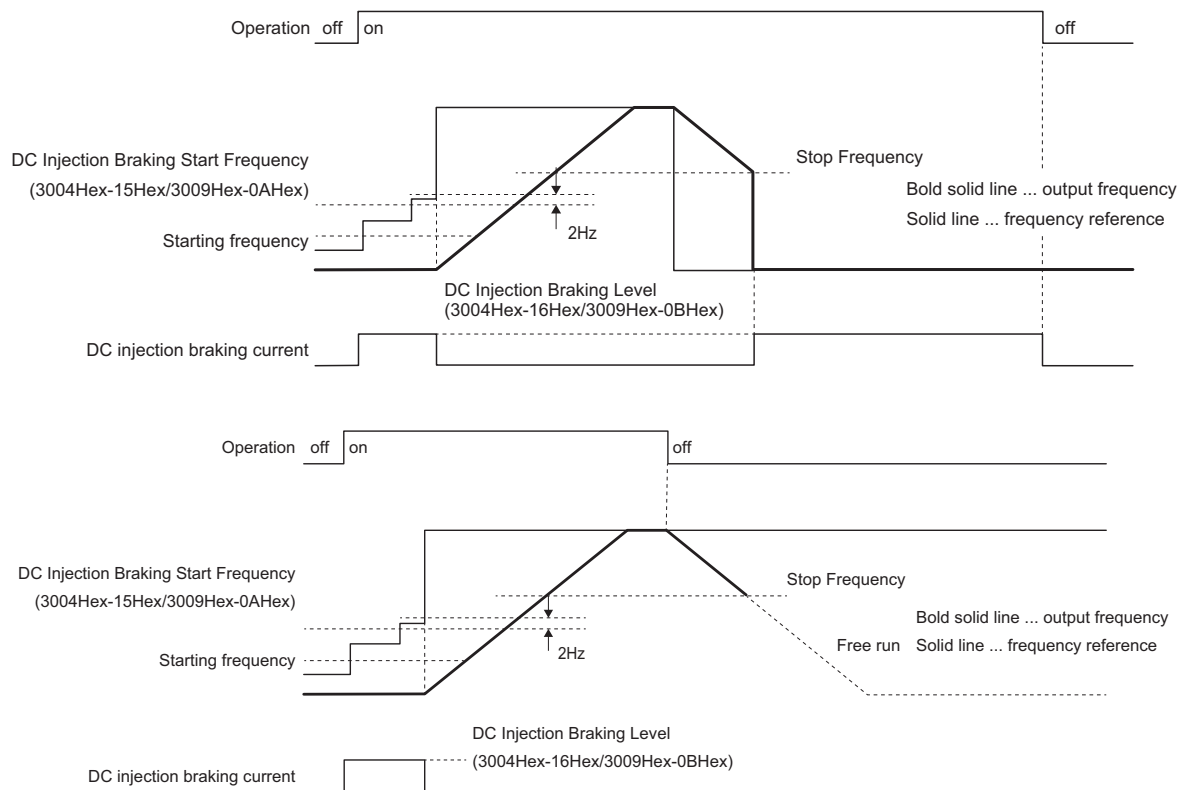
- During a deceleration stop, DC injection braking is performed for the period set at the DC Injection Braking Time (3004Hex-15Hex/3009Hex-0AHex) from the time that the output frequency reaches or falls below the DC Injection Braking Start Frequency (3004Hex-17Hex/3009Hex-0CHex). However, if the Stop Frequency (3004Hex-1AHex) is higher than the DC Injection Braking Start Frequency (3004Hex-15Hex/3009Hex-0AHex), DC injection braking is started from the time the output frequency reaches the Stop Frequency (3004Hex-1AHex), and is performed for the period of DC Injection Braking Time (3004Hex-17Hex/3009Hex-0CHex).



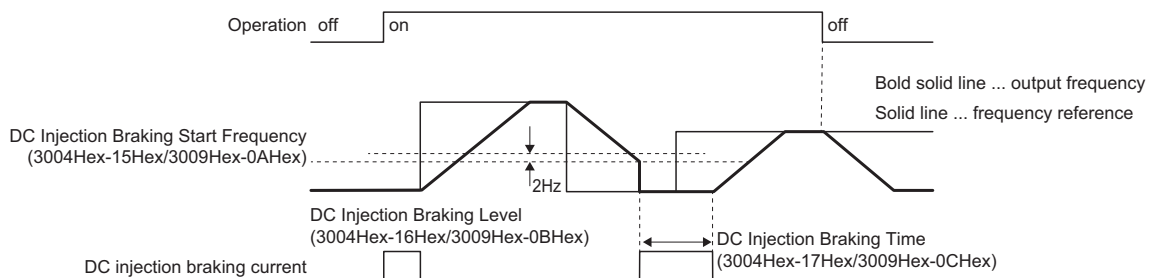
DC Injection Braking Start at Frequency Reference and Output Frequency (301FHex-0FHex = "2: Setting Frequency")

- Use this method to control DC injection braking only by changing the set frequency (frequency reference). DC injection braking by DB terminal is disabled. The DC injection braking during startup by the settings of DC Injection Braking Startup Time (3020Hex-60Hex) is also disabled.

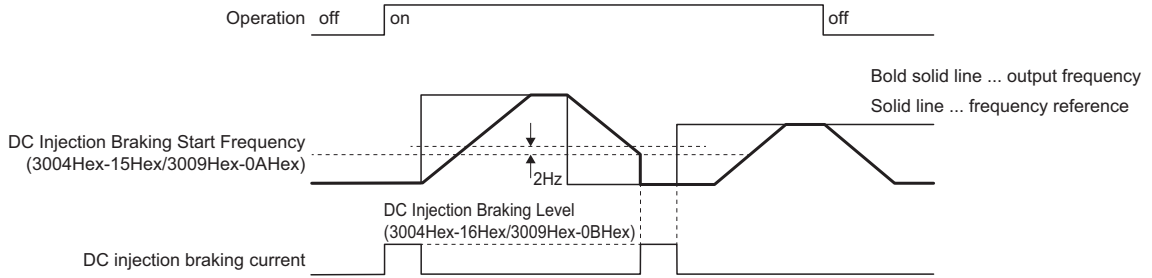
- DC injection braking is started for the period of DC Injection Braking Time (3004Hex-17Hex/3009Hex-0CHex) from the time that both the frequency reference and the output frequency reach or fall below the DC Injection Braking Start Frequency (3004Hex-15Hex/3009Hex-0AHex). However, if the Stop Frequency (3004Hex-1AHex) is higher than the DC Injection Braking Start Frequency (3004Hex-15Hex/3009Hex-0AHex), DC injection braking is started from the time the output frequency reaches the Stop Frequency (3004Hex-1AHex), and is performed for the period of DC Injection Braking Time (3004Hex-17Hex/3009Hex-0CHex).
- If, during DC injection braking, the set frequency becomes higher than the DC Injection Braking Frequency (3004Hex-15Hex/3009Hex-0AHex) + 2 Hz, the Starting Frequency (3004Hex-18Hex/3009Hex-0DHex) or the maximum value set in the Stop Frequency (3004Hex-1AHex/3009Hex-40Hex), the inverter cancels DC injection braking and returns to normal operation. DC injection braking is also canceled when the RUN command is OFF.



- When “0: Edge operation” is selected for External DC Injection Braking Edge/Level Selection (301FHex-10Hex), DC injection braking operates for the period set at the DC Injection Braking Time (3004Hex-17Hex/3009Hex-0CHex) after the conditions to start DC injection braking are established.



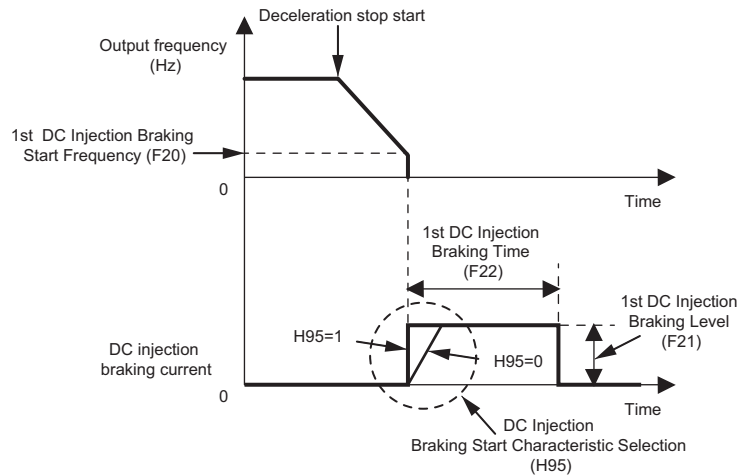
- When “1: Level operation” is selected for External DC Injection Braking Edge/Level Selection (301FHex-10Hex), DC injection braking operates while the conditions to start DC injection braking are established.



DC Injection Braking Start Characteristic Selection (3008Hex-60Hex)

You can select the rise characteristics for DC braking.

H95 data	Characteristics
0	Slow response. The rise of the DC braking current is increased gently.
1	Quick response. The rise of the DC braking current is increased momentarily up to the braking level.



8-6 Safety Function

The safety function stops the motor by signals from the safety controller.

This section provides a functional outline of the safety function, examples of operation and examples of connections.

8-6-1 Overview of Safety Function

The safety function is designed so that the safety stop function of category 0 (uncontrolled stop) specified in IEC 60204-1 is used to meet the safety standards of PL-e under ISO 13849-1.

The safe torque OFF (STO) function cuts off the motor current and stops the motor by input signals from the safety controller.

When the STO function is activated, the servo driver turns servo ready output (READY) OFF to set the inverter to the safety state.

The M1 Series Inverter EtherCAT type has the following two STO functions. Use either of the functions according to the configuration of the safety devices.

- STO function by safety input signal
- STO function via EtherCAT communication

Safety Functions

Function	Standard
STO (Safe Torque Off)	EN/IEC 61800-5-2
Stop Category 0	EN/IEC 60204-1

Response Time

Response time		Remarks
STO (via signal line) re-sponse time	50 ms or lower	Time from when the SF1/SF2 signal state changes to STO up to when power to the motor is cut off
EDM response time	50 ms	Time from when the SF1/SF2 signal state changes to STO up to when the EDM signal state changes to ON
STO function via Ether-CAT communication re-sponse time	80ms max.	Time from when the FSoE state changes to STO up to when power to the motor is cut off

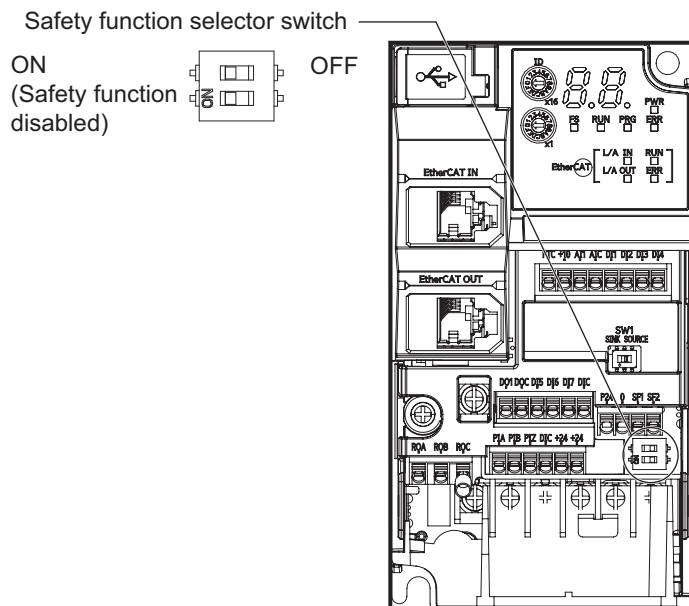
Safety Related Parameters

Parameter	Value	Standard
PL	e	EN/ISO 13849-1
Cat	3	
MTTFd	>62 years	EN/IEC 60204-1
DCavg	Medium	

Parameter		Value	Standard
SIL		3	EN/IEC 61508-1 to -7 EN/IEC 61800-5-2 EN/IEC 62061
HFT		1	
SFF		>90%	
STO Function by Safe Input Signal	PFH	3.00×10^{-9}	
	PFD	4.00×10^{-5}	
	Mission time	20 years	
STO Function via EtherCAT Communications	PFH	1.10×10^{-8}	
	PFD	1.10×10^{-4}	
	Mission time	10 years	

8-6-2 Safety Function Settings

Turn OFF the safety function selector switch SW9 when the inverter power supply is turned OFF. Set SW9 to enabled (OFF) or disabled (ON) so that both sides are at the same position at all times.



Turn both OFF to use the safety function.

Turn both ON to not use the safety function.

When only one is ON, the logic of the SF1 and SF2 signals no longer matches and this causes an EN circuit failure (alarm code: 39).

8-6-3 STO Function by Safety Input Signal

The safety input function allows the inverter output when current flows in both the terminals [SF1] and [SF2]. When the safety input function is activated, in compliance with the safety standards described in 8-6-1 *Overview of Safety Function* on page 8-61, the output transistor operation of the inverter is stopped safely (by shutting off its output). As a result, the motor stops with free run.

- It takes 50 ms or shorter from when the safety input is input till when the inverter shuts off the output.
- St is displayed on the data display.

Perform wiring with reference to the wiring example to meet the applicable safety standards. Be sure to use both the safety input [SF1] and [SF2] terminals and configure a system that turns OFF both of the [SF1] and [SF2] terminals when the safety function is activated.

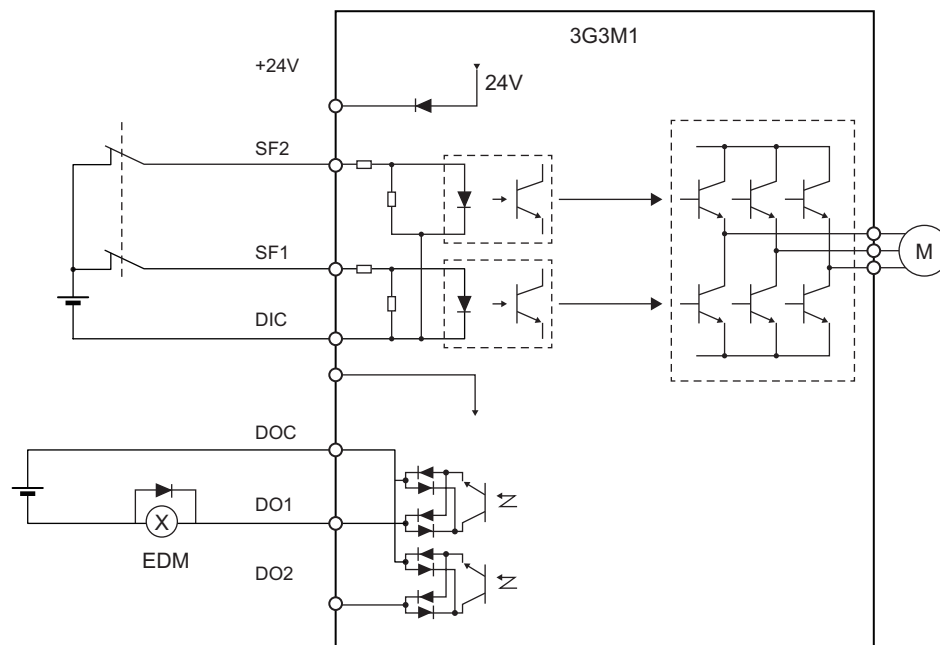
If the inverter detects that either the [SF1] or [SF2] terminal is OFF, the safety function is activated and the inverter shuts off the output.

- The STO (Safe Torque Off) Performance Monitor (102: EDM) turns ON when the inverter detects that both of the [SF1] and [SF2] terminal signals turn OFF and shuts off the output. If the EDM output does not turn ON even when the inverter shuts off the output by the safety function, check the [SF1] and [SF2] terminal input circuits and the EDM detection circuit.
- The EN circuit failure detected (101: DECF) turns ON when an error occurs in the circuit that detects that the SF terminal is OFF.

Parameter No.	Function name	Data	Default data	Unit
3005Hex-15Hex/ 3005Hex-1CHex	Output Terminal [DO1] Function Selection/Output Terminal [ROA, ROB] Function Selection	101: DECF (EN circuit failure detected) 102: EDM (STO (Safe Torque Off) Performance Monitor)	-	-

Wiring Example

Wiring example when EDM is enabled (for compliance with ISO13849-1 PL-e)



System Configuration Example

To attain CAT.3, PL e/SIL3 as an overall system that uses the 3G3M1 Series, a PL e/SIL3 device must at least be combined into the system.

Test pulse that is input to safety input terminals [SF1] and [SF2] from an external device must be 1 ms or less.

The following shows an example of a safety interlock that is combined with the 3G3M1 Series.

Model	Applicable standard for system configuration	Certification authority
G9SP	EN ISO13849-1 PL-e Cat4 (IEC61508 SIL3)	TÜV Rheinland

Periodic Inspection

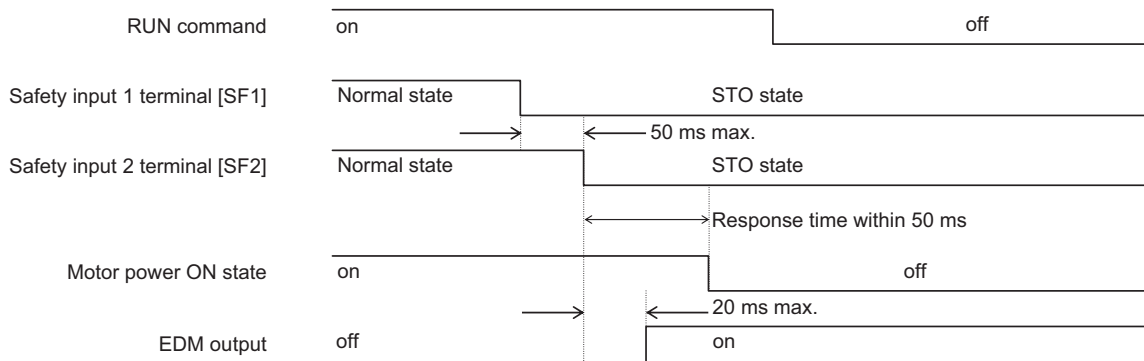
The redundancy circuit is configured so that when the safety function is activated, the inverter shuts off its output if current no longer flows to either the safety input terminal [SF1] or [SF2]. Therefore, the inverter must be periodically inspected to ensure that there is no defect in the [SF1] and [SF2] terminal wirings so that redundancy is not lost to ensure reliable operation. Be sure to perform periodical inspection at least once in three months.

In periodic inspection, inspect the statuses shown in the table below.

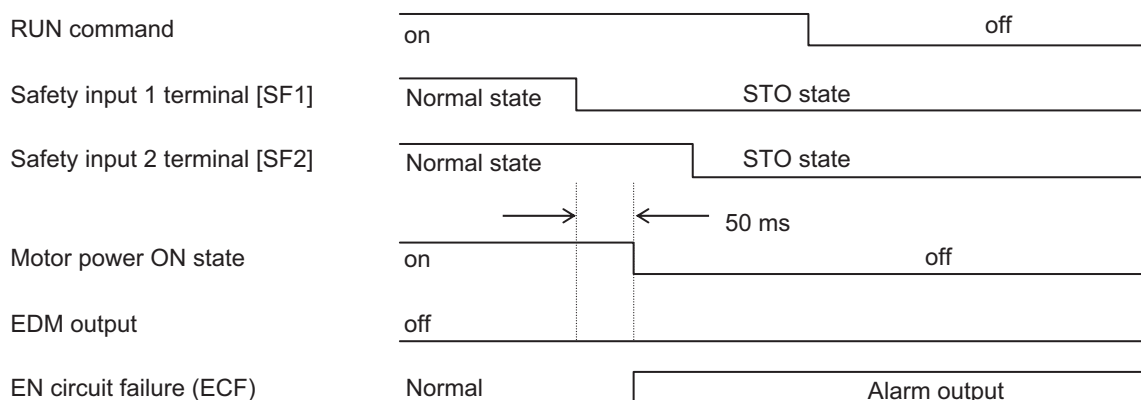
Signal		Status 1	Status 2	Status 3	Status 4
Input	SF1	OFF	ON	OFF	ON
	SF2	OFF	OFF	ON	ON
Output	EDM	ON	OFF	OFF	OFF
	Output to motor	Shut off	Shut off	Shut off	Output enabled
Alarm		None	ECF	ECF	None

Timing of transition to safety status

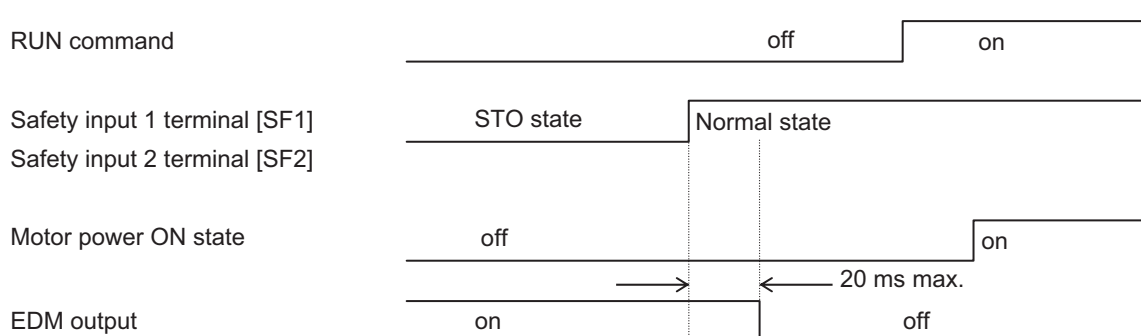
When one of safety input terminals [SF1] and [SF2] turns OFF and then both terminals turn OFF within 50 ms, control transitions to the STO state.



When one of terminals [SF1] and [SF2] turns OFF and then both terminals do not turn OFF within 50 ms, EN circuit failure (alarm code: ECF) is generated.



When terminals [SF1] and [SF2] are turned ON from an STO state, control returns from the STO state.



- To ensure that the safety function works normally, evaluate the entire safety system on every possible risk factor.
- The safety function is not intended to shut off the input or to isolate the output electrically. Be sure to shut off the input power supply to the inverter before attempting installation or maintenance.
- For the safety function, always use a cable length of 20 m or shorter.
- To restart the inverter after the safety function is activated, follow the steps below. Be sure to turn OFF the RUN command before you reset the safety equipment. Resetting the host safety equipment with the RUN command ON may cause the inverter to restart suddenly.
 1. Turn OFF the RUN command.
 2. Release the emergency stop switch.
 3. Reset the host safety equipment.
 4. After resetting the safety equipment, make sure that the inputs of the [SF1] and [SF2] terminals of the inverter are ON.
 5. Turn ON the RUN command to restart the inverter.
- Setting of the start check function is recommended to prevent sudden operation.
- It takes 50 ms or shorter from when the safety input is input till when the inverter shuts off the output.
- Install the inverter in a control panel with an enclosure rating of IP54 or higher.
- If minute pulses are to be input to terminals [SF1] and [SF2] based on the diagnosis of the safety PLC, ensure that the pulse width is less than 1 ms.
- The logical mismatch between the [SF1] and [SF2] terminals based on the signal delay must be within 50 ms. If it exceeds 50 ms, an EN circuit failure (alarm code: 39) is output.

8-7 Functions Related to Operations

8-7-1 Forced Terminal Block Function (F-TM)

If other than the control circuit terminal block is selected for 1st Frequency Reference Selection (3004Hex-02Hex)/2nd Frequency Reference Selection (3006Hex-1FHex) and 1st RUN Command Selection (3004Hex-03Hex)/2nd RUN Command Selection (301FHex-03Hex), use this function to forcibly enable the operations from the control circuit terminal block by turning the input terminal ON/OFF.

If “162: F-TM (Forced terminal block)” is allocated to Input Terminal [DI1] to [DI7] Function Selection (3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex), the operation is performed from the frequency reference source and RUN command source selected by 1st Frequency Reference Selection (3004Hex-02Hex)/2nd Frequency Reference Selection (3006Hex-1FHex) and 1st RUN Command Selection (3004Hex-03Hex)/2nd RUN Command Selection (301FHex-03Hex) if the F-TM terminal has been canceled, and the operation is performed forcibly by the frequency reference and the RUN command from the control circuit terminal block if there is an input.

If the forced terminal block function is enabled during operation, the RUN command is canceled and the inverter output stops.

If input is performed simultaneously with the OPE terminal (35: Forced operator), the forced operator is given priority.

The frequency reference for the forced terminal block function is the frequency reference based on the input terminal [AI1].

The RUN command for the forced terminal block function is the FW terminal and the RV terminal allocated to the input terminal. If the FW terminal and RV terminal are not allocated to the input terminal, it becomes impossible to perform operation.

The forced terminal block function is given priority in the case of frequency reference than the multi-step speed reference.

When the start check function is set to enabled, the start check function is executed when the F-TM terminal (162: Forced terminal block) is turned ON. (For details on the start check function, refer to 8-7-3 *Start Check Function* on page 8-69.)

Parameter No.	Function name	Data	Default data	Unit
3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex	Input Terminal [DI1] to [DI7] Function Selection	162: F-TM (Forced terminal block)	-	-
Related function		1st Frequency Reference Selection (3004Hex-02Hex) 2nd Frequency Reference Selection (3006Hex-1FHex) 1st RUN Command Selection (3004Hex-03Hex) 2nd RUN Command Selection (301FHex-03Hex)		

8-7-2 Password Function

This is a function for completely or partially obscuring the parameters set in the inverter.

The set values of all parameters can be protected by two types of passwords as rewriting prohibited. While password 1 enables the selection of the protection operation, password 2 disables the disclosure and changing of all parameters.

Pay sufficient attention to the use of password as once a password is set, it cannot be changed or deleted.

Parameter No.	Function name	Data	Default data	Unit
3020Hex-62Hex	User password 1 Mode selection	0: All parameters cannot be changed 1: Those other than favorite parameters cannot be displayed or changed 2: Do not use	0	-
3020Hex-63Hex	User Password 1 Setting/Verification	0000 to FFFF Hex	0000	-
3008Hex-64Hex	Password 2 Setting/Verification	0000 to FFFF Hex	0000	-
3020Hex-64Hex	User Password 1 Setting	0: Disable 1: Protected	0	-

Password Protection

By setting a password (four digit in hexadecimal) at User Password 1 Setting/Verification (3020Hex-63Hex) and setting 1 at User Password 1 Setting (3020Hex-64Hex), the parameter is protected by password 1 (protection against rewriting).

Select the parameters targeted for protection at User password 1 Mode selection (3020Hex-62Hex).

- When "0" is set to User password 1 Mode selection (3020Hex-62Hex), the values of all parameters cannot be rewritten.
- When "1" is set to User password 1 Mode selection (3020Hex-62Hex), parameters other than those registered as favorite parameters cannot be read or written.

With password 2, the set value of all parameters can be protected against reading and rewriting regardless of the selection in User password 1 Mode selection (3020Hex-62Hex).

The following parameters are not protected by passwords 1 and 2.

- ◆ Communication commands and communication monitors
Parameter group S, M, W, X, Z

By setting a password at Password 2 Setting/Verification (3008Hex-64Hex) and setting 1 to User Password 1 Setting (3020Hex-64Hex), the parameter is protected by password 2 (protection against reading or writing).

As for parameters for which reading or writing is prohibited, it is not possible to write set values and also to read the set values.

If a parameter is protected by password 1 and the password set to User Password 1 Setting/Verification (3020Hex-63Hex) is entered again, the protected state is canceled. If password 2 is also set simultaneously, password 2 must be canceled beforehand at Password 2 Setting/Verification (3008Hex-64Hex).

If the value of the password entered to User Password 1 Setting/Verification (3020Hex-63Hex) or Password 2 Setting/Verification (3008Hex-64Hex) to cancel the protection status is wrong, the protection status cannot be temporarily canceled, and, when five retries to enter the password are continuously wrong, a password cancellation error (alarm code: FD) is generated.

In the password cancellation error status, User Password 1 Setting/Verification (3020Hex-63Hex) or Password 2 Setting/Verification (3008Hex-64Hex) cannot be entered. (The inverter can be operated) To cancel the password cancellation error, either turn the inverter power supply OFF then back ON again, or wait for 20 minutes.

Enabling/Disabling Conditions

The password is enabled when a value other than 0 is set in User Password 1 Setting/Verification (3020Hex-63Hex) and Password 2 Setting/Verification (3008Hex-64Hex).

From the viewpoint of ensuring security, to make sure that only the person who sets the password can change or delete it, a password cannot be disabled (password deletion) once it has been enabled.

Moreover, a password cannot be changed.

However, the password is deleted by initializing the inverter itself, and password protection is disabled.

How To Use the Password Function

Perform the following operations to use the password function.

<Setting a password from a password not set status>

When a hexadecimal 4-digit password is entered to one or both of User Password 1 Setting/Verification (3020Hex-63Hex) and Password 2 Setting/Verification (3008Hex-64Hex), the password is set and it is in protection cancellation state.

To use user password 1, select the target to be protected at User password 1 Mode selection (3020Hex-62Hex).

Note that once a password is set, it cannot be changed or deleted.

<Changing the protection cancellation state to the protected state>

The status of a password changes to the protection state by setting 1 at User Password 1 Setting (3020Hex-64Hex). The state also changes to the protection status after turning the inverter back ON again or after four hours have elapsed since the state was set to the protection cancellation state.

When user password 1 is set, the status of the target to be protected that is set at User password 1 Mode selection (3020Hex-62Hex) is rewriting prohibited.

When user password 2 is set, the status of all parameters is reading/writing prohibited.

When both two user passwords are set, priority is given to user password 2.

<Canceling the protection status (when only one of the user passwords is set)>

The password protection status can be canceled by entering the password from the protection status.

When only one of user password 1 or user password 2 is set, the status of all protection is canceled by entering the set password.

<Canceling the protection status (when both two user passwords are set)>

When both two user passwords are set, begin entry with user password 2.

When user password 2 is canceled, the status changes to user password 1 protection status, and the status of the target to be protected selected at User password 1 Mode selection (3020Hex-62Hex) changes to protected. When user password 1 is canceled in this status, this means that all passwords will have been canceled.

Cautions Regarding the Password Function

- 0000 cannot be set to passwords.
- Once a password is set, it cannot be changed or deleted.
- There is no way of checking a password once it is set. When you have forgotten a password, its protection status cannot be canceled. So, the inverter itself must be initialized. To perform initialization while in the protection status, this will be executed on condition that the inverter will be in the password cancellation error (FD) status. Enter a wrong password five times to set the invert to the password cancellation error status, and then perform initialization by Data Initialization (3008Hex-04Hex). At this time, only “1: Initialize all parameters” can be selected at Data Initialization (3008Hex-04Hex).

8-7-3 Start Check Function

Select whether to enable or disable the start check function.

Parameter No.	Function name	Data	Default data	Unit
3008Hex-61Hex	STOP Key Priority/ Start Check Function	0: Start check function disable 2: Start check function enable	0	-
Related function		Stop Selection (3008Hex-0CHex) 1st Acceleration Time 1 (3004Hex-08Hex) 2nd Acceleration Time 1 (3005Hex-0BHex) 1st Deceleration Time 1 (3004Hex-09Hex) 2nd Deceleration Time 1 (3005Hex-0CHex)		

Start Check Function (3008Hex-61Hex = “2,” “4”)

- The start check function checks the status of the RUN command at the following check timing and generates an error.
- When a RUN command is input, the inverter is not operated and a run operation error (24: sub codes 2 to 5) is generated. (For details on RUN command, refer to 6-4-1 *RUN command selection* on page 6-22.)
- The content of sub codes 2 to 5 of a run operation error and the check timing are as follows.

Sub code	Alarm sub code contents	Check timing
2	Start check function	When switching is performed on the SET terminal (12: Set 2nd control), OPE terminal (35: Forced operator) or F-TM terminal (162: Forced terminal block)
3	Start check function (when operation is permitted)	When the ROK terminal (38: Permission of Run command) is turned ON while the RUN command is ON

Sub code	Alarm sub code contents	Check timing
4	Start check function (at a reset power ON)	When the RS terminal (8: Reset) is turned ON
5	Start check function (at power restoration when power is turned ON)	When the power is turned ON

- The check function is enabled even in the following status in which the RUN command is input and the RUN command is disabled.

FRS terminal (7: Free-run stop) ON and RUN command ON

ROK terminal (38: Permission of Run command) OFF and RUN command ON

STO terminal status (EN terminal OFF) and RUN command ON

FW terminal (98: Forward Run/Stop) ON and RV terminal (99: Reverse Run/Stop) ON

8-8 Functions Related to Protection, Warning and Various Output Signals

This section describes the protection functions such as warning signals.

8-8-1 Current Limit/Overload Prevention Control/Overload Warning

Current limit

If the output current of the inverter becomes equal to or above the current limitation level, the output frequency is controlled to prevent the engine from stalling.

- It is enabled when "0: IM V/f control," "1: IM Dynamic torque vector control without speed sensor," "3: IM V/f control with speed sensor" or "4: IM Dynamic torque vector control with speed sensor" is selected for Drive Control Selection (3004Hex-2BHex/3009Hex-0FHex).

Select the operation of this function at 1st Overload Protect Function Selection (3004Hex-2CHex)/2nd Overload Protect Function Selection (301FHex-2FHex).

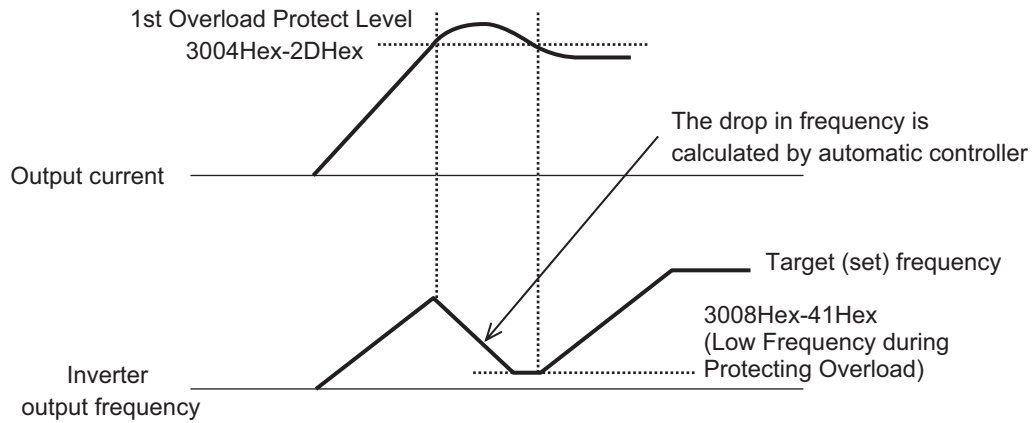
At 1st Overload Protect Level (3004Hex-2DHex)/2nd Overload Protect Level (301FHex-30Hex), set an operation level with the inverter rated output current value as 100%.

If this function is operated while the inverter is accelerating, the acceleration time becomes longer than the set time.

The lower limit value of the frequency when the current limitation is operated can be set at Low Frequency during Protecting Overload (3008Hex-41Hex), but generally, there is no need to change the settings. Besides current limitation, Low Frequency during Protecting Overload (3008Hex-41Hex) is also applicable to torque limitation and overload prevention control.

Parameter No.	Function name	Data	Default data	Unit
3004Hex-2CHex/ 301FHex-2FHex	1st Overload Protect Function Selection/ 2nd Overload Protect Function Selection	0: Disable (Current limiter does not work.) 1: Enable at constant speed (Disable during ACC/DEC) 2: Enable during ACC/constant speed operation	2	-
3004Hex-2DHex/ 301FHex-30Hex	1st Overload Protect Level/ 2nd Overload Protect Level	20 to 200 (The data is interpreted as the rated output current of the inverter for 100%.)	180	%
3008Hex-41Hex	Low Frequency during Protecting Overload	0.0: Depends on 3004Hex-11Hex/ 301FHex-13Hex (1st Frequency Lower Limit/2nd Frequency Lower Limit) 0.1 to 590.0	1.6	Hz

Example case where overload limit function is activated during acceleration (3004Hex-2CHex/301FHex-2FHex = 2)



Overload Prevention Control

Set the rate of decline of the output frequency of overload prevention control. This function causes the inverter output frequency to drop before the cooling fin of the inverter overheats (alarm code: 11) or an overload trip occurs (alarm code: 19), and thus prevents tripping. This function is effective in equipment such as pumps where the load reduces with a drop in the output frequency, but it is necessary to continue with the operation even when the output frequency drops.

Allocating “36: OLP (Overload prevention controlling)” to Output Terminal [DO1] Function Selection (3005Hex-15Hex) and Output Terminal [ROA, ROB] Function Selection (3005Hex-1CHex) activates overload prevention control and indicates that the output frequency changes, and the signal “OLP” that turns ON during the overload prevention control is output.

Parameter No.	Function name	Data	Default data	Unit
3008Hex-47Hex	Overload Prevention Control	0.00: Depend on selected deceleration time 0.01 to 100.00 Hz/s 999: Cancel	999	Hz/s
3005Hex-15Hex/ 3005Hex-1CHex	Output Terminal [DO1] Function Selection/Output Terminal [ROA, ROB] Function Selection	36: OLP (Overload prevention controlling)	-	-
Related function		Output Terminal [DO1] ON Delay Time (3051Hex-0AHex) Output Terminal [DO1] OFF Delay Time (3051Hex-0BHex) Output Terminal [ROA, ROB] ON Delay Time (3051Hex-0EHex) Output Terminal [ROA, ROB] OFF Delay Time (3051Hex-0FHex)		

*1. Deceleration is performed according to the currently selected deceleration time by the SET, RT1 and RT2 terminals.

*2. The OFF delay becomes the time obtained by adding 0.1 s to Output Terminal[DO1] OFF Delay Time (3051Hex-0BHex) and Output Terminal [ROA, ROB] OFF Delay Time (3051Hex-0FHex).

Overload Warning

The overload warning function causes the inverter to output an overload warning if the load is too large, before it detects an overload trip.

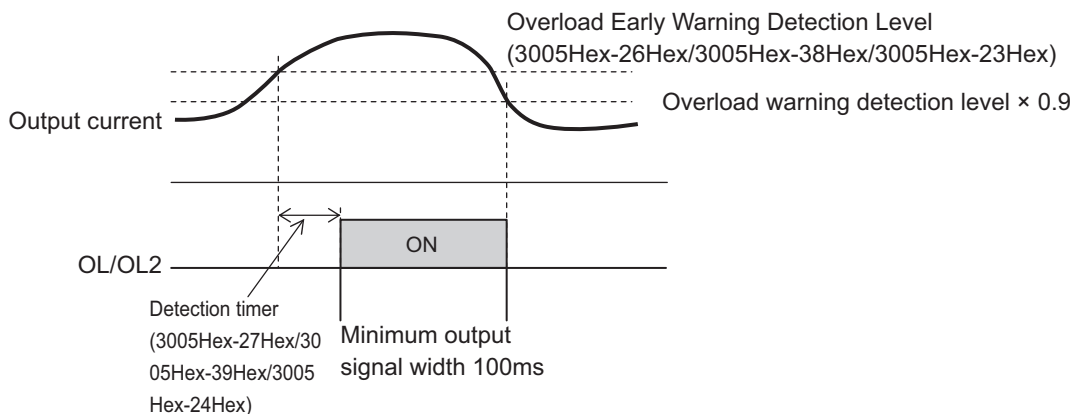
- This is useful to prevent mechanical damage to transfer machines, etc. due to overweighed loading, or stoppage of transfer lines due to an overload, through the use of the overload protection function of the inverter.
- To output this signal, allocate “38: OL (Overload warning)” or “37: OL2 (Overload warning 2)” to Output Terminal [DO1] Function Selection (3005Hex-15Hex) and Output Terminal [ROA, ROB] Function Selection (3005Hex-1CHex). (Two types of overload warning signals can be output.)
- When using “38: OL (Overload warning),” set the overload warning detection level and overload warning detection timer for each of 1st and 2nd control. When using “37: OL2 (Overload warning 2),” set Overload early warning 2 Level (OL2) (3005Hex-23Hex) and Overload early warning 2 Detection Timer (OL2) (3005Hex-24Hex) regardless of 1st and 2nd control.

Parameter No.	Function name	Data	Default data	Unit
Common settings for OL and OL2				
301FHex-56Hex	Overload Warning Detection Condition Selection (OL1, OL2)	0: Output during acceleration/deceleration and constant-speed operation 1: Output only during constant-speed operation	1	-
Overload warning OL (Detection level and detection timer are set for each 1st and 2nd drive controls.)				
3005Hex-26Hex	1st Overload Early Warning Detection Level	0.00: Disable 0.01 to 176.0 # Setting range from 1% (HHD) to 200%(ND) of the rated inverter current.	21.00	A
3005Hex-27Hex	1st Overload Early Warning Detection Timer / Low Current detection level (OL, LOC)	0.01 to 600.00	10.00	s
3005Hex-38Hex	2nd Overload Warning Detection Level *1	0.00: Disable 0.01 to 176.0 # Setting range from 1% (HHD) to 200%(ND) of the rated inverter current.	21.00	A
3005Hex-39Hex	2nd Overload Early Warning Detection Timer *1	0.01 to 600.00	10.00	s
3005Hex-15Hex/ 3005Hex-1CHex	Output Terminal [DO1] Function Selection/ Output Terminal [ROA, ROB] Function Selection	38: OL (Overload warning)	-	-
Overload warning OL2 (Common to 1st and 2nd drive controls.)				
3005Hex-23Hex	Overload early warning 2 Level (OL2)	0.00: Disable 0.01 to 176.0 # Setting range from 1% (HHD) to 200% (ND) of the rated inverter current.	21.00	A
3005Hex-24Hex	Overload early warning 2 Detection Timer (OL2)	0.01 to 600.00	10.00	s

Parameter No.	Function name	Data	Default data	Unit
3005Hex-15Hex/ 3005Hex-1CHex	Output Terminal [DO1] Function Selection/Output Terminal [ROA, ROB] Function Selection	37: OL2 (Overload warning 2)	-	-
Related function		Output Terminal [DO1] ON Delay Time (3051Hex-0AHex) Output Terminal [DO1] OFF Delay Time (3051Hex-0BHex) Output Terminal [ROA, ROB] ON Delay Time (3051Hex-0EHex) Output Terminal [ROA, ROB] OFF Delay Time (3051Hex-0FHex)		

- *1. To enable switching to the 1st and 2nd control, allocate "12: SET (Set 2nd control)" to either of input terminal [DI1] to [DI7].
- *2. The OFF delay becomes the time obtained by adding 0.1 s to Output Terminal[DO1] OFF Delay Time (3051Hex-0BHex) and Output Terminal [ROA, ROB] OFF Delay Time (3051Hex-0FHex).

- Overload warning has a hysteresis characteristic of operation level $\times 10\%$. The minimum output signal width of the signal is 100 ms.



8-8-2 Anti-regenerative Control Function

- This function controls the output frequency to suppress regenerative energy and avoid overvoltage tripping.
- The action of this function can be selected at Anti-regenerative Control Function Selection (3008Hex-46Hex).
- This function is temporarily disabled when the AR-CCL terminal is turned ON.

Parameter No.	Function name	Data	Default data	Unit
3008Hex-46Hex	Anti-regenerative Control Function Selection	0: Disable 2: Torque limit control with forced stop after three times deceleration time has passed 3: Main Circuit DC Voltage control with forced stop after three times deceleration time has passed 4: Torque limit control without forced stop 5: Main Circuit DC Voltage control without force-to-stop	0	-
3020Hex-0FHex	Anti-regenerative Control Level	0.0 to 50.0 999: Auto	999	%
3008Hex-4DHex	Frequency Rising Limit for Torque Limit	0.0 to 590.0	5.0	Hz
Related function	Input Terminal [DI1] to [DI7] Function Selection (3005Hex-02Hex to 3005-06Hex, 3005Hex-63Hex, 3005Hex-64Hex) = "82 (AR-CCL: Cancel anti-regenerative control)"			

- Anti-regenerative control sometimes increases the deceleration time.
- When the braking unit is connected, do not use anti-regenerative control. Anti-regenerative control sometimes acts simultaneously with operation of the braking unit and the deceleration time is not as set.
- When the deceleration time is too short, the Main Circuit DC Voltage of the inverter sometimes rises quickly and anti-regenerative control cannot keep up. In instances like this, set a longer deceleration time.

Torque Limit (3008Hex-46Hex = 2, 4)

- A feature is that response is high and an overvoltage trip is less likely to occur even by an impact load. The frequency control value can be adjusted by Anti-regenerative Control Level (3020Hex-0FHex), and, when the Anti-regenerative Control Level (3020Hex-0FHex) is increased, frequency control increases.
- This is enabled during acceleration, constant speed and deceleration.
- The output frequency is controlled until braking torque reaches almost 0 (zero).
- Although Anti-regenerative Control Level (3020Hex-0FHex) can be adjusted, normally adjustment is not required.
- When the output frequency is limited, an overvoltage trip sometimes is generated as anti-regenerative control is limited. Anti-regenerative capability can be improved by setting a larger Frequency Rising Limit for Torque Limit (3008Hex-4DHex).

Main Circuit DC Voltage Control (3008Hex-46Hex = 3, 5)

- This is enabled only at deceleration.

- When the main circuit intermediate voltage exceeds limitation level, the output frequency is controlled so that the main circuit intermediate voltage is lowered.
- The regeneration capacity of an inverter can be made use of to shorten the deceleration time.
- When “Main Circuit DC Voltage control with forced stop after three times deceleration time has passed” has been set, anti-regenerative control is suspended and the motor is stopped according to the selected deceleration time when a time three times of the currently selected deceleration time elapses after the RUN command is turned OFF. Use this function when the load state causes the output frequency to rise by anti-regenerative control and the motor does not stop.

8-8-3 Instantaneous Overcurrent Limitation

- This function is used to select whether to perform the current limitation process (a process where the inverter output is momentarily turned OFF to suppress an increase in the current, and the output frequency is operated) or overcurrent tripping when the output current of the inverter becomes equal to or above the instantaneous overcurrent limitation level.
- If the torque generated by the motor is temporarily reduced due to the current limitation process, and a failure occurs for the use of the equipment or machinery, it is necessary to perform overcurrent tripping and use a mechanical brake.
- During instantaneous current limitation operation, Inverter output limiting signal (5: IOL), (22: IOL2) is output.

Parameter No.	Function name	Data	Default data	Unit
3008Hex-0DHex	Instantaneous Overcurrent Limiting Function Selection	0: Disable 1: Enable	1	-
3005Hex-15Hex/ 3005Hex-1CHex	Output Terminal [DO1] Function Selection/ Output Terminal [ROA, ROB] Function Selection	5: IOL (Inverter output limiting) 22: IOL2 (Inverter output limiting with delay)	-	-

8-8-4 External Trip (EXT)

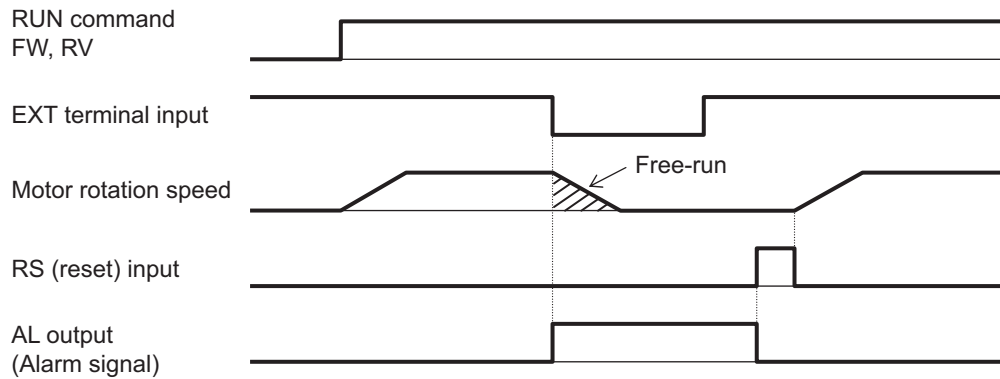
Use this signal to have the inverter trip via an error signal generated by a peripheral system. To do so, allocate “9: EXT (External trip)” to Input Terminal [DI1] to [DI7] Function Selection (3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex).

When the EXT terminal turns OFF, the inverter trips and generates the external alarm (alarm code: 12), and shuts off its output.

Once the inverter trips and generates the external alarm (alarm code: 12), the trip status will not be reset even if the error signal from external equipment is reset (the EXT terminal is turned ON).

In this case, perform the reset operation or cycle the power supply to reset the trip. For details on a reset operation, refer to *Reset* on page 6-59.

Parameter No.	Function name	Data	Default data	Unit
3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex	Input Terminal [DI1] to [DI7] Function Selection	9: EXT (External trip)	-	-



If the RUN command is being input when the alarm is cleared by a reset after a trip, operation is started in accordance with the frequency reference. To prevent operation from being started unintentionally, set the start check function to enabled. For details on the start check function, refer to *8-7-3 Start Check Function* on page 8-69.

8-8-5 Thermistor Trip Function

You can provide thermal protection for external equipment such as a motor by connecting a thermistor installed on it to the inverter and enabling this function.

Parameter No.	Function name	Data	Default data	Unit
3008Hex-1BHex	Thermistor Function Selection (MOH)	0: Disable 1: PTC (Inverter immediately trips with OH4 displayed) 2: PTC (Inverter issues output signal MOH and continues to run)	0	-
3008Hex-1CHex	1st Thermistor Error Detection Level (MOH)	0.00 to 5.00	1.60	V
3005Hex-15Hex/ 3005Hex-1CHex	Output Terminal [DO1] Function Selection/Output Terminal [ROA, ROB] Function Selection	56: MOH (Motor overhear detected by thermistor) *1	-	-
Related function		Output Terminal [DO1] ON Delay Time (3051Hex-0AHex) Output Terminal [DO1] OFF Delay Time (3051Hex-0BHex) Output Terminal [ROA, ROB] ON Delay Time (3051Hex-0EHex) Output Terminal [ROA, ROB] OFF Delay Time (3051Hex-0FHex)		

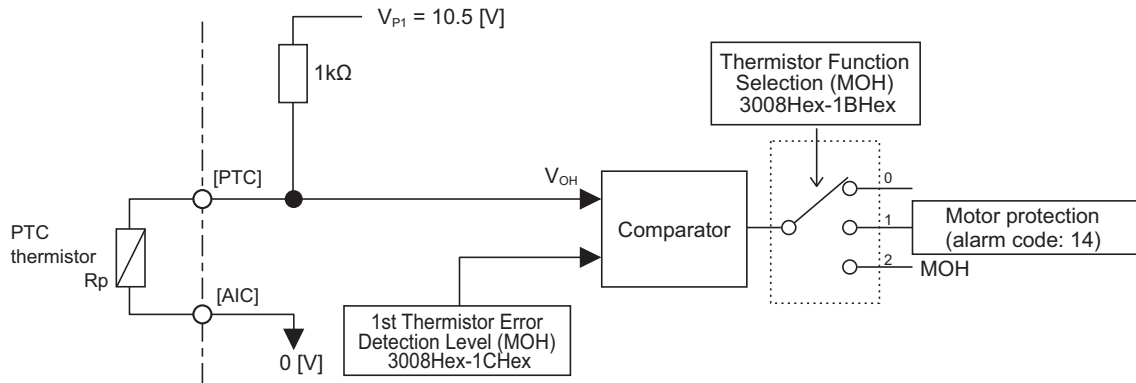
*1. The OFF delay of the Motor overhear detected by thermistor (56: MOH) terminal becomes the time obtained by adding 0.1 s to Output Terminal[DO1] OFF Delay Time (3051Hex-0BHex) and Output Terminal [ROA, ROB] ON Delay Time (3051Hex-0FHex).

Connect a PTC thermistor between the [PTC] terminal and the [AIC] terminal. If, as a result of the resistance value of the connected PTC thermistor, the internal power supply is divided, and the voltage between the [PTC] terminal and the [AIC] terminal exceeds 1st Thermistor Error Detection Level (MOH) (3008Hex-1CHex), operation set at Thermistor Function Selection (MOH) (3008Hex-1BHex) is performed. Take thermistor error into consideration when setting the 1st Thermistor Error Detection

Level (MOH) (3008Hex-1CHex). If the resistance value of a PTC thermistor at the protection temperature is considered as R_p , the operation level V_{OH} is calculated by the formula below.

$$V_{OH} = \frac{R_p}{1000 + R_p} \times 10.5(V)$$

See below for the block part of the operation.



8-8-6 Frequency Arrival Signal (FAR1 to 3, FDT1 to 4, FAR1FDT1)

The inverter outputs the frequency arrival signal when the output frequency reaches the set level.

Allocate “1: FAR1 (Frequency arrival signal 1 (constant speed)),” “2: FDT1 (Over set frequency arrival signal 1),” “21: FAR2 (Frequency arrival signal 2),” “31: FDT2 (Over set frequency arrival signal 2),” “72: FAR3 (Frequency arrival signal 3),” “87: FAR1FDT1 (Frequency match detection),” “183: FDT3 (Set-frequency-only arrival signal),” or “185: FDT4 (Set-frequency-only arrival signal 2)” to Output Terminal [DO1] Function Selection (3005Hex-15Hex) and Output Terminal [ROA, ROB] Function Selection (3005Hex-1CHex).

Parameter No.	Function name	Data	Default data	Unit
3005Hex-15Hex/ 3005Hex-1CHex	Output Terminal [DO1] Function Selection/ Output Terminal [ROA, ROB] Function Selection	1: FAR1 (Frequency arrival signal 1 (constant speed)) 2: FDT1 (Over set frequency arrival signal 1) 21: FAR2 (Frequency arrival signal 2) 31: FDT2 (Over set frequency arrival signal 2) 72: FAR3 (Frequency arrival signal 3) 87: FAR1FDT1 (Frequency match detection) 183: FDT3 (Set-frequency-only arrival signal) 185: FDT4 (Set-frequency-only arrival signal 2)	-	-
3005Hex-1EHex	Frequency Arrival 2 ON Timer	0.01 to 10.00	0.10	s

Parameter No.	Function name	Data	Default data	Unit
3005Hex-1FHex	Frequency Arrival Detection Width (FAR1/FAR2/FAR3/FDT3/FDT4)	0.0 to 10.0	2.5	Hz
3005Hex-20Hex	Frequency Detection Level1 (FDT1/FDT3)	0.0 to 590.0	60.0	Hz
3005Hex-21Hex	Frequency Detection Hysteresis Width (FDT1/ FDT2)	0.0 to 590.0	1.0	Hz
3005Hex-25Hex	Frequency Detection Level 2 (FDT2/FDT4)	0.0 to 590.0	60.0	Hz

Frequency Arrival Signal (Constant Speed) (3005Hex-15Hex, 3005Hex-1CHex = 1: FAR1, 21: FAR2, 72: FAR3)

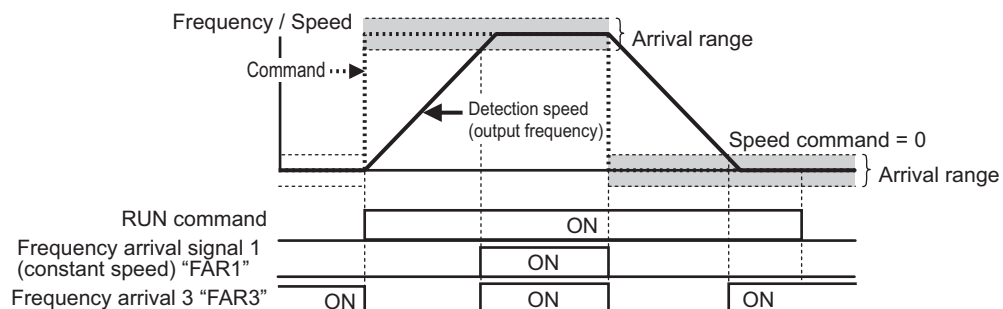
FAR1, FAR2 and FAR3 turn ON when the output frequency falls within the set frequency \pm Frequency Arrival Detection Width (3005Hex-1FHex), and turn OFF when the output frequency falls outside the Frequency Arrival Detection Width (3005Hex-1FHex). In addition to FAR1 signal functions, the Frequency Arrival 2 ON Timer (3005Hex-1EHex) can be set to the FAR2 signal.

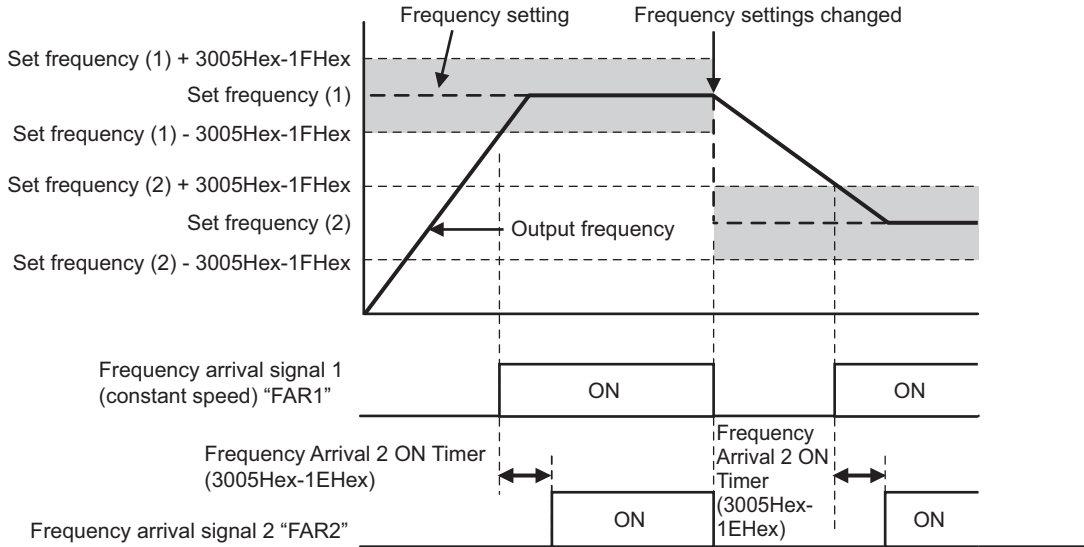
Also, operation when the RUN command is OFF differs between FAR1, FAR2 and FAR3 as follows.

FAR1, FAR2: The signal is always OFF when the RUN command is OFF or the speed command is 0.

FAR3: The signal is turned ON when the output frequency is within $0 \pm$ frequency arrival detection range while the frequency reference is considered to be 0 with the RUN command being OFF.

Name	Output signal	3005Hex-15Hex, 3005Hex-1CHex allocated data	Operation level	Detection range	Remarks
Frequency arrival signal 1 (constant speed)	FAR 1	1	Set frequency	Frequency Arrival Detection Width (3005Hex-1FHex)	OFF when the RUN command is OFF
Frequency arrival signal 2 (constant speed)	FAR 2	21			OFF when the RUN command is OFF
Frequency arrival signal 3 (constant speed)	FAR 3	72			When the RUN command is OFF, the frequency reference is treated and processed as 0

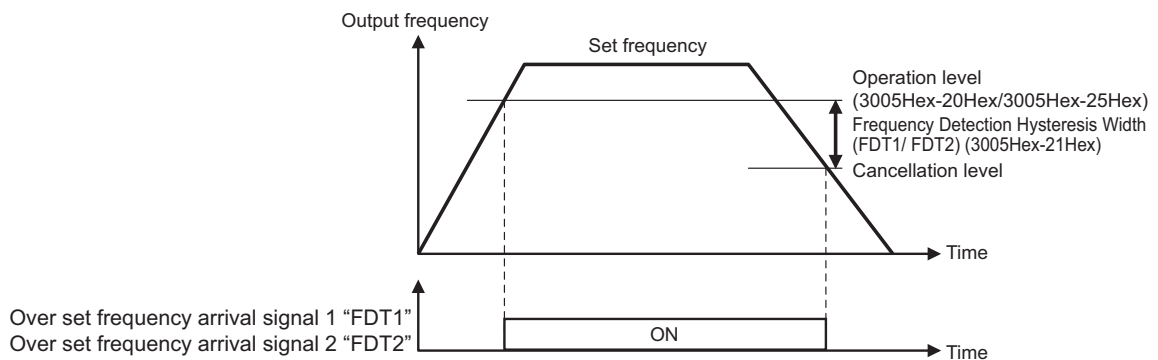




Over Set Frequency Arrival Signal (3005Hex-15Hex, 3005Hex-1CHex = 2: FDT1, 31:FDT2)

An ON signal is output when the output frequency becomes equal to or higher than Frequency Detection Level (3005Hex-20Hex/3005Hex-25Hex), and the signal is turned OFF when the frequency falls below Frequency Detection Hysteresis Width (3005Hex-21Hex).

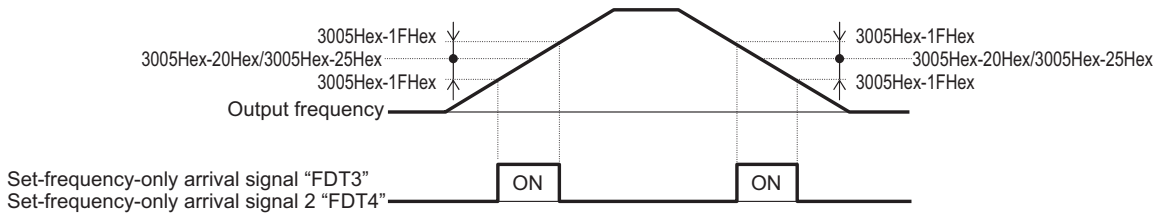
Name	Output signal	3005Hex-15Hex, 3005Hex-1CHex allocated data	Operation level	Hysteresis width
			Range: 0.0 to 500.0Hz	Range: 0.0 to 500.0Hz
Over set frequency arrival signal 1	FDT1	2	3005Hex-20Hex	3005Hex-21Hex
Over set frequency arrival signal 2	FDT2	31	3005Hex-25Hex	



Set-Frequency-Only Arrival Signal (3005Hex-15Hex, 3005Hex-1CHex = 183: FDT3, 185: FDT4)

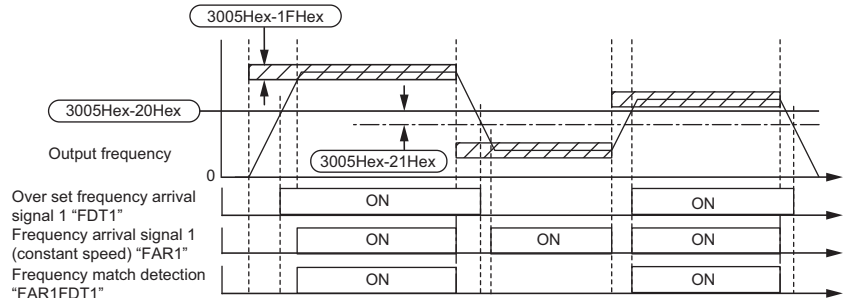
An ON signal is output when the output frequency is within the range of Frequency Detection Level (3005Hex-20Hex/3005Hex-25Hex), and the signal is turned OFF when the output frequency is out of range.

Name	Output signal	3005Hex-15Hex, 3005Hex-1CHex allocated data	Operation level	Hysteresis width
			Range: 0.0 to 500.0Hz	Range: 0.0 to 500.0Hz
Set-frequency-only arrival signal	FDT3	2	3005Hex-20Hex	3005Hex-1FHex
Set-frequency-only arrival signal 2	FDT4	31	3005Hex-25Hex	3005Hex-1FHex



Frequency Match Detection (3005Hex-15Hex, 3005Hex-1CHex = 87: FAR1FDT1)

This is an AND composite signal of FAR1 and FDT1, which turns ON when both the conditions are established.



8-8-7 Power ON Time Over/RUN Time (ONT/RNT)

- If the total RUN time and power ON time of the inverter main circuit exceeds the time set at RUN Time Over (RNT)/Power ON Time Over (ONT) Detection Level (301FHex-37Hex), the inverter will output the RUN time over/Power ON time over (RNT/ONT) signal.

Parameter No.	Function name	Data	Default data	Unit
301FHex-37Hex	RUN time over (RNT)/Power ON time over (ONT) Detection Level	0 to 9999	0	10h
3005Hex-15Hex/ 3005Hex-1CHex	Output Terminal [DO1] Function Selection/ Output Terminal [ROA, ROB] Function Selection	237: RNT (RUN time over) 236: ONT (Power ON time over)	-	-
Related function		Cumulative Operation Time (3003Hex-15Hex) Total RUN Time Monitor (3017Hex-50Hex)		

Power ON Time Over (236: ONT)

- Allocate “236: ONT” to Output Terminal [DO1] Function Selection (3005Hex-15Hex) and Output Terminal [ROA, ROB] Function Selection (3005Hex-1CHex).
- The power ON time of the inverter's main circuit is counted and output to Cumulative Operation Time (3003Hex-15Hex). When RUN Time Over (RNT)/Power ON Time Over (ONT) Detection Level (301FHex-37Hex) elapses, the ONT terminal (236: Power ON time over) turns ON.

RUN time over (238: RNT)

- Allocate “238: RNT” to Output Terminal [DO1] Function Selection (3005Hex-15Hex) and Output Terminal [ROA, ROB] Function Selection (3005Hex-1CHex).
- Time is measured during inverter operation (inverter output signal (35: RUN2) is ON) and the result is output to Total RUN Time Monitor (3017Hex-50Hex). When RUN Time Over (RNT)/Power ON Time Over (ONT) Detection Level (301FHex-37Hex) elapses, RNT terminal (237: RUN time over) turns ON.

8-8-8 Maintenance monitor

The Maintenance timer counted up (MNT) signal is output when the cumulative operation time for motor 1 exceeds the preset time, or when the number of startups for motor 1 exceeds the preset number of times.

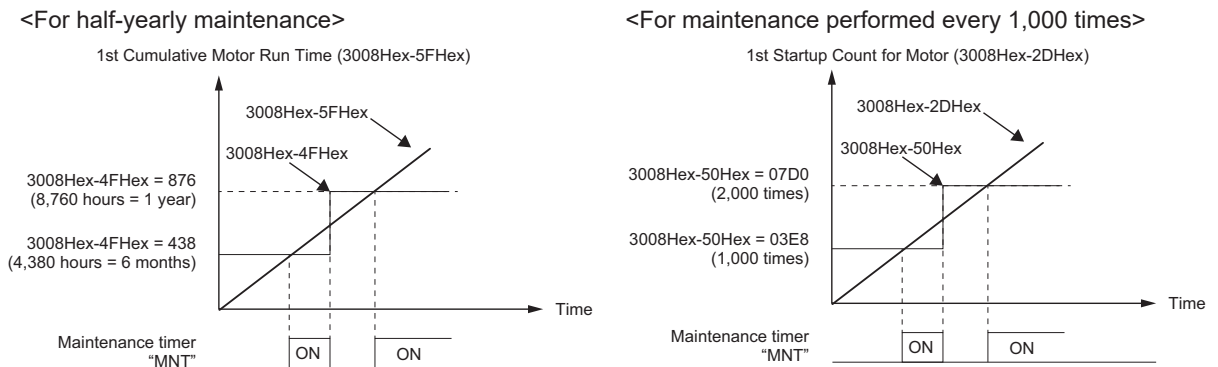
Parameter No.	Function name	Data	Default data	Unit
3008Hex-4FHex	1st Motor Maintenance Interval	0: Disable 1 to 9999 (in 10 hours)	8760	Hours
3008Hex-5FHex/ 3009Hex-34Hex	1st Cumulative Motor Run Time/2nd Cumulative Motor Run Time	0 to 9999 (in 10 hours)	0	Hours
3008Hex-50Hex	1st Preset Startup Count for Motor Maintenance	0: Disable 1 to 65,535	0	-
3008Hex-2DHex/ 3009Hex-35Hex	1st Startup Count for Motor/ 2nd Startup Counter for Motor	0 to 65,535	0	-
3005Hex-15Hex/ 3005Hex-1CHex	Output Terminal [DO1] Function Selection/ Output Terminal [ROA, ROB] Function Selection	84: MNT (Maintenance timer counted up)	-	-

Maintenance Timer (3005Hex-15Hex, 3005Hex-1CHex = 84: MNT)

Allocate “84: MNT (Maintenance timer counted up)” to Output Terminal [DO1] Function Selection (3005Hex-15Hex) and Output Terminal [ROA, ROB] Function Selection (3005Hex-1CHex).

The signal is output when 1st Startup Count for Motor (3008Hex-2DHex) reaches the value set at 1st Preset Startup Count for Motor Maintenance (3008Hex-50Hex), or 1st Cumulative Motor Run Time (3008Hex-5FHex) reaches the value set at 1st Motor Maintenance Interval (3008Hex-4FHex).

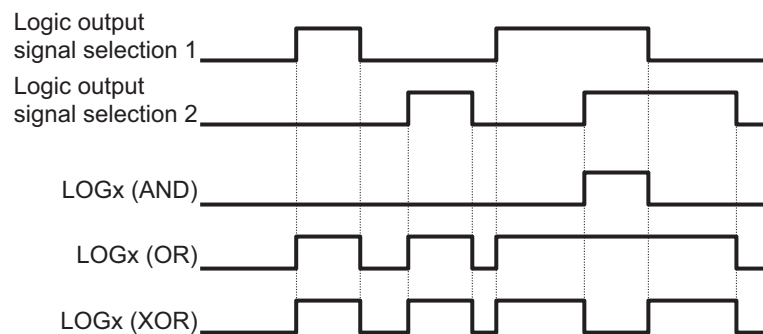
This function is exclusively for the 1st control. The maintenance timer signal is not output even if 2nd Cumulative Motor Run Time (3009Hex-34Hex)/2nd Startup Counter for Motor (3009Hex-35Hex) exceeds the set time period or set number of times.



When the maintenance time is reached, or when the set number of startups for maintenance is reached, again set a numeric value to 1st Motor Maintenance Interval (3008Hex-4FHex) or 1st Preset Startup Count for Motor Maintenance (3008Hex-50Hex) to reset the output signal, and restart the measurement of the time period or the number of startups.

8-8-9 Logic Operation Output Signal (LOG1 to LOG3)

Logical operations (AND, OR, XOR) are performed on signals that can be allocated to output terminals [DO1] and [ROA, ROB], and the result can be output from output terminals. Set "206: LOG1 (Logic operation output 1)," "207: LOG2 (Logic operation output 2)," or "208: LOG3 (Logic operation output 3)" to Output Terminal [DO1] Function Selection (3005Hex-15Hex) and Output Terminal [ROA, ROB] Function Selection (3005Hex-1CHex). However, "206: LOG1 (Logic operation output 1)" to "208: LOG3 (Logic operation output 3)" cannot be selected for the operation target data.



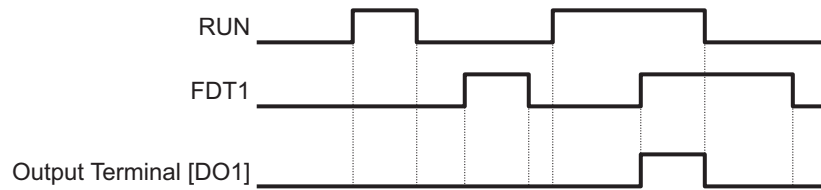
Parameter No.	Function name	Data	Default data	Unit
3051Hex-10Hex/ 3051Hex-13Hex/ 3051Hex-16Hex	Logical Expression 1 Operation Target 1/ Logical Expression 2 Operation Target 1/ Logical Expression 3 Operation Target 1	0 to 241: Same as the options for 3005Hex-15Hex (Except 206 to 208: LOG1 to LOG3)	0	-
3051Hex-11Hex/ 3051Hex-14Hex/ 3051Hex-17Hex	Logical Expression 1 Operation Target 2/ Logical Expression 2 Operation Target 2/ Logical Expression 3 Operation Target 2		0	-
3051Hex-12Hex/ 3051Hex-15Hex/ 3051Hex-18Hex	Logical Expression 1 Logical Operator/ Logical Expression 2 Logical Operator/ Logical Expression 3 Logical Operator	0: AND 1: OR 2: XOR	0	-
3005Hex-15Hex/ 3005Hex-1CHex	Output Terminal [DO1] Function Selection/ Output Terminal [ROA, ROB] Function Selection	206: LOG1 (Logic operation output 1) 207: LOG2 (Logic operation output 2) 208: LOG3 (Logic operation output 3)	---	-

Each logic operation output signal requires different parameter settings.
Set the necessary parameters according to the table below.

Selected signal	Logic output signal selection 1	Logic output signal selection 2	Operator selection
206: Logic operation output 1 (LOG1)	3051Hex-10Hex	3051Hex-11Hex	3051Hex-12Hex
207: Logic operation output 2 (LOG2)	3051Hex-13Hex	3051Hex-14Hex	3051Hex-15Hex
208: Logic operation output 3 (LOG3)	3051Hex-16Hex	3051Hex-17Hex	3051Hex-18Hex

(Example) To output the result of the AND operation between Run Signal (0: RUN) and Over set frequency arrival signal 1 (2: FDT1) to the multifunction output terminal [DO1] as a Logic operation output 1 (LOG1).

Output Terminal [DO1] Function Selection (3005Hex-15Hex): 206 (LOG1)
 Logical Expression 1 Operation Target 1 (3051Hex-10Hex): 0 (RUN)
 Logical Expression 1 Operation Target 2 (3051Hex-11Hex): 2 (FDT1)
 Logical Expression 1 Logical Operator (3051Hex-12Hex): 0 (AND)



8-8-10 Capacitor Life Warning Signal (WAC)

Use this signal to determine the life expectancy of the internal capacitor based on the inverter's internal temperature, conduction time, and the capacity of the capacitor.

By turning bit 4 of Protection/Maintenance Function Mode Selection (3008Hex-63Hex) ON, the service life of the capacitor is judged to have reached its end when any one of the following conditions is satisfied, and WAC (Capacitor life warning signal) is turned ON.

- The capacity of the capacitor becomes 85 % or below the factory default value.
- The conduction time exceeds 61,000 hours (7 years) in all models of the HND mode "A2022/037, A4022/040, AB002-022" and ND mode.
- The conduction time exceeds 87,000 hours (10 years) in models other than the above.

The capacity of the capacitor can be monitored by Main Circuit Capacitor's Capacitor Monitor (3010Hex-4CHex), and the conduction time by Cumulative Run Time of Electrolytic Capacitors on PC Board (3003Hex-4DHex).

This function is set based on *A-8 Smoothing Capacitor Life Curve* on page A-291.

The time until the service life of the main circuit capacitor is reached (in 10 hours) is displayed in Service Life of Main Circuit Capacitor Remaining Time (3008Hex-4EHex).

Parameter No.	Function name	Data	Default data	Unit
3008Hex-63Hex	Protection/Maintenance Function Mode Selection	Bit 4: Judge main circuit capacitor life 0: Disable 1: Enable	-	-
3005Hex-15Hex/ 3005Hex-1CHex	Output Terminal [DO1] Function Selection/Output Terminal [ROA, ROB] Function Selection	240: WAC (Capacitor life warning signal)	-	-

Method for Comparing the Main Circuit Capacitor's Capacity and the Default Value during Shipment from Factory

When bit 3 = 0 at Protection/Maintenance Function Mode Selection (3008Hex-63Hex), follow the measurement procedure below to measure the capacitance of the main circuit capacitor when the power supply is cut off, and compare the value with the default value at the time of shipment from the factory. The measurement result is displayed as a percentage (%) with respect to the default value at the time of shipment from the factory.

Capacity measurement procedure

1. To compare with the default value measured at the time of shipment from the factory, return the state of the actual product to the state during shipment from the factory.
 - If another inverter is connected to the main circuit terminals P(+) and N(-) via a DC bus line, disconnect it. A DC reactor (option), even if connected, need not be removed.
 - Remove the wires of the control power auxiliary inputs (R0, T0).
 - Turn OFF all digital inputs (DI1 to DI7) of the control circuit terminals.
 - Make the setting to ensure that the transistor output (DO1) and relay output (ROA, ROB) do not turn ON.
 - If the setting is made to perform logical inversion of the transistor output and relay output, the output turns ON even when the inverter is not running. In such a case, change the setting.
 - Ensure an ambient temperature of $25^{\circ}\text{C}\pm 10^{\circ}\text{C}$.
2. Turn ON the main power supply.
3. Make sure the cooling fan is operating and the inverter is in a stopped state.
4. When the main power supply is cut off, the measurement of the capacity of the main circuit capacitor starts automatically.
5. Once the display on the LED is cleared, again turn ON the main power supply.
6. Check Main Circuit Capacitor's Capacitor Monitor (3010Hex-4CHex).

Method of Measuring the Capacity of the Main Circuit Capacitor when Power Supply is Cut Off during Normal Operation

The capacity of the main circuit capacitor in the normal operation state is measured automatically when the power supply is cut off, if bit 3 = 1 at Protection/Maintenance Function Mode Selection (3008Hex-63Hex).

To perform this measurement, it is necessary to measure the reference capacitor capacity according to the measurement procedure below.

Parameter No.	Function name	Description
3008Hex-2BHex	Main Circuit Capacitor Service Life Coefficient (Measurement Value)	<ul style="list-style-type: none"> • Measurement value when the capacity of the main circuit capacitor is measured • Start the default value measurement mode during normal operation (0000) • Measurement failure (0001)
3008Hex-30Hex	Main Circuit Capacitor Service Life Coefficient (Initial Value)	<ul style="list-style-type: none"> • Default value of the main circuit capacitor • Start the default value measurement mode during normal operation (0000) • Measurement failure (0001)

When a part is replaced, it is necessary to clear or replace the data at Main Circuit Capacitor Service Life Coefficient (Measurement Value) (3008Hex-2BHex) and Main Circuit Capacitor Service Life Coefficient (Initial Value) (3008Hex-30Hex).

Reference capacity measurement procedure

1. Change Protection/Maintenance Function Mode Selection (3008Hex-63Hex) to user measurement value standard (bit 3 = 1).

2. Stop the inverter.
 3. Set the inverter to a state when the power supply is cut off during normal operation.
 4. Set Main Circuit Capacitor Service Life Coefficient (Measurement Value) (3008Hex-2BHex) and Main Circuit Capacitor Service Life Coefficient (Initial Value) (3008Hex-30Hex) to 0000, respectively.
 5. Cut off the power supply to the inverter (the operation described below is executed automatically when the power is cut off).
Measure the discharge time of the main circuit capacitor and save it to Main Circuit Capacitor Service Life Coefficient (Initial Value) (3008Hex-30Hex).
The measurement conditions for main circuit capacitor are detected automatically, and the conditions are saved.
 6. Turn ON the inverter power supply again.
Make sure Main Circuit Capacitor Service Life Coefficient (Measurement Value) (3008Hex-2BHex) and Main Circuit Capacitor Service Life Coefficient (Initial Value) (3008Hex-30Hex) are correct.
Make sure Main Circuit Capacitor's Capacitor Monitor (3010Hex-4CHex) is 100%.
If measurement fails, 0001 is set respectively at Main Circuit Capacitor Service Life Coefficient (Measurement Value) (3008Hex-2BHex) and Main Circuit Capacitor Service Life Coefficient (Initial Value) (3008Hex-30Hex). Remove the cause of the failure and perform measurement again.
If the conditions described above are satisfied when the power supply is cut off the next time, the discharge time of the main circuit capacitor is measured automatically. Periodically check Main Circuit Capacitor's Capacitor Monitor (3010Hex-4CHex).
- A large measurement error may occur in the measurement method described above. If life estimation is performed in this mode, return the judgment standard for the service life of the main circuit capacitor in Protection/Maintenance Function Mode Selection (3008Hex-63Hex) to the factory default standard, perform the measurement again under the factory default conditions, and check the service life.

8-8-11 Braking Transistor Broken (DBAL)

Use this signal to determine the life expectancy of the internal capacitor based on the inverter's internal temperature, conduction time, and the capacity of the capacitor.

When bit 6 = 1 at Protection/Maintenance Function Mode Selection (3008Hex-63Hex), an error in the built-in braking transistor is detected, the inverter is topped, and the braking transistor error (alarm code: 3B) is displayed.

When bit 6 = 0 at Protection/Maintenance Function Mode Selection (3008Hex-63Hex), the braking transistor is not used and an alarm does not occur.

Parameter No.	Function name	Data	Default data	Unit
3005Hex-15Hex/ 3005Hex-1CHex	Output Terminal [DO1] Function Selection/Output Terminal [ROA, ROB] Function Selection	105: DBAL (Braking transistor broken)	-	-

8-8-12 Cooling FAN Control Method Selection

To extend the life of the cooling fan and reduce the noise from the cooling fan, the cooling fan can be stopped according to the internal temperature of the inverter when there is no motor output.

Parameter No.	Function name	Data	Default data	Unit
3008Hex-07Hex	Cooling Fan Function Selection	0: Always Fan ON 1: ON/OFF control effective	-	-
3005Hex-15Hex/ 3005Hex-1CHex	Output Terminal [DO1] Function Selection/Output Terminal [ROA, ROB] Function Selection	25: FAN (Cooling fan in operation)	-	-

- When Cooling Fan Function Selection (3008Hex-07Hex) is set to “1: ON/OFF control effective,” the cooling fan operates during motor output, and, when the motor is stopped, the cooling fan operates until the internal temperature of the inverter is at a fixed value or less.
- When Cooling Fan Function Selection (3008Hex-07Hex) is set to “1: ON/OFF control effective,” the ON signal is output when the cooling fan is in operation and the OFF signal is output when it has stopped by allocating “25: FAN (Cooling fan in operation)” to Output Terminal [DO1] Function Selection (3005Hex-15Hex) and Output Terminal [ROA, ROB] Function Selection (3005Hex-1CHex).

8-8-13 Cooling Fan Life Warning Signal (WAF)

The number of hours of operation of the cooling fan is counted. The cooling fan is judged to have reached the end of its life when it exceeds 87,000 hours (10 years) of operation, and WAF (Cooling fan life warning signal) is turned ON.

The operation time of the cooling fan can be monitored by Cumulative Run Time of Cooling Fan (3008Hex-2CHex). When the cooling fan is replaced, the cumulative run time can be cleared by setting 0.

Parameter No.	Function name	Data	Default data	Unit
3005Hex-15Hex/ 3005Hex-1CHex	Output Terminal [DO1] Function Selection/Output Terminal [ROA, ROB] Function Selection	241: WAF (Cooling fan life warning signal)	-	-
3008Hex-2CHex	Cumulative Run Time of Cooling Fan	0 to 9999 (in 10 hours)	0	10h

8-8-14 Life Alarm (LIFE)

For models with a main circuit capacitor, cooling fan, and inverter capacity of 18.5 kW or more, if any of the capacitors including electrolytic capacitors exceeds the life judgment standard, the LIFE terminal (30: Lifetime alarm) is turned ON. In addition, the lifetime alarm (alarm code: 67) can be output as a minor alarm. For details, refer to 8-8-23 *Minor Alarm Selection* on page 8-95.

Parameter No.	Function name	Data	Default data	Unit
3005Hex-15Hex/ 3005Hex-1CHex	Output Terminal [DO1] Function Selection/Output Terminal [ROA, ROB] Function Selection	30: LIFE (Lifetime alarm)	-	-

De-tection tar-get	Detection method	Individual output terminal*1	Monitor No.	Remarks
Main circuit capacitor	Measure the discharge time of the main circuit capacitor when the main power supply is shut off and calculate the capacity of the main circuit capacitor. It is judged that the end of life has been reached when capacity has reached 85% of the factory default capacitor capacity or the main circuit capacitor capacity (pre-measured at startup) in a user normal operation state.	WAC terminal (240: WAC)	Main Circuit Capacitor's Capacitor Monitor (3010Hex-4CHex)	Adjustment is possible (For details, refer to 8-8-10 Capacitor Life Warning Signal (WAC) on page 8-85.) Can be disabled by Protection/Maintenance Function Mode Selection (3008Hex-63Hex).
	The time during which voltage is applied to the main circuit capacitor (the time during which the main power supply is ON) is counted. Also, the time is corrected by measuring the capacity of the main circuit capacitor. When the operation time exceeds 87,000 hours (10 years)*2, it is judged that the end of life has reached.		<ul style="list-style-type: none"> Elapsed time Service Life of Main Circuit Capacitor Elapsed Time (3003Hex-4DHex) Remaining time Service Life of Main Circuit Capacitor Remaining Time (3003Hex-4EHex) 	Can be reset by Service Life of Main Circuit Capacitor Remaining Time (3008Hex-4EHex).
Electrolytic capacitor	The time during which voltage is applied to the electrolytic capacitor is counted. Also, the elapsed time is corrected by the ambient temperature. When the operation time exceeds 87,000 hours (10 years), it is judged that the end of life has reached.	-	Cumulative Run Time of Capacitors on Printed Circuit Boards (3010Hex-44Hex)	Can be reset by Cumulative Run Time of Electrolytic capacitor (3008Hex-31Hex).
Cooling fan	The time during which the cooling fan is operating is counted. When the operation time exceeds 87,000 hours (10 years), it is judged that the end of life has reached.	WAF terminal (241: WAF)	Cumulative Run Time of Cooling Fan (3010Hex-45Hex)	Can be reset by Cumulative Run Time of Cooling Fan (3008Hex-2CHex).

*1. Select by output terminal function selection.

*2. With specifications and models shown below, the life is 61,000 hours (7 years) according to Load Mode Selection (3004Hex-51Hex).

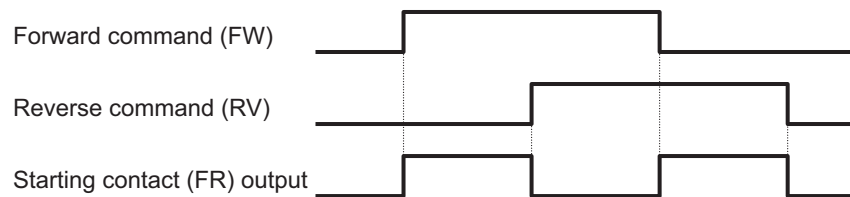
HND mode: A2022/037, A4022/040, AB002-022

ND mode: All models

8-8-15 Starting Contact Signal (FR)

The starting contact signal is output for the duration that the FW terminal or RV terminal is being input. The inverter will stop if the FW and RV terminals are input simultaneously, and the FR terminal (187: Starting contact signal) turns OFF.

Parameter No.	Function name	Data	Default data	Unit
3005Hex-15Hex/ 3005Hex-1CHex	Output Terminal [DO1] Function Selection/Output Terminal [ROA, ROB] Function Selection	187: FR (Starting contact signal)	-	-



8-8-16 Cooling Fin Overheat Warning (OHF)

This function monitors the temperature of the cooling fin of the inverter and turns the cooling fin overheat warning signal ON/OFF according to the conditions below.

- When the cooling fin overheat warning signal is OFF
The cooling fin overheat warning signal turns ON when the cooling fin temperature is overheat trip temperature - 5°C or above.
- When the cooling fin overheat warning signal is ON
The cooling fin overheat warning signal turns OFF when the cooling fin temperature is overheat trip temperature - 8°C or below.
- When the cooling fin temperature is the overheat trip temperature or above, cooling fin overheat occurs (alarm code: 11).

Parameter No.	Function name	Data	Default data	Unit
3005Hex-15Hex/ 3005Hex-1CHex	Output Terminal [DO1] Function Selection/Output Terminal [ROA, ROB] Function Selection	28: OHF (Fin overheat warning)	-	-

8-8-17 Low Current Signal (LOC)

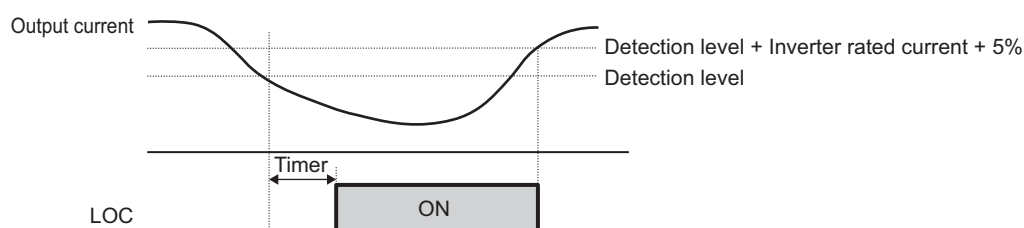
This Light load detection signal (LOC) is output when the output current falls to or below 1st Overload Early Warning Detection Level (3005Hex-26Hex).

At Low Current Detection Condition Selection (LOC) (301FHex-55Hex), select whether to have the inverter output this signal constantly during run or only during constant speed operation.

Parameter No.	Function name	Data	Default data	Unit
3005Hex-26Hex	1st Overload Early Warning Detection Level	0.00: Disable 0.01 to 176.0 # Setting range from 1% (HHD) to 200% (ND) of the rated inverter current.	21.00	A
3005Hex-27Hex	1st Overload Early Warning Detection Timer / Low Current detection level (OL, LOC)	0.01 to 600.00	10.00	s
301FHex-55Hex	Low Current Detection Condition Selection (LOC)	0: Output during acceleration/ deceleration and constant-speed operation 1: Output only during constant-speed operation ^{*1}	-	-
3005Hex-15Hex/ 3005Hex-1CHex	Output Terminal [DO1] Function Selection/ Output Terminal [ROA, ROB] Function Selection	41: LOC (Light load detection signal) ^{*2}	-	-
Related function		Output Terminal [DO1] ON Delay Time (3051Hex-0AHex) Output Terminal [DO1] OFF Delay Time (3051Hex-0BHex) Output Terminal [ROA, ROB] ON Delay Time (3051Hex-0EHex) Output Terminal [ROA, ROB] OFF Delay Time (3051Hex-0FHex)		

*1. If analog input (3004Hex-02Hex/3006Hex-1FHex = 1) is selected for 1st Frequency Reference Selection (3004Hex-02Hex)/2nd Frequency Reference Selection (3006Hex-1FHex), the signal may not be judged as a constant speed depending on the sampling condition. In this case, set 301FHex-55Hex = 0 (Output during acceleration/deceleration and constant-speed operation), or increase the value set in the Input Terminal [AI1] Filter (3006Hex-22Hex).

*2. The OFF delay becomes the time obtained by adding 0.1 s to Output Terminal [DO1] OFF Delay Time (3051Hex-0BHex) and Output Terminal [ROA, ROB] OFF Delay Time (3051Hex-0FHex).

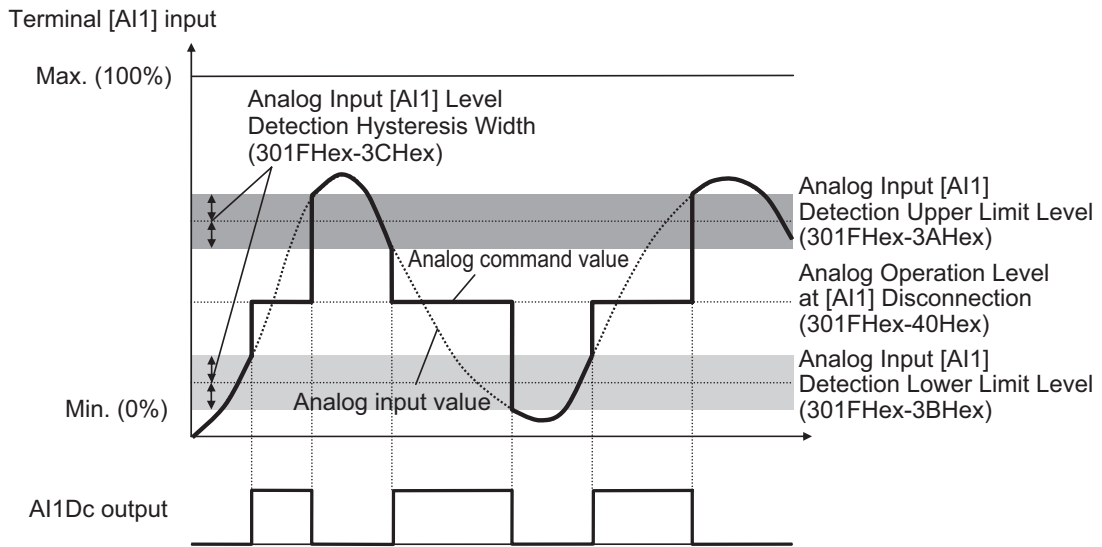


8-8-18 Window Comparator/Disconnection Detection (AI1Dc)

The window comparator signal is output when the input value of the analog input terminal [AI1] is between the upper and lower limit level of the window comparator. It is useful for monitoring the analog input at a level to detect disconnection or other faults.

Set the detection upper limit level by Analog Input [AI1] Detection Upper Limit Level (301FHex-3AHex), detection lower limit level by Analog Input [AI1] Detection Lower Limit Level (301FHex-3BHex) and detection hysteresis width by Analog Input [AI1] Level Detection Hysteresis Width (301FHex-3CHex).

Analog operation level at AI1Dc output can be set to any value by Analog Operation Level at [AI1] Disconnection (301FHex-40Hex). When set to 999, the analog input value will be used as is.



Parameter No.	Function name	Data	Default data	Unit
301FHex-3AHex	Analog Input [AI1] Detection Upper Limit Level	0 to 100	100	%
301FHex-3BHex	Analog Input [AI1] Detection Lower Limit Level	0 to 100	0	%
301FHex-3CHex	Analog Input [AI1] Level Detection Hysteresis Width	0 to 100	0	%
301FHex-40Hex	Analog Operation Level at [AI1] Disconnection	-100 to 100 999: Disable	999	%
3005Hex-15Hex/ 3005Hex-1CHex	Output Terminal [DO1] Function Selection/Output Terminal [ROA, ROB] Function Selection	238: AI1Dc (Analog AI1 disconnection detection)	-	-

Note Set the upper and lower limit level settings for the window comparator function as a percentage [%] of the 10 V input voltage rather than making the start and end settings for analog input.



Additional Information

When using this signal for disconnection detection, set the disconnection detection level to Analog Input [AI1] Detection Upper Limit Level (301FHex-3AHex). (During normal operation, range exceeding the upper limit value is used. If the range falls below the lower limit value, a disconnection will be detected.)

8-8-19 2nd Control Selection Signal (SETM/SWM1)

The SETM signal is output when the SET terminal (12: Set 2nd control) of multifunction input is ON and the 2nd control has been selected. If the SET terminal is OFF and the 1st control has been selected, the SWM1 signal is output.

Parameter No.	Function name	Data	Default data	Unit
3005Hex-15Hex/ 3005Hex-1CHex	Output Terminal [DO1] Function Selection/Output Terminal [ROA, ROB] Function Selection	48: SWM1 (1st motor in operation) 49: SETM (2nd motor in operation)	-	-

8-8-20 Inverter Output Limiting (IOL, IOL2)

This signal is output when the inverter is performing one of the limitation operations described below. (Minimum output signal width 100 ms)

The signal is output when the limitation operation in “22: IOL2 (Inverter output limiting with delay)” continues for 20 ms or longer.

- Torque limit operation
Torque Limit 1/2/3/4 (3004Hex-29Hex/3004Hex-2AHex/3005Hex-11Hex/3005Hex-12Hex)
- Current limitation operation by software
Overload Protect Function Selection (3004Hex-2CHex/301FHex-2FHex)
Overload Protect Level (3004Hex-2DHex/301FHex-30Hex)
- Current limitation operation by hardware
Instantaneous Overcurrent Limiting Function Selection (3008Hex-0DHex)
- Anti-regenerative control
Anti-regenerative Control Function Selection (3008Hex-46Hex)
- Overload Stop Function
Overload Stop Mode Selection (300EHex-42Hex)

Parameter No.	Function name	Data	Default data	Unit
3005Hex-15Hex/ 3005Hex-1CHex	Output Terminal [DO1] Function Selection/Output Terminal [ROA, ROB] Function Selection	5: IOL (Inverter output limiting) 22: IOL2 (Inverter output limiting with delay)	-	-
Related function		Output Terminal [DO1] ON Delay Time (3051Hex-0AHex) Output Terminal [DO1] OFF Delay Time (3051Hex-0BHex) Output Terminal [ROA, ROB] ON Delay Time (3051Hex-0EHex) Output Terminal [ROA, ROB] OFF Delay Time (3051Hex-0FHex)		

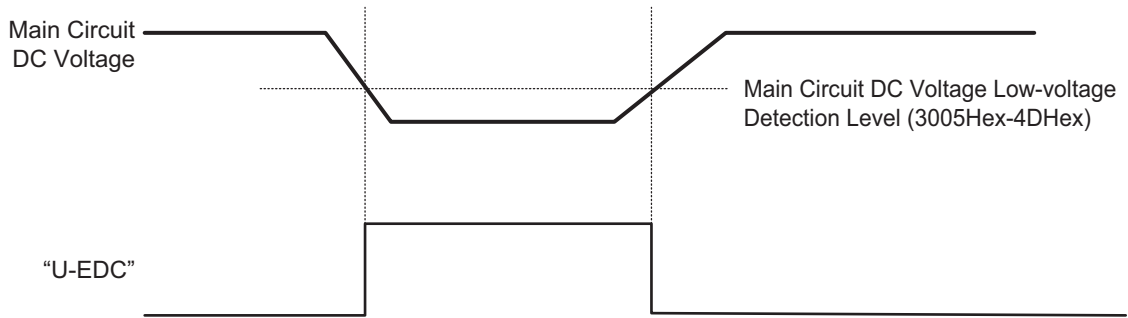
The OFF delay becomes the time obtained by adding 0.1 s to Output Terminal [DO1] OFF Delay Time (3051Hex-0BHex) and Output Terminal [ROA, ROB] OFF Delay Time (3051Hex-0FHex).

- When the IOL signal or the ILO2 signal is ON, the output frequency of the inverter is automatically controlled by the limitation processes described above, and thus, the set frequency may not be achieved.

8-8-21 Low DC link bus voltage detection (U-EDC)

This signal turns ON when the Main Circuit DC Voltage becomes equal to or below Main Circuit DC Voltage low-voltage detection level (3005Hex-4DHex), and turns OFF when it becomes above the Main Circuit DC Voltage low-voltage detection level (3005Hex-4DHex).

Parameter No.	Function name	Data	Default data	Unit
3005Hex-4DHex	Main Circuit DC Voltage Low-voltage Detection Level	200 to 400V (200Vseries) 400 to 800V (400Vseries)	235	V
3005Hex-15Hex/ 3005Hex-1CHex	Output Terminal [DO1] Function Selection/Output Terminal [ROA, ROB] Function Selection	77: U-EDC (Low DC link bus voltage detection)	-	-

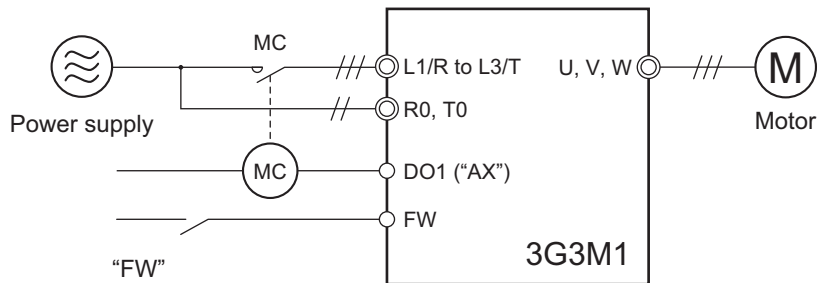


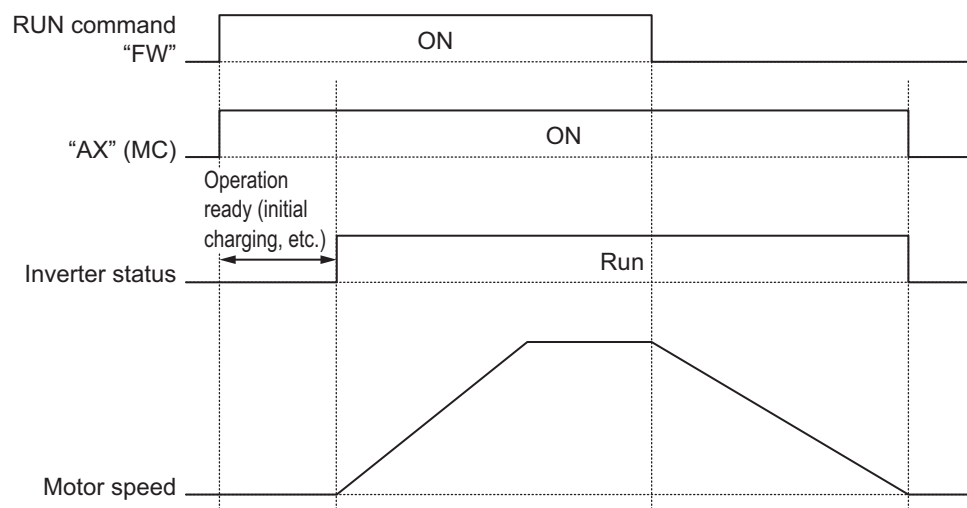
8-8-22 AX Terminal Function (AX)

This function is used to control the electromagnetic contactor (MC) at the inverter input side in association with the RUN command. It turns ON when the RUN command is input. When the stop command is input, this function turns OFF after the inverter undergoes a deceleration stop. This function turns OFF momentarily when the free run command is input and an alarm is generated. "AX" can be selected at a capacity of 18.5kW or more of auxiliary power supply.

Connect the power supply directly between R0 and T0.

Parameter No.	Function name	Data	Default data	Unit
3005Hex-15Hex/ 3005Hex-1CHex	Output Terminal [DO1] Function Selection/Output Terminal [ROA, ROB] Function Selection	15: AX (Switch MC on the input power lines)	-	-





8-8-23 Minor Alarm Selection

When various error states are detected, this function enables continuation of operation without tripping the inverter if they are minor errors. When this is selected, the alarm becomes a minor alarm. The contents of the minor alarm can be selected at Light Alarm Selection 1 (H81)/Light Alarm Selection 2 (H82).

Parameter No.	Function name	Data	Default data	Unit
3008Hex-52Hex	Light Alarm Selection 1	0000 to FFFF	0	-
3008Hex-53Hex	Light Alarm Selection 2	0000 to FFFF	0	-

● Precautions for Correct Use

Overheat protection (alarm code: 11, 13, 46) protects by overheat protection (alarm code: 19) of the inverter that cannot ultimately be turned into a minor alarm. When Motor Electronic Thermal (alarm code: 17, 18), Braking Resistor Thermal (alarm code: 16) and External Alarm (alarm code: 12) are turned into minor alarms, there is the risk of motors and other external devices burning depending on setting and method of use.

● Alarms That Can Be Changed to Minor Alarms

The following alarms can be changed to minor alarms.

Alarm code hex	Name	Overview
11 (0H1)	Cooling fin overheating	The cooling fin temperature has risen to the trip level.
12 (0H2)	External trip	An error has occurred in a peripheral equipment, and the external trip "EXT" signal has turned ON.
13 (0H3)	Inverter internal overheating	The internal temperature of the inverter has risen abnormally.
46 (0H6)	Inrush current prevention resistor	The temperature of the inrush current prevention resistor has risen abnormally due to frequently turning the power supply ON/OFF.
16 (dbH)	Braking resistor overheating	The estimated temperature of the braking resistor coil has risen above the permissible temperature.

Alarm code hex	Name	Overview
17,18 (0L1,0L2)	Motor 1, 2 overload	The motor temperature is calculated from the output current of the inverter, and the motor temperature has reached the trip level.
23 (ER5)	EtherCAT communications error	EtherCAT communications error occurs one or more times
2F (ErE)	Speed mismatch (Excessive speed deviation)	The deviation in the speed adjuster (deviation between the speed command and speed estimated value/detected speed) continued for more than the set time (d22) outside the set range (d21).
38 (Ero)	Position control error	During a servo lock, the position error becomes four rotations or more by motor shaft conversion due to insufficient gain of the position control system

● Minor Alarm Selectable Events

The following events can be set to minor alarms.

Alarm code	Name	Overview
65 (0L)	Motor overload early warning	Early warning before the occurrence of motor overload alarm.
66 (0H)	Cooling fin overheating early warning	Early warning before the occurrence of cooling fin overheat tripping.
67 (LiF)	Lifetime alarm	Any one of the main circuit capacitor used in the inverter, the capacitors on the printed circuit board, and the cooling fan has reached the end of its life
68 (rEF)	Reference loss	The analog frequency reference is disconnected.
69 (PiD)	PID warning output	Warning related to PID control (Absolute value warning/Deviation warning).
6A (UTL)	Low output torque detection	The output torque continued to be below the low torque detection level for more than the time set in the timer.
6B (PTC)	Motor overheat detected by thermistor (PTC)	Temperature detection by the PTC thermistor of the motor.
6C (rTE)	Inverter life (Cumulative operation time of motor)	The cumulative operation time of motor has reached the set maintenance time.
6D (CnT)	Inverter life (Number of startups)	The number of startups has reached the set number of maintenance.

● Method of selecting light alarm causes

The causes of the light alarm that can be selected are allocated to 0 to 15 bits as shown below, and are set and displayed in hexadecimals. By setting the bit corresponding to the cause to be selected to 1, the concerned cause can be treated as a light alarm.

Light Alarm Selection 1 (3008Hex-52Hex)

Bit	Alarm code	Description	Bit	Alarm code	Description
15	46 (0H6)	Inrush current prevention resistor overheat	7	-	-
14	-	-	6	18 (0L2)	Motor 2 overload
13	-	-	5	17 (0L1)	Motor 1 overload

Bit	Alarm code	Description	Bit	Alarm code	Description
12	-	-	4	16 (dbH)	Braking resistor overheating
11	23 (Er5)	EtherCAT communications error	3	-	-
10	-	-	2	13 (0H3)	Inverter internal overheating
9	-	-	1	12 (0H2)	External trip
8	-	-	0	11 (0H1)	Cooling fin overheating

Light Alarm Selection 2 (3008Hex-53Hex)

Bit	Alarm code	Description	Bit	Alarm code	Description
15	-	-	7	67 (LiF)	Lifetime alarm
14	-	-	6	66 (0H)	Cooling fin overheating early warning
13	6D (CnT)	Inverter life (Number of startups)	5	65 (0L)	Motor overload early warning
12	6C (rTE)	Inverter life (Cumulative run time)	4	-	-
11	6B (PTC)	PTC thermistor activated	3	-	-
10	6A (UTL)	Low output torque detection	2	38 (Ero)	Position control error
9	69 (PiD)	PID warning output	1	34 (d0)	Excessive Positional Deviation
8	68 (rEF)	Reference loss	0	2F (ErE)	Speed mismatch (Excessive speed deviation)

(Example) When “Motor 1 overload” or “Cooling fin overheat” is selected at Light Alarm Selection 1 (3008Hex-52Hex)

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Alarm code	46	-	-	-	23	-	-	-	-	18	17	16	-	13	12	11
Display example	Binary	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
	Hexadecimal	0				0				2				1		

The input of light alarm selection must be made by converting a binary 4 bits unit to hexadecimal. The conversion table is shown below.

Binary				Hexadecimal	Binary				Hexadecimal
0	0	0	0	0	1	0	0	0	8
0	0	0	1	1	1	0	0	1	9
0	0	1	0	2	1	0	1	0	A
0	0	1	1	3	1	0	1	1	b
0	1	0	0	4	1	1	0	0	C
0	1	0	1	5	1	1	0	1	d
0	1	1	0	6	1	1	1	0	E
0	1	1	1	7	1	1	1	1	F

● Minor alarm L-ALM Signal

If “98: L-ALM (Minor alarm)” is allocated to Output Terminal [DO1] Function Selection (3005Hex-15Hex) and Output Terminal [ROA, ROB] Function Selection (3005Hex-1CHex), the minor alarm “L-ALM” signal is output when the cause of a minor alarm occurs.

Parameter No.	Function name	Data	Default data	Unit
3005Hex-15Hex/ 3005Hex-1CHex	Output Terminal [DO1] Function Selection/Output Terminal [ROA, ROB] Function Selection	98: L-ALM (Minor alarm)	-	-

8-8-24 Input Phase Loss Protection / Output Phase Loss Protection

By setting Input Phase Loss Protection Function Selection (3052Hex-0CHex) and Output Phase Loss Protection Function Selection (3052Hex-0DHex), it is possible to set whether to continue with the operation or trip the inverter when an input loss or output loss is detected.

Parameter No.	Function name	Data	Default data	Unit
3052Hex-0CHex	Input Phase Loss Protection Function Selection	0: Disable (Continue to run) 1: Enable (Trip)	-	-
3052Hex-0DHex	Output Phase Loss Protection Function Selection			

- Input phase loss protection

If excessive stress is generated on the main circuit devices as a result of the loss of the three-phase power supply input to the inverter or the unbalance between phases, it is detected and the input loss protection function (alarm code: 0B) is activated.

If the load to be connected is light and a DC reactor has been connected, the stress on the main circuit devices is low. Therefore, even if there is an input loss or an unbalance between phases, the loss may not be detected.

- Output phase loss protection

If an output loss is detected during the inverter operation, the output loss protection function (alarm code: 0B) is activated.

In a configuration where an electromagnetic contactor is connected at the output side, if the electromagnetic contactor turns OFF during operation, the current of all phases becomes zero. In such a case, the output loss protection function is not activated.

8-8-25 Integrated power clear (KHC)

When the KHC terminal is turned ON, the integrated power is cleared to zero. Integrating operation is not performed while this terminal command is ON. To resume integrating operation, turn the KHC terminal OFF.

Parameter No.	Function name	Data	Default data	Unit
3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex	Input Terminal [DI1] to [DI7] Function Selection	164: KHC (Integrated power clear)	-	-

8-9 Other Operation Functions

8-9-1 Carrier frequency

Use this function to change the carrier frequency output from the inverter in a PWM waveform.

Set a higher carrier frequency value to reduce the metallic noise from the motor.

However, this results in an increase in electrical noise or leakage current from the inverter.

By setting the level of Motor Sound Tone (3004Hex-1CHex), it may be possible to reduce the metallic noise generated by the motor. Motor Sound Tone (3004Hex-1CHex) is enabled if the setting of Carrier Frequency (3004Hex-1BHex) is 7 kHz or below.

Parameter No.	Function name	Data	Default data	Unit
3004Hex-1BHex	Carrier Frequency	0: 0.75 kHz 1: 1 kHz 2: 2 kHz 3: 3 kHz 4: 4 kHz 5: 5 kHz 6: 6 kHz 7: 7 kHz 8: 8 kHz 9: 9 kHz 10: 10 kHz 11: 11 kHz 12: 12 kHz 13: 13 kHz 14: 14 kHz 15: 15 kHz 16: 16 kHz	2	kHz
3004Hex-1CHex	Motor Sound Tone	0: Level 0 (Disable) 1: Level 1 2: Level 2 3: Level 3	0	-
Related function		Carrier Frequency Automatic Reduction Function Selection (301FHex-42Hex)		

- Derating of the output current may be required depending on the installation environment or the setting of Carrier Frequency (3004Hex-1BHex). For derating in each inverter model, refer to *A-7 Derating Table* on page A-287.

Set the output current value to be derated as electronic thermal level.

This setting, however, is unnecessary if the electronic thermal level is already set to the derating value or lower.

For details on the electronic thermal function, refer to *6-3-3 Motor Electronic Thermal Function* on page 6-18.

- Depending on the motor, the effect of Motor Sound Tone (3004Hex-1CHex) may be less. If the level of Motor Sound Tone (3004Hex-1CHex) is increased too much, the output current may become disordered, and the machine vibrations or noise may increase.

8-9-2 Automatic Carrier Frequency Reduction

Use this function to reduce the carrier frequency automatically as the output current and the cooling fin temperature increase.

Parameter No.	Function name	Data	Default data	Unit
301FHex-42Hex	Carrier Frequency Automatic Reduction Function Selection	0: Disable 1: Enable	1	-
Related function		Carrier Frequency (3004Hex-1BHex)		

- When this function is enabled, overheating or overload trips sometimes can be avoided.

8-9-3 Starting Frequency and Stop Frequency

Set the frequency for starting inverter output when the RUN signal is turned ON, and the frequency for stopping the inverter output when the RUN signal is turned OFF.

Starting frequency

- During V/f control (Drive Control Selection (3004Hex-2BHex/3009Hex-0FHex) = 0, 3)
When the inverter operation is started, the output frequency starts from the starting frequency. Set the starting frequency to enable securing sufficient starting torque. It is also possible to set the Starting Frequency Holding Time (3004Hex-19Hex/3009Hex-3FHex).
- During vector control (Drive Control Selection (3004Hex-2BHex/3009Hex-0FHex) = 1, 4, 5, 6, 15, 16)
When the inverter is started, the speed starts from zero, and acceleration is performed up to the starting frequency in accordance with the set acceleration time and acceleration pattern. After the starting frequency holding time has elapsed, acceleration is again performed to the frequency instructed in accordance with the acceleration time.

Parameter No.	Function name	Data	Default data	Unit
3004Hex-18Hex	1st Starting Frequency	0.0 to 60.0	0.5	Hz
3004Hex-19Hex	1st Starting Frequency 1 Holding Time	0.00 to 10.00	0.00	s
3009Hex-0DHex	2nd Starting Frequency	0.0 to 60.0	0.5	Hz
3009Hex-3FHex	2nd Starting Frequency Holding Time	0.00 to 10.00	0.00	s

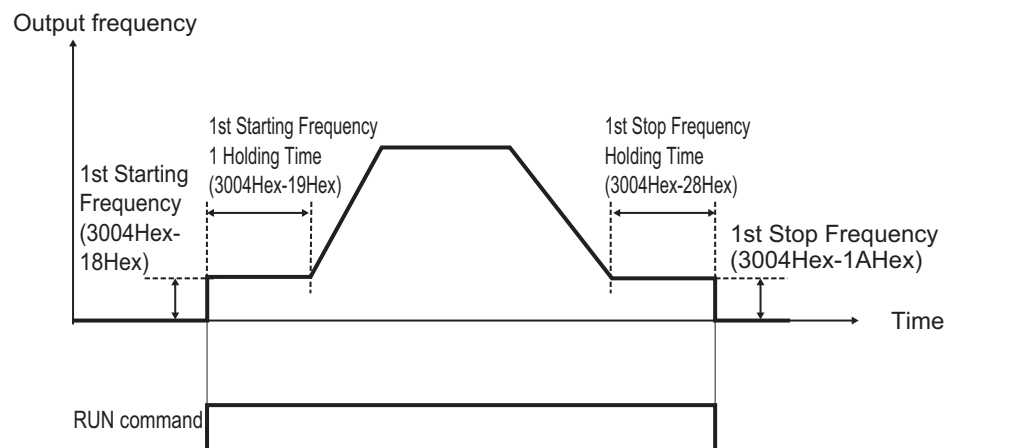
Stop Frequency

- During V/f control (Drive Control Selection (3004Hex-2BHex/3009Hex-0FHex) = 0, 3)
The inverter output is cut off at the time the output frequency reaches the stop frequency. It is also possible to set the stop frequency (holding time).
- During vector control (Drive Control Selection (3004Hex-2BHex/3009Hex-0FHex) = 1, 4, 5, 6, 15, 16)
The speed detection value/speed estimated value or the speed command reaches the stop frequency, and the stop frequency holding time elapses, and then inverter output is cut off.

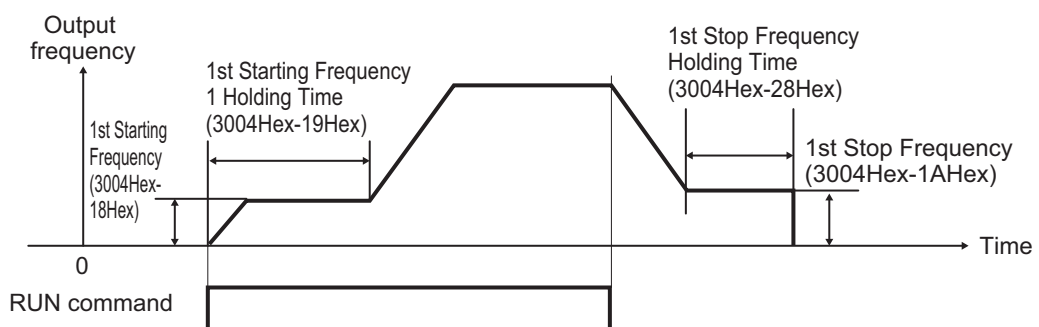
Select the speed detection value/speed estimated value or the speed command at Stop Frequency Detection Method Selection (3004Hex-27Hex/3009Hex-41Hex).

Parameter No.	Function name	Data	Default data	Unit
3004Hex-1AHex	1st Stop Frequency	0.0 to 60.0	0.2	Hz
3004Hex-27Hex	1st Stop Frequency Detection Method Selection	0: Detected/Estimated speed 1: Reference speed	0	-
3004Hex-28Hex	1st Stop Frequency Holding Time	0.00 to 10.00	0.00	s
3009Hex-40Hex	2nd Stop Frequency	0.0 to 60.0	0.2	Hz
3009Hex-41Hex	2nd Stop Frequency Detection Method Selection	0: Detected/Estimated speed 1: Reference speed	0	-
3009Hex-42Hex	2nd Stop Frequency Holding Time	0.00 to 10.00	0.00	s

- **During V/f control (Drive Control Selection (3004Hex-2BHex/3009Hex-0FHex) = 0, 3)**



- **During Vector Control (Drive Control Selection (3004Hex-2BHex/3009Hex-0FHex) = 1, 4, 5, 6, 15, 16)**



8-9-4 Zero Speed Control

Zero speed control keeps the frequency reference motor speed at 0 (zero).

- This is enabled when “5: IM Vector control without speed sensor,” “6: IM Vector control with speed sensor” or “16: PM Vector control with speed and pole position sensor” is set to Drive Control Selection (3004Hex-2BHex/3009Hex-0FHex). As this control is enabled only in speed control, set it to ON (speed control) when the speed control/position control switching terminal (137: SPD) is allocated.
- Zero speed control is executed at a startup and stop, and enable/disable is selected at Zero Speed Control (3014Hex-19Hex).

Parameter No.	Function name	Data	Default data	Unit
3014Hex-19Hex	Zero Speed Control	0: Disable at startup, enable at stop 1: Enable at startup, enable at stop 2: Disable at startup, disable at stop	0	-
Related function		Drive Control Selection (3004Hex-2BHex/3009Hex-0FHex), Starting Frequency (3004Hex-18Hex/3009Hex-0DHex), Stop Frequency (3004Hex-1AHex/3009Hex-40Hex), Starting Frequency Holding Time (3004Hex-19Hex/3009Hex-3FHex), Stop Frequency Holding Time (3004Hex-28Hex/3009Hex-42Hex)		

- When zero speed control is enabled, it is executed when the RUN command is ON and the frequency reference is less than the starting frequency and less than the stop frequency. Note, however, that when the starting frequency and stop frequency are 0.0 Hz, zero speed control is executed with the speed command set to 0.00 Hz.

The following shows the time chart during vector control when “1: Enable at startup, enable at stop” is set to Zero Speed Control (3014Hex-19Hex). With vector control, acceleration is performed in accordance with the acceleration time up to the starting frequency.

8-9-5 Frequency Jump Function

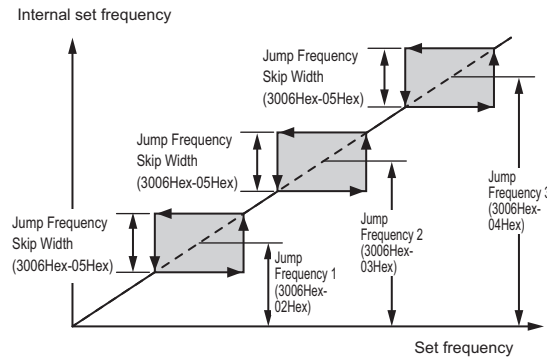
Use this function to avoid the resonant point of the load machine during operation. Three points can be set for the jump frequency range.

Parameter No.	Function name	Data	Default data	Unit
3006Hex-02Hex/ 3006Hex-03Hex/ 3006Hex-04Hex	Jump Frequency 1/Jump Frequency 2/Jump Frequency 3	0.0 to 590.0 Set the center frequency of the frequency skip width to be jumped.*1	0.0	Hz
3006Hex-05Hex	Jump Frequency Skip Width	0.0 to 30.0 Set the skip width of the frequency to be jumped.	3.0	Hz

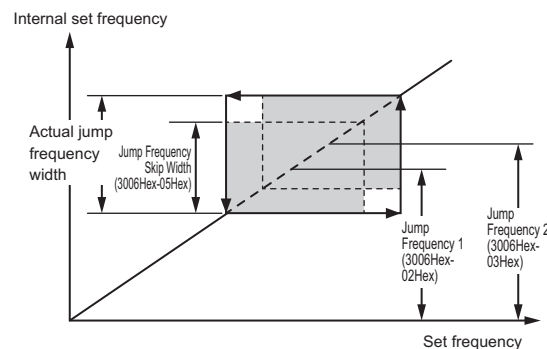
*1. This function is disabled when 0 Hz is set.

If the jump frequency is set to avoid steady operation within the jump frequency range, the setting of the frequency reference within the jump frequency range operates as described below.

- When the set frequency is increased and the set frequency enters the jump frequency band, the internal set frequency is kept constant at the lower limit of the jump frequency band. If the set frequency exceeds the upper limit of the jump frequency band, the internal set frequency reaches the value of the set frequency. When the set frequency is reduced, the opposite relationship to that during increase is realized.



- If two or more jump frequency ranges overlap each other, the lower limit value and the upper limit value of the overlapped jump frequency become the lower limit and upper limit frequencies of the actual jump frequency range.



During acceleration and deceleration, the output frequency changes continuously in accordance with the acceleration/deceleration time.

Although the jump frequency can be set at three locations, the jump frequency width is common at the three locations.

8-9-6 RUN Direction Limit Selection

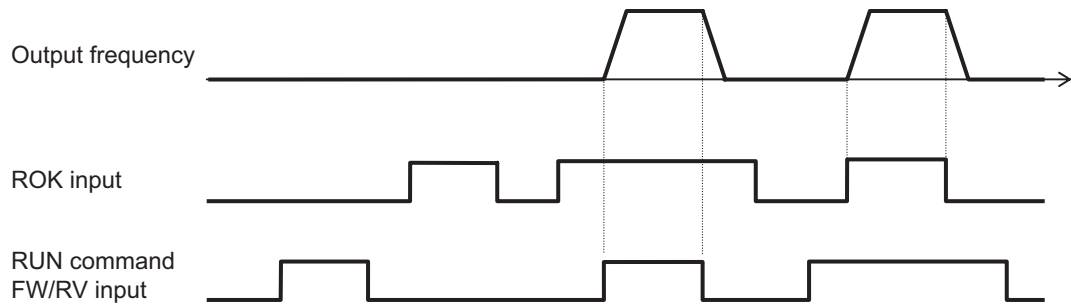
This function limits the rotation direction of the motor output.

Parameter No.	Function name	Data	Default data	Unit
3008Hex-09Hex	Reverse Rotation Prevention Function	0: Disable 1: Reverse rotation inhibited 2: Forward rotation inhibited	0	-

8-9-7 Permission of RUN Command

The RUN command is not accepted while the Permission of Run command is OFF.

Parameter No.	Function name	Data	Default data	Unit
3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex	Input Terminal [DI1] to [DI7] Function Selection	38: ROK (Permission of Run command)	-	-



8-9-8 Frequency Calculation Function

When “13: Calculation result” is set to Frequency Reference Selection (3004Hex-02Hex/3006Hex-1FHex), two frequency references are calculated.

Parameter No.	Function name	Data	Default data	Unit
3004Hex-02Hex/ 3006Hex-1FHex	1st Frequency Reference Selection/2nd Frequency Reference Selection	13: Calculation result	0	-
301FHex-20Hex	Frequency Calculation Operation Target 1	1: Voltage input to terminal [AI1]	1	-
301FHex-21Hex	Frequency Calculation Operation Target 2	5: Pulse train input 7: EtherCAT	2	-
301FHex-22Hex	Frequency Calculation Operator Selection	0: Addition (301FHex-20Hex + 301FHex-21Hex) 1: Subtraction (301FHex-20Hex - 301FHex-21Hex) 2: Multiplication (301FHex-20Hex × 301FHex-21Hex)	0	-

Note 1. The same setting can be made in 301FHex-20Hex/301FHex-21Hex.

Note 2. If the calculation results exceed 1st Maximum Output Frequency (3004Hex-04Hex)/2nd Maximum Output Frequency (3009Hex-02Hex), the limit is set at the maximum frequency. Similarly, if the calculation results are below 0.0 Hz, the limit is set at 0.0 Hz.

8-9-9 Frequency Addition Function

Use this function to add or subtract the value set in Frequency Addition Amount (301FHex-23Hex) to or from the selected frequency reference.

If “161: ADD” is not allocated to the multifunction input terminal, or if the ADD terminal is ON, add or subtract Frequency Addition Amount (301FHex-23Hex). If the ADD terminal is turned OFF, the addition or subtraction of Frequency Addition Amount (301FHex-23Hex) is canceled, and the inverter returns to the status of the selected frequency reference.

Parameter No.	Function name	Data	Default data	Unit
301FHex-23Hex	Frequency Addition Amount	0.00 to 590.00	0.00	Hz
301FHex-24Hex	Frequency Addition Sign Selection	0: Frequency command + (301FHex-23Hex) 1: Frequency command - (301FHex-23Hex)	0	-
3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex	Input Terminal [DI1] to [DI7] Function Selection	161: ADD (Frequency addition)	-	-

Note 1. If the sign of the frequency reference changes (from (-) to (+), or from (+) to (-)) as a result of the calculation, the rotation direction is reversed.

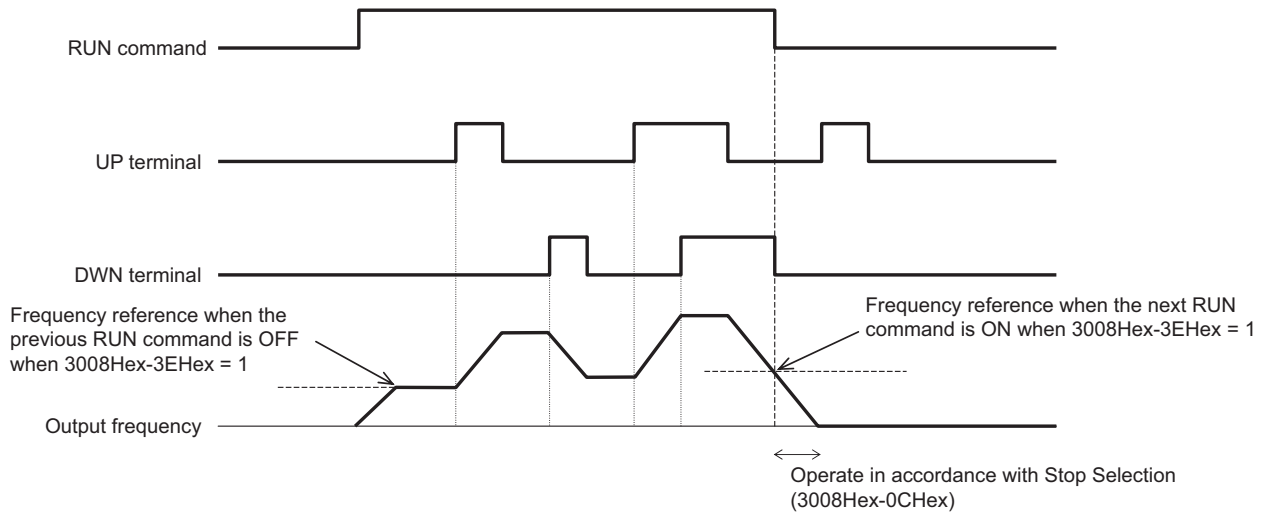
Note 2. When the PID function is used, this function is enabled even for the PID target value. The value is added in increments of 0.01% where the Frequency Addition Amount (301FHex-23Hex) with respect to the target PID value is taken to be 100%. At this time, if a value larger than 100.0 is set, the limit is set at 100.0.

8-9-10 UP/DOWN control

Use this function to change the inverter output frequency via the multifunction input terminals UP and DWN.

Parameter No.	Function name	Data	Default data	Unit
3004Hex-02Hex/3006Hex-1FHex	1st Frequency Reference Selection/2nd Frequency Reference Selection	7: UP/DOWN control	0/2	-
3008Hex-3EHex	UP/DOWN Control Initial Value Selection	0: 0.00Hz 1: Last UP/DOWN command value	1	-
3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex	Input Terminal [DI1] to [DI7] Function Selection	17: UP (UP/DWN function accelerated) 18: DWN (UP/DWN function decelerated) 58: UDC (UP/DWN function data clear)	-	-

- When the RUN command is turned ON, the frequency reference when the previous RUN command is OFF is output. To operate from 0 Hz when the RUN command is ON, set UP/DOWN Control Initial Value Selection (3008Hex-3EHex) to 0.
- Commands from the UP and DWN terminals are enabled only when the RUN command is ON. The frequency reference is added when the UP terminal is ON. The frequency reference is subtracted when the DWN terminal is ON. Addition and subtraction of the frequency reference is stopped when both are ON. When either of the terminals is OFF, the frequency reference is added or subtracted according to the command from the ON terminal.



- The frequency reference operates in accordance with the acceleration/deceleration time and acceleration/deceleration pattern (refer to 6-6-2 *Acceleration/Deceleration Pattern* on page 6-34) that is adopted during operation.
- When the UDC terminal turns ON, the frequency reference is set to 0 Hz and a deceleration stop is performed. The UDC terminal is enabled and the frequency reference becomes 0 Hz also when the UP terminal or DWN terminal is ON. When the UDC terminal is turned OFF during a deceleration stop, the frequency reference is operated from 0 Hz in accordance with the UP terminal or DWN terminal.

Note) When 0: Other than linear acceleration/deceleration, 1: S-curve acceleration/deceleration, 2: S-curve acceleration/deceleration (Arbitrary) and 3: Curve acceleration/deceleration is selected at Acceleration/Deceleration Pattern Selection (3008Hex-08Hex), the output frequency changes for a while even if the “UP” terminal and “DWN” terminal are turned OFF.

8-9-11 AVR

This is a function for automatically correcting the output voltage to the motor even if the inverter incoming voltage fluctuates.

This function is used to avoid a drop in the output torque of the motor or the overexcitation state.

Note, however, that the inverter cannot output voltage exceeding the incoming voltage to the inverter.

AVR (Automatic Voltage Regulator) Function Setting

The AVR (automatic voltage regulator) function is set to enabled or disabled by 1st AVR Function Selection (301FHex-17Hex)/2nd AVR Function Selection (301FHex-18Hex).

- The voltage output in the motor is based on the voltage selected at 1st Rated Voltage at Base Frequency (3004Hex-06Hex)/2nd Rated Voltage at Base Frequency (3009Hex-04Hex).

Note, however, that the inverter cannot output voltage exceeding the incoming voltage to the inverter.

Parameter No.	Function name	Data	Default data	Unit
301FHex-17Hex/ 301FHex-18Hex	1st AVR Function Selection/2nd AVR Function Selection	0: Disable 1: Enable	1	-

Parameter No.	Function name	Data	Default data	Unit
3004Hex-06Hex/ 3009Hex-04Hex	1st Rated Voltage at Base Frequency/2nd Rated Voltage at Base Frequency	80 to 240 V (200 V class series) 160 to 500 V (400 V class series)	200	V

8-9-12 Overexcitation Control during Deceleration

Overexcitation control during deceleration is a function that decreases the regenerative energy to be fed back to the inverter by forcing the motor during deceleration to be in an overexcited state. It enables you to shorten the deceleration time without use of external braking resistors.

If, in spite of using this function, the operation cannot be performed at the target deceleration time, or if an overcurrent occurs, use the optional braking resistors.

Avoid frequent acceleration and deceleration as it may cause the motor to burn.

This function is enabled in V/f control, V/f control with speed sensor, and vector control with speed sensor. If Anti-regenerative Control Function Selection (3008Hex-46Hex) in the torque limit method is set to "2: Torque limit control with forced stop after three times deceleration time has passed" or "4: Torque limit control without forced stop," this function is disabled.

- When using this function, set "1: Enable" to Over-Excitation Control Selection during Deceleration Function Selection (3008Hex-48Hex).
- By setting Magnetic Flux Level during Deceleration (3014Hex-5BHex) to higher than 100%, the overexcitation state of the motor is adjusted. Set this as a percentage with the set value of the 1st Rated Voltage at Base Frequency (3004Hex-06Hex)/2nd Rated Voltage at Base Frequency (3009Hex-04Hex) as 100%. When 100% is set, this function is disabled regardless of the setting of Over-Excitation Control Selection during Deceleration Function Selection (3008Hex-4BHex).

Parameter No.	Function name	Data	Default data	Unit
3008Hex-48Hex	Over-Excitation Control Selection during Deceleration Function Selection	0: Disable 1: Enable	0	-
3004Hex-06Hex/ 3009Hex-04Hex	1st Rated Voltage at Base Frequency/2nd Rated Voltage at Base Frequency	80 to 240 V (200 V class series) 160 to 500 V (400 V class series)	200	V
3014Hex-5BHex	Magnetic Flux Level during Deceleration	100 to 300	120	%
Related function		Anti-regenerative Control Function Selection (3008Hex-46Hex)		

- Adjusting overexcitation control during deceleration
Set Over-Excitation Control Selection during Deceleration Function Selection (3008Hex-48Hex) to "1: Enable," and gradually keep increasing the set data of Magnetic Flux Level during Deceleration (3014Hex-5BHex) so as to approach the desired deceleration time. If, in spite of using this function, the operation cannot be performed at the target deceleration time, or if an overcurrent occurs, use the external braking resistors.

8-9-13 PID Function

PID control detects the status (control amount) of the object to be controlled by a sensor, etc., and compares it with the target value (such as the temperature command). If there is a deviation during this time, operation is performed to set the deviation to zero. It is a closed loop control method that matches the control amount (feedback value) with the target value.

It is possible to perform process controls such as the flow rate control, pressure control, temperature control, etc., and speed controls such as the dancer control.

If PID control is enabled (PID Control Function Selection (300EHex-02Hex) = 1 to 5), the frequency setting block switches to PID control block.

The PID function is disabled in the case of the torque control (refer to 7-6 *Torque control* on page 7-31) and the position control (refer to 7-7 *Position Control* on page 7-36).

Parameter No.	Function name	Data	Default data	Unit
301FHex-14Hex	PID Control Feedback Selection	0: Analog input 3: Pulse train input	0	-
301FHex-15Hex	PID Control PID Output Variable Range for Process Control	0.0: Disable 0.1 to 100.0	0.0	%
301FHex-16Hex	PID Control PID Feedforward Selection for Process Control	0: Disable 1: Input terminal [AI1]	0	-
3006Hex-3CHex	Input Terminal [AI1] Analog Input Adjustment Maximum Scale	-999.00 to 0.00 to 9,990.00	100	-
3006Hex-3DHex	Input Terminal [AI1] Analog Input Adjustment Minimum Scale	-999.00 to 0.00 to 9,990.00	0	-
300EHex-02Hex	PID Control Function Selection	0: Disable 1: Process normal operation 2: Process inverse operation 3: Dancer 4: Process normal operation, opposite operation available 5: Process inverse operation, opposite operation available	0	-
300EHex-03Hex	PID Control PID Command Selection	1: Analog input 3: UP/DOWN control 4: EtherCAT	0	-
300EHex-04Hex	PID Control P Proportional Gain	0.000 to 30.000	0.1	-
300EHex-05Hex	PID Control I Integral Time	0.0 to 3600.0	0	s
300EHex-06Hex	PID Control D Differential Time	0.00 to 600.00	0	s
300EHex-07Hex	PID Control Feedback Filter	0.0 to 900.0	0.5	s
300EHex-0BHex	PID Control Anti-reset Windup Width	0 to 200 Percentage of PID command	200	%

Parameter No.	Function name	Data	Default data	Unit
300EHex-0CHex	PID Control Select Warning Output Selection	0: Warning from absolute value 1: Warning from absolute value with hold 2: Warning from absolute value with latch 3: Warning from absolute value with hold and latch 4: Warning from PID error 5: Warning from PID error with hold 6: Warning from PID error with latch 7: Warning from PID error with hold and latch	0	-
300EHex-0DHex	PID Control Upper Limit of Warning (AH)	-100 to 100	100	%
300EHex-0EHex	PID Control Lower Limit of Warning (AL)	-100 to 100	0	%
300EHex-10Hex	PID Control Sleep Frequency for Process Control	0.0: Disable 1.0 to 590.0	0	Hz
300EHex-11Hex	PID Control Sleep Timer for Process Control	0 to 60	30	s
300EHex-12Hex	PID Control Restart Frequency after Stopping for Process Control	0.0 to 590.0	0	Hz
300EHex-13Hex	PID Control PID Output Upper Limit	-150 to 150 999: Depends on setting of 3004Hex-10Hex	32767	%
300EHex-14Hex	PID Control PID Output Lower Limit	-150 to 150 999: Depends on setting of 3004Hex-11Hex	32767	%
300EHex-18Hex	PID Control Restart Feedback Deviation after Stopping for Process Control	0.0 to 100.0	0	%
300EHex-19Hex	PID Control Restart Delay Time after Stopping for Process Control	0 to 3600	0	s
300EHex-3AHex	PID Control Operator PID Reference Position for Dancer	-100 to 100	0	%
300EHex-3BHex	PID Control PID Reference Position Detection Width for Dancer	0: Disable switching PID constant 1 to 100 (Manually set value)	0	%
300EHex-3CHex	PID Control P Gain 2	0.000 to 30.000	0.1	-
300EHex-3DHex	PID Control I Integral Time 2	0.0 to 3600.0	0	s
300EHex-3EHex	PID Control D Differential Time 2	0.00 to 600.00	0	s

Parameter No.	Function name	Data	Default data	Unit
300EHex-3FHex	PID Control Block Selection	Bit1: PID output ratio selection 0: Ratio to frequency command 1: Ratio to maximum frequency Bit0: PID output polarity selection 0: Plus (Addition) 1: Minus (Subtraction)	0	-
3024Hex-07Hex	PID Control Maximum Scale	-999.00 to 9990.00	100	-
3024Hex-08Hex	PID Control Minimum Scale	-999.00 to 9990.00	0	-
3024Hex-25Hex	PID Control Multistep PID Command 1	-999.00 to 9990.00	0	-
3024Hex-26Hex	PID Control Multistep PID Command 2	-999.00 to 9990.00	0	-
3024Hex-27Hex	PID Control Multistep PID Command 3	-999.00 to 9990.00	0	-
3052Hex-27Hex	Feedback Value Comparison Signal Off Level	0.0 to 100.0	100	%
3052Hex-28Hex	Feedback Value Comparison Signal On Level	0.0 to 100.0	0	%
3002Hex-0EHex	PID Control PID Command via Communication	-32768 to 32767 -20000 = -100%, 20000 = 100%	0	-
3002Hex-1FHex	PID Control Feedback Value via Communication	-32768 to 32767 -20000 = -100%, 20000 = 100%	0	-
3003Hex-4AHex	PID Output Monitor	-32768 to 32767 -20000 = -100%, 20000 = 100%	0	-
3023Hex-10Hex	PID Output Non Filter	-150.0 to 150.0	0	%
3010Hex-0CHex	PID Process Command	-999.00 to 9990.00	0	-
3010Hex-0DHex	PID Feedback Value Monitor	-999.00 to 9990.00	0	-

Parameter No.	Function name	Data	Default data	Unit
3010Hex-1EHex	Frequency and PID Command Source Monitor	0: Operator (UP and DOWN keys) 1 : Analog Voltage Input (Input Terminal[A11]) 7: UP/DOWN control 10: Pattern operation / Timer Operation 13: Pulse train input or Frequency calculation 22: EtherCAT 23: Support Tool 24: Multi-step Frequency 25: Jogging Frequency 30: PID Control Operator Process 31: PID Control Analog Process 33: PID Control UP/DOWN control 34: PID Control Communication Process 36: PID Control Multi-Step Terminal Process 255: Not Selected Others : Reserved	0	-
3010Hex-21Hex	PID Output Monitor	-150.00 to 150.00	0	%
3017Hex-20Hex	PID Control PID Deviation (After Scale Transformation)	-999.00 to 0.00 to 9990.00	0	-
3017Hex-21Hex	PID Control PID Deviation (No Scale Transformation)	-32768 to 32767 -20000 = -100%, 20000 = +100%	0	-
3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex	Input Terminal [DI1] to [DI7] Function Selection	20: PID (PID enabled/disabled) 21: IVS (Switch normal/inverse operation) 33: PID-RST (PID integral reset) 34: PID-HLD (Hold PID integral component) 171: PID-SS1 (PID control multistage command 1) 172: PID-SS2 (PID control multistage command 2)	-	-
3005Hex-15Hex/ 3005Hex-1CHex	Output Terminal [DO1] Function Selection/Output Terminal [ROA, ROB] Function Selection	42: OD (Excessive PID deviation) 43: PID-CTL (Under PID control) 44: PID-STP (Under sleep mode of PID control)*2 186: FBV (PID FB status output)	-	-

Parameter No.	Function name	Data	Default data	Unit
3005Hex-3EHex	Input Terminal [AI1] Function Selection	21: PID feed forward	-	-
Related function		Output Terminal [DO1] ON Delay Time (3051Hex-0AHex) Output Terminal [DO1] OFF Delay Time (3051Hex-0BHex) Output Terminal [ROA, ROB] ON Delay Time (3051Hex-0EHex) Output Terminal [ROA, ROB] OFF Delay Time (3051Hex-0FHex)		

*1. It can be referenced or set only from the communications function or Sysmac Studio.

*2. The OFF delay of the Under sleep mode of PID control (44: PID-STP) terminal becomes the time obtained by adding 0.1 s to Output Terminal[DO1] OFF Delay Time (3051Hex-0BHex) and Output Terminal [ROA, ROB] ON Delay Time (3051Hex-0FHex).

PID Control Function Selection

PID control is enabled by setting other than 0 to PID Control Function Selection (300EHex-02Hex).

- PID Control Function Selection (300EHex-02Hex) = "1: Process normal operation," "2: Process inverse operation"

If the PID process control is performed and PID calculation results are negative, the frequency reference to the inverter is limited at 0 Hz.

- PID Control Function Selection (300EHex-02Hex) = "4: Process normal operation, opposite operation available," "5: Process inverse operation, opposite operation available"

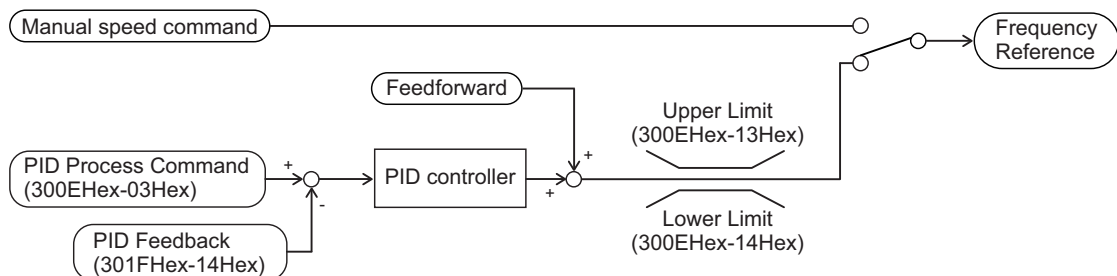
If the PID process control is performed and PID calculation results are negative, an opposite operation can be performed for the inverter. PID Control PID Output Variable Range for Process Control (301FHex-15Hex) is disabled.

- PID Control Function Selection (300EHex-02Hex) = "3: Dancer"

PID dancer control is performed. Opposite operation can be done for dancer control.

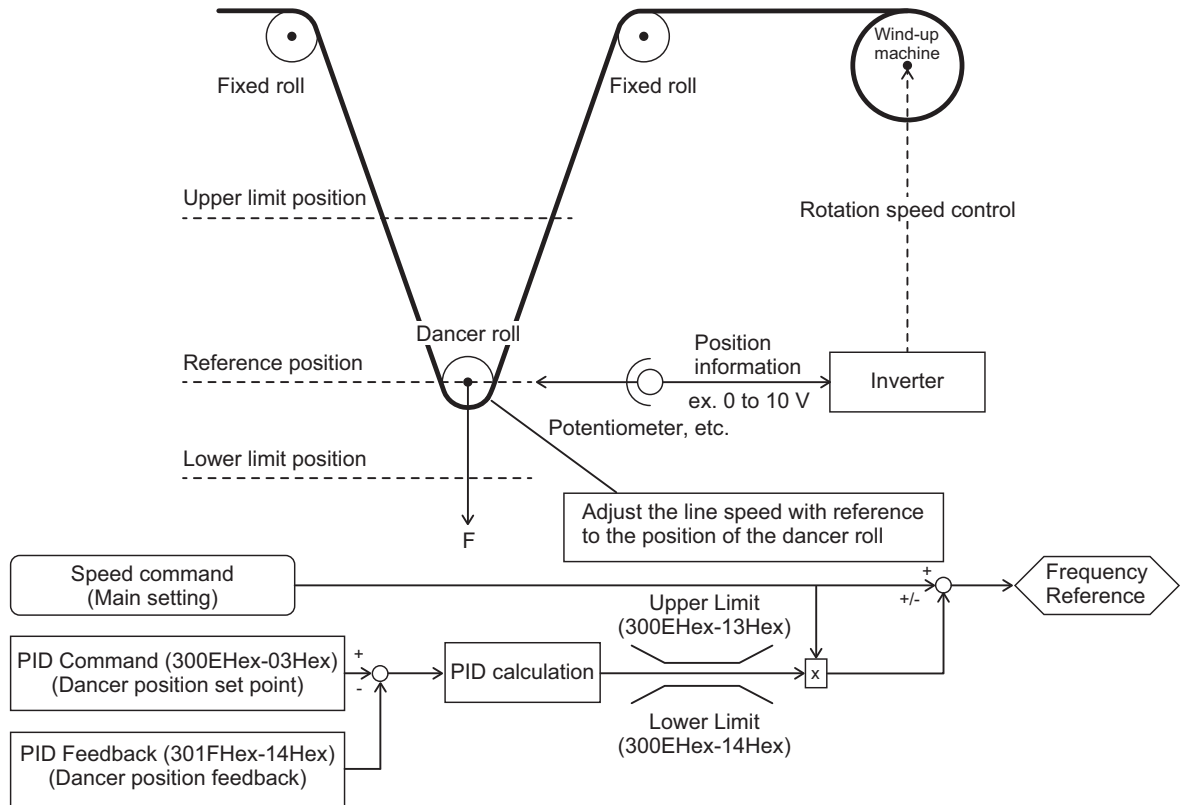
● Schematic block diagram of PID process control

When PID Control Function Selection (300EHex-02Hex) = "1," "2," "4," "5"



● Schematic block diagram of PID dancer control

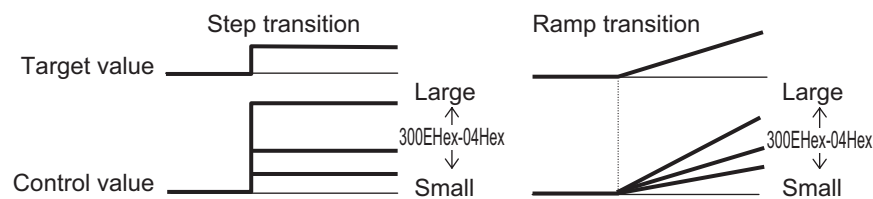
When PID Control Function Selection (300EHex-02Hex) = "3"



PID Operation

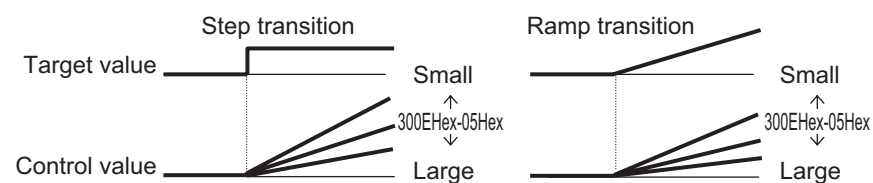
1. P operation (PID Control P Proportional Gain (300EHex-04Hex))

In this operation, the operation amount is proportional to the deviation (difference between the target value and the current value).



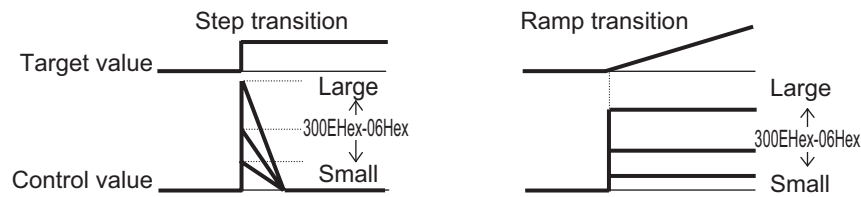
2. I operation (PID Control I Integral Time (300EHex-05Hex))

In this operation, the operation amount is proportional to the time integral value of the deviation. The P operation is less effective as the current value approaches the target value due to smaller deviation, taking a long time to reach the target value. The I operation compensates this disadvantage.



3. D operation (PID Control D Differential Time (300EHex-06Hex))

In this operation, the operation amount is proportional to the percentage of change in the deviation. Because using only the PI operation is time-consuming, the D operation is used to effectively compensate for the disadvantage in responsiveness.



PID Normal Operation/Reverse Operation

Since normal operation or reverse operation can be selected for the output of PID process control, the fluctuations in the motor rotation speed with respect to the deviation (difference between the command value and feedback value) can be set. Switching of normal operation and reverse operation by an external signal (21:IVS (Normal/Inverse switching)) is also possible.

PID command

This command is used to select the means for setting the command values of PID control.

300EHex-03Hex	Function
1	PID command 1 (Analog input: Terminal [AI1]) Setting based on the voltage value (0 to ± 10 VDC, PID 100% command/ ± 10 VDC) input to the terminal [AI1].
3	PID command by the UP/DOWN commands With the UP command "UP" and the DOWN command "DOWN," the PID control commands 0% to 100% can be set to a value obtained by conversion to a physical quantity by PID Control Minimum Scale (3024Hex-08Hex) and PID Control Maximum Scale (3024Hex-07Hex).
4	Command by communication Communication parameter (3002Hex-0EHex): Transmission data 2000d/100% PID command

- PID command 1 by analog input (300EHex-03Hex = 1)
The PID command value can be set arbitrarily by multiplying the gain with the voltage value input to the analog input (terminal [AI1]), and then adding the bias. Polarity selection, filtering and offset adjustment are also possible. In addition to the setting of 300EHex-03Hex, "3: PID command" must be selected for Input Terminal [AI1] Function Selection (3005Hex-3EHex).
- PID command by UP/DOWN control (300EHex-03Hex = 3)
If UP/DOWN control is selected as the PID control command, and either the UP terminal or DWN terminal is turned ON, the command value of PID control fluctuates in the range of maximum scale to minimum scale accordingly.

UP	DWN	Operation
OFF	OFF	The current command values of PID control are retained.
ON	OFF	The command values of PID control increase according to the change rate from 0.1%/0.1 s to 1%/0.1 s.

UP	DWN	Operation
OFF	ON	The command values of PID control decrease according to the change rate from 0.1%/0.1 s to 1%/0.1 s.
ON	ON	The current command values of PID control are retained.

In the inverter, the PID control values set by the UP/DOWN control are maintained internally, and when the operation is resumed (including when the power is turned ON), the control is started from the previous PID command value.

When analog input is applied to the PID command value, the following gains, biases, filters and offsets are applicable.

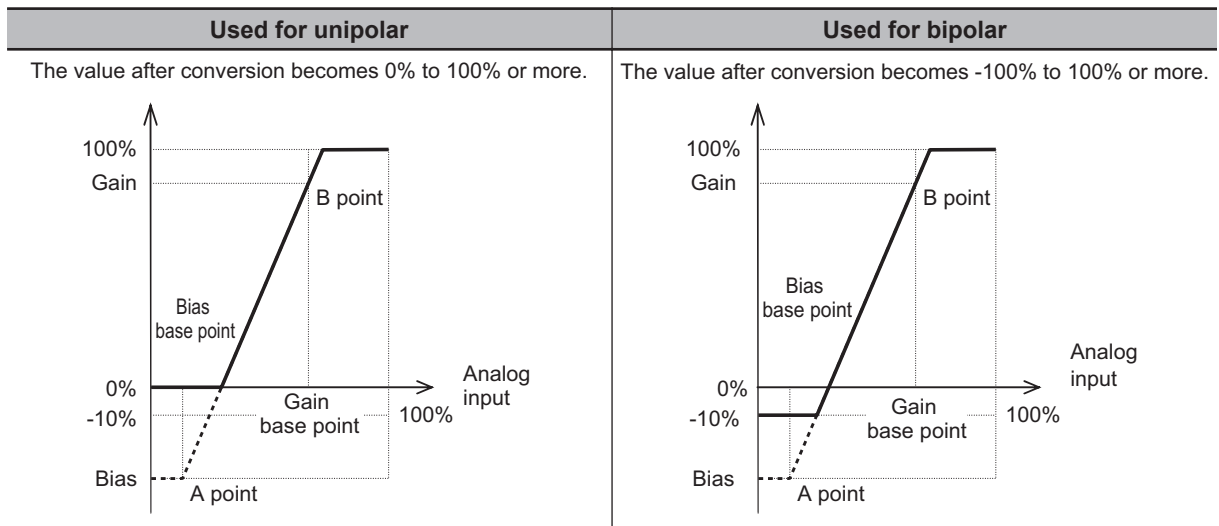
Input terminal	Input range	Bias		Gain		Polarity selection (Range selection)	Filter	Offset
		Bias	Base point	Gain	Base point			
AI1	0 to +10V, -10 to +10V	3006Hex- 38Hex	3006Hex- 39Hex	3006Hex- 21Hex	3006Hex- 23Hex	3006Hex- 24Hex	3006Hex- 22Hex	3006Hex- 20Hex

The following processing is performed during polarity selection 3006Hex-24Hex.

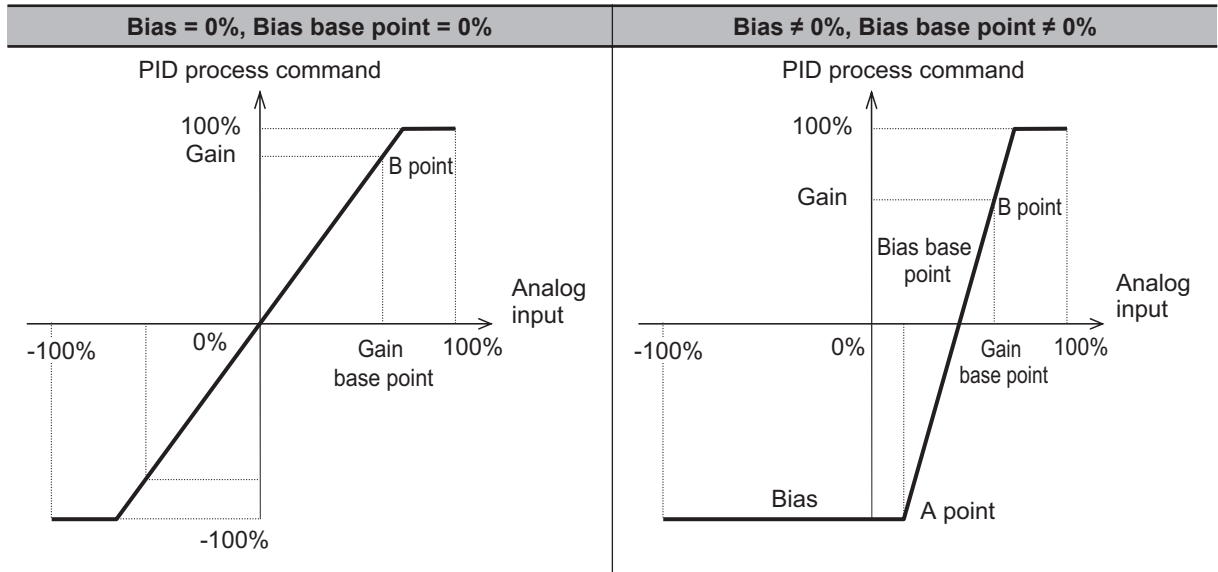
3006Hex-24Hex: Set the input range of the AI1 terminal.

3006Hex-24Hex	Terminal input specifications
0	-10 to +10V,
1	0 to +10V (A negative voltage is considered as 0V.)

An example of PID process control is shown below.



An example of dancer control is shown below.



- PID command by communication (300EHex-03Hex = 4)
Communication parameter (3002Hex-0EHex): Transmission data 20000d/100% PID command

PID Control Feedback Selection (301FHex-14Hex)

- 301FHex-14Hex = 0: Analog input
If “0: Analog input” is selected for PID Control Feedback Selection (301FHex-14Hex), allocate “5: PID feedback value” to Input Terminal [AI1] Function Selection (3005Hex-3EHex). The analog input value is internally controlled as 0% to 100%. For details on analog input, refer to 8-3-1 Analog Input (Function Selection) on page 8-32.

When analog input is applied to PID feedback, the following gains, biases, filters and offsets are applicable.

Input terminal	Input range	Bias		Gain		Polarity selection (Range selection)	Filter	Offset
		Bias	Base point	Gain	Base point			
AI1	0 to +10V, -10 to +10V	3006Hex-38Hex	3006Hex-39Hex	3006Hex-21Hex	3006Hex-23Hex	3006Hex-24Hex	3006Hex-22Hex	3006Hex-20Hex

- 301FHex-14Hex = 3: Pulse train input
If “3: Pulse train input” is set to PID Control Feedback Selection (301FHex-14Hex), the inverter captures a value converted into a percentage with the maximum frequency as 100% where the pulse correction factor (3024Hex-07Hex/3024Hex-08Hex) is multiplied with the frequency value [kP/s] of the captured pulse train input.

$$f^* [\text{Hz}] = N_p [\text{kp/S}] \times \frac{\text{Input Terminal [PIA][PIB] Pulse Scaling Factor Numerator (3014Hex-12Hex)}}{\text{Input Terminal [PIA][PIB] Pulse Scaling Factor Denominator (3014Hex-11Hex)}}$$

$$\text{PV} [\%] = f^* [\text{Hz}] \times \frac{100}{\text{Maximum output frequency} [\text{Hz}]}$$

PV [%]: PID feedback input

f^* [Hz]: Frequency set value

N_p [kp/s]: Entered input pulse frequency

PV [%]: PID feedback input

f^* [Hz]: Frequency set value

N_p [kp/s]: Entered input pulse frequency

Feedforward Selection

Feedforward is applied during PID process control. PID Control PID Feedforward Selection for Process Control (301FHex-16Hex) If 1: Analog input terminal is selected for PID Control PID Feedforward Selection for Process Control (301FHex-16Hex), allocate "21: PID feed forward" to Input Terminal [AI1] Function Selection (3005Hex-3EHex) as the setting for the terminal used in the feedforward signal. If not allocated, feedforward control is not performed.

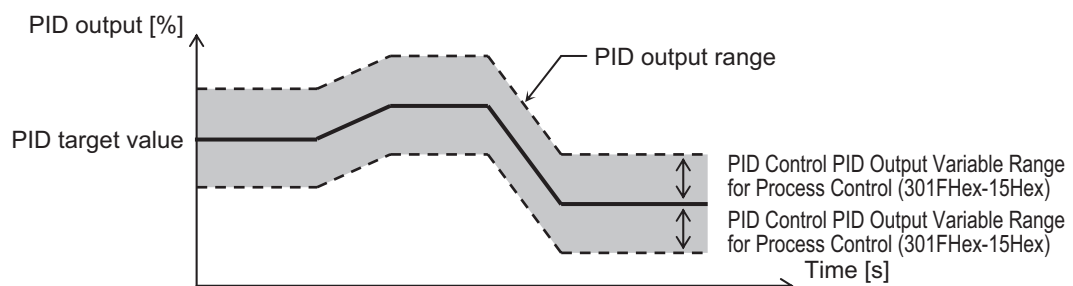
Feedforward is disabled during dancer control.

PID Variable Range

In the case of PID process control, the PID output is restricted to a variable range with reference to the target value.

When using this function, set PID Control PID Output Variable Range for Process Control (301FHex-15Hex). Then, the output frequency will be limited to within a range of Target value \pm (301FHex-15Hex) with the maximum frequency as 100%.

The function is disabled when PID Control PID Output Variable Range for Process Control (301FHex-15Hex) is 0.0. The function is also disabled when "4: Process normal operation, opposite operation available" or "5: Process inverse operation, opposite operation available" is set to PID Control Function Selection (300EHex-02Hex).



PID Reverse Output

If the PID calculation results are negative during regular PID control (300EHex-02Hex = 1, 2), the frequency reference to the inverter is limited at 0 Hz. If “4: Process normal operation, opposite operation available” or “5: Process inverse operation, opposite operation available” is set to PID Control Function Selection (300EHex-02Hex), an opposite operation can be performed for the inverter if the PID calculation results are negative.

If 4 or 5 is set to PID Control Function Selection (300EHex-02Hex), PID Control PID Output Variable Range for Process Control (301FHex-15Hex) is disabled.

PID Gain Adjustment

If the PID function does not provide a stable response, adjust each gain as described below depending on the state.

State	Adjustment method
Changes in target value are not reflected quickly on feedback value.	Increase PID P Gain 300EHex-04Hex
Changes are reflected quickly on feedback value, but not stable.	Decrease PID P Gain 300EHex-04Hex
Target and feedback values do not match quickly.	Decrease PID I Gain 300EHex-05Hex
Feedback value fluctuates unstably.	Increase PID I Gain 300EHex-05Hex
Increasing PID P Gain does not improve response speed.	Increase PID D Gain 300EHex-06Hex
Increasing PID P Gain results in fluctuating and unstable feedback value.	Decrease PID D Gain 300EHex-06Hex

Excessive PID deviation (OD)

An absolute value warning or a deviation warning can be output in PID control. As a warning output, allocate “42: OD (Excessive PID deviation)” to Output Terminal [DO1] Function Selection (3005Hex-15Hex) and Output Terminal [ROA, ROB] Function Selection (3005Hex-1CHex).

At PID Control Select Warning Output Selection (300EHex-0CHex), set the warning type, and at PID Control Upper Limit of Warning (AH) (300EHex-0DHex) and PID Control Lower Limit of Warning (AL) (300EHex-0EHex), set the upper limit value and lower limit value of the warning, respectively.

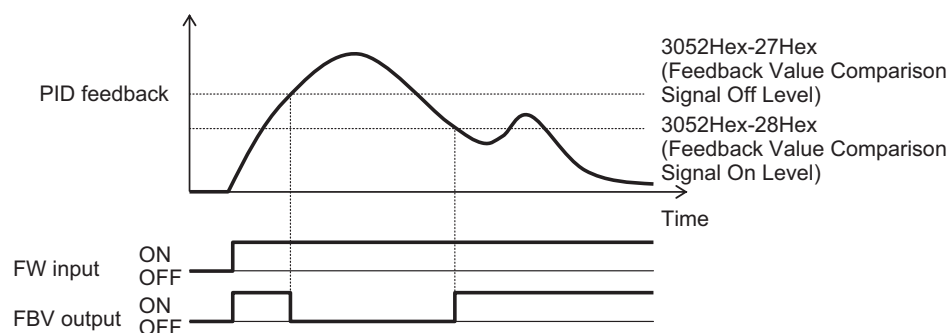
300EHex-0CHex	Type	Description
0	Warning caused by process command value	<p>“OD” is ON when $PV < AL$ or $AH < PV$</p> <p>PID feedback value (PV)</p> <p>PID Control PID Control</p> <p>Lower Limit of Warning (AL) Upper Limit of Warning (AH)</p> <p>(300EHex-0EHex) (300EHex-0DHex)</p>
1	Warning from absolute value with hold	Same as above (with hold)
2	Warning from absolute value with latch	Same as above (with latch)
3	Warning from absolute value with hold and latch	Same as above (with hold and latch)

300EHex-0CHex	Type	Description
4	Warning caused by PID error value	<p>"OD" is ON when $PV < SV - AL$, $SV + AH < PV$</p> <p>PID Control Lower Limit of Warning (AL) (300EHex-0EHex)</p> <p>PID Control Upper Limit of Warning (AH) (300EHex-0DHex)</p>
5	Warning from PID error with hold	Same as above (with hold)
6	Warning from PID error with latch	Same as above (with latch)
7	Warning from PID error with hold and latch	Same as above (with hold and latch)

- Hold function : When the power is turned ON, the warning output turns OFF even within the warning range. The warning output is enabled when it goes outside the warning range and then again enters the warning range.
- Touch probe function : Once the warning output turns ON after entering the warning range, the warning output does not turn OFF even if it goes outside the range. To release the touch probe, turn ON the RS allocated to the multifunction input terminal.
- The OD terminal has an OFF delay of 0.1 s. The final OFF delay time becomes the time obtained by adding 0.1 s to Output Terminal [DO1] OFF Delay Time (3051Hex-0BHex) and Output Terminal [ROA, ROB] OFF Delay Time (3051Hex-0FHex).

Feedback Comparison Signal

If PID feedback is outside the setting range, the signal is output to the multifunction output terminal. Allocate "186: FBV (PID FB status output)" to Output Terminal [DO1] Function Selection (3005Hex-15Hex) and Output Terminal [ROA, ROB] Function Selection (3005Hex-1CHex). Set Feedback Value Comparison Signal Off Level (3052Hex-27Hex)/Feedback Value Comparison Signal On Level (3052Hex-28Hex) in units of percentage with 1st Maximum Output Frequency (3004Hex-04Hex)/2nd Maximum Output Frequency (3009Hex-02Hex) as 100%.



PID Feedback Value Monitor (PID Feedback Value Monitor (3010Hex-0DHex))

The PID feedback value is converted to the control-target physical quantity (such as the temperature, pressure, etc.) using the data of PID Control Maximum Scale (3024Hex-07Hex) and PID Control Minimum Scale (3024Hex-08Hex).

Monitor value = (PID feedback value (%)/100) × (Maximum scale - Minimum scale) + Minimum scale

PID Integral Reset (PIDC)

Use this function to clear the integral value of PID operation.

Allocate “33: PIDC (PID integral reset)” to Output Terminal [DO1] Function Selection (3005Hex-15Hex) and Output Terminal [ROA, ROB] Function Selection (3005Hex-1CHex).

The values are cleared each time the PIDC terminal is turned ON.

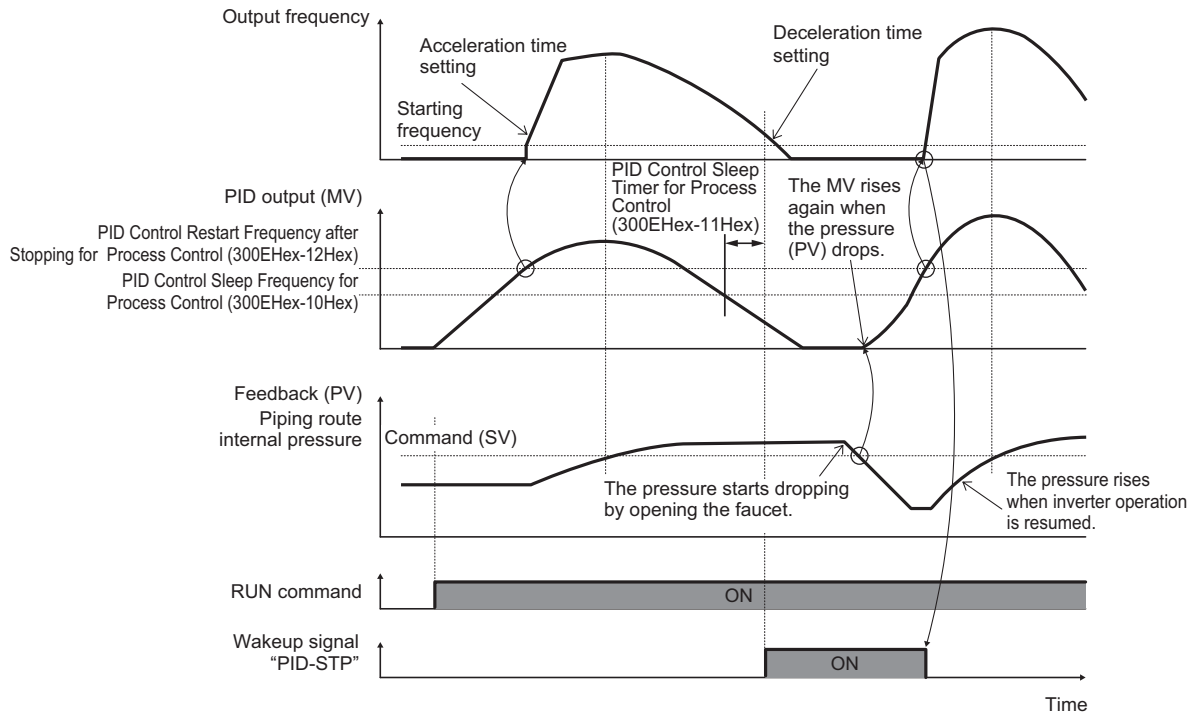
Never turn ON the PIDC terminal during the PID operation as overcurrent tripping may occur.

Be sure to deactivate the PID operation before turning ON the PIDC terminal.

PID Sleep Function

In parameters 300EHex-10Hex to 300EHex-12Hex, 300EHex-18Hex, 300EHex-19Hex, a sleep function for stopping the inverter when the discharge pressure rises and the discharge volume reduces during pump control is set. When the discharge pressure rises, the frequency set value of the output of PID controller drops, and the PID Control Sleep Timer for Process Control (300EHex-10Hex) elapses at the PID Control Sleep Frequency for Process Control (300EHex-11Hex) or below, the inverter decelerates and stops. However, PID control itself continues. When the discharge pressure falls, the frequency set value of the output of PID controller rises, and the PID Control Restart Frequency after Stopping for Process Control (300EHex-12Hex) is exceeded, the inverter resumes operation. The restart conditions can be adjusted by PID Control Restart Feedback Deviation after Stopping for Process Control (300EHex-18Hex) and PID Control Restart Delay Time after Stopping for Process Control (300EHex-19Hex) based on the time and pressure variation.

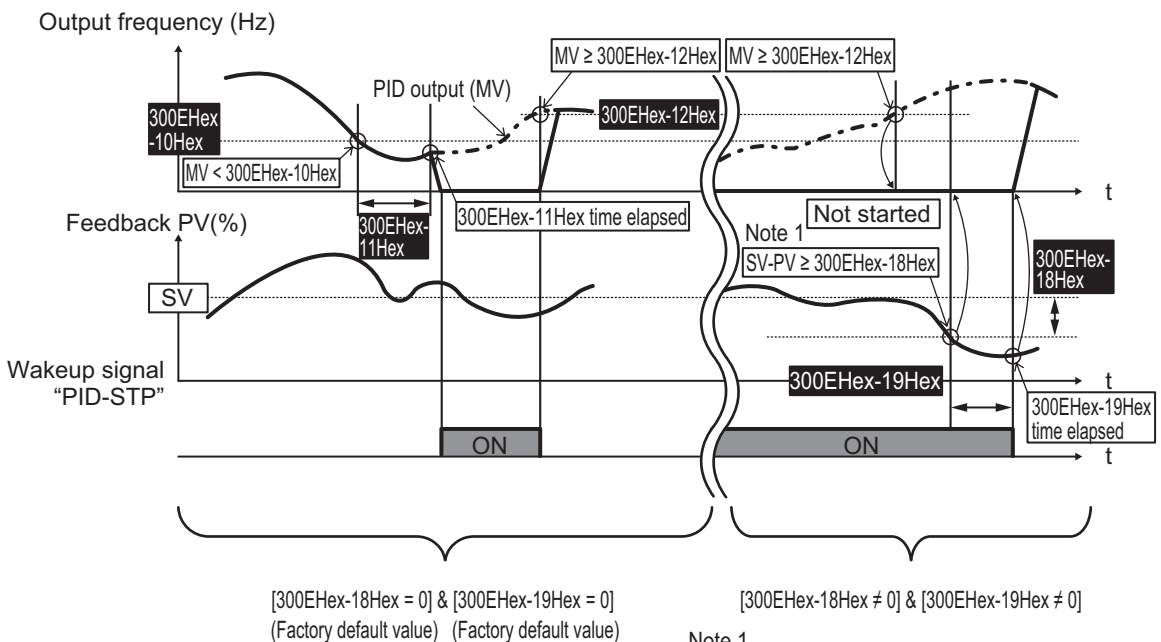
- PID Control Sleep Frequency for Process Control (300EHex-10Hex)
The sleep frequency is set.
- PID Control Sleep Timer for Process Control (300EHex-11Hex)
The time from when the PID output reaches or falls below the value set in PID Control Sleep Frequency for Process Control (300EHex-10Hex) until the inverter starts deceleration stop is set.
- PID Control Restart Frequency after Stopping for Process Control (300EHex-12Hex)
The wakeup frequency is set. Set the wakeup frequency larger than PID Control Sleep Frequency for Process Control (300EHex-10Hex). If the wakeup frequency is set smaller than the sleep frequency, the sleep frequency is ignored, and the sleep function operates when the PID output falls below the wakeup frequency set value.
- Allocating Under sleep mode of PID control “PID-STP” (Output Terminal [DO1] Function Selection (3005Hex-15Hex), Output Terminal [ROA, ROB] Function Selection (3005Hex-1CHex) = 44)
PID wakeup “PID-STP” outputs an ON signal when the inverter stops by the sleep function during PID control. If a signal output indicating that the inverter is in a stopped state is required, it is necessary to allocate “PID-STP.”



• PID Control Restart Delay Time after Stopping for Process Control (300EHex-19Hex)

The inverter restarts when both of the following conditions are satisfied.

1. The discharge pressure falls, the frequency reference value of the PID controller output rises, PID Control Restart Frequency after Stopping for Process Control (300EHex-12Hex) is exceeded, and PID Control Restart Delay Time after Stopping for Process Control (300EHex-19Hex) elapses.
2. The difference between SV (command value) and PV (feedback value) becomes more than PID Control Restart Feedback Deviation after Stopping for Process Control (300EHex-18Hex), and the PID Control Restart Delay Time after Stopping for Process Control (300EHex-19Hex) elapses.



[300EHex-18Hex = 0] & [300EHex-19Hex = 0]
(Factory default value) (Factory default value)

[300EHex-18Hex ≠ 0] & [300EHex-19Hex ≠ 0]

Note 1

Normal operation: $SV - PV \geq 300EHex-18Hex$
Reverse operation: $SV - PV \leq 300EHex-18Hex$

Multistep PID Command

- Multistep PID Command 1 to 3 (3024Hex-25Hex, 3024Hex-26Hex, 3024Hex-27Hex)

The PID command value can be applied by the multi-step command of digital input. To use this function, allocate “171: PID-SS1” and “172: PID-SS2” to Input Terminal [DI1] to [DI7] Function Selection (3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex).

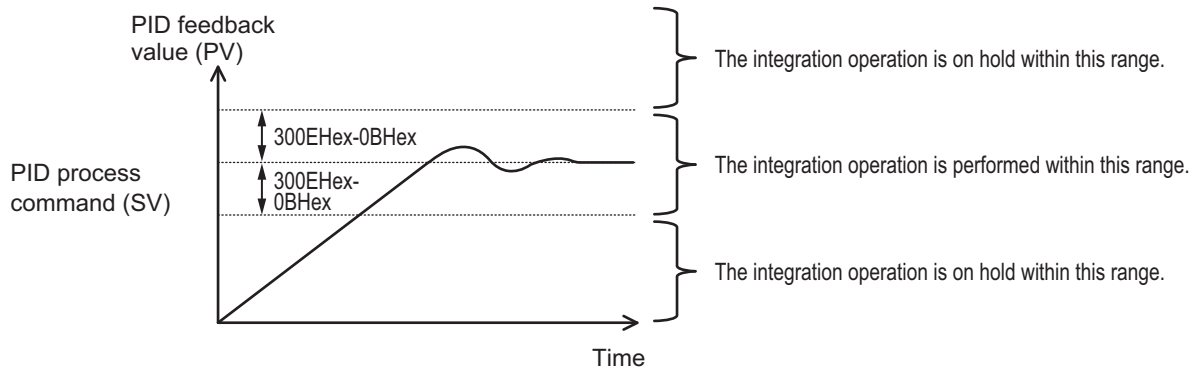
PID-SS2	PID-SS1	PID Multi-step Command
OFF	OFF	Not selected
OFF	ON	3024Hex-25Hex: PID Control Multistep PID Command 1 Change range: -999.0 to 0.00 to 9990
ON	OFF	3024Hex-26Hex: PID Control Multistep PID Command 2 Change range: -999.0 to 0.00 to 9990
ON	ON	3024Hex-27Hex: PID Control Multistep PID Command 3 Change range: -999.0 to 0.00 to 9990

Anti-reset Windup

- PID Control Anti-reset Windup Width (300EHex-0BHex)

Restrains overshooting during control by a PID controller. If the difference between the command and the feedback value is outside the range of the set value, the integrator holds the value and the integration operation is not performed.

Data setting range: 0 to 200 (%)



PID Output Limiter

It is possible to set a limiter for the upper limit and lower limit in the PID output exclusively for PID control. The limiter is disabled when PID cancellation “Hz/PID” is entered and operation is performed at the normal frequency setting.

- PID Control PID Output Upper Limit (300EHex-13Hex)

The upper limit value for the limiter of PID controller output is set in percentage. If the set value is specified as 999, the settings of 1st Frequency Upper Limit (3004Hex-10Hex) are followed.

- PID Control PID Output Lower Limit (300EHex-14Hex)

The lower limit value for the limiter of PID controller output is set in percentage. If the set value is specified as 999, the settings of 1st Frequency Lower Limit (3004Hex-11Hex) are followed.

Setting Dancer Control

- PID Control PID Command via Communication (3002Hex-0EHex)
When “4: EtherCAT communication” is selected, the reference position during dancer control is set in the range of -100% to 100% to PID Control PID Command via Communication (3002Hex-0EHex).
- PID Control (Dancer control gain switching) (300EHex-3BHex to 300EHex-3EHex)
When the position of the dancer roll (feedback) enters the “Dancer position set point \pm PID Control PID Reference Position Detection Width for Dancer (300EHex-3BHex),” the PID constant of the PID controller is switched from 300EHex-04Hex, 300EHex-05Hex and 300EHex-06Hex to 300EHex-3CHex, 300EHex-3DHex and 300EHex-3EHex. It is possible to increase the gain and thus improve the responsiveness, and increase the accuracy.

PID Control PID Reference Position Detection Width for Dancer (300EHex-3BHex)

Set in the range of 1% to 100%. If set to 0, switching of the PID constant is not performed.

PID Control P Gain 2 (300EHex-3CHex)

PID Control I Integral Time 2 (300EHex-3DHex)

PID Control D Differential Time 2 (300EHex-3EHex)

Same as PID Control P Proportional Gain (300EHex-04Hex), PID Control I Integral Time (300EHex-05Hex) and PID Control D Differential Time (300EHex-06Hex).

- PID Control Block Selection (300EHex-3FHex)
It is possible to select whether to add or subtract the output of the PID controller of dancer control to or from the main settings. It is also possible to select whether to perform control of the main settings by the output of the PID controller based on the ratio, or to perform correction based on the absolute value (Hz).

300EHex-3FHex data			Block selection	
Decimal	bit 1	bit 2	Control amount	Operation on the main settings
0	0	0	Ratio control	Addition
1	0	1	Ratio control	Subtraction
2	1	0	Absolute value control	Addition
3	1	1	Absolute value control	Subtraction

Terminal Input Function

- PID control cancellation “PID” (20: PID enabled/disabled)
When “PID enabled/disabled (20: PID)” is ON, switching occurs from PID control to manual frequency setting.

Input signal “PID”	Function selected
OFF	PID control enabled
ON	PID control disabled (manual frequency setting)

“PID (20: PID enabled/disabled)” OFF -> ON operation

If, during PID operation, the PID terminal is switched from OFF to ON and set to the PID canceled state, and Frequency Reference Selection (3004Hex-02Hex/3006Hex-1FHex) is set to “7: UP/

DOWN control,” the output frequency is inherited (balanceless-bumpless). If PID control is set to “Opposite operation available” (PID Control Function Selection (300EHex-02Hex) = 4, 5), and PID output is in opposite operation, the output frequency of PID control is not inherited and becomes 0 Hz.

“PID (20: PID enabled/disabled)” ON -> OFF operation

When PID operation is restored by switching the PID terminal from ON to OFF during normal operation, and PID process control (300EHex-02Hex = 1, 2, 4, 5) is enabled, the output frequency during switching is inherited in the PID output (MV) (balanceless-bumpless), and shifted to PID control.

When inverse operation is being performed due to a negative setting of the frequency reference during PID cancellation, and the PID control is set to “Opposite operation not available”

(300EHex-02Hex = 1, 2), the absolute value of the output frequency is inherited in the PID output (MV), and switching occurs from reverse output to normal output.

- Normal/inverse operation switching “IVS”

In modes in which process control is performed by the PID control function built into the inverter, PID control enable (operation based on PID controller) and PID control disable (operation based on the manual frequency setting) can be switched by the “PID (20: PID enabled/disabled)” terminal. Input Terminal [AI1] Normal/Inverse Operation for 1st Frequency Command and PID Control Function Selection (300EHex-02Hex) can be combined with the Switch normal/inverse operation “IVS” signal on each operation, and determination of normal/inverse operation is performed as follows.

When PID control is enabled: Normal/reverse operation of PID controller output (frequency setting)

PID Control Function Selection (300EHex-02Hex)	Input signal IVS	Operation
1: Process normal operation	OFF	Normal operation
4: Process normal operation, opposite operation available	ON	Reverse operation
2: Process (inverse operation)	OFF	Reverse operation
5: Process inverse operation, opposite operation available	ON	Normal operation

When PID control is disabled: Normal/reverse operation of manual frequency setting

Input Terminal [AI1, AI2] Normal/Inverse Operation for 1st Frequency Command (3006Hex-36Hex)	Input signal IVS	Operation
0: Normal	-	Normal operation
1: Inverse	-	Reverse operation



Additional Information

When process control is performed by the PID control function built into the inverter, the Normal/Inverse switching “IVS” signal is used for switching normal/reverse operation of the output (frequency setting) of the PID controller, and is not used for normal/reverse operation switching in the manual frequency setting.

- PID differential/integral reset “PID-RST”

When "PID-RST" is turned ON, the derivative terms and integration terms of the PID controller are reset.

- Hold PID integral component "PID-HLD"
When "PID-HLD" is turned ON, the integration terms of the PID controller are held.

Terminal Output Function

- Under PID control "PID-CTL"
When PID control is enabled and the RUN command is ON, the ON signal is output.
- During PID control, although control is in progress, the inverter may stop as a result of the sleep function. Even in such a case, the "PID-CTL" signal remains ON.



Additional Information

During PID control, although control is in progress, the inverter may stop as a result of the sleep function. Even in such a case, the "PID-CTL" signal remains ON.

8-9-14 Automatic Energy-saving Operation Function

This function automatically adjusts the inverter output power during constant speed operation to the minimum level. It is suitable for load with reduced torque characteristics, such as fans and pumps. To perform energy-saving operation using this function, set Energy-saving Operation Function Selection (301FHex-19Hex) to "1: Energy-saving operation."

When the automatic energy-saving operation is enabled, it is possible to select Enable during running at constant speed, and Enable during running at constant speed and acceleration/deceleration with Auto Energy Saving Operation Condition Selection (3008Hex-44Hex).

Because this function controls the output power to the minimum necessary level, the motor may stall if the rapid load fluctuation, such as impact load, occurs, which may result in an overcurrent trip.

Parameter No.	Function name	Data	Default data	Unit
301FHex-19Hex	Energy-saving Operation Function Selection	0: Normal operation 1: Energy-saving operation	0	-
3008Hex-44Hex	Auto Energy Saving Operation Condition Selection	0: Enable only at constant speed 1: Enable in all modes	0	-

8-9-15 Commercial switch (CS)

Commercial operation and inverter operation are switched by the "CS" terminal (15: Commercial switch).

When switching between commercial operation/inverter operation is performed in an external sequence, input the CS allocated to multifunction input in accordance with the operation chart below. Then, the inverter can be started from the commercial power supply frequency regardless of the set frequency of the inverter, and the motor during the commercial operation can be smoothly switched to inverter operation.

This function is enabled when Drive Control Selection (3004Hex-2BHex/3009Hex-0FHex) = “0, 1, 3, 4.”

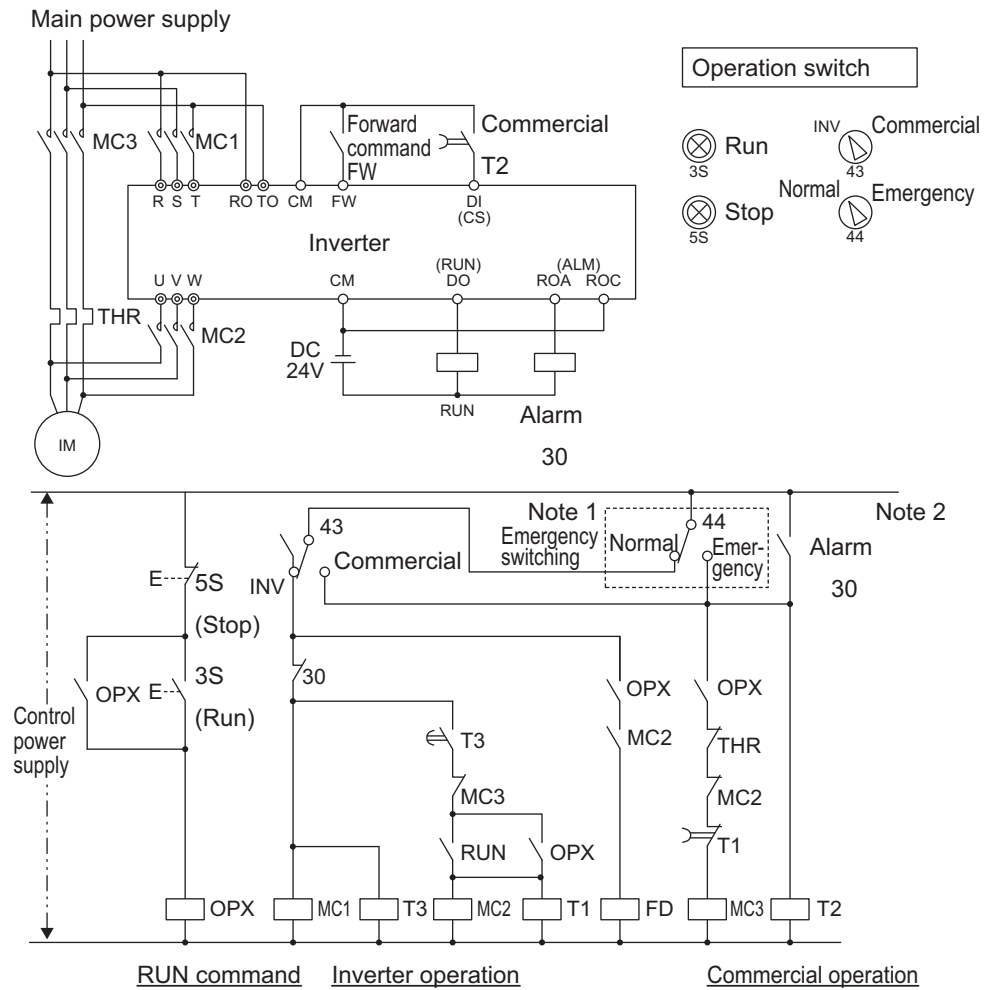
When the power supply frequency is 50 Hz, use “15: CS” and when the power supply frequency is 60 Hz, use “16: SW60.”

Parameter No.	Function name	Data	Default data	Unit
3004Hex-2BHex/ 3009Hex-0FHex	1st Drive Control Selection/2nd Drive Control Selection	0: IM V/f control 1: IM Dynamic torque vector control 3: IM V/f control with speed sensor 4: IM Dynamic torque vector control with speed sensor	0	-
3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex	Input Terminal [DI1] to [DI7] Function Selection	15: CS (Commercial switch) 16: SW60 (Commercial switch (60Hz))	-	-
3008Hex-0EHex	Power Interruption Restart Wait Time	0.1 to 100.0	0.5	s

Switching between Inverter Operation and Commercial Power Supply Operation

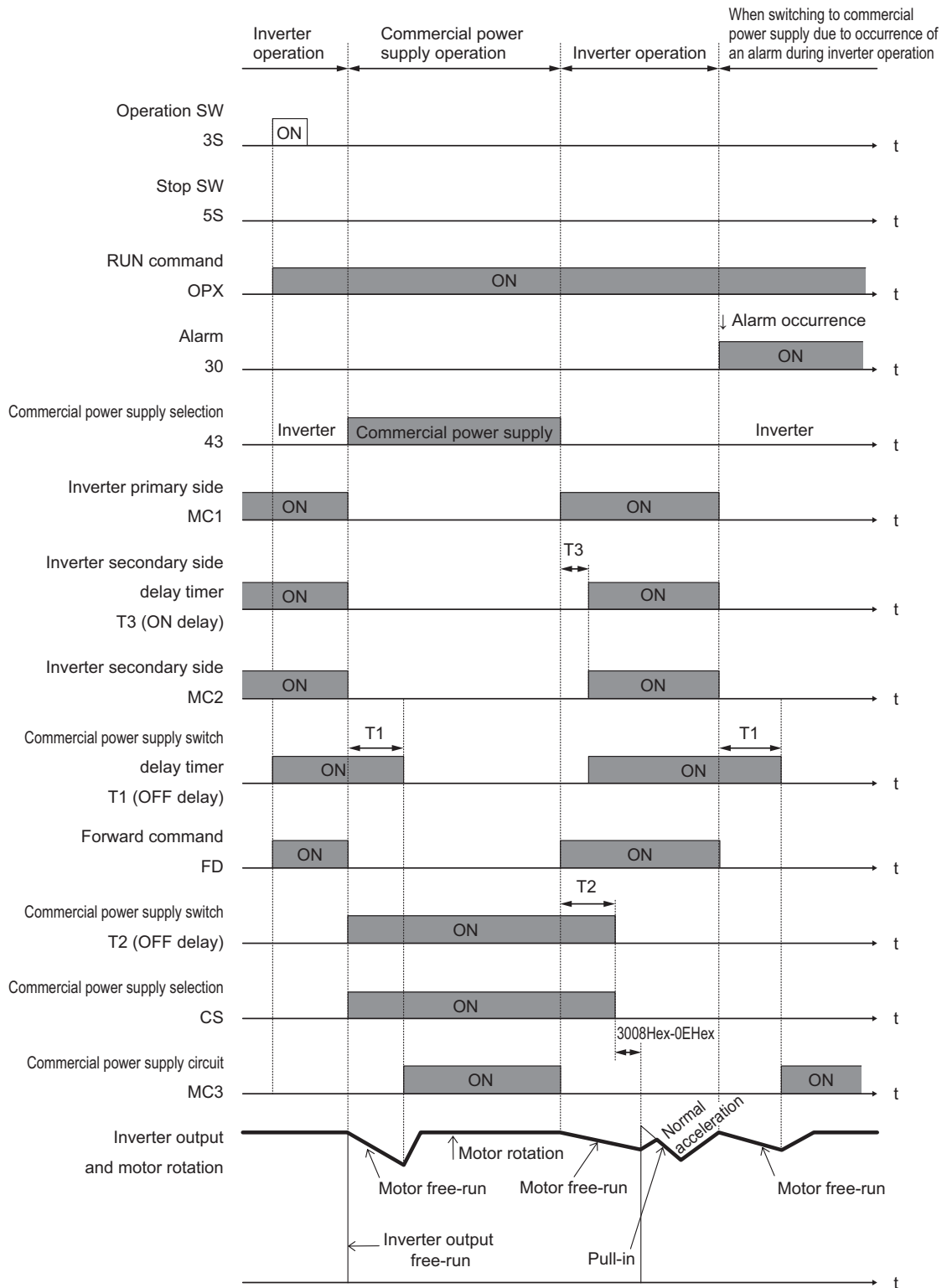
- Follow the sequence diagram given below to switch among the terminals MC1 to MC3, FW and CS, and switch from inverter operation to commercial power supply operation. When the CS terminal turns ON, the inverter shuts off its output and the motor falls in a free-run state.
- When the commercial switching signal “CS” or “SW60” is turned OFF, the operation switches to inverter operation from commercial power supply operation, and following the elapse of the Power Interruption Restart Wait Time (3008Hex-0EHex), the 50 Hz output starts when the signal during commercial 50 Hz selection turns OFF, and the 60 Hz output starts when the signal during commercial 60 Hz selection turns OFF. (Start of pull-in operation)
- If the output frequency is deviating from the motor rotation speed, perform adjustment of the output frequency during the pull-in operation based on the fall rate of restart after momentary power failure (3008Hex-0FHex).

● Connection diagram for commercial switching operation



- Note 1.** Emergency switching
Manual switching performed when the sequence for switching to commercial power supply is not performed normally due to a major breakdown of the inverter.
- Note 2.** When an alarm is issued in the inverter, switching to commercial power supply occurs automatically.

● Timing diagram for commercial switching



Input during Commercial Operation (CRUN-M1, CRUN-M2)

If operation is not performed by the inverter during the commercial switching operation, it is possible to integrate 1st Cumulative Motor Run Time (3008Hex-5FHex)/2nd Cumulative Motor Run Time (3009Hex-34Hex) by incorporating the auxiliary contact points of the electromagnetic contactor for commercial switching to CRUN-M1 and CRUN-M2 allocated to multifunction input as a digital signal.

Parameter No.	Function name	Data	Default data	Unit
3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex	Input Terminal [DI1] to [DI7] Function Selection	72: CRUN-M1 (Count the run time of commercial power-driven motor 1) 73: CRUN-M2 (Count the run time of commercial power-driven motor 2)	-	-

8-9-16 Output current fluctuation damping

When the motor is driven, the output current of the inverter may fluctuate (current fluctuation) due to the motor characteristics or the backlash at the load machine side. This parameter increases the 1st Output Current Fluctuation Damping Gain (3008Hex-51Hex) and 2nd Output Current Fluctuation Damping Gain (3009Hex-2AHex) when the control function for suppressing such current fluctuation is to be adjusted.

Parameter No.	Function name	Data	Default data	Unit
3008Hex-51Hex/ 3009Hex-2AHex	1st Output Current Fluctuation Damping Gain/2nd Output Current Fluctuation Damping Gain	0.00 to 1.00	0.20	-

- If inappropriate adjustments are made, the current fluctuation may increase. Therefore, do not change the factory default set values, unless required.

8-9-17 Pulse Train Frequency Input

Pulse train input can be used for the frequency reference, operation target used for frequency reference and PID feedback value in PID control.

- To use pulse train input for the frequency reference, set Frequency Reference Selection (3004Hex-02Hex/3006Hex-1FHex) to “12: Pulse train input.”
- To use pulse train input for the operation target, set Frequency Reference Selection (3004Hex-02Hex/3006Hex-1FHex) to “13: Calculation result” and set Frequency Calculation Operation Target 1/2 (301FHex-20Hex/301FHex-21Hex) to “5: Pulse train frequency.”
- To use pulse train input for PID feedback, set PID Control Feedback Selection (301FHex-14Hex) to “3: Pulse train input.”
- Pulse train input uses input terminals [PIA], [PIB] and [PIZ].

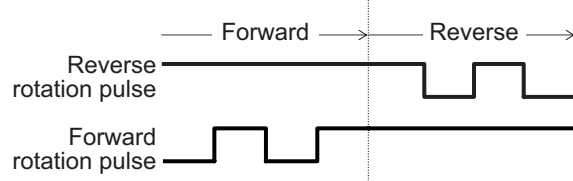
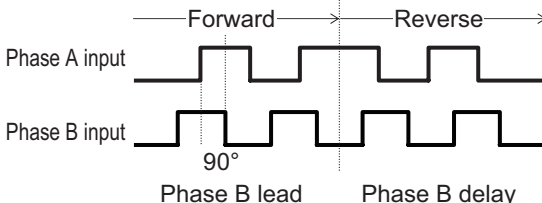
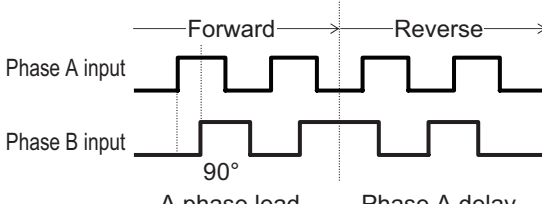
Parameter No.	Function name	Data	Default data	Unit
3004Hex-02Hex/ 3006Hex-1FHex	1st Frequency Reference Selection/2nd Frequency Reference Selection	12: Pulse train input 13: Calculation result	0/2	-
301FHex-14Hex	PID Control Feedback Selection	3: Pulse train input	0	-

Parameter No.	Function name	Data	Default data	Unit
3014Hex-0FHex	Input Terminal [PIA][PIB] Pulse Input Format Selection	0: Pulse train signing/pulse train input 1: Forward/reverse rotation pulse 2: Quadrature A/B signal (B phase lead) 3: Quadrature A/B signal (A phase lead)	2	-
3014Hex-10Hex	Input Terminal [PIA][PIB] Encoder Pulse Resolution	20 to 60000	1024	pulse
3014Hex-11Hex	Input Terminal [PIA][PIB] Pulse Scaling Factor Denominator	1 to 32767	1	-
3014Hex-12Hex	Input Terminal [PIA][PIB] Pulse Scaling Factor Numerator	1 to 32767	1	-
3014Hex-13Hex	Input Terminal [PIA][PIB] Pulse Train Filter Time Constant	0.000 to 5.000	0.005	s
3010Hex-38Hex	Pulse Input (A/B Phase [PIA] [PIB])	-327.68 to 327.67	-	kp/s
3010Hex-39Hex	Pulse Input (Z Phase [PIZ])	0 to 16000	-	p/s
3017Hex-28Hex	Pulse Train Frequency Monitor	-163.84 to 163.83	-	%
Related function		Frequency Calculation Operation Target 1 (301FHex-20Hex) Frequency Calculation Operation Target 2 (301FHex-21Hex) Frequency Addition Sign Selection (301FHex-24Hex)		

• Pulse train input method (3014Hex-0FHex)

By entering a pulse train in the input terminals [PIA] and [PIB] of the inverter control circuit, it is possible to make a frequency setting proportional to the frequency of the pulse. The pulse train input method is specified by the Input Terminal [PIA][PIB] Pulse Input Format Selection (3014Hex-0FHex). Input can be made in four types, namely the Pulse train signing/pulse train input, Forward and reverse pulse, and Quadrature A/B signal (A phase lead, B phase lead).

3014Hex-0FHex data	Target terminal	Pulse input method	Remarks
0	Input Terminal [PIA]	Pulse train signing	A speed command corresponding to the frequency of pulse train input is applied. Moreover, the polarity of the speed command can be set by the pulse train signing.
	Input Terminal [PIB]	Pulse train input	

3014Hex-0FHex data	Target terminal	Pulse input method	Remarks
1	Input Terminal [PIA]	Forward rotation pulse	A speed command corresponding to the frequency of pulse train input is applied. If the input pulse is a forward rotation pulse, it results in straight polarity, and if the input pulse is a reverse rotation pulse, it results in reverse polarity. 
	Input Terminal [PIB]	Reverse rotation pulse	
2	Input Terminal [PIA]	Quadrature A/B signal (B phase lead)	A speed command with polarity is applied based on the phase difference and frequency, by two types of pulse signals having a 90° phase difference (B phase lead). 
	Input Terminal [PIB]		
3	Input Terminal [PIA]	Quadrature A/B signal (A phase lead)	The polarity is reversed (A phase lead becomes forward rotation) when Input Terminal [PIA][PIB] Pulse Input Format Selection (3014Hex-0FHex) = 2. If the A phase and B phase are wired in the reverse order, the polarity can be corrected by setting Input Terminal [PIA][PIB] Pulse Input Format Selection (3014Hex-0FHex) = 3. 
	Input Terminal [PIB]		

- Input Terminal [PIA][PIB] Encoder Pulse Resolution (3014Hex-10Hex)
Set the number of encoder pulses of pulse train input.
- Pulse scaling factor 1 (3014Hex-11Hex), Pulse scaling factor 2 (3014Hex-12Hex)
Convert the pulse train input (kps) into the set frequency by Pulse Scaling Factor 1/Pulse Scaling Factor 2 (3014Hex-11Hex/3014Hex-12Hex).

$$f^* [\text{Hz}] = N_p [\text{kp/s}] \times \frac{\text{Input Terminal [PIA][PIB] Pulse Scaling Factor Numerator (3014Hex-12Hex)}}{\text{Input Terminal [PIA][PIB] Pulse Scaling Factor Denominator (3014Hex-11Hex)}}$$

$f^* [\text{Hz}]$: Frequency set value

$N_p [\text{kp/s}]$: Entered input pulse frequency

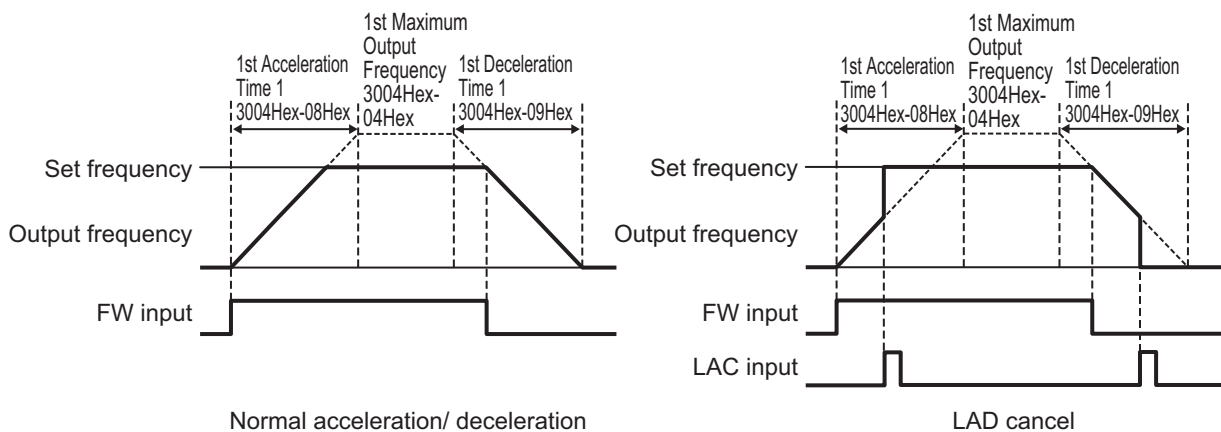
- Filter time constant (3014Hex-13Hex)
Set the filter time constant with respect to the pulse train input.
- PID feedback based on pulse train input (301FHex-14Hex = 3)
Perform the same processing as the frequency setting process for the pulse train, and convert to the feedback value with the maximum frequency with respect to the frequency reference value of the result as 100%. When one of the following conditions is satisfied at the same time, pulse train input is used for both the set frequency and PID feedback.
 - Set “12: Pulse train input” to Frequency Reference Selection (3004Hex-02Hex/3006Hex-1FHex).
 - Set “13: Calculation result” to Frequency Reference Selection (3004Hex-02Hex/3006Hex-1FHex), and set “5: Pulse train frequency” to Frequency Calculation Operation Target 1/Frequency Calculation Operation Target 2 (301FHex-20Hex/301FHex-21Hex).
- Operation frequency input setting based on pulse train input (301FHex-20Hex/301FHex-21Hex = 5)
Perform the same processing as the frequency setting process for the pulse train, and set the frequency reference value of the result as the selection value of the operation frequency.

8-9-18 LAD Cancel Function

“LAD” is the function for calculating the acceleration/deceleration time. The LAD cancel function forcibly sets the acceleration/deceleration time to 0. When the LAC terminal is turned ON, the frequency acceleration/deceleration function (LAD) is disabled and the frequency reference is output momentarily.

This function is also applicable to the acceleration/deceleration during the jogging operation and the deceleration during forced stop.

Parameter No.	Function name	Data	Default data	Unit
3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex	Input Terminal [DI1] to [DI7] Function Selection	84: LAC (Acceleration and deceleration time cancel)	-	-
Related function		3004Hex-08Hex, 3004Hex-09Hex, 3005Hex-0BHex to 3005Hex-10Hex		



8-9-19 Servo Lock Function

The servo lock function is used to control the position of the motor, and continue to retain the position even when an external force is applied.

It is enabled only during vector control with speed sensor. The servo lock function is enabled by turning the LOCK terminal ON.

If operation is stopped even with position control disabled (SPD terminal ON) when the servo lock is enabled, a deceleration is performed to the stop frequency, then position control is performed with the position where the output frequency becomes 0 taken as the target stop position, and then servo lock is performed.

The servo lock operates at a low speed, and therefore, if it is used by applying an external force over a long period of time, overheat protection may be activated.

Servo lock is started when all of the following conditions are satisfied.

- RUN command is OFF, or set frequency < stop frequency (3004Hex-1AHex)
- LOCK terminal ON
- ["0: Output frequency, Detected speed" is set for 1st Stop Frequency Detection Method Selection (F3004Hex-27Hex) and speed detection value is Stop Frequency (F3004Hex-1AHex) or less] or ["1: Frequency reference" is selected for 1st Stop Frequency Detection Method Selection (3004Hex-27Hex) and frequency reference value is Stop Frequency (3004Hex-1AHex) or less]

Set the gain for the position control of the servo lock by Servo Lock Gain (J97). The behavior of stopping the inverter during a servo lock, and the axial holding force can be adjusted.

When setting smaller value to J97, the response is delayed, but the behavior becomes smoother and the axial holding force is reduced. When setting larger value, the response becomes faster, but hunting increases and the axial holding force also increases.

Parameter No.	Function name	Data	Default data	Unit
3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex	Input Terminal [DI1] to [DI7] Function Selection	47: LOCK (Servo lock com- mand)	-	-
300EHex-62Hex	Servo Lock Gain	0.000 to 9.999	0.010	Time
300EHex-63Hex	Servo Lock Completion Timer	0.000 to 1.000	0.1	s
300EHex-64Hex	Servo Lock Completion Range	0 to 9999	10	Pulse

- When the servo lock command is ON, the voltage is output to the output terminals [U], [V] and [W] of the inverter even if the RUN command has not been turned ON.
- During a servo lock, if the position error becomes four rotations or more by motor shaft conversion, the position control error (alarm code: 38) is output.
- With the servo lock function, as control is started from the 1st Stop Frequency (3004Hex-1AHex) or less, adjust 1st Stop Frequency (3004Hex-1AHex) and Gain (300EHex-62Hex) to satisfy the following formula:

$$1st\ Stop\ Frequency\ (3004Hex-1AHex) < (4 \times Gain\ (300EHex-62Hex) \times Maximum\ output\ frequency)$$
- If servo lock control is enabled, the stop frequency continuation operation and rotational direction limitation are disabled.

8-9-20 Droop Control

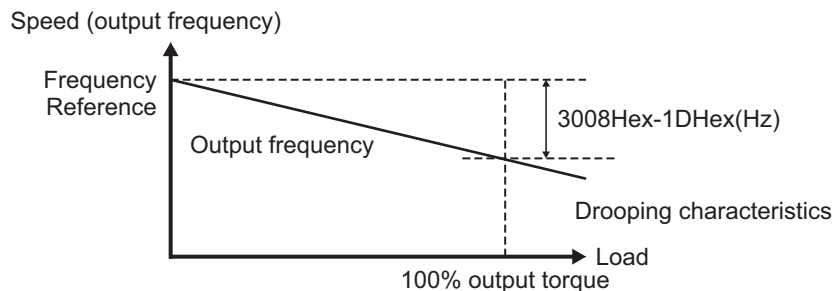
If a single mechanical system is driven by multiple motors, and there is a speed difference in each of the motors, a load unbalance occurs. Droop control is a function for ensuring load balance by providing drooping characteristics to the motor speed in response to an increase in load.

When the output torque is 100%, the output frequency is subtracted by the frequency set at Droop Control (3008Hex-1DHex), and when the output torque is 0%, the output frequency is subtracted as a percentage that is output according to the frequency reference in accordance with the torque actually being output by the inverter (Output Torque Monitor (3010Hex-08Hex)).

The set value of Droop Control (3008Hex-1DHex) is around the rated slip frequency of the applicable motor.

To enable droop control, turn the DROOP terminal ON.

Parameter No.	Function name	Data	Default data	Unit
3008Hex-1DHex	Droop Control	-60.0 to 0.0	0.0	Hz
3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex	Input Terminal [DI1] to [DI7] Function Selection	76: DROOP (Select droop control)	-	-



- When using droop control, be sure to perform auto-tuning.
- During droop control for V/f control, the acceleration/deceleration time is enabled for the resultant frequency of droop control so that tripping does not occur even when there is a sudden change in load. As a result, the reflection of the frequency corrected during droop control on the motor speed under the influence of the acceleration/deceleration time is delayed, and the droop control may operate as disabled.

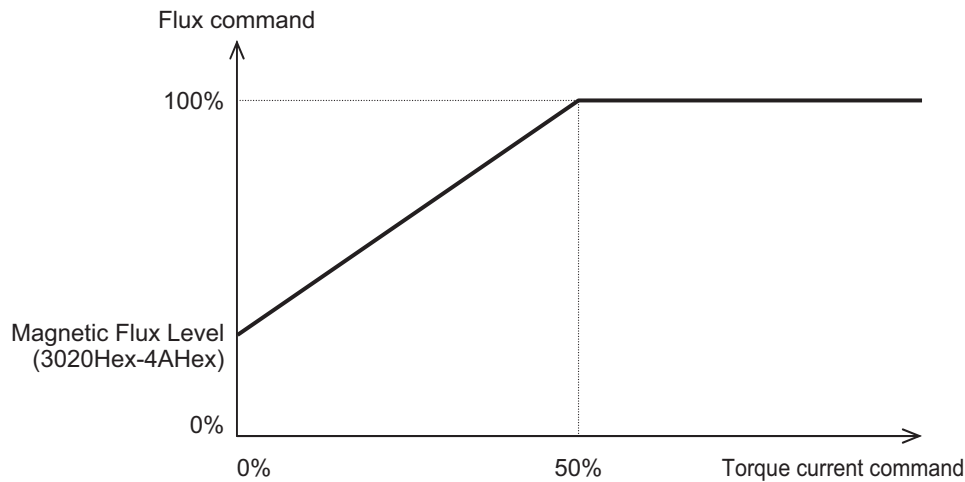
8-9-21 Magnetic Flux Level at Light Load

By setting Magnetic Flux Level at Light Load (3020Hex-4AHex), the magnetic flux of the motor during a light load can be reduced, and thus, the motor noise can be reduced. This function can be used only during vector control with speed sensor.

This is regardless of Load Mode Selection (3004Hex-51Hex).

Parameter No.	Function name	Data	Default data	Unit
3020Hex-4AHex	Magnetic Flux Level at Light Load	10 to 100	100	%

- The magnetic flux command when the Torque Current Command value is less than 50% can be changed. Set the magnetic flux command when the Torque Current Command value is 0% to Magnetic Flux Level at Light Load (3020Hex-4AHex). Refer to the figure below.



8-9-22 Pre-excitation

The motor generates torque through magnetic flux and torque current. Since the establishment of magnetic flux has a lag element, sufficient torque is not generated at the time of starting.

Pre-excitation is a function for establishing the magnetic flux before startup to ensure sufficient torque even during the time of starting.

There are two methods for issuing pre-excitation commands: one is to execute for the period of Pre-excitation Timer (3008Hex-56Hex) after the RUN command is turned ON, and the other is to turn ON the EXITE terminal and apply pre-excitation until the RUN command is input.

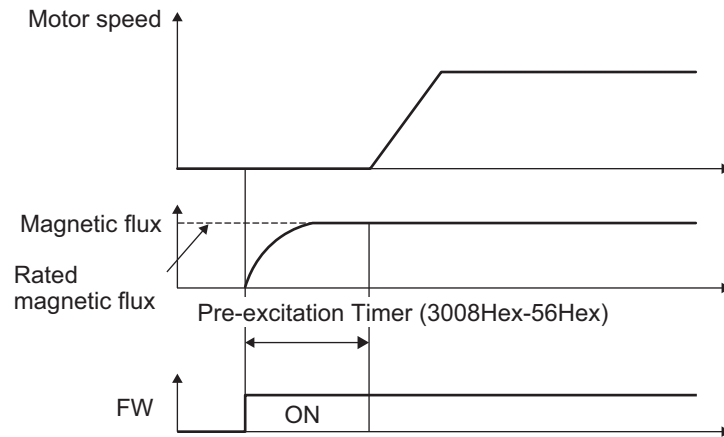
Controlling by Pre-excitation Timer

When the pre-excitation (Timer) elapses, it is judged that magnetic flux has been established, and acceleration is started. Secure sufficient time for establishment of magnetic flux with Pre-excitation Timer (3008Hex-56Hex).

The appropriate value of the pre-excitation (Timer) is different for each capacity. As a standard, consider it equivalent to the default value of the Power Interruption Restart Wait Time (3008Hex-0EHex). This function is disabled when the pre-excitation timer is set to 0.00.

Parameter No.	Function name	Data	Default data	Unit
3008Hex-56Hex	Pre-excitation Timer	0.00: Disable 0.01 to 30.00	0.00	s
3008Hex-55Hex	Pre-excitation Level*1	100 to 400	100	%

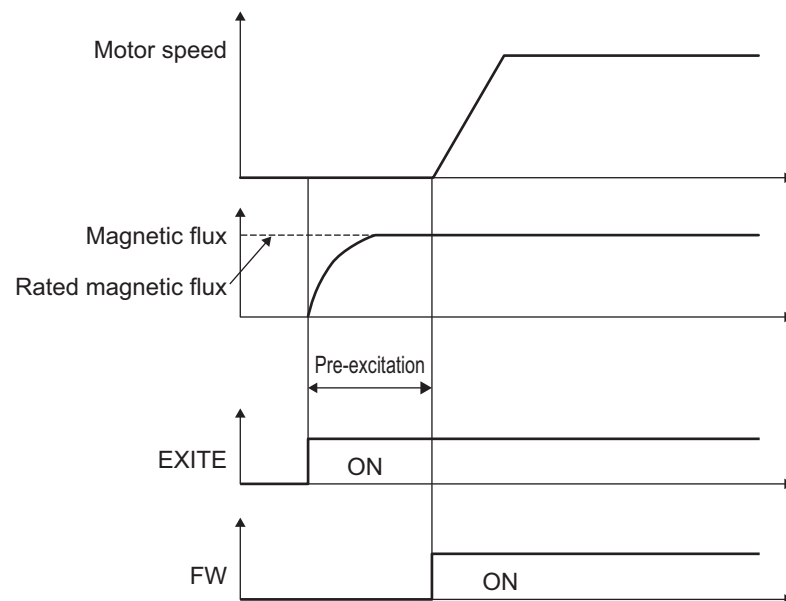
- *1. Pre-excitation Level (3008Hex-55Hex) sets the ratio with the rated magnetic flux as 100%. This is used to raise the output current to more than specified to shorten the pre-excitation timer. Generally, there is no need to change the settings. If a set value is too large, instantaneous overcurrent (alarm code: 01) sometimes is generated.



Controlling by Pre-excitation Command Terminal (32: EXITE)

Pre-excitation starts operating when the EXITE terminal is turned ON regardless of the setting of Pre-excitation Timer (3008Hex-56Hex). After this, when the RUN command is input, pre-excitation operation ends, and acceleration starts. When the time until the RUN command is input is short, establishment of magnetic flux sometimes does not arrive at a sufficient level. In this case, lengthen the time until the RUN command is input.

Parameter No.	Function name	Data	Default data	Unit
3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex	Input Terminal [DI1] to [DI7] Function Selection	32: EXITE (Pre-excite)	-	-



- The pre-excitation function is disabled in V/f control (including automatic torque boost and torque vector). Substitute it with DC braking or starting frequency continuation.
- Even when the motor is stopped by the pre-excitation operation, the voltage is output to the output terminals [U], [V] and [W] of the inverter.

8-9-23 Forced Stop

The forced stop function is used to perform a deceleration stop by Deceleration Time for Forced Stop (3008Hex-39Hex) when the STOP terminal is turned OFF.

After the deceleration stop, the operation error (alarm code: 24) is displayed and the status changes to alarm status.

When a forced stop is detected, the STOP-OUT terminal turns ON.

Parameter No.	Function name	Data	Default data	Unit
3008Hex-39Hex	Deceleration Time for Forced Stop	0.00 to 6000	6.00	s
3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex	Input Terminal [DI1] to [DI7] Function Selection	30: STOP (Force to stop)*1	-	-
3005Hex-15Hex/ 3005Hex-1CHex	Output Terminal [DO1] Function Selection/Output Terminal [ROA, ROB] Function Selection	152: STOP-OUT (Forced stop detection)	-	-

*1. As standard, Force to stop (30: STOP) is an NC contact. To use the function for an NO contact, set "1030."

8-9-24 Overload Stop Function

This function is used to detect the load condition, and if the state exceeding the Overload Stop Detection Level (300EHex-41Hex) continues for the Overload Stop Detection Timer (300EHex-44Hex) or longer, stop operation is performed by the overload stop function.

Select the stop operation at Overload Stop Mode Selection (300EHex-42Hex). If "0: Disable" is selected, the overload stop function is disabled.

The overload stop function is enabled only for the 1st control.

Select the operation to detect at Overload Stop Operation Mode (300EHex-43Hex).

Select the item to detect at Overload Stop Item Selection (300EHex-40Hex).

Parameter No.	Function name	Data	Default data	Unit
300EHex-42Hex	Overload Stop Mode Selection	0: Disable 1: Deceleration stop 2: Free run stop 3: Torque limit operation (Deceleration)	0	-
300EHex-40Hex	Overload Stop Item Selection	0: Torque 1: Current	0	-
300EHex-41Hex	Overload Stop Detection Level	20 to 200	100	%
300EHex-43Hex	Overload Stop Operation Mode	0: During constant speed running and deceleration 1: During constant speed running 2: Anytime	0	-
300EHex-44Hex	Overload Stop Detection Timer	0.00 to 600.00	0	s
300EHex-5BHex	Overload Stop Function P gain	0.000 to 2.000 999: 0.050	32767	Times

Parameter No.	Function name	Data	Default data	Unit
300EHex-5CHex	Overload Stop Function Integral time	0.001 to 9.999 999: 0.025	32767	Times
300EHex-5DHex	Overload Stop Function Current level	50.0 to 150.0	100	%
3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex	Input Terminal [DI1] to [DI7] Function Selection	46 : OLS (Enable overload stop)	-	-

Overload stop enabled OLS

Turning the OLS terminal ON enables overload stop and turning the terminal OFF disables overload stop.

Note that if overload stop is disabled by turning OFF the OLS terminal in a state when the inverter has stopped due to overload stop, the inverter will restart.

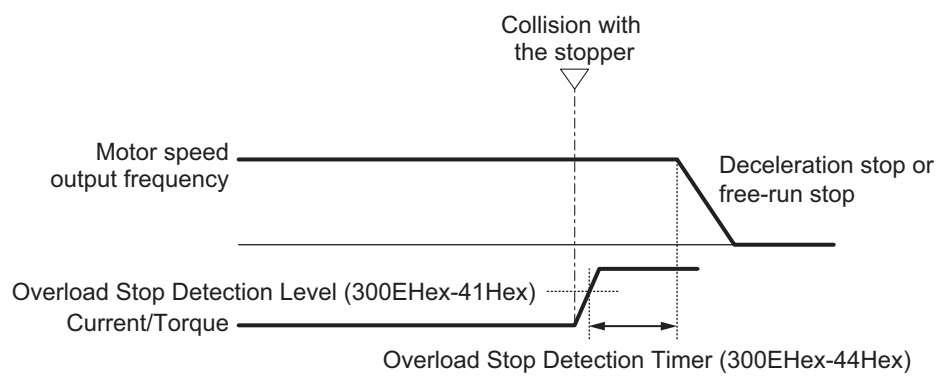
Overload Stop Mode Selection (300EHex-42Hex)

- Select the stop operation at Overload Stop Mode Selection (300EHex-42Hex). If “0: Disable” is selected, the overload stop function is disabled.

● For operation selection (300EHex-42Hex = 1, 2)

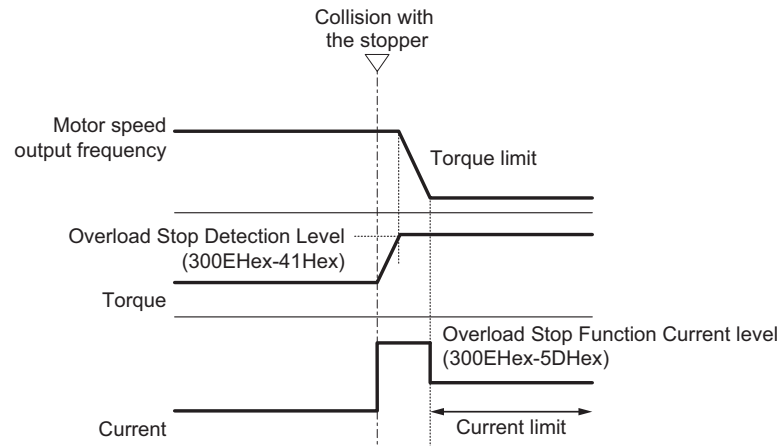
If deceleration stop (300EHex-42Hex= 1) is set when output torque or output current has continued for the detection timer (300EHex-41Hex) or longer set with the Overload Stop Detection Level (300EHex-44Hex), a deceleration stop is performed at the selected deceleration time.

When free run stop (300EHex-42Hex= 2) is set, inverter immediately shuts down and the motor enters the free-run state.



● For operation selection (300EHex-42Hex = 3)

- PI control is started by the set values of Overload Stop Function P gain (P) (300EHex-41Hex) and Overload Stop Function Integral time (300EHex-5BHex) when the Overload Stop Detection Level (300EHex-5CHex) is reached. Torque is controlled by PI control so that the Overload Stop Detection Level (300EHex-41Hex) is maintained. When the Frequency Lower Limit (3004Hex-11Hex/301FHex-13Hex) is reached, control is switched to current control. Overload Stop Item Selection (300EHex-40Hex) is not related to this setting.



Proportional Gain (P), Integral Time (I) and Current Limitation Level

When “3: Torque limit operation (Deceleration)” function is selected for Overload Stop Mode Selection (300EHex-42Hex), the parameters described below can be set.

- Overload Stop Function P gain (300EHex-5BHex)
If the response of the torque limitation operation is slow, increase the gain, and if hunting occurs, decrease the gain.
- Overload Stop Function Integral time (300EHex-5CHex)
If the response of the torque limitation operation is slow, decrease the integral time, and if hunting occurs, increase the integral time.
- Overload Stop Function Current level (300EHex-5DHex)
This function is used to correct the current command during current limitation. When the set value is increased, the retention torque increases, but an inverter overload alarm (OLU) or a motor overload alarm (OL1) may occur, and vibrations may occur in the mechanical system.

8-9-25 Battery Operation Enable Command (BATRY)

When the BATRY terminal is turned ON, undervoltage protection is disabled, and the motor can be operated even in an undervoltage state. In an event that an elevator fails to stop at a normal position due to power failure, this command is expected to operate the elevator to the normal position with a low-voltage and small-capacity emergency power supply.

When “BATRY” is allocated to the input terminal, the momentary power failure operation is not performed regardless of the setting of Power Interruption Restart Mode Selection (3004Hex-0FHex), and the inverter trips during a power failure.

When the BATRY terminal is ON, the input phase loss protection is disabled regardless of the setting of Input Phase Loss Protection Function Selection (3052Hex-0CHex).

While the BATRY terminal is ON, the IRDY terminal turns OFF.

Parameter No.	Function name	Data	Default data	Unit
3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex	Input Terminal [DI1] to [DI7] Function Selection	59: BATTERY (Enable battery-driven operation)	-	-
3005Hex-15Hex/ 3005Hex-1CHex	Output Terminal [DO1] Function Selection/Output Terminal [ROA, ROB] Function Selection	10: IRDY (Operation ready signal)	-	-

8-9-26 Universal Terminal

- The input terminal is not used as startup of the inverter functions, but it can be used as a signal monitor.
- The inverter status is not output; the value set to parameters can be output from output terminals [DO1] and [ROA, ROB].

Universal DI

When "25:U-DI (Universal DI)" is allocated to the input terminal, ON/OFF can be checked by Operation command (3002Hex-07Hex) and the input signal can be checked by Input Terminal Monitor (3010Hex-29Hex) regardless of inverter operation.

Parameter No.	Function name	Data	Default data	Unit
3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex	Input Terminal [DI1] to [DI7] Function Selection	25: U-DI (Universal DI)	-	-
3002Hex-07Hex	Operation command	Bit15: RST Bit14: DI7 Bit13: DI6 Bit12: - Bit11: - Bit10: - Bit9: - Bit8: - Bit7: - Bit6: DI5 Bit5: DI4 Bit4: DI3 Bit3: DI2 Bit2: DI1 Bit1: REV Bit0: FWD	0	-

Parameter No.	Function name	Data	Default data	Unit
3010Hex-29Hex	Input Terminal Monitor	Bit15: - Bit14: - Bit13: - Bit12: EN2 Bit11: EN1 Bit10: - Bit9: - Bit8: - Bit7: - Bit6: DI5 Bit5: DI4 Bit4: DI3 Bit3: DI2 Bit2: DI1 Bit1: DI7 Bit0: DI6	0	-

Universal DO

When “27: OPO (Option board output)” is allocated to the output terminal, output is performed from the corresponding output terminal when data is written to the Communication Data Terminal [DO] (3002Hex-08Hex) from communication regardless of inverter operation.

Parameter No.	Function name	Data	Default data	Unit
3002Hex-08Hex	Communication Data Terminal [DO]	Bit8: RO Bit0: DO1	0	-

8-9-27 Protection/Maintenance Mode Selection Function

Main circuit capacitor life judgment selection, main circuit capacitor life judgment, inrush current prevention resistor overheat detection, and braking transistor broken detection operations can be selected and set as combined operations.

Parameter No.	Function name	Data	Default data	Unit
3008Hex-63Hex	Protection/Maintenance Function Mode Selection	0 to 255	80	-

Set function settings as binary values to their respective bits, and set the resulting data as decimal data to Protection/Maintenance Function Mode Selection (3008Hex-63Hex).

The following shows the settings of each bit and each function.

Bit	Function	Data = 0	Data = 1
Bit 0 to 2	Reserved	-	-
Bit 3	Main circuit capacitor life judgment standards selection	Default value	User setting
Bit 4	Judge main circuit capacitor life	Disable	Enable
Bit 5	Detect inrush current prevention resistor overheat	Enable	Disable

Bit	Function	Data = 0	Data = 1
Bit 6	Braking transistor error detection	Continuous running	Alarm processing
Bit 7	Reserved	-	-

Use the reserved bit fixed at 0.

Below are the details of each function.

Main Circuit Capacitor Life Judgment Selection (Bit 3)

Either of the factory default standards or user setting standards can be selected as the criteria level for judging the life of the main circuit capacitor.

When user setting standards are selected, the reference level must be measured and set beforehand. For details, refer to *8-8-10 Capacitor Life Warning Signal (WAC)* on page 8-85.

Judge Main Circuit Capacitor Life (Bit 4)

To judge the life of the main circuit capacitor, measure the discharge time when the power supply is shut off. The discharge time is determined by the capacity of the main circuit capacitor and the inverter's internal load. Accordingly, accurate measurement is not possible when the inverter's internal load conditions fluctuate considerably. Life is also sometimes judged erroneously in some conditions. To prevent erroneous judgment of the life of the main circuit capacitor, life judgment based on the discharge time of the main circuit capacitor can be disabled (life judgment based on incrementation of the time that voltage is applied to the main circuit capacitor continues to stay active). For details, refer to *8-8-10 Capacitor Life Warning Signal (WAC)* on page 8-85.

When using the control power supply auxiliary inputs, the load varies considerably. For this reason, during run operation, either disable life judgment and then enable life judgment after aligning conditions at periodic inspection, or measure by a method matched to actual usage conditions.

Inrush Current Prevention Resistor Overheat Detection Protection (Alarm Code: 46) (Bit 5)

On 0.1 to 15 kW inverters, when overheating of the inrush current prevention resistor inside the inverter is detected when the main circuit power is turned ON and started, the overheat protection function (alarm code: 46) is activated. When startup is slow due to the main circuit power being a variable power supply device, the overheat protection function is sometimes activated. In this case, protection can be disabled.

Braking Transistor Error Detection (Alarm Code: 16) (Bit 6)

Detects the built-in braking transistor error and stops the inverter by Braking transistor broken detection (alarm code: 16). To disable alarm generation without using the braking transistor, set this bit to "0."



Troubleshooting

This section describes how to analyze the cause and take countermeasures if the inverter fails, and provides troubleshooting for possible troubles.

9-1	Alarm Display and Remedies	9-2
9-1-1	Alarm Display	9-2
9-1-2	Alarm Code List	9-3
9-1-3	Minor Fault Code List	9-25
9-1-4	Errors on a Communications Line	9-26
9-2	Troubleshooting	9-29

9-1 Alarm Display and Remedies

9-1-1 Alarm Display

If an error occurs, the inverter shuts off its output (“trip”), turns ON or causes the ERROR LED to flash, and displays an alarm code and sub code. After checking the RUN command and other signals, you can reset the alarm.

Before resetting the alarm, be sure to investigate the cause of the trip and remove the trip factor(s) according to the displayed alarm code.

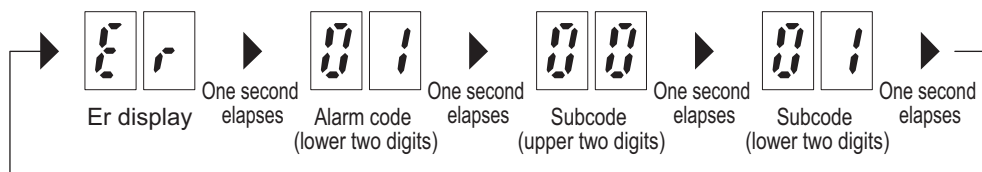
This section describes how to deal with troubles that may occur after you start using the inverter.

Alarm Display

- Alarm, light alarm occurred

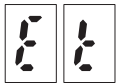
When an alarm or a light alarm has occurred, the display is as follows.

The alarm code displayed is the lower two digits of the error code (603FHex).



- ECT terminal block board error occurred

When an ECT terminal block board error has occurred, the display is as follows.



- STO state

The STO state is displayed as follows.



These displays flash at 0.5 second intervals while in an alarm state.

When multiple causes for an alarm occur simultaneously when an alarm is displayed, display priority is as follows: “ECT terminal block board error,” “Alarm, light alarm” and “STO state.”

How to Reset a Trip State

For details on how to reset an inverter trip state, refer to *6-8 Reset* on page 6-43.

The above reset methods may not be effective depending on the trip factor.

In such cases, cycle the power supply.

Data Clear Processing for Communications Error

Communications command parameter (Parameter S) data can be automatically cleared when a communications error alarm (alarm code: 23 Hex) is generated.

Clearing this will remove the frequency reference and RUN command, therefore the inverter will not start inadvertently when clearing the alarm.

Parameter No.	Function name	Data	Default data	Unit
300FHex-60Hex	Data Clear Processing for EtherCAT Communications Error	0: Do not clear the data of function codes S when a communications error occurs. (compatible with the conventional inverters) 1: Clear the data of function codes S001, S005, and S019 when a communications error occurs 2: Clear the run command assigned bit of function code S06 when a communications error occurs 3: Clear both data 1 and 2 above	0	-

9-1-2 Alarm Code List

Alarm code	Alarm subcode	Name	Description	Check point and remedy reference
3B Hex (dbA)	0000 Hex	Braking transistor error	Error in braking resistor connection terminal wiring	Check that the braking resistor is correctly wired in to the [P+] and [DB] terminals on the main circuit terminal block. Check that the motor wiring is not erroneously connected to the terminal [DB]. → If there is no miswiring, request repair of the inverter.
			The braking transistor is damaged.	Check that the braking resistor value is correct, and that it is not miswired. → If there is no problem, request repair of the inverter.

Alarm code	Alarm subcode	Name	Description	Check point and remedy reference
16 Hex (dbH)	0000 Hex	Braking resistor overheating	(1) High braking load	<p>Re-calculate the relationship between braking load calculations and braking capacity.</p> <ul style="list-style-type: none"> → Reduce braking load. → Review braking resistor selection, and increase braking capacity. <p>(Resetting of objects 3004Hex-33Hex, 3004Hex-34Hex, 3004Hex-35Hex data is necessary)</p>
			(2) Short deceleration time	<p>Recalculate deceleration torque and deceleration time required from the moment of inertia of the load and deceleration time.</p> <ul style="list-style-type: none"> → Lengthen deceleration time (parameters 3004Hex-09Hex, 3005Hex-0CHex, 3005Hex-0EHex, 3005Hex-10Hex, 3008Hex-39Hex) → Review braking resistor selection, and increase braking capacity. <p>(Resetting of objects 3004Hex-33Hex, 3004Hex-34Hex, 3004Hex-35Hex data is necessary)</p>
39 Hex (ECF)	0000 Hex	EN circuit failure	(1) Enable circuit (safe stop circuit) logic failure	<ul style="list-style-type: none"> • Check that the output from the safety switch is input using the same logic (High or Low/Low) to both terminals [SF1]/[SF2]. → Cycle the power to clear the alarm.
			(2) Enable circuit (safe stop circuit) damage (single failure) detected	<p>If this is not resolved by the procedure above, the inverter is faulty.</p> <ul style="list-style-type: none"> → Replace the inverter.

Alarm code	Alarm subcode	Name	Description	Check point and remedy reference
1F Hex (Er1)	0000 Hex	Memory error	(1) Power disconnected during parameter data writing (in particular during initialization) and control power dropped	Initialize data with Data Initialization (3008Hex-04Hex), and when initialization is complete, use the reset to check that the alarm can be canceled. → Restore the initialized parameter data, and restart operation.
			(2) During parameter data writing (in particular during initialization), strong noise received from surrounds	Check methods for measures against noise (grounding conditions, control/main circuit wiring and installation). Additionally, perform the same checks as in (1). → Perform measures against noise, restore the initialized parameter data, and restart operation.
			(3) Error occurred in control circuit	Initialize data with Data Initialization (3008Hex-04Hex), and when initialization is complete, use the reset to check if the alarm continues even when trying to cancel this. → Replace the inverter.
			(4) Power disconnected during saving of user settings with object 3020Hex-5EHex, and control power dropped	Save user settings with object 3020Hex-5EHex, and when saving is complete, use the reset to check if the alarm continues even when trying to cancel this. → Replace the inverter.
			(5) During saving of user settings with object 3020Hex-5EHex, strong noise received from surrounds	Check methods for measures against noise (grounding conditions, control/main circuit wiring and installation). Additionally, perform the same checks as in (4). → Replace the inverter.
21 Hex (Er3)	0000 Hex	CPU error	(1) Strong noise received from surrounds	Check measures against noise (grounding conditions, signal wiring and communication cable/main circuit wiring and installation methods, etc.). → Improve measures against noise.

Alarm code	Alarm subcode	Name	Description	Check point and remedy reference
23 Hex (Er5)	2000 Hex	EtherCAT communications error	(1) An EtherCAT communications cable is disconnected, broken, short-circuited, or has a contact failure in a daisy chain configuration.	Connect the EtherCAT communications cable securely. If the cable is broken, replace it.
			(2) The ring disconnection <ul style="list-style-type: none"> In a ring topology configuration, the ring disconnection status occurred. In a ring topology configuration, the ring disconnection status was fixed. 	Refer to Method for Ring Disconnection Maintenance and Inspection and perform inspection.
			(3) Noise	Take noise countermeasures so that the noise does not affect the EtherCAT communications cable.
			(4) Failure of the EtherCAT physical layer of a Inverter.	If this event occurs again after you performed all corrections shown above, replace the Inverter.
	2015 Hex		(5) Failure of the FSoE Safety Circuit.	If this event occurs again after you performed all corrections shown in (3), replace the Inverter.

Alarm code	Alarm subcode	Name	Description	Check point and remedy reference
24 Hex (Er6)	2 to 6	Operation error	(1) With the start check function enabled (object 3008Hex-61Hex = 2), the start check function has operated	<p>Check if the following operation has been performed while there is a RUN command input.</p> <ul style="list-style-type: none"> • Power supply ON • Alarm cancel • Switch to link RUN command <p>→ With the Run operation error occurring, review sequences, etc. so that a RUN command is not input.</p> <p>If unintended operation, review object 3008Hex-61Hex settings.</p> <p>(Before clearing the alarm, turn the RUN command OFF.)</p>
	1		(2) Forced stop "STOP" (digital input terminal) turned OFF	<p>Check if forced stop "STOP" has been turned OFF.</p> <p>→ If unintended operation, review terminals [DI1] to [DI7] object 3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex settings.</p>
	8		(3) Brake check signal "BRKE" and brake control signal "BRKS" mismatch	<p>Check that the signal input into the X terminal to which brake check signal "BRKE" is assigned and the brake control signal "BRKS" output from the Y terminal match.</p> <ul style="list-style-type: none"> • Signal disconnection • Check that the logic matches • If there is a delay, adjust the object 3020Hex-51Hex (brake control signal) time.
	30		(4) A RUN command (FW/REV signals are ON) is input while the power recovery restart prevention (USP) signal is input	<p>Check the power recovery restart prevention (USP) signal.</p>

Alarm code	Alarm subcode	Name	Description	Check point and remedy reference
25 Hex (Er7)	0000 Hex	Tuning error	(1) The connection between the inverter and the motor is missing phases	→ Ensure a correct connection between the inverter and motor.
			(2) V/f settings and motor rated current are not set correctly	Check that object (3004Hex-05Hex*, 3004Hex-06Hex*, {H50}, {H51}, {H52}, {H53}, {H65}, {H66}, 3007Hex-03Hex*, 3007Hex-04Hex*) data matches motor specifications.
			(3) Wiring between the inverter and motor is too long	Check that wiring between the inverter and motor does not exceed 50 m. (Smaller inverter capacity will be more impacted by wiring length) → Review layout so that wiring between the inverter and motor can be made shorter. Alternatively, shorten wiring lengths as much as possible. → Does not use automatic tuning, and does not use automatic torque boost (Set object 301FHex-0DHex/ 301FHex-0EHex* = 0)
			(4) Major discrepancy between the inverter rated capacity and the capacity of the connected motor	Check that the capacity of the connected motor is lower than three or more ranks of the inverter rated capacity, or higher than two or more ranks. → Review the inverter capacity. → Manually set the motor constant (object 3007Hex-07Hex*, 3007Hex-08Hex*, 3007Hex-09Hex*). → Does not use automatic tuning, and does not use automatic torque boost (Set object 3004Hex-26Hex* = 1)
			(5) A special motor, such as a high-speed motor	→ Does not use automatic tuning, and does not use automatic torque boost (Set object 3004Hex-26Hex* = 1)
			(6) Tuning operation during which the motor is rotated with the brake applied (object 3007Hex-05Hex* = 2) performed	→ Tune the motor while stopped (object 3007Hex-05Hex* = 1). → Release the brake then tune the motor (object 3007Hex-05Hex* = 2).

Alarm code	Alarm subcode	Name	Description	Check point and remedy reference
2A Hex (Erd)		Stall detection/startup magnetic pole position detection failure	(1) Different motor characteristics	Check that object 3004Hex-05Hex, 3004Hex-06Hex, 3007Hex-02Hex, 3007Hex-03Hex, 3007Hex-04Hex, 3007Hex-3DHex, 3007Hex-3EHex, 3007Hex-3FHex, 3007Hex-40Hex, 3007Hex-41Hex data matches motor constants. → Perform auto tuning.
			(2) Magnetic pole position detection method is not appropriate	Check that the magnetic pole position detection method matches the motor type. → Match the magnetic pole position detection method (object 3007Hex-1FHex) selection to the motor type.
			(3) Insufficient starting frequency (holding time) (object 3004Hex-19Hex)	Check that, when setting the magnetic pole position detection method selection (object 3007Hex-1FHex*) to 0 or 3, the starting frequency (holding time) (object 3004Hex-19Hex) is set optimally. → Set a time that enables the motor to rotate one revolution or more. $3004\text{Hex-}19\text{Hex} \geq 3007\text{Hex-}02\text{Hex} / 2 / 3004\text{Hex-}18\text{Hex}$ (3007Hex-02Hex: pole, 3004Hex-18Hex: starting frequency)
			(4) Insufficient starting torque	Check acceleration time (object 3004Hex-08Hex, 3005Hex-0BHex, 3005Hex-0DHex, 3005Hex-0FHex) and reference current at starting (object 3007Hex-4BHex) data. → Set an acceleration time that matches the load. → Raise the reference current at starting.
			(5) Low braking load	Check reference current at starting (object 3007Hex-4BHex*) data. → Lower the reference current at starting. When a motor is run on its own, such as during a test run, set to 80% or lower.
			(6) The connection between the inverter and the motor is missing phases	→ Ensure a correct connection between the inverter and motor.

Alarm code	Alarm subcode	Name	Description	Check point and remedy reference
32 Hex (ErC)		Magnetic pole position detection error	(1) Inverter settings are not appropriate	<p>Check presence and model of the used motor, and of the speed/magnetic pole position sensor, and that 1st Drive Control Selection (3004Hex-2BHex)/Input Terminal [PIA][PIB] Pulse Input Format Selection (3014Hex-0FHex) and Input Terminal [PIA][PIB] Encoder Pulse Resolution (3014Hex-10Hex) are coordinated.</p> <p>→ Check the equipment configuration (model and specifications of motor, speed/magnetic pole position sensor), and set 3004Hex-2BHex/3014Hex-0FHex/3014Hex-10Hex correctly.</p> <p>Set the 1st PM Motor Starting Method (3007Hex-1FHex) to 0 or 3, and check if the 1st PM Motor Magnetic Pole position Offset(3007Hex-60Hex*) is set to "999: Offset not adjusted."</p> <p>→ Set 3007Hex-60Hex correctly. (Auto-tuning also is possible. Refer to <i>Offline Auto-tuning of Synchronous Motor (PM Motor)</i> on page 7-67.)</p>
			(2) Error with speed/magnetic pole position sensor connection	<p>Check for errors with speed/magnetic pole position sensor output wiring connection, and the phase sequence of AB or UVW phase.</p>
			(3) Motor rotation direction and sensor output do not match	<p>→ Correctly connect the feedback input terminal block board with the speed/magnetic pole position sensor.</p> <p>Check for bad connections in the motor wiring, and the phase sequence.</p> <p>→ Ensure a correct connection with the inverter and motor.</p>
			(4) Error in terminal block board connection	<p>Check if the terminal block board connector and inverter unit connector are correctly connected.</p> <p>→ Mount the terminal block board correctly in the inverter unit.</p>
			(5) Strong noise received from surroundings	<p>Check measures against noise (grounding conditions, signal wiring and communication cable/main circuit wiring and installation methods, etc.).</p> <p>→ Implement measures against noise.</p>

Alarm code	Alarm subcode	Name	Description	Check point and remedy reference
2F Hex (ErE)	0000 Hex	Speed mismatch/excessive speed deviation	(1) Error in parameter settings	Check 1st Motor Pole Number (3007Hex-02Hex*) settings. → Set 3007Hex-02Hex* to match the motor used.
			(2) Excessive load	Measure the output current. → Reduce the load.
				Check if mechanical braking is occurring. → Eliminate any mechanical braking.
			(3) Speed does not increase because of current limiter operation	Check 1st Overload Protect Level (3004Hex-2DHex) data. → Change 3004Hex-2DHex to appropriate values, or if current limiter operation is not necessary, change 3004Hex-2CHex data to 0 (Disable).
				Check the object (3004Hex-05Hex*, 3004Hex-06Hex*, 3007Hex-02Hex*, 3007Hex-0DHex*) data to ensure that V/f settings are correct. → Coordinate V/f settings with motor ratings. → Change settings to match the motor used.
			(4) Parameter settings and the motor have different characteristics	Check that 3007Hex-02Hex*, 3007Hex-03Hex*, 3007Hex-04Hex*, 3007Hex-07Hex*, 3007Hex-08Hex*, 3007Hex-09Hex*, 3007Hex-0AHex*, 3007Hex-0BHex*, and 3007Hex-0DHex* match motor constants. → Perform auto tuning with 3007Hex-05Hex*.
(5) Erroneous wiring to motor	Check wiring to the motor. → Wire the inverter output wiring (U, V, W) to motor wiring (U, V, W) respectively.			
(6) Speed does not increase because of torque limit operation	Check Torque Limit 3 (3005Hex-11Hex) data. → Change Torque Limit 3 (3005Hex-11Hex) to appropriate value, or if torque limit operation is not necessary, set it to 300%.			

Alarm code	Alarm subcode	Name	Description	Check point and remedy reference
33 Hex (ErF)	0000 Hex	Data save error in case of undervoltage	(1) During data save at power interruptions, the control power supply dropped suddenly as a result of rapid discharge of the Main Circuit DC Voltage, etc.	Check the power drop time at Main Circuit DC Voltage at power interruption. → Eliminate the cause of rapid discharge of the Main Circuit DC Voltage, etc. After performing a reset to cancel the alarm, return the frequency reference and PID command to their original settings, and restart operation.
			(2) Strong noise received from surroundings during data saving at power interruption.	Check methods for measures against noise (grounding conditions, control/main circuit wiring and installation). → Implement measures against noise. After performing a reset to cancel the alarm, return the frequency reference and PID command to their original settings, and restart operation.
			(3) Error occurred in control circuit	Check that error occurs every time at power on. → Replace the inverter.
36 Hex (ErH)	0000 Hex	Hardware error	(1) Error in combination of control PCB and power PCB	Replace the inverter.
38 Hex (Ero)	0000 Hex	Position control error	(1) Position control system insufficient gain (servo lock)	Readjust Servo Lock Gain (300EHex-62Hex) and Speed Control 1 P Proportional Gain (3014Hex-04Hex).
FE Hex (Err)	0000 Hex	Mock alarm	(1) Object 3008Hex-2EHex (Mock alarm) set to 1.	→ Perform a reset.
44 Hex (ErU)		Tool disconnection diagnosis	(1) A disconnection occurred on the tool during a test run.	Check if the USB cable or a connector is disconnected. → Perform a reset.
			(2) A disconnection occurred on the tool during forced status changing of multi-function output.	

Alarm code	Alarm subcode	Name	Description	Check point and remedy reference
0B Hex (Lin)	0000 Hex	Input phase loss	(1) Main power supply input terminal wiring disconnected	Measure the input voltage. → Repair or replace the main power supply input wiring or input equipment (molded case circuit breaker, magnetic contactor, etc.)
			(2) Loose main power supply input terminal connection	Check if main power supply input terminal screws are loose. → Tighten to the recommended tightening torque.
			(3) High phase imbalance in three-phase power supply	Measure the input voltage. → Install an AC reactor (ACR) to reduce the phase imbalance. → Increase the inverter capacity.
			(4) Frequent excessive load	Measure the ripple waveform of the Main Circuit DC Voltage. → If a ripple in the Main Circuit DC Voltage is high, increase the inverter capacity.
			(5) Three-phase power supply connected to a product with three-phase power supply specifications	Recheck the inverter model. → Reselect an inverter matching the power supply specifications.
FD Hex (LoK)	0000 Hex	Password cancellation error	(1) User password 1 or 2 entered incorrectly more than a specified number of times	Cancel the alarm. → Turn OFF the inverter power supply, then turn ON the power supply again. Or 20 minutes elapse after the occurrence of the error. If you have forgotten the password. → Set Data Initialization (3008Hex-04Hex) to 1 and execute parameter initialization.

Alarm code	Alarm subcode	Name	Description	Check point and remedy reference	
0A Hex (LU)	1	Undervoltage	(1) Momentary power failure occurred	→ Cancel the alarm.	
	3			→ To restart without an alarm, set the Power Interruption Restart Mode Selection (3004Hex-0FHex) data to 3, 4, or 5 depending on the type of load.	
	2		(2) Short interval when cycling power (if 3004Hex-0FHex = 1)	→ Increase the interval for turning the power supply OFF then back ON.	
	0000 Hex			(3) The power supply voltage has not reached the inverter specification range (three-phase 200 V: 180 VDC/three-phase 400 V: 360 VDC/single-phase 200 V: 160 VDC)	Measure the input voltage. → Increase the power supply voltage to within the specified range.
				(4) Equipment damage or miswiring in power supply circuit	Measure the input voltage and identify the damaged equipment or miswiring. → Replace damaged equipment, or repair miswiring.
				(5) A large starting current flows to a different load connected to the same power supply, and the power supply voltage temporarily drops	Measure the input voltage, and check for voltage fluctuations. → Review the power supply system.
(6) Insufficient capacity in the power supply transformer resulting in drop in power supply voltage due to inverter inrush current.		Check that an alarm occurs when the molded case circuit breaker, ground leakage circuit breaker (with overcurrent protection function), and magnetic contactor are on. → Review the power supply transformer capacity.			

Alarm code	Alarm subcode	Name	Description	Check point and remedy reference
01 Hex (during acceleration) (0C1) 02 Hex (during deceleration) (0C2) 03 Hex (during constant speed operation) (0C3) (0Cn)	0000 Hex	Instantaneous overcurrent	(1) Short in inverter output	Remove wiring from the inverter output terminal (U, V, W), and measure the resistance between motor wiring phases. Check for phases with very low resistance. → Remove the shorted section (including replacement of wiring, relay terminals, and motors) If an overcurrent is displayed when run with wiring removed from the inverter output terminal (U, V, W). → This indicates an inverter fault possibility. Replace the inverter.
			(2) Inverter output terminal has a ground fault	Remove wiring from the inverter output terminal (U, V, W), and perform a megger test. → Remove ground faults (including replacement of wiring, relay terminals, and motors). If an overcurrent is displayed when run with wiring removed from the inverter output terminal (U, V, W). → This indicates an inverter fault possibility. Replace the inverter.
			(3) High load	Measure current going in to the motor, establish current trends, and determine if this is larger than the load calculation values designed in to the system. → If overload, either decrease the load or increase the inverter capacity. Check current trends, and check if there are rapid changes in current. → If the current changes rapidly, either decrease the load or increase the inverter capacity. → Enable instantaneous overcurrent limiting (3008Hex-0DHex = 1).
			(4) Large torque boost (If manual torque boost (3004Hex-26Hex* = 0, 1, 3, 4))	Check if the current drops when 1st Manual Torque Boost Voltage (3004Hex-0AHex*) is lowered, or if there is a stall. → If it is determined that there is no stall, lower 3004Hex-0AHex*.

Alarm code	Alarm subcode	Name	Description	Check point and remedy reference
01 Hex (during acceleration) (0C1) 02 Hex (during deceleration) (0C2) 03 Hex (during constant speed operation) (0C3) (0Cn)	0000 Hex	Instantaneous overcurrent	(5) Short acceleration/deceleration time	<p>Recalculate torque required from the moment of inertia of the load and acceleration/deceleration time, and determine if appropriate.</p> <ul style="list-style-type: none"> → Lengthen the acceleration/deceleration time (3004Hex-08Hex, 3004Hex-09Hex, 3005Hex-0BHex, 3005Hex-10Hex, 3008Hex-39Hex). → Enable 1st Overload Protect Function Selection (3004Hex-2CHe) and torque limit (3004Hex-29Hex, 3004Hex-2AHex, 3005Hex-11Hex, 3005Hex-12Hex). → Increase the inverter capacity.
			(6) Internal braking transistor short detection has operated	<p>Check that the braking resistor connection terminal (P+, DB) is not shorted.</p> <p>Check if the connected braking resistor resistance value is very low.</p> <ul style="list-style-type: none"> → Connect the appropriate braking resistor.
			(7) Malfunction because of noise	<p>Check methods for measures against noise (grounding conditions, control/main circuit wiring and installation).</p> <ul style="list-style-type: none"> → Implement measures against noise. For details, refer to <i>2-3-4 Wiring for Main Circuit Terminals</i> on page 2-15. → Enable the retry function (3008Hex-05Hex). → Connect a surge absorber to coils, solenoids, etc. in magnetic contactors that are the cause of noise.

Alarm code	Alarm subcode	Name	Description	Check point and remedy reference
11 Hex (OH1)	0000 Hex	Cooling fin overheating	(1) The ambient temperature exceeds the inverter specification range	Measure the ambient temperature. → Reduce the ambient temperature such as by improving the air flow to the panel.
			(2) The airflow path is blocked	Check that there is sufficient installation space. → Re-install at a site where sufficient installation space can be ensured. Check for fin clogging. → Clean.
			(3) Reduced fan airflow because of the cooling fan service life or of damage	Check Cumulative Run Time of Cooling Fan (3008Hex-2CHex). → Replace the cooling fan. Visually check that the cooling fan is operating correctly. → Replace the cooling fan.
			(4) High load	Measure the output current. → Set 28: OHF (Cooling fan overheat warning) to Output Terminal [DO1] Function Selection (3005Hex-15Hex) and Output Terminal [ROA, ROB] Function Selection (3005Hex-1CHex) whose load is to be reduced. Alternatively, reduce the load before an overload occurs using the Overload early warning 2 Level (OL2) (3005Hex-23Hex). → Reduce Carrier Frequency (3004Hex-1BHex). → Enable Overload Prevention Control (3008Hex-47Hex)

Alarm code	Alarm subcode	Name	Description	Check point and remedy reference
12 Hex (0H2)	0000 Hex	External trip	(1) External equipment alarm function is operating	Inspect the operation of the external equipment. → Remove the cause of the alarm caused in the external equipment.
			(2) Miswiring or bad connection in external trip wiring	Check that wiring is correctly connected to the terminal for which "9: External trip (EXT)" is selected from 3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex. → Connect the external alarm wiring correctly.
			(3) Error in parameter settings	Check if "9: External trip (EXT)" is selected for an unused terminal from 3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex. → Change assignment. Check that the "EXT" logic set in 3005Hex-02Hex to 3005Hex-06Hex, 3005Hex-63Hex, 3005Hex-64Hex and the external signal logic (positive/negative) match. → Set the logic correctly.
13 Hex (0H3)	0000 Hex	Inverter internal overheating	(1) The ambient temperature exceeds the inverter specification range	Measure the ambient temperature. → Reduce the inverter ambient temperature such as by improving the air flow to the panel.

Alarm code	Alarm subcode	Name	Description	Check point and remedy reference
14 Hex (0H4)	0000 Hex	Motor protection (PTC thermistor)	(1) The motor ambient temperature exceeds the specification range	Measure the ambient temperature. → Reduce the ambient temperature.
			(2) Motor cooling system damaged	Check that the motor cooling system is operating correctly. → Replace or repair the motor cooling system.
			(3) High load	Measure the output current. → Reduce the load (use the Overload early warning 2 Level (OL2) (3005Hex-23Hex), and reduce the load before an overload occurs.) (During winter, the load may increase.) → Reduce the ambient temperature. → Increase Carrier Frequency (3004Hex-1BHex).
			(4) Incorrect PTC thermistor operating level (3008Hex-1CHex*)	Check the PTC thermistor specifications, and recalculate the detection voltage. → Change the parameter data.
			(5) 1st Manual Torque Boost Voltage (3004Hex-0AHex*) too high	Check the 3004Hex-0AHex* data, and readjust so that this does not stall even if data is lowered. → Adjust 3004Hex-0AHex*.
			(6) Error in V/f settings	Check that 1st Base Frequency (3004Hex-05Hex*) and 1st Rated Voltage at Base Frequency (3004Hex-06Hex*) match the rated nameplate value. → Match these to the rated nameplate value.
			(7) Error in parameter settings	While not using PTC thermistor, the Thermistor Function Selection (MOH) (3008Hex-1BHex*) is in an operation state. → Change Thermistor Function Selection (MOH) (3008Hex-1BHex*) to 0 (Disable).
46 Hex (0H6)	0000 Hex	Inrush current prevention resistor overheat	(1) The inverter power supply has been turned OFF and then ON frequently.	Reduce the frequency at which the power supply is turned OFF and then ON. → Turn OFF and then ON less than once every 30 minutes.
			(2) The inverter power supply has not been turned OFF and then ON frequently.	An error is generated each time the power supply is turned OFF and then ON. → The inrush current protection circuit is damaged. Request repair.

Alarm code	Alarm subcode	Name	Description	Check point and remedy reference
17 Hex (OL1) 18 Hex (OL2) (OLn)	0000 Hex	Motor over-load 1 Motor over-load 2	(1) The thermal characteristics of the electronics and the motor overload characteristics do not match	Check motor characteristics. → Review object (3004Hex-0BHex*, 3004Hex-0DHex*) data. → Use an external thermal relay.
			(2) Inappropriate electronics thermal operating level	Recheck motor allowable continuous current. → Reconsider and change object (3004Hex-0CHex*) data.
			(3) Short acceleration/deceleration time	Recalculate acceleration/deceleration torque and acceleration/deceleration time required from the moment of inertia of the load and acceleration/deceleration time. → Lengthen the acceleration/deceleration time (3004Hex-08Hex, 3004Hex-09Hex, 3005Hex-0BHex, 3005Hex-10Hex, 3008Hex-39Hex).
			(4) High load	Measure the output current. → Reduce the load (use the Overload early warning 2 Level (OL2) (3005Hex-23Hex), and reduce the load before an overload occurs.) (During winter, the load may increase.)
			(5) 1st Manual Torque Boost Voltage (3004Hex-0AHex*) too high	Check the 3004Hex-0AHex* data, and readjust so that this does not stall even if data is lowered. → Adjust 3004Hex-0AHex*.

Alarm code	Alarm subcode	Name	Description	Check point and remedy reference
19 Hex (OLU)	0000 Hex	Inverter over- load	(1) The ambient temperature exceeds the inverter specification range	Measure the ambient temperature. → Reduce the ambient temperature such as by improving the air flow to the panel.
			(2) 1st Manual Torque Boost Voltage (3004Hex-0AHex*) too high	Check 1st Manual Torque Boost Voltage (3004Hex-0AHex*) and readjust so that this does not stall even if data is lowered. → Adjust 3004Hex-0AHex*.
			(3) Short acceleration/deceleration time	Recalculate acceleration/deceleration torque and acceleration/deceleration time required from the moment of inertia of the load and acceleration/deceleration time. → Lengthen the acceleration/deceleration time (3004Hex-08Hex, 3004Hex-09Hex, 3005Hex-0BHex, 3005Hex-10Hex, 3008Hex-39Hex).
			(4) High load	Measure the output current. → Reduce the load (use the Overload early warning 2 Level (OL2) (3005Hex-23Hex), and reduce the load before an overload occurs.) (During winter, the load may increase.) → Decrease Carrier Frequency (3004Hex-1BHex). → Enable Overload Prevention Control (3008Hex-47Hex).
			(5) The airflow path is blocked	Check that there is sufficient installation space. → Ensure sufficient installation space. Check for fin clogging. → Clean.
			(6) Reduced fan airflow because of the cooling fan service life or of damage	Check the cumulative run time of the cooling fan. (Refer to 8-8-13 <i>Cooling Fan Life Warning Signal (WAF)</i> on page 8-88.) → Replace the cooling fan. Visually check that the cooling fan is operating correctly. → Replace the cooling fan.
			(7) Long output wiring, with high leakage current	Measure the leakage current → Insert an output circuit filter (OFL).
E2 Hex (OPL)	0000 Hex	Output phase loss detection	(1) Disconnected invert output wiring	Measure the output current. → Replace the output wiring.
			(2) Motor windings broken	Measure the output current. → Replace the motor.
			(3) Loose inverter output terminal connection	Check if inverter output terminal screws are loose. → Tighten to the recommended tightening torque.

Alarm code	Alarm subcode	Name	Description	Check point and remedy reference
1B Hex (0S)	0000 Hex	Excessive speed protection	(1) Error in parameter settings	Check 1st Motor Pole Number (3007Hex-02Hex*) settings. → Set 3007Hex-02Hex* to match the motor used.
				Check 1st Maximum Output Frequency (3004Hex-04Hex*) settings. → Set 3004Hex-04Hex* to match the output frequency.
				Check Speed Limit 1 in Forward (3014Hex-21Hex) and Speed Limit 2 in Reverse (3014Hex-22Hex) settings. → Disable Speed Limit 1 in Forward (3014Hex-21Hex) and Speed Limit 2 in Reverse (3014Hex-22Hex).
				Check Over Speed Detection Level (3014Hex-24Hex) settings. → Set Over Speed Detection Level (3014Hex-24Hex) to 120%.
			(2) Insufficient speed regulator gain	Check that the speed does not overshoot during high-speed running. → Increase Speed Control 1 P Proportional Gain (3014Hex-04Hex*). (In some cases, a review of filters and integral time will be necessary.)
			(3) Noise superimposed on the PG signal	Check the PG signal input monitor, and check measures against noise (grounding conditions, signal wiring/main circuit wiring and installation methods, etc.). → Implement measures against noise.
			(4) Output frequency and motor rotation speed exceeded 599 Hz	If using at near 590 Hz, check that the acceleration time is not short, there is no load variation, and that the speed regulator Speed Control 1 P Proportional Gain (3014Hex-04Hex*) and Speed Control 1 I Integral Time (3014Hex-05Hex*) are appropriate. → Decrease the run frequency.
06 Hex (during acceleration) (0U1) 07 Hex (during deceleration) (0U2) 08 Hex (during constant speed operation) (0U3) (0Un)	0000 Hex	Overvoltage	(1) The power supply voltage exceeds the inverter specification range (three-phase 200 V and single-phase 200 V: 420 VDC/three-phase 400 V: 840 VDC)	Measure the input voltage. → Decrease the power supply voltage to within the specified range. → If the power supply voltage is within the specification range, this indicates an inverter fault. Replace the inverter.
(2) Surge in the input power supply			When a phase advance capacitor is turned ON/OFF or a thyristor converter operates on the same power supply system, a transient abnormal surge may occur in input voltage. → Set a DC reactor.	

Alarm code	Alarm subcode	Name	Description	Check point and remedy reference
06 Hex (during acceleration) (0U1) 07 Hex (during deceleration) (0U2) 08 Hex (during constant speed operation) (0U3) (0Un)	0000 Hex	Overvoltage	(3) Short deceleration time for the moment of inertia of the load.	Recalculate the deceleration torque from the moment of inertia of the load and the deceleration time. → Lengthen the deceleration time (3004Hex-09Hex, 3005Hex-0CHex, 3005Hex-0EHex, 3005Hex-10Hex, 3008Hex-39Hex). → Enable Anti-regenerative Control Function Selection (3008Hex-46Hex) or Over-Excitation Control Selection during Deceleration Function Selection (3008Hex-48Hex). → Enable torque limit (3004Hex-29Hex, 3004Hex-2AHex, 3005Hex-11Hex, 3005Hex-12Hex). → Set 1st Rated Voltage at Base Frequency (3004Hex-06Hex*) to 0, and increase braking performance. → Consider use of braking resistor.
			(4) Short acceleration time	Check if an overvoltage alarm occurs at the end of sudden acceleration. → Lengthen the acceleration time (3004Hex-08Hex, 3005Hex-0BHex, 3005Hex-0DHex, 3005Hex-0FHex). → Use Acceleration/Deceleration Pattern Selection (3008Hex-08Hex). → Consider use of braking resistor.
			(5) High braking load	Compare load braking torque and inverter braking torque. → Set 1st Rated Voltage at Base Frequency (3004Hex-06Hex*) to 0, and increase braking performance. → Consider use of braking resistor.
			(6) Output has a ground fault	If this operates correctly when run with wiring removed from the inverter output terminal (U, V, W). → Check that the output wiring or the motor do not have a ground fault. If an overvoltage is displayed when run with wiring removed from the inverter output terminal (U, V, W). → This indicates an inverter fault possibility. Replace the inverter.
			(7) Malfunction because of noise	Check that the Main Circuit DC Voltage at the time of overvoltage is at or below the overvoltage level. → Implement measures against noise. → Enable Retry Count at Trip (3008Hex-05Hex). → Connect a surge absorber to coils, solenoids, etc. in magnetic contactors that are the cause of noise.

Alarm code	Alarm subcode	Name	Description	Check point and remedy reference
10 Hex (PbF)	0000 Hex	Charging circuit malfunction (1.5 kW min.)	(1) The charging circuit is damaged	Repair of the inverter is required. → Replace the inverter.
1C Hex (PG)	0000 Hex	PG disconnection	(1) Break in wiring between pulse generator and option	Check that the pulse generator is correctly connected, and that there is no break in wiring. → Check that the pulse generator is correctly connected, or tighten screws. → Check that the connecting sections are not caught. → Replace with wiring that is not broken.
			(2) Strong noise received from surroundings	Check measures against noise (grounding conditions, signal wiring and communication cable/main circuit wiring and installation methods, etc.). → Implement measures against noise. → Separate main circuit wiring and control circuit wiring as much as possible.
34 Hex (d0)	0000 Hex	Excessive positioning deviation	(1) Encoder disconnection	Check that there are no breaks in encoder wiring.
			(2) Mismatch between the encoder rotation direction (wiring phase sequence) and motor rotation direction (inverter output phase sequence)	Connect so that all directions match, and review settings. Review 3014Hex-0FHex to 3014Hex-12Hex settings values.
			(3) Deviation over settings values are too low	Review 3037Hex-18Hex, 3037Hex-19Hex settings values. If settings values are low, increase these.
			(4) Position control gain is too low	Review 3037Hex-04Hex, 3037Hex-05Hex settings values. If settings values are low, increase these.
			(5) Speed control gain is too low.	Review 3014Hex-04Hex (3009Hex-2EHex, 3013Hex-2EHex, 300CHex-2EHex) settings values. If settings values are low, increase these.
			(6) Torque is limited	If a torque limit is operating, then position control and speed control will not operate correctly. Take the following measures so that the torque limit is not applied. <ul style="list-style-type: none"> • Reduce load • Review acceleration/deceleration time • To reduce load, review the speed reduction ratio, motor capacity, and other equipment configuration.

Parameters marked with * are for 1st control only. When using 2nd control, refer to *2nd Control Switch Function (SET)* on page 6-46 and replace these values.

9-1-3 Minor Fault Code List

Alarm code	Alarm subcode	Name	Description		Check point and remedy reference
6D Hex (CnT)	0000 Hex	Equipment service life (number of startups)	(1) Equipment service life (number of startups)	-	Displayed when the motor number of startups reaches the number set in 1st Preset Startup Count for Motor Maintenance (3008Hex-50Hex). Additionally, the current number of startups can be confirmed in 1st Startup Count for Motor (3008Hex-2DHex), therefore before reset, set 3008Hex-2DHex data to 0000.
67 Hex (LiF)	0000 Hex	Life prediction	(1) Life prediction	-	Any one of the main circuit capacitor used in the inverter, the electrolytic capacitor inside the inverter, and the cooling fan has reached the end of its life. Referring to <i>8-8-10 Capacitor Life Warning Signal (WAC)</i> on page 8-85, <i>8-8-13 Cooling Fan Life Warning Signal (WAF)</i> on page 8-88 and <i>8-8-14 Life Alarm (LIFE)</i> on page 8-88, check the status of consumable parts.
66 Hex (OH)	0000 Hex	Cooling fin overheat prediction	(1) Cooling fin overheat prediction	-	Displayed as a prediction before the cooling fine overheat (alarm code: 11) occurs. For measures, refer to cooling fine overheat (alarm code: 11) (page 9-17).
65 Hex (OL)	0000 Hex	Motor overload prediction	(1) Motor overload prediction	-	Displayed as a prediction prior to a motor overload alarm (alarm code: 17, 18) occurring, and sets the current value at which the Overload early warning 2 Level (OL2) (3005Hex-23Hex) operates. Check that the actual current flowing in the motor is not higher than the value set in 3005Hex-23Hex.
69 Hex (Pid)	0000 Hex	PID warning output	(1) PID warning output	-	Displayed when a warning (warning from absolute value, warning from PID error) is output during PID operation. For details, refer to <i>Excessive PID deviation (OD)</i> on page 8-118.
68 Hex (rEF)	0000 Hex	Command loss	(1) Command loss	-	When the analog frequency settings (terminal A11) command suddenly decreases to 10% or less, it is judged to be a wire break and a reference loss alarm (alarm code: 68) is displayed. Check the wiring.

Alarm code	Alarm subcode	Name	Description		Check point and remedy reference
6B Hex (rTE)	0000 Hex	Equipment service life (cumulative operation time of motor)	(1) Equipment service life (cumulative operation time of motor)	-	Displayed when the cumulative operation time of motor reaches the time set in object 3008Hex-4FHex (Maintenance interval). Cumulative motor run time can be checked in 3008Hex-5FHex* (Cumulative operation time of motor). This can also be reset by setting the 3008Hex-5FHex* value to 0.
FD Hex (LoK)	0000 Hex	Password cancellation error	(1) User password 1 or 2 entered incorrectly 5 times.	-	Cancel the alarm. → Turn OFF the inverter power supply, then turn ON the power supply again. Or 20 minutes elapse.

9-1-4 Errors on a Communications Line

There are seven EtherCAT LED lit states as follows.

Abbreviation	Name/State
On	ON
Off	OFF
F	Flashes by flickering ON and OFF at 50 ms intervals.
B	Flashes by blinking ON and OFF at 200 ms intervals.
SF	Flashes as a single flash ON for 200 ms and OFF for 1,000 ms.
D	Flashes as a double flash ON for 200 ms, OFF for 200 ms, ON for 200 ms and OFF for 1,000 ms.
-	Unknown

EtherCAT RUN	EtherCAT ERR	L/A IN L/A OUT	Description		Remarks
On	Off	F	EtherCAT communications in progress	EtherCAT communications is currently being executed.	A normal state if either or both of process data communications or message communications is currently being executed.
-	-	On	Physical layer link established	Operation wait state after the physical layer link is established.	There was a state transition instruction from the host system during operation, and the state transitioned to a state other than Operational. Check that the Master Unit is correctly operating. Refer to the manual for the Master Unit.

EtherCAT RUN	EtherCAT ERR	L/A IN L/A OUT	Description		Remarks
-	-	Off	Physical layer link not established	The physical layer link is not established (the Master Unit is not participating in the network).	<ul style="list-style-type: none"> Check that communication cables are correctly connected to connectors. Check that the wiring of communication cables is correct. Check that the Master Unit is correctly operating. If using an OMRON Master Unit, check the Master Unit mode and the node address-setting ID switches of the inverter. If the Master Unit is made by another manufacturer, refer to the instruction manual for that product. When there are devices in the surrounding area that generate noise, adopt measures against noise for the Master Unit, inverter and communication cables.
Off	Off	Off	Power supply abnormality	Power is not being supplied normally to the inverter.	<ul style="list-style-type: none"> Check that the inverter power supply is being supplied normally (for example, the main power supply of the inverter is wired correctly, the power supply voltage has not dropped, and inverter operation is normal). Remove the cause of the abnormality and turn the inverter power supply OFF then back ON again.
Off	On	-	Inverter abnormality	A hardware alarm has occurred.	<ul style="list-style-type: none"> A slave initialization error occurred in the master. Replace the inverter.
	F		Communication Unit hardware error	A hardware alarm has occurred.	Replace the inverter.
	B				
-	B	-	Sync Manager setting error	The Sync Manager settings are in error.	Correct the set values.
-	D	-	Process data communications timeout	An error occurred in PDO communication.	<p>After checking the following items, turn OFF the inverter power supply and then restart the inverter.</p> <ul style="list-style-type: none"> Is cable length appropriate (max. 100 m)? Is the cable disconnected or loose? Is there a lot of noise?

EtherCAT RUN	EtherCAT ERR	L/A IN L/A OUT	Description		Remarks
SF	-	-	Safe operational state	There was a transition instruction to the safe operational state from the master.	When this occurs during system operation, check the status of the host master.
B	-	-	Pre-operational state	There was a transition instruction to the pre-operational state from the master.	
Off	-	-	Initialization state	There was a transition instruction to the initialization state from the master.	

9-2 Troubleshooting

If you feel that the inverter operation is strange or that the inverter does not operate as intended, use the following information as a reference, even if the inverter displays no alarm indication.

If the inverter trips with an alarm indication, refer to *9-1 Alarm Display and Remedies* on page 9-2.

Symptom	Possible cause	Remedy	Reference page
The power supply is not turned on. (The POWER LED on the inverter is not lit.)	The short-circuit bar between the terminal +1 and P/+2 is removed, or no DC reactor is connected.	Install the short-circuit bar, or connect a DC reactor.	page 2-10 page 2-53
	Input wiring is disconnected.	Check the input wiring.	

Symptom	Possible cause	Remedy	Reference page	
The RUN command is input, but the motor does not rotate.	1st RUN Command Selection (3004Hex-03Hex) is incorrect.	Set 1st RUN Command Selection (3004Hex-03Hex) correctly.	page 6-22	
	1st Frequency Reference Selection (3004Hex-02Hex) is incorrect.	Set 1st Frequency Reference Selection (3004Hex-02Hex) correctly according to the frequency reference input method, and specify the frequency.	page 6-24	
	There frequency is set to 0 Hz.	When the 1st Frequency Reference Selection (3004Hex-02Hex) is set to "1: Analog voltage input," input the analog voltage corresponding to the frequency to the terminal AI1.		page 6-51
		Input the frequency according to the 1st Frequency Reference Selection (3004Hex-02Hex). (The input frequency will be displayed in the frequency reference monitor (monitor mode: 3_02).)		
		For the multi-step speed operation, set the frequency to the multi-step speed reference 0 to 15 (3006Hex-06Hex to 3006Hex-14Hex).		
	No multifunction input terminal is allocated for the RUN command.	To input the RUN command via a multifunction input terminal, set the used terminal to "98: FW (forward rotation)" or "99: RV (reverse rotation)." To input the RUN command via the 3-wire input function, set them to "98: FW," "6: STP" and "97: F/R."	page 6-49 page 6-50	
	Multi-step speed settings "0: CF1" to "03: CF4" are set to the multifunction input terminal, and these are ON.	Disable the multi-step speed setting. (When this setting is enabled, multi-step speed operation is performed, so the motor does not rotate if the frequency values in the Multi-step Frequency Reference 1 to 15 (3006Hex-10Hex to 3006Hex-14Hex) are 0 (default)).	page 6-51	
	Both the forward and reverse input terminals are ON.	To input the RUN command via the forward/reverse input terminal, turn ON either of them.	page 6-49	
	The Reverse Rotation Prevention Function (3008Hex-09Hex) is set to limit the forward or reverse rotation.	Set Reverse Rotation Prevention Function (3008Hex-09Hex) correctly.	page 8-103	
The input terminal wiring or short-circuit bar connection for the RUN command is incorrect.	Wire correctly. (The multi-function input terminal status can be checked in the Input Terminal Monitor (3010Hex-29Hex)/Output Signal Monitor (3010Hex-2AHex).)	page 2-10 page 2-12 page 2-59		
The analog input or variable resistor wiring for the frequency reference is incorrect.	Wire correctly. <ul style="list-style-type: none"> For the analog voltage or variable resistor input, measure the voltage between the terminals AI1 to AIC with a tester, etc. to check that the voltage is correct. 	page 2-10 page 8-32		

Symptom	Possible cause	Remedy	Reference page
The RUN command is input, but the motor does not rotate.	Although the inverter is operated via the digital operator, the multifunction input terminal is set to "162: F-TM (Forced terminal block)" and that terminal is ON.	Turn OFF the terminal to which the function is allocated.	page 8-62
	An inverter trip occurred. (The ERR LED lights and the alarm code is displayed)	Perform a reset to cancel the trip, after determining the cause and taking countermeasures based on the alarm code, restart the inverter.	page 6-43 page 9-2
	When the safety function selector switch (SW9) is OFF, either the multifunction input terminal SF1 or SF2 is OFF.	To use the safety function, turn ON both of the safety input terminals SF1 and SF2. To disable this function, set the safety function selector switch to ON.	page 8-61
	The multifunction input terminal is set to "8: RS (Reset)," "15: CS (Commercial switching)," "16: SW60 (Commercial switching)" or "7: FRS (Free-run stop)," and that terminal is ON.	Turn OFF the terminal to which the function is allocated.	page 8-52 page 6-43 page 8-125
	The multifunction input terminal is set to "38: ROK: (Permission of run command)" and that terminal is ON.	Turn ON the terminal to which the function is allocated.	page 8-103
	The wiring from the inverter to the motor, or the internal wiring of the motor, is disconnected.	Check the input wiring.	page 2-10 page 2-56
	The load is too heavy.	Reduce the load.	-
	The motor brake is applied.	Release the brake.	-
	There is a contact failure for the analog input or variable resistor.	Check the input wiring. • For the analog voltage or variable resistor input, measure the voltage between the terminals AI1 to AIC with a tester, etc. to check that the voltage is correct.	page 2-10 page 8-32
	The overload limit or overcurrent suppression function is active.	Disable the function, or increase the level at which the function is activated.	page 8-71 page 8-76
	The 1st Maximum Output Frequency (3004Hex-04Hex) and 1st Frequency Upper Limit (3004Hex-10Hex)/2nd Frequency Upper Limit (301FHex-12Hex) are set too low.	Change the set value.	page 6-17 page 6-27
	The acceleration time is too long.	Decrease the acceleration time (3004Hex-08Hex/3005Hex-0BHex/3005Hex-0DHex/3005Hex-0FHex).	page 6-33

Symptom	Possible cause	Remedy	Reference page
The RUN command is input, but the motor does not rotate.	The multifunction input terminal is set to "10: JOG: (Jogging)" and that terminal is ON.	Turn OFF the terminal to which the function is allocated.	page 6-53
The motor rotation speed does not increase.	Multi-step speed settings "0: CF1" to "3: CF4" are set to the multifunction input terminal, and these are ON.	Disable the multi-step speed setting. (When this setting is enabled, multi-step speed operation is performed, so the motor runs according to the frequency set in the Multi-step Frequency Reference 1 to 15 (3006Hex-06Hex to 3006Hex-14Hex).)	page 6-52
	The load is too heavy.	Reduce the load.	-
	The motor brake is applied.	Release the brake.	-
The parameter settings cannot be changed.	The inverter is in operation.	Stop the inverter. Then, set the parameters again after the motor stops with deceleration. Some parameters can be switched even when the inverter is operating.	-
The motor rotates in reverse.	The phase sequence of wiring to the motor is incorrect. (The motor is not designed to rotate forward in the phase sequence: U/T1, V/T2, W/T3.)	Reverse the order of two wires connected to U/T1, V/T2, W/T3, or change the phase sequence to match that of the motor.	page 2-11
	The 3-wire input function is enabled, but the forward/reverse logic is incorrect.	Check the logic of the "97: F/R (3-wire forward/reverse)" allocated to a multifunction input terminal.	page 6-50

Symptom	Possible cause	Remedy	Reference page
The inverter trips with an overcurrent protection during operation.	The acceleration time is set too short.	Increase the acceleration time (3004Hex-08Hex/3005Hex-0BHex/3005Hex-0DHex/3005Hex-0FHex).	page 6-33 page 6-37
		Use the acceleration/deceleration stop function to change the operation pattern to stop accelerating temporarily.	page 6-36
	The load is too heavy.	Reduce the load.	-
		Use the torque boost function to adjust the torque.	page 6-65
		With 1st Drive Control Selection (3004Hex-2BHex)/2nd Drive Control Selection (3009Hex-0FHex) set to "0: IM V/f control," set "Free V/f voltage (301FHex-44Hex/301FHex-46Hex/301FHex-48Hex/301FHex-4AHex/301FHex-4CHex/301FHex-4EHex/301FHex-50Hex)" or "5: IM Vector control without speed sensor" and "15: PM Vector control without speed and pole position sensor" and perform tuning.	page 6-8 page 7-16
	1st Overload Protect Function Selection (3004Hex-2CHex)/2nd Overload Protect Function Selection (301FHex-2FHex) is set to "0: Disable."	Enable 1st Overload Protect Function Selection (3004Hex-2CHex)/2nd Overload Protect Function Selection (301FHex-2FHex).	page 8-71
	If an overcurrent trip occurs during operation although the overload limit function is enabled:		
1st Overload Protect Level (3004Hex-2DHex)/2nd Overload Protect Level (301FHex-30Hex) is too high.	Decrease 1st Overload Protect Level (3004Hex-2DHex)/2nd Overload Protect Level (301FHex-30Hex).	page 8-74	

Symptom	Possible cause	Remedy	Reference page	
The motor or machine causes a loud noise.	The carrier frequency is too low.	Increase Carrier Frequency (3004Hex-1BHex). However, this may increase noise or leakage current from the inverter. In addition, the output current must be derated depending on the model. For details, refer to <i>A-7 Derating Table</i> on page A-287.	page 8-99 page A-287	
	The frequency of the motor in rotation resonates with the machine's natural frequency.	Change the frequency setting. If resonance occurs during acceleration/deceleration, use the Jump Frequency (3006Hex-02Hex to 3006Hex-05Hex) to avoid the resonance frequency.	page 8-102	
	The motor is overexcited.	Set 1st Base Frequency (3004Hex-05Hex)/2nd Base Frequency (3009Hex-03Hex), 1st Rated Voltage at Maximum Output Frequency (3004Hex-07Hex)/2nd Rated Voltage at Maximum Output Frequency (3009Hex-05Hex) according to the motor ratings. If this does not improve the condition, slightly lower the 1st Rated Voltage at Base Frequency (3004Hex-06Hex)/2nd Rated Voltage at Base Frequency (3009Hex-04Hex) value. Or set 1st Drive Control Selection (3004Hex-2BHex)/2nd Drive Control Selection (3009Hex-0FHex) to "0: V/f control (No slip compensation)," or, if using "V/f control with speed sensor," use Non-linear V/f Frequency 1 (301FHex-43Hex)/Non-linear V/f Voltage 7 (301FHex-50Hex) and perform tuning.	page 6-8 page 6-17	
The inverter trips with an overcurrent protection (alarm code: 19).	The thermistor trip is not set appropriately.	Disable Thermistor Function Selection (MOH) (3008Hex-1BHex). Alternatively, adjust 1st Thermistor Error Detection Level (MOH) (3008Hex-1CHex).	page 8-77	
The inverter trips with an overvoltage protection (alarm code: 06, 07, 08) during deceleration.	The set deceleration time is too short.	Increase the deceleration time (3004Hex-09Hex/3005Hex-0CHex/3005Hex-0EHex/3005Hex-10Hex).	page 6-33 page 6-37	
	Anti-regenerative Control Function Selection (3008Hex-46Hex) is set to "0: Disable."	Enable Anti-regenerative Control Function Selection (3008Hex-46Hex). However, when this function is enabled, the actual deceleration time may be longer than the set value. For details, refer to <i>8-8-2 Anti-regenerative Control Function</i> on page 8-74.	page 8-74	
	If an overvoltage trip occurs during deceleration although Anti-regenerative Control Function Selection (3008Hex-46Hex) is enabled:			
	The Frequency Rising Limit for Torque Limit (3008Hex-4DHex) value is inappropriate.	Change the set values. For details, refer to <i>8-8-2 Anti-regenerative Control Function</i> on page 8-74.	page 8-74	

Symptom	Possible cause	Remedy	Reference page
The inverter trips with a thermistor error (alarm code: 14).	24-VDC voltage is input to the PTC terminal.	Remove 24-VDC voltage from the PTC terminal.	page 8-77
The output frequency is unstable.	The parameter settings are inappropriate.	Change the output frequency value slightly away from the power supply frequency.	page 6-24
		Change 1st Output Current Fluctuation Damping Gain (3008Hex-51Hex) and 2nd Output Current Fluctuation Damping Gain (3009Hex-2AHex).	page 8-129
	The load changes significantly.	Increase the motor/inverter capacity.	-
	The power supply voltage fluctuates.	Take measure to reduce the fluctuation.	-
The torque is insufficient.	The parameter settings are inappropriate. (During acceleration/constant speed)	Increase 1st Manual Torque Boost Voltage (3004Hex-0AHex)/2nd Manual Torque Boost Voltage (3009Hex-06Hex).	page 6-65
		Set 1st Torque Boost Function Selection (301FHex-0DHex) and 2nd Torque Boost Function Selection (301FHex-0EHex) to "1: Automatic torque boost."	page 6-65
		Decrease the Carrier Frequency (3004Hex-1BHex) value.	page 8-99
		Set 1st Drive Control Selection (3004Hex-2BHex)/2nd Drive Control Selection (3009Hex-0FHex) to "5: IM Vector control without speed sensor."	page 7-16
	The parameter settings are inappropriate. (During deceleration)	Increase the deceleration time (3004Hex-09Hex/3005Hex-0CHex/3005Hex-0EHex/3005Hex-10Hex).	page 6-33
		Set 1st AVR Function Selection (301FHex-17Hex)/2nd AVR Function Selection (301FHex-18Hex) to OFF.	page 8-106
		Use braking resistors or regenerative braking units.	-
Operating the inverter activates the earth leakage breaker.	The leakage current from the inverter is too large.	Decrease the Carrier Frequency (3004Hex-1BHex) value.	page 8-99
		Increase the sensitivity current of the earth leakage breaker. Or, replace the earth leakage breaker with one with a higher sensitivity current.	page 2-50
The DC injection braking function does not work.	The DC injection braking power is not set.	Set 1st DC Injection Braking Level (3004Hex-16Hex)/2nd DC Injection Braking Level (3009Hex-0BHex).	page 8-55
	The DC injection braking time is not set.	Set 1st DC Injection Braking Time (3004Hex-17Hex)/2nd DC Injection Braking Time (3009Hex-0CHex).	page 8-55
The inverter trips with an undervoltage (alarm code: 0A).	The voltage dropped because the power supply capacity is insufficient.	Increase the power supply capacity.	-

Symptom	Possible cause	Remedy	Reference page
Noise enters in the TV or radio located near the inverter.	The TV or radio is affected by the radiated noise from inverter.	Move the TV or radio as far away as possible from the inverter.	-
An option error (alarm code: 23) occurred.	The inverter received an error detected in the option unit.	Refer to the manual for the option unit.	-
	Inverter fault: The option connector does not work normally.	The connector may be faulty if the problem persists even after taking a remedy on the option unit side. If the problem persists even after checking the option connector for loose fitting and dirt on the contacts, replace the inverter.	-
An option communications error (alarm code: 23) occurred.	The inverter stops communicating with the option unit after recognizing it. The option unit is not mounted securely.	Check the option connector for loose fitting and dirt on terminal contacts. Check that the terminal block cover of the inverter is fit securely on the inverter.	-
Sysmac Studio cannot make an online connection.	The USB cable is not connected correctly.	Fully insert the USB cable into both the PC and controller.	-
	Sysmac Studio "Communications Settings" > "Communications Method" is not set to "USB-Direct Connection."	Set Sysmac Studio "Communications Settings" > "Communications Method" to "USB-Direct Connection."	-
	The USB driver is not correctly installed.	Install the USB driver. For details of USB driver installation methods, refer to the appendix of <i>Sysmac Studio Version 1 Operation Manual (SBCA-470)</i> .	-
The brake control function causes an overload protection (alarm code: 19).	The inverter is in operation with the brake force.	Turn OFF the RUN command to the inverter in the brake force state. Even under DC injection braking, an overload protection alarm may occur.	page 7-72
	With at or lower than the Brake Control Brake-release Frequency (300EHex-46Hex) set frequency, the brake does not release.	Set the frequency to a value exceeding the Brake Control Brake-release Frequency (300EHex-46Hex) value.	page 7-72
Brake transistor error (alarm code: 3B) occurred.	The brake transistor is damaged.	Replace the inverter.	-

Symptom	Possible cause	Remedy	Reference page
Brake error (alarm code: 24) occurred.	The output current does not reach the set brake release current value.	Increase Brake Control Brake-release Timer (300EHex-47Hex) or decrease Brake Control Brake-release Current (300EHex-45Hex).	page 7-72
	The brake confirmation signal is not input.	<ul style="list-style-type: none"> Correct the wiring for the brake confirmation signal (57: BRK). If not used, deallocate the brake confirmation function from the multi-function input setting. Review the operation sequence so that the brake confirmation signal (57: BRK) is input after the brake is released. Replace the brake if it is faulty. 	page 7-72
	Brake confirmation signal is not input within the time set in Brake Error Detection Time (3020Hex-51Hex).	Adjust Brake Error Detection Time (3020Hex-51Hex).	page 7-72
The brake control function causes the load to fall.	The set brake release current is insufficient.	Increase the Brake Control Brake-release Current (300EHex-45Hex) value.	page 7-72
	The frequency setting for releasing/forcing the brake is too low.	Increase the Brake Control Brake-release Frequency (300EHex-46Hex), Brake Force Frequency (300EHex-48Hex), or Brake Control Brake-applied Frequency (300EHex-48Hex) values.	page 7-72
The PM motor rotates during startup.	The magnetic pole position of the motor during startup is incorrect.	Set 1st PM Motor Starting Method (3007Hex-1FHex) to "1: IPM (Embedded magnet motor method 1)," and reduce initial rotation at startup. If 0 or 3 is used in 3007Hex-1FHex, reduce 1st PM Motor Reference Current at Starting (3007Hex-4BHex) to make reverse rotation more difficult.	page 7-22
	The PM motor stalls.	Increase the 1st PM Motor Reference Current at Starting (3007Hex-4BHex) value. Or perform adjustments according to 7-4-4 Adjustment of PM Motor Mode Settings on page 7-22.	page 7-22
	The load is too heavy.	Reduce the load. Or, increase the acceleration/deceleration time.	-
The parameter settings cannot be changed (changed from link function)	(1) Attempted to change a parameter that cannot be changed during operation	<ul style="list-style-type: none"> Stop operation and then change the parameter. 	-
	(2) Object 3004Hex-03Hex data cannot be changed	<ul style="list-style-type: none"> Turn both terminal signals "FW" and "RV" OFF. 	page 6-49
St display	(1) SF1 and SF2 terminals are OFF	<ul style="list-style-type: none"> Turn SF1 and SF2 ON. 	page 8-61
		<ul style="list-style-type: none"> When FW/RV signals are ON, turn the FW/RV signals OFF. 	page 6-49

Symptom	Possible cause	Remedy	Reference page
The EtherCAT RUN LED and ERR LED both are out	<ul style="list-style-type: none"> Power is not being supplied normally to the inverter. 	<ul style="list-style-type: none"> Check that the inverter power supply is wired correctly. Remove the cause of the power supply disconnection and turn the inverter power supply OFF then back ON again. 	page 2-10 page 2-49
EtherCAT ERR LED is lit red	Fatal error such as a watchdog timeout	The communications unit is faulty. Replace the inverter.	-
EtherCAT ERR LED is lit red	<ul style="list-style-type: none"> The Sync Manager settings are in error. An error occurred in communication. 	<ul style="list-style-type: none"> Correct the set values. Check the connection and the length of the communication cable. In addition, take noise control measures such as mounting the ferrite core on the communication cable. If the ERR LED continues to flash in spite of performing the above corrective action, replace the inverter. 	-
The EtherCAT RUN LED continues to flash green and there is no change in the state of the LED.	There was a state transition instruction from the host system during operation, and the state transitioned to a state other than Operational.	<ul style="list-style-type: none"> Referring to the manual for the Master Unit, check that the Host Master Unit is correctly operating. 	-
The EtherCAT L/A IN LED and L/A OUT LED stay out and there is no change in the state of the LEDs	<ul style="list-style-type: none"> The slave is not connected to the network. When the L/A IN LED and L/A OUT LED of a specific slave stay continually out and there is no change in the state of the LEDs, replace that slave. When there are devices in the surrounding area that generate noise, adopt measures against noise. Mounting ferrite cores on the communication cable, near the connectors will be effective. 	<ul style="list-style-type: none"> Check that the Master Unit is correctly operating. If using an OMRON Master Unit, check the Master Unit mode and the slave node address. If the Master Unit is made by another manufacturer, refer to the instruction manual for that product. Check that the wiring of communication cables is correct. Check that there are no breaks in the wiring sections of the communication cable to the connector. When the L/A IN LED and L/A OUT LED of a specific slave stay continually out and there is no change in the state of the LEDs, replace that slave. When there are devices in the surrounding area that generate noise, adopt measures against noise. Mounting ferrite cores on the communication cable, near the connectors will be effective. 	-
The EtherCAT L/A IN LED and L/A OUT LED stay flashing green and there is no change in the state of the LEDs	<ul style="list-style-type: none"> The slave state has not transitioned to the operational state. 	<ul style="list-style-type: none"> Referring to the manual for the Master Unit, check that the Master Unit is correctly operating. When the L/A IN LED and L/A OUT LED of a specific slave stay continually flashing and there is no change in the state of the LEDs, replace that slave. 	-

Symptom	Possible cause	Remedy	Reference page
Et display (PDO setting error)	<ul style="list-style-type: none"> • The EtherCAT master RxPDO and TxPDO settings are in error. • The inverter is faulty. 	<p>Correct the RxPDO and TxPDO settings according to the definitions in the ESI of the inverter, and download the settings again to the EtherCAT master.</p> <p>If this problem persists even after downloading the corrected settings to the EtherCAT master, the inverter is faulty. Replace the inverter.</p>	-

10

Maintenance and Inspection

This section describes the daily maintenance and periodical inspection items.

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10-1 Maintenance and Inspection

10-1-1 Daily Inspection

Check the following during operation.

- The motor operates according to the settings.
- There are no faults in the installation environment.
- There are no faults in the cooling system.
- There is no abnormal vibration or sound.
- There is no abnormal overheat or discoloration.
- There is no abnormal odor.
- There is no alarm display.

Check the input voltage of the inverter during operation by using a tester or other measuring equipment.

- There is no frequent power supply voltage fluctuation.
- The line voltage is balanced.

10-1-2 Cleaning

Always keep the inverter clean.

Lightly wipe the exterior surfaces of the inverter with a soft cloth moistened with a neutral detergent to remove dirt.

Do not use solutions such as acetone, benzene, toluene, or alcohol for cleaning. Doing so may cause the inverter surfaces to dissolve or its coating to come off.

In particular, do not use any detergent or alcohol to clean the data display.

10-1-3 Periodic Inspection

Check the parts that must be checked with the operation stopped, as well as those that require periodic inspection.

Even if the power supply is turned OFF, it takes time for the smoothing capacitor of the main circuit DC section to discharge. Since this can be dangerous, use a tester or something similar to confirm that the Main Circuit DC Voltage has dropped down to a safe value (+25 VDC or below), and then perform inspection.

- There are no faults in the cooling system.
→Clean the air filter etc.
- Check for loose screws, and retighten.
→The screws, bolts and other tightened parts may become loose due to vibration, temperature change, or other influences. Check these parts carefully and retighten them if necessary.
- Check for corrosion or damage to conductors and insulators.
- Measure the insulation resistance.
- Check the cooling fan, smoothing capacitor and relay.

Using STO safety function, periodical inspection must be performed at least once in three months, to maintain reliability of the safety function.

- See 8-6-5 and 8-6-4 for detail of inspection

10-1-4 Daily/Periodic Inspection Items

Inspection category	Inspection item	Inspection point	Inspection frequency			Inspection method	Criteria	Meter
			Daily	Periodic				
				1 year	2 years			
General	Ambient environment	Check ambient temperature, humidity and surrounding atmosphere (presence of dust, gas, oil mist, water droplets, etc.).	Required			Refer to 2-1 <i>Installation</i> on page 2-2.	Ambient temperature: -10 to 50°C, no freezing Operating humidity: 95% max., no condensation	Thermometer Hygrometer Recorder
	Entire system	There is no abnormal vibration or sound.	Required			Perform visual and acoustic inspection.	No faults	
	Power supply voltage	Is the backup power supply voltage normal?	Required			Measure the voltage of the backup power supply +24 VDC (across the [P24][0] terminals).	The voltage must be within the allowable voltage.	Tester, digital multimeter
		Check main circuit voltage.	Required			Measure line voltage between inverter main circuit terminals L1/R, L2/S and L3/T.	Within allowable AC voltage fluctuation range	
	Structural components such as the casing or cover	Check for deformation or damage.	Required			Perform visual inspection.	No faults	
		No deposition of dirt or dust	Required			Perform visual inspection.	No faults	

Inspection category	Inspection item	Inspection point	Inspection frequency			Inspection method	Criteria	Meter
			Daily	Periodic				
				1 year	2 years			
Main circuit	General	Perform megger check (Between main circuit terminals and ground terminal).		Required		Disconnect I/O wires from the inverter main circuit terminal block and remove the control terminal block PCB. Then, after removing the short-circuit bar for switching the inverter built-in filter function, measure using a megger the resistance between the ground terminal and the short-circuited terminals L1/R, L2/S, L3/T, U, V, W, P(+), P1, N(-) and DB.	5 MΩ min.	500-VDC class megger
		Check for loose bolts and screws.		Required		Retighten loose bolts and screws.	No faults	
		Check each part for traces of overheating.		Required		Perform visual inspection.	No faults	
	Conductors/wires	Check for distorted conductors.		Required		Perform visual inspection.	No faults	
		Check for broken cable sheaths.		Required				
	Terminal Blocks	Check for damage.		Required		Perform visual inspection.	No faults	
	Smoothing capacitor*1	Check that there is no liquid leakage.	Required			Perform visual inspection.	No faults	Capacity meter
		Check that the safety valve does not come out and that there is no bulge.	Required					

Inspection category	Inspection item	Inspection point	Inspection frequency			Inspection method	Criteria	Meter
			Daily	Periodic				
				1 year	2 years			
Main circuit	Relay	Check for chattering sound during operation.		Required		Perform acoustic inspection.	No faults	
		Check for rough contact surface.		Required		Perform visual inspection.	No faults	
Control circuit, protection circuit	Operation check	Check output voltage balance between phases during stand-alone inverter operation.		Required		Measure the line voltage between the inverter main circuit terminals U, V and W.	Phase-to-phase voltage balance 200-V 4 V max. 400-V 8V max. Class:	Digital multimeter Rectifier Voltmeter
		Check that there is no error in protection and display circuits through sequence protection function test.		Required		Short-circuit or open the inverter protection circuit output under simulated conditions.	Error is found in the sequence.	
Cooling system	Cooling fan	There is no abnormal vibration or sound.	Required			Rotate the fan manually with the power off.	Smooth rotation, no faults*2	
		Check for loose connections.		Required		Perform visual inspection.		
	Cooling fin	Check for clogging.		Required		Perform visual inspection.	No clogging.	
Display	Display	Check that the LED indicators are lit properly.	Required			Perform visual inspection.	The LED indicators are lit.	
		Perform cleaning.		Required		Clean with rags.		

Inspection category	Inspection item	Inspection point	Inspection frequency			Inspection method	Criteria	Meter
			Daily	Periodic				
				1 year	2 years			
Motor	General	There is no abnormal vibration or sound.	Required			Perform acoustic, sensory and visual inspection.	No faults	
		There is no abnormal odor.	Required			Check for abnormal odor due to overheating, damage, etc.	No faults	
	Isolation resistance	Perform megger check (between motor terminals and ground terminal).			Required	Disconnect wires from the inverter main circuit terminals U, V, W and short-circuit the three-phase motor wires. Then, use a megger to measure the resistance between each motor wire and the ground terminal.	5 MΩ min.	500-VDC class megger

*1. The capacitor service life is influenced by the ambient temperature.

For inverter replacement guidelines, refer to *A-8 Smoothing Capacitor Life Curve* on page A-291.

*2. The life of the cooling fan depends on environmental conditions, such as the ambient temperature and/or dust. Check the operating conditions in daily inspection.

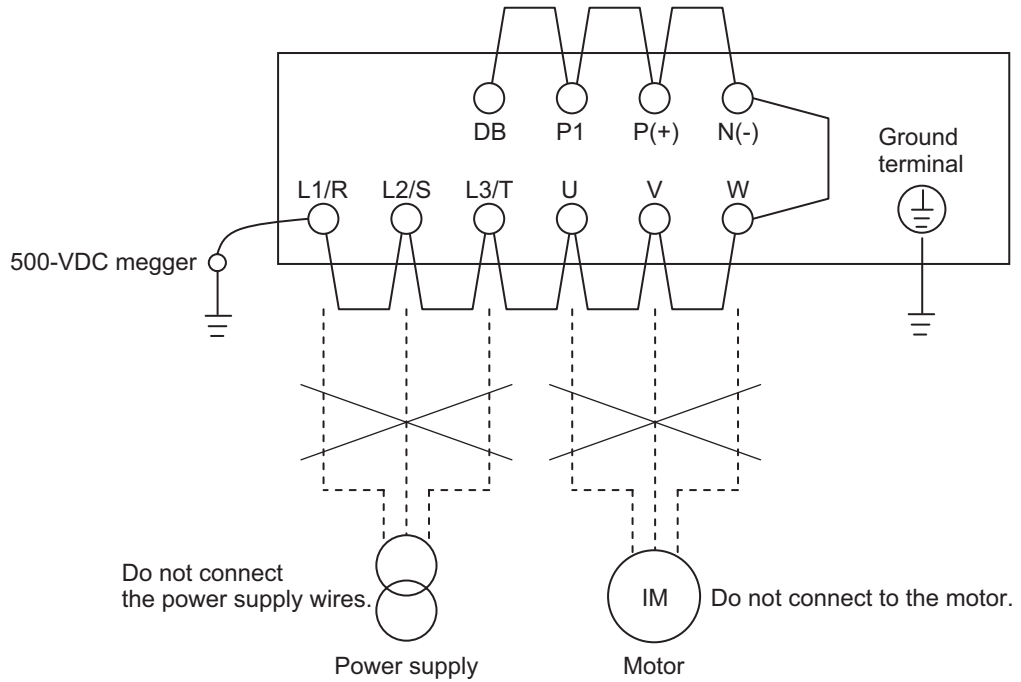
10-1-5 Megger Test

Before performing a megger test on external circuits, be sure to disconnect all the terminals of the inverter and not to apply the test voltage to the inverter. Use a 500 VDC megger for a megger test.

For a megger test on the inverter main circuit, short-circuit the terminals L1/R, L2/S, L3/T, U, V, W, DB, P1, P(+) and N(-) with wires, as shown below.

Because the insulation resistance rating of the single inverter unit is 5 MΩ or higher, it is normal if the resistance is 5 MΩ or higher.

- For the inverter, do not perform a megger test on the control circuit. Perform it only on the main circuit.
- Use a tester (in a high resistance range) for a power-on test on the control circuit. Do not use a megger or buzzer.



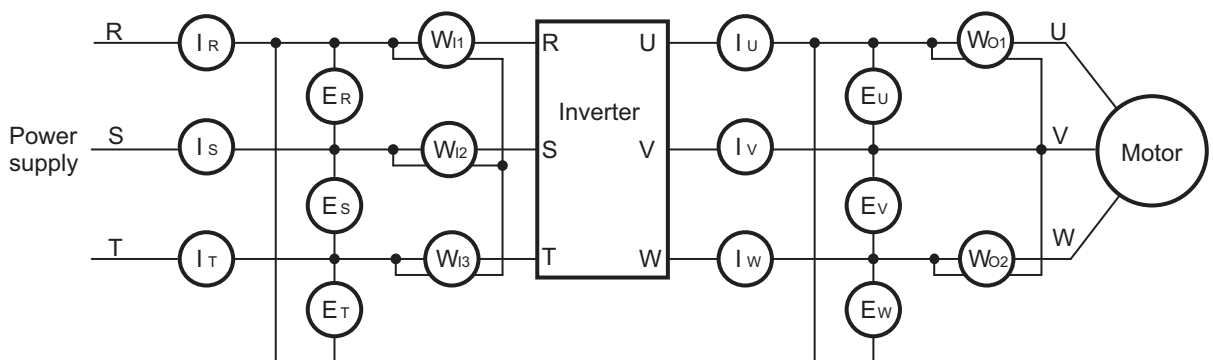
10-1-6 Withstand Voltage Test

Do not conduct a withstand voltage test on any part of the inverter.






Doing this test is dangerous because it may cause damage to or deterioration of the parts inside the inverter.

10-1-7 I/O Voltage/Current/Electric Power Measurement Method

Measuring instruments commonly used for input/output voltage, current, or electric power measurement are shown below.



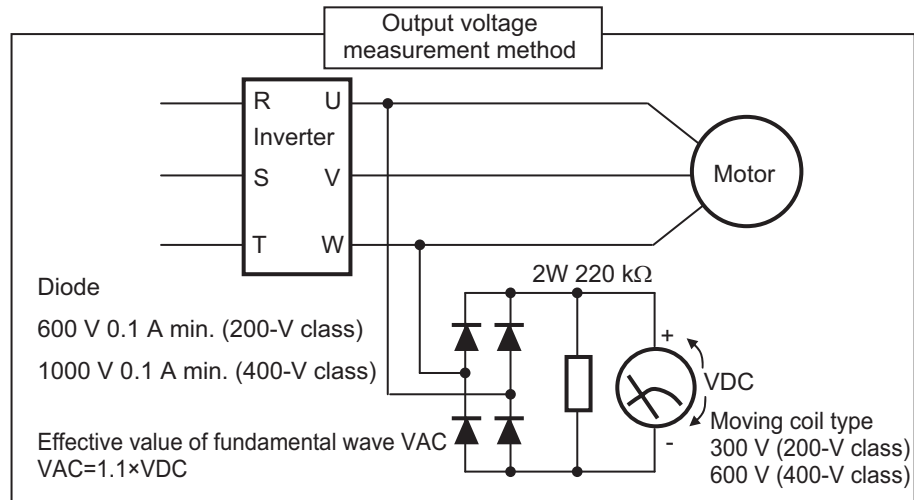
Measurement item	Measurement point	Measuring instrument	Remarks	Measurement value reference
Power supply voltage E_{IN}	Between L1/R and L2/S (E_R) Between L2/S and L3/T (E_S) Between L3/T and L1/R (E_T)	 Moving-iron voltmeter or rectifier type voltmeter	All effective values	200-V class: 200 to 240 V, 50/60 Hz 400-V class: 380 to 480 V, 50/60 Hz

Measurement item	Measurement point	Measuring instrument	Remarks	Measurement value reference
Power supply current I_{IN}	Current in L1/R, L2/S, L3/T (I_R), (I_S), (I_T)	 Moving iron ammeter	All effective values	When input current is not balanced: $I_{IN} = (I_R + I_S + I_T) / 3$
Input electric power W_{IN}	Between L1/R and L2/S (W_{I1}) Between L2/S and L3/T (W_{I2}) Between L3/T and L1/R (W_{I3})	 Electrodynamic wattmeter	All effective values	Three-wattmeter method $(W_{I1}) + (W_{I2}) + (W_{I3})$
Input power factor Pf_{IN}	Calculate this from the measured values of power supply voltage E_{IN} , power supply current I_{IN} , and input electric power W_{IN} . $Pf_{IN} = \frac{W_{IN}}{\sqrt{3} \cdot E_{IN} \cdot I_{IN}} \times 100 [\%]$			-
Output voltage E_{OUT}	Between U and V (E_U) Between V and W (E_V) Between W and U (E_W)	 Refer to the figure on the next page, or rectifier type voltmeter.	Effective value of fundamental wave	-
Output current I_{OUT}	Current of U, V and W (I_U), (I_V), (I_W)	 Moving iron ammeter	All effective values	-
Output power W_{OUT}	Between U and V (W_{O1}) Between V and W (W_{O2})	 Electrodynamic wattmeter	All effective values	Two-wattmeter method (or three-wattmeter method) (W_{O1}) + (W_{O2})
Output power factor Pf_{OUT}	Calculate this from the measured values of output voltage E_{OUT} , output current I_{OUT} , and output electric power W_{OUT} . $Pf_{OUT} = \frac{W_{OUT}}{\sqrt{3} \cdot E_{OUT} \cdot I_{OUT}} \times 100 [\%]$			-

Note 1. For the output voltage, use a measuring instrument that shows effective values of fundamental wave.

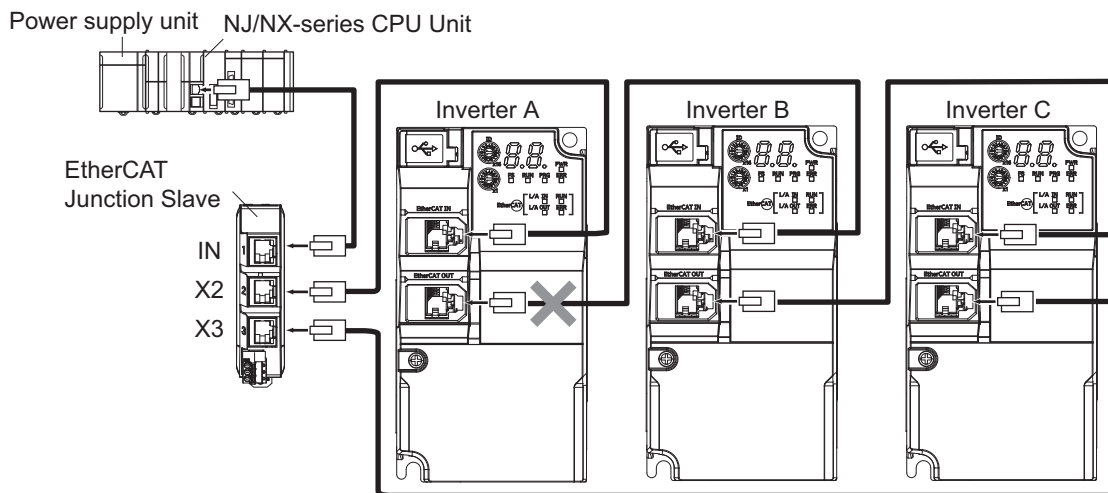
For the current and the electric power, use a measuring instrument that shows all effective values.

Note 2. The output waveform of the inverter has a margin of error, especially at low frequencies, because it was generated under PWM control. Note that many general-purpose testers may not be usable due to noise.



10-1-8 Method for Ring Disconnection Maintenance and Inspection

This section takes the following example of a configuration in which the ring is disconnected between Inverter A and Inverter B, and describes how to perform inspection and how to replace the faulty inverter.



- 1** Identify where the ring is disconnected.
 - With a tool such as support software, find the node address of the inverter breaking the ring. For the NJ/NX-series Controller, check the `_EC_RingBreakNodeAdr` system-defined variable that will provide you with the node address of "Inverter A". Check that the L/A OUT indicator of "Inverter A" and the L/A IN indicator of "Inverter B" are OFF.
- 2** Reconnect the EtherCAT communications cable between "Inverter A" and "Inverter B".
 - Stop operation and turn OFF the power supply to the EtherCAT master and to the slaves.
 - After the 7-segment LED displays of Inverter A and Inverter B turn OFF, reconnect the EtherCAT communications cable, and then turn ON the power supply to "Inverter A" and "Inverter B".
 - If the L/A OUT indicator of "Inverter A" and the L/A IN indicator of "Inverter B" are ON, the ring disconnection status has been fixed.

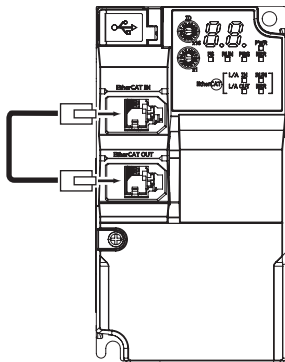
- If the L/A IN and L/A OUT indicators are OFF, the ring disconnection status has not been fixed yet. Move on to the next step.

3 Replace the relevant cable with a new EtherCAT communications cable.

- Replace the EtherCAT communications cable between "Inverter A" and "Inverter B" with a new cable. To avoid incorrect wiring, do not remove any other cable.
- If the L/A OUT indicator of "Inverter A" and the L/A IN indicator of "Inverter B" are ON or flashing, the ring disconnection status has been resolved.
- If the L/A IN and L/A OUT indicators are OFF, Inverter A or B is faulty. Move on to the next step.

4 Identify a faulty inverter.

- As in the following figure, connect one EtherCAT communications cable to the ECAT IN and ECAT OUT connectors on "Inverter A". If the L/A IN and L/A OUT indicators remain OFF, "Inverter A" is faulty.
- In the same way, connect one EtherCAT communications cable to the ECAT IN and ECAT OUT connectors on "Inverter B". If the L/A IN and L/A OUT indicators remain OFF, "Inverter B" is faulty.



5 Replace the identified faulty inverter.

- Turn OFF the power supply, and replace the inverter.

6 Turn ON the power supply to the devices, and then establish EtherCAT communications.

- Connect the EtherCAT communications cables correctly, and turn ON the power supply to the EtherCAT master and to the slaves.



Appendices

This section provides explanation of the profile that is used to control the inverter, lists of objects, Sysmac error status codes, derating tables, capacitor life curves, and an overview of inverter selection.

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A-1 CiA 402 Drive Profile

This section describes the profile that is used to control the inverter.

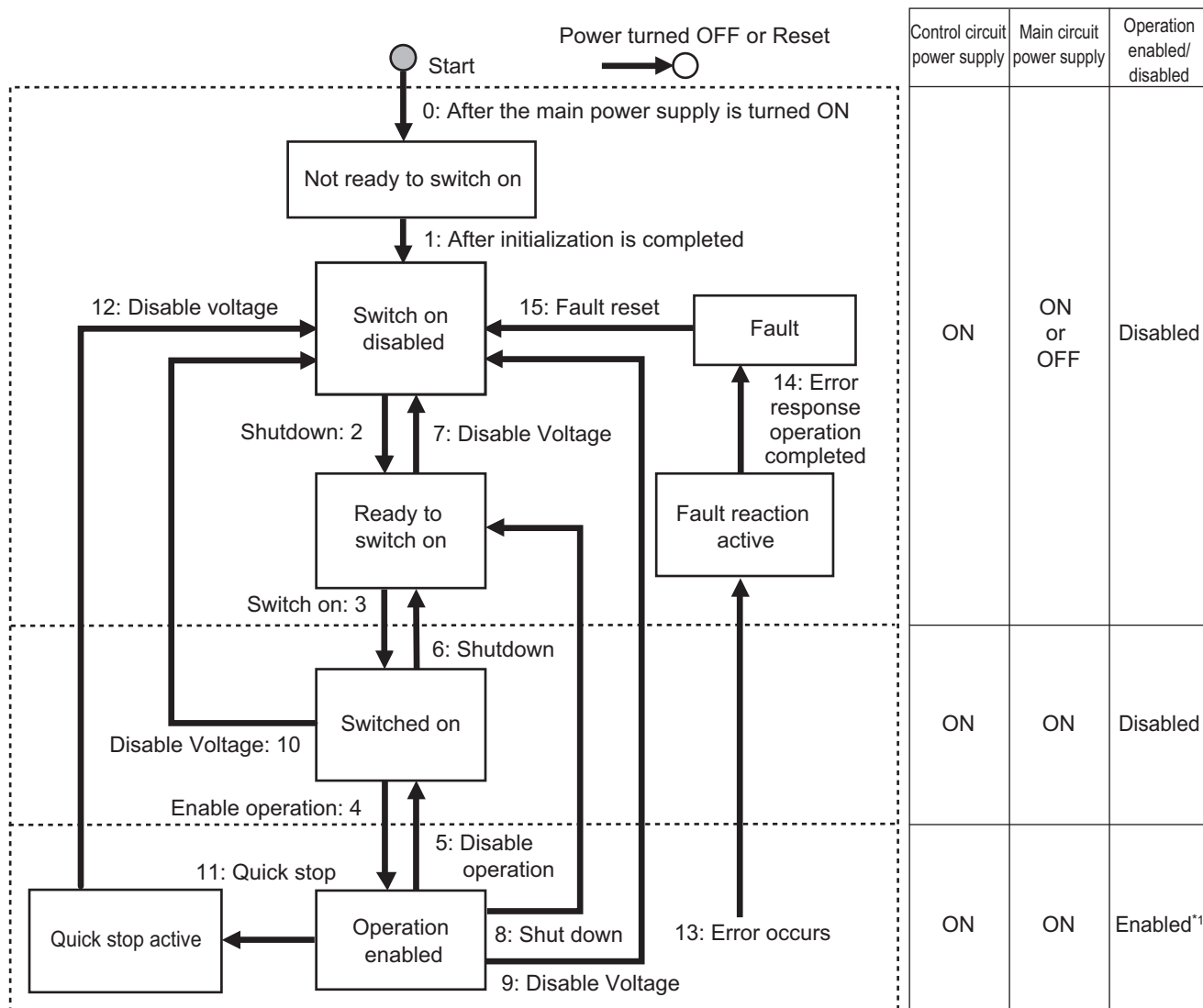
A

A-1-1 Controlling the State Machine of the Inverter

The state of M1-series Inverters with Built-in EtherCAT Communications is called "PDS state". The PDS state is controlled by **Controlword** (6040 hex). Each PDS state is shown in **Statusword** (6041 hex).

State Machine

The state of an M1-series Inverter changes as shown below. Each □ indicates a state, while numbers "2 to 10" and "15" indicate the state control commands. Refer to *State Descriptions* on page A-4 for details on the states, and *State Control Commands* on page A-4 for details on the state control.



*1. The state may be Operation disabled when the command speed is less than the 1st Starting Frequency (F23) or free-run state is set by FRS terminal or FsoE STO command input.

State Descriptions

State	Description
Not ready to switch on	The main power supply is turned ON and initialization is in progress.
Switch on disabled	Initialization is completed. Inverter parameters can be set.
Ready to switch on	The main circuit power supply can be turned ON. Inverter parameters can be set.
Switched on	The main circuit power supply is ON. (NUV ON) Inverter parameters can be set.
Operation enabled	Reference input is possible. Inverter parameters can be set (only for parameters that can be changed during operation).
Quick stop active	The inverter is in a forced stop state. Inverter parameters can be set.
Fault reaction active	There was an error in the inverter and the cause determination is in progress. Inverter parameters can be set.
Fault	There was an error in the inverter. Inverter parameters can be set.

If the state changes from “Operation enabled” to other states, the inverter decelerates and then stops. The stop operation for each state is as shown below.

State	Stop operation
Switch on disabled, Ready to switch on	Set by Shut down option code (605B hex)*1
Switched on	Set by Disable operation option code (605C hex)*1
Fault reaction active, Fault	Free run stop

*1. 2: Fixed to deceleration stop

State Control Commands

State is controlled by combining the bits in **Controlword** (6040 hex) as shown in the following table. fr = fault reset, eo = enable operation, qs = quick stop, ev = enable voltage, so = switch on

Command	Controlword bit					Move to
	Bit 7 fr	Bit 3 eo	Bit 2 qs	Bit 1 ev	Bit 0 so	
Shutdown	Disabled	Disabled	1	1	0	2, 6, 8
Switch on	Disabled	0	1	1	1	3
Switch on + enable operation	Disabled	1	1	1	1	3 + 4*1
Disable voltage	Disabled	Disabled	Disabled	0	Disabled	7, 9, 10

Command	Controlword bit					Move to
	Bit 7 fr	Bit 3 eo	Bit 2 qs	Bit 1 ev	Bit 0 so	
Disable operation	Disabled	0	1	1	1	5
Enable operation	Disabled	1	1	1	1	4
Quick stop	Disabled	1	0	1	1	11
Disable voltage (During quick stop active)	Disabled	0	Disabled	0	0	12
Fault reset	0 → 1*2	Disabled	Disabled	Disabled	Disabled	15

*1. The state automatically changes to Operation enabled state after Switched on state.

*2. Bit 7: Operation when the Fault Reset bit turns ON

Fault state : Errors are reset and the inverter returns to the Switch on disabled state.

State other than Fault state : The state will change according to command bits 0 to 3.

After you execute a Fault reset by bit 7, return it to "0" before issuing the next command.

State Coding

State is indicated by the combination of bits in **Statusword** (6041 hex), as shown in the following table.

Status	Bit 6 sod*1	Bit 5 qs*2	Bit 4 ve*3	Bit 3 f*4	Bit 2 oe*5	Bit 1 so*6	Bit 0 rtso*7
Not ready to switch on	0	0	0	0	0	0	0
Switch on disabled	1	Disabled	Disabled	0	0	0	0
Ready to switch on	0	1	Disabled	0	0	0	1
Switched on	0	1	Disabled	0	0	1	1
Operation enabled	0	1	Disabled	0	1	1	1
Quick stop active	0	0	Disabled	0	1	1	1
Fault reaction active	0	Disabled	Disabled	1	1	1	1
Fault	0	Disabled	Disabled	1	0	0	0

*1. sod = switch on disabled

*2. qs = quick stop

*3. ve = voltage enabled

*4. f = fault

*5. oe = operation enabled

*6. so = switched on

*7. rtso = ready to switch on

A-1-2 Modes of Operation

The inverter supports the following operation mode.

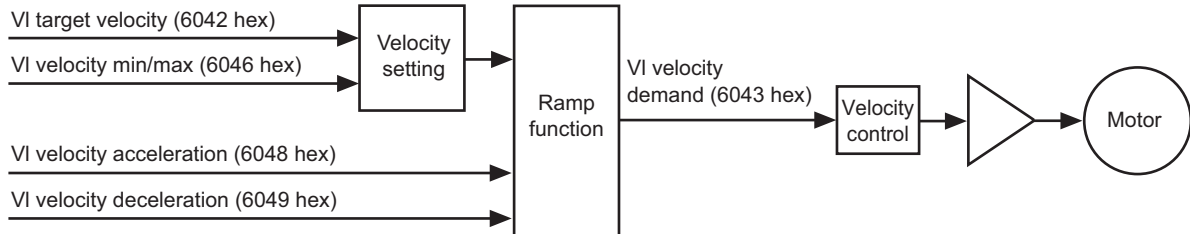
vl: Velocity mode

To set the operation mode, use **Modes of operation** (6060 hex). The operation mode is displayed in **Modes of operation display** (6061 hex).

You can check the operation mode supported by the inverter with **Supported drive modes** (6502 hex).

A-1-3 Velocity Mode Specifications

You can control the output velocity of the inverter.



- Related Objects

Index	Name	Description
6040 hex	Controlword	Controls the inverter.
6042 hex	VI target velocity	Sets the velocity of the inverter.
6046 hex	VI velocity min max amount	Sets the maximum and minimum velocity that can be output.
6048 hex	VI velocity acceleration	Sets the acceleration time.
6049 hex	VI velocity deceleration	Sets the deceleration time.
6041 hex	Statusword	Gives the status of the inverter.
6043 hex	VI velocity demand	Gives the operation velocity.
6044 hex	VI velocity actual value	Gives the output velocity.

For details, refer to *A-2-8 Inverter Profile Objects* on page A-27.

A-2 CoE Objects

This section explains the CoE objects implemented in M1-series Inverters.

A-2-1 Object Dictionary Area

CAN application protocol over EtherCAT (CoE) uses the object dictionary as its base. All objects are assigned four-digit hexadecimal indexes in the areas shown in the following table.

Index (hex)	Area	Description	Reference
0000 to 0FFF	Data Type Area	Definitions of data types.	---
1000 to 1FFF	CoE Communications Area	Definitions of objects that can be used by all servers for designated communications.	A-2-4 <i>Communication Objects</i> on page A-9
2000 to 2FFF	Manufacturer Specific Area 1	Objects with common definitions for all OMRON products.	A-2-7 <i>Manufacturer Specific Objects 1</i> on page A-24
3000 to 5FFF	Manufacturer Specific Area 2	Objects with common definitions for all M1-series Inverters (inverter parameters).	A-4 <i>Lists of Manufacturer Specific Objects 2 (Inverter Parameters)</i> on page A-47
6000 to DFFF	Device Profile Area	Objects defined in the inverter's CiA402 drive profile.	A-2-8 <i>Inverter Profile Objects</i> on page A-27
E000 to EFFF	Device Profile Area 2	Objects defined in the inverter's FSoE CiA402 slave connection.	A-2-9 <i>Safety Function Objects</i> on page A-35
F000 to FFFF	Device Area	Objects defined in a device.	

A-2-2 Data Type

Data types shown in the following table are used in this profile.

Data type	Code	Size	Range
Boolean	BOOL	1 bit	0 to 1
Unsigned 8	U8	1 byte	0 to 255
Unsigned 16	U16	2 bytes	0 to 65,535
Unsigned 32	U32	4 bytes	0 to 4,294,967,295
Unsigned 64	U64	8 bytes	0 to 18,446,744,073,709,551,615
Integer 8	INT8	1 byte	-128 to 127
Integer 16	INT16	2 bytes	-32,768 to 32,767
Integer 32	INT32	4 bytes	-2,147,483,648 to 2,147,483,647
Visible string	VS	---	---
Octet string	OS	---	---

A-2-3 Object Description Format

In this manual, objects are described in the following format.

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Data attribute	Size	Access	PDO map	Complete access	Modes of operation
<Index>	<Subindex>	<Object name>	<Range>	<Unit>	<Default>	<Attribute>	<Size>	<Access>	<PDO map>	<Complete access>	<Modes of operation>

Data is indicated in pointed brackets <>. Details on data are as follows.

Item	Description
Index	Object index given by a four-digit hexadecimal number.
Subindex	Object subindex given by a two-digit hexadecimal number.
Object name	The object name. For a subindex, the subindex name is given.
Setting range	Indicates the range of data that can be set for a writable object.
Unit	Physical units.
Default setting	Default value set before shipment.
Data attribute	The timing when a change in the contents is updated for a writable object. A: Always updated D: Possible to change only when the EtherCAT communications state is Pre-Operational E: Updated in the Operation enabled state (Not applicable to M1-series Inverters) R: Updated after the power is reset (Not applicable to M1-series Inverters) -: Write prohibited
Size	Gives the object size.
Access	Indicates whether the object is to read only, or read and write. RO: Read only RW: Read and write (Saved in non-volatile memory) W: Read and write (Not saved in non-volatile memory)
PDO map	Indicates the PDO mapping attribute. RxPDO: Reception PDOs can be mapped TxPDO: Transmission PDOs can be mapped -: PDOs cannot be mapped
Complete access	Indicates whether Complete access is allowed or not. *1
Modes of operation	The profile mode in which the object is enabled. -: Independent of the Modes of operation vl: Velocity mode

*1. This is a mechanism to read and write all objects. All subindexes of an object can be read and written at once.

A-2-4 Communication Objects

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Data attribute	Size	Access	PDO map	Complete access	Modes of operation
1000	---	Device Type	---	---	00090192 hex	---	4 bytes (U32)	RO	---	Not possible	---

- Gives the CoE device profile number.

• Description of Set Values

Bit	Name	Description
0 to 15	Device profile number	402 (192 hex): Drive Profile
16 to 23	Type	09: FSoE general-purpose inverter
25 to 31	Mode	0: Manufacturer specific

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Data attribute	Size	Access	PDO map	Complete access	Modes of operation
1001	---	Error Register	---	---	0	---	1 byte (U8)	RO	---	Not possible	---

- Gives the error type that has occurred in the inverter.

• Description of Set Values

Bit	Description	Bit	Description
0	Generic error	4	Communication error (unsupported)*1
1	Current error (unsupported)	5	Device profile specific error (unsupported)
2	Voltage error (unsupported)	6	Reserved
3	Temperature error (unsupported)	7	Manufacturer specific error (unsupported)

*1. In M1-series Inverters, bit 0 turns ON when an alarm occurs. It does not turn ON for a light alarm or EtherCAT communication error.

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Data attribute	Size	Access	PDO map	Complete access	Modes of operation
1008	---	Manufacturer Device Name	---	---	*1	---	20 bytes (VS)	RO	---	Not possible	---

*1. The following table shows the default settings. It gives the inverter models.

Specifications	Model	
3-phase 200 VAC	0.1 kW	3G3M1-A2001-ECT
	0.2 kW	3G3M1-A2002-ECT
	0.4 kW	3G3M1-A2004-ECT
	0.75 kW	3G3M1-A2007-ECT
	1.5 kW	3G3M1-A2015-ECT
	2.2 kW	3G3M1-A2022-ECT
	3.7 kW	3G3M1-A2037-ECT
	5.5 kW	3G3M1-A2055-ECT
	7.5 kW	3G3M1-A2075-ECT
	11 kW	3G3M1-A2110-ECT
	15 kW	3G3M1-A2150-ECT
Single-phase 200 VAC	0.1 kW	3G3M1-AB001-ECT
	0.2 kW	3G3M1-AB002-ECT
	0.4 kW	3G3M1-AB004-ECT
	0.75 kW	3G3M1-AB007-ECT
	1.5 kW	3G3M1-AB015-ECT
	2.2 kW	3G3M1-AB022-ECT
	3.7 kW	3G3M1-AB037-ECT
	3-phase 400 VAC	0.4 kW
0.75 kW		3G3M1-A4007-ECT
1.5 kW		3G3M1-A4015-ECT
2.2 kW		3G3M1-A4022-ECT
3 kW		3G3M1-A4030-ECT
4 kW		3G3M1-A4040-ECT
5.5 kW		3G3M1-A4055-ECT
7.5 kW		3G3M1-A4075-ECT
11 kW		3G3M1-A4110-ECT
15 kW		3G3M1-A4150-ECT
18.5 kW		3G3M1-A4185-ECT
22 kW	3G3M1-A4220-ECT	

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Data attribute	Size	Access	PDO map	Complete access	Modes of operation
1009	---	Manufacturer Hardware Version	---	---	---	---	20 bytes (VS)	RO	---	Not possible	---

- Gives the version of the inverter hardware.

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Data attribute	Size	Access	PDO map	Complete access	Modes of operation
100A	---	Manufacturer Software Version	---	---	---	---	20 bytes (VS)	RO	---	Not possible	---

- Gives the version of the inverter software.

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Data attribute	Size	Access	PDO map	Complete access	Modes of operation
1010	---	Store Parameters	---	---	---	---	---	---	---	Possible	---
	00	Number of entries	---	---	01 hex	---	1 byte (U8)	RO	---	---	---
	01	Store Parameters	00000000 to FFFFFFFF F hex	---	00000001 hex	A	4 bytes (U32)	W	---	---	---

- Parameters with RW access are stored in the inverter non-volatile memory.
- Storing is executed only when a specific value is written to subindex 01 hex. This prevents parameter values from being stored accidentally.
- The specific value means "save".

MSB		LSB	
e	v	a	s
65 hex	76 hex	61 hex	73 hex

- A value of 00000001 hex (command valid) is given when reading.
- If a value other than 65766173 hex is written, an ABORT code for SDO communications will be returned.
- Writing to the non-volatile memory may take up to 10 seconds. This is when all objects are changed.
- There is a limit to the number of times to write to the non-volatile memory.

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Data attribute	Size	Access	PDO map	Complete access	Modes of operation
1011	---	Restore Default Parameters	---	---	---	---	---	---	---	Not possible	---
	00	Number of entries	---	---	01 hex	---	1 byte (U8)	RO	---	---	---
	01	Restore Default Parameters	00000000 to FFFFFFFF F hex	---	00000001 hex	A	4 bytes (U32)	W	---	---	---

- Subindex 01 hex **Restore Default Parameters** can restore the objects with RW access to their default values by the writing of 64616F6C hex (load). The restored objects are stored in the non-volatile memory.
- If any of the following operation is attempted, an ABORT code for SDO communications will be returned.
 - a) Writing other than the specific value.
 - b) Writing in the Operation enabled state.
- Writing to the non-volatile memory may take up to 10 seconds.
- There is a limit to the number of times to write to the non-volatile memory.

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Data attribute	Size	Access	PDO map	Complete access	Modes of operation
1018	---	Identity Object	---	---	---	---	---	---	---	Possible	---
	00	Number of entries	---	---	04 hex	---	1 byte (U8)	RO	---	---	---
	01	Vendor ID	---	---	00000083 hex	---	4 bytes (U32)	RO	---	---	---
	02	Product Code	---	---	Refer to the table.	---	4 bytes (U32)	RO	---	---	---
	03	Revision Number	---	---	Refer to the table.	---	4 bytes (U32)	RO	---	---	---
	04	Serial Number	---	---	Refer to the description.	---	4 bytes (U32)	RO	---	---	---

- This object gives the device information.
- Subindex 01 hex **Vendor ID** gives the manufacturer identifier.
- Subindex 02 hex **Product Code** gives the code specific to each model.

Specifications		Model	Product Code
3-phase 200 VAC	0.1 kW	3G3M1-A2001-ECT	00000164 hex
	0.2 kW	3G3M1-A2002-ECT	00000165 hex
	0.4 kW	3G3M1-A2004-ECT	00000166 hex
	0.75 kW	3G3M1-A2007-ECT	00000167 hex
	1.5 kW	3G3M1-A2015-ECT	00000168 hex
	2.2 kW	3G3M1-A2022-ECT	00000169 hex
	3.7 kW	3G3M1-A2037-ECT	0000016A hex
	5.5 kW	3G3M1-A2055-ECT	0000016B hex
	7.5 kW	3G3M1-A2075-ECT	0000016C hex
	11 kW	3G3M1-A2110-ECT	0000016D hex
	15 kW	3G3M1-A2150-ECT	0000016E hex
Single-phase 200 VAC	1.85 kW	3G3M1-A2185-ECT	0000016F hex
	0.1 kW	3G3M1-AB001-ECT	00000151 hex
	0.2 kW	3G3M1-AB002-ECT	00000152 hex
	0.4 kW	3G3M1-AB004-ECT	00000153 hex
	0.75 kW	3G3M1-AB007-ECT	00000154 hex
	1.5 kW	3G3M1-AB015-ECT	00000155 hex
	2.2 kW	3G3M1-AB022-ECT	00000156 hex
	3.7 kW	3G3M1-AB037-ECT	00000157 hex
3-phase 400 VAC	0.4 kW	3G3M1-A4004-ECT	00000158 hex
	0.75 kW	3G3M1-A4007-ECT	00000159 hex
	1.5 kW	3G3M1-A4015-ECT	0000015A hex
	2.2 kW	3G3M1-A4022-ECT	0000015B hex
	3 kW	3G3M1-A4030-ECT	0000015C hex
	4 kW	3G3M1-A4040-ECT	0000015D hex
	5.5 kW	3G3M1-A4055-ECT	0000015E hex
	7.5 kW	3G3M1-A4075-ECT	0000015F hex
	11 kW	3G3M1-A4110-ECT	00000160 hex
	15 kW	3G3M1-A4150-ECT	00000161 hex
	18.5 kW	3G3M1-A4185-ECT	00000162 hex
22 kW	3G3M1-A4220-ECT	00000163 hex	

- Subindex 03 hex **Revision Number** gives the device revision number.

Bit	Description
0 to 15	Minor revision number
16 to 31	Major revision number

- Subindex 04 hex **Serial Number** gives the product serial number.

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Data attribute	Size	Access	PDO map	Complete access	Modes of operation
10E0	---	Node Address Reload	---	---	---	---	---	---	---	Not possible	---
	00	Number of entries	---	---	02 hex	---	1 byte (U8)	RO	---	---	---
	01	Configured Station Alias value	0000 to FFFF hex	---	0	A	2 bytes (U16)	W	---	---	---
	03	ID-Selector validation	0000 to FFFF hex	---	0	A	2 bytes (U16)	W	---	---	---

- This object sets the node address reload function.
- Subindex 01 hex **Configured Station Alias value** is used when the node address is set and updated from the master.
- Subindex 03 hex **ID-Selector validation** is used when the node address is set and updated from the rotary switch.

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Data attribute	Size	Access	PDO map	Complete access	Modes of operation
10F3	---	Diagnosis History	---	---	---	---	---	---	---	Possible	---
	00	Number of entries	---	---	0D hex	---	1 byte (U8)	RO	---	---	---
	01	Maximum Messages	---	---	08 hex	---	1 byte (U8)	RO	---	---	---
	02	Newest Message	---	---	00 hex	---	1 byte (U8)	RO	---	---	---
	03	Newest Acknowledged Message	00 to FF hex	---	00 hex	A	1 byte (U8)	W	---	---	---
	04	New Messages Available	---	---	---	---	1 bit (BOOL)	RO	TxPDO	---	---
	05	Flags	0000 to 003F hex	---	0000 hex	A	2 bytes (U16)	W	---	---	---
	06 to 0D	Diagnosis Message 1 to 8	---	---	---	---	30 bytes (OS)	RO	---	---	---

- This object gives up to 8 Diagnosis Messages. It also enables or disables emergency messages.
- Subindex 01 hex **Maximum Messages** gives the number of Diagnosis Messages.
- Subindex 02 hex **Newest Message** gives the subindex where the latest Diagnosis Message is saved.
- Subindex 03 hex **Newest Acknowledged Message** is used to execute the message clear.

Value	Description
0	The slave will clear all messages.
1 to 5	An abort code is returned.

Value	Description
06 to 0D hex	The written value can be read.
0E to FF hex	An abort code is returned.

- Subindex 04 hex **New Messages Available** gives whether there are new messages to be read.

Value of subindex 04 hex	Description
0	No new message to be read.
1	New messages to be read are available.

- Subindex 05 hex **Flags** sets whether or not to notify the Diagnosis History as an emergency message. It is set to 0000 hex (not notify) when power is turned ON. Write 0001 hex to send emergency messages.
- Subindexes 06 to 0D hex **Diagnosis Message 1 to Diagnosis Message 8** give the Diagnosis History. Diagnosis History is saved in Diagnosis Message 1 to 8 in ascending order. When 8 messages are saved, the 9th message is saved in Diagnosis Message 1 and the sequence starts again. The format of the Diagnosis History is shown below.

Items of subindex 06 to 0D hex	Data type	Details	
Diag Code	UINT32	Bit 16 to 31: Emergency Error Code (Object 603F hex) Bit 0 to 15: E800 hex	
Flags	UINT16	Bit 8 to 15: 01 hex (number of parameters) Bit 4 to 7: 02 hex (time stamp is based on time distribution)	
		Bit 0 to 3: Type	0: Info message 1: Warning message 2: Alarm
Text ID	UINT16	0000 hex: No text ID	
Time Stamp	UINT64	0: No time stamp Not 0: Time information (Contents of object 10F9-01 hex at occurrence of event)	
Flags Parameter 1	UINT16	Bit 12 to 15: 1 hex Bit 0 to 11: 00C hex (size of parameter 1)	
Parameter 1	ARRAY (0.4) OF BYTE	Contents of Sysmac Minor Fault (2004 hex) and Sysmac Observation (2003 hex)	

The time stamp is recorded based on the contents of 10F9-01 hex at the time of occurrence of the event.

If the time information cannot be obtained from 10F9-01 hex, the time stamp on the Sysmac Studio will be displayed as *1970/1/1 0:00:00*. The time stamp of a Diagnosis Message that is saved before the time information is obtained from 10F9-01 hex will also be displayed as *1970/1/1 0:00:00*.

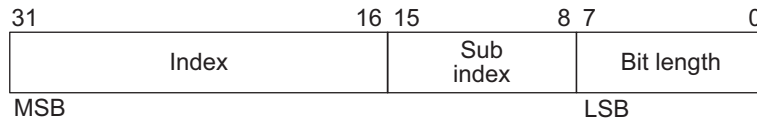
Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Data attribute	Size	Access	PDO map	Complete access	Modes of operation
10F9	---	Present Time for Event Log	---	---	---	---	---	---	---	Possible	---
	00	Number of entries	---	---	01 hex	---	1 byte (U8)	RO	---	---	---
	01	Present Time for Event Log	0 to 18,446,744,073,709,551,615	---	0	A	8 bytes (U64)	W	---	---	---

- Subindex 01 hex **Present Time for Event Log** stores the time information that is distributed by the EtherCAT master, and uses it for time stamp of the event log, i.e., Diagnosis Message.

A-2-5 PDO Mapping Objects

Indexes 1600 to 17FF hex are used for receive PDO mapping and indexes 1A00 to 1BFF hex are used for transmit PDO mapping.

Subindexes after subindex 01 hex provide information about the mapped application object.



- Bit 16 to 31 : Index of the mapped object
- Bit 8 to 15 : Subindex of the mapped object
- Bit 0 to 7 : Bit length of the mapped object
For example, for 32 bits, 20 hex is given.

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Data attribute	Size	Access	PDO map	Complete access	Modes of operation
1600	---	1st receive PDO Mapping	---	---	---	---	---	---	---	Possible	---
	00	Number of objects in this PDO	00 to 0A hex	---	00 hex	D	1 byte (U8)	W	---	---	---
	01	1st Output Object to be mapped	---	---	00000000 hex	D	4 bytes (U32)	W	---	---	---
	02	2nd Output Object to be mapped	---	---	00000000 hex	D	4 bytes (U32)	W	---	---	---
	03	3rd Output Object to be mapped	---	---	00000000 hex	D	4 bytes (U32)	W	---	---	---
	04	4th Output Object to be mapped	---	---	00000000 hex	D	4 bytes (U32)	W	---	---	---
	05	5th Output Object to be mapped	---	---	00000000 hex	D	4 bytes (U32)	W	---	---	---
	06	6th Output Object to be mapped	---	---	00000000 hex	D	4 bytes (U32)	W	---	---	---
	07	7th Output Object to be mapped	---	---	00000000 hex	D	4 bytes (U32)	W	---	---	---
	08	8th Output Object to be mapped	---	---	00000000 hex	D	4 bytes (U32)	W	---	---	---
	09	9th Output Object to be mapped	---	---	00000000 hex	D	4 bytes (U32)	W	---	---	---
	0A	10th Output Object to be mapped	---	---	00000000 hex	D	4 bytes (U32)	W	---	---	---

- You can change these objects only when the EtherCAT communications state is Pre-Operational.
- The mapping you changed is not saved in the non-volatile memory. To use the mapping other than the default setting, specify objects each time you turn ON the power supply.
- You can map up to 10 objects in a PDO mapping. If you attempt to map 11 or more objects, an RxPDO Setting Error (7-segment display: Et, **Error code** (603F hex): 6341 hex) will occur.
- If the same object is mapped more than once, the value of the last object is used.
- If any of the following operation is attempted, an ABORT code for SDO communications will be returned.
 - a) Writing when the EtherCAT communications state is Safe-Operational or Operational
 - b) Writing with non-existent objects specified
 - c) Writing with incorrect object size specified
 - d) Writing with objects that cannot be mapped in the PDO mapping specified
- Refer to the object list (A-3 Object List on page A-39) and parameter lists (A-4 Lists of Manufacturer Specific Objects 2 (Inverter Parameters) on page A-47) for objects that can be mapped to receive PDOs.

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Data attribute	Size	Access	PDO map	Complete access	Modes of operation
1700	---	257th receive PDO Mapping	---	---	---	---	---	---	---	Possible	---
	00	Number of entries	---	---	02 hex	---	1 byte (U8)	RO	---	---	---
	01	Mapping entry 1	---	---	60400010 hex	---	4 bytes (U32)	RO	---	---	---
	02	Mapping entry 2	---	---	60420010 hex	---	4 bytes (U32)	RO	---	---	---

- This mapping is for applications that use the Velocity mode of the CiA402 drive profile.
- The following objects are mapped.

Controlword (6040 hex) and **vl target velocity** (6042 hex)

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Data attribute	Size	Access	PDO map	Complete access	Modes of operation
1701	---	258th receive PDO Mapping	---	---	---	---	---	---	---	Possible	---
	00	Number of objects in this PDO	---	---	02 hex	---	1 byte (U8)	RO	---	---	---
	01	1st Output Object to be mapped	---	---	50000010 hex	---	4 bytes (U32)	RO	---	---	---
	02	2nd Output Object to be mapped	---	---	50100010 hex	---	4 bytes (U32)	RO	---	---	---

- This is the PDO mapping when a fixed profile is used.
- The following objects are mapped.

Command (5000 hex) and **Frequency Reference** (5010 hex)

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Data attribute	Size	Access	PDO map	Complete access	Modes of operation
1710	---	273th receive PDO Mapping	---	---	---	---	---	---	---	Possible	---
	00	Number of objects in this PDO	---	---	13 hex	---	1 byte (U8)	RO	---	---	---
	01	1st Output Object to be mapped	---	---	E7000108 hex	---	4 bytes (U32)	RO	---	---	---
	02	2nd Output Object to be mapped	---	---	66400001 hex	---	4 bytes (U32)	RO	---	---	---
	03 to 08	3rd-8th Output Object to be mapped	---	---	00000001 hex	---	4 bytes (U32)	RO	---	---	---
	09	9th Output Object to be mapped	---	---	66320001 hex	---	4 bytes (U32)	RO	---	---	---
	0A to 11	10th-17th Output Object to be mapped	---	---	00000001 hex	---	4 bytes (U32)	RO	---	---	---
	12	18th Output Object to be mapped	---	---	E7000310 hex	---	4 bytes (U32)	RO	---	---	---
	13	19th Output Object to be mapped	---	---	E7000210 hex	---	4 bytes (U32)	RO	---	---	---

- This PDO Mapping is required when the STO Function via EtherCAT Communications is used.

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Data attribute	Size	Access	PDO map	Complete access	Modes of operation
1A00	---	1st transmit PDO Mapping	---	---	---	---	---	---	---	Possible	---
	00	Number of objects in this PDO	00 to 0A hex	---	00 hex	D	1 byte (U8)	W	---	---	---
	01	1st Output Object to be mapped	---	---	00000000 hex	D	4 bytes (U32)	W	---	---	---
	02	2nd Output Object to be mapped	---	---	00000000 hex	D	4 bytes (U32)	W	---	---	---
	03	3rd Input Object to be mapped	---	---	00000000 hex	D	4 bytes (U32)	W	---	---	---
	04	4th Input Object to be mapped	---	---	00000000 hex	D	4 bytes (U32)	W	---	---	---
	05	5th Input Object to be mapped	---	---	00000000 hex	D	4 bytes (U32)	W	---	---	---
	06	6th Input Object to be mapped	---	---	00000000 hex	D	4 bytes (U32)	W	---	---	---
	07	7th Input Object to be mapped	---	---	00000000 hex	D	4 bytes (U32)	W	---	---	---
	08	8th Output Object to be mapped	---	---	00000000 hex	D	4 bytes (U32)	W	---	---	---
	09	9th Input Object to be mapped	---	---	00000000 hex	D	4 bytes (U32)	W	---	---	---
	0A	10th Input Object to be mapped	---	---	00000000 hex	D	4 bytes (U32)	W	---	---	---

- You can change these objects only when the EtherCAT communications state is Pre-Operational.
- The mapping you changed is not saved in the non-volatile memory. To use the mapping other than the default setting, specify objects each time you turn ON the power supply.
- You can map up to 10 objects in a PDO mapping. If you attempt to map 11 or more objects, a TxPDO Setting Error (7-segment display: Et, **Error code** (603F hex): 6341 hex) will occur.
- If the same object is mapped more than once, the value of the last object is used.
- If any of the following operation is attempted, an ABORT code for SDO communications will be returned.
 - a) Writing when the EtherCAT communications state is Safe-Operational or Operational
 - b) Writing with non-existent objects specified
 - c) Writing with incorrect object size specified
 - d) Writing with objects that cannot be mapped in the PDO mapping specified
- Refer to the object list and parameter lists for objects that can be mapped to transmit PDOs.

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Data attribute	Size	Access	PDO map	Complete access	Modes of operation
1B00	---	257th transmit PDO Mapping	---	---	---	---	---	---	---	Possible	---
	00	Number of entries	---	---	02 hex	---	1 byte (U8)	RO	---	---	---
	01	Mapping entry 1	---	---	60410010 hex	---	4 bytes (U32)	RO	---	---	---
	02	Mapping entry 2	---	---	60430010 hex	---	4 bytes (U32)	RO	---	---	---

- This mapping is for applications that use the Velocity mode of the CiA402 drive profile.
- The following objects are mapped.

Statusword (6041 hex) and **vl velocity demand** (6043 hex)

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Data attribute	Size	Access	PDO map	Complete access	Modes of operation
1B01	---	258th transmit PDO Mapping	---	---	---	---	---	---	---	Possible	---
	00	Number of objects in this PDO	---	---	02 hex	---	1 byte (U8)	RO	---	---	---
	01	1st Output Object to be mapped	---	---	51000010 hex	---	4 bytes (U32)	RO	---	---	---
	02	2nd Output Object to be mapped	---	---	51100010 hex	---	4 bytes (U32)	RO	---	---	---

- This is the PDO mapping when a fixed profile is used.
- The following objects are mapped.

Status (5100 hex) and **Output Frequency Monitor** (5110 hex)

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Data attribute	Size	Access	PDO map	Complete access	Modes of operation
1B10	---	273th transmit PDO Mapping	---	---	---	---	---	---	---	Possible	---
	00	Number of objects in this PDO	---	---	13 hex	---	1 byte (U8)	RO	---	---	---
	01	1st Output Object to be mapped	---	---	E6000108 hex	---	4 bytes (U32)	RO	---	---	---
	02	2nd Output Object to be mapped	---	---	66400001 hex	---	4 bytes (U32)	RO	---	---	---
	03 to 08	3rd-8th Input Object to be mapped	---	---	00000001 hex	---	4 bytes (U32)	RO	---	---	---
	09	9th Input Object to be mapped	---	---	66320001 hex	---	4 bytes (U32)	RO	---	---	---
	0A to 10	10th-16th Input Object to be mapped	---	---	00000001 hex	---	4 bytes (U32)	RO	---	---	---
	11	17th Input Object to be mapped	---	---	E6010101 hex	---	4 bytes (U32)	RO	---	---	---
	12	18th Input Object to be mapped	---	---	E6000310 hex	---	4 bytes (U32)	RO	---	---	---
	13	19th Input Object to be mapped	---	---	E6000210 hex	---	4 bytes (U32)	RO	---	---	---

- This PDO Mapping is required when the STO Function via EtherCAT Communications is used.

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Data attribute	Size	Access	PDO map	Complete access	Modes of operation
1BFE	---	511th transmit PDO Mapping	---	---	---	---	---	---	---	Possible	---
	00	Number of entries	---	---	02 hex	---	1 byte (U8)	RO	---	---	---
	01	Mapping entry 1	---	---	10F30401 hex	---	4 bytes (U32)	RO	---	---	---
	02	Mapping entry 2	---	---	00000007 hex	---	4 bytes (U32)	RO	---	---	---

- This transmit mapping notifies the host controller that a new log was registered in the Diagnosis History.
- Diagnosis History - New Messages Available (10F3-04 hex) is mapped.

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Data attribute	Size	Access	PDO map	Complete access	Modes of operation
1BFF	---	512th transmit PDO Mapping	---	---	---	---	---	---	---	Possible	---
	00	Number of objects in this PDO	---	---	01 hex	---	1 byte (U8)	RO	---	---	---
	01	1st Output Object to be mapped	---	---	20020108 hex	---	4 bytes (U32)	RO	---	---	---

- This transmit mapping notifies the host controller that the inverter detected an error.
- Sysmac Error Status (2002-01 hex) is mapped.

A-2-6 Sync Manager Communication Objects

Objects 1C00 to 1C33 hex set how to use the EtherCAT communications memory.

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Data attribute	Size	Access	PDO map	Complete access	Modes of operation
1C00	---	Sync Manager Communication Type	---	---	---	---	---	---	---	Possible	---
	00	Number of used Sync Manager channels	---	---	04 hex	---	1 byte (U8)	RO	---	---	---
	01	Communication Type Sync Manager 0	---	---	01 hex	---	1 byte (U8)	RO	---	---	---
	02	Communication Type Sync Manager 1	---	---	02 hex	---	1 byte (U8)	RO	---	---	---
	03	Communication Type Sync Manager 2	---	---	03 hex	---	1 byte (U8)	RO	---	---	---
	04	Communication Type Sync Manager 3	---	---	04 hex	---	1 byte (U8)	RO	---	---	---

- The Sync Manager has the following settings.
 SM0 : Mailbox receive (Master to Slave)
 SM1: Mailbox send (Slave to Master)
 SM2 : Process data output (Master to Slave)
 SM3 : Process data input (Slave to Master)

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Data attribute	Size	Access	PDO map	Complete access	Modes of operation
1C10	---	Sync Manager 0 PDO Assignment	---	---	00 hex	---	1 byte (U8)	W	---	---	---

- This object gives the number of PDO mapping objects used by this Sync Manager. The Mailbox Receive Sync Manager has no PDOs.

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Data attribute	Size	Access	PDO map	Complete access	Modes of operation
1C11	---	Sync Manager 1 PDO Assignment	---	---	00 hex	---	1 byte (U8)	W	---	---	---

- This object gives the number of PDO mapping objects used by this Sync Manager. The Mailbox Transmit Sync Manager has no PDOs.

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Data attribute	Size	Access	PDO map	Complete access	Modes of operation
1C12	---	Sync Manager 2 PDO Assignment	---	---	---	---	---	---	---	Possible	---
	00	Number of assigned PDOs	00 to 03 hex	---	01 hex	D	1 byte (U8)	W	---	---	---
	01	1st PDO Mapping Object Index of assigned PDO	0000 to 17FF hex	---	1701 hex	D	2 bytes (U16)	W	---	---	---
	02	2nd PDO Mapping Object Index of assigned PDO	0000 to 17FF hex	---	0000 hex	D	2 bytes (U16)	W	---	---	---
	03	3rd PDO Mapping Object Index of assigned PDO	0000 to 17FF hex	---	0000 hex	D	2 bytes (U16)	W	---	---	---

- This object gives the reception PDOs used by this Sync Manager.
- You can change these objects only when the EtherCAT communications state is Pre-Operational.
- The mapping you changed is not saved in the non-volatile memory. To use the mapping other than the default setting, specify objects each time you turn ON the power supply.
- If any of the following operation is attempted, an ABORT code for SDO communications will be returned.
 - a) Writing when the communications state is other than Pre-Operational
 - b) Writing a value other than 1600 hex, 1701 to 1705 hex, and 1710 hex

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Data attribute	Size	Access	PDO map	Complete access	Modes of operation
1C13	---	Sync Manager 3 PDO Assignment	---	---	---	---	---	---	---	Possible	---
	00	Number of assigned PDOs	00 to 03 hex	---	01 hex	D	1 byte (U8)	W	---	---	---
	01	1st PDO Mapping Object Index of assigned PDO	0000 to 1BFF hex	---	1B01 hex	D	2 bytes (U16)	W	---	---	---
	02	2nd PDO Mapping Object Index of assigned PDO	0000 to 1BFF hex	---	0000 hex	D	2 bytes (U16)	W	---	---	---
	03	3rd PDO Mapping Object Index of assigned PDO	0000 to 1BFF hex	---	0000 hex	D	2 bytes (U16)	W	---	---	---

- This object gives the transmission PDOs used by this Sync Manager.
- You can change these objects only when the EtherCAT communications state is Pre-Operational.
- The mapping you changed is not saved in the non-volatile memory. To use the mapping other than the default setting, specify objects each time you turn ON the power supply.
- If any of the following operation is attempted, an ABORT code for SDO communications will be returned.
 - a) Writing when the communications state is other than Pre-Operational
 - b) Writing a value other than 1A00 hex, 1B01 to 1B04 hex, 1B10 hex, or 1BFF hex

A-2-7 Manufacturer Specific Objects 1

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Data attribute	Size	Access	PDO map	Complete access	Modes of operation
2002	---	Sysmac Error	---	---	---	---	---	---	---	Possible	---
	00	Number of entries	---	---	02 hex	---	1 byte (U8)	RO	---	---	---
	01	Sysmac Error Status	---	---	01 hex	---	1 byte (U8)	RO	TxPDO	---	---
	02	Sysmac Error Status Clear	00 to 01 hex	---	00 hex	A	1 byte (U8)	W	---	---	---

- This object is used to notify and clear the data of the Sysmac Error Status.
- Subindex 01 hex **Sysmac Error Status** notifies that the inverter detected an error.
If you connect the inverter with a Machine Automation Controller NJ/NX-series CPU Unit, map this object to the PDO.
- Subindex 02 hex **Sysmac Error Status Clear** enables a Machine Automation Controller NJ/NX-series CPU Unit to reset the error that occurred in the inverter.



Additional Information

Sysmac Studio, by default, uses the **512th transmit PDO Mapping** (1BFF hex) assignment to map the **Sysmac Error Status** (subindex 01 hex) automatically to the PDO.

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Data attribute	Size	Access	PDO map	Complete access	Modes of operation
2003	---	Sysmac Observation	---	---	---	---	---	---	---	Possible	---
	00	Number of entries	---	---	00 hex	---	1 byte (U8)	RO	---	---	---
	01	Observation 1	---	---	---	---	12 bytes (OS)	RO	---	---	---
	02	Observation 2	---	---	---	---	12 bytes (OS)	RO	---	---	---
	03	Observation 3	---	---	---	---	12 bytes (OS)	RO	---	---	---
	04	Observation 4	---	---	---	---	12 bytes (OS)	RO	---	---	---
	05	Observation 5	---	---	---	---	12 bytes (OS)	RO	---	---	---

- This object gives data of the existing observation.
- Subindexes 01 to 05 hex **Observation 1 to 5** give the code of the existing observation-level event.
- The format of the observation is shown below.

Byte	Description
0 to 3	Converts and output the alarm to Sysmac common code. *1
4	Indicates whether detailed data is available. 00 hex: No detailed data, 01 hex: Detailed data available
5	Indicates the data size of the detailed data. 00 hex: No detailed data, 04 hex: Detailed data available
6 to 7	Indicates the type of the detailed data. 0000 hex: No detailed data, 0007 hex: Detailed data available
8 to 9	Detailed data 1 0000 hex: No detailed data Other than 0000 hex: An alarm code specific to M1-series Inverters is stored.
10 to 11	Detailed data 2 0000 hex: No detailed data Other than 0000 hex: An alarm code specific to M1-series Inverters is stored.

*1.

Sysmac common code (hex)	Alarm code (hex)	Contents
08790000	0001	Overcurrent Protection (During Acceleration)
087A0000	0002	Overcurrent Protection (During Deceleration)
087B0000	0003	Overcurrent Protection (During Constant Speed)
087C0000	0006	Overvoltage Protection (During Acceleration)
087D0000	0007	Overvoltage Protection (During Deceleration)
087E0000	0008	Overvoltage Protection (During Constant Speed)
087F0000	000A	Undervoltage
08800000	0011	Cooling Fin Overheat Error
08810000	0013	Inverter Overheat Error
08820000	0046	Inrush Current Prevention Resistor Overheat
08830000	0016	Braking Resistor Overheat Error
08840000	0019	Inverter Overload Protection
08850000	003B	Breaking Transistor Error
08860000	0017	1st Motor Overload Protection

Sysmac common code (hex)	Alarm code (hex)	Contents
08870000	0018	2nd Motor Overload Protection
08880000	0014	Thermistor Error
08890000	0036	Hardware Error
088A0000	0039	Enable Circuit Failure
088B0000	0010	Inrush Current Prevention Circuit Error
183D0000	001F	EEPROM Error
183E0000	0021	CPU Error
183F0000	0033	Data Save Error during Undervoltage
280F0000	000B	Input Phase Loss Error
28100000	002E	Output Phase Loss Error
28110000	0020	Operator Communications Error
28130000	0022	EtherCAT Communications Error
28140000	0068	Analog Input Reference Command Loss Detected
389C0000	001B	Overspeed
389D0000	0024	Operation Error
389E0000	0025	Tuning Error
38A00000	002A	Step-out Detection/Magnetic Pole Position Detection Error during Startup
38A10000	002F	Speed Mismatch or Excessive Speed Deviation
38A20000	0038	Positioning Control Error
38A30000	001C	Abnormal Setting Related to the PG Option Card
38A50000	00FD	Locked by Password
38A60000	0032	Magnetic Pole Position Detection Error
38A70000	0034	Excessive Position Deviation Error
68430000	0012	External Trip
68440000	00FE	Mock Alarm
68460000	0065	Motor Overload Warning
68470000	0066	Cooling Fin Overheat Warning
68480000	0067	Life Warning
68490000	0069	PID Warning Output
684A0000	006A	Low Torque Detected
684B0000	006C	Motor Run Time Over
684C0000	006D	Number of Startups Over
96530000	0044	Communication Timeout with Sysmac Studio

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Data attribute	Size	Access	PDO map	Complete access	Modes of operation
2004	---	Sysmac Minor Fault	---	---	---	---	---	---	---	Possible	---
	00	Number of entries	---	---	00 hex	---	1 byte (U8)	RO	---	---	---
	01	Minor Fault 1	---	---	---	---	12 bytes (OS)	RO	---	---	---
	02	Minor Fault 2	---	---	---	---	12 bytes (OS)	RO	---	---	---
	03	Minor Fault 3	---	---	---	---	12 bytes (OS)	RO	---	---	---
	04	Minor Fault 4	---	---	---	---	12 bytes (OS)	RO	---	---	---
	05	Minor Fault 5	---	---	---	---	12 bytes (OS)	RO	---	---	---

- This object gives data of the existing minor fault.
- Subindexes 01 to 05 hex **Minor Fault 1 to 5** give the code of the existing minor-fault-level event.
- The format of the minor fault is shown below.

Byte	Description
0 to 3	Converts and output the alarm to Sysmac common code. *1
4	Indicates whether detailed data is available. 00 hex: No detailed data, 01 hex: Detailed data available
5	Indicates the data size of the detailed data. 00 hex: No detailed data, 04 hex: Detailed data available
6 to 7	Indicates the type of the detailed data. 0000 hex: No detailed data, 0007 hex: Detailed data available
8 to 9	Detailed data 1: Fixed to 0000 hex
10 to 11	Detailed data 2 0000 hex: No detailed data Other than 0000 hex: An alarm code specific to M1-series Inverters is stored.

*1. Refer to the description of object 2003 hex.

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Data attribute	Size	Access	PDO map	Complete access	Modes of operation
2100	---	Error History Clear	00000000 to FFFFFFFF F hex	---	00000000 hex	A	4 bytes (U32)	W	---	Not possible	---

- This object clears the data of **Diagnosis History** (10F3 hex).
- The data is cleared by the writing of 6c636c65 hex.
- If a value other than 6c636c65 hex is written, an ABORT code for SDO communications will be returned.

A-2-8 Inverter Profile Objects

This section explains the CiA402 drive profile supported by M1-series Inverters.

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Data attribute	Size	Access	PDO map	Complete access	Modes of operation
603F	---	Error code	---	---	---	---	2 bytes (U16)	RO	TxPDO	Not possible	---

- This object gives the code of the latest event or alarm which exists in the inverter.
- When more than one error or warning occurs at the same time, the highest-priority one is given.

Index (hex)	Name	Data type	Specifications
603F	Error code	U16	0000 hex : No error 5300 hex : Communications error between communications and control CPU 6331 hex EEPROM data error (for EtherCAT) 6341 hex PDO setting error FF01 hex Alarm code (01) : : FFFF hex Alarm code (FF)

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Data attribute	Size	Access	PDO map	Complete access	Modes of operation
6040	---	Controlword	0000 to FFFF hex	---	0000 hex	A	2 bytes (U16)	W	RxPDO	Not possible	vl

- This object is used to control the state machine of the inverter (PDS).

• **Description of Set Values**

Bit	Name	Description
0	Switch on	The state is controlled by these bits. For details, refer to <i>State Control Commands</i> on page A-4.
1	Enable voltage	
2	Quick stop	
3	Enable operation	
4 to 6	Reserved	Not used. Always keep them at 0.
7	Fault reset	Errors (alarms) and warnings (light alarms) are reset when this bit turns ON.
8 to 15	Reserved	Not used. Always keep them at 0.

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Data attribute	Size	Access	PDO map	Complete access	Modes of operation
6041	---	Statusword	0000 to FFFF hex	---	0000 hex	---	2 bytes (U16)	RO	TxPDO	Not possible	vl

- This object gives the present status of the inverter (PDS).

• **Bit Descriptions**

Bit	Name	Description
0	Ready to switch on	These bits give the status. For details, refer to <i>State Coding</i> on page A-5.
1	Switched on	
2	Operation enabled	
3	Fault	
4	Voltage enabled*1	
5	Quick stop	
6	Switch on disabled	
7	Warning	This bit indicates that warning (9-1-3 <i>Minor Fault Code List</i> on page 9-25) is occurring. The inverter operation continues.
8	Reserved	Not used. Always keep them at 0.
9	Remote	This bit indicates that the inverter is currently controlled with Controlword. After initialization is completed, this bit changes to 1 (<i>remote</i>). When 0 (<i>local</i>) is given, it indicates that the support software has the control right to the inverter.
10 to 15	Reserved	Not used. Always keep them at 0.

*1. The Voltage enabled bit indicates that the main circuit power supply voltage is applied when it is 1.

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Data attribute	Size	Access	PDO map	Complete access	Modes of operation
6042	---	vl target velocity	-32,767 to 32,768	r/min	0	---	2 bytes (INT16)	W	Possible	---	vl

- This object commands the velocity and rotation direction to the inverter.
When set to a negative value, the inverter operates in the reverse direction.

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Data attribute	Size	Access	PDO map	Complete access	Modes of operation
6043	---	vl velocity demand	---	r/min	0	---	2 bytes (INT16)	RO	Possible (TxPDO)	---	vl

- This object gives the operation velocity of the inverter in increments of 1 r/min.

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Data attribute	Size	Access	PDO map	Complete access	Modes of operation
6044	---	vl velocity actual value	---	r/min	---	---	2 bytes (INT16)	RO	Possible (TxPDO)	---	vl

- This object gives the output velocity of the inverter in increments of 1 r/min based on **1st Motor Pole Number (P01)** (3007-02 hex).
Display contents depend on the control mode of the inverter.
IM Vector control with speed sensor, IM V/f control with speed sensor: Actual velocity
Vector control without speed sensor: Estimated velocity
V/f control: Output velocity (before slip compensation)

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Data attribute	Size	Access	PDO map	Complete access	Modes of operation
6046	---	vl velocity min max amount	---	---	---	---	---	---	---	Possible	vl
	00	Number of entries	---	---	2	---	1 byte (U8)	RO	---	---	---
	01	vl velocity min amount	---	r/min	0	---	4 bytes (U32)	RW	---	---	---
	02	vl velocity max amount	---	r/min	00000834 hex	---	4 bytes (U32)	RW	---	---	---

- This object gives the minimum and maximum velocity of the inverter in increments of 1 r/min.
- Subindex 01 hex **vl velocity min amount** is set in increments of 1 r/min, which is converted from the setting of **1st Motor Pole Number (P01)** (3007-02 hex) to frequency units to set **1st Frequency Lower Limit (F16)** (3004-11 hex).
An error occurs if the converted value exceeds 590.0 Hz.
- Subindex 02 hex **vl velocity max amount** is set in increments of 1 r/min, which is converted from the setting of **1st Motor Pole Number (P01)** (3007-02 hex) to frequency units to set **1st Frequency Upper Limit (F15)** (3004-10 hex).
An error occurs if the converted value exceeds 590.0 Hz.

• **Read Value of Subindex 01 hex**

When subindex 01 hex is not set, or when the power supply is cycled with Save not executed by object 1010 hex, the value calculated based on **1st Frequency Lower Limit (F16)** (3004-11 hex) and **1st Motor Pole Number (P01)** (3007-02 hex) will be read.

When the power supply is cycled, the inverter reads the value saved by object 1010 hex.

However, if **1st Frequency Lower Limit (F16)** (3004-11 hex) or **1st Motor Pole Number (P01)** (3007-02 hex) is changed with Save executed by object 1010 hex, the value will be recalculated based on **1st Frequency Lower Limit (F16)** (3004-11 hex) and **1st Motor Pole Number (P01)** (3007-02 hex).

• **Read Value of Subindex 02 hex**

When subindex 02 hex is not set, or when the power supply is cycled with Save not executed by object 1010 hex, the value calculated based on **1st Frequency Upper Limit (F15)** (3004-10 hex) and **1st Motor Pole Number (P01)** (3007-02 hex) will be read.

When the power supply is cycled, the inverter reads the value saved by object 1010 hex.

However, if **1st Frequency Upper Limit (F15)** (3004-10 hex) or **1st Motor Pole Number (P01)** (3007-02 hex) is changed with Save executed by object 1010 hex, the value will be recalculated based on **1st Frequency Upper Limit (F15)** (3004-10 hex) and **1st Motor Pole Number (P01)** (3007-02 hex).

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Data attribute	Size	Access	PDO map	Complete access	Modes of operation
6048	---	vl velocity min acceleration	---	---	---	---	---	---	---	Possible	vl
	00	Number of entries	---	---	2	---	1 byte (U8)	RO	---	---	---
	01	Delta speed	---	r/min	00000708 hex	---	4 bytes (U32)	RW	---	---	---
	02	Delta time	---	s	0006 hex	---	2 bytes (U16)	RW	---	---	---

- This object sets the acceleration time of the inverter.
- Subindex 01 hex **Delta speed** is set in increments of 1 r/min, and the value converted from the settings of **1st Maximum Output Frequency (F03)** (3004-04 hex) and **1st Motor Pole Number (P01)** (3007-02 hex) is set to **1st Acceleration Time 1 (F07)** (3004-08 hex).
- Subindex 02 hex **Delta time** is set in increments of 1 s, and the value converted from the settings of **1st Maximum Output Frequency (F03)** (3004-04 hex) and **1st Motor Pole Number (P01)** (3007-02 hex) is set to **1st Acceleration Time 1 (F07)** (3004-08 hex).

• **Read Value of Subindex 01 hex**

When subindex 01 hex is not set, or when the power supply is cycled with Save not executed by object 1010 hex, the value calculated based on **1st Maximum Output Frequency (F03)** (3004-04 hex) and **1st Motor Pole Number (P01)** (3007-02 hex) will be read.

When the power supply is cycled, the inverter reads the value saved by object 1010 hex.

However, if **1st Maximum Output Frequency (F03)** (3004-04 hex), **1st Motor Pole Number (P01)** (3007-02 hex), or **1st Acceleration Time 1 (F07)** (3004-08 hex) is changed with Save executed by object 1010 hex, the value will be recalculated based on **1st Maximum Output Frequency (F03)** (3004-04 hex) and **1st Motor Pole Number (P01)** (3007-02 hex).

• **Read Value of Subindex 02 hex**

When subindex 02 hex is not set, or when the power supply is cycled with Save not executed by object 1010 hex, **1st Acceleration Time 1 (F07)** (3004-08 hex) will be converted in increments of 1 s.

When the power supply is cycled, the inverter reads the value saved by object 1010 hex.

However, if **1st Maximum Output Frequency (F03)** (3004-04 hex), **1st Motor Pole Number (P01)** (3007-02 hex), or **1st Acceleration Time 1 (F07)** (3004-08 hex) is changed with Save executed by object 1010 hex, **1st Acceleration Time 1 (F07)** (3004-08 hex) will be converted in increments of 1 s.

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Data attribute	Size	Access	PDO map	Complete access	Modes of operation
6049	---	vl velocity deceleration	---	---	---	---	---	---	---	Possible	vl
	00	Number of entries	---	---	2	---	1 byte (U8)	RO	---	---	---
	01	Delta speed	---	r/min	00000708 hex	---	4 bytes (U32)	RW	---	---	---
	02	Delta time	---	s	0006 hex	---	2 bytes (U16)	RW	---	---	---

- This object sets the deceleration time of the inverter.
- Subindex 01 hex **Delta speed** is set in increments of 1 r/min, and the value converted from the settings of **1st Maximum Output Frequency (F03)** (3004-04 hex) and **1st Motor Pole Number (P01)** (3007-02 hex) is set to **1st Deceleration Time 1 (F08)** (3004-09 hex).
- Subindex 02 hex **Delta time** is set in increments of 1 s, and the value converted from the settings of **1st Maximum Output Frequency (F03)** (3004-04 hex) and **1st Motor Pole Number (P01)** (3007-02 hex) is set to **1st Deceleration Time 1 (F08)** (3004-09 hex).

• **Read Value of Subindex 01 hex**

When subindex 01 hex is not set, or when the power supply is cycled with Save not executed by object 1010 hex, the value calculated based on **1st Maximum Output Frequency (F03)** (3004-04 hex) and **1st Motor Pole Number (P01)** (3007-02 hex) will be read.

When the power supply is cycled, the inverter reads the value saved by object 1010 hex.

However, if **1st Maximum Output Frequency (F03)** (3004-04 hex), **1st Motor Pole Number (P01)** (3007-02 hex), or **1st Deceleration Time 1 (F08)** (3004-09 hex) is changed with Save executed by object 1010 hex, the value will be recalculated based on **1st Maximum Output Frequency (F03)** (3004-04 hex) and **1st Motor Pole Number (P01)** (3007-02 hex).

• **Read Value of Subindex 02 hex**

When subindex 02 hex is not set, or when the power supply is cycled with Save not executed by object 1010 hex, **1st Deceleration Time 1 (F08)** (3004-09 hex) will be converted in increments of 1 s.

When the power supply is cycled, the inverter reads the value saved by object 1010 hex.

However, if **1st Maximum Output Frequency (F03)** (3004-04 hex), **1st Motor Pole Number (P01)** (3007-02 hex), or **1st Deceleration Time 1 (F08)** (3004-09 hex) is changed with Save executed by object 1010 hex, **1st Deceleration Time 1 (F08)** (3004-09 hex) will be converted in increments of 1 s.

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Data attribute	Size	Access	PDO map	Complete access	Modes of operation
604A	---	vl velocity quick stop	---	---	---	---	---	---	---	Possible	vl
	00	Number of entries	---	---	2	---	1 byte (U8)	RO	---	---	---
	01	Delta speed	---	r/min	00000708 hex	---	4 bytes (U32)	RW	---	---	---
	02	Delta time	---	s	0006 hex	---	2 bytes (U16)	RW	---	---	---

- This object sets the deceleration time for forced stop of the inverter.
- Subindex 01 hex **Delta speed** is set in increments of 1 r/min, and the value converted from the settings of **1st Maximum Output Frequency (F03)** (3004-04 hex) and **1st Motor Pole Number (P01)** (3007-02 hex) is set to **Deceleration Time for Forced Stop** (3008-39 hex).
- Subindex 02 hex **Delta time** is set in increments of 1 s, and the value converted from the settings of **1st Maximum Output Frequency (F03)** (3004-04 hex) and **1st Motor Pole Number (P01)** (3007-02 hex) is set to **Deceleration Time for Forced Stop** (3008-39 hex).

• **Read Value of Subindex 01 hex**

When subindex 01 hex is not set, or when the power supply is cycled with Save not executed by object 1010 hex, the value calculated based on **1st Maximum Output Frequency (F03)** (3004-04 hex) and **1st Motor Pole Number (P01)** (3007-02 hex) will be read.

When the power supply is cycled, the inverter reads the value saved by object 1010 hex.

However, if **1st Maximum Output Frequency (F03)** (3004-04 hex), **1st Motor Pole Number (P01)** (3007-02 hex), or **Deceleration Time for Forced Stop (H56)** (3008-39 hex) is changed with Save executed by object 1010 hex, the value will be recalculated based on **1st Maximum Output Frequency (F03)** (3004-04 hex) and **1st Motor Pole Number (P01)** (3007-02 hex).

• **Read Value of Subindex 02 hex**

When subindex 02 hex is not set, or when the power supply is cycled with Save not executed by object 1010 hex, **Deceleration Time for Forced Stop (H56)** (3008-39 hex) will be converted in increments of 1 s.

When the power supply is cycled, the inverter reads the value saved by object 1010 hex.

However, if **1st Maximum Output Frequency (F03)** (3004-04 hex), **1st Motor Pole Number (P01)** (3007-02 hex), or **Deceleration Time for Forced Stop (H56)** (3008-39 hex) is changed with Save executed by object 1010 hex, **Deceleration Time for Forced Stop (H56)** (3008-39 hex) will be converted in increments of 1 s.

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Data attribute	Size	Access	PDO map	Complete access	Modes of operation
604D	---	vl vpole number	02 to 80 hex	---	04 hex	---	1 byte (U8)	W	---	Possible	vl

- This object sets and displays the pole number.
- It has the same value as **1st Motor Pole Number (P01)** (3007-02 hex).

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Data attribute	Size	Access	PDO map	Complete access	Modes of operation
605B	---	Shutdown option code	1	---	1	E	2 bytes (INT16)	W	---	Not possible	---

- This object sets the operation of the inverter during Shutdown (transition from the Operation enabled state to the Ready to switch on state).

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Data attribute	Size	Access	PDO map	Complete access	Modes of operation
605C	---	Disable operation option code	1	---	1	E	2 bytes (INT16)	W	---	Not possible	---

- This object sets the operation of the inverter during Disable operation (transition from the Operation enabled state to the Switched on state). “During Disable operation” refers to the duration in which the inverter decelerates and then stops after Servo OFF (Disable operation).

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Data attribute	Size	Access	PDO map	Complete access	Modes of operation
6060	---	Modes of operation	0	---	2	A	1 byte (INT8)	W	RxPDO	Not possible	---

- This object sets the operation mode. Always set 2 (vI (Velocity mode)).

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Data attribute	Size	Access	PDO map	Complete access	Modes of operation
6061	---	Modes of operation display	---	---	2	---	1 byte (INT8)	RO	TxPDO	Not possible	---

- This object gives the present operation mode. (It is fixed to vI (Velocity mode).)

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Data attribute	Size	Access	PDO map	Complete access	Modes of operation
60FE	---	Digital outputs	---	---	---	---	---	---	---	Possible	---
	00	Number of entries	---	---	02 hex	---	1 byte (U8)	RO	---	---	---
	01	Physical outputs	00000000 to FFFFFFFF hex	---	00000000 hex	A	4 bytes (U32)	W	RxPDO	---	---
	02	Bit mask	00000000 to FFFFFFFF hex	---	01010000 hex	A	4 bytes (U32)	rw	---	---	---

- This object sets and controls the function output.
- Subindex 01 hex **Physical outputs** writes values to its bits to change the function output status.

Bit Description of Subindex 01 hex

Set 0 for the bits that are not listed in the table.

Bit	Signal	Value	Description
16	Output terminal [DO1]	0	OFF
		1	ON
24	Relay output terminal [ROA, ROB]	0	OFF
		1	ON

- **Bit Description of Subindex 02 hex**

Bit	Signal	Value	Description
16	Output terminal [DO1]	0	Forced operation enabled
		1	Forced operation disabled
24	Relay output terminal [ROA, ROB]	0	Forced operation enabled
		1	Forced operation disabled (Setting of subindex 01 hex invalid)

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Data attribute	Size	Access	PDO map	Complete access	Modes of operation
6502	---	Supported drive modes	---	---	00000002 hex	---	4 bytes (U32)	RO	---	Not possible	---

- This object gives the supported modes of operation.

• **Bit Descriptions**

Bit	Supported mode	Value
0	pp (Profile position mode)	0: Not supported
1	vl (Velocity mode)	1: Supported
2	pv (Profile velocity mode)	0: Not supported
3	tq (Profile torque mode)	0: Not supported
4	Reserved	0: Not supported
5	hm (Homing mode)	0: Not supported
6	ip (Interpolated position mode)	0: Not supported
7	csp (Cyclic synchronous position mode)	0: Not supported
8	csv (Cyclic synchronous velocity mode)	0: Not supported
9	cst (Cyclic synchronous torque mode)	0: Not supported
10 to 31	Reserved	0: Not supported

A-2-9 Safety Function Objects

This section explains objects defined in the FSoE CiA402 slave connection.

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Data attribute	Size	Access	PDO map	Complete access	Modes of operation
6620	---	safety controlword	---	---	---	---	---	---	---	Possible	---
	00	Number of entries	---	---	02 hex	---	1 byte (U8)	RO	---	---	---
	01	safety controlword 1st Byte	---	---	---	---	1 byte (U8)	RO	---	---	---
	02	safety controlword 2nd Byte	---	---	---	---	1 byte (U8)	RO	---	---	---

- This object gives the command status of the safety function.

• **Bit Description of Subindex 01 hex**

Bit	Description
0	Gives the status of STO command. 0: STO activate command issued 1: STO activate command not issued
7	Gives the status of error reset command. 0: Error reset command not issued 1: Error reset command issued

- No bit of subindex 02 hex is used.

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Data attribute	Size	Access	PDO map	Complete access	Modes of operation
6621	---	safety statusword	---	---	---	---	---	---	---	Possible	---
	00	Number of entries	---	---	02 hex	---	1 byte (U8)	RO	---	---	---
	01	safety statusword 1st Byte	---	---	---	---	1 byte (U8)	RO	---	---	---
	02	safety statusword 2nd Byte	---	---	---	---	1 byte (U8)	RO	---	---	---

- This object gives the status of safety function.

• **Bit Description of Subindex 01 hex**

Bit	Description
0	Gives the STO status. 0: Normal status 1: STO status
7	Gives the error status of the safety function. 0: No error 1: Error detected

• **Bit Description of Subindex 02 hex**

Bit	Description
7	Gives the safety connection status. 0: Without safety connection 1: With safety connection

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Data attribute	Size	Access	PDO map	Complete access	Modes of operation
6632	---	error acknowledge	0 to 1	---	0	---	1 bit (BOOL)	W	RxPDO, TxPDO	Not possible	---

- This object gives and resets an error of the safety function.
- You can use this function by mapping this object to the safety process data.
- If you map this object to the SDO communications or normal PDOs, the written value will be ignored.

• **Description of Reading and Writing**

Access	Description
Read	Gives an error of the safety function. 0: No error 1: Error detected (STO internal circuit error detection)
Write	Resets an error of the safety function. From 0 to 1: Error reset

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Data attribute	Size	Access	PDO map	Complete access	Modes of operation
6640	---	STO command	0 to 1	---	0	---	1 bit (BOOL)	W	RxPDO, TxPDO	Not possible	---

- This object gives the STO status and issues the STO command.
- You can use this function by mapping this object to the safety process data.
- If you map this object to the SDO communications or normal PDOs, the written value will be ignored.

• **Description of Reading and Writing**

Access	Description
Read	Gives the STO status. 0: Normal status 1: STO status
Write	Issues the STO command. 0: Activate STO 1: Reset STO

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Data attribute	Size	Access	PDO map	Complete access	Modes of operation
E600	---	FSoE Slave Frame Elements Axis Ch1	---	---	---	---	---	---	---	Possible	---
	00	Number of entries	---	---	03 hex	---	1 byte (U8)	RO	---	---	---
	01	FSoE Slave CMD	---	---	---	---	1 byte (U8)	RO	TxPDO	---	---
	02	FSoE Slave Conn_ID	---	---	---	---	2 bytes (U16)	RO	TxPDO	---	---
	03	FSoE Slave CRC_0	---	---	---	---	2 bytes (U16)	RO	TxPDO	---	---

- This object is used to send safety process data.
- Subindex 01 hex **FSoE Slave CMD** gives the command which is sent from the slave.
- Subindex 02 hex **FSoE Slave Conn_ID** gives the connection ID which is sent from the slave.
- Subindex 03 hex **FSoE Slave CRC_0** gives the cyclic redundancy code which is sent from the slave.

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Data attribute	Size	Access	PDO map	Complete access	Modes of operation
E601	---	Safety input 1	---	---	---	---	---	---	---	Possible	---
	00	Number of entries	---	---	01 hex	---	1 byte (U8)	RO	---	---	---
	01	Safety Connection Status	---	---	---	---	1 bit (BOOL)	RO	TxPDO	---	---

- This object indicates that the safety connection is in execution.
- When the value is **1**, the safety connection is in execution.

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Data attribute	Size	Access	PDO map	Complete access	Modes of operation
E700	---	FSoE Master Frame Elements Axis Ch1	---	---	---	---	---	---	---	Possible	---
	00	Number of entries	---	---	03 hex	---	1 byte (U8)	RO	---	---	---
	01	FSoE Master CMD	00 to FF hex	---	00 hex	---	1 byte (U8)	W	RxPDO	---	---
	02	FSoE Master Conn_ID	0000 to FFFF hex	---	0000 hex	---	2 bytes (U16)	W	RxPDO	---	---
	03	FSoE Master CRC_0	0000 to FFFF hex	---	0000 hex	---	2 bytes (U16)	W	RxPDO	---	---

- This object is used to send safety process data.
- Subindex 01 hex **FSoE Master CMD** gives the command which is sent from the master.
- Subindex 02 hex **FSoE Master Conn_ID** gives the connection ID which is sent from the master.
- Subindex 03 hex **FSoE Master CRC_0** gives the cyclic redundancy code which is sent from the master.

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Data attribute	Size	Access	PDO map	Complete access	Modes of operation
F980	---	Device Safety Address	---	---	---	---	---	---	---	Possible	---
	00	Number of entries	---	---	01 hex	---	1 byte (U8)	RO	---	---	---
	01	FSoE Address	---	---	---	---	2 bytes (U16)	RO	---	---	---

- This object gives and clears the FSoE slave address.
- Subindex 01 hex **FSoE Address** gives the address set by **FSoE Address** (3052-54 hex).
- There is no function to clear the FSoE address. If the communications cannot be established after you change the Safety CPU Unit setting, set **FSoE Address** (3052-54 hex) again.

A-3 Object List

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Size	Access	PDO map
1000	00	Device Type	---	---	00090192 hex	4 bytes (U32)	RO	Not possible
1001	00	Error Register	00 to FF hex	---	00 hex	1 byte (U8)	RO	Not possible
1008	00	Manufacturer Device Name	---	---	00 hex	20 bytes (VS)	RO	Not possible
1009	00	Manufacturer Hardware Version	---	---	00 hex	20 bytes (VS)	RO	Not possible
100A	00	Manufacturer Software Version	---	---	00 hex	20 bytes (VS)	RO	Not possible
1010	---	Store Parameters						
	00	Number of Entries	---	---	01 hex	1 byte (U8)	RO	Not possible
	01	Store Parameters	00000000 to FFFFFFFF hex	---	00000001 hex	4 bytes (U32)	RW	Not possible
1011	---	Restore Default Parameters						
	00	Number of Entries	---	---	01 hex	1 byte (U8)	RO	Not possible
	01	Restore Default Parameters	00000000 to FFFFFFFF hex	---	00000001 hex	4 bytes (U32)	RW	Not possible
1018	---	Identity Object						
	00	Number of Entries	---	---	04 hex	1 byte (U8)	RO	Not possible
	01	Vendor ID	---	---	00000083 hex	4 bytes (U32)	RO	Not possible
	02	Product Code	00000000 to FFFFFFFF hex	---	00000000 hex	4 bytes (U32)	RO	Not possible
	03	Revision Number	00000000 to FFFFFFFF hex	---	00000000 hex	4 bytes (U32)	RO	Not possible
	04	Serial Number	00000000 to FFFFFFFF hex	---	00000000 hex	4 bytes (U32)	RO	Not possible
10E0	---	Device Identification Reload Object						
	00	Number of Entries	---	---	03 hex	1 byte (U8)	RO	Not possible
	01	Configured Station Alias Register Value	0000 to FFFF hex	---	0000 hex	2 bytes (U16)	RW	Not possible
	03	Reload ID-Selector Value	0000 to FFFF hex	---	0000 hex	2 bytes (U16)	RW	Not possible
10F3	---	Diagnosis History						
	00	Number of Entries	---	---	0D hex	1 byte (U8)	RO	Not possible
	01	Maximum Messages	00 to 08 hex	---	00 hex	1 byte (U8)	RO	Not possible
	02	Newest Message	00 to 0D hex	---	00 hex	1 byte (U8)	RO	Not possible
	03	Newest Acknowledged Message	00 to FF hex	---	00 hex	1 byte (U8)	RW	Not possible
	04	New Messages Available	FALSE or TRUE	---	FALSE	1 bit (BOOL)	RO	Possible (TxPDO)

Index (hex)	Subindex (hex)	Object name	Setting range	Unit	Default setting	Size	Access	PDO map
	05	Flags	0000 to 003F hex	---	0000 hex	2 bytes (U16)	RW	Not possible
	06 to 0D	Diagnosis Message 1-8	---	---	00 hex	30 bytes (OS)	RO	Not possible
10F9	---	Present Time for Event Log						
	00	Number of Entries	---	---	01 hex	1 byte (U8)	RO	Not possible
	01	Present Time for Event Log	00 to FFFFFFFF hex	---	00 hex	8 bytes (U64)	RW	Not possible
1600	---	1st Receive PDO Mapping						
	00	Number of Objects in this PDO	00 to 0A hex	---	00 hex	1 byte (U8)	RW	Not possible
	01 to 0A	1st-10th Output Object to be mapped	00000000 to FFFFFFFF hex	---	00000000 hex	4 bytes (U32)	RW	Not possible
1700	---	257th Receive PDO Mapping						
	00	Number of Objects in this PDO	---	---	02 hex	1 byte (U8)	RO	Not possible
	01	1st Output Object to be mapped	---	---	60400010 hex	4 bytes (U32)	RO	Not possible
	02	2nd Output Object to be mapped	---	---	60420010 hex	4 bytes (U32)	RO	Not possible
1701	---	258th Receive PDO Mapping						
	00	Number of Objects in this PDO	---	---	02 hex	1 byte (U8)	RO	Not possible
	01	1st Output Object to be mapped	---	---	50000010 hex	4 bytes (U32)	RO	Not possible
	02	2nd Output Object to be mapped	---	---	50100010 hex	4 bytes (U32)	RO	Not possible
1710	---	273th Receive PDO Mapping						
	00	Number of Objects in this PDO	---	---	13 hex	1 byte (U8)	RO	Not possible
	01	1st Output Object to be mapped	---	---	E7000108 hex	4 bytes (U32)	RO	Not possible
	02	2nd Output Object to be mapped	---	---	66400001 hex	4 bytes (U32)	RO	Not possible
	03 to 08	3rd-8th Output Object to be mapped	---	---	00000001 hex	4 bytes (U32)	RO	Not possible
	09	9th Output Object to be mapped	---	---	66320001 hex	4 bytes (U32)	RO	Not possible
	0A to 11	10th-17th Output Object to be mapped	---	---	00000001 hex	4 bytes (U32)	RO	Not possible
	12	18th Output Object to be mapped	---	---	E7000310 hex	4 bytes (U32)	RO	Not possible
	13	19th Output Object to be mapped	---	---	E7000210 hex	4 bytes (U32)	RO	Not possible
1A00	---	1st Transmit PDO Mapping						
	00	Number of Objects in this PDO	00 to 10 hex	---	00 hex	1 byte (U8)	RW	Not possible
	01 to 0A	1st-10th Input Object to be mapped	00000000 to FFFFFFFF hex	---	00000000 hex	4 bytes (U32)	RW	Not possible
1B00	---	257th Transmit PDO Mapping						

Index (hex)	Subindex (hex)	Object name	Setting range	Unit	Default setting	Size	Access	PDO map
	00	Number of Objects in this PDO	---	---	02 hex	1 byte (U8)	RO	Not possible
	01	1st Input Object to be mapped	---	---	60410010 hex	4 bytes (U32)	RO	Not possible
	02	2nd Input Object to be mapped	---	---	60430010 hex	4 bytes (U32)	RO	Not possible
1B01	---	258th Transmit PDO Mapping						
	00	Number of Objects in this PDO	---	---	02 hex	1 byte (U8)	RO	Not possible
	01	1st Input Object to be mapped	---	---	51000010 hex	4 bytes (U32)	RO	Not possible
	02	2nd Input Object to be mapped	---	---	51000010 hex	4 bytes (U32)	RO	Not possible
1B10	---	273th Transmit PDO Mapping						
	00	Number of Objects in this PDO	---	---	13 hex	1 byte (U8)	RO	Not possible
	01	1st Input Object to be mapped	---	---	E6000108 hex	4 bytes (U32)	RO	Not possible
	02	2nd Input Object to be mapped	---	---	66400001 hex	4 bytes (U32)	RO	Not possible
	03 to 08	3rd-8th Input Object to be mapped	---	---	00000001 hex	4 bytes (U32)	RO	Not possible
	09	9th Input Object to be mapped	---	---	66320001 hex	4 bytes (U32)	RO	Not possible
	0A to 10	10th-17th Input Object to be mapped	---	---	00000001 hex	4 bytes (U32)	RO	Not possible
	11	17th Input Object to be mapped	---	---	E6010101 hex	4 bytes (U32)	RO	Not possible
	12	18th Input Object to be mapped	---	---	E6000310 hex	4 bytes (U32)	RO	Not possible
	13	19th Input Object to be mapped	---	---	E6000210 hex	4 bytes (U32)	RO	Not possible
1BFE	---	511th Transmit PDO mapping						
	00	Number of Objects in this PDO	---	---	02 hex	1 byte (U8)	RO	Not possible
	01	1st Input Object to be mapped	---	---	10F30401 hex	4 bytes (U32)	RO	Not possible
	02	2nd Input Object to be mapped	---	---	00000007 hex	4 bytes (U32)	RO	Not possible
1BFF	---	512th Transmit PDO Mapping						
	00	Number of Objects in this PDO	---	---	01 hex	1 byte (U8)	RO	Not possible
	01	1st Input Object to be mapped	---	---	20020108 hex	4 bytes (U32)	RO	Not possible
1C00	---	Sync Manager Communication Type						
	00	Number of used Sync Manager Channels	---	---	04 hex	1 byte (U8)	RO	Not possible
	01	Communication Type Sync Manager 0	---	---	01 hex	1 byte (U8)	RO	Not possible
	02	Communication Type Sync Manager 1	---	---	02 hex	1 byte (U8)	RO	Not possible

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Size	Access	PDO map
	03	Communication Type Sync Manager 2	---	---	03 hex	1 byte (U8)	RO	Not possible
	04	Communication Type Sync Manager 3	---	---	04 hex	1 byte (U8)	RO	Not possible
1C10	00	Sync Manager 0 PDO Assignment	---	---	00 hex	1 byte (U8)	RO	Not possible
1C11	00	Sync Manager 1 PDO Assignment	---	---	00 hex	1 byte (U8)	RO	Not possible
1C12	---	Sync Manager 2 PDO Assignment						
	00	Number of assigned PDOs	00 to 03 hex	---	01 hex	1 byte (U8)	RW	Not possible
	01	1st PDO Mapping Object Index of assigned PDO	1600 to 1710 hex	---	1701 hex	2 bytes (U16)	RW	Not possible
	02	2nd PDO Mapping Object Index of assigned PDO	1600 to 1710 hex	---	0000 hex	2 bytes (U16)	RW	Not possible
	03	3rd PDO Mapping Object Index of assigned PDO	1600 to 1710 hex	---	0000 hex	2 bytes (U16)	RW	Not possible
1C13	---	Sync Manager 3 PDO Assignment						
	00	Number of assigned PDOs	00 to 03 hex	---	01 hex	1 byte (U8)	RW	Not possible
	01	1st PDO Mapping Object Index of assigned PDO	1A00 to 1BFF hex	---	1B01 hex	2 bytes (U16)	RW	Not possible
	02	2nd PDO Mapping Object Index of assigned PDO	1A00 to 1BFF hex	---	0000 hex	2 bytes (U16)	RW	Not possible
	03	3rd PDO Mapping Object Index of assigned PDO	1A00 to 1BFF hex	---	0000 hex	2 bytes (U16)	RW	Not possible
1C32	---	Sync Manager 2 Synchronization						
	00	Number of Synchronization Parameters	---	---	20 hex	1 byte (U8)	RO	Not possible
	01	Synchronization Type	00 to 03 hex	---	00 hex	2 bytes (U16)	RW	Not possible
	02	Cycle Time	00000000 to FFFFFFFF hex	ns	000F4240 hex	4 bytes (U32)	RO	Not possible
	03	Shift Time	---	ns	00000000 hex	4 bytes (U32)	RO	Not possible
	04	Synchronization Types supported	---	---	0005 hex	2 bytes (U16)	RO	Not possible
	05	Minimum Cycle Time	---	ns	0001E848 hex	4 bytes (U32)	RO	Not possible
	0A	Sync0 Cycle Time	00000000 to FFFFFFFF hex	ns	00000000 hex	4 bytes (U32)	RO	Not possible
1C33	---	Sync Manager 3 Synchronization						
	00	Number of Synchronization Parameters	---	---	20 hex	1 byte (U8)	RO	Not possible
	01	Synchronization Type	00 to 03 hex	---	00 hex	2 bytes (U16)	RW	Not possible
	02	Cycle Time	00000000 to FFFFFFFF hex	ns	000F4240 hex	4 bytes (U32)	RO	Not possible

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Size	Access	PDO map
	04	Synchronization Types supported	---	---	0005 hex	2 bytes (U16)	RO	Not possible
	05	Minimum Cycle Time	---	ns	0001E848 hex	4 bytes (U32)	RO	Not possible
2002	---	Sysmac Error						
	00	Number of Entries	---	---	02 hex	1 byte (U8)	RO	Not possible
	01	Sysmac Error Status	00 to FF hex	---	00 hex	1 byte (U8)	RO	Possible (TxPDO)
	02	Sysmac Error Status Clear	00 to 01 hex	---	00 hex	1 byte (U8)	RW	Not possible
2003	---	Sysmac Observation						
	00	Number of Entries	00 to 05 hex	---	00 hex	1 byte (U8)	RO	Not possible
	01	Observation 1	---	---	00 hex	12 bytes (OS)	RO	Not possible
	02	Observation 2	---	---	00 hex	12 bytes (OS)	RO	Not possible
	03	Observation 3	---	---	00 hex	12 bytes (OS)	RO	Not possible
	04	Observation 4	---	---	00 hex	12 bytes (OS)	RO	Not possible
	05	Observation 5	---	---	00 hex	12 bytes (OS)	RO	Not possible
2004	---	Sysmac Minor Fault						
	00	Number of Entries	00 to 05 hex	---	00 hex	1 byte (U8)	RO	Not possible
	01	Minor Fault 1	---	---	00 hex	12 bytes (OS)	RO	Not possible
	02	Minor Fault 2	---	---	00 hex	12 bytes (OS)	RO	Not possible
	03	Minor Fault 3	---	---	00 hex	12 bytes (OS)	RO	Not possible
	04	Minor Fault 4	---	---	00 hex	12 bytes (OS)	RO	Not possible
	05	Minor Fault 5	---	---	00 hex	12 bytes (OS)	RO	Not possible
2100	00	Error History Clear	00000000 to FFFFFFFF hex	---	00000000 hex	4 bytes (U32)	RO	Not possible
2200	00	Communications Error Setting	00 to 0F hex	Times	00 hex	1 byte (U8)	RW	Not possible
2201	00	Sync not Received Timeout Setting	0000 to 0258 hex	s	0000 hex	2 bytes (U16)	RW	Not possible
5000	00	Command	0000 to FFFF hex	---	0000 hex	2 bytes (U16)	RW	Possible
5010	00	Frequency Reference	0000 to E678 hex	0.01 Hz	0000 hex	2 bytes (U16)	RW	Possible
5100	00	Status	0000 to FFFF hex	---	0000 hex	2 bytes (U16)	RO	Possible (TxPDO)
5110	00	Output Frequency Monitor	0000 to E678 hex	0.01 Hz	0000 hex	2 bytes (U16)	RO	Possible (TxPDO)
603F	00	Error Code	0000 to FFFF hex	---	0000 hex	2 bytes (U16)	RO	Possible (TxPDO)

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Size	Access	PDO map
6040	00	ControlWord	0000 to FFFF hex	---	0000 hex	2 bytes (U16)	RW	Possible
6041	00	Statusword	0000 to FFFF hex	---	0000 hex	2 bytes (U16)	RO	Possible (TxPDO)
6042	00	vI Target Velocity	-32768 to 32,767 hex	r/min	0 hex	2 bytes (INT16)	RW	Possible
6043	00	vI Velocity Demand	-32768 to 32,767 hex	r/min	0 hex	2 bytes (INT16)	RO	Possible (TxPDO)
6044	00	vI Velocity Actual Value	-32768 to 32,767 hex	r/min	0 hex	2 bytes (INT16)	RO	Possible (TxPDO)
6046	---	vI Velocity Min Max Amount						
	00	Number of Entries	---	---	02 hex	1 byte (U8)	RO	Not possible
	01	vI Velocity Min Amount	00000000 to FFFFFFFF hex	r/min	00000000 hex	4 bytes (U32)	RW	Not possible
	02	vI Velocity Max Amount	00000000 to FFFFFFFF hex	r/min	00000834 hex	4 bytes (U32)	RW	Not possible
6048	---	vI Velocity Acceleration						
	00	Number of Entries	---	---	02 hex	1 byte (U8)	RO	Not possible
	01	Delta Speed	00000000 to FFFFFFFF hex	r/min	00000708 hex	4 bytes (U32)	RW	Not possible
	02	Delta Time	0000 to FFFF hex	s	0006 hex	2 bytes (U16)	RW	Not possible
6049	---	vI Velocity Deceleration						
	00	Number of Entries	---	---	02 hex	1 byte (U8)	RO	Not possible
	01	Delta Speed	00000000 to FFFFFFFF hex	r/min	00000708 hex	4 bytes (U32)	RW	Not possible
	02	Delta Time	0000 to FFFF hex	s	0006 hex	2 bytes (U16)	RW	Not possible
604A	---	vI Velocity Quick Stop						
	00	Number of Entries	---	---	02 hex	1 byte (U8)	RO	Not possible
	01	Delta Speed	00000000 to FFFFFFFF hex	r/min	00000708 hex	4 bytes (U32)	RW	Not possible
	02	Delta Time	0000 to FFFF hex	s	0006 hex	2 bytes (U16)	RW	Not possible
604D	00	vI Pole Number	02 to 80 hex	---	04 hex	1 byte (U8)	RW	Not possible
605B	00	Shutdown Option Code	---	---	1	2 bytes (INT16)	RW	Not possible
605C	00	Disable Operation Option Code	---	---	1	2 bytes (INT16)	RW	Not possible
6060	00	Modes of Operation	---	---	2	1 byte (INT8)	RW	Possible
6061	00	Modes of Operation Display	---	---	2	1 byte (INT8)	RO	Possible (TxPDO)
60FE	---	Digital Outputs						
	00	Number of Entries	---	---	02 hex	1 byte (U8)	RO	Not possible
	01	Physical Outputs	00000000 to FFFFFFFF hex	---	00000000 hex	4 bytes (U32)	RW	Possible

Index (hex)	Sub-index (hex)	Object name	Setting range	Unit	Default setting	Size	Access	PDO map
6502	02	Bit Mask	00000000 to 01010000 hex	---	01010000 hex	4 bytes (U32)	RO	Not possible
	00	Supported Drive Modes	---	---	00000002 hex	4 bytes (U32)	RO	Not possible
6620	---	Safety Controlword						
	00	Number of Entries	---	---	02 hex	1 byte (U8)	RO	Not possible
	01	Safety Controlword 1st Byte	00 to FF hex	---	00 hex	1 byte (U8)	RO	Not possible
	02	Safety Controlword 2nd Byte	00 to FF hex	---	00 hex	1 byte (U8)	RO	Not possible
6621	---	safety Statusword						
	00	Number of Entries	---	---	02 hex	1 byte (U8)	RO	Not possible
	01	Safety Statusword 1st Byte	00 to FF hex	---	00 hex	1 byte (U8)	RO	Not possible
	02	Safety Statusword 2nd Byte	00 to FF hex	---	00 hex	1 byte (U8)	RO	Not possible
6632	00	Error Acknowledge	FALSE or TRUE	---	FALSE	1 bit (BOOL)	RW	Possible
6640	00	STO Command	FALSE or TRUE	---	FALSE	1 bit (BOOL)	RW	Possible
E600	---	FSoE Slave Frame Elements Axis Ch1						
	00	Number of Entries	---	---	03 hex	1 byte (U8)	RO	Not possible
	01	FSoE Slave CMD	00 to FF hex	---	00 hex	1 byte (U8)	RO	Possible (TxPDO)
	02	FSoE Slave Conn_ID	0000 to FFFF hex	---	0000 hex	2 bytes (U16)	RO	Possible (TxPDO)
	03	FSoE Slave CRC_0	0000 to FFFF hex	---	0000 hex	2 bytes (U16)	RO	Possible (TxPDO)
E601	---	Safety Input 1						
	00	Number of Entries	---	---	01 hex	1 byte (U8)	RO	Not possible
	01	Safety Connection Status	FALSE or TRUE	---	FALSE	1 bit (BOOL)	RO	Possible (TxPDO)
E700	---	FSoE Master Frame Elements Axis Ch1						
	00	Number of Entries	---	---	03 hex	1 byte (U8)	RO	Not possible
	01	FSoE Master CMD	00 to FF hex	---	00 hex	1 byte (U8)	RW	Possible
	02	FSoE Master Conn_ID	0000 to FFFF hex	---	0000 hex	2 bytes (U16)	RW	Possible
	03	FSoE Master CRC_0	0000 to FFFF hex	---	0000 hex	2 bytes (U16)	RW	Possible
E901	---	FSoE Communication Parameter						
	00	Number of Entries	---	---	08 hex	1 byte (U8)	RO	Not possible
	01	Version	---	---	01 hex	2 bytes (VS)	RO	Not possible
	02	Safety Address	0000 to FFFF hex	---	0000 hex	2 bytes (U16)	RO	Not possible

Index (hex)	Subindex (hex)	Object name	Setting range	Unit	Default setting	Size	Access	PDO map
	03	FSoE Connection ID	0000 to FFFF hex	---	0000 hex	2 bytes (U16)	RO	Not possible
	04	Watchdog Time	0020 to FFFD hex	---	0064 hex	2 bytes (U16)	RO	Not possible
	06	Connection Type	---	---	01 hex	2 bytes (U16)	RO	Not possible
	07	Communication Parameter Length	---	---	0002 hex	2 bytes (U16)	RO	Not possible
	08	Application Parameter Length	---	---	0000 hex	2 bytes (U16)	RO	Not possible
F000	---	Modular Device Profile						
	00	Number of Entries	---	---	02 hex	1 byte (U8)	RO	Not possible
	01	Index Distance	---	---	0800 hex	2 bytes (U16)	RO	Not possible
	02	Maximum Number of Modules	---	---	0001 hex	2 bytes (U16)	RO	Not possible
F010	---	Module List						
	00	Number of Entries	---	---	01 hex	1 byte (U8)	RO	Not possible
	01	Subindex01	---	---	00000316 hex	4 bytes (U32)	RO	Not possible
F050	---	Module Ident List						
	00	Number of Entries	---	---	01 hex	1 byte (U8)	RO	Not possible
	01	Module Ident	---	---	00002000 hex	2 bytes (U16)	RO	Not possible
F980	00	Device Safety Address	---	---	01 hex	1 byte (U8)	RO	Not possible
	01	FSoE Address	0000 to FFFF hex	---	0000 hex	2 bytes (U16)	RO	Not possible

A-4 Lists of Manufacturer Specific Objects 2 (Inverter Parameters)

Inverter parameters are allocated to objects 3000 to 302A hex.

The parameter lists in the subsequent sections use symbols to indicate whether a parameter is enabled or disabled in its data range for different control methods, as shown below.

Symbol	Control method object (3004-2B hex)
<input type="checkbox"/> V/f	0: IM V/f control
<input type="checkbox"/> DTV	1: IM Dynamic torque vector control
<input type="checkbox"/> PG V/f	3: IM V/f control with speed sensor
<input type="checkbox"/> PG DTV	4: IM Dynamic torque vector control with speed sensor
<input type="checkbox"/> SLV	5: IM Vector control without speed sensor
<input type="checkbox"/> PGV	6: IM Vector control with speed sensor
<input type="checkbox"/> PM SLV	15: PM Vector control without sensor
<input type="checkbox"/> PM PGV	16: PM Vector control with sensor

V/f : Enabled, V/f : Disabled

A-4-1 M Group Parameter List (Monitor 1)

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
3003	02	M01	Frequency Reference at Final	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>-32,768 to 32,767</p> <p>-164% to 164% +20,000 or -20,000 = Maximum output frequency</p>	0	---	---	Possible (TxPDO)
	03	M02	Torque Reference Monitor at Last	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>-327.68 to 327.67</p>	0	---	%	Possible (TxPDO)
	04	M03	Torque Current Command at Final	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>-327.68 to 327.67</p>	0	---	%	Possible (TxPDO)
	05	M04	Magnetic Flux Command Value	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>-327.68 to 327.67</p>	0	---	%	Possible (TxPDO)
	06	M05	Frequency Reference at Final	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 655.35</p>	0	---	Hz	Possible (TxPDO)
	07	M06	Output Frequency 1 without Slip Compensation	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>-32,768 to 32,767</p> <p>-164% to 164% +20,000 or -20,000 = Maximum output frequency</p>	0	---	---	Possible (TxPDO)
	08	M07	Torque Value	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>-327.68 to 327.67</p>	0	---	%	Possible (TxPDO)
	09	M08	Torque Current Value	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>-327.68 to 327.67</p>	0	---	%	Possible (TxPDO)
	0A	M09	Output Frequency without Slip Compensation	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 655.35</p>	0	---	Hz	Possible (TxPDO)
	0B	M10	Input Power	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 399.99</p>	0	---	%	Possible (TxPDO)

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map								
	0C	M11	Output Current Monitor	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> 0.00 to 399.99	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	%	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	0D	M12	Output Voltage Monitor	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> 0.0 to 1,000.0	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	V	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	0E	M13	Operation Command at Final	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> 0000 to FFFF hex Bit 15: RST Bit 14: DI7 Bit 13: DI6 Bit 12: --- Bit 11: EN Bit 10: --- Bit 9: --- Bit 8: --- Bit 7: --- Bit 6: DI5 Bit 5: DI4 Bit 4: DI3 Bit 3: DI2 Bit 2: DI1 Bit 1: REV Bit 0: FWD	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	---	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	0F	M14	Operation Status 1 Monitor	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0000 to FFFF hex</p> <p>Bit 15: BUSY (During Parameter code data writing)</p> <p>Bit 14: ---</p> <p>Bit 13: ---</p> <p>Bit 12: RL (Communications effective)</p> <p>Bit 11: ALM (Alarm relay)</p> <p>Bit 10: DEC (During deceleration)</p> <p>Bit 9: ACC (During acceleration)</p> <p>Bit 8: IL (During current limiting)</p> <p>Bit 7: VL (During voltage limiting)</p> <p>Bit 6: TL (Torque limiting)</p> <p>Bit 5: NUV (Main circuit DC voltage established)</p> <p>Bit 4: BRK (During braking)</p> <p>Bit 3: INT (Inverter shut down)</p> <p>Bit 2: EXT (During DC braking or during pre-exciting)</p> <p>Bit 1: REV (During reverse operation)</p> <p>Bit 0: FWD (During forward operation)</p>	0	---	---	Possible (TxPDO)
	10	M15	Output Terminal Monitor	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0000 to FFFF hex</p> <p>Bit 15: ---</p> <p>Bit 14: ---</p> <p>Bit 13: ---</p> <p>Bit 12: ---</p> <p>Bit 11: ---</p> <p>Bit 10: ---</p> <p>Bit 9: ---</p> <p>Bit 8: RO</p> <p>Bit 7: ---</p> <p>Bit 6: ---</p> <p>Bit 5: ---</p> <p>Bit 4: ---</p> <p>Bit 3: ---</p> <p>Bit 2: ---</p> <p>Bit 1: DO2</p> <p>Bit 0: DO1</p>	0	---	---	Possible (TxPDO)

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map								
	11	M16	Latest Alarm Contents	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	---	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	12	M17	Last Alarm Contents	0: No alarm 1: OC1 Overcurrent protection (during acceleration) 2: OC2 Overcurrent protection (during deceleration) 3: OC3 Overcurrent protection (during constant speed operation) 6: OU1 Overvoltage protection (during acceleration) 7: OU2 Overvoltage protection (during deceleration) 8: OU3 Overvoltage protection (during constant speed operation or stopping) 10: LU Undervoltage protection 11: Lin Input phase loss protection 16: PbF Inrush Current Prevention Circuit Error 17: OH1 Heat sink overheat 18: OH2 External alarm input 19: OH3 Inverter internal overheat 20: OH4 Motor protection (PTC thermistor) 22: dbH Braking resistor overheat 23: OL1 Motor 1 overload 24: OL2 Motor 2 overload 25: OLU Inverter overload 27: OS Over speed protection 28: Pg PG disconnection 31: Er1 Memory error 32: Reserved 33: Er3 CPU error 34: Reserved 35: Er5 EtherCAT board error 36: Er6 Operation protection 37: Er7 Tuning error												
	13	M18	Second Last Alarm Contents													
	14	M19	Third Last Alarm Contents													

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map								
				42: Erd Detection of step-out 46: OPL Output phase loss protection 47: ErE Following error (excessive speed deviation) 50: ErC Magnetic pole position detection error 51: ErF Data save error in case of undervoltage 52: d0 Excessive positioning deviation 53: Reserved 56: Ero Position control error 57: ECF EN circuit failure 58: Reserved 59: dbA DB transistor trouble 65: Reserved 68: ErU Support tool communication disconnection 70: OH6 Inrush current prevention resistor overheat 253: Lok Locked by password 254: Err Mock alarm (Subcode = 9998)												
	15	M20	Cumulative Operation Time	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> 0 to 655,350	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	h	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	16	M21	Main Circuit DC Voltage	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> 0 to 1,000	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	V	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	1A	M25	ROM version	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> 0 to 9,999	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	100	---	---	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	1B	M26	Transmission Error Transaction Code for RS-485 Port1	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> 1: Improper FC (Non-existent parameter block specified) 2: Improper address (Non-existent parameter number specified) 3: Improper data (Range error) 7: NAK (Link priority, no right, write disabled) 71: Checksum error, CRC error 72: Parity error 73: Framing error, overrun error, buffer full	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	---	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	1C	M27	Final Frequency Reference Monitor on Alarm Monitor	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>-32,768 to 32,767</p> <p>-164% to 164% +20,000 or -20,000 = Maximum output frequency</p>	0	---	---	Possible (TxPDO)
	1D	M28	Final Torque Command Monitor on Alarm	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>-327.68 to 327.67</p>	0	---	%	Possible (TxPDO)
	1E	M29	Final Torque Current Command Monitor on Alarm	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>-327.68 to 327.67</p>	0	---	%	Possible (TxPDO)
	1F	M30	Final Magnetic flux command Monitor on Alarm	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>-327.68 to 327.67</p>	0	---	%	Possible (TxPDO)
	20	M31	Final Frequency Reference Monitor on Alarm	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 655.35</p>	0	---	Hz	Possible (TxPDO)
	21	M32	Output Frequency Monitor on Alarm without Slip Compensation	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>-32,768 to 32,767</p> <p>-164% to 164% +20,000 or -20,000 = Maximum output frequency</p>	0	---	---	Possible (TxPDO)
	22	M33	Output Torque Monitor on Alarm	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>-327.68 to 327.67</p>	0	---	%	Possible (TxPDO)
	23	M34	Torque Current Monitor on Alarm	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>-327.68 to 327.67</p>	0	---	%	Possible (TxPDO)
	24	M35	Output Frequency Monitor on Alarm	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 655.35</p>	0	---	Hz	Possible (TxPDO)
	25	M36	Input Power Monitor on Alarm	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 399.99</p>	0	---	%	Possible (TxPDO)
	26	M37	Output Current Effective Value Monitor on Alarm	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 399.99</p>	0	---	%	Possible (TxPDO)

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	27	M38	Output Voltage Effective Value Monitor on Alarm	<div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> SLV PGV PM SLV PM PGV </div> <p>0.0 to 1,000.0</p>	0	---	V	Possible (TxPDO)
	28	M39	Operation Command Monitor on Alarm	<div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> SLV PGV PM SLV PM PGV </div> <p>0000 to FFFF hex</p> <p>Bit 15: RST Bit 14: DI7 Bit 13: DI6 Bit 12: --- Bit 11: EN Bit 10: --- Bit 9: --- Bit 8: --- Bit 7: --- Bit 6: DI5 Bit 5: DI4 Bit 4: DI3 Bit 3: DI2 Bit 2: DI1 Bit 1: REV Bit 0: FWD</p>	0	---	---	Possible (TxPDO)

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	29	M40	Operation Status 1 Monitor on Alarm	<div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> SLV PGV PM SLV PM PGV </div> <p>0000 to FFFF hex</p> <p>Bit 15: BUSY (During Parameter code data writing)</p> <p>Bit 14: ---</p> <p>Bit 13: ---</p> <p>Bit 12: RL (Communications effective)</p> <p>Bit 11: ALM (Alarm relay)</p> <p>Bit 10: DEC (During deceleration)</p> <p>Bit 9: ACC (During acceleration)</p> <p>Bit 8: IL (During current limiting)</p> <p>Bit 7: VL (During voltage limiting)</p> <p>Bit 6: TL (Torque limiting)</p> <p>Bit 5: NUV (Main circuit DC voltage established)</p> <p>Bit 4: BRK (During braking)</p> <p>Bit 3: INT (Inverter shut down)</p> <p>Bit 2: EXT (During DC braking or during pre-exciting)</p> <p>Bit 1: REV (During reverse operation)</p> <p>Bit 0: FWD (During forward operation)</p>	0	---	---	Possible (TxPDO)
	2A	M41	Latest Output Terminal Information Monitor on Alarm	<div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> SLV PGV PM SLV PM PGV </div> <p>0000 to FFFF hex</p> <p>Bit 15: ---</p> <p>Bit 14: ---</p> <p>Bit 13: ---</p> <p>Bit 12: ---</p> <p>Bit 11: ---</p> <p>Bit 10: ---</p> <p>Bit 9: ---</p> <p>Bit 8: RO</p> <p>Bit 7: ---</p> <p>Bit 6: ---</p> <p>Bit 5: ---</p> <p>Bit 4: ---</p> <p>Bit 3: ---</p> <p>Bit 2: ---</p> <p>Bit 1: DO2</p> <p>Bit 0: DO1</p>	0	---	---	Possible (TxPDO)

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map								
	2B	M42	Cumulative Operation Time Monitor on Alarm	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0 to 655,350</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	h	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	2C	M43	Main Circuit DC Voltage Monitor on Alarm	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0 to 1,000</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	V	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	2D	M44	Inverter Internal Air Temperature Monitor on Alarm	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>-32,768 to 32,767</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	°C	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	2E	M45	Heat Sink Temperature Monitor on Alarm	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>-32,768 to 32,767</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	°C	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	2F	M46	Life of Main Circuit Capacitor Monitor	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0.0 to 100.0</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	%	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	30	M47	Life of PC Board Electrolytic Capacitor	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0 to 65,535</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	10 h	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	31	M48	Life of Cooling Fan	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0 to 9,999</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	10 h	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	32	M49	Input Terminal [AI1] Input Voltage Monitor	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>-32,768 to 32,767 -164% to 164% 20,000 = 10 V (100%)</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	---	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	39	M56	Input Terminal [PTC] Input Voltage Monitor	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>-32,768 to 32,767 -164% to 164% 20,000 = 10 V (100%)</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	---	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	3A	M57	Electric Angle Monitor	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0.0 to 359.9</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	°	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	3B	M58	Rotor Angle Monitor	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0.0 to 359.9</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	°	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map								
	3C	M59	Motor Electronic Thermal Monitor	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> 0 to 100	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	%	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	3E	M61	Inverter Internal Air Temperature Monitor	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> -3,276.8 to 3,276.7	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	°C	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	3F	M62	Fin Temperature Monitor	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> -3,276.8 to 3,276.7	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	°C	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	40	M63	Load Factor Monitor	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> -3276.8 to 3276.7	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	%	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	41	M64	Motor Output Monitor	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> -3276.8 to 3276.7 % of rated power	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	%	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	42	M65	Motor Output Monitor on Alarm	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> -32,768 to 32,767	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	---	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	43	M66	Speed Detection Monitor	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> -32,768 to 32,767	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	---	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	44	M67	Transmission Error Transaction Code for RS485 Port	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> 1: Improper FC (Non-existent parameter block specified) 2: Improper address (Non-existent parameter number specified) 3: Improper data (Range error) 7: NAK (Link priority, no right, write disabled) 71: Checksum error, CRC error 72: Parity error 73: Framing error, overrun error, buffer full	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	---	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	45	M68	Reserved	Do not use.	---	---	---	---								
	46	M69	Inverter rated current	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> 0.00 to 9,999	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	A	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	47	M70	Running Status 3 Monitor	<div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> SLV PGV PM SLV PM PGV </div> <p>0000 to FFFF hex</p> <p>Bit 15: --- Bit 14: OL (Overload warning) Bit 13: LOC (Light load detection) Bit 12: OL2 (Overload warning 2) Bit 11: OLP (During active drive) Bit 10: LIFE (Life warning) Bit 9: OHF (Fin Overheat warning) Bit 8: TRY (During retry) Bit 7: FAN (Fan operation signal) Bit 6: Reserved Bit 5: THM (Thermal warning) Bit 4: IPF (During restart after instantaneous power failure) Bit 3: SETM (2nd motor selection) Bit 2: IRDY (Operation ready) Bit 1: FDT1 (Over set Frequency arrival) Bit 0: FAR1 (Constant speed arrival)</p>	0	---	---	Possible (TxPDO)
	48	M71	Input Terminal Monitor	<div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> SLV PGV PM SLV PM PGV </div> <p>0000 to FFFF hex</p> <p>Bit 15: RST Bit 14: DI7 Bit 13: DI6 Bit 12: --- Bit 11: EN Bit 10: --- Bit 9: --- Bit 8: --- Bit 7: --- Bit 6: DI5 Bit 5: DI4 Bit 4: DI3 Bit 3: DI2 Bit 2: DI1 Bit 1: REV Bit 0: FWD</p>	0	---	---	Possible (TxPDO)
	49	M72	Reserved	Do not use.	---	---	---	---

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	4A	M73	PID Output Monitor	<div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> SLV PGV PM SLV PM PGV </div> <p>-32768 to 32767</p> <p>-164% to 164% +20,000 or -20,000 = ±100%</p>	0	---	---	Possible (TxPDO)
	4B	M74	Running Status 2 Monitor	<div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> SLV PGV PM SLV PM PGV </div> <p>0000 to FFFF hex</p> <p>Bit 15: Motor type (1: PM motor, 0: Induction motor)</p> <p>Bit 14: During EN circuit diagnosis</p> <p>Bit 7: During speed control (1 during control)</p> <p>Bit 5 to 4: Selected motor</p> <p style="margin-left: 20px;">00: 1st motor</p> <p style="margin-left: 20px;">01: 2nd motor</p> <p style="margin-left: 20px;">10: Reserved</p> <p style="margin-left: 20px;">11: Reserved</p> <p>Bit 3 to 0: Control method</p> <p style="margin-left: 20px;">0000: V/f control without slip compensation</p> <p style="margin-left: 20px;">0001: Dynamic torque vector control</p> <p style="margin-left: 20px;">0010: V/f control with slip compensation</p> <p style="margin-left: 20px;">0011: V/f control with speed sensor</p> <p style="margin-left: 20px;">0100: Dynamic torque vector control with speed sensor</p> <p style="margin-left: 20px;">0101: Vector control without speed sensor</p> <p style="margin-left: 20px;">0110: Vector control with speed sensor</p> <p style="margin-left: 20px;">0111: Torque control (Vector control without speed sensor)</p> <p style="margin-left: 20px;">1000: Torque control (Vector control with speed sensor)</p>	0	---	---	Possible (TxPDO)
	4D	M76	Service Life of Main Circuit Capacitor Elapsed Time	<div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> SLV PGV PM SLV PM PGV </div> <p>0 to 65,535</p>	0	---	10 h	Possible (TxPDO)
	4E	M77	Service Life of Main Circuit Capacitor Remaining Time	<div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> SLV PGV PM SLV PM PGV </div> <p>0 to 65,535</p>	0	---	10 h	Possible (TxPDO)

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	4F	M78	Rotation Speed Command Monitor	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>-32,768 to 32,767</p>	0	---	r/min	Possible (TxPDO)
	50	M79	Rotation Speed Monitor	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>-32,768 to 32,767</p>	0	---	r/min	Possible (TxPDO)
	52	M81	1st Remaining Time before the Next Motor Maintenance	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0 to 65,535</p>	0	---	10 h	Possible (TxPDO)
	55	M84	Torque Command at Final	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>-327 to 327</p>	0	---	%	Possible (TxPDO)
	56	M85	1st Remaining Startup Times before the Next Motor Maintenance	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0 to 65,535</p>	0	---	---	Possible (TxPDO)

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map								
	57	M86	Latest Light Alarm Factor	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	---	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	58	M87	Light Alarm Factor Last	0: No alarm 17: OH1 Heat sink overheat 18: OH2 External alarm input 19: OH3 Inverter internal overheat 22: dbH Braking resistor overheat 23: OL1 Motor 1 overload 24: OL2 Motor 2 overload 34: Reserved 35: Reserved 47: ErE Following error (excessive speed deviation) 53: ErP RS-485 communications error (Option card) 56: Ero Position control error 58: CoF PID feedback disconnection detected 100: FAL Detect DC fan lock 101: OL Motor overload early warning 102: OH Heat sink overheat early warning 103: LiF Lifetime alarm 104: rEF Reference loss 105: Pid PID alarm 106: UTL Low output torque detection 107: PTC PTC thermistor activated 108: rTE Inverter life (Cumulative run time) 109: CnT (Inverter life, Number of startups)	0	---	---									
	59	M88	Light Alarm Factor 2nd Last													
	5A	M89	Light Alarm Factor 3rd Last													
	60	M95	Cumulative Running Time at Tripping					<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> 0 to 655,350	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	61	M96	Fourth Last Alarm Contents	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0: No alarm 1: OC1 Overcurrent protection (during acceleration) 2: OC2 Overcurrent protection (during deceleration) 3: OC3 Overcurrent protection (during constant speed operation) 6: OU1 Overvoltage protection (during acceleration) 7: OU2 Overvoltage protection (during deceleration) 8: OU3 Overvoltage protection (during constant speed operation or stopping) 10: LU Undervoltage protection 11: Lin Input phase loss protection 16: PbF Inrush Current Prevention Circuit Error 17: OH1 Heat sink overheat 18: OH2 External alarm input 19: OH3 Inverter internal overheat 20: OH4 Motor protection (PTC thermistor) 22: dbH Braking resistor overheat 23: OL1 1st Motor Overload Protection 24: OL2 2nd Motor Overload Protection 25: OLU Inverter overload 27: OS Over speed protection 28: Pg PG disconnection 31: Er1 Memory error 32: Reserved 33: Er3 CPU error 34: Reserved 35: Er5 EtherCAT board error 36: Er6 Operation protection 37: Er7 Tuning error 42: Erd Detection of step-out 46: OPL Output phase loss protection 47: ErE Following error (excessive speed deviation) 50: ErC Magnetic pole position detection error 51: ErF Data save error in case of undervoltage</p>	0	---	---	Possible (TxPDO)

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map								
	62	M97	Fifth Last Alarm Contents	52: d0 Excessive positioning deviation 53: Reserved 56: Ero Position control error 57: ECF EN circuit failure 58: Reserved 59: dbA DB transistor trouble 65: Reserved 68: ErU Support tool communication disconnection 70: OH6 Inrush Current Prevention Resistor Overheat 253: Lok Locked by password 254: Err Mock alarm (Subcode = 9998)												
	63	M98	Warning status monitor	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> 0: Warning not occurred 1: Warning occurring	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	---	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
3023	0F	M114	Reserved	Do not use.	---	---	---	---								
	10	M115	PID Output Non Filter	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> -150.0 to 150.0	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	%	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													

A-4-2 W Group Parameter List (Monitor 2)

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
3010	02	W01	Running Status 1 Monitor	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0000 to FFFF hex</p> <p>Bit 15: BUSY (During Parameter code data writing)</p> <p>Bit 14: ---</p> <p>Bit 13: ---</p> <p>Bit 12: RL (Communications effective)</p> <p>Bit 11: ALM (Alarm relay)</p> <p>Bit 10: DEC (During deceleration)</p> <p>Bit 9: ACC (During acceleration)</p> <p>Bit 8: IL (During current limiting)</p> <p>Bit 7: VL (During voltage limiting)</p> <p>Bit 6: TL (Torque limiting)</p> <p>Bit 5: NUV (Main circuit DC voltage established)</p> <p>Bit 4: BRK (During braking)</p> <p>Bit 3: INT (Inverter shut down)</p> <p>Bit 2: EXT (During DC braking or during pre-exciting)</p> <p>Bit 1: REV (During reverse operation)</p> <p>Bit 0: FWD (During forward operation)</p>	0	---	---	Possible (TxPDO)
	03	W02	Frequency Reference Monitor	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 655.35</p>	0	---	Hz	Possible (TxPDO)
	04	W03	Output Frequency Monitor before Slip Compensation	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 655.35</p>	0	---	Hz	Possible (TxPDO)
	05	W04	Output Frequency after Slip Compensation					
	06	W05	Output Current Monitor	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 655.35</p>	0	---	A	Possible (TxPDO)
	07	W06	Output Voltage Monitor	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0.0 to 1,000.0</p>	0	---	V	Possible (TxPDO)

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	08	W07	Output Torque Monitor	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>-999 to 999</p>	0	---	%	Possible (TxPDO)
	09	W08	Rotate Speed Monitor	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 99,990</p>	0	---	r/min	Possible (TxPDO)
	0A	W09	Load Shaft Speed	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 99,990</p>	0	---	r/min	Possible (TxPDO)
	0B	W10	Feed Speed	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 99,990</p>	0	---	m/min	Possible (TxPDO)
	0C	W11	PID Process Command	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>-999.00 to 9,990.00</p>	0	---	---	Possible (TxPDO)
	0D	W12	PID Feedback Value Monitor	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>-999.00 to 9,990.00</p>	0	---	---	Possible (TxPDO)
	0E	W13	Analog Torque Limit Value Monitor	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>-300 to 300</p>	300	---	%	Possible (TxPDO)
	0F	W14	Reserved	Do not use.	---	---	---	---
	10	W15	Ratio value Monitor	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 200.00</p>	0	---	%	Possible (TxPDO)
	11	W16	Motor Speed Set Value	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 99,990</p>	0	---	r/min	Possible (TxPDO)
	12	W17	Load Shaft Set Value	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 99,990</p>	0	---	r/min	Possible (TxPDO)
	13	W18	Feed Speed Set Value	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 99,990</p>	0	---	m/min	Possible (TxPDO)
	14	W19	Transport Time Set Value for Specified Length	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 99,990</p>	999.9	---	min	Possible (TxPDO)

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map								
	15	W20	Transport Time for Specified Length	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0.00 to 99,990</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	999.9	---	min	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	16	W21	Power Consumption Monitor	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0.00 to 9,999</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	kW	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	17	W22	Motor Output Power Monitor	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0.00 to 9,999</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	kW	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	18	W23	Load Rate Monitor	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>-999 to 999</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	%	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	19	W24	Torque Current Monitor	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>-999 to 999</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	%	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	1A	W25	Output Current Monitor	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0.0 to 3,276.7</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	A	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	1B	W26	Magnetic Flux Command Value	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>-999 to 999</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	%	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	1C	W27	Timed Operation Remaining Time	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0 to 9,999</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	s	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	1D	W28	RUN Command Source Monitor	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>1: Terminal command (FW or RV) 22: EtherCAT 23: Support Tool Others: Reserved</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	---	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	1E	W29	Frequency and PID Command Source Monitor	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>1: Analog Voltage Input (Input Terminal[A11]) 7: UP/DOWN control 10: Pattern operation 13: Pulse train input or Frequency calculation 22: EtherCAT 23: Support Tool 24: Multi-step Frequency 25: Jogging Frequency 30: PID Control Operator Process 31: PID Control Analog Process 33: PID Control UP/DOWN control 34: PID Control Communication Process 36: PID Control Multi-Step Terminal Process 255: Not Selected Others: Reserved</p>	0	---	---	Possible (TxPDO)
	1F	W30	Speed in Percentage	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 100.00</p>	0	---	%	Possible (TxPDO)
	20	W31	Speed Set Value in Percentage	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 100.00</p>	0	---	%	Possible (TxPDO)
	21	W32	PID Output Monitor	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>-150.00 to 150.00</p>	0	---	%	Possible (TxPDO)
	22	W33	Analog Input Monitor	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>-9,990 to 9,990</p>	0	---	---	Possible (TxPDO)

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	29	W40	Input Terminal Monitor	<div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; padding-bottom: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; padding-bottom: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0000 to FFFF hex</p> <p>Bit 15: --- Bit 14: --- Bit 13: --- Bit 12: EN2 Bit 11: EN1 Bit 10: --- Bit 9: --- Bit 8: --- Bit 7: --- Bit 6: DI5 Bit 5: DI4 Bit 4: DI3 Bit 3: DI2 Bit 2: DI1 Bit 1: DI7 Bit 0: DI6</p>	0	---	---	Possible (TxPDO)
	2A	W41	Output Signal Monitor	<div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; padding-bottom: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; padding-bottom: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0000 to FFFF hex</p> <p>Bit 15: --- Bit 14: --- Bit 13: --- Bit 12: --- Bit 11: --- Bit 10: --- Bit 9: --- Bit 8: RO Bit 7: --- Bit 6: --- Bit 5: --- Bit 4: --- Bit 3: --- Bit 2: --- Bit 1: DO2 Bit 0: DO1</p>	0	---	---	Possible (TxPDO)

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map								
	2B	W42	Communications Input Signal Monitor	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0000 to FFFF hex</p> <p>Bit 15: RST Bit 14: DI7 Bit 13: DI6 Bit 12: --- Bit 11: --- Bit 10: --- Bit 9: --- Bit 8: --- Bit 7: --- Bit 6: DI5 Bit 5: DI4 Bit 4: DI3 Bit 3: DI2 Bit 2: DI1 Bit 1: REV Bit 0: FWD</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	---	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	2C	W43	Communications Control Output Signal Monitor	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0000 to FFFF hex</p> <p>Bit 15: --- Bit 14: --- Bit 13: --- Bit 12: --- Bit 11: --- Bit 10: --- Bit 9: --- Bit 8: RO Bit 7: --- Bit 6: --- Bit 5: --- Bit 4: --- Bit 3: --- Bit 2: --- Bit 1: DO2 Bit 0: DO1</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	---	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	2D	W44	Input Terminal [AI1] Input Voltage	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>-12.0 to 12.0</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	V	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	38	W55	Pulse Input (A/B Phase [PIA][PIB])	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>-327.68 to 327.67</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	kp/s	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map								
	39	W56	Pulse Input (Z Phase [PIZ])	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0 to 16,000</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	p/s	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	44	W67	Cumulative Run Time of Capacitors on Printed Circuit Boards	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0 to 9,999</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	10 h	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	45	W68	Cumulative Run Time of Cooling Fan	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0 to 9,999</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	10 h	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	47	W70	Total Power ON Time Monitor	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0 to 655,350</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	h	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	48	W71	Reserved	Do not use.	---	---	---	---								
	49	W72	Internal Air Highest Temperature	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>-32,768 to 32,767</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	°C	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	4A	W73	Heat Sink Maximum Temperature	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>-32,768 to 32,767</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	°C	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	4B	W74	Maximum Effective Current Value	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0.00 to 655.35</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	A	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	4C	W75	Main Circuit Capacitor's Capacitor Monitor	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0.0 to 100.0</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	%	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	4D	W76	Cumulative Run Time of Electrolytic Capacitors on PC Board	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0 to 65,535</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	h	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	4E	W77	Cumulative Run Time of Cooling Fan	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0 to 65,535</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	h	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	4F	W78	Number of Start-ups	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0 to 65,535</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	---	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	50	W79	Cumulative Operation Time of Motor	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0 to 65,535</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	h	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	52	W81	Integrated Power Monitor	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.0 to 999,900.0</p>	0	---	kWh	Possible (TxPDO)
	53	W82	Data Used Integrating Electric Power	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.0 to 9,999</p>	0	---	---	Possible (TxPDO)
	57	W86	Reserved	Do not use.	---	---	---	---
	58	W87	Inverter ROM Version 1 Main	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div>	0	---	---	Possible (TxPDO)
	59	W88	Inverter ROM Version 2 Sub	0 to 59,999				
	5A	W89	ROM Version Operator	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0 to 9,999</p>	0	---	---	Possible (TxPDO)
	5B	W90	ROM version (ECT terminal board 1)	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div>	0	---	---	Possible (TxPDO)
	5C	W91	ROM Version ECT Terminal Board 2	0 to 9,999				
	60	W95	Reserved	Do not use.	---	---	---	---
	61	W96	Reserved	Do not use.	---	---	---	---
	62	W97	Contents of ECT Terminal Board error	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0 to 9,999</p>	0	---	---	Possible (TxPDO)
3017	0B	W110	Motor Speed	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 99,990</p>	0	---	r/min	Possible (TxPDO)
	0C	W111	Load Shaft Speed	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 99,990</p>	0	---	r/min	Possible (TxPDO)
	10	W115	Output Frequency After Slip Compensation	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 655.35</p>	0	---	Hz	Possible (TxPDO)
	11	W116	PG Feedback Value	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 655.35</p>	0	---	Hz	Possible (TxPDO)

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	13	W118	Torque Bias Monitor	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>-999 to 999</p>	0	---	%	Possible (TxPDO)
	20	W131	PID Control PID Deviation (After Scale Transformation)	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>-999.00 to 9,990.00</p>	0	---	---	Possible (TxPDO)
	21	W132	PID Control PID Deviation (No Scale Transformation)	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>-32,768 to 32,767</p> <p>-164% to 164% +20,000 or -20,000 = ±100%</p>	0	---	---	Possible (TxPDO)
	24	W135	Input Power Monitor	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.0 to 6,553.5</p>	0	---	kW	Possible (TxPDO)
	25	W136	Input Terminal [AI1] Input Voltage (AIV)	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>-1,024 to 1,023</p> <p>1,023 = equivalent to 10.9 V</p>	0	---	---	Possible (TxPDO)
	28	W139	Pulse Train Frequency Monitor	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>-163.84 to 163.83</p>	0	---	%	Possible (TxPDO)
	2B	W142	Feedback Current Position Monitor (MSB)	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div>	0	---	---	Possible (TxPDO)
	2C	W143	Feedback Current Position Monitor (LSB)	<p>-268,435,455 to 268,435,455</p> <p>MSB: -4,096 to 4,095</p> <p>LSB: 0 to 65,535</p>				
	2D	W144	Target Position Monitor (MSB)	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div>	0	---	---	Possible (TxPDO)
	2E	W145	Target Position Monitor (LSB)	<p>-268,435,455 to 268,435,455</p> <p>MSB: -4,096 to 4,095</p> <p>LSB: 0 to 65,535</p>				
	2F	W146	Position Deviation Monitor (MSB)	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div>	0	---	---	Possible (TxPDO)
	30	W147	Position Deviation Monitor (LSB)	<p>-268,435,455 to 268,435,455</p> <p>MSB: -4,096 to 4,095</p> <p>LSB: 0 to 65,535</p>				

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	31	W148	Touch Probe 1 Positive Edge (MSB)	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div>	0	---	---	Possible (TxPDO)
	32	W149	Touch Probe 1 Positive Edge (LSB)	-268,435,455 to 268,435,455 MSB: -4,096 to 4,095 LSB: 0 to 65,535				
	33	W150	Touch Probe 2 Positive Edge (MSB)	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div>	0	---	---	Possible (TxPDO)
	34	W151	Touch Probe 2 Positive Edge (LSB)	-268,435,455 to 268,435,455 MSB: -4,096 to 4,095 LSB: 0 to 65,535				
	35	W152	Touch Probe Status	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0000 to FFFF hex</p> <p>Bit 15: --- Bit 14: --- Bit 13: --- Bit 12: --- Bit 11: --- Bit 10: --- Bit 9: Touch probe 2 PLc Bit 8: Touch probe 2 Enb Bit 7: --- Bit 6: --- Bit 5: --- Bit 4: --- Bit 3: --- Bit 2: --- Bit 1: Touch probe 1 PLc Bit 0: Touch probe 1 Enb</p>	0	---	---	Possible (TxPDO)
	36	W153	Pulse Input Rate for A/B Phase of Reference Side	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>-327.68 to 327.67</p>	0	---	kp/s	Possible (TxPDO)
	37	W154	Pulse Input Rate for Z Phase of Reference Side	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0 to 16,000</p>	0	---	p/s	Possible (TxPDO)
	38	W155	Pulse Input Rate for A/B Phase of Feedback Side	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>-327.68 to 327.67</p>	0	---	kp/s	Possible (TxPDO)
	39	W156	Pulse Input Rate for Z Phase of Feedback Side	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0 to 16,000</p>	0	---	p/s	Possible (TxPDO)

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map								
	3E	W161	Braking Resistor Thermal Monitor	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> 0.0 to 100.0	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0.0	---	%	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	4F	W178	Number of Start-ups	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> 0.00 to 655.35 1.00 to 10,000	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0.00	---	---	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	50	W179	Total RUN Time Monitor	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> 0 to 655,350	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	h	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	51	W180	Tuning Progress	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> 0 to 100	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	%	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
3018	03	W202	Reserved	Do not use.	---	---	---	---								
	04	W203	Reserved	Do not use.	---	---	---	---								

A-4-3 Z Group Parameter List (Alarm Information 1)

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map								
3012	01	Z00	Second Last Alarm Info. Output Frequency	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> 0.00 to 655.35	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	Hz	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	02	Z01	Second last Alarm info. Output Current	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> 0.00 to 655.35	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	A	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	03	Z02	Second last Alarm info. Output Voltage	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> 0 to 1,000	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	V	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	04	Z03	Second Last Alarm Info. Torque Monitor	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> -999 to 999	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	%	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	05	Z04	Second Last Alarm Info. Frequency Command	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> 0.00 to 655.35	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	Hz	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	06	Z05	Second Last Alarm Info. Running Status	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0000 to FFFF hex</p> <p>Bit 15: BUSY (During Parameter code data writing)</p> <p>Bit 14: ---</p> <p>Bit 13: ---</p> <p>Bit 12: RL (Communications effective)</p> <p>Bit 11: ALM (Alarm relay)</p> <p>Bit 10: DEC (During deceleration)</p> <p>Bit 9: ACC (During acceleration)</p> <p>Bit 8: IL (During current limiting)</p> <p>Bit 7: VL (During voltage limiting)</p> <p>Bit 6: TL (Torque limiting)</p> <p>Bit 5: NUV (Main circuit DC voltage established)</p> <p>Bit 4: BRK (During braking)</p> <p>Bit 3: INT (Inverter shut down)</p> <p>Bit 2: EXT (During DC braking or during pre-exciting)</p> <p>Bit 1: REV (During reverse operation)</p> <p>Bit 0: FWD (During forward operation)</p>	0	---	---	Possible (TxPDO)
	07	Z06	Second Last Alarm Info. Cumulative Ope. Time	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0 to 655,350</p>	0	---	h	Possible (TxPDO)
	08	Z07	Second last Alarm Info. Number Of Startups	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0 to 65,535</p>	0	---	---	Possible (TxPDO)
	09	Z08	Second Last Alarm Info. Main Circuit DC Voltage	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0.0 to 1,000.0</p>	0.0	---	V	Possible (TxPDO)
	0A	Z09	Second Last Alarm Info. Internal Air Temperature	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>-32,768 to 32,767</p>	0	---	°C	Possible (TxPDO)
	0B	Z10	Second last Alarm Info. Heat Sink Temperature	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>-32,768 to 32,767</p>	0	---	°C	Possible (TxPDO)

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	0C	Z11	Second Last Alarm Info. Input Terminal	<div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> SLV PGV PM SLV PM PGV </div> <p>0000 to FFFF hex</p> <p>Bit 15: --- Bit 14: --- Bit 13: --- Bit 12: EN2 Bit 11: EN1 Bit 10: --- Bit 9: --- Bit 8: --- Bit 7: --- Bit 6: DI5 Bit 5: DI4 Bit 4: DI3 Bit 3: DI2 Bit 2: DI1 Bit 1: DI7 Bit 0: DI6</p>	0	---	---	Possible (TxPDO)
	0D	Z12	Second Last Alarm Info. Output Terminal	<div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> SLV PGV PM SLV PM PGV </div> <p>0000 to FFFF hex</p> <p>Bit 15: --- Bit 14: --- Bit 13: --- Bit 12: --- Bit 11: --- Bit 10: --- Bit 9: --- Bit 8: RO Bit 7: --- Bit 6: --- Bit 5: --- Bit 4: --- Bit 3: --- Bit 2: --- Bit 1: DO2 Bit 0: DO1</p>	0	---	---	Possible (TxPDO)

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	0E	Z13	Second Last Alarm Info. Input Terminal via Communication	<div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; padding-bottom: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; padding-bottom: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0000 to FFFF hex</p> <p>Bit 15: RST Bit 14: DI7 Bit 13: DI6 Bit 12: --- Bit 11: --- Bit 10: --- Bit 9: --- Bit 8: --- Bit 7: --- Bit 6: DI5 Bit 5: DI4 Bit 4: DI3 Bit 3: DI2 Bit 2: DI1 Bit 1: REV Bit 0: FWD</p>	0	---	---	Possible (TxPDO)
	0F	Z14	Second Last Alarm Info. Output Terminal via Communication	<div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; padding-bottom: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; padding-bottom: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0000 to FFFF hex</p> <p>Bit 15: --- Bit 14: --- Bit 13: --- Bit 12: --- Bit 11: --- Bit 10: --- Bit 9: --- Bit 8: RO Bit 7: --- Bit 6: --- Bit 5: --- Bit 4: --- Bit 3: --- Bit 2: --- Bit 1: DO2 Bit 0: DO1</p>	0	---	---	Possible (TxPDO)

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map								
	11	Z16	Second Last Alarm Info. Running Status 2	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0000 to FFFF hex</p> <p>Bit 15: Motor type (1: PM motor, 0: Induction motor)</p> <p>Bit 14: During EN circuit diagnosis</p> <p>Bit 7: During speed control (1 during control)</p> <p>Bit 5 to 4: Selected motor</p> <p>00: 1st motor</p> <p>01: 2nd motor</p> <p>10: Reserved</p> <p>11: Reserved</p> <p>Bit 3 to 0: Control method</p> <p>0000: V/f control without slip compensation</p> <p>0001: Dynamic torque vector control</p> <p>0010: V/f control with slip compensation</p> <p>0011: V/f control with speed sensor</p> <p>0100: Dynamic torque vector control with speed sensor</p> <p>0101: Vector control without speed sensor</p> <p>0110: Vector control with speed sensor</p> <p>0111: Torque control (Vector control without speed sensor)</p> <p>1000: Torque control (Vector control with speed sensor)</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	---	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	12	Z17	Second Last Alarm Info. Speed Detection	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>-32,768 to 32,767</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	---	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	13	Z18	Second Last Alarm Info. Running Status 3	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0000 to FFFF hex</p> <p>Bit 15: --- Bit 14: OL (Overload warning) Bit 13: LOC (Light load detection) Bit 12: OL2 (Overload warning 2) Bit 11: OLP (During active drive) Bit 10: LIFE (Life warning) Bit 9: OHF (Fin Overheat warning) Bit 8: TRY (During retry) Bit 7: FAN (Fan operation signal) Bit 6: Reserved Bit 5: THM (Thermal warning) Bit 4: IPF (During restart after instantaneous power failure) Bit 3: SETM (2nd motor selection) Bit 2: IRDY (Operation ready) Bit 1: FDT1 (Over set Frequency arrival) Bit 0: FAR1 (Constant speed arrival)</p>	0	---	---	Possible (TxPDO)
	29	Z40	1st Cumulative Run Time	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div>	0	---	10 h	Possible (TxPDO)
	2A	Z41	2nd Cumulative Run Time of motor	0 to 65,535				
	2D	Z44	2nd Number of Startups	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0 to 65,535</p>	0	---	---	Possible (TxPDO)
	33	Z50	Third Last Alarm Info. Output Frequency	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 655.35</p>	0	---	Hz	Possible (TxPDO)
	34	Z51	Third last Alarm info. Output Current	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 655.35</p>	0	---	A	Possible (TxPDO)
	35	Z52	Third last Alarm info. Output Voltage	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0 to 1,000</p>	0	---	V	Possible (TxPDO)
	36	Z53	Third Last Alarm Info. Torque Monitor	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>-999 to 999</p>	0	---	%	Possible (TxPDO)

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	37	Z54	Third Last Alarm Info. Frequency Command	<div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 655.35</p>	0	---	Hz	Possible (TxPDO)
	38	Z55	Third Last Alarm Info. Running Status	<div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> SLV PGV PM SLV PM PGV </div> <p>0000 to FFFF hex</p> <p>Bit 15: BUSY (During Parameter code data writing) Bit 14: --- Bit 13: --- Bit 12: RL (Communications effective) Bit 11: ALM (Alarm relay) Bit 10: DEC (During deceleration) Bit 9: ACC (During acceleration) Bit 8: IL (During current limiting) Bit 7: VL (During voltage limiting) Bit 6: TL (Torque limiting) Bit 5: NUV (Main circuit DC voltage established) Bit 4: BRK (During braking) Bit 3: INT (Inverter shut down) Bit 2: EXT (During DC braking or during pre-exciting) Bit 1: REV (During reverse operation) Bit 0: FWD (During forward operation)</p>	0	---	---	Possible (TxPDO)
	39	Z56	Third Last Alarm Info. Cumulative Ope. Time	<div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> SLV PGV PM SLV PM PGV </div> <p>0 to 655,350</p>	0	---	h	Possible (TxPDO)
	3A	Z57	Third last Alarm Info. Number Of Startups	<div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> SLV PGV PM SLV PM PGV </div> <p>0 to 65,535</p>	0	---	---	Possible (TxPDO)
	3B	Z58	Third Last Alarm Info. Main Circuit DC Voltage	<div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> SLV PGV PM SLV PM PGV </div> <p>0.0 to 1,000.0</p>	0.0	---	V	Possible (TxPDO)
	3C	Z59	Third Last Alarm Info. Internal Air Temperature	<div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> SLV PGV PM SLV PM PGV </div> <p>-32,768 to 32,767</p>	0	---	°C	Possible (TxPDO)

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map								
	3D	Z60	Third last Alarm Info. Heat Sink Temperature	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%;">V/f</td> <td style="width: 25%;">DTV</td> <td style="width: 25%;">PG V/f</td> <td style="width: 25%;">PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p style="margin-top: 5px;">-32,768 to 32,767</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	°C	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	3E	Z61	Third Last Alarm Info. Input Terminal	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%;">V/f</td> <td style="width: 25%;">DTV</td> <td style="width: 25%;">PG V/f</td> <td style="width: 25%;">PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p style="margin-top: 5px;">0000 to FFFF hex</p> <p>Bit 15: --- Bit 14: --- Bit 13: --- Bit 12: EN2 Bit 11: EN1 Bit 10: --- Bit 9: --- Bit 8: --- Bit 7: --- Bit 6: DI5 Bit 5: DI4 Bit 4: DI3 Bit 3: DI2 Bit 2: DI1 Bit 1: DI7 Bit 0: DI6</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	---	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	3F	Z62	Third Last Alarm Info. Output Terminal	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%;">V/f</td> <td style="width: 25%;">DTV</td> <td style="width: 25%;">PG V/f</td> <td style="width: 25%;">PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p style="margin-top: 5px;">0000 to FFFF hex</p> <p>Bit 15: --- Bit 14: --- Bit 13: --- Bit 12: --- Bit 11: --- Bit 10: --- Bit 9: --- Bit 8: RO Bit 7: --- Bit 6: --- Bit 5: --- Bit 4: --- Bit 3: --- Bit 2: --- Bit 1: DO2 Bit 0: DO1</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	---	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	40	Z63	Third Last Alarm Info. Input Terminal via Communication	<div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> SLV PGV PM SLV PM PGV </div> <p>0000 to FFFF hex</p> <p>Bit 15: RST Bit 14: DI7 Bit 13: DI6 Bit 12: --- Bit 11: --- Bit 10: --- Bit 9: --- Bit 8: --- Bit 7: --- Bit 6: DI5 Bit 5: DI4 Bit 4: DI3 Bit 3: DI2 Bit 2: DI1 Bit 1: REV Bit 0: FWD</p>	0	---	---	Possible (TxPDO)
	41	Z64	Third Last Alarm Info. Output Terminal via Communication	<div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> SLV PGV PM SLV PM PGV </div> <p>0000 to FFFF hex</p> <p>Bit 15: --- Bit 14: --- Bit 13: --- Bit 12: --- Bit 11: --- Bit 10: --- Bit 9: --- Bit 8: RO Bit 7: --- Bit 6: --- Bit 5: --- Bit 4: --- Bit 3: --- Bit 2: --- Bit 1: DO2 Bit 0: DO1</p>	0	---	---	Possible (TxPDO)

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map								
	43	Z66	Third last info. on alarm Running Status 2	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0000 to FFFF hex</p> <p>Bit 15: Motor type (1: PM motor, 0: Induction motor)</p> <p>Bit 14: During EN circuit diagnosis</p> <p>Bit 7: During speed control (1 during control)</p> <p>Bit 5 to 4: Selected motor 00: 1st motor 01: 2nd motor 10: Reserved 11: Reserved</p> <p>Bit 3 to 0: Control method 0000: V/f control without slip compensation 0001: Dynamic torque vector control 0010: V/f control with slip compensation 0011: V/f control with speed sensor 0100: Dynamic torque vector control with speed sensor 0101: Vector control without speed sensor 0110: Vector control with speed sensor 0111: Torque control (Vector control without speed sensor) 1000: Torque control (Vector control with speed sensor)</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	---	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	44	Z67	Third Last Alarm Info. Speed Detection	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>-32,768 to 32,767</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	---	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	45	Z68	Third Last Alarm Info. Running Status 3	<div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> SLV PGV PM SLV PM PGV </div> <p>0000 to FFFF hex</p> <p>Bit 15: --- Bit 14: OL (Overload warning) Bit 13: LOC (Light load detection) Bit 12: OL2 (Overload warning 2) Bit 11: OLP (During active drive) Bit 10: LIFE (Life warning) Bit 9: OHF (Fin Overheat warning) Bit 8: TRY (During retry) Bit 7: FAN (Fan operation signal) Bit 6: Reserved Bit 5: THM (Thermal warning) Bit 4: IPF (During restart after instantaneous power failure) Bit 3: SETM (2nd motor selection) Bit 2: IRDY (Operation ready) Bit 1: FDT1 (Over set Frequency arrival) Bit 0: FAR1 (Constant speed arrival)</p>	0	---	---	Possible (TxPDO)
	55	Z84	Output Current Monitor	<div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 655.35</p>	0	---	A	Possible (TxPDO)

A-4-4 X Group Parameter List (Alarm Information 2)

Index (hex)	Sub-index (hex)	Pa-rameter No.	Function name	Monitor or data range	Default data	Set-ting dur-ing RUN	Unit	PDO map
3011	01	X00	Latest Alarm History/Number of Consecutive Same Alarms	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0000 to FFFF hex</p> <p>MSB: 00 to FF hex LSB: 00 to FE hex</p> <p>MSB: Number of alarm ("00 hex") LSB: 00 to FE hex</p> <p>00 hex (0): No alarm 01 hex (1): OC1 Overcurrent protection (during acceleration) 02 hex (2): OC2 Overcurrent protection (during deceleration) 03 hex (3): OC3 Overcurrent protection (during constant speed operation) 06 hex (4): OU1 Overvoltage protection (during acceleration) 07 hex (7): OU2 Overvoltage protection (during deceleration) 08 hex (8): OU3 Overvoltage protection (during constant speed operation or stopping) 0A hex (10): LU Undervoltage protection 0B hex (11): Lin Input phase loss protection 10 hex (16): PbF Inrush current avoidance circuit error 11 hex (17): OH1 Heat sink overheat 12 hex (18): OH2 External alarm input 13 hex (19): OH3 Inverter internal overheat 14 hex (20): OH4 Motor protection (PTC thermistor) 16 hex (22): dbH Braking resistor overheat 17 hex (23): OL1 Motor 1 overload 18 hex (24): OL2 Motor 2 overload 19 hex (25): OLU Inverter overload 1B hex (27): OS Over speed protection 1C hex (28): Pg PG disconnection 1F hex (31): Er1 Memory error 20 hex (32): Reserved</p>	0	---	---	Possible (TxPDO)

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
				22 hex (34): Reserved 23 hex (35): Er5 EtherCAT board error 24 hex (36): Er6 Operation protection 25 hex (37): Er7 Tuning error 2A hex (42): Erd Detection of step-out 2E hex (46): OPL Output phase loss protection 2F hex (47): ErE Following error (excessive speed deviation) 32 hex (50): ErC Magnetic pole position detection error 33 hex (51): ErF Data save error in case of undervoltage 34 hex (52): d0 Excessive positioning deviation 35 hex (53): Reserved 38 hex (56): Ero Position control error 39 hex (57): ECF EN circuit failure 3A hex (58): Reserved 3B hex (59): dbA Braking resistor overheat 44 hex (68): ErU Support tool communication disconnection 46 hex (70): OH6 Inrush current prevention resistor overheat FD hex (253): Lok Locked by password FE hex (254): Err Mock alarm (Sub-code = 9998)				
	02	X01	Latest Multiple Alarm1	<input type="checkbox"/> V/f <input type="checkbox"/> DTV <input type="checkbox"/> PG V/f <input type="checkbox"/> PG DTV <input type="checkbox"/> SLV <input type="checkbox"/> PGV <input type="checkbox"/> PM SLV <input type="checkbox"/> PM PGV	0	---	---	Possible (TxPDO)
	03	X02	Latest Multiple Alarm2	0000 to FFFF hex				
	04	X03	Latest Alarm Sub Code 1	<input type="checkbox"/> V/f <input type="checkbox"/> DTV <input type="checkbox"/> PG V/f <input type="checkbox"/> PG DTV <input type="checkbox"/> SLV <input type="checkbox"/> PGV <input type="checkbox"/> PM SLV <input type="checkbox"/> PM PGV	0	---	---	Possible (TxPDO)
	05	X04	Latest Multiple Alarm Sub Code 2	0 to 9,999				

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	06	X05	Last Alarm History/Number of Consecutive Same Alarms	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0000 to FFFF hex</p> <p>MSB: 00 to FF hex LSB: 00 to FE hex</p> <p>MSB: Number of alarm LSB: 00 to FE hex</p> <p>00 hex (0): No alarm 01 hex (1): OC1 Overcurrent protection (during acceleration) 02 hex (2): OC2 Overcurrent protection (during deceleration) 03 hex (3): OC3 Overcurrent protection (during constant speed operation) 06 hex (4): OU1 Overvoltage protection (during acceleration) 07 hex (7): OU2 Overvoltage protection (during deceleration) 08 hex (8): OU3 Overvoltage protection (during constant speed operation or stopping) 0A hex (10): LU Undervoltage protection 0B hex (11): Lin Input phase loss protection 10 hex (16): PbF Inrush current avoidance circuit error 11 hex (17): OH1 Heat sink overheat 12 hex (18): OH2 External alarm input 13 hex (19): OH3 Inverter internal overheat 14 hex (20): OH4 Motor protection (PTC thermistor) 16 hex (22): dbH Braking resistor overheat 17 hex (23): OL1 Motor 1 overload 18 hex (24): OL2 Motor 2 overload 19 hex (25): OLU Inverter overload 1B hex (27): OS Over speed protection 1C hex (28): Pg PG disconnection 1F hex (31): Er1 Memory error 20 hex (32): Reserved</p>	0	---	---	Possible (TxPDO)

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map								
				22 hex (34): Reserved 23 hex (35): Er5 EtherCAT board error 24 hex (36): Er6 Operation protection 25 hex (37): Er7 Tuning error 2A hex (42): Erd Detection of step-out 2E hex (46): OPL Output phase loss protection 2F hex (47): ErE Following error (excessive speed deviation) 32 hex (50): ErC Magnetic pole position detection error 33 hex (51): ErF Data save error in case of undervoltage 34 hex (52): d0 Excessive positioning deviation 35 hex (53): Reserved 38 hex (56): Ero Position control error 39 hex (57): ECF EN circuit failure 3A hex (58): Reserved 3B hex (59): dbA Braking resistor overheat 44 hex (68): ErU Support tool communication disconnection 46 hex (70): OH6 Inrush current prevention resistor overheat FD hex (253): Lok Locked by password FE hex (254): Err Mock alarm (Sub-code = 9998)												
	07	X06	Last Multiple Alarm 2	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	---	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	08	X07	Last Multiple Alarm 3	0000 to FFFF hex												
	09	X08	Last Alarm Sub Code 1	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	---	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	0A	X09	Last Multiple Alarm Sub Code	0 to 9,999												

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	0B	X10	Second Last Alarm History/ Number of Consecutive Same Alarms	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0000 to FFFF hex</p> <p>MSB: 00 to FF hex LSB: 00 to FE hex</p> <p>MSB: Number of alarm LSB: 00 to FE hex</p> <p>00 hex (0): No alarm 01 hex (1): OC1 Overcurrent protection (during acceleration) 02 hex (2): OC2 Overcurrent protection (during deceleration) 03 hex (3): OC3 Overcurrent protection (during constant speed operation) 06 hex (4): OU1 Overvoltage protection (during acceleration) 07 hex (7): OU2 Overvoltage protection (during deceleration) 08 hex (8): OU3 Overvoltage protection (during constant speed operation or stopping) 0A hex (10): LU Undervoltage protection 0B hex (11): Lin Input phase loss protection 10 hex (16): PbF Inrush current avoidance circuit error 11 hex (17): OH1 Heat sink overheat 12 hex (18): OH2 External alarm input 13 hex (19): OH3 Inverter internal overheat 14 hex (20): OH4 Motor protection (PTC thermistor) 16 hex (22): dbH Braking resistor overheat 17 hex (23): OL1 Motor 1 overload 18 hex (24): OL2 Motor 2 overload 19 hex (25): OLU Inverter overload 1B hex (27): OS Over speed protection 1C hex (28): Pg PG disconnection 1F hex (31): Er1 Memory error 20 hex (32): Reserved</p>	0	---	---	Possible (TxPDO)

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map								
				22 hex (34): Reserved 23 hex (35): Er5 EtherCAT board error 24 hex (36): Er6 Operation protection 25 hex (37): Er7 Tuning error 2A hex (42): Erd Detection of step-out 2E hex (46): OPL Output phase loss protection 2F hex (47): ErE Following error (excessive speed deviation) 32 hex (50): ErC Magnetic pole position detection error 33 hex (51): ErF Data save error in case of undervoltage 34 hex (52): d0 Excessive positioning deviation 35 hex (53): Reserved 38 hex (56): Ero Position control error 39 hex (57): ECF EN circuit failure 3A hex (58): Reserved 3B hex (59): dbA Braking resistor overheat 44 hex (68): ErU Support tool communication disconnection 46 hex (70): OH6 Inrush current prevention resistor overheat FD hex (253): Lok Locked by password FE hex (254): Err Mock alarm (Sub-code = 9998)												
	0C	X11	Second last Multiple Alarm2	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	---	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	0D	X12	Second Last Multiple Alarm3	0000 to FFFF hex												
	0E	X13	Second Last Alarm Sub Code	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	---	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	0F	X14	Second Last Multiple Alarm Sub Code	0 to 9,999												

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	10	X15	Third Last Alarm History/Number of Consecutive Same Alarms	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0000 to FFFF hex</p> <p>MSB: 00 to FF hex LSB: 00 to FE hex</p> <p>MSB: Number of alarm LSB: 00 to FE hex</p> <p>00 hex (0): No alarm 01 hex (1): OC1 Overcurrent protection (during acceleration) 02 hex (2): OC2 Overcurrent protection (during deceleration) 03 hex (3): OC3 Overcurrent protection (during constant speed operation) 06 hex (4): OU1 Overvoltage protection (during acceleration) 07 hex (7): OU2 Overvoltage protection (during deceleration) 08 hex (8): OU3 Overvoltage protection (during constant speed operation or stopping) 0A hex (10): LU Undervoltage protection 0B hex (11): Lin Input phase loss protection 10 hex (16): PbF Inrush current avoidance circuit error 11 hex (17): OH1 Heat sink overheat 12 hex (18): OH2 External alarm input 13 hex (19): OH3 Inverter internal overheat 14 hex (20): OH4 Motor protection (PTC thermistor) 16 hex (22): dbH Braking resistor overheat 17 hex (23): OL1 Motor 1 overload 18 hex (24): OL2 Motor 2 overload 19 hex (25): OLU Inverter overload 1B hex (27): OS Over speed protection 1C hex (28): Pg PG disconnection 1F hex (31): Er1 Memory error 20 hex (32): Reserved</p>	0	---	---	Possible (TxPDO)

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map								
				22 hex (34): Reserved 23 hex (35): Er5 EtherCAT board error 24 hex (36): Er6 Operation protection 25 hex (37): Er7 Tuning error 2A hex (42): Erd Detection of step-out 2E hex (46): OPL Output phase loss protection 2F hex (47): ErE Following error (excessive speed deviation) 32 hex (50): ErC Magnetic pole position detection error 33 hex (51): ErF Data save error in case of undervoltage 34 hex (52): d0 Excessive positioning deviation 35 hex (53): Reserved 38 hex (56): Ero Position control error 39 hex (57): ECF EN circuit failure 3A hex (58): Reserved 3B hex (59): dbA Braking resistor overheat 44 hex (68): ErU Support tool communication disconnection 46 hex (70): OH6 Inrush current prevention resistor overheat FD hex (253): Lok Locked by password FE hex (254): Err Mock alarm (Sub-code = 9998)												
	11	X16	Third Last Multiple Alarm 2	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	---	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	12	X17	Third Last Multiple Alarm 3	0000 to FFFF hex												
	13	X18	Third Last Alarm Sub Code 1	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	---	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	14	X19	Third Last Multiple Alarm Sub Code 2	0 to 9,999												
	15	X20	Latest Alarm Info. Output Frequency	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> 0.00 to 655.35	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	Hz	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	16	X21	Latest Alarm Info. Output Current	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> 0.00 to 655.35	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	A	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map								
	17	X22	Latest Alarm Info. Output Voltage	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0 to 1,000</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	V	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	18	X23	Latest Alarm Info. Torque Monitor	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>-999 to 999</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	%	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	19	X24	Latest Alarm Info. Frequency Command	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0.00 to 655.35</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	Hz	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	1A	X25	Latest Alarm Info. Running Status 1	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0000 to FFFF hex</p> <p>Bit 15: BUSY (During Parameter code data writing) Bit 14: --- Bit 13: --- Bit 12: RL (Communications effective) Bit 11: ALM (Alarm relay) Bit 10: DEC (During deceleration) Bit 9: ACC (During acceleration) Bit 8: IL (During current limiting) Bit 7: VL (During voltage limiting) Bit 6: TL (Torque limiting) Bit 5: NUJ (Main circuit DC voltage established) Bit 4: BRK (During braking) Bit 3: INT (Inverter shut down) Bit 2: EXT (During DC braking or during pre-exciting) Bit 1: REV (During reverse operation) Bit 0: FWD (During forward operation)</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	---	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	1B	X26	Latest Alarm Info. Cumulative Ope. time	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0 to 655,350</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	h	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	1C	X27	Latest Alarm Info. Number of Startups	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0 to 65,535</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	---	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	1D	X28	Latest Alarm Info. Main Circuit DC Voltage	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.0 to 1,000.0</p>	0.0	---	V	Possible (TxPDO)
	1E	X29	Latest Alarm Info. Internal Air Temperature	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>-32,768 to 32,767</p>	0	---	°C	Possible (TxPDO)
	1F	X30	Latest Alarm Info. Heat Sink Temperature	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>-32,768 to 32,767</p>	0	---	°C	Possible (TxPDO)
	20	X31	Latest Alarm Info. Input Terminal	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0000 to FFFF hex</p> <p>Bit 15: --- Bit 14: --- Bit 13: --- Bit 12: EN2 Bit 11: EN1 Bit 10: --- Bit 9: --- Bit 8: --- Bit 7: --- Bit 6: DI5 Bit 5: DI4 Bit 4: DI3 Bit 3: DI2 Bit 2: DI1 Bit 1: DI7 Bit 0: DI6</p>	0	---	---	Possible (TxPDO)

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	21	X32	Latest Alarm Info. Output Terminal	<div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> SLV PGV PM SLV PM PGV </div> <p>0000 to FFFF hex</p> <p>Bit 15: --- Bit 14: --- Bit 13: --- Bit 12: --- Bit 11: --- Bit 10: --- Bit 9: --- Bit 8: RO Bit 7: --- Bit 6: --- Bit 5: --- Bit 4: --- Bit 3: --- Bit 2: --- Bit 1: DO2 Bit 0: DO1</p>	0	---	---	Possible (TxPDO)
	22	X33	Latest Alarm Info. Input Terminal via Communication	<div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> SLV PGV PM SLV PM PGV </div> <p>0000 to FFFF hex</p> <p>Bit 15: RST Bit 14: DI7 Bit 13: DI6 Bit 12: --- Bit 11: --- Bit 10: --- Bit 9: --- Bit 8: --- Bit 7: --- Bit 6: DI5 Bit 5: DI4 Bit 4: DI3 Bit 3: DI2 Bit 2: DI1 Bit 1: REV Bit 0: FWD</p>	0	---	---	Possible (TxPDO)

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	23	X34	Latest Alarm Info. Output Terminal via Communication	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0000 to FFFF hex</p> <p>Bit 15: --- Bit 14: --- Bit 13: --- Bit 12: --- Bit 11: --- Bit 10: --- Bit 9: --- Bit 8: RO Bit 7: --- Bit 6: --- Bit 5: --- Bit 4: --- Bit 3: --- Bit 2: --- Bit 1: DO2 Bit 0: DO1</p>	0	---	---	Possible (TxPDO)
	24	X35	Latest Alarm Info. Input Power	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 9,999</p>	0	---	kW	Possible (TxPDO)

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map								
	25	X36	Latest info. on alarm Running Status 2	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0000 to FFFF hex</p> <p>Bit 15: Motor type (1: PM motor, 0: Induction motor)</p> <p>Bit 14: During EN circuit diagnosis</p> <p>Bit 7: During speed control (1 during control)</p> <p>Bit 5 to 4: Selected motor</p> <p>00: 1st motor</p> <p>01: 2nd motor</p> <p>10: Reserved</p> <p>11: Reserved</p> <p>Bit 3 to 0: Control method</p> <p>0000: V/f control without slip compensation</p> <p>0001: Dynamic torque vector control</p> <p>0010: V/f control with slip compensation</p> <p>0011: V/f control with speed sensor</p> <p>0100: Dynamic torque vector control with speed sensor</p> <p>0101: Vector control without speed sensor</p> <p>0110: Vector control with speed sensor</p> <p>0111: Torque control (Vector control without speed sensor)</p> <p>1000: Torque control (Vector control with speed sensor)</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	---	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	26	X37	Latest Alarm Info. Speed Detection	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>-32,768 to 32,767</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	---	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	27	X38	Latest Alarm Info. Running Status 3	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0000 to FFFF hex</p> <p>Bit 15: --- Bit 14: OL (Overload warning) Bit 13: LOC (Light load detection) Bit 12: OL2 (Overload warning 2) Bit 11: OLP (During active drive) Bit 10: LIFE (Life warning) Bit 9: OHF (Fin Overheat warning) Bit 8: TRY (During retry) Bit 7: FAN (Fan operation signal) Bit 6: Reserved Bit 5: THM (Thermal warning) Bit 4: IPF (During restart after instantaneous power failure) Bit 3: SETM (2nd motor selection) Bit 2: IRDY (Operation ready) Bit 1: FDT1 (Over set Frequency arrival) Bit 0: FAR1 (Constant speed arrival)</p>	0	---	---	Possible (TxPDO)
	32	X49	Fault Counter	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0 to 65,535</p>	0	---	---	Possible (TxPDO)
	3D	X60	Last Info. Alarm Info. Output Frequency	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 655.35</p>	0	---	Hz	Possible (TxPDO)
	3E	X61	Last Alarm info. Output Current	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 655.35</p>	0	---	A	Possible (TxPDO)
	3F	X62	Last Alarm info. Output Voltage	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0 to 1,000</p>	0	---	V	Possible (TxPDO)
	40	X63	Last Alarm Info. Torque Monitor	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>-999 to 999</p>	0	---	%	Possible (TxPDO)
	41	X64	Last Alarm Info. Frequency Command	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 655.35</p>	0	---	Hz	Possible (TxPDO)

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	42	X65	Last Alarm Info. Running Status	<div style="display: flex; flex-wrap: wrap; gap: 5px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; flex-wrap: wrap; gap: 5px;"> SLV PGV PM SLV PM PGV </div> <p>0000 to FFFF hex</p> <p>Bit 15: BUSY (During Parameter code data writing)</p> <p>Bit 14: ---</p> <p>Bit 13: ---</p> <p>Bit 12: RL (Communications effective)</p> <p>Bit 11: ALM (Alarm relay)</p> <p>Bit 10: DEC (During deceleration)</p> <p>Bit 9: ACC (During acceleration)</p> <p>Bit 8: IL (During current limiting)</p> <p>Bit 7: VL (During voltage limiting)</p> <p>Bit 6: TL (Torque limiting)</p> <p>Bit 5: NUV (Main circuit DC voltage established)</p> <p>Bit 4: BRK (During braking)</p> <p>Bit 3: INT (Inverter shut down)</p> <p>Bit 2: EXT (During DC braking or during pre-exciting)</p> <p>Bit 1: REV (During reverse operation)</p> <p>Bit 0: FWD (During forward operation)</p>	0	---	---	Possible (TxPDO)
	43	X66	Last Alarm Info. Cumulative Ope. Time	<div style="display: flex; flex-wrap: wrap; gap: 5px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; flex-wrap: wrap; gap: 5px;"> SLV PGV PM SLV PM PGV </div> <p>0 to 655,350</p>	0	---	h	Possible (TxPDO)
	44	X67	Last Alarm Info. Number Of Start-ups	<div style="display: flex; flex-wrap: wrap; gap: 5px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; flex-wrap: wrap; gap: 5px;"> SLV PGV PM SLV PM PGV </div> <p>0 to 65,535</p>	0	---	---	Possible (TxPDO)
	45	X68	Last Alarm Info. Main Circuit DC Voltage	<div style="display: flex; flex-wrap: wrap; gap: 5px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; flex-wrap: wrap; gap: 5px;"> SLV PGV PM SLV PM PGV </div> <p>0.0 to 1,000.0</p>	0.0	---	V	Possible (TxPDO)
	46	X69	Last Alarm Info Internal Air Temperature	<div style="display: flex; flex-wrap: wrap; gap: 5px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; flex-wrap: wrap; gap: 5px;"> SLV PGV PM SLV PM PGV </div> <p>-32,768 to 32,767</p>	0	---	°C	Possible (TxPDO)
	47	X70	Last Alarm Info. Heat Sink Temperature	<div style="display: flex; flex-wrap: wrap; gap: 5px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; flex-wrap: wrap; gap: 5px;"> SLV PGV PM SLV PM PGV </div> <p>-32,768 to 32,767</p>	0	---	°C	Possible (TxPDO)

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	48	X71	Last Alarm Info. Input Terminal	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0000 to FFFF hex</p> <p>Bit 15: --- Bit 14: --- Bit 13: --- Bit 12: EN2 Bit 11: EN1 Bit 10: --- Bit 9: --- Bit 8: --- Bit 7: --- Bit 6: DI5 Bit 5: DI4 Bit 4: DI3 Bit 3: DI2 Bit 2: DI1 Bit 1: DI7 Bit 0: DI6</p>	0	---	---	Possible (TxPDO)
	49	X72	Last Alarm Info. Output Terminal	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0000 to FFFF hex</p> <p>Bit 15: --- Bit 14: --- Bit 13: --- Bit 12: --- Bit 11: --- Bit 10: --- Bit 9: --- Bit 8: RO Bit 7: --- Bit 6: --- Bit 5: --- Bit 4: --- Bit 3: --- Bit 2: --- Bit 1: DO2 Bit 0: DO1</p>	0	---	---	Possible (TxPDO)

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	4A	X73	Last Alarm Info. Input Terminal via Communication	<div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; padding-bottom: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; padding-bottom: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0000 to FFFF hex</p> <p>Bit 15: RST Bit 14: DI7 Bit 13: DI6 Bit 12: --- Bit 11: --- Bit 10: --- Bit 9: --- Bit 8: --- Bit 7: --- Bit 6: DI5 Bit 5: DI4 Bit 4: DI3 Bit 3: DI2 Bit 2: DI1 Bit 1: REV Bit 0: FWD</p>	0	---	---	Possible (TxPDO)
	4B	X74	Last Alarm Info. Output Terminal via Communication	<div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; padding-bottom: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; padding-bottom: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0000 to FFFF hex</p> <p>Bit 15: --- Bit 14: --- Bit 13: --- Bit 12: --- Bit 11: --- Bit 10: --- Bit 9: --- Bit 8: RO Bit 7: --- Bit 6: --- Bit 5: --- Bit 4: --- Bit 3: --- Bit 2: --- Bit 1: DO2 Bit 0: DO1</p>	0	---	---	Possible (TxPDO)

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map								
	4D	X76	Last info. on alarm Running Status 2	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0000 to FFFF hex</p> <p>Bit 15: Motor type (1: PM motor, 0: Induction motor)</p> <p>Bit 14: During EN circuit diagnosis</p> <p>Bit 7: During speed control (1 during control)</p> <p>Bit 5 to 4: Selected motor</p> <p>00: 1st motor</p> <p>01: 2nd motor</p> <p>10: Reserved</p> <p>11: Reserved</p> <p>Bit 3 to 0: Control method</p> <p>0000: V/f control without slip compensation</p> <p>0001: Dynamic torque vector control</p> <p>0010: V/f control with slip compensation</p> <p>0011: V/f control with speed sensor</p> <p>0100: Dynamic torque vector control with speed sensor</p> <p>0101: Vector control without speed sensor</p> <p>0110: Vector control with speed sensor</p> <p>0111: Torque control (Vector control without speed sensor)</p> <p>1000: Torque control (Vector control with speed sensor)</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	---	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	4E	X77	Last Alarm Info. Speed Detection	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>-32,768 to 32,767</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	---	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map								
	4F	X78	Last Alarm Info. Running Status 3	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0000 to FFFF hex</p> <p>Bit 15: --- Bit 14: OL (Overload warning) Bit 13: LOC (Light load detection) Bit 12: OL2 (Overload warning 2) Bit 11: OLP (During active drive) Bit 10: LIFE (Life warning) Bit 9: OHF (Fin Overheat warning) Bit 8: TRY (During retry) Bit 7: FAN (Fan operation signal) Bit 6: Reserved Bit 5: THM (Thermal warning) Bit 4: IPF (During restart after instantaneous power failure) Bit 3: SETM (2nd motor selection) Bit 2: IRDY (Operation ready) Bit 1: FDT1 (Over set Frequency arrival) Bit 0: FAR1 (Constant speed arrival)</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	---	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	62	X97	Input Input Terminal [PTC] Input Voltage	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0.0 to 12.0</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	V	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
301A	09	X108	Latest Alarm Info. Cumulative Running Time	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	h	Possible (TxPDO)
	V/f	DTV	PG V/f	PG DTV												
	SLV	PGV	PM SLV	PM PGV												
	13	X118	Last Alarm Info. Cumulative Running time	0 to 655,350												
1D	X128	Second last Alarm Info. Cumulative Running time														
27	X138	Third last Alarm Info. Cumulative Running time														

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	29	X140	4th last Alarm History/Number of Consecutive Same Alarms	<div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> SLV PGV PM SLV PM PGV </div> <p>0000 to FFFF hex</p> <p>MSB: 00 to FF hex LSB: 00 to FE hex</p> <p>MSB: Number of alarm LSB: 00 to FE hex</p> <p>00 hex (0): No alarm 01 hex (1): OC1 Overcurrent protection (during acceleration) 02 hex (2): OC2 Overcurrent protection (during deceleration) 03 hex (3): OC3 Overcurrent protection (during constant speed operation) 06 hex (4): OU1 Overvoltage protection (during acceleration) 07 hex (7): OU2 Overvoltage protection (during deceleration) 08 hex (8): OU3 Overvoltage protection (during constant speed operation or stopping) 0A hex (10): LU Undervoltage protection 0B hex (11): Lin Input phase loss protection 10 hex (16): PbF Inrush current avoidance circuit error 11 hex (17): OH1 Heat sink overheat 12 hex (18): OH2 External alarm input 13 hex (19): OH3 Inverter internal overheat 14 hex (20): OH4 Motor protection (PTC thermistor) 16 hex (22): dbH Braking resistor overheat 17 hex (23): OL1 Motor 1 overload 18 hex (24): OL2 Motor 2 overload 19 hex (25): OLU Inverter overload 1B hex (27): OS Over speed protection 1C hex (28): Pg PG disconnection 1F hex (31): Er1 Memory error 20 hex (32): Reserved</p>	0	---	---	Possible (TxPDO)

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map								
				22 hex (34): Reserved 23 hex (35): Er5 EtherCAT board error 24 hex (36): Er6 Operation protection 25 hex (37): Er7 Tuning error 2A hex (42): Erd Detection of step-out 2E hex (46): OPL Output phase loss protection 2F hex (47): ErE Following error (excessive speed deviation) 32 hex (50): ErC Magnetic pole position detection error 33 hex (51): ErF Data save error in case of undervoltage 34 hex (52): d0 Excessive positioning deviation 35 hex (53): Reserved 38 hex (56): Ero Position control error 39 hex (57): ECF EN circuit failure 3A hex (58): Reserved 3B hex (59): dbA Braking resistor overheat 44 hex (68): ErU Support tool communication disconnection 46 hex (70): OH6 Inrush current prevention resistor overheat FD hex (253): Lok Locked by password FE hex (254): Err Mock alarm (Subcode = 9998)												
	2A	X141	Fourth last Alarm Info. Output Frequency	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> 0.00 to 655.35	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	Hz	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	2B	X142	Fourth last Alarm info. Output Current	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> 0.00 to 655.35	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	A	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	2C	X143	Fourth Last Alarm Info. Cumulative Ope. time	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> 0 to 655,350	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	h	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	2D	X144	Fourth Last Alarm Info. Main Circuit DC Voltage	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> 0.0 to 1,000.0	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0.0	---	V	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map								
	31	X148	Fourth Last Alarm Info. Cumulative Running Time	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0 to 655,350</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	h	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	32	X149	Fourth Last Alarm Info. Running Status	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0000 to FFFF hex</p> <p>Bit 15: BUSY (During Parameter code data writing) Bit 14: --- Bit 13: --- Bit 12: RL (Communications effective) Bit 11: ALM (Alarm relay) Bit 10: DEC (During deceleration) Bit 9: ACC (During acceleration) Bit 8: IL (During current limiting) Bit 7: VL (During voltage limiting) Bit 6: TL (Torque limiting) Bit 5: NUV (Main circuit DC voltage established) Bit 4: BRK (During braking) Bit 3: INT (Inverter shut down) Bit 2: EXT (During DC braking or during pre-exciting) Bit 1: REV (During reverse operation) Bit 0: FWD (During forward operation)</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	---	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	33	X150	5th last Alarm History/Number of Consecutive Same Alarms	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0000 to FFFF hex</p> <p>MSB: 00 to FF hex LSB: 00 to FE hex</p> <p>MSB: Number of alarm LSB: 00 to FE hex</p> <p>00 hex (0): No alarm 01 hex (1): OC1 Overcurrent protection (during acceleration) 02 hex (2): OC2 Overcurrent protection (during deceleration) 03 hex (3): OC3 Overcurrent protection (during constant speed operation) 06 hex (4): OU1 Overvoltage protection (during acceleration) 07 hex (7): OU2 Overvoltage protection (during deceleration) 08 hex (8): OU3 Overvoltage protection (during constant speed operation or stopping) 0A hex (10): LU Undervoltage protection 0B hex (11): Lin Input phase loss protection 10 hex (16): PbF Inrush current avoidance circuit error 11 hex (17): OH1 Heat sink overheat 12 hex (18): OH2 External alarm input 13 hex (19): OH3 Inverter internal overheat 14 hex (20): OH4 Motor protection (PTC thermistor) 16 hex (22): dbH Braking resistor overheat 17 hex (23): OL1 Motor 1 overload 18 hex (24): OL2 Motor 2 overload 19 hex (25): OLU Inverter overload 1B hex (27): OS Over speed protection 1C hex (28): Pg PG disconnection 1F hex (31): Er1 Memory error 20 hex (32): Reserved</p>	0	---	---	Possible (TxPDO)

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map								
				22 hex (34): Reserved 23 hex (35): Er5 EtherCAT board error 24 hex (36): Er6 Operation protection 25 hex (37): Er7 Tuning error 2A hex (42): Erd Detection of step-out 2E hex (46): OPL Output phase loss protection 2F hex (47): ErE Following error (excessive speed deviation) 32 hex (50): ErC Magnetic pole position detection error 33 hex (51): ErF Data save error in case of undervoltage 34 hex (52): d0 Excessive positioning deviation 35 hex (53): Reserved 38 hex (56): Ero Position control error 39 hex (57): ECF EN circuit failure 3A hex (58): Reserved 3B hex (59): dbA Braking resistor overheat 44 hex (68): ErU Support tool communication disconnection 46 hex (70): OH6 Inrush current prevention resistor overheat FD hex (253): Lok Locked by password FE hex (254): Err Mock alarm (Sub-code = 9998)												
	34	X151	Fifth Last Alarm Info. Output Frequency	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> 0.00 to 655.35	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	Hz	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	35	X152	Fifth Last Alarm Info. Output Current	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> 0.00 to 655.35	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	A	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	36	X153	Fifth Last Alarm Info. Cumulative Ope. Time	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> 0 to 655,350	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	h	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	37	X154	Fifth last Alarm Info. Main Circuit DC Voltage	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> 0.0 to 1,000.0	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0.0	---	V	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map								
	3B	X158	Fifth last Alarm Info. Cumulative Running time	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0 to 655,350</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	h	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	3C	X159	Fifth Last Alarm Info. Running Status	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0000 to FFFF hex</p> <p>Bit 15: BUSY (During Parameter code data writing) Bit 14: --- Bit 13: --- Bit 12: RL (Communications effective) Bit 11: ALM (Alarm relay) Bit 10: DEC (During deceleration) Bit 9: ACC (During acceleration) Bit 8: IL (During current limiting) Bit 7: VL (During voltage limiting) Bit 6: TL (Torque limiting) Bit 5: NUV (Main circuit DC voltage established) Bit 4: BRK (During braking) Bit 3: INT (Inverter shut down) Bit 2: EXT (During DC braking or during pre-exciting) Bit 1: REV (During reverse operation) Bit 0: FWD (During forward operation)</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	---	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													

A-4-5 F Group Parameter List (Basic Functions)

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
3004	01	F00	Do not use	Do not use.	---	---	---	---

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	02	F01	1st Frequency Reference Selection	<div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; padding-bottom: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; padding-bottom: 2px;"> SLV PGV PM SLV PM PGV </div> <p>1: Analog voltage input (terminal [AI1]) 7: UP/DOWN control 10: Pattern operation 12: Pulse train input 13: Calculation result 15: EtherCAT</p>	15	---	---	Possible
	03	F02	1st RUN Command Selection	<div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; padding-bottom: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; padding-bottom: 2px;"> SLV PGV PM SLV PM PGV </div> <p>1: Terminal command (FW or RV) 5: EtherCAT</p>	5	---	---	Possible
	04	F03	1st Maximum Output Frequency	<div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; padding-bottom: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; padding-bottom: 2px;"> SLV PGV PM SLV PM PGV </div> <p>5.0 to 590.0</p>	60.0	---	Hz	Possible
	05	F04	1st Base Frequency	<div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; padding-bottom: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; padding-bottom: 2px;"> SLV PGV PM SLV PM PGV </div> <p>5.0 to 590.0</p>	50.0	---	Hz	Possible
	06	F05	1st Rated Voltage at Base Frequency	<div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; padding-bottom: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; padding-bottom: 2px;"> SLV PGV PM SLV PM PGV </div> <p>80 to 240 (200 V class series) 160 to 500 (400 V class series)</p>	200	---	V	Possible
	07	F06	1st Rated Voltage at Maximum Output Frequency	<div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; padding-bottom: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; padding-bottom: 2px;"> SLV PGV PM SLV PM PGV </div> <p>80 to 240 (200 V class series) 160 to 500 (400 V class series)</p>	200	---	V	Possible
	08	F07	1st Acceleration Time 1	<div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; padding-bottom: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; padding-bottom: 2px;"> SLV PGV PM SLV PM PGV </div>	6.00	√	s	Possible
	09	F08	1st Deceleration Time 1	0.00 to 6,000.00				
	0A	F09	1st Manual Torque Boost Voltage	<div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; padding-bottom: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; padding-bottom: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0.0 to 20.0</p> <p>Percentage with respect to 1st Rated Voltage at Base Frequency (F05)</p>	1.9	√	%	Possible

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	0B	F10	1st Motor Electronic Thermal Characteristic Selection	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>1: For a general-purpose motor with shaft-driven cooling fan 2: For an inverter-driven motor non-ventilated motor or motor with separately powered cooling fan</p>	1	√	---	Possible
	0C	F11	1st Motor Electronic Thermal Level	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.00: Disable 0.01 to 118.8</p> <p>Setting range from 1% (HHD) to 135% (ND) of the rated inverter current</p>	21	√	A	Possible
	0D	F12	1st Motor Electronic Thermal Time Constant	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.5 to 75.0</p>	5	√	min	Possible
	0F	F14	Power Interruption Restart Mode Selection	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0: Immediately trip (Free run stop) 1: Trip after a recovery from power failure (Free run stop) 2: Trip after decelerate-to-stop 3: Continue to run 4: Restart at the frequency selected by E152 6: Decelerate-to-stop (w/o trip)</p>	1	√	---	Possible
	10	F15	1st Frequency Upper Limit	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 590.00</p>	70.00	√	Hz	Possible
	11	F16	1st Frequency Lower Limit	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 590.00</p>	0.00	√	Hz	Possible
	13	F18	Input Terminal [AI1, AI2] Bias for 1st Frequency Command	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>-100.00 to 100.00</p>	0.00	√	%	Possible
	15	F20	1st DC Injection Braking Start Frequency	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.0 to 60.0</p>	0.0	√	Hz	Possible

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	16	F21	1st DC Injection Braking Level	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0 to 100 (HHD mode) 0 to 80 (HND/HD mode) 0 to 60 (ND mode)</p> <p>Based on inverter rated current</p>	0	√	%	Possible
	17	F22	1st DC Injection Braking Time	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.00: Disable 0.01 to 30.00</p>	0.00	√	s	Possible
	18	F23	1st Starting Frequency	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.0 to 60.0</p>	0.5	√	Hz	Possible
	19	F24	1st Starting Frequency 1 Holding Time	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 10.00</p>	0.00	√	s	Possible
	1A	F25	1st Stop Frequency	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.0 to 60.0</p>	0.2	√	Hz	Possible
	1B	F26	Carrier Frequency	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0: 0.75 1 to 16</p>	2	√	kHz	Possible
	1C	F27	Motor Sound Tone	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0: Level 0 (Disable) 1: Level 1 2: Level 2 3: Level 3</p>	0	√	---	Possible
	26	F37	1st V/f Characteristics Selection	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0: Variable torque load 1: Constant torque load</p>	1	---	---	Possible
	27	F38	1st Stop Frequency Detection Method Selection	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0: Output frequency, Detected speed 1: Frequency reference</p>	0	---	---	Possible

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map								
	28	F39	1st Stop Frequency Holding Time	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0.00 to 10.00</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0.00	√	s	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	29	F40	Torque Limit 1	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	300	√	%	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	2A	F41	Torque Limit 2	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0 to 300</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV				
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	2B	F42	1st Drive Control Selection	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0: IM V/f control 1: IM Dynamic torque vector control without speed sensor 3: IM V/f control with speed sensor 4: IM Dynamic torque vector control with speed sensor 5: IM Vector control without speed sensor 6: IM Vector control with speed sensor 15: PM Vector control without speed and pole position sensor 16: PM Vector control with speed and pole position sensor</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	2C	F43	1st Overload Protect Function Selection	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0: Disable 1: Enable at constant speed 2: Enable during ACC/constant speed operation (Disable during DEC)</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	2	√	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	2D	F44	1st Overload Protect Level	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>20 to 200</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	180	√	%	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	33	F50	Electronic Thermal for Braking Resistor Discharging Capacity	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>1 to 9,000 32,767: Disable</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	32,767	√	kWs	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	34	F51	Electronic Thermal for Braking Resistor Allowable Average Loss	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0.001 to 99.99</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0.001	√	kW	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map								
	35	F52	Braking Resistor Resistance	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0.01 to 999</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0.01	√	Ω	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	51	F80	Load Mode Selection	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0: HHD 1: HND 3: HD (only for 400 V) 4: ND (only for 400 V)</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													

A-4-6 E Group Parameter List (Terminal Functions)

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map								
3005	02	E01	Input Terminal [DI1] Function Selection	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0 to 188 (normally-open input) 1,000 to 1,188 (normally-close input)</p> <p>Refer to 8-2-1 Multifunction Input Selection on page 8-23.</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	03	E02	Input Terminal [DI2] Function Selection	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0 to 188 (normally-open input) 1,000 to 1,188 (normally-close input)</p> <p>Refer to 8-2-1 Multifunction Input Selection on page 8-23.</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	1	---	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	04	E03	Input Terminal [DI3] Function Selection	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0 to 188 (normally-open input) 1,000 to 1,188 (normally-close input)</p> <p>Refer to 8-2-1 Multifunction Input Selection on page 8-23.</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	2	---	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	05	E04	Input Terminal [DI4] Function Selection	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0 to 188 (normally-open input) 1,000 to 1,188 (normally-close input)</p> <p>Refer to 8-2-1 Multifunction Input Selection on page 8-23.</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	7	---	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	06	E05	Input Terminal [DI5] Function Selection	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0 to 188 (normally-open input) 1,000 to 1,188 (normally-close input)</p> <p>Refer to 8-2-1 Multifunction Input Selection on page 8-23.</p>	8	---	---	Possible
	0B	E10	2nd Acceleration Time 1	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div>	6.00	√	s	Possible
	0C	E11	2nd Deceleration Time 1	0.00 to 6,000.00				
	0D	E12	1st Acceleration Time 2	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div>	6.00	√	s	Possible
	0E	E13	1st Deceleration Time 2	0.00 to 6,000.00				
	0F	E14	2nd Acceleration Time 2	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div>	6.00	√	s	Possible
	10	E15	2nd Deceleration Time 2	0.00 to 6,000.00				
	11	E16	Torque Limit 3	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div>	300	√	%	Possible
	12	E17	Torque Limit 4	0 to 300				
	15	E20	Output Terminal [DO1] Function Selection	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0 to 241 (normally-open output) 1,000 to 1,241 (normally-close output)</p> <p>Refer to 8-2-2 Multifunction Output Selection on page 8-28.</p>	0	---	---	Possible
	1C	E27	Output Terminal [ROA, ROB] Function Selection	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0 to 241 (normally-open output) 1,000 to 1,241 (normally-close output)</p> <p>Refer to 8-2-2 Multifunction Output Selection on page 8-28.</p>	99	---	---	Possible
	1E	E29	Frequency Arrival 2 ON Timer	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.01 to 10.00</p>	0.1	√	s	Possible

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	1F	E30	Frequency Arrival Detection Width (FAR1/FAR2/FAR3/FDT3/FDT4)	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.0 to 10.0</p>	2.5	√	Hz	Possible
	20	E31	Frequency Detection Level1 (FDT1/FDT3)	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>5.0 to 590.0</p>	60.0	√	Hz	Possible
	21	E32	Frequency Detection Hysteresis Width (FDT1/FDT2)	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>5.0 to 590.0</p>	1	√	Hz	Possible
	23	E34	Overload early warning 2 Level (OL2)	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.00: Disable 0.01 to 176.0</p>	21	√	A	Possible
	24	E35	Overload early warning 2 Detection Timer (OL2)	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.01 to 600.00</p>	10	√	s	Possible
	25	E36	Frequency Detection Level 2 (FDT2/FDT4)	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>5.0 to 590.0</p>	60.0	√	Hz	Possible
	26	E37	1st Overload Early Warning Detection Level	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.00: Disable 0.01 to 176.0</p>	21	√	A	Possible
	27	E38	1st Overload Early Warning Detection Timer / Low Current detection level (OL, LOC)	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.01 to 600.00</p>	10	√	s	Possible
	28	E39	Display Coefficient 1 for Transport Time / Auxiliary Display Coefficient 1 for Speed Monitor	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.000 to 9,999</p>	1	√	---	Possible
	32	E49	Torque Command Monitor Polarity Selection	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0: Torque polarity 1: Plus for driving, minus for braking</p>	1	√	---	Possible

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map								
	33	E50	1st Frequency Conversion Coefficient	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> 0.01 to 600.00	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	30	√	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	34	E51	Display Coefficient for Integrated Power	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> 0.000: Cancel/reset 0.001 to 9,999	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0.01	√	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	38	E55	2nd Overload Warning Detection Level	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> 0.00: Disable 0.01 to 176.0	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	21	√	A	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	39	E56	2nd Overload Early Warning Detection Timer	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> 0.01 to 600.00	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	10	√	s	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	3E	E61	Input Terminal [A1] Function Selection	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> 0: Frequency command 1: Auxiliary frequency setting 1 2: Auxiliary frequency setting 2 3: PID command 5: PID feedback 6: Ratio setting 7: Analog torque limiter 9: Torque bias 10: Torque command 11: Torque current command 17: Speed limit for forward rotation 18: Speed limit for reverse rotation 20: Analog signal input monitor 21: PID feed forward	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	42	E65	Reference Loss Detection Operation Selection	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> 0: Deceleration stop 20 to 120: Continuous operation frequency ratio 999: Disable*1	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	999	√	%	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	4D	E76	Main Circuit DC Voltage Low-voltage Detection Level	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> 200 to 400 (200 V class series) 400 to 800 (400 V class series)	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	235	√	V	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	4F	E78	Overtorque/Undertorque Detection Level at Forward Power Running	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0 to 300</p>	100	√	%	Possible
	50	E79	Torque detection 1 Detection Timer	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0.01 to 600.00</p>	10	√	s	Possible
	51	E80	Overtorque/Undertorque Detection Level at Reverse Regeneration	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0 to 300</p>	100	√	%	Possible
	63	E98	Input Terminal [DI6] Function Selection	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0 to 188 (normally-open output) 1,000 to 1,188 (normally-close output)</p> <p>Refer to 8-2-1 Multifunction Input Selection on page 8-23.</p>	98	---	---	Possible
	64	E99	Input Terminal [DI7] Function Selection	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0 to 188 (normally-open output) 1,000 to 1,188 (normally-close output)</p> <p>Refer to 8-2-1 Multifunction Input Selection on page 8-23.</p>	99	---	---	Possible
301F	03	E102	2nd RUN Command Selection	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>1: Terminal command (FW or RV) 5: EtherCAT</p>	5	---	---	Possible
	04	E103	Acceleration Stop Frequency	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0.00: Disable 0.00 to 590.00</p>	0.0	---	Hz	Possible
	05	E104	Acceleration Stop Time	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0.0: Disable 0.1 to 60.0</p>	0.00	---	s	Possible

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map								
	06	E105	Deceleration Stop Frequency	<table border="1" style="font-size: small;"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0.00: Disable 0.01 to 590.00</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0.00	---	Hz	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	07	E106	Deceleration Stop Time	<table border="1" style="font-size: small;"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0.0: Disable 0.0 to 60.0</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0.0	---	s	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	08	E107	Multi-step Frequency Selection	<table border="1" style="font-size: small;"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0: Binary (CF1 to CF4) 1: Bit (SF1 to SF7)</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	0C	E111	Jogging Operation Selection	<table border="1" style="font-size: small;"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0: Free run stop on jogging stop , disabled in operation 1: Deceleration stop on jogging stop , disabled in operation 2: DC injection braking on jogging stop , disabled in operation 3: Free run stop on jogging stop , enabled in operation 4: Deceleration stop on jogging stop , enabled in operation 5: DC injection braking on jogging stop , enabled in operation</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	4	---	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	0D	E112	1st Torque Boost Function Selection	<table border="1" style="font-size: small;"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	1	---	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	0E	E113	2nd Torque Boost Function Selection	<p>0: Manual torque boost 1: Automatic torque boost</p>												
	0F	E114	DC Injection Braking Selection	<table border="1" style="font-size: small;"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0: External DC injection braking 1: External DC injection braking/ setting frequency 2: Setting frequency</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	10	E115	External DC Injection Braking Edge/Level Selection	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0: Edge operation 1: Level operation</p>	1	---	---	Possible
	12	E117	2nd Frequency Upper Limit	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 590.00</p>	70.00	---	Hz	Possible
	13	E118	2nd Frequency Lower Limit	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 590.00</p>	0.00	---	Hz	Possible
	14	E119	PID Control Feedback Selection	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0: Analog input 3: Pulse train input</p>	0	---	---	Possible
	15	E120	PID Control PID Output Variable Range for Process Control	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0.0: Disable 0.1 to 100.0</p>	0.0	---	%	Possible
	16	E121	PID Control PID Feedforward Selection for Process Control	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0: Disable 1: Input terminal [AI1]</p>	0	---	---	Possible
	17	E122	1st AVR Function Selection	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div>	1	---	---	Possible
	18	E123	2nd AVR Function Selection	<p>0: Disable 1: Enable</p>				
	19	E124	Energy-saving Operation Function Selection	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0: Normal operation 1: Auto energy saving operation</p>	0	---	---	Possible
	1A	E125	1st 2-step Acceleration/ Deceleration switching Condition Selection	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0: Switching by 2CH terminal 1: Switching by 2-step Acceleration Switching Frequency/2-step Deceleration Switching Frequency</p>	0	---	---	Possible
	1B	E126	2nd 2-step Acceleration/Deceleration Switching Condition Selection	<p>2: Switching between forward/ reverse rotation only 3: Switching by RT1/RT2 terminal</p>				

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	1C	E127	1st 2-step Acceleration Switching Frequency	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 590.00</p>	0.00	---	Hz	Possible
	1D	E128	2nd 2-step Acceleration Switching Frequency					
	1E	E129	1st 2-step Deceleration Switching Frequency					
	1F	E130	2nd 2-step Deceleration Frequency					
	20	E131	Frequency Calculation Operation Target 1	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>1: Analog voltage input (terminal [A1]) 5: Pulse train input 7: EtherCAT</p>	1	---	---	Possible
	21	E132	Frequency Calculation Operation Target 2	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>1: Analog voltage input (terminal [A1]) 5: Pulse train input 7: EtherCAT</p>	7	---	---	Possible
	22	E133	Frequency Calculation Operator Selection	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0: Addition (E131 + E132) 1: Subtraction (E131 - E132) 2: Multiplication (E131 x E132)</p>	0	---	---	Possible
	23	E134	Frequency Addition Amount	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 590.00</p>	0.00	---	Hz	Possible
	24	E135	Frequency Addition Sign Selection	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0: Frequency command + E134 1: Frequency command - E134</p>	0	---	---	Possible
	28	E139	Overvoltage/Overcurrent Restart Function Selection	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0: Immediately trip 4: Restart at the frequency selected by E152</p>	0	---	---	Possible

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	2F	E146	2nd Overload Protect Function Selection	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0: Disable 1: Enable at constant speed 2: Enable during ACC/constant speed operation (Disable during DEC)</p>	2	√	---	Possible
	30	E147	2nd Overload Protect Level	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>20 to 200</p>	180	√	%	Possible
	35	E152	Starting Frequency Selection at Frequency Pull-in Restart	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0: Frequency at which the power failure occurred 1: Maximum output frequency 2: Frequency command 3: Starting frequency</p>	3	---	---	Possible
	37	E154	RUN Time Over (RNT)/Power ON Time Over (ONT) Detection Level	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0 to 9,999</p>	0	---	10 h	Possible
	3A	E157	Analog Input [AI1] Detection Upper Limit Level	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0 to 100</p>	100	√	%	Possible
	3B	E158	Analog Input [AI1] Detection Lower Limit Level	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0 to 100</p>	0	√	%	Possible
	3C	E159	Analog Input [AI1] Level Detection Hysteresis Width	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0 to 10</p>	0	√	%	Possible
	40	E163	Analog Operation Level at [AI1] Disconnection	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>-100 to 100 999: Disable*1</p>	999	---	%	Possible
	42	E165	Carrier Frequency Automatic Reduction Function Selection	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0: Disable 1: Enable</p>	1	---	---	Possible

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	43	E166	Non-linear V/f Frequency 1	<input type="checkbox"/> V/f <input type="checkbox"/> DTV <input type="checkbox"/> PG V/f <input type="checkbox"/> PG DTV <input type="checkbox"/> SLV <input type="checkbox"/> PGV <input type="checkbox"/> PM SLV <input type="checkbox"/> PM PGV 0.0: Disable 0.1 to 590.0	0.0	---	Hz	Possible
	44	E167	Non-linear V/f Voltage 1	<input type="checkbox"/> V/f <input type="checkbox"/> DTV <input type="checkbox"/> PG V/f <input type="checkbox"/> PG DTV <input type="checkbox"/> SLV <input type="checkbox"/> PGV <input type="checkbox"/> PM SLV <input type="checkbox"/> PM PGV 0 to 240 (200 V class series) 0 to 500 (400 V class series)	0	---	V	Possible
	45	E168	Non-linear V/f Frequency 2	<input type="checkbox"/> V/f <input type="checkbox"/> DTV <input type="checkbox"/> PG V/f <input type="checkbox"/> PG DTV <input type="checkbox"/> SLV <input type="checkbox"/> PGV <input type="checkbox"/> PM SLV <input type="checkbox"/> PM PGV 0.0: Disable 0.1 to 590.0	0.0	---	Hz	Possible
	46	E169	Non-linear V/f Voltage 2	<input type="checkbox"/> V/f <input type="checkbox"/> DTV <input type="checkbox"/> PG V/f <input type="checkbox"/> PG DTV <input type="checkbox"/> SLV <input type="checkbox"/> PGV <input type="checkbox"/> PM SLV <input type="checkbox"/> PM PGV 0 to 240 (200 V class series) 0 to 500 (400 V class series)	0	---	V	Possible
	47	E170	Non-linear V/f Frequency 3	<input type="checkbox"/> V/f <input type="checkbox"/> DTV <input type="checkbox"/> PG V/f <input type="checkbox"/> PG DTV <input type="checkbox"/> SLV <input type="checkbox"/> PGV <input type="checkbox"/> PM SLV <input type="checkbox"/> PM PGV 0.0: Disable 0.1 to 590.0	0.0	---	Hz	Possible
	48	E171	Non-linear V/f Voltage 3	<input type="checkbox"/> V/f <input type="checkbox"/> DTV <input type="checkbox"/> PG V/f <input type="checkbox"/> PG DTV <input type="checkbox"/> SLV <input type="checkbox"/> PGV <input type="checkbox"/> PM SLV <input type="checkbox"/> PM PGV 0 to 240 (200 V class series) 0 to 500 (400 V class series)	0	---	V	Possible
	49	E172	Non-linear V/f Frequency 4	<input type="checkbox"/> V/f <input type="checkbox"/> DTV <input type="checkbox"/> PG V/f <input type="checkbox"/> PG DTV <input type="checkbox"/> SLV <input type="checkbox"/> PGV <input type="checkbox"/> PM SLV <input type="checkbox"/> PM PGV 0.0: Disable 0.1 to 590.0	0.0	---	Hz	Possible
	4A	E173	Non-linear V/f Voltage 4	<input type="checkbox"/> V/f <input type="checkbox"/> DTV <input type="checkbox"/> PG V/f <input type="checkbox"/> PG DTV <input type="checkbox"/> SLV <input type="checkbox"/> PGV <input type="checkbox"/> PM SLV <input type="checkbox"/> PM PGV 0 to 240 (200 V class series) 0 to 500 (400 V class series)	0	---	V	Possible
	4B	E174	Non-linear V/f Frequency 5	<input type="checkbox"/> V/f <input type="checkbox"/> DTV <input type="checkbox"/> PG V/f <input type="checkbox"/> PG DTV <input type="checkbox"/> SLV <input type="checkbox"/> PGV <input type="checkbox"/> PM SLV <input type="checkbox"/> PM PGV 0.0: Disable 0.1 to 590.0	0.0	---	Hz	Possible

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	4C	E175	Non-linear V/f Voltage 5	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0 to 240 (200 V class series) 0 to 500 (400 V class series)</p>	0	---	V	Possible
	4D	E176	Non-linear V/f Frequency 6	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0.0: Disable 0.1 to 590.0</p>	0.0	---	Hz	Possible
	4E	E177	Non-linear V/f Voltage 6	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0 to 240 (200 V class series) 0 to 500 (400 V class series)</p>	0	---	V	Possible
	4F	E178	Non-linear V/f Frequency 7	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0.0: Disable 0.1 to 590.0</p>	0.0	---	Hz	Possible
	50	E179	Non-linear V/f Voltage 7	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0 to 240 (200 V class series) 0 to 500 (400 V class series)</p>	0	---	V	Possible
	52	E181	Acceleration Wait Time on Brake Control	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0.000 to 5.000</p>	0.000	---	s	Possible
	55	E184	Low Current Detection Condition Selection (LOC)	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0: Output during acceleration/deceleration and constant-speed operation 1: Output only during constant-speed operation</p>	1	---	---	Possible
	56	E185	Overload Warning Detection Condition Selection (OL1, OL2)	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0: Output during acceleration/deceleration and constant-speed operation 1: Output only during constant-speed operation</p>	1	---	---	Possible

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map								
	61	E196	Overtorque/Undertorque Detection Level Reverse Power Running	<table border="1" style="font-size: small;"> <tr> <td>V/f</td><td>DTV</td><td>PG V/f</td><td>PG DTV</td></tr> <tr> <td>SLV</td><td>PGV</td><td>PM SLV</td><td>PM PGV</td></tr> </table> 0 to 300	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	100	---	%	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	62	E197	Overtorque/Undertorque Detection Level Forward Regeneration	<table border="1" style="font-size: small;"> <tr> <td>V/f</td><td>DTV</td><td>PG V/f</td><td>PG DTV</td></tr> <tr> <td>SLV</td><td>PGV</td><td>PM SLV</td><td>PM PGV</td></tr> </table> 0 to 300	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	100	---	%	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	63	E198	Overtorque/Undertorque Detection Condition Selection	<table border="1" style="font-size: small;"> <tr> <td>V/f</td><td>DTV</td><td>PG V/f</td><td>PG DTV</td></tr> <tr> <td>SLV</td><td>PGV</td><td>PM SLV</td><td>PM PGV</td></tr> </table> 0: Output during acceleration/deceleration and constant-speed operation 1: Output only during constant-speed operation	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	64	E199	0Hz Detection Output Detection Level (ZS)	<table border="1" style="font-size: small;"> <tr> <td>V/f</td><td>DTV</td><td>PG V/f</td><td>PG DTV</td></tr> <tr> <td>SLV</td><td>PGV</td><td>PM SLV</td><td>PM PGV</td></tr> </table> 0.00 to 100.00	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	Hz	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													

*1. For SDO communications and PDO communications, it is 7FFF hex.

A-4-7 C Group Parameter List (Frequency Reference and Analog Input Functions)

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map								
3006	02	C01	Jump Frequency 1	<table border="1" style="font-size: small;"> <tr> <td>V/f</td><td>DTV</td><td>PG V/f</td><td>PG DTV</td></tr> <tr> <td>SLV</td><td>PGV</td><td>PM SLV</td><td>PM PGV</td></tr> </table> 0.0 to 590.0	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0.0	√	Hz	Possible
	V/f	DTV	PG V/f		PG DTV											
	SLV	PGV	PM SLV		PM PGV											
	03	C02	Jump Frequency 2													
04	C03	Jump Frequency 3														
05	C04	Jump Frequency Skip Width	<table border="1" style="font-size: small;"> <tr> <td>V/f</td><td>DTV</td><td>PG V/f</td><td>PG DTV</td></tr> <tr> <td>SLV</td><td>PGV</td><td>PM SLV</td><td>PM PGV</td></tr> </table> 0.0 to 30.0	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	3.0	√	Hz	Possible	
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	06	C05	Multi-step Speed Reference 1	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 590.00</p>	0.00	√	Hz	Possible
	07	C06	Multi-step Speed Reference 2					
	08	C07	Multi-step Speed Reference 3					
	09	C08	Multi-step Speed Reference 4					
	0A	C09	Multi-step Speed Reference 5					
	0B	C10	Multi-step Speed Reference 6					
	0C	C11	Multi-step Speed Reference 7					
	0D	C12	Multi-step Speed Reference 8					
	0E	C13	Multi-step Speed Reference 9					
	0F	C14	Multi-step Speed Reference 10					
	10	C15	Multi-step Speed Reference 11					
	11	C16	Multi-step Speed Reference 12					
	12	C17	Multi-step Speed Reference 13					
	13	C18	Multi-step Speed Reference 14					
	14	C19	Multi-step Speed Reference 15					
	15	C20	Jogging Frequency	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 590.00</p>	0.00	√	Hz	Possible
	16	C21	Pattern Operation Function Selection	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0: 1 cycle operation (Pattern operation) 1: Repetition operation (Pattern operation) 2: Constant speed operation (Pattern operation) after 1 cycle operation</p>	0	---	---	Possible

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map								
	17	C22	Pattern Operation Stage 1 Operation Setting	<table border="1" style="border-collapse: collapse; width: 100%;"> <tr> <td style="padding: 2px;">V/f</td> <td style="padding: 2px;">DTV</td> <td style="padding: 2px;">PG V/f</td> <td style="padding: 2px;">PG DTV</td> </tr> <tr> <td style="padding: 2px;">SLV</td> <td style="padding: 2px;">PGV</td> <td style="padding: 2px;">PM SLV</td> <td style="padding: 2px;">PM PGV</td> </tr> </table>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	√	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	18	C23	Pattern Operation Stage 2 Operation Setting	0000 to FFFF hex Bit 15: 0 = Forward, 1 = Reverse Bit 14: Fixed to 0 (Not used) Bit 13 to 12: Acceleration/Deceleration time selection 0: 1st Acceleration Time 1 (F07) /1st Deceleration Time 1 (F08) 1: 2nd Acceleration Time 1 (E10) /2nd Deceleration Time 1 (E11) 2: 1st Acceleration Time 2 (E12) /1st Deceleration Time 2 (E13) 3: 2nd Acceleration Time 2 (E14) /2nd Deceleration Time 2 (E15) Bit 11 to 10: Minimum unit of operation time 0 = X0.01 1 = X0.1 2 = X1 3 = X10 Bit 9 to 0: Data part of operation time <ul style="list-style-type: none"> • If Minimum unit is 0: X0.01, 000 to 3E7 hex (0.00 to 9.99) • If Minimum unit is 1: X0.1, 064 to 3E7 hex (10.0 to 99.9)*1 • If Minimum unit is 2: X1, 064 to 3E7 hex (100 to 999)*1 • If Minimum unit is 3: X10, 064 to 258 hex (1,000 to 6,000)*2 *1. 0000 to 0063 hex and 03E8 to 03FF hex cannot be set. *2. 0000 to 0063 hex and 0259 to 03FF hex cannot be set.												
	19	C24	Pattern Operation Stage 3 Operation Setting													
	1A	C25	Pattern Operation Stage 4 Operation Setting													
	1B	C26	Pattern Operation Stage 5 Operation Setting													
	1C	C27	Pattern Operation Stage 6 Operation Setting													
	1D	C28	Pattern Operation Stage 7 Operation Setting													
	1F	C30	2nd Frequency Reference Selection		<table border="1" style="border-collapse: collapse; width: 100%;"> <tr> <td style="padding: 2px;">V/f</td> <td style="padding: 2px;">DTV</td> <td style="padding: 2px;">PG V/f</td> <td style="padding: 2px;">PG DTV</td> </tr> <tr> <td style="padding: 2px;">SLV</td> <td style="padding: 2px;">PGV</td> <td style="padding: 2px;">PM SLV</td> <td style="padding: 2px;">PM PGV</td> </tr> </table> 1: Analog voltage input (terminal [AI1]) 7: UP/DOWN control 10: Pattern operation 12: Pulse train input 13: Calculation result 15: EtherCAT	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	15	---	---
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	20	C31	Input Terminal [AI1] Offset	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>-5.0 to 5.0</p>	0.0	√	%	Possible
	21	C32	Input Terminal [AI1] Gain (Command)	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 400.00</p>	100.00	√	%	Possible
	22	C33	Input Terminal [AI1] Filter	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 5.00</p>	0.05	√	s	Possible
	23	C34	Input Terminal [AI1] Gain (Analog Input)	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 100.00</p>	100.00	√	%	Possible
	24	C35	Input Terminal [AI1] Polarity Selection	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0: Bipolar 1: Unipolar</p>	1	---	---	Possible
	33	C50	Input Terminal [AI1, AI2] Bias Analog Input for 1st Frequency Command	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 100.00</p>	0.00	√	%	Possible
	36	C53	Input Terminal [AI1, AI2] Normal/Inverse Operation for 1st Frequency Command	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0: Normal 1: Inverse</p>	0	√	---	Possible
	37	C54	Input Terminal [AI1, AI2] Normal/Inverse Operation for 2nd Frequency Command	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0: Normal 1: Inverse</p>	0	√	---	Possible
	38	C55	Input Terminal [AI1] Bias (Command)	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>-200.00 to 200.00</p>	0.00	√	%	Possible
	39	C56	Input Terminal [AI1] Bias (Analog Input)	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 100.00</p>	0.00	√	%	Possible
	3B	C58	Reserved	Do not use.	---	---	---	---

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	3C	C59	Input Terminal [AI1] Analog Input Adjustment Maximum Scale	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>-999.00 to 9,990.00</p>	100	---	---	Possible
	3D	C60	Input Terminal [AI1] Analog Input Adjustment Minimum Scale	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>-999.00 to 9,990.00</p>	0	---	---	Possible
	5A	C89	Set-point Factor Numerator via Communication	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>-32,768 to 32,767</p>	1	√	---	Possible
	5B	C90	Set-point Factor Denominator via Communication	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>-32,768 to 32,767</p>	1	√	---	Possible

A-4-8 P Group Parameter List (Motor 1 Parameters)

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
3007	02	P01	1st Motor Pole Number	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>2 to 128</p>	4	---	Poles	Possible
	03	P02	1st Motor Capacity	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.01 to 1,000</p>	5.50	---	kW	Possible
	04	P03	1st Motor Rated Current	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 500.0</p>	21	---	A	Possible
	05	P04	1st Auto Tuning Function Selection	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0: Disable 1: Tune the motor parameters while stopped 2: Tune the motor parameters while rotating 4: Tune the PM motor magnetic pole position offset while rotating 5: Tune the motor %R1 and %X while stopped</p>	0	---	---	Possible

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	06	P05	1st Online Tuning Function Selection	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0: Disable 1: Enable</p>	0	√	---	Possible
	07	P06	1st Motor Armature Resistance	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 500.0</p>	10.55	---	A	Possible
	08	P07	1st Motor Parameter %R1	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 50.00</p>	3.17	√	%	Possible
	09	P08	1st Motor Parameter %X	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 50.00</p>	11.47	√	%	Possible
	0A	P09	1st Slip Compensation Gain for Driving	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0.0 to 200.0</p>	100.0	√	%	Possible
	0B	P10	1st Slip Compensation Response Time	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0.01 to 10.00</p>	0.12	√	s	Possible
	0C	P11	1st Slip Compensation Gain for Braking	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0.0 to 200.0</p>	100.0	√	%	Possible
	0D	P12	1st Rated Slip Frequency	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 15.00</p>	1	---	Hz	Possible
	0E	P13	1st Iron Loss Factor 1	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 20.00</p>	2.86	√	%	Possible
	11	P16	1st Magnetic Saturation Factor 1	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0.0 to 300.0</p>	92	√	%	Possible
	12	P17	1st Magnetic Saturation Factor 2	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0.0 to 300.0</p>	84.2	√	%	Possible
	13	P18	1st Magnetic Saturation Factor 3	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0.0 to 300.0</p>	70.5	√	%	Possible

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	14	P19	1st Magnetic Saturation Factor 4	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.0 to 300.0</p>	58.3	√	%	Possible
	15	P20	1st Magnetic Saturation Factor 5	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.0 to 300.0</p>	46.1	√	%	Possible
	1F	P30	1st PM Motor Starting Method	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0: Pull-in by current 1: IPM motor type 1 2: SPM motor type 3: Pull-in by current for IPM motor 4: IPM motor type 2</p>	1	---	---	Possible
	29	P40	Reserved	Do not use.	---	---	---	---
	2A	P41	Reserved	Do not use.	---	---	---	---
	36	P53	1st Motor %X Correction Factor	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0 to 300</p>	100	√	%	Possible
	38	P55	1st Motor Torque Current under Vector Control	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 500.0</p>	16.71	---	A	Possible
	39	P56	1st Induced Voltage Factor under Vector Control	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>50 to 100</p>	95	---	%	Possible
	3A	P57	Reserved	Do not use.	---	---	---	---
	3D	P60	1st PM Motor Armature Resistance	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.000 to 50.00</p>	0.253	---	Ω	Possible
	3E	P61	1st PM Motor d-axis Inductance	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 500.0</p>	4.77	---	mH	Possible
	3F	P62	1st PM Motor q-axis Inductance	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 500.0</p>	10.70	---	mH	Possible
	40	P63	1st PM Motor Induced Voltage Ke	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0 to 240 (200 V class series) 0 to 500 (400 V class series)</p>	177	---	V	Possible

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	41	P64	1st PM Motor Iron Loss	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.0 to 20.0 100% = Motor rated current</p>	5.50	√	%	Possible
	42	P65	1st PM Motor d-axis Inductance Magnetic Saturation Correction	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.0 to 100.0 (100.0% = No magnetic saturation) 999: Factory default*1</p>	999	√	%	Possible
	4B	P74	1st PM Motor Reference Current at Starting	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>10 to 200 100% = Motor rated current</p>	80	√	%	Possible
	54	P83	Reserved	Do not use.	---	---	---	---
	55	P84	Reserved	Do not use.	---	---	---	---
	56	P85	1st PM Motor Flux Limitation Value	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>50.0 to 150.0 999: Factory default*1</p>	999	√	%	Possible
	57	P86	Reserved	Do not use.	---	---	---	---
	58	P87	1st PM Motor Reference Current for Magnetic Pole Detection	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0 to 200 100% = Motor rated current</p>	60	---	%	Possible
	59	P88	Reserved	Do not use.	---	---	---	---
	5A	P89	Reserved	Do not use.	---	---	---	---
	5B	P90	1st PM Motor Overcurrent Protection Level	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.00: Disable 0.01 to 500.0</p>	50.00	---	A	Possible
	60	P95	1st PM Motor Magnetic Pole position Offset	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.0 to 359.9 999: Offset not adjusted*1</p>	999	√	°	Possible

*1. For SDO communications and PDO communications, it is 7FFF hex.

A-4-9 H Group Parameter List (High Level Functions)

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map								
3008	04	H03	Data Initialization	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0: Disable 1: Initialize all parameters 2: Initialize motor 1 parameters 3: Initialize motor 2 parameters 4: Restore user defined data 5: Initialize all parameters (except I/O and communications) 6: Reserved 7: Clear alarm history 8: Clear selection of favorite function code</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	05	H04	Retry Count at Trip	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0: Disable 1 to 20: Number of retries</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	√	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	06	H05	Retry Standby Time at Trip	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0.5 to 20.0</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	5	√	s	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	07	H06	Cooling Fan Function Selection	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0: Always Fan ON 1: ON/OFF control effective</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	√	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	08	H07	Acceleration/Deceleration Pattern Selection	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0: Disable (Linear acceleration/deceleration) 1: S-curve acceleration/deceleration (Weak) 2: S-curve acceleration/deceleration (Arbitrary: According to H57 to H60) 3: Curve acceleration/deceleration</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	√	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	09	H08	Reverse Rotation Prevention Function	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0: Disable 1: Reverse rotation inhibited 2: Forward rotation inhibited</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	0A	H09	Starting Mode Auto Search Function Selection	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0: Disable 1: Enable only at restart after momentary power failure 2: Enable at normal start and restart after momentary power failure</p>	0	---	---	Possible
	0C	H11	Stop Selection	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0: Deceleration stop 1: Free run stop</p>	0	√	---	Possible
	0D	H12	Instantaneous Overcurrent Limiting Function Selection	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0: Disable 1: Enable</p>	1	√	---	Possible
	0E	H13	Power Interruption Restart Wait Time	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.1 to 100.0</p>	0.5	√	s	Possible
	0F	H14	Deceleration Setting During Current Limit for Restart Mode after Power Interruption	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.00: Selected deceleration time 0.01 to 100.00 999: According to current limiter*1</p>	999	√	Hz/s	Possible
	10	H15	Continuous Running Voltage Level	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>200 to 300 (200 V class series) 400 to 600 (400 V class series)</p>	235	√	V	Possible
	11	H16	Allowable Time for Power Interruption Restart	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.0 to 30.0 999: Auto judgment*1</p>	999	√	s	Possible
	13	H18	Torque Control Operate Selection	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0: Disable (Speed control) 2: Torque current command input 3: Torque command input</p>	0	---	---	Possible

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map								
	1B	H26	Thermistor Function Selection (MOH)	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0: Disable 1: PTC (Inverter immediately trips with OH4 displayed) 2: PTC (Inverter issues output signal MOH and continues to run)</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	√	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	1C	H27	1st Thermistor Error Detection Level (MOH)	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0.00 to 5.00</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	1.60	√	V	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	1D	H28	Droop Control	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>-60.0 to 0.0</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	√	Hz	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	2B	H42	Main Circuit Capacitor Service Life Coefficient (Measurement Value)	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0: Start measurement 1: Measurement failure 2 to 65,535: Measurement value</p> <p>For replacement timing adjustment (For monitoring)</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	√	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	2C	H43	Cumulative run time of cooling fan	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0 to 9,999</p> <p>For replacement timing adjustment (For monitoring)</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	√	10 h	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	2D	H44	1st Startup Count for Motor	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0 to 65,535</p> <p>Cleared to 0 by the writing of 0</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	√	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	2E	H45	Mock Alarm	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0: Disable 1: Enable (Generate mock alarm)</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	√	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	2F	H46	Auto Search Delay Time 2 for Starting Mode	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0.1 to 100.0</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	1.0	√	s	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	30	H47	Main Circuit Capacitor Service Life Coefficient (Initial Value)	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0: Start measurement 1: Measurement failure 2 to 65,535: Measurement value</p> <p>For replacement timing adjustment (For monitoring)</p>	0	√	---	Possible
	31	H48	Cumulative Run Time of Capacitors on Printed Circuit Boards	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0 to 9,999</p> <p>For replacement timing adjustment (For monitoring)</p>	0	√	10 h	Possible
	32	H49	Auto Search Delay Time 1 for Starting Characteristic	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.0 to 10.0</p>	0	√	s	Possible
	37	H54	Jogging Acceleration time	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div>	6.00	√	s	Possible
	38	H55	Jogging Deceleration time	0.00 to 6,000				
	39	H56	Deceleration Time for Forced Stop	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 6,000</p>	6.00	√	s	Possible
	3A	H57	S-curve Acceleration Range Frequency at Starting	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0 to 100</p>	10	√	%	Possible
	3B	H58	S-curve Acceleration Range Frequency at End					
	3C	H59	S-curve Deceleration Range Frequency at Starting					
	3D	H60	S-curve Deceleration Range Frequency at End					
	3E	H61	UP/DOWN Control Initial Value Selection	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0: 0.00 Hz 1: Last UP/DOWN command value</p>	1	---	---	Possible

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map								
	40	H63	Frequency Lower Limit Operation Selection	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>Mode selection when frequency reference is below lower limit 0: Operate at lower limit 1: Operate at frequency reference 0 Hz</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	√	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	41	H64	Low Frequency during Protecting Overload	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0.0: Depends on Frequency Lower Limit (F16) 0.1 to 590.0</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	1.6	√	Hz	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	44	H67	Auto Energy Saving Operation Condition Selection	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0: Enable only at constant speed 1: Enable in all modes</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	√	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	45	H68	1st Slip Compensation Operating Conditions Selection	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0: Enable during acceleration/deceleration, enable at base frequency or higher 1: Disable during acceleration/deceleration, enable at base frequency or higher 2: Enable during acceleration/deceleration, disable at base frequency or higher 3: Disable during acceleration/deceleration, disable at base frequency or higher</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	46	H69	Anti-regenerative Control Function Selection	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0: Disable 2: Torque limit control with forced stop after three times deceleration time has passed 3: Main Circuit DC Voltage control with forced stop after three times deceleration time has passed 4: Torque limit control without forced stop 5: Main Circuit DC Voltage control without force-to-stop</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	√	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	47	H70	Overload Prevention Control	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.00: Depend on selected deceleration time 0.01 to 100.00 999: Cancel*1</p>	999	√	Hz/s	Possible
	48	H71	Over-Excitation Control Selection during Deceleration Function Selection	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0: Disable 1: Enable</p>	0	√	---	Possible
	49	H72	Reserved	Do not use.	---	---	---	---
	4B	H74	Torque Limit Function Selection	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0: Torque limit 1: Torque current limit</p>	1	---	---	Possible
	4C	H75	Torque Limit Operation Selection	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0: Four quadrants independent 1: Four quadrants identical</p>	0	---	---	Possible
	4D	H76	Frequency Rising Limit for Torque Limit	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.0 to 590.0</p>	5	√	Hz	Possible
	4E	H77	Service Life of Main Circuit Capacitor Remaining Time	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0 to 8,760</p>	8760	√	10 h	Possible
	4F	H78	1st Motor Maintenance Interval	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0: Disable 1 to 9,999</p>	8760	√	10 h	Possible
	50	H79	1st Preset Start-up Count for Motor Maintenance	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0: Disable 1 to 65,535</p>	0	√	---	Possible
	51	H80	1st Output Current Fluctuation Damping Gain	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 1.00</p>	0.20	√	---	Possible

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map								
	52	H81	Light Alarm Selection 1	<table border="1" style="font-size: small;"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	√	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	53	H82	Light Alarm Selection 2	0000 to FFFF hex												
	55	H84	Pre-excitation Level	<table border="1" style="font-size: small;"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> 100 to 400	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	100	√	%	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	56	H85	Pre-excitation Timer	<table border="1" style="font-size: small;"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> 0.00: Disable 0.01 to 30.00	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0.00	√	s	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	57	H86	Reserved	Do not use.	---	---	---	---								
	5A	H89	Motor Electronic Thermal Overload Protection Data Retention	<table border="1" style="font-size: small;"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> 0: Disable 1: Enable	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	1	√	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	5B	H90	Reserved	Do not use.	---	---	---	---								
	5D	H92	Continuous Running at the Momentary Power Failure P Proportional Gain	<table border="1" style="font-size: small;"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> 0.000 to 10.000 999: Auto judgment*1	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	999	√	s	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	5E	H93	Continuous Running at the Momentary Power Failure Integral Time	<table border="1" style="font-size: small;"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> 0.010 to 10.000 999: Auto judgment*1	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	999	√	s	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	5F	H94	1st Cumulative Motor Run Time	<table border="1" style="font-size: small;"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> 0 to 9,999 The cumulative motor run time can be modified or reset.	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	10 h	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	60	H95	DC Injection Braking Start Characteristic Selection	<table border="1" style="font-size: small;"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> 0: Slow response 1: Quick response	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	1	√	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	61	H96	STOP Key Priority/Start Check Function	<table border="1" style="font-size: small;"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> 0: Start check function disable 2: Start check function enable	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	√	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	63	H98	Protection/Maintenance Function Mode Selection	<div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> SLV PGV PM SLV PM PGV </div> <p>0 to FF hex</p> <p>Bit 7: Reserved</p> <p>Bit 6: Braking transistor error detection 0: Disable 1: Enable</p> <p>Bit 5: Detect inrush current prevention resistor overheat 0: Enable 1: Disable</p> <p>Bit 4: Judge main circuit capacitor life 0: Disable 1: Enable</p> <p>Bit 3: Main circuit capacitor life judgment selection 0: Factory default standard 1: User measurement value standard</p> <p>Bit 2 to 0: Reserved</p>	80	√	---	Possible
	64	H99	Password 2 Setting / Verification	<div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> SLV PGV PM SLV PM PGV </div> <p>0000 to FFFF hex</p>	0	√	---	Possible
3020	0F	H114	Anti-regenerative Control Level	<div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> SLV PGV PM SLV PM PGV </div> <p>0.0 to 50.0</p> <p>999: Auto judgment*1</p>	999	√	%	Possible
	11	H116	Reserved	Do not use.	---	---	---	---
	12	H117	Reserved	Do not use.	---	---	---	---
	13	H118	Reserved	Do not use.	---	---	---	---
	14	H119	Reserved	Do not use.	---	---	---	---
	15	H120	Reserved	Do not use.	---	---	---	---
	16	H121	Reserved	Do not use.	---	---	---	---
	1F	H130	Reserved	Do not use.	---	---	---	---
	20	H131	Reserved	Do not use.	---	---	---	---
	22	H133	Reserved	Do not use.	---	---	---	---
	23	H134	Reserved	Do not use.	---	---	---	---
	30	H147	Speed Control Jogging Feed Forward Gain	<div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 99.99</p>	0	√	s	Possible

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	37	H154	Torque Bias Function Selection	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>1: Parameter (Torque Bias Level 1 to 3) (H155 to H157) 2: Analog input 5: EtherCAT</p>	0	---	---	Possible
	38	H155	Torque Bias Level 1	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div>	0	√	%	Possible
	39	H156	Torque Bias Level 2	-300 to 300				
	3A	H157	Torque Bias Level 3					
	3B	H158	Torque Bias Mechanical Loss Compensation	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0 to 300</p>	0	√	%	Possible
	3C	H159	Torque Bias Startup Timer	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 1.00</p>	0	---	s	Possible
	3E	H161	Torque Bias Shutdown Timer	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 1.00</p>	0	---	s	Possible
	3F	H162	Torque Bias Limit	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0 to 300</p>	200	---	%	Possible
	4A	H173	Magnetic Flux Level at Light Load	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>10 to 100</p>	100	√	%	Possible
	51	H180	Brake Error Detection Time	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 10.00</p>	1.00	√	s	Possible
	56	H185	Reserved	Do not use.	---	---	---	---
	5E	H193	User preference dataset Registration	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0: Disable 1: Save</p>	0	---	---	Possible
	5F	H194	User Preference Dataset Protection Function Selection	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0: Unprotected 1: Protected (Saving prohibited)</p>	0	√	---	Possible

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	60	H195	DC Injection Braking Startup Time	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.00: Disable 0.01 to 30.00</p>	0	√	s	Possible
	61	H196	Reserved	Do not use.	---	---	---	---
	62	H197	User password 1 Mode selection	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0: All parameters cannot be changed 1: Those other than favorite parameters cannot be displayed or changed</p> <p>Select protection mode for user password 1.</p>	0	√	---	Possible
	63	H198	User Password 1 Setting/Verification	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0000 to FFFF hex</p>	0	√	---	Possible
	64	H199	User Password 1 Setting	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0: Disable 1: Enable</p>	0	√	---	Possible
3051	0A	H309	Output Terminal [DO1] ON Delay Time	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.0 to 100.0</p>	0.00	---	s	Possible
	0B	H310	Output Terminal [DO1] OFF Delay Time	0.0 to 100.0				
	0E	H313	Output Terminal [ROA, ROB] ON Delay Time	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.0 to 100.0</p>	0.00	---	s	Possible
	0F	H314	Output Terminal [ROA, ROB] OFF Delay Time	0.0 to 100.0				
	10	H315	Logical Expression 1 Operation Target 1	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0 to 241 (normally-open output) 1,000 to 1,241 (normally-close output)</p> <p>Refer to 8-2-2 Multifunction Output Selection on page 8-28. 27, 100, 206, 207, and 208 cannot be selected.</p>	0	---	---	Possible
	11	H316	Logical Expression 1 Operation Target 2	0 to 241 (normally-open output) 1,000 to 1,241 (normally-close output)				

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map								
	12	H317	Logical Expression 1 Logical Operator	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0: AND 1: OR 2: XOR</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	13	H318	Logical Expression 2 Operation Target 1	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	14	H319	Logical Expression 2 Operation Target 2	<p>0 to 241 (normally-open output) 1,000 to 1,241 (normally-close output)</p> <p>Refer to 8-2-2 Multifunction Output Selection on page 8-28. 27, 100, 206, 207, and 208 cannot be selected.</p>												
	15	H320	Logical Expression 2 Logical Operator	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0: AND 1: OR 2: XOR</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	16	H321	Logical Expression 3 Operation Target 1	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	17	H322	Logical Expression 3 Operation Target 2	<p>0 to 241 (normally-open output) 1,000 to 1,241 (normally-close output)</p> <p>Refer to 8-2-2 Multifunction Output Selection on page 8-28. 27, 100, 206, 207, and 208 cannot be selected.</p>												
	18	H323	Logical Expression 3 Logical Operator	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0: AND 1: OR 2: XOR</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	19	H324	Input Terminal [DI1] Response Time	1 to 400	1	---	ms	Possible
	1A	H325	Input Terminal [DI2] Response Time					
	1B	H326	Input Terminal [DI3] Response Time					
	1C	H327	Input Terminal [DI4] Response Time					
	1D	H328	Input Terminal [DI5] Response Time					
	1E	H329	Input Terminal [DI6] Response Time					
	1F	H330	Input Terminal [DI7] Response Time					
	21	H332	Torque Reference Selection	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0: Analog input 2: Parameter (Torque Reference) (H333) 5: EtherCAT</p>	0	---	---	Possible
	22	H333	Torque Reference	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0 to 200</p>	0	√	%	Possible
	23	H334	Torque Bias Polarity Selection	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0: As signed 1: Depend on run direction</p>	0	---	---	Possible
3052	0C	H411	Input Phase Loss Protection Function Selection	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0: Disable (Continue to run) 1: Enable (Trip)</p>	1	√	---	Possible
	0D	H412	Output Phase Loss Protection Function Selection	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0: Disable (Continue to run) 1: Enable (Trip)</p>	0	√	---	Possible

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map								
	24	H435	Touch Probe 1 Source	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>1: External Latch Input 1 (EXT1) 2: External Latch Input 2 (EXT2) 6: Phase Z</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	1	---	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	25	H436	Touch Probe 2 Source	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>1: External Latch Input 1 (EXT1) 2: External Latch Input 2 (EXT2) 6: Phase Z</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	2	---	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	26	H437	Touch Probe Function	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0000 to FFFF hex</p> <p>Bit 15 to 13: Fixed to 0</p> <p>Bit 12: Latch operation 2 0: Disable 1: Enable</p> <p>Bit 11 to 10: Latch trigger 2 00: External Latch Input 2 (EXT2) 01: Phase Z 10: Depends on setting of H436 11: Disable</p> <p>Bit 9: Latch mode 2 0: Trigger First Event Mode 1: Continuous Mode</p> <p>Bit 8: Latch function 2 0: Disable 1: Enable</p> <p>Bit 7 to 5: Fixed to 0</p> <p>Bit 4: Latch operation 1 0: Disable 1: Enable</p> <p>Bit 3 to 2: Latch trigger 1 00: External Latch Input 1 (EXT1) 01: Phase Z 10: Depends on setting of H435 11: Disable</p> <p>Bit 1: Latch mode 1 0: Trigger First Event Mode 1: Continuous Mode</p> <p>Bit 0: Latch function 1 0: Disable 1: Enable</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	√	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map								
	27	H438	Feedback Value Comparison Signal Off Level	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0.0 to 100.0</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	100.0	---	%	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	28	H439	Feedback Value Comparison Signal On Level	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0.0 to 100.0</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0.0	---	%	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	29	H440	Free Run Stop Restart Allowable Time	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0.0 to 30.0</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	30.0	---	s	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	2A	H441	Free Run Stop Restart Operation Selection	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>1: Starting with matching frequency 2: Starting with active matching frequency</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	2	---	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	2B	H442	Slip compensation Function Selection	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0: Disable 1: Enable</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	√	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	52	H481	7SEG Monitor Item Selection	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0: Display drive status 1: ID by rotary switch</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	53	H482	Reserved	Do not use.	---	---	---	---								
	54	H483	FSoE address	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0 to 65,535</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	55	H484	Reserved	Do not use.	---	---	---	---								
	56	H485	Reserved	Do not use.	---	---	---	---								
	57	H486	Reserved	Do not use.	---	---	---	---								
	58	H487	Reserved	Do not use.	---	---	---	---								
	59	H488	Reserved	Do not use.	---	---	---	---								
	5A	H489	Reserved	Do not use.	---	---	---	---								
	5B	H490	Reserved	Do not use.	---	---	---	---								

*1. For SDO communications and PDO communications, it is 7FFF hex.

A-4-10 A Group Parameter List (Motor 2 Parameters)

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
3009	02	A01	2nd Maximum Output Frequency	<div style="display: flex; justify-content: space-between; font-size: 0.8em;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: 0.8em;"> SLV PGV PM SLV PM PGV </div> <p>5.0 to 590.0</p>	60.0	---	Hz	Possible
	03	A02	2nd Base Frequency	<div style="display: flex; justify-content: space-between; font-size: 0.8em;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: 0.8em;"> SLV PGV PM SLV PM PGV </div> <p>5.0 to 590.0</p>	50.0	---	Hz	Possible
	04	A03	2nd Rated Voltage at Base Frequency	<div style="display: flex; justify-content: space-between; font-size: 0.8em;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: 0.8em;"> SLV PGV PM SLV PM PGV </div> <p>80 to 240 (200 V class series) 160 to 500 (400 V class series)</p>	200	---	V	Possible
	05	A04	2nd Rated Voltage at Maximum Output Frequency	<div style="display: flex; justify-content: space-between; font-size: 0.8em;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: 0.8em;"> SLV PGV PM SLV PM PGV </div> <p>80 to 240 (200 V class series) 160 to 500 (400 V class series)</p>	200	---	V	Possible
	06	A05	2nd Manual Torque Boost Voltage	<div style="display: flex; justify-content: space-between; font-size: 0.8em;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: 0.8em;"> SLV PGV PM SLV PM PGV </div> <p>0.0 to 20.0</p> <p>Percentage with respect to 2nd Rated Voltage at Base Frequency (A03)</p>	1.9	√	%	Possible
	07	A06	2nd Motor Electronic Thermal Characteristic selection	<div style="display: flex; justify-content: space-between; font-size: 0.8em;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: 0.8em;"> SLV PGV PM SLV PM PGV </div> <p>1: For a general-purpose motor with shaft-driven cooling fan 2: For an inverter-driven motor non-ventilated motor or motor with separately powered cooling fan</p>	1	√	---	Possible
	08	A07	2nd Motor Electronic Thermal Level	<div style="display: flex; justify-content: space-between; font-size: 0.8em;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: 0.8em;"> SLV PGV PM SLV PM PGV </div> <p>0.00: Disable 0.01 to 118.8</p>	21	√	A	Possible
	09	A08	2nd Motor Electronic Thermal Time Constant	<div style="display: flex; justify-content: space-between; font-size: 0.8em;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: 0.8em;"> SLV PGV PM SLV PM PGV </div> <p>0.5 to 75.0</p>	5	√	min	Possible
	0A	A09	2nd DC Injection Braking Start Frequency	<div style="display: flex; justify-content: space-between; font-size: 0.8em;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: 0.8em;"> SLV PGV PM SLV PM PGV </div> <p>0.0 to 60.0</p>	0.0	√	Hz	Possible

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	0B	A10	2nd DC Injection Braking Level	<div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> SLV PGV PM SLV PM PGV </div> <p>0 to 100 (HHD mode) 0 to 80 (HND/HD mode) 0 to 60 (ND mode)</p> <p>Based on inverter rated current</p>	0	√	%	Possible
	0C	A11	2nd DC Injection Braking Time	<div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> SLV PGV PM SLV PM PGV </div> <p>0.00: Disable 0.01 to 30.00</p>	0.00	√	s	Possible
	0D	A12	2nd Starting Frequency	<div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> SLV PGV PM SLV PM PGV </div> <p>0.0 to 60.0</p>	0.5	√	Hz	Possible
	0E	A13	2nd V/f Characteristics Selection	<div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> SLV PGV PM SLV PM PGV </div> <p>0: Variable torque load 1: Constant torque load</p>	1	---	---	Possible
	0F	A14	2nd Drive Control Selection	<div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> SLV PGV PM SLV PM PGV </div> <p>0: IM V/f control 1: IM Dynamic torque vector control without speed sensor 3: IM V/f control with speed sensor 4: IM Dynamic torque vector control with speed sensor 5: IM Vector control without speed sensor 6: IM Vector control with speed sensor</p>	0	---	---	Possible
	10	A15	2nd Motor Pole Number	<div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> SLV PGV PM SLV PM PGV </div> <p>2 to 128</p>	4	---	Poles	Possible
	11	A16	2nd Motor Capacity	<div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> SLV PGV PM SLV PM PGV </div> <p>0.01 to 1,000</p>	5.50	---	kW	Possible
	12	A17	2nd Motor Rated Current	<div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border-bottom: 1px solid black; margin-bottom: 5px;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 500.0</p>	21	---	A	Possible

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	13	A18	2nd Auto-tuning Selection Function Selection	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0: Disable 1: Tune the motor parameters while stopped 2: Tune the motor parameters while rotating 5: Tune the motor %R1 and %X while stopped</p>	0	---	---	Possible
	14	A19	2nd Online tuning Function Selection	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0: Disable 1: Enable</p>	0	√	---	Possible
	15	A20	2nd Motor Armature Resistance	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 500.0</p>	10.55	---	A	Possible
	16	A21	2nd Motor Motor Constant %R1	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 50.00</p>	3.17	√	%	Possible
	17	A22	2nd Motor Motor Constant %X	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 50.00</p>	11.47	√	%	Possible
	18	A23	2nd Slip Compensation Gain for Driving	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0.0 to 200.0</p>	100.0	√	%	Possible
	19	A24	2nd Slip Compensation Response Time	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0.01 to 10.00</p>	0.12	√	s	Possible
	1A	A25	2nd Slip Compensation Gain for Braking	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0.0 to 200.0</p>	100.0	√	%	Possible
	1B	A26	2nd Rated Slip Frequency	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 15.00</p>	1	---	Hz	Possible
	1C	A27	2nd Iron Loss Factor 1	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 20.00</p>	2.86	√	%	Possible

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	1F	A30	2nd Magnetic Saturation Factor 1	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0.0 to 300.0</p>	92	√	%	Possible
	20	A31	2nd Magnetic Saturation Factor 2	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0.0 to 300.0</p>	84.2	√	%	Possible
	21	A32	2nd Magnetic Saturation Factor 3	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0.0 to 300.0</p>	70.5	√	%	Possible
	22	A33	2nd Magnetic Saturation Factor 4	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0.0 to 300.0</p>	58.3	√	%	Possible
	23	A34	2nd Magnetic Saturation Factor 5	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0.0 to 300.0</p>	46.1	√	%	Possible
	29	A40	2nd Slip Compensation Operating Conditions Selection	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0: Enable during acceleration/deceleration, enable at base frequency or higher 1: Disable during acceleration/deceleration, enable at base frequency or higher 2: Enable during acceleration/deceleration, disable at base frequency or higher 3: Disable during acceleration/deceleration, disable at base frequency or higher</p>	0	---	---	Possible
	2A	A41	2nd Output Current Fluctuation Damping Gain	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 1.00</p>	0.20	√	---	Possible
	2C	A43	Speed Control 2 Speed Command Filter	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0.000 to 5.000</p>	0.02	√	s	Possible
	2D	A44	Speed Control 2 Speed Detection Filter	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0.000 to 0.100</p>	0.005	√	s	Possible

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	2E	A45	Speed Control 2 P Proportional Gain	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.1 to 200.0</p>	10	√	---	Possible
	2F	A46	Speed Control 2 I Integral Time	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.001 to 9.999 999: Disable</p>	0.1	√	s	Possible
	30	A47	Speed Control 2 FF Gain	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 99.99</p>	0	√	s	Possible
	31	A48	Speed Control 2 Output Filter	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.000 to 0.100</p>	0.002	√	s	Possible
	32	A49	Speed Control 2 Notch Filter Resonance Frequency	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>1 to 500</p>	200	√	Hz	Possible
	33	A50	Speed Control 2 Notch Filter Attenuation Level	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0 to 40</p>	0	√	dB	Possible
	34	A51	2nd Cumulative Motor Run Time	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0 to 9,999</p> <p>The cumulative motor run time can be modified or reset.</p>	0	---	10 h	Possible
	35	A52	2nd Startup Counter for Motor	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0 to 65,535</p> <p>Cleared to 0 by the writing of 0</p>	0	√	---	Possible
	36	A53	2nd Motor 2 %X Correction Factor 1	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0 to 300</p>	100	√	%	Possible
	38	A55	Torque Current for 2nd Vector Control	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 500.0</p>	16.71	---	A	Possible
	39	A56	Induced Voltage Factor for 2nd Vector Control	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>50 to 100</p>	95	---	%	Possible

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map								
	3A	A57	Reserved	Do not use.	---	---	---	---								
	3D	A60	2nd Speed Conversion Coefficient	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0.00: Using E50 value 0.01 to 600.00</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	√	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	3E	A61	2nd Display Coefficient for Transport time / Auxiliary Display Coefficient for Speed Monitor	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0.000 to 9,999</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	1	√	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	3F	A62	2nd Starting Frequency Holding Time	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0.00 to 10.00</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0.00	√	s	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	40	A63	2nd Stop Frequency	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0.0 to 60.0 999: According to F25*1</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	999	√	Hz	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	41	A64	2nd Stop Frequency Detection Method Selection	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0: Output frequency, Detected speed 1: Frequency reference 100: According to F38</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	100	---	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	42	A65	2nd Stop Frequency Holding Time	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0.00 to 10.00</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0.00	√	s	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													

*1. For SDO communications and PDO communications, it is 7FFF hex.

A-4-11 b Group Parameter List (Velocity Control 3)

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map								
3013	2C	b43	Speed Control 3 Speed Command Filter	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0.000 to 5.000</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0.02	√	s	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	2D	b44	Speed Control 3 Speed Detection Filter	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0.000 to 0.100</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0.005	√	s	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	2E	b45	Speed Control 3 P Proportional Gain	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.1 to 200.0</p>	10	√	---	Possible
	2F	b46	Speed Control 3 I Integral Time	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.001 to 9.999 999: Disable</p>	0.1	√	s	Possible
	30	b47	Speed Control 3 FF Gain	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 99.99</p>	0	√	s	Possible
	31	b48	Speed Control 3 Output Filter	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.000 to 0.100</p>	0.002	√	s	Possible
	32	b49	Speed Control 3 Notch Filter Resonance Frequency	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>1 to 500</p>	200	√	Hz	Possible
	33	b50	Speed Control 3 Notch Filter Attenuation Level	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0 to 40</p>	0	√	dB	Possible

A-4-12 r Group Parameter List (Velocity Control 4)

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
300C	2C	r43	Speed Control 4 Speed Command Filter	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.000 to 5.000</p>	0.02	√	s	Possible
	2D	r44	Speed Control 4 Speed Detection Filter	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.000 to 0.100</p>	0.005	√	s	Possible
	2E	r45	Speed Control 4 P Proportional Gain	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.1 to 200.0</p>	10	√	---	Possible

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map								
	2F	r46	Speed Control 4 I Integral Time	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> 0.001 to 9.999 999: Disable	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0.1	√	s	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	30	r47	Speed Control 4 FF Gain	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> 0.00 to 99.99	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	√	s	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	31	r48	Speed Control 4 Output Filter	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> 0.000 to 0.100	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0.002	√	s	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	32	r49	Speed Control 4 Notch Filter Resonance Frequency	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> 1 to 500	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	200	√	Hz	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	33	r50	Speed Control 4 Notch Filter Attenuation Level	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> 0 to 40	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	√	dB	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													

A-4-13 J Group Parameter List (Applied Functions 1)

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map								
300E	02	J01	PID Control Function Selection	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> 0: Disable 1: PID control (Process normal operation) 2: PID control (Process inverse operation) 3: PID control (Dancer) 4: PID control (Process normal operation, opposite operation available) 5: PID control (Process inverse operation, opposite operation available)	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	03	J02	PID Control PID Command Selection	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> 1: Analog input 3: UP/DOWN control 4: EtherCAT	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	4	---	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	04	J03	PID Control P Proportional Gain	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.000 to 30.000</p>	0.1	√	---	Possible
	05	J04	PID Control I Integral Time	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.0 to 3,600.0</p>	0	√	s	Possible
	06	J05	PID Control D Differential Time	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 600.00</p>	0	√	s	Possible
	07	J06	PID Control Feedback Filter	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.0 to 900.0</p>	0.5	√	s	Possible
	0B	J10	PID Control Anti-reset Windup Width	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0 to 200 Set by percentage of PID command value</p>	200	√	%	Possible
	0C	J11	PID Control Select Warning Output Selection	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0: Warning from absolute value 1: Warning from absolute value (with hold) 2: Warning from absolute value (with latch) 3: Warning from absolute value (with hold and latch) 4: Warning from PID error 5: Warning from PID error (with hold) 6: Warning from PID error (with latch) 7: Warning from PID error (with hold and latch)</p>	0	√	---	Possible
	0D	J12	PID Control Upper Limit of Warning (AH)	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>-100 to 100</p>	100	√	%	Possible
	0E	J13	PID Control Lower Limit of Warning (AL)	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>-100 to 100</p>	0	√	%	Possible

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	10	J15	PID Control Sleep Frequency for Process Control	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.0: Disable 1.0 to 590.0</p>	0	√	Hz	Possible
	11	J16	PID Control Sleep Timer for Process Control	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0 to 60</p>	30	√	s	Possible
	12	J17	PID Control Restart Frequency after Stopping for Process Control	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.0 to 590.0</p>	0	√	Hz	Possible
	13	J18	PID Control PID Output Upper Limit	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>-150 to 150 999: Depends on setting of F15*1</p>	999	√	%	Possible
	14	J19	PID Control PID Output Lower Limit	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>-150 to 150 999: Depends on setting of F16*1</p>	999	√	%	Possible
	18	J23	PID Control Restart Feedback Deviation after Stopping for Process Control	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.0 to 100.0</p>	0	√	%	Possible
	19	J24	PID Control Restart Delay Time after Stopping for Process Control	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0 to 3,600</p>	0	√	s	Possible
	3A	J57	PID Control Operator PID Reference Position for Dancer	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>-100 to 100</p>	0	√	%	Possible
	3B	J58	PID Control PID Reference Position Detection Width for Dancer	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0: Disable switching PID constant 1 to 100</p>	0	√	%	Possible
	3C	J59	PID Control P Gain 2	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.000 to 30.000</p>	0.1	√	---	Possible

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	3D	J60	PID Control I Integral Time 2	<div style="display: flex; justify-content: space-between; font-size: 0.8em;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: 0.8em;"> SLV PGV PM SLV PM PGV </div> <p>0.0 to 3,600.0</p>	0	√	s	Possible
	3E	J61	PID Control D Differential Time 2	<div style="display: flex; justify-content: space-between; font-size: 0.8em;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: 0.8em;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 600.00</p>	0	√	s	Possible
	3F	J62	PID Control Block Selection	<div style="display: flex; justify-content: space-between; font-size: 0.8em;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: 0.8em;"> SLV PGV PM SLV PM PGV </div> <p>0000 to 0003 hex</p> <p>Bit 1: PID output ratio selection 0: Ratio to frequency reference 1: Ratio to maximum output frequency</p> <p>Bit 0: PID output polarity selection 0: Plus (Addition) 1: Minus (Subtraction)</p>	0	---	---	Possible
	40	J63	Overload Stop Item Selection	<div style="display: flex; justify-content: space-between; font-size: 0.8em;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: 0.8em;"> SLV PGV PM SLV PM PGV </div> <p>0: Torque 1: Current</p>	0	√	---	Possible
	41	J64	Overload Stop Detection Level	<div style="display: flex; justify-content: space-between; font-size: 0.8em;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: 0.8em;"> SLV PGV PM SLV PM PGV </div> <p>20 to 200</p>	100	√	%	Possible
	42	J65	Overload Stop Mode Selection	<div style="display: flex; justify-content: space-between; font-size: 0.8em;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: 0.8em;"> SLV PGV PM SLV PM PGV </div> <p>0: Disable 1: Deceleration stop 2: Free run stop 3: Torque limit operation (Deceleration)</p>	0	---	---	Possible
	43	J66	Overload Stop Operation Mode	<div style="display: flex; justify-content: space-between; font-size: 0.8em;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: 0.8em;"> SLV PGV PM SLV PM PGV </div> <p>0: During constant speed running and deceleration 1: During constant speed running 2: Anytime</p>	0	√	---	Possible
	44	J67	Overload Stop Detection Timer	<div style="display: flex; justify-content: space-between; font-size: 0.8em;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: 0.8em;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 600.00</p>	0	√	s	Possible

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	45	J68	Brake Control Brake-release Current	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 300.00</p>	100.00	√	%	Possible
	46	J69	Brake Control Brake-release Frequency	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0.0 to 25.0</p>	1.0	√	Hz	Possible
	47	J70	Brake Control Brake-release Timer	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0.000 to 5.000</p>	1.000	√	s	Possible
	48	J71	Brake Control Brake-applied Frequency	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0.0 to 25.0</p>	1.0	√	Hz	Possible
	49	J72	Brake Control Brake-applied Timer	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0.000 to 5.000</p>	1.000	√	s	Possible
	5B	J90	Overload Stop Function P gain	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0.000 to 2.000 999: 0.050*¹</p>	999	√	---	Possible
	5C	J91	Overload Stop Function Integral time	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0.001 to 9.999 999: 0.025*¹</p>	999	√	s	Possible
	5D	J92	Overload Stop Function Current level	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>50.0 to 150.0</p>	100	√	%	Possible
	60	J95	Brake control Brake-release Torque	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 300.00</p>	100	√	%	Possible

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	61	J96	Brake Control Operation Selection	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>00 to 7F hex</p> <p>Bit 6: Stop condition at Position control 0: Brake release (BRK) OFF 1: Brake release (BRK) ON</p> <p>Bit 4: Brake-applied condition 0: Disable RUN command "OFF" 1: Enable RUN command "OFF"</p> <p>Bit 3: Not used Bit 2: Not used Bit 1: Reserved Bit 0: Speed detection/Speed command 0: Speed detection 1: Speed command</p>	0	√	---	Possible
	62	J97	Servo Lock Gain	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0.000 to 9.999</p>	0.01	√	---	Possible
	63	J98	Servo Lock Completion Timer	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0.000 to 1.000</p>	0.1	√	s	Possible
	64	J99	Servo Lock Completion Range	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0 to 9,999</p>	10	√	---	Possible
3024	06	J105	Reserved	Do not use.	---	---	---	---
	07	J106	PID Control Maximum Scale	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>-999.00 to 9,990.00</p>	100	---	---	Possible
	08	J107	PID Control Minimum Scale	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>-999.00 to 9,990.00</p>	0	---	---	Possible

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	25	J136	PID Control Multistep PID Command 1	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div>	0	√	---	Possible
	26	J137	PID Control Multistep PID Command 2	-999.00 to 9,990.00				
	27	J138	PID Control Multistep PID Command 3					

*1. For SDO communications and PDO communications, it is 7FFF hex.

A-4-14 d Group Parameter List (Applied Functions 2)

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
3014	02	d01	Speed Control 1 Speed Command Filter	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div>	0.02	√	s	Possible
				0.000 to 5.000				
	03	d02	Speed Control 1 Speed Detection Filter	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div>	0.005	√	s	Possible
				0.000 to 0.100				
	04	d03	Speed Control 1 P Proportional Gain	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div>	10	√	---	Possible
				0.1 to 200.0				
	05	d04	Speed Control 1 I Integral Time	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div>	0.1	√	s	Possible
				0.001 to 9.999 999: Disable				
	06	d05	Speed Control 1 FF Gain	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div>	0	√	s	Possible
				0.00 to 99.99				
	07	d06	Speed Control 1 Output Filter	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div>	0.002	√	s	Possible
				0.000 to 0.100				
	08	d07	Speed Control 1 Notch Filter Resonance Frequency	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div>	200	√	Hz	Possible
				1 to 500				

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	09	d08	Speed Control 1 Notch Filter Attenuation Level	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0 to 40</p>	0	√	dB	Possible
	0A	d09	Speed Control Jogging Speed Command Filter	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0.000 to 5.000</p>	0.02	√	s	Possible
	0B	d10	Speed Control Jogging Speed Detection Filter	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0.000 to 0.100</p>	0.005	√	s	Possible
	0C	d11	Speed Control Jogging P Proportional Gain	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0.1 to 200.0</p>	10	√	---	Possible
	0D	d12	Speed Control Jogging I Integral Time	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0.001 to 9.999 999: Disable</p>	0.1	√	s	Possible
	0E	d13	Speed Control Jogging Output Filter	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0.000 to 0.100</p>	0.002	√	s	Possible
	0F	d14	Input Terminal [PIA][PIB] Pulse Input Format Selection	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0: Sign/Pulse 1: Forward/reverse rotation pulse 2: Quadrature A/B signal (B phase lead) 3: Quadrature A/B signal (A phase lead)</p>	2	---	---	Possible
	10	d15	Input Terminal [PIA][PIB] Encoder Pulse Resolution	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>20 to 60,000</p>	1,024	---	---	Possible
	11	d16	Input Terminal [PIA][PIB] Pulse Scaling Factor Denominator	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>1 to 32,767</p>	1	√	---	Possible
	12	d17	Input Terminal [PIA][PIB] Pulse Scaling Factor Numerator					

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	13	d18	Input Terminal [PIA][PIB] Pulse Train Filter Time Constant	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.000 to 5.000</p>	0.005	√	s	Possible
	16	d21	Speed Agreement / Speed Deviation Error Hysteresis Width	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.0 to 50.0</p>	10	√	%	Possible
	17	d22	Speed Agreement / Speed Deviation Error Detection Timer	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 10.00</p>	0.5	√	s	Possible
	18	d23	Speed Deviation Error Processing Selection	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0: Continue to run 1 1: Stop with alarm 1 2: Stop with alarm 2 3: Continue to run 2 4: Stop with alarm 3 5: Stop with alarm 4</p>	2	---	---	Possible
	19	d24	Zero speed control	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0: Disable at startup, enable at stop 1: Enable at startup, enable at stop 2: Disable at startup, disable at stop</p>	0	---	---	Possible
	1A	d25	Speed Control Speed Loop Switching Time at Parameter Change	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.000 to 1.000</p>	0	√	s	Possible
	21	d32	Speed Limit 1 in Forward	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0 to 110</p>	100	√	%	Possible
	22	d33	Speed Limit 2 in Reverse	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0 to 110</p>	100	√	%	Possible
	24	d35	Overspeed Error Detection Level	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0 to 120 999: Depend on d32 and d33*1</p>	999	√	%	Possible

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	2A	d41	Special Control Selection	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0: Disable (Normal control) 1: Enable (Peripheral speed constant control)</p>	0	---	---	Possible
	34	d51	Reserved	Do not use.	---	---	---	---
	35	d52	Reserved	Do not use.	---	---	---	---
	38	d55	Reserved	Do not use.	---	---	---	---
	44	d67	Motor Starting Mode Auto Search in Speed Sensor Vector Control	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0: Disable 1: Enable (Only at restart after momentary power failure) 2: Enable (At normal start and restart after momentary power failure)</p>	1	---	---	Possible
	45	d68	Reserved	Do not use.	---	---	---	---
	47	d70	Speed Control Slip Frequency Limit	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 100.00</p>	100	√	%	Possible
	50	d79	Reserved	Do not use.	---	---	---	---
	51	d80	1st PM Motor Magnetic Pole Position Pull-in Frequency	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0.1 to 10.0</p>	1	√	Hz	Possible
	52	d81	Reserved	Do not use.	---	---	---	---
	53	d82	Magnetic Flux Weakening Control Function Selection	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0: Disable 1: Enable</p>	1	√	---	Possible
	54	d83	Magnetic Flux Weakening Lower Limit	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>10 to 70</p>	40	√	%	Possible
	55	d84	Reserved	Do not use.	---	---	---	---
	56	d85	Reserved	Do not use.	---	---	---	---
	57	d86	Acc/Dec Output Frequency Filter	<div style="display: flex; justify-content: space-between; font-size: small;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; font-size: small;"> SLV PGV PM SLV PM PGV </div> <p>0.000 to 5.000</p>	0	√	s	Possible
	59	d88	Reserved	Do not use.	---	---	---	---

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	5A	d89	PM Motor High-efficiency Control Selection	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0: Disable 1: Enable</p>	1	---	---	Possible
	5B	d90	Magnetic Flux Level during Deceleration	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>100 to 300</p>	120	√	%	Possible
	5C	d91	Reserved	Do not use.	---	---	---	---
	5D	d92	Reserved	Do not use.	---	---	---	---
	5E	d93	Reserved	Do not use.	---	---	---	---
	5F	d94	Reserved	Do not use.	---	---	---	---
	60	d95	Reserved	Do not use.	---	---	---	---
	61	d96	Reserved	Do not use.	---	---	---	---
	62	d97	Reserved	Do not use.	---	---	---	---
	63	d98	Reserved	Do not use.	---	---	---	---
	64	d99	Extension function 1	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0000 to FFFF hex Bit 3: Jogging Enable via communications Do not use other bits</p>	8	√	---	Possible
302A	5B	d190	Reserved	Do not use.	---	---	---	---
	5D	d192	Reserved	Do not use.	---	---	---	---
	63	d198	Reserved	Do not use.	---	---	---	---
3037	02	d201	Position Control Feed Forward Gain	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.00: Disable feed-forward 0.01 to 1.50</p>	0.00	√	---	Possible
	03	d202	Position Control Feed Forward Filter	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.000 to 5.000</p>	0.500	√	s	Possible
	04	d203	Position Loop Gain 1	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div>	1.0	√	---	Possible
	05	d204	Position Loop Gain 2	0.1 to 300.0				
	06	d205	Position Loop Gain Switch Frequency	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.0 to 590.0</p>	0.0	√	Hz	Possible

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map								
	07	d206	Electronic Gear Denominator	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	1	---	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	08	d207	Electronic Gear Numerator	1 to 65,535												
	09	d208	Orientation Selection	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0: Nearest direction (Valid for reverse rotation) 1: Command direction (Direction of operation command source)</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	1	---	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	0A	d209	Homing Operation Selection	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>00 to FF hex</p> <p>Bit 7: Z phase correction 0: Disable 1: Enable</p> <p>Bit 6 to 4: Reserved</p> <p>Bit 3: Detection timing of homing limit switch 0: By rising edge 1: By falling edge</p> <p>Bit 2: OT detected operation selection 0: Return at FOT/ROT detection 1: Stop at OT detection (Cancel homing)</p> <p>Bit 1: Homing Start direction 0: Forward direction 1: Reverse direction</p> <p>Bit 0: Homing shaft direction 0: Forward direction 1: Reverse direction</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	0C	d211	Homing Reference Signal Selection	<table border="1"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0: Z phase 1: Origin limit input (ORL) 2: Overtravel input in the positive direction (FOT) 3: Overtravel input in the negative direction (ROT)</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	1	---	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	0D	d212	Reference Signal for Homing Offset	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0: Z phase 1: Origin limit input (ORL) (Edge) 2: Overtravel input in the positive direction (FOT) 3: Overtravel input in the negative direction (ROT) 4: Stopper (Mechanical stop)</p>	0	---	---	Possible
	0E	d213	Homing frequency/Orientation frequency	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.1 to 590.0</p>	5	√	Hz	Possible
	0F	d214	Creep Frequency	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.1 to 590.0</p>	0.5	√	Hz	Possible
	10	d215	Deceleration Time for Homing/Orientation	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 6,000</p>	6.00	√	s	Possible
	15	d220	Position Feedback Store Selection at Power Off	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0: Disable 1: Store at low voltage detected</p>	0	√	---	Possible
	16	d221	Current Position Clear Signal Operation Selection	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0: Edge 1: Level</p>	0	√	---	Possible
	17	d222	Overtravel Function Selection	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0: Disable 1: Valid (Positioning at OT position at over traveling), normal PTP 2: Valid (Immediately stopped at over traveling), normal PTP</p>	0	√	---	Possible
	18	d223	Detection Level of Excessive Positioning Deviation (MSB)	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0: Disable (MSB: 0, LSB: 0)</p>	0	√	---	Possible
	19	d224	Detection Level of Excessive Positioning Deviation (LSB)	<p>1 to 268,435,455 (MSB: 0 to 4,095, LSB: 1 to 65,535)</p>				

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	1A	d225	Software Over-travel Detection Position in the Positive Direction (MSB)	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>-268,435,455 to 268,435,455 MSB: -4,096 to 4,095 LSB: 0 to 65,535</p>	4095	---	---	Possible
	1B	d226	Software Over-travel Detection Position in the Positive Direction (LSB)	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>-268,435,455 to 268,435,455 MSB: -4,096 to 4,095 LSB: 0 to 65,535</p>	65,535	---	---	Possible
	1C	d227	Software Over-travel Detection Position in the Negative Direction (MSB)	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>-268,435,455 to 268,435,455 MSB: -4,096 to 4,095 LSB: 0 to 65,535</p>	-4,096	---	---	Possible
	1D	d228	Software Over-travel Detection Position in the Negative Direction (LSB)	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>-268,435,455 to 268,435,455 MSB: -4,096 to 4,095 LSB: 0 to 65,535</p>	1	---	---	Possible
	26	d237	Positioning Data Type	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0: Absolute position (ABS) 1: Relative position (INC)</p>	0	√	---	Possible
	27	d238	Position Data Determination Time	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.000 to 0.100</p>	0.000	√	s	Possible
	28	d239	Positioning Completed Range	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0 to 9,999</p>	1	√	---	Possible
	29	d240	Preset Position (MSB)	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div>	0	√	---	Possible
	2A	d241	Preset Position (LSB)	<p>-268,435,455 to 268,435,455 MSB: -4,096 to 4,095 LSB: 0 to 65,535</p>				

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	2B	d242	Homing Offset (MSB)	<input type="checkbox"/> V/f <input type="checkbox"/> DTV <input type="checkbox"/> PG V/f <input type="checkbox"/> PG DTV <input type="checkbox"/> SLV <input type="checkbox"/> PGV <input type="checkbox"/> PM SLV <input type="checkbox"/> PM PGV	0	√	---	Possible
	2C	d243	Homing Offset (LSB)	0 to 268,435,455 MSB: 0 to 4,095 LSB: 0 to 65,535				
	2D	d244	Positioning Data 1 (MSB)	<input type="checkbox"/> V/f <input type="checkbox"/> DTV <input type="checkbox"/> PG V/f <input type="checkbox"/> PG DTV <input type="checkbox"/> SLV <input type="checkbox"/> PGV <input type="checkbox"/> PM SLV <input type="checkbox"/> PM PGV	0	√	---	Possible
	2E	d245	Positioning Data 1 (LSB)	-268,435,455 to 268,435,455 MSB: -4,096 to 4,095 LSB: 0 to 65,535				
	2F	d246	Positioning Data 2 (MSB)	<input type="checkbox"/> V/f <input type="checkbox"/> DTV <input type="checkbox"/> PG V/f <input type="checkbox"/> PG DTV <input type="checkbox"/> SLV <input type="checkbox"/> PGV <input type="checkbox"/> PM SLV <input type="checkbox"/> PM PGV	0	√	---	Possible
	30	d247	Positioning Data 2 (LSB)	-268,435,455 to 268,435,455 MSB: -4,096 to 4,095 LSB: 0 to 65,535				
	31	d248	Positioning Data 3 (MSB)	<input type="checkbox"/> V/f <input type="checkbox"/> DTV <input type="checkbox"/> PG V/f <input type="checkbox"/> PG DTV <input type="checkbox"/> SLV <input type="checkbox"/> PGV <input type="checkbox"/> PM SLV <input type="checkbox"/> PM PGV	0	√	---	Possible
	32	d249	Positioning Data 3 (LSB)	-268,435,455 to 268,435,455 MSB: -4,096 to 4,095 LSB: 0 to 65,535				
	33	d250	Positioning Data 4 (MSB)	<input type="checkbox"/> V/f <input type="checkbox"/> DTV <input type="checkbox"/> PG V/f <input type="checkbox"/> PG DTV <input type="checkbox"/> SLV <input type="checkbox"/> PGV <input type="checkbox"/> PM SLV <input type="checkbox"/> PM PGV	0	√	---	Possible
	34	d251	Positioning Data 4 (LSB)	-268,435,455 to 268,435,455 MSB: -4,096 to 4,095 LSB: 0 to 65,535				
	35	d252	Positioning Data 5 (MSB)	<input type="checkbox"/> V/f <input type="checkbox"/> DTV <input type="checkbox"/> PG V/f <input type="checkbox"/> PG DTV <input type="checkbox"/> SLV <input type="checkbox"/> PGV <input type="checkbox"/> PM SLV <input type="checkbox"/> PM PGV	0	√	---	Possible
	36	d253	Positioning Data 5 (LSB)	-268,435,455 to 268,435,455 MSB: -4,096 to 4,095 LSB: 0 to 65,535				
	37	d254	Positioning Data 6 (MSB)	<input type="checkbox"/> V/f <input type="checkbox"/> DTV <input type="checkbox"/> PG V/f <input type="checkbox"/> PG DTV <input type="checkbox"/> SLV <input type="checkbox"/> PGV <input type="checkbox"/> PM SLV <input type="checkbox"/> PM PGV	0	√	---	Possible
	38	d255	Positioning Data 6 (LSB)	-268,435,455 to 268,435,455 MSB: -4,096 to 4,095 LSB: 0 to 65,535				

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map								
	39	d256	Positioning Data 7 (MSB)	<table border="1" style="font-size: small;"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	√	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	3A	d257	Positioning Data 7 (LSB)	-268,435,455 to 268,435,455 MSB: -4,096 to 4,095 LSB: 0 to 65,535												
	3B	d258	Positioning Data 8 (MSB)	<table border="1" style="font-size: small;"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	√	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	3C	d259	Positioning Data 8 (LSB)	-268,435,455 to 268,435,455 MSB: -4,096 to 4,095 LSB: 0 to 65,535												
	4E	d277	Positioning Data Setting Selection via communication	<table border="1" style="font-size: small;"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0: Disable Communications Positioning Data (S20, S21) 1: Enable Communications Positioning Data (S20, S21)</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	√	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	4F	d278	Restarting Positioning Range Setting	<table border="1" style="font-size: small;"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0: Disable 1 to 9,999: Enable Restarting Positioning in the set range</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	√	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	51	d280	Over Travel Forced Stop Operation Selection	<table border="1" style="font-size: small;"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table> <p>0: Servo lock after deceleration stop 1: Er6 fault occurs after deceleration stop</p>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	√	---	Possible
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	61	d296	Current Reference Position Monitor (MSB)	<table border="1" style="font-size: small;"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	---	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	62	d297	Current Reference Position Monitor (LSB)	-268,435,455 to 268,435,455 MSB: -4,096 to 4,095 LSB: 0 to 65,535												
	63	d298	Current Feedback Position Monitor (MSB)	<table border="1" style="font-size: small;"> <tr> <td>V/f</td> <td>DTV</td> <td>PG V/f</td> <td>PG DTV</td> </tr> <tr> <td>SLV</td> <td>PGV</td> <td>PM SLV</td> <td>PM PGV</td> </tr> </table>	V/f	DTV	PG V/f	PG DTV	SLV	PGV	PM SLV	PM PGV	0	---	---	Possible (TxPDO)
V/f	DTV	PG V/f	PG DTV													
SLV	PGV	PM SLV	PM PGV													
	64	d299	Current Feedback Position Monitor (LSB)	-268,435,455 to 268,435,455 MSB: -4,096 to 4,095 LSB: 0 to 65,535												

*1. For SDO communications and PDO communications, it is 7FFF hex.

A-4-15 y Group Parameter List (EtherCAT Communications Command Function Selection)

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
300F	60	y95	Data Clear Processing for EtherCAT Communications Error	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>Selection of data to be cleared to 0 when a communications error (Er5 (alarm code 23)) occurs 0: Do not clear the data 1: Clear the data of Frequency Reference (3002-02 hex), Frequency Reference (3002-06 hex), Speed Command via Communication (3002-14 hex) 2: Clear the run command assigned bit of Operation command (3002-07 hex) 3: Clear both data 1 and 2 above Related alarms: ErP, Er4, and Er5</p>	0	√	---	Possible
	62	y97	Communication Data Storage Selection	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0: Store into nonvolatile memory (Rewritable times are limited) 1: Write into temporary memory (Rewritable times are unlimited) 2: Save all data from temporary memory to nonvolatile memory (After all data is saved, return to Data 1)</p>	1	√	---	Possible

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	64	y99	Support Tool Link Function Selection	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>0: Disable support tool link function (Settings in those other than function codes S)</p> <p>1: Support tool link function command value Enabled, Output terminal disabled</p> <ul style="list-style-type: none"> Enable commands from Frequency Reference (S01), Torque Reference (S02), and Torque Bias Value (S24) <p>2: Support tool link function command value Enabled, Output terminal disabled</p> <ul style="list-style-type: none"> Enable settings from Communication Data Terminal [DO] (S07) and Communication Data Terminal [AO] (S12) <p>3: Support tool link function command value Enabled, Output terminal enabled</p> <ul style="list-style-type: none"> Enable commands from Frequency Reference (S01), Torque Reference (S02), and Torque Bias Value (S24) Enable settings from Communication Data Terminal [DO] (S07) and Communication Data Terminal [AO] (S12) 	0	√	---	Possible

A-4-16 S Group Parameter List (EtherCAT Communications Commands)

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
3002	02	S01	Frequency Reference	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>-32,768 to 32,767</p> <p>-164% to 164% +20,000 or -20,000 = Maximum output frequency</p>	0	√	---	Possible
	03	S02	Torque Reference	<div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between; border: 1px solid black; padding: 2px;"> SLV PGV PM SLV PM PGV </div> <p>-327.68 to 327.67</p>	0	√	%	Possible

Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	04	S03	Torque Current Command	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>-327.68 to 327.67</p>	0	√	%	Possible
	06	S05	Frequency Reference	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0.00 to 655.35</p>	0	√	Hz	Possible
	07	S06	Operation command	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0000 to FFFF hex</p> <p>Bit 15: RST Bit 14: DI7 Bit 13: DI6 Bit 12: --- Bit 11: --- Bit 10: --- Bit 9: --- Bit 8: --- Bit 7: --- Bit 6: DI5 Bit 5: DI4 Bit 4: DI3 Bit 3: DI2 Bit 2: DI1 Bit 1: REV Bit 0: FWD</p>	0	√	---	Possible
	08	S07	Communication Data Terminal [DO]	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0000 to FFFF hex</p> <p>Bit 15: --- Bit 14: --- Bit 13: --- Bit 12: --- Bit 11: --- Bit 10: --- Bit 9: --- Bit 8: RO Bit 7: --- Bit 6: --- Bit 5: --- Bit 4: --- Bit 3: --- Bit 2: --- Bit 1: DO2 Bit 0: DO1</p>	0	√	---	Possible

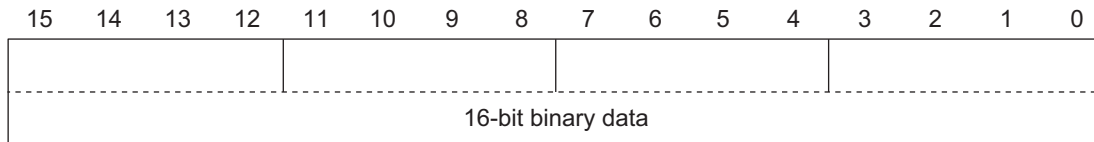
Index (hex)	Sub-index (hex)	Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Unit	PDO map
	0E	S13	PID Control PID Command via Communication	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>-32,768 to 32,767</p> <p>-164% to 164% +20,000 or -20,000 = ±100%</p>	0	√	---	Possible
	0F	S14	Alarm Reset Command	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>0: Disable 1: Alarm reset</p>	0	√	---	Possible
	10	S15	Torque Bias Value via Communication	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>-327.68 to 327.67</p>	0	√	%	Possible
	14	S19	Speed Command via Communication	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>-32,768 to 32,767</p>	0	√	r/min	Possible
	15	S20	Positioning Data via Communication (MSB)	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>-268,435,455 to 268,435,455</p>	0	√	---	Possible
	16	S21	Positioning Data via Communication (LSB)	<p>MSB: -4,096 to 4,095 LSB: 0 to 65,535</p>				
	17	S22	Torque Reference via Communication	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>-327 to 327</p>	0	√	%	Possible
	18	S23	Torque Current Command via Communication	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>-327 to 327</p>	0	√	%	Possible
	19	S24	Torque Bias Value	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>-327 to 327</p>	0	√	%	Possible
	1F	S30	PID Control Feedback Value via Communication	<div style="display: flex; justify-content: space-between;"> V/f DTV PG V/f PG DTV </div> <div style="display: flex; justify-content: space-between;"> SLV PGV PM SLV PM PGV </div> <p>-32,768 to 32,767</p> <p>-164% to 164% +20,000 or -20,000 = ±100%</p>	0	√	---	Possible

A-4-17 Communication Data Formats of Parameters

This section describes the communication data format for accessing manufacturer-specific objects 2 (inverter parameters) in EtherCAT communications (PDO and SDO).

Data Format Specification

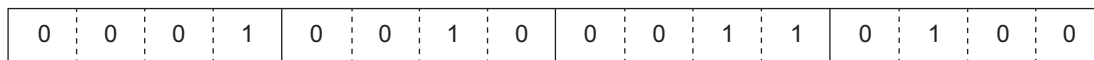
All data in the data field of a communications frame is represented as 16-bit binary data as shown below.



For convenience of description, 16-bit data is divided into the upper byte (8 bits from 15 to 8) and the lower byte (8 bits from 7 to 0) and represented in hexadecimal.

For example, the following data is 1234 hex in hexadecimal representation and is described as

12_{Hex} | 34_{Hex}



Data Format [1]: Integer Data (Positive), Resolution 1

Example: **1st Rated Voltage at Base Frequency** (3004-06 hex) = 200 V

200 = 00C8 hex → 00_{Hex} | C8_{Hex}

Data Format [2]: Integer Data (Positive/Negative), Resolution 1

Example: -20

-20 = FFEC hex → FF_{Hex} | EC_{Hex}

Data Format [3]: Decimal Point Data (Positive), Resolution 0.1

Example: **1st Maximum Output Frequency** (3004-04 hex) = 70.0 Hz

70.0 × 10 = 700 = 02BC hex → 02_{Hex} | BC_{Hex}

Data Format [4]: Decimal Point Data (Positive/Negative), Resolution 0.1

Example: **Input Terminal [AI1] Offset** (3006-20 hex) = -5.0%

-5.0 × 10 = -50 = FFCE hex → FF_{Hex} | CE_{Hex}

Data Format [5]: Decimal Point Data (Positive), Resolution 0.01

Example: **Multi-step Frequency Reference 1** (3006-06 hex) = 50.25 Hz

50.25 × 100 = 5,025 = 13A1 hex → 13_{Hex} | A1_{Hex}

Data Format [6]: Decimal Point Data (Positive/Negative), Resolution 0.01

Example: **Torque Value** (3003-08 hex) = -85.38%

$$-85.38 \times 100 = -8,538 = \text{DEA6 hex} \rightarrow \boxed{\text{DE}_{\text{Hex}}} \boxed{\text{A6}_{\text{Hex}}}$$

Data Format [7]: Decimal Point Data (Positive), Resolution 0.001

Example: **Electronic Thermal for Braking Resistor Allowable Average Loss** (3004-34 hex) = 0.105 kW

$$0.105 \times 1,000 = 105 = 0069 \text{ hex} \rightarrow \boxed{00}_{\text{Hex}} \boxed{69}_{\text{Hex}}$$

Data Format [10]: Alarm Code

Code	Description	Code	Description	
0	No alarm	---	37	Tuning Error er7
1	Overcurrent Protection (During Acceleration)	0c1	42	Step-out Detection/Magnetic Pole Position Detection Error during Startup erd
2	Overcurrent Protection (During Deceleration)	0c2	46	Output Phase Loss Error 0pl
3	Overcurrent Protection (During Constant Speed)	0c3	47	Speed Mismatch or Excessive Speed Deviation ere
6	Overvoltage Protection (During Acceleration)	0u1	50	Magnetic Pole Position Detection Error erc
7	Overvoltage Protection (During Deceleration)	0u2	51	Data Save Error during Undervoltage erf
8	Overvoltage Protection (During Constant Speed)	0u3	52	Excessive Position Deviation Error d0
10	Undervoltage	lu	53	RS-485 Communication Error erp
11	Input Phase Loss Error	lin	54	Hardware Error erh
16	Inrush Current Prevention Circuit Error	pbf	56	Positioning Control Error ero
17	Cooling Fin Overheat Error	0h1	57	Enable Circuit Failure ecf
18	External Trip	0h2	58	Terminal [Ai2]All Current Input Wire Break Detection cof
19	Inverter Overheat Error	0h3	59	Breaking Transistor Error dba
20	Thermistor Error	0h4	65	Customizable Logic Abnormality ecl
22	Braking Resistor Overheat Error	dbh	70	Inrush Current Prevention Resistor Overheat 0h6
23	1st Motor Overload Protection	0l1	101	Motor Overload Warning 0l
24	2nd Motor Overload Protection	0l2	102	Cooling Fin Overheat Warning 0h
25	Inverter Overload Protection	0lu	103	Life Warning lif
27	Overspeed	0s	104	Analog Input Reference Command Loss Detected ref
28	Abnormal Setting Related to the PG Option Card	pg	105	PID Warning Output pid
31	EEPROM Error	er1	106	Low Torque Detected uTl
32	Operator Communications Error	er2	107	PTC thermistor activated pTc
33	CPU Error	er3	108	Motor Run Time Over rTe
34	Option Timeout	er4	109	Number of Startups Over cnT
35	Option Error	er5	253	Locked by Password lok
36	Operation Error	er6	254	Mock Alarm err

Example: Overvoltage Protection (During Acceleration) (0u1)

6 = 0006 hex → 00_{Hex} 06_{Hex}

Data Format [11]: Capacity Code (in kW)

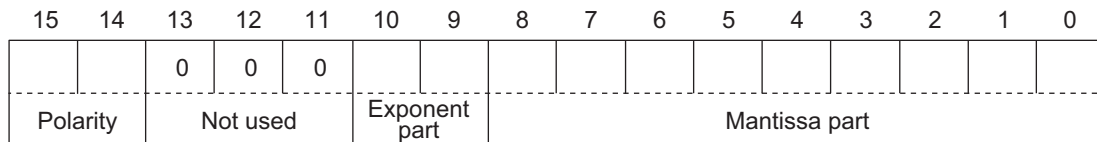
The data is 100 times the capacity (kW) as shown in the table below.

Capacity (kW)	Data
0.1	10
0.2	20
0.4	40
0.75	75
1.5	150
2.2	220
3.7	370
5.5	550
7.5	750
11	1,100
15	1,500
18.5	1,850
22	2,200

Example: 2.2 kW

2.20 × 100 = 220 = 00DC hex → 00_{Hex} DC_{Hex}

Data Format [12]: Floating Point Data (Acceleration/Deceleration Time, PID Conversion Coefficient)



Polarity: 0 → Positive (+), 1 → Negative (-), Exponent part: 0 to 3, Mantissa part: 1 to 999

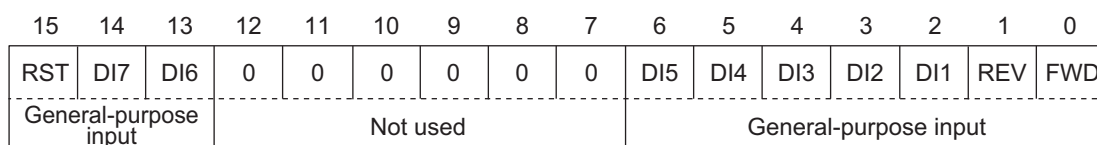
Value represented in this format = (Polarity) mantissa part × 10 to the power of (exponent part - 2)

Value	Mantissa part	Exponent part	10 to the power of (exponent part - 2)
0.01 to 9.99	1 to 999	0	0.01
10.0 to 99.9	100 to 999	1	0.1
100 to 999	100 to 999	2	1
1,000 to 9,990	100 to 999	3	10

Example: **1st Acceleration Time 1** (3004-08 hex) = 20.0 s

20.0 = 200 × 0.1 → 0000 0100 1100 1000_b = 04C8 hex → 00_{Hex} C8_{Hex}

Data Format [14]: Operation Command



RST: Alarm reset

FWD: Forward command

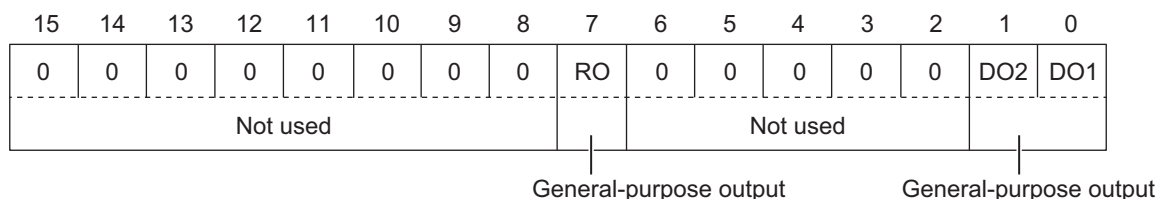
REV: Reverse command

(All bits are ON with 1 regardless of the positive/negative logic setting.)

Example: **Operation command** (3002-07 hex) = FWD, DI1 = ON

0000 0000 0000 0101_b = 0005 hex → 00Hex 05Hex

Data Format [15]: General-purpose Output Terminal



RO: Relay output

FWD: Forward command

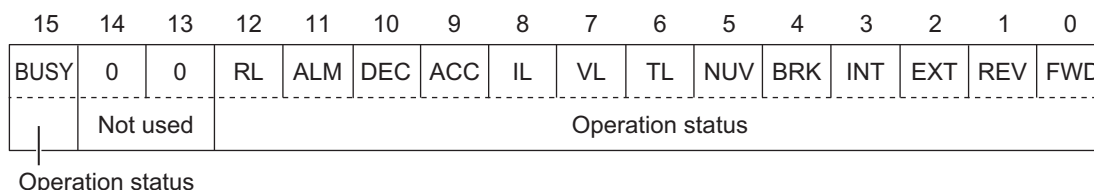
REV: Reverse command

(All bits are ON with 1 regardless of the positive/negative logic setting.)

Example: **Output Terminal Monitor** (3003-10 hex) DO1 = ON

0000 0000 0000 0001_b = 0001 hex → 00Hex 01Hex

Data Format [16]: Operation Status



(All bits are ON or active with 1.)

Bit	Symbol	Description	Bit	Symbol	Description
0	FWD	During forward operation	8	IL	During current limiting
1	REV	During reverse operation	9	ACC	During acceleration
2	EXT	Direct DC braking (or during pre-exciting)	10	DEC	During deceleration
3	INT	Inverter shut down	11	ALM	Alarm relay
4	BRK	During braking	12	RL	Communications effective
5	NUV	Main circuit DC voltage estab- lished (Undervoltage with 0)	13	0	---
6	TL	Torque limiting	14	0	---
7	VL	During voltage limiting	15	BUSY	During parameter code data writing

Example: **Operation Status 1 Monitor** (3003-0F hex) = During forward operation and during acceleration

0000 0010 0000 0001_b = 0401 hex → 04_{Hex} 01_{Hex}

Data Format [19]: Current Value

A current value is decimal point data (positive), resolution 0.01.

Example: **1st Motor Electronic Thermal Level** (3004-0C hex) = 3.60 A

3.60 × 100 = 360 = 0168 hex → 01_{Hex} 68_{Hex}

Data Format [20]: Communications Error Code

Code	Description
1	Non-existent object (parameter number) specified
2	Non-existent object (parameter number) specified
3	Improper data (Range error)
7	NAK (Link priority, no right, write disabled)
71	Checksum error, CRC error
72	Parity error
73	Framing error, overrun error, buffer full

Example: Improper address

2 = 0002 hex → 00_{Hex} 02_{Hex}

Data Format [21]: Auto Tuning

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	0	0	REV	FWD								
Not used						Rotation direction		Data part							

(Data part)

- 0: Disable
- 1: Tune the motor parameters while stopped
- 2: Tune the motor parameters while rotating
- 4: Tune the PM motor magnetic pole position offset while rotating
- 5: Tune the motor %R1 and %X while stopped

Example: **1st Auto Tuning Function Selection** (3007-05 hex) = 2: Tune the motor parameters while rotating, forward operation

2 = 0102 hex → 01_{Hex} 02_{Hex}

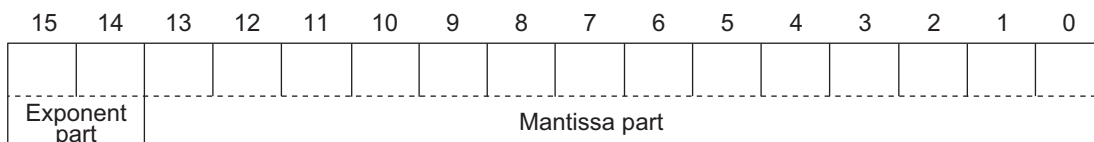
Data Format [22]: Frequency Data

Decimal point data (positive), resolution 0.01 Hz

Example: **Multi-step Frequency Reference 1** (3006-06 hex) = 50.25 Hz

50.25 × 100 = 5,025 = 13A1 hex → 13_{Hex} A1_{Hex}

Data Format [24]: Floating Point Data



Exponent part: 0 to 3, Mantissa part: 1 to 9,999

Value represented in this format = Mantissa part × 10 to the power of (exponent part - 2)

Value	Mantissa part	Exponent part	10 to the power of (exponent part - 2)
0.00 to 99.99	0 to 9,999	0	0.01
100.0 to 999.9	1,000 to 9,999	1	0.1
1,000 to 9,999	1,000 to 9,999	2	1
10,000 to 99,990	1,000 to 9,999	3	10

Example: **Power Consumption Monitor** (3010-16 hex) = 10.02 kW

10.02 = Mantissa part: 1,002 (3EA hex), Exponent part: 0 = 03EA hex → 03Hex EAHex

Example: **Power Consumption Monitor** (3010-16 hex) = 100.2 kW

100.2 = Mantissa part: 1,002 (3EA hex), Exponent part: 1 = 43EA hex → 43Hex EAHex

Example: **Power Consumption Monitor** (3010-16 hex) = 9,999 kW

100.2 = Mantissa part: 9,999 (270F hex), Exponent part: 2 = 670F hex → 67Hex 0FHex

Data Format [29]: Positive/Negative Data with ±20,000 as ±100%

Example: **Frequency Reference** (3002-02 hex) = -20,000 (= -100% = Maximum output frequency)

-20,000 = B1E0 hex → B1Hex E0Hex

Example: **Frequency Reference** (3002-02 hex) = 20,000 (= 100% = Maximum output frequency)

20,000 = 4E20 hex → 4EHex 20Hex

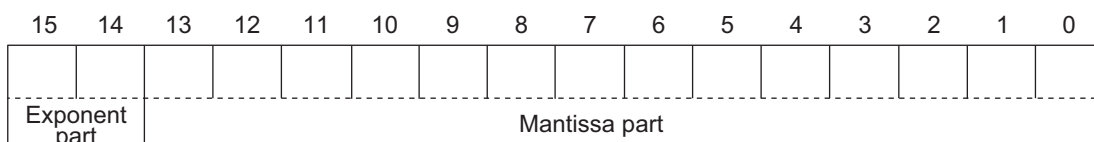
Data Format [35]: ROM Version

Setting range: 0 to 59,999

Example: **ROM Version** (3003-1A hex) = 0064 hex

00Hex 64Hex → 0064 hex = 100

Data Format [37]: Floating Point Data (Load Shaft Speed, etc.)



Exponent part: 0 to 3, Mantissa part: 1 to 9,999

Value represented in this format = Mantissa part × 10 to the power of (exponent part - 2)

Value	Mantissa part	Exponent part	10 to the power of (exponent part - 2)
0.01 to 99.99	1 to 9,999	0	0.01
100.0 to 999.9	1,000 to 9,999	1	0.1

Value	Mantissa part	Exponent part	10 to the power of (exponent part - 2)
1,000 to 9,999	1,000 to 9,999	2	1
10,000 to 99,990	1,000 to 9,999	3	10

Example: **Rotate Speed Monitor** (3010-09 hex) = 99,990 r/min

99,990 = Mantissa part: 9,999 (270F hex), Exponent part: 3 = E70F hex → E7_{Hex} 0F_{Hex}

Example: **Rotate Speed Monitor** (3010-09 hex) = 9,999 r/min

9,999 = Mantissa part: 9,999 (270F hex), Exponent part: 2 = A70F hex → A7_{Hex} 0F_{Hex}

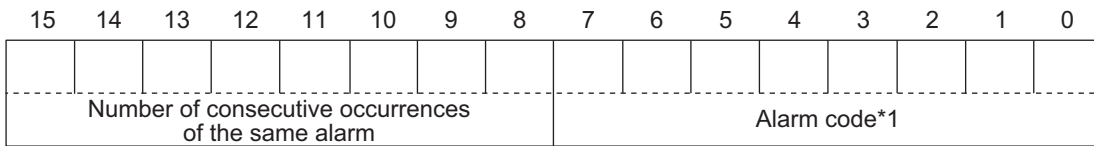
Example: **Rotate Speed Monitor** (3010-09 hex) = 9.999 r/min

999.9 = Mantissa part: 9,999 (270F hex), Exponent part: 1 = 670F hex → 67_{Hex} 0F_{Hex}

Example: **Rotate Speed Monitor** (3010-09 hex) = 99.99 r/min

99.99 = Mantissa part: 9,999 (270F hex), Exponent part: 0 = 270F hex → 27_{Hex} 0F_{Hex}

Data Format [41]: Alarm History



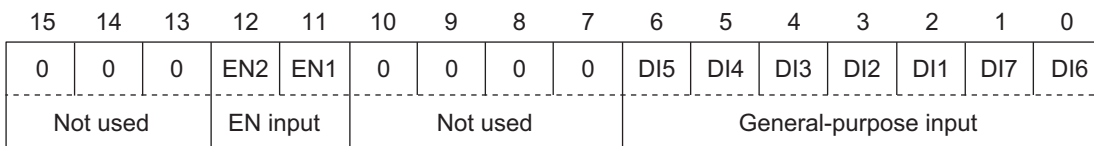
*1: For alarm codes, refer to “Data Format [10]: Alarm Code” in this section.

This gives the contents of the alarm that occurred and the number of consecutive occurrences of the alarm.

Example: **Last Alarm History/Number of Consecutive Same Alarms** (3011-06 hex) = 021B hex

02_{Hex} 1B_{Hex} → Number of consecutive occurrences of the same alarm: 2, Alarm code: 1B hex = 27 OS (Overspeed)

Data Format [43]: Operation Command (for I/O Check)

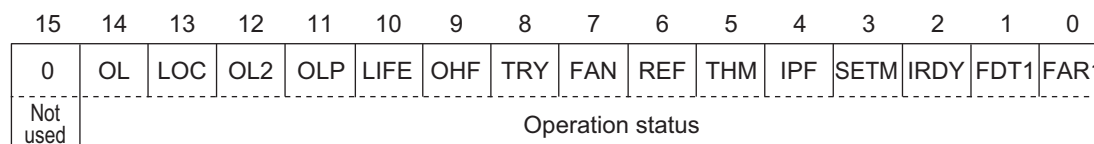


(All bits are ON with 1.)

Example: **Input Terminal Monitor** (3010-29 hex) = 0061 hex

00_{Hex} 61_{Hex} → 0000 0000 0110 0001_b = DI4, DI5, and DI6 are ON

Data Format [44]: Operation Status 2



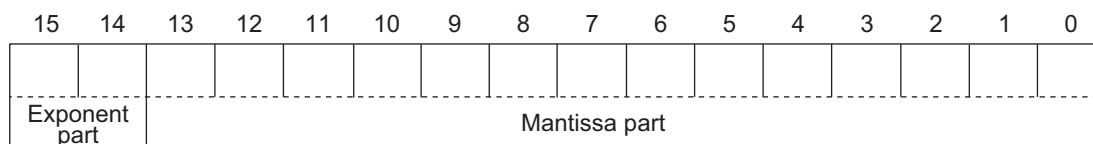
(All bits are ON or active with 1.)

Bit	Symbol	Description	Bit	Symbol	Description
0	FAR1	Constant speed arrival	8	TRY	During retry
1	FDT1	Over set Frequency arrival	9	OHF	Fin Overheat warning
2	IRDY	Operation ready	10	LIFE	Life warning
3	SETM	2nd motor selection	11	OLP	During active drive
4	IPF	During restart after instantaneous power failure	12	OL2	Overload warning 2
5	THM	Thermal warning	13	LOC	Light load detection
6	REF	RUN command source	14	OL	Overload warning
7	FAN	Fan operation signal	15	0	---

Example: **Running Status 3 Monitor** (3003-47 hex) = 0281 hex

02_{Hex} 81_{Hex} → 0000 0010 1000 0001_b = FAR1, FAN, and OHF are ON

Data Format [45]: Floating Point Data



Exponent part: 0 to 3, Mantissa part: 0 to 9,999

Value represented in this format = Mantissa part × 10 to the power of (exponent part - 3)

Value	Mantissa part	Exponent part	10 to the power of (exponent part - 3)
0.000 to 9.999	0 to 9,999	0	0.001
10.00 to 99.99	1,000 to 9,999	1	0.01
100.0 to 999.9	1,000 to 9,999	2	0.1
1,000 to 9,999	1,000 to 9,999	3	1

Example: **Data Used Integrating Electric Power** (3010-53 hex) = 9,999 kW

9,999 = Mantissa part: 9,999 (270F hex), Exponent part: 2 = A70F hex → A7_{Hex} 0F_{Hex}

Example: **Data Used Integrating Electric Power** (3010-53 hex) = 999.9 kW

999.9 = Mantissa part: 9,999 (270F hex), Exponent part: 1 = 670F hex → 67_{Hex} 0F_{Hex}

Example: **Data Used Integrating Electric Power** (3010-53 hex) = 99.99 kW

99.99 = Mantissa part: 9,999 (270F hex), Exponent part: 0 = 270F hex → 27_{Hex} 0F_{Hex}

Data Format [67]: RUN Command Source Monitor

Code	Description	Remarks
0	Digital Operator positive direction terminal	Same as the selection for RUN Command Selection (3004-03 hex/301F-03 hex)
1	Terminal command (FW or RV)	
2	Digital Operator forward rotation	
3	Digital Operator reverse rotation	
4 to 20	Reserved	

Code	Description	Remarks
21	RS-485 communications	
22	Fieldbus (Reserved)	
23	Support Tool	

Example: **RUN Command Source Monitor** (3010-1D hex) = 0001 hex

00Hex 01Hex → 1 = Terminal command (FW or RV)

Data Format [68]: Frequency Reference Source Code

Code	Description	Remarks
0	Digital Operator (Increment/Decrement key) (No output frequency takeover)	Same as the selection for Frequency Reference Selection (3004-02 hex/3006-1F hex)
1	Analog voltage input (terminal [AI1])	
2	Analog current input (terminal [AI2] (AI))	
3	Analog voltage input (terminal [AI1]) + analog current input (terminal [AI2] (AI))	
5	Analog voltage input (terminal AI2 (AIV))	
7	UP/DOWN control	
8	Digital Operator (Increment/Decrement key) (Output frequency takeover)	
10	Pattern operation	
13	Pulse train input or Frequency calculation	
21	RS-485 communications	
22	Fieldbus (Reserved)	
23	Support Tool	
24	Multi-step Frequency	
25	Jogging Frequency	
30	PID Control Operator Process	
31	PID Control Analog Process	
33	PID Control UP/DOWN control	
34	PID Control Communication Process	
36	PID Control Multi-Step Terminal Process	
255	Not Selected	

Example: **Frequency and PID Command Source Monitor** (3010-1E hex) = 000A hex

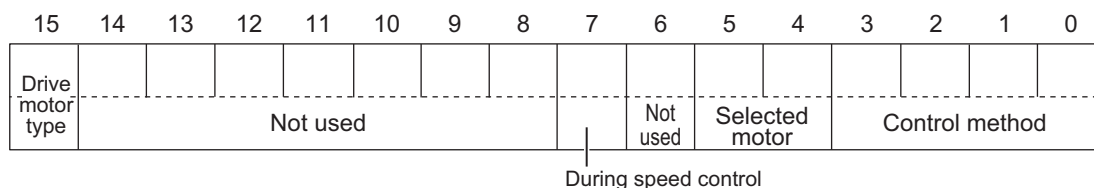
00Hex 0AHex → 10 = Pattern operation

Data Format [74]: Integer Data (Positive), in 10 Hours

Example: **1st Remaining Time before the Next Motor Maintenance** (3003-52 hex) = 12,340 h

12340 ÷ 10 = 04D2_h → 04H D2H

Data Format [76]: Operation Status 2

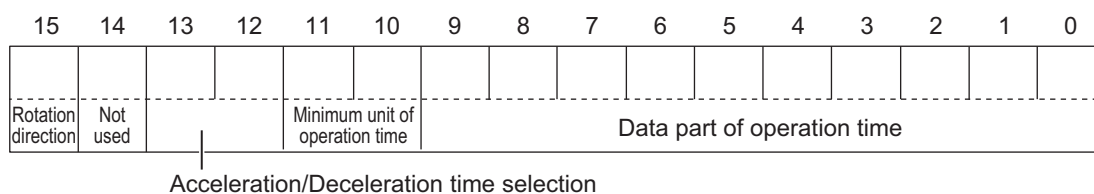


Signal name	Description
Control method	Indicates the final control method including set value, terminal status, etc. 0: IM V/f control 1: IM Dynamic torque vector control without speed sensor 3: IM V/f control with speed sensor 4: IM Dynamic torque vector control with speed sensor 5: IM Vector control without speed sensor 6: IM Vector control with speed sensor 15: PM Vector control without speed and pole position sensor 16: PM Vector control with speed and pole position sensor Others: Reserved
Selected motor	Indicates the selected motor number. 00 _b : 1st motor 01 _b : 2nd motor
During speed control	1 during control
Drive motor type	0: Induction motor 1: Synchronous motor

Example: **Running Status 2 Monitor** (3003-4B hex) = 0003 hex

00_{Hex} 03_{Hex} → 0000 0000 0000 0011_b = IM V/f control with speed sensor, 1st motor, indication motor

Data Format [84]: Pattern Operation



Item	Description
Rotation direction	0: Forward, 1: Reverse
Acceleration/Deceleration time selection	0: 1st Acceleration Time 1 (3004-08 hex)/ 1st Deceleration Time 1 (3004-09 hex) 1: 2nd Acceleration Time 1 (3005-0B hex)/ 2nd Deceleration Time 1 (3005-0C hex) 2: 1st Acceleration Time 2 (3005-0D hex)/ 1st Deceleration Time 2 (3005-0E hex) 3: 2nd Acceleration Time 2 (3005-0F hex)/ 2nd Deceleration Time 2 (3005-10 hex)

Item	Description
Minimum unit of operation time	0: 0.01 1: 0.1 2: 1 3: 10
Data part of operation time	Exponent part 0: 000 to 999 Exponent part not 0: 100 to 999

Example: **Pattern Operation Stage 1 Operation Setting** (3006-17 hex) = Reverse, 2nd Acceleration/Deceleration Time, and 10.0 s

Rotation direction: Reverse (8000 hex)

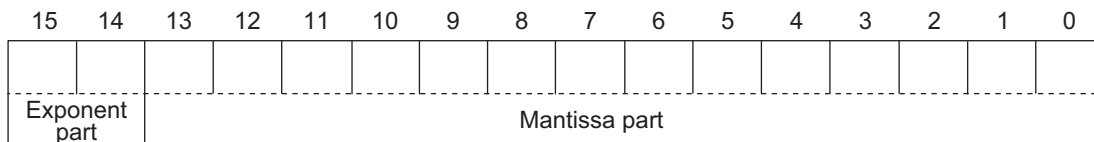
Acceleration/Deceleration time: 2nd Acceleration/Deceleration Time (1000 hex)

Operation time: 10.0 s = 0.1 × 100 (0400 hex + 0064 hex)

Therefore, the set value is

8000 hex + 1000 hex + 0400 hex + 0064 hex = 9464 hex → 94_{Hex} 64_{Hex}

Data Format [93]: Floating Point Data



Exponent part: 0 to 3, Mantissa part: 0 to 9,999

Value represented in this format = Mantissa part × 10 to the power of (exponent part - 1)

Value	Mantissa part	Exponent part	10 to the power of (exponent part - 1)
0.0 to 999.9	0 to 9,999	0	0.1
1,000 to 9,999	1,000 to 9,999	1	1
10,000 to 99,990	1,000 to 9,999	2	10
100,000 to 999,900	1,000 to 9,999	3	100

Example: **Integrated Power Monitor** (3010-52 hex) = 12,340

12,340 = Mantissa part: 1,234 (04D2 hex), Exponent part: 2 = C4D2 hex → C4_{Hex} D2_{Hex}

Example: **Integrated Power Monitor** (3010-52 hex) = 567.8

567.8 = Mantissa part: 5,678 (162E hex), Exponent part: 0 = 162E hex → 16_{Hex} 2E_{Hex}

Data Format of Inverter Parameters

Parameter No.	EtherCAT Object	Parameter	Communication data format (2 bytes)
F00	3004-01 hex	Operator Operation Prevention Function Selection	1
F01	3004-02 hex	1st Frequency Reference Selection	1
F02	3004-03 hex	1st RUN Command Selection	1
F03	3004-04 hex	1st Maximum Output Frequency	3
F04	3004-05 hex	1st Base Frequency	3

Parameter No.	EtherCAT Object	Parameter	Communication data format (2 bytes)
F05	3004-06 hex	1st Rated Voltage at Base Frequency	1
F06	3004-07 hex	1st Rated Voltage at Maximum Output Frequency	1
F07	3004-08 hex	1st Acceleration Time 1	12
F08	3004-09 hex	1st Deceleration Time 1	12
F09	3004-0A hex	1st Manual Torque Boost Voltage	3
F10	3004-0B hex	1st Motor Electronic Thermal Characteristic Selection	1
F11	3004-0C hex	1st Motor Electronic Thermal Level	24
F12	3004-0D hex	1st Motor Electronic Thermal Time Constant	3
F14	3004-0F hex	Power Interruption Restart Mode Selection	1
F15	3004-10 hex	1st Frequency Upper Limit	5
F16	3004-11 hex	1st Frequency Lower Limit	5
F18	3004-13 hex	Input Terminal [AI1, AI2] Bias for 1st Frequency Command	6
F20	3004-15 hex	1st DC Injection Braking Start Frequency	3
F21	3004-16 hex	1st DC Injection Braking Level	1
F22	3004-17 hex	1st DC Injection Braking Time	5
F23	3004-18 hex	1st Starting Frequency	3
F24	3004-19 hex	1st Starting Frequency 1 Holding Time	5
F25	3004-1A hex	1st Stop Frequency	3
F26	3004-1B hex	Carrier Frequency	1
F27	3004-1C hex	Motor Sound Tone	1
F37	3004-26 hex	1st V/f Characteristics Selection	1
F38	3004-27 hex	1st Stop Frequency Detection Method Selection	1
F39	3004-28 hex	1st Stop Frequency Holding Time	5
F40	3004-29 hex	Torque Limit 1	1
F41	3004-2A hex	Torque Limit 2	1
F42	3004-2B hex	1st Drive Control Selection	1
F43	3004-2C hex	1st Overload Protect Function Selection	1
F44	3004-2D hex	1st Overload Protect Level	1
F50	3004-33 hex	Electronic Thermal for Braking Resistor Discharging Capacity	1
F51	3004-34 hex	Electronic Thermal for Braking Resistor Allowable Average Loss	45
F52	3004-35 hex	Braking Resistor Resistance	12
F80	3004-51 hex	Load Mode Selection	1
E01	3005-02 hex	Input Terminal [DI1] Function Selection	1
E02	3005-03 hex	Input Terminal [DI2] Function Selection	1
E03	3005-04 hex	Input Terminal [DI3] Function Selection	1
E04	3005-05 hex	Input Terminal [DI4] Function Selection	1
E05	3005-06 hex	Input Terminal [DI5] Function Selection	1
E10	3005-0B hex	2nd Acceleration Time 1	12
E11	3005-0C hex	2nd Deceleration Time 1	12
E12	3005-0D hex	1st Acceleration Time 2	12
E13	3005-0E hex	1st Deceleration Time 2	12
E14	3005-0F hex	2nd Acceleration Time 2	12
E15	3005-10 hex	2nd Deceleration Time 2	12

Parameter No.	EtherCAT Object	Parameter	Communication data format (2 bytes)
E16	3005-11 hex	Torque Limit 3	1
E17	3005-12 hex	Torque Limit 4	1
E20	3005-15 hex	Output Terminal [DO1] Function Selection	1
E27	3005-1C hex	Output Terminal [ROA, ROB] Function Selection	1
E29	3005-1E hex	Frequency Arrival 2 ON Timer	5
E30	3005-1F hex	Frequency Arrival Detection Width (FAR1/FAR2/FAR3/FDT3/FDT4)	3
E31	3005-20 hex	Frequency Detection Level1 (FDT1/FDT3)	3
E32	3005-21 hex	Frequency Detection Hysteresis Width (FDT1/ FDT2)	3
E34	3005-23 hex	Overload early warning 2 Level (OL2)	24
E35	3005-24 hex	Overload early warning 2 Detection Timer (OL2)	5
E36	3005-25 hex	Frequency Detection Level 2 (FDT2/FDT4)	3
E37	3005-26 hex	1st Overload Early Warning Detection Level	24
E38	3005-27 hex	1st Overload Early Warning Detection Timer / Low Current detection level (OL, LOC)	5
E39	3005-28 hex	Display Coefficient 1 for Transport Time / Auxiliary Display Coefficient 1 for Speed Monitor	45
E49	3005-32 hex	Torque Command Monitor Polarity Selection	1
E50	3005-33 hex	1st Frequency Conversion Coefficient	5
E51	3005-34 hex	Display Coefficient for Integrated Power	45
E55	3005-38 hex	2nd Overload Warning Detection Level	24
E56	3005-39 hex	2nd Overload Early Warning Detection Timer	5
E61	3005-3E hex	Input Terminal [AI1] Function Selection	1
E65	3005-42 hex	Reference Loss Detection Operation Selection	1
E76	3005-4D hex	Main Circuit DC Voltage Low-voltage Detection Level	1
E78	3005-4F hex	Overtorque/Undertorque Detection Level at Forward Power Running	1
E79	3005-50 hex	Torque detection 1 Detection Timer	5
E80	3005-51 hex	Overtorque/Undertorque Detection Level at Reverse Regeneration	1
E98	3005-63 hex	Input Terminal [DI6] Function Selection	1
E99	3005-64 hex	Input Terminal [DI7] Function Selection	1
E102	301F-03 hex	2nd RUN Command Selection	1
E103	301F-04 hex	Acceleration Stop Frequency	22
E104	301F-05 hex	Acceleration Stop Time	3
E105	301F-06 hex	Deceleration Stop Frequency	22
E106	301F-07 hex	Deceleration Stop Time	3
E107	301F-08 hex	Multi-step Frequency Selection	1
E111	301F-0C hex	Jogging Operation Selection	1
E112	301F-0D hex	1st Torque Boost Function Selection	1
E113	301F-0E hex	2nd Torque Boost Function Selection	1
E114	301F-0F hex	DC Injection Braking Selection	1
E115	301F-10 hex	External DC Injection Braking Edge/Level Selection	1
E117	301F-12 hex	2nd Frequency Upper Limit	5
E118	301F-13 hex	2nd Frequency Lower Limit	5

Parameter No.	EtherCAT Object	Parameter	Communication data format (2 bytes)
E119	301F-14 hex	PID Control Feedback Selection	1
E120	301F-15 hex	PID Control PID Output Variable Range for Process Control	3
E121	301F-16 hex	PID Control PID Feedforward Selection for Process Control	1
E122	301F-17 hex	1st AVR Function Selection	1
E123	301F-18 hex	2nd AVR Function Selection	1
E124	301F-19 hex	Energy-saving Operation Function Selection	1
E125	301F-1A hex	1st 2-step Acceleration/ Deceleration switching Condition Selection	1
E126	301F-1B hex	2nd 2-step Acceleration/Deceleration Switching Condition Selection	1
E127	301F-1C hex	1st 2-step Acceleration Switching Frequency	22
E128	301F-1D hex	2nd 2-step Acceleration Switching Frequency	22
E129	301F-1E hex	1st 2-step Deceleration Switching Frequency	22
E130	301F-1F hex	2nd 2-step Deceleration Frequency	22
E131	301F-20 hex	Frequency Calculation Operation Target 1	1
E132	301F-21 hex	Frequency Calculation Operation Target 2	1
E133	301F-22 hex	Frequency Calculation Operator Selection	1
E134	301F-23 hex	Frequency Addition Amount	22
E135	301F-24 hex	Frequency Addition Sign Selection	1
E139	301F-28 hex	Overvoltage/Overcurrent Restart Function Selection	1
E146	301F-2F hex	2nd Overload Protect Function Selection	1
E147	301F-30 hex	2nd Overload Protect Level	1
E152	301F-35 hex	Starting Frequency Selection at Frequency Pull-in Restart	1
E154	301F-37 hex	RUN Time Over (RNT)/Power ON Time Over (ONT) Detection Level	1
E157	301F-3A hex	Analog Input [AI1] Detection Upper Limit Level	1
E158	301F-3B hex	Analog Input [AI1] Detection Lower Limit Level	1
E159	301F-3C hex	Analog Input [AI1] Level Detection Hysteresis Width	1
E163	301F-40 hex	Analog Operation Level at [AI1] Disconnection	2
E165	301F-42 hex	Carrier Frequency Automatic Reduction Function Selection	1
E166	301F-43 hex	Non-linear V/f Frequency 1	3
E167	301F-44 hex	Non-linear V/f Voltage 1	1
E168	301F-45 hex	Non-linear V/f Frequency 2	3
E169	301F-46 hex	Non-linear V/f Voltage 2	1
E170	301F-47 hex	Non-linear V/f Frequency 3	3
E171	301F-48 hex	Non-linear V/f Voltage 3	1
E172	301F-49 hex	Non-linear V/f Frequency 4	3
E173	301F-4A hex	Non-linear V/f Voltage 4	1
E174	301F-4B hex	Non-linear V/f Frequency 5	3
E175	301F-4C hex	Non-linear V/f Voltage 5	1
E176	301F-4D hex	Non-linear V/f Frequency 6	3
E177	301F-4E hex	Non-linear V/f Voltage 6	1
E178	301F-4F hex	Non-linear V/f Frequency 7	3
E179	301F-50 hex	Non-linear V/f Voltage 7	1
E181	301F-52 hex	Acceleration Wait Time on Brake Control	7

Parameter No.	EtherCAT Object	Parameter	Communication data format (2 bytes)
E184	301F-55 hex	Low Current Detection Condition Selection (LOC)	1
E185	301F-56 hex	Overload Warning Detection Condition Selection (OL1, OL2)	1
E196	301F-61 hex	Overtorque/Undertorque Detection Level Reverse Power Running	1
E197	301F-62 hex	Overtorque/Undertorque Detection Level Forward Regeneration	1
E198	301F-63 hex	Overtorque/Undertorque Detection Condition Selection	1
E199	301F-64 hex	0Hz Detection Output Detection Level (ZS)	5
C01	3006-02 hex	Jump Frequency 1	3
C02	3006-03 hex	Jump Frequency 2	3
C03	3006-04 hex	Jump Frequency 3	3
C04	3006-05 hex	Jump Frequency Skip Width	3
C05	3006-06 hex	Multi-step Frequency Reference 1	22
C06	3006-07 hex	Multi-step Frequency Reference 2	22
C07	3006-08 hex	Multi-step Frequency Reference 3	22
C08	3006-09 hex	Multi-step Frequency Reference 4	22
C09	3006-0A hex	Multi-step Frequency Reference 5	22
C10	3006-0B hex	Multi-step Frequency Reference 6	22
C11	3006-0C hex	Multi-step Frequency Reference 7	22
C12	3006-0D hex	Multi-step Frequency Reference 8	22
C13	3006-0E hex	Multi-step Frequency Reference 9	22
C14	3006-0F hex	Multi-step Frequency Reference 10	22
C15	3006-10 hex	Multi-step Frequency Reference 11	22
C16	3006-11 hex	Multi-step Frequency Reference 12	22
C17	3006-12 hex	Multi-step Frequency Reference 13	22
C18	3006-13 hex	Multi-step Frequency Reference 14	22
C19	3006-14 hex	Multi-step Frequency Reference 15	22
C20	3006-15 hex	Jogging Frequency	22
C21	3006-16 hex	Pattern Operation Function Selection	1
C22	3006-17 hex	Pattern Operation Stage 1 Operation Setting	84
C23	3006-18 hex	Pattern Operation Stage 2 Operation Setting	84
C24	3006-19 hex	Pattern Operation Stage 3 Operation Setting	84
C25	3006-1A hex	Pattern Operation Stage 4 Operation Setting	84
C26	3006-1B hex	Pattern Operation Stage 5 Operation Setting	84
C27	3006-1C hex	Pattern Operation Stage 6 Operation Setting	84
C28	3006-1D hex	Pattern Operation Stage 7 Operation Setting	84
C30	3006-1F hex	2nd Frequency Reference Selection	1
C31	3006-20 hex	Input Terminal [AI1] Offset	4
C32	3006-21 hex	Input Terminal [AI1] Gain (Command)	5
C33	3006-22 hex	Input Terminal [AI1] Filter	5
C34	3006-23 hex	Input Terminal [AI1] Gain (Analog Input)	5
C35	3006-24 hex	Input Terminal [AI1] Polarity Selection	1
C50	3006-33 hex	Input Terminal [AI1, AI2] Bias Analog Input for 1st Frequency Command	5

Parameter No.	EtherCAT Object	Parameter	Communication data format (2 bytes)
C53	3006-36 hex	Input Terminal [AI1, AI2] Normal/Inverse Operation for 1st Frequency Command	1
C54	3006-37 hex	Input Terminal [AI1, AI2] Normal/Inverse Operation for 2nd Frequency Command	1
C55	3006-38 hex	Input Terminal [AI1] Bias (Command)	6
C56	3006-39 hex	Input Terminal [AI1] Bias (Analog Input)	5
C58	3006-3B hex	Reserved	1
C59	3006-3C hex	Input Terminal [AI1] Analog Input Adjustment Maximum Scale	12
C60	3006-3D hex	Input Terminal [AI1] Analog Input Adjustment Minimum Scale	12
C89	3006-5A hex	Set-point Factor Numerator via Communication	2
C90	3006-5B hex	Set-point Factor Denominator via Communication	2
P01	3007-02 hex	1st Motor Pole Number	1
P02	3007-03 hex	1st Motor Capacity	11
P03	3007-04 hex	1st Motor Rated Current	24
P04	3007-05 hex	1st Auto Tuning Function Selection	21
P05	3007-06 hex	1st Online Tuning Function Selection	1
P06	3007-07 hex	1st Motor Armature Resistance	24
P07	3007-08 hex	1st Motor Parameter %R1	5
P08	3007-09 hex	1st Motor Parameter %X	5
P09	3007-0A hex	1st Slip Compensation Gain for Driving	3
P10	3007-0B hex	1st Slip Compensation Response Time	5
P11	3007-0C hex	1st Slip Compensation Gain for Braking	3
P12	3007-0D hex	1st Rated Slip Frequency	5
P13	3007-0E hex	1st Iron Loss Factor 1	5
P16	3007-11 hex	1st Magnetic Saturation Factor 1	3
P17	3007-12 hex	1st Magnetic Saturation Factor 2	3
P18	3007-13 hex	1st Magnetic Saturation Factor 3	3
P19	3007-14 hex	1st Magnetic Saturation Factor 4	3
P20	3007-15 hex	1st Magnetic Saturation Factor 5	3
P30	3007-1F hex	1st PM Motor Starting Method	1
P40	3007-29 hex	Reserved	1
P41	3007-2A hex	Reserved	4
P53	3007-36 hex	1st Motor %X Correction Factor	1
P55	3007-38 hex	1st Motor Torque Current under Vector Control	24
P56	3007-39 hex	1st Induced Voltage Factor under Vector Control	1
P57	3007-3A hex	Reserved	7
P60	3007-3D hex	1st PM Motor Armature Resistance	45
P61	3007-3E hex	1st PM Motor d-axis Inductance	24
P62	3007-3F hex	1st PM Motor q-axis Inductance	24
P63	3007-40 hex	1st PM Motor Induced Voltage Ke	1
P64	3007-41 hex	1st PM Motor Iron Loss	3
P65	3007-42 hex	1st PM Motor d-axis Inductance Magnetic Saturation Correction	3

Parameter No.	EtherCAT Object	Parameter	Communication data format (2 bytes)
P74	3007-4B hex	1st PM Motor Reference Current at Starting	1
P83	3007-54 hex	Reserved	3
P84	3007-55 hex	Reserved	3
P85	3007-56 hex	1st PM Motor Flux Limitation Value	3
P86	3007-57 hex	Reserved	3
P87	3007-58 hex	1st PM Motor Reference Current for Magnetic Pole Detection	1
P88	3007-59 hex	Reserved	1
P89	3007-5A hex	Reserved	1
P90	3007-5B hex	1st PM Motor Overcurrent Protection Level	24
P95	3007-60 hex	1st PM Motor Magnetic Pole position Offset	3
H03	3008-04 hex	Data Initialization	1
H04	3008-05 hex	Retry Count at Trip	1
H05	3008-06 hex	Retry Standby Time at Trip	3
H06	3008-07 hex	Cooling Fan Function Selection	1
H07	3008-08 hex	Acceleration/Deceleration Pattern Selection	1
H08	3008-09 hex	Reverse Rotation Prevention Function	1
H09	3008-0A hex	Starting Mode Auto Search Function Selection	1
H11	3008-0C hex	Stop Selection	1
H12	3008-0D hex	Instantaneous Overcurrent Limiting Function Selection	1
H13	3008-0E hex	Power Interruption Restart Wait Time	3
H14	3008-0F hex	Deceleration Setting During Current Limit for Restart Mode after Power Interruption	5
H15	3008-10 hex	Continuous Running Voltage Level	1
H16	3008-11 hex	Allowable Time for Power Interruption Restart	3
H18	3008-13 hex	Torque Control Operate Selection	1
H26	3008-1B hex	Thermistor Function Selection (MOH)	1
H27	3008-1C hex	1st Thermistor Error Detection Level (MOH)	5
H28	3008-1D hex	Droop Control	4
H42	3008-2B hex	Main Circuit Capacitor Service Life Coefficient (Measurement Value)	1
H43	3008-2C hex	Cumulative Run Time of Cooling Fan	74
H44	3008-2D hex	1st Startup Count for Motor	1
H45	3008-2E hex	Mock Alarm	1
H46	3008-2F hex	Auto Search Delay Time 2 for Starting Mode	3
H47	3008-30 hex	Main Circuit Capacitor Service Life Coefficient (Initial Value)	1
H48	3008-31 hex	Cumulative Run Time of Capacitors on Printed Circuit Boards	74
H49	3008-32 hex	Auto Search Delay Time 1 for Starting Characteristic	3
H54	3008-37 hex	Jogging Acceleration Time	12
H55	3008-38 hex	Jogging Deceleration Time	12
H56	3008-39 hex	Deceleration Time for Forced Stop	12
H57	3008-3A hex	S-curve Acceleration Range Frequency at Starting	1
H58	3008-3B hex	S-curve Acceleration Range Frequency at End	1
H59	3008-3C hex	S-curve Deceleration Range Frequency at Starting	1

Parameter No.	EtherCAT Object	Parameter	Communication data format (2 bytes)
H60	3008-3D hex	S-curve Deceleration Range Frequency at End	1
H61	3008-3E hex	UP/DOWN Control Initial Value Selection	1
H63	3008-40 hex	Frequency Lower Limit Operation Selection	1
H64	3008-41 hex	Low Frequency during Protecting Overload	3
H67	3008-44 hex	Auto Energy Saving Operation Condition Selection	1
H68	3008-45 hex	1st Slip Compensation Operating Conditions Selection	1
H69	3008-46 hex	Anti-regenerative Control Function Selection	1
H70	3008-47 hex	Overload Prevention Control	5
H71	3008-48 hex	Over-Excitation Control Selection during Deceleration Function Selection	1
H72	3008-49 hex	Reserved	1
H74	3008-4B hex	Torque Limit Function Selection	1
H75	3008-4C hex	Torque Limit Operation Selection	1
H76	3008-4D hex	Frequency Rising Limit for Torque Limit	3
H77	3008-4E hex	Service Life of Main Circuit Capacitor Remaining Time	74
H78	3008-4F hex	1st Motor Maintenance Interval	74
H79	3008-50 hex	1st Preset Startup Count for Motor Maintenance	1
H80	3008-51 hex	1st Output Current Fluctuation Damping Gain	5
H81	3008-52 hex	Light Alarm Selection 1	1
H82	3008-53 hex	Light Alarm Selection 2	1
H84	3008-55 hex	Pre-excitation Level	1
H85	3008-56 hex	Pre-excitation Timer	5
H86	3008-57 hex	Reserved	1
H89	3008-5A hex	Motor Electronic Thermal Overload Protection Data Retention	1
H90	3008-5B hex	Reserved	1
H91	3008-5C hex	Current Input Wire Break Detection	3
H92	3008-5D hex	Continuous Running at the Momentary Power Failure P Proportional Gain	7
H93	3008-5E hex	Continuous Running at the Momentary Power Failure Integral Time	7
H94	3008-5F hex	1st Cumulative Motor Run Time	74
H95	3008-60 hex	DC Injection Braking Start Characteristic Selection	1
H96	3008-61 hex	STOP Key Priority/Start Check Function	1
H98	3008-63 hex	Protection/Maintenance Function Mode Selection	1
H99	3008-64 hex	Password 2 Setting/Verification	1
H114	3020-0F hex	Anti-regenerative Control Level	3
H116	3020-11 hex	Reserved	1
H117	3020-12 hex	Reserved	3
H118	3020-13 hex	Reserved	3
H119	3020-14 hex	Reserved	1
H120	3020-15 hex	Reserved	1
H121	3020-16 hex	Reserved	3
H130	3020-1F hex	Reserved	7
H131	3020-20 hex	Reserved	7

Parameter No.	EtherCAT Object	Parameter	Communication data format (2 bytes)
H133	3020-22 hex	Reserved	7
H134	3020-23 hex	Reserved	7
H147	3020-30 hex	Speed Control Jogging Feed Forward Gain	5
H154	3020-37 hex	Torque Bias Function Selection	1
H155	3020-38 hex	Torque Bias Level 1	2
H156	3020-39 hex	Torque Bias Level 2	2
H157	3020-3A hex	Torque Bias Level 3	2
H158	3020-3B hex	Torque Bias Mechanical Loss Compensation	1
H159	3020-3C hex	Torque Bias Startup Timer	5
H161	3020-3E hex	Torque Bias Shutdown Timer	5
H162	3020-3F hex	Torque Bias Limit	1
H173	3020-4A hex	Magnetic Flux Level at Light Load	1
H180	3020-51 hex	Brake Error Detection Time	5
H185	3020-56 hex	Reserved	1
H193	3020-5E hex	User Preference Dataset Registration	1
H194	3020-5F hex	User Preference Dataset Protection Function Selection	1
H195	3020-60 hex	DC Injection Braking Startup Time	5
H196	3020-61 hex	Reserved	7
H197	3020-62 hex	User password 1 Mode selection	1
H198	3020-63 hex	User Password 1 Setting/Verification	1
H199	3020-64 hex	User Password 1 Setting	1
H309	3051-0A hex	Output Terminal [DO1] ON Delay Time	3
H310	3051-0B hex	Output Terminal[DO1] OFF Delay Time	3
H311	3051-0C hex	Output Terminal[DO2] ON Delay Time	3
H312	3051-0D hex	Output Terminal[DO2] OFF Delay Time	3
H313	3051-0E hex	Output Terminal [ROA, ROB] ON Delay Time	3
H314	3051-0F hex	Output Terminal [ROA, ROB] OFF Delay Time	3
H315	3051-10 hex	Logical Expression 1 Operation Target 1	1
H316	3051-11 hex	Logical Expression 1 Operation Target 2	1
H317	3051-12 hex	Logical Expression 1 Logical Operator	1
H318	3051-13 hex	Logical Expression 2 Operation Target 1	1
H319	3051-14 hex	Logical Expression 2 Operation Target 2	1
H320	3051-15 hex	Logical Expression 2 Logical Operator	1
H321	3051-16 hex	Logical Expression 3 Operation Target 1	1
H322	3051-17 hex	Logical Expression 3 Operation Target 2	1
H323	3051-18 hex	Logical Expression 3 Logical Operator	1
H324	3051-19 hex	Input Terminal [DI1] Response Time	1
H325	3051-1A hex	Input Terminal [DI2] Response Time	1
H326	3051-1B hex	Input Terminal [DI3] Response Time	1
H327	3051-1C hex	Input Terminal [DI4] Response Time	1
H328	3051-1D hex	Input Terminal [DI5] Response Time	1
H329	3051-1E hex	Input Terminal [DI6] Response Time	1
H330	3051-1F hex	Input Terminal [DI7] Response Time	1
H332	3051-21 hex	Torque Reference Selection	1

Parameter No.	EtherCAT Object	Parameter	Communication data format (2 bytes)
H333	3051-22 hex	Torque Reference	1
H334	3051-23 hex	Torque Bias Polarity Selection	1
H411	3052-0C hex	Input Phase Loss Protection Function Selection	1
H412	3052-0D hex	Output Phase Loss Protection Function Selection	1
H435	3052-24 hex	Touch Probe 1 Source	1
H436	3052-25 hex	Touch Probe 2 Source	1
H437	3052-26 hex	Touch Probe Function	1
H438	3052-27 hex	Feedback Value Comparison Signal Off Level	3
H439	3052-28 hex	Feedback Value Comparison Signal On Level	3
H440	3052-29 hex	Free Run Stop Restart Allowable Time	3
H441	3052-2A hex	Free Run Stop Restart Operation Selection	1
H442	3052-2B hex	Slip compensation Function Selection	1
H481	3052-52 hex	7SEG Monitor Item Selection	1
H482	3052-53 hex	Reserved	1
H483	3052-54 hex	FSoE Address	1
H484	3052-55 hex	Reserved	1
H485	3052-56 hex	Reserved	1
H486	3052-57 hex	Reserved	1
H487	3052-58 hex	Reserved	1
H488	3052-59 hex	Reserved	1
H489	3052-5A hex	Reserved	1
H490	3052-5B hex	Reserved	3
A01	3009-02 hex	2nd Maximum Output Frequency	3
A02	3009-03 hex	2nd Base Frequency	3
A03	3009-04 hex	2nd Rated Voltage at Base Frequency	1
A04	3009-05 hex	2nd Rated Voltage at Maximum Output Frequency	1
A05	3009-06 hex	2nd Manual Torque Boost Voltage	3
A06	3009-07 hex	2nd Motor Electronic Thermal Characteristic selection	1
A07	3009-08 hex	2nd Motor Electronic Thermal Level	24
A08	3009-09 hex	2nd Motor Electronic Thermal Time Constant	3
A09	3009-0A hex	2nd DC Injection Braking Start Frequency	3
A10	3009-0B hex	2nd DC Injection Braking Level	1
A11	3009-0C hex	2nd DC Injection Braking Time	5
A12	3009-0D hex	2nd Starting Frequency	3
A13	3009-0E hex	2nd V/f Characteristics Selection	1
A14	3009-0F hex	2nd Drive Control Selection	1
A15	3009-10 hex	2nd Motor Pole Number	1
A16	3009-11 hex	2nd Motor Capacity	11
A17	3009-12 hex	2nd Motor Rated Current	24
A18	3009-13 hex	2nd Auto-tuning Selection Function Selection	21
A19	3009-14 hex	2nd Online tuning Function Selection	1
A20	3009-15 hex	2nd Motor Armature Resistance	24
A21	3009-16 hex	2nd Motor Motor Constant %R1	5
A22	3009-17 hex	2nd Motor Motor Constant %X	5

Parameter No.	EtherCAT Object	Parameter	Communication data format (2 bytes)
A23	3009-18 hex	2nd Slip Compensation Gain for Driving	3
A24	3009-19 hex	2nd Slip Compensation Response Time	5
A25	3009-1A hex	2nd Slip Compensation Gain for Braking	3
A26	3009-1B hex	2nd Rated Slip Frequency	5
A27	3009-1C hex	2nd Iron Loss Factor 1	5
A30	3009-1F hex	2nd Magnetic Saturation Factor 1	3
A31	3009-20 hex	2nd Magnetic Saturation Factor 2	3
A32	3009-21 hex	2nd Magnetic Saturation Factor 3	3
A33	3009-22 hex	2nd Magnetic Saturation Factor 4	3
A34	3009-23 hex	2nd Magnetic Saturation Factor 5	3
A40	3009-29 hex	2nd Slip Compensation Operating Conditions Selection	1
A41	3009-2A hex	2nd Output Current Fluctuation Damping Gain	5
A43	3009-2C hex	Speed Control 2 Speed Command Filter	7
A44	3009-2D hex	Speed Control 2 Speed Detection Filter	7
A45	3009-2E hex	Speed Control 2 P Proportional Gain	3
A46	3009-2F hex	Speed Control 2 I Integral Time	7
A47	3009-30 hex	Speed Control 2 FF Gain	5
A48	3009-31 hex	Speed Control 2 Output Filter	7
A49	3009-32 hex	Speed Control 2 Notch Filter Resonance Frequency	1
A50	3009-33 hex	Speed Control 2 Notch Filter Attenuation Level	1
A51	3009-34 hex	2nd Cumulative Motor Run Time	74
A52	3009-35 hex	2nd Startup Counter for Motor	1
A53	3009-36 hex	2nd Motor 2 %X Correction Factor 1	1
A55	3009-38 hex	Torque Current for 2nd Vector Control	24
A56	3009-39 hex	Induced Voltage Factor for 2nd Vector Control	1
A57	3009-3A hex	Reserved	7
A60	3009-3D hex	2nd Speed Conversion Coefficient	5
A61	3009-3E hex	2nd Display Coefficient for Transport time / Auxiliary Display Coefficient for Speed Monitor	45
A62	3009-3F hex	2nd Starting Frequency Holding Time	5
A63	3009-40 hex	2nd Stop Frequency	3
A64	3009-41 hex	2nd Stop Frequency Detection Method Selection	1
A65	3009-42 hex	2nd Stop Frequency Holding Time	5
b43	3013-2C hex	Speed Control 3 Speed Command Filter	7
b44	3013-2D hex	Speed Control 3 Speed Detection Filter	7
b45	3013-2E hex	Speed Control 3 P Proportional Gain	3
b46	3013-2F hex	Speed Control 3 I Integral Time	7
b47	3013-30 hex	Speed Control 3 FF Gain	5
b48	3013-31 hex	Speed Control 3 Output Filter	7
b49	3013-32 hex	Speed Control 3 Notch Filter Resonance Frequency	1
b50	3013-33 hex	Speed Control 3 Notch Filter Attenuation Level	1
r43	300C-2C hex	Speed Control 4 Speed Command Filter	7
r44	300C-2D hex	Speed Control 4 Speed Detection Filter	7
r45	300C-2E hex	Speed Control 4 P Proportional Gain	3
r46	300C-2F hex	Speed Control 4 I Integral Time	7

Parameter No.	EtherCAT Object	Parameter	Communication data format (2 bytes)
r47	300C-30 hex	Speed Control 4 FF Gain	5
r48	300C-31 hex	Speed Control 4 Output Filter	7
r49	300C-32 hex	Speed Control 4 Notch Filter Resonance Frequency	1
r50	300C-33 hex	Speed Control 4 Notch Filter Attenuation Level	1
J01	300E-02 hex	PID Control Function Selection	1
J02	300E-03 hex	PID Control PID Command Selection	1
J03	300E-04 hex	PID Control P Proportional Gain	7
J04	300E-05 hex	PID Control I Integral Time	3
J05	300E-06 hex	PID Control D Differential Time	5
J06	300E-07 hex	PID Control Feedback Filter	3
J10	300E-0B hex	PID Control Anti-reset Windup Width	1
J11	300E-0C hex	PID Control Select Warning Output Selection	1
J12	300E-0D hex	PID Control Upper Limit of Warning (AH)	2
J13	300E-0E hex	PID Control Lower Limit of Warning (AL)	2
J15	300E-10 hex	PID Control Sleep Frequency for Process Control	3
J16	300E-11 hex	PID Control Sleep Timer for Process Control	1
J17	300E-12 hex	PID Control Restart Frequency after Stopping for Process Control	3
J18	300E-13 hex	PID Control PID Output Upper Limit	2
J19	300E-14 hex	PID Control PID Output Lower Limit	2
J23	300E-18 hex	PID Control Restart Feedback Deviation after Stopping for Process Control	3
J24	300E-19 hex	PID Control Restart Delay Time after Stopping for Process Control	1
J57	300E-3A hex	PID Control Operator PID Reference Position for Dancer	2
J58	300E-3B hex	PID Control PID Reference Position Detection Width for Dancer	1
J59	300E-3C hex	PID Control P Gain 2	7
J60	300E-3D hex	PID Control I Integral Time 2	3
J61	300E-3E hex	PID Control D Differential Time 2	5
J62	300E-3F hex	PID Control Block Selection	1
J63	300E-40 hex	Overload Stop Item Selection	1
J64	300E-41 hex	Overload Stop Detection Level	1
J65	300E-42 hex	Overload Stop Mode Selection	1
J66	300E-43 hex	Overload Stop Operation Mode	1
J67	300E-44 hex	Overload Stop Detection Timer	5
J68	300E-45 hex	Brake Control Brake-release Current	5
J69	300E-46 hex	Brake Control Brake-release Frequency	3
J70	300E-47 hex	Brake Control Brake-release Timer	7
J71	300E-48 hex	Brake Control Brake-applied Frequency	3
J72	300E-49 hex	Brake Control Brake-applied Timer	7
J90	300E-5B hex	Overload Stop Function P gain	7
J91	300E-5C hex	Overload Stop Function Integral time	7
J92	300E-5D hex	Overload Stop Function Current level	3
J95	300E-60 hex	Brake control Brake-release Torque	5

Parameter No.	EtherCAT Object	Parameter	Communication data format (2 bytes)
J96	300E-61 hex	Brake Control Operation Selection	1
J97	300E-62 hex	Servo Lock Gain	7
J98	300E-63 hex	Servo Lock Completion Timer	7
J99	300E-64 hex	Servo Lock Completion Range	1
J105	3024-06 hex	Reserved	1
J106	3024-07 hex	PID Control Maximum Scale	12
J107	3024-08 hex	PID Control Minimum Scale	12
J136	3024-25 hex	PID Control Multistep PID Command 1	12
J137	3024-26 hex	PID Control Multistep PID Command 2	12
J138	3024-27 hex	PID Control Multistep PID Command 3	12
d01	3014-02 hex	Speed Control 1 Speed Command Filter	7
d02	3014-03 hex	Speed Control 1 Speed Detection Filter	7
d03	3014-04 hex	Speed Control 1 P Proportional Gain	3
d04	3014-05 hex	Speed Control 1 I Integral Time	7
d05	3014-06 hex	Speed Control 1 FF Gain	5
d06	3014-07 hex	Speed Control 1 Output Filter	7
d07	3014-08 hex	Speed Control 1 Notch Filter Resonance Frequency	1
d08	3014-09 hex	Speed Control 1 Notch Filter Attenuation Level	1
d09	3014-0A hex	Speed Control Jogging Speed Command Filter	7
d10	3014-0B hex	Speed Control Jogging Speed Detection Filter	7
d11	3014-0C hex	Speed Control Jogging P Proportional Gain	3
d12	3014-0D hex	Speed Control Jogging I Integral Time	7
d13	3014-0E hex	Speed Control Jogging Output Filter	7
d14	3014-0F hex	Input Terminal [PIA][PIB] Pulse Input Format Selection	1
d15	3014-10 hex	Input Terminal [PIA][PIB] Encoder Pulse Resolution	1
d16	3014-11 hex	Input Terminal [PIA][PIB] Pulse Scaling Factor Denominator	1
d17	3014-12 hex	Input Terminal [PIA][PIB] Pulse Scaling Factor Numerator	1
d18	3014-13 hex	Input Terminal [PIA][PIB] Pulse Train Filter Time Constant	7
d21	3014-16 hex	Speed Agreement / Speed Deviation Error Hysteresis Width	3
d22	3014-17 hex	Speed Agreement / Speed Deviation Error Detection Timer	5
d23	3014-18 hex	Speed Deviation Error Processing Selection	1
d24	3014-19 hex	Zero Speed Control	1
d25	3014-1A hex	Speed Control Speed Loop Switching Time at Parameter Change	7
d32	3014-21 hex	Speed Limit 1 in Forward	1
d33	3014-22 hex	Speed Limit 2 in Reverse	1
d35	3014-24 hex	Over Speed Detection Level	1
d41	3014-2A hex	Special Control Selection	1
d51	3014-34 hex	Reserved	2
d52	3014-35 hex	Reserved	2
d55	3014-38 hex	Reserved	1
d67	3014-44 hex	Motor Starting Mode Auto Search in Speed Sensor Vector Control	1
d68	3014-45 hex	Reserved	3
d70	3014-47 hex	Speed Control Slip Frequency Limit	5

Parameter No.	EtherCAT Object	Parameter	Communication data format (2 bytes)
d79	3014-50 hex	Reserved	1
d80	3014-51 hex	1st PM Motor Magnetic Pole Position Pull-in Frequency	3
d81	3014-52 hex	Reserved	1
d82	3014-53 hex	Magnetic Flux Weakening Control Function Selection	1
d83	3014-54 hex	Magnetic Flux Weakening Lower Limit	1
d84	3014-55 hex	Reserved	1
d85	3014-56 hex	Reserved	1
d86	3014-57 hex	Acc/Dec Output Frequency Filter	7
d88	3014-59 hex	Reserved	5
d89	3014-5A hex	PM Motor High-efficiency Control Selection	1
d90	3014-5B hex	Magnetic Flux Level during Deceleration	1
d91	3014-5C hex	Reserved	5
d92	3014-5D hex	Reserved	5
d93	3014-5E hex	Reserved	5
d94	3014-5F hex	Reserved	5
d95	3014-60 hex	Reserved	5
d96	3014-61 hex	Reserved	4
d97	3014-62 hex	Reserved	4
d98	3014-63 hex	Reserved	1
d99	3014-64 hex	Extension Function 1	1
d190	302A-5B hex	Reserved	1
d192	302A-5D hex	Reserved	5
d198	302A-63 hex	Reserved	1
d201	3037-02 hex	Position Control Feed Forward Gain	5
d202	3037-03 hex	Position Control Feed Forward Filter	7
d203	3037-04 hex	Position Loop Gain 1	3
d204	3037-05 hex	Position Loop Gain 2	3
d205	3037-06 hex	Position Loop Gain Switch Frequency	3
d206	3037-07 hex	Electronic Gear Denominator	1
d207	3037-08 hex	Electronic Gear Numerator	1
d208	3037-09 hex	Orientation Selection	1
d209	3037-0A hex	Homing Operation Selection	1
d211	3037-0C hex	Homing Reference Signal Selection	1
d212	3037-0D hex	Reference Signal for Homing Offset	1
d213	3037-0E hex	Homing Frequency/Orientation Frequency	3
d214	3037-0F hex	Creep Frequency	3
d215	3037-10 hex	Deceleration Time for Homing/Orientation	12
d220	3037-15 hex	Position Feedback Store Selection at Power Off	1
d221	3037-16 hex	Current Position Clear Signal Operation Selection	1
d222	3037-17 hex	Overtravel Function Selection	1
d223	3037-18 hex	Detection Level of Excessive Positioning Deviation (MSB)	1
d224	3037-19 hex	Detection Level of Excessive Positioning Deviation (LSB)	1
d225	3037-1A hex	Software Overtravel Detection Position in the Positive Direction (MSB)	2

Parameter No.	EtherCAT Object	Parameter	Communication data format (2 bytes)
d226	3037-1B hex	Software Overtravel Detection Position in the Positive Direction (LSB)	1
d227	3037-1C hex	Software Overtravel Detection Position in the Negative Direction (MSB)	2
d228	3037-1D hex	Software Overtravel Detection Position in the Negative Direction (LSB)	1
d237	3037-26 hex	Positioning Data Type	1
d238	3037-27 hex	Position Data Determination Time	7
d239	3037-28 hex	Positioning Completed Range	1
d240	3037-29 hex	Preset Position (MSB)	2
d241	3037-2A hex	Preset Position (LSB)	1
d242	3037-2B hex	Homing Offset (MSB)	1
d243	3037-2C hex	Homing Offset (LSB)	1
d244	3037-2D hex	Positioning Data 1 (MSB)	2
d245	3037-2E hex	Positioning Data 1 (LSB)	1
d246	3037-2F hex	Positioning Data 2 (MSB)	2
d247	3037-30 hex	Positioning Data 2 (LSB)	1
d248	3037-31 hex	Positioning Data 3 (MSB)	2
d249	3037-32 hex	Positioning Data 3 (LSB)	1
d250	3037-33 hex	Positioning Data 4 (MSB)	2
d251	3037-34 hex	Positioning Data 4 (LSB)	1
d252	3037-35 hex	Positioning Data 5 (MSB)	2
d253	3037-36 hex	Positioning Data 5 (LSB)	1
d254	3037-37 hex	Positioning Data 6 (MSB)	2
d255	3037-38 hex	Positioning Data 6 (LSB)	1
d256	3037-39 hex	Positioning Data 7 (MSB)	2
d257	3037-3A hex	Positioning Data 7 (LSB)	1
d258	3037-3B hex	Positioning Data 8 (MSB)	2
d259	3037-3C hex	Positioning Data 8 (LSB)	1
d277	3037-4E hex	Positioning Data Setting Selection via communication	1
d278	3037-4F hex	Restarting Positioning Range Setting	1
d280	3037-51 hex	Over Travel Forced Stop Operation Selection	1
d296	3037-61 hex	Current Reference Position Monitor (MSB)	2
d297	3037-62 hex	Current Reference Position Monitor (LSB)	1
d298	3037-63 hex	Current Feedback Position Monitor (MSB)	2
d299	3037-64 hex	Current Feedback Position Monitor (LSB)	1
y95	300F-60 hex	Data Clear Processing for EtherCAT Communications Error	1
y97	300F-62 hex	Communication Data Storage Selection	1
y99	300F-64 hex	Support Tool Link Function Selection	1
S01	3002-02 hex	Frequency Reference	29
S02	3002-03 hex	Torque Reference	6
S03	3002-04 hex	Torque Current Command	6
S05	3002-06 hex	Frequency Reference	22
S06	3002-07 hex	Operation command	14
S07	3002-08 hex	Communication Data Terminal [DO]	15

Parameter No.	EtherCAT Object	Parameter	Communication data format (2 bytes)
S13	3002-0E hex	PID Control PID Command via Communication	29
S14	3002-0F hex	Alarm Reset Command	1
S15	3002-10 hex	Torque Bias Value via Communication	6
S19	3002-14 hex	Speed Command via Communication	2
S20	3002-15 hex	Positioning Data via Communication (MSB)	2
S21	3002-16 hex	Positioning Data via Communication (LSB)	1
S22	3002-17 hex	Torque Reference via Communication	2
S23	3002-18 hex	Torque Current Command via Communication	2
S24	3002-19 hex	Torque Bias Value	2
S30	3002-1F hex	PID Control Feedback Value via Communication	29
M01	3003-02 hex	Frequency Reference at Final	29
M02	3003-03 hex	Torque Reference Monitor at Last	6
M03	3003-04 hex	Torque Current Command at Final	6
M04	3003-05 hex	Magnetic Flux Command Value	6
M05	3003-06 hex	Frequency Reference at Final	22
M06	3003-07 hex	Output Frequency 1 without Slip Compensation	29
M07	3003-08 hex	Torque Value	6
M08	3003-09 hex	Torque Current Value	6
M09	3003-0A hex	Output Frequency 1 without Slip Compensation	22
M10	3003-0B hex	Input Power	5
M11	3003-0C hex	Output Current Monitor	5
M12	3003-0D hex	Output Voltage Monitor	3
M13	3003-0E hex	Operation Command at Final	14
M14	3003-0F hex	Operation Status 1 Monitor	16
M15	3003-10 hex	Output Terminal Monitor	15
M16	3003-11 hex	Latest Alarm Contents	10
M17	3003-12 hex	Last Alarm Contents	10
M18	3003-13 hex	Second Last Alarm Contents	10
M19	3003-14 hex	Third Last Alarm Contents	10
M20	3003-15 hex	Cumulative Operation Time	1
M21	3003-16 hex	Main Circuit DC Voltage	1
M25	3003-1A hex	ROM Version	35
M26	3003-1B hex	Transmission Error Transaction Code for RS-485 Port1	20
M27	3003-1C hex	Final Frequency Reference Monitor on Alarm Monitor	29
M28	3003-1D hex	Final Torque Command Monitor on Alarm	6
M29	3003-1E hex	Final Torque Current Command Monitor on Alarm	6
M30	3003-1F hex	Final Magnetic flux command Monitor on Alarm	6
M31	3003-20 hex	Final Frequency Reference Monitor on Alarm	22
M32	3003-21 hex	Output Frequency Monitor on Alarm without Slip Compensation	29
M33	3003-22 hex	Output Torque Monitor on Alarm	6
M34	3003-23 hex	Torque Current Monitor on Alarm	6
M35	3003-24 hex	Output Frequency Monitor on Alarm	22
M36	3003-25 hex	Input Power Monitor on Alarm	5
M37	3003-26 hex	Output Current Effective Value Monitor on Alarm	5

Parameter No.	EtherCAT Object	Parameter	Communication data format (2 bytes)
M38	3003-27 hex	Output Voltage Effective Value Monitor on Alarm	3
M39	3003-28 hex	Operation Command Monitor on Alarm	14
M40	3003-29 hex	Operation Status 1 Monitor on Alarm	16
M41	3003-2A hex	Latest Output Terminal Information Monitor on Alarm	15
M42	3003-2B hex	Cumulative Operation Time Monitor on Alarm	1
M43	3003-2C hex	Main Circuit DC Voltage Monitor on Alarm	1
M44	3003-2D hex	Inverter Internal Air Temperature Monitor on Alarm	2
M45	3003-2E hex	Heat Sink Temperature Monitor on Alarm	2
M46	3003-2F hex	Life of Main Circuit Capacitor Monitor	3
M47	3003-30 hex	Life of PC Board Electrolytic Capacitor	74
M48	3003-31 hex	Life of Cooling Fan	74
M49	3003-32 hex	Input Terminal [AI1] Input Voltage Monitor	29
M56	3003-39 hex	Input Terminal [PTC] Input Voltage Monitor	29
M57	3003-3A hex	Electric Angle Monitor	3
M58	3003-3B hex	Rotor Angle Monitor	3
M59	3003-3C hex	Motor Electronic Thermal Monitor	1
M61	3003-3E hex	Inverter Internal Air Temperature Monitor	4
M62	3003-3F hex	Fin Temperature Monitor	4
M63	3003-40 hex	Load Factor Monitor	6
M64	3003-41 hex	Motor Output Monitor	6
M65	3003-42 hex	Motor Output Monitor on Alarm	29
M66	3003-43 hex	Speed Detection Monitor	29
M67	3003-44 hex	Transmission Error Transaction Code for RS485 Port	20
M68	3003-45 hex	Reserved	29
M69	3003-46 hex	Inverter Rated Current	24
M70	3003-47 hex	Running Status 3 Monitor	44
M71	3003-48 hex	Input Terminal Monitor	14
M72	3003-49 hex	Reserved	29
M73	3003-4A hex	PID Output Monitor	29
M74	3003-4B hex	Running Status 2 Monitor	76
M76	3003-4D hex	Service Life of Main Circuit Capacitor Elapsed Time	74
M77	3003-4E hex	Service Life of Main Circuit Capacitor Remaining Time	74
M78	3003-4F hex	Rotation Speed Command Monitor	2
M79	3003-50 hex	Rotation Speed Monitor	2
M81	3003-52 hex	1st Remaining Time before the Next Motor Maintenance	74
M84	3003-55 hex	Torque Command at Final	2
M85	3003-56 hex	1st Remaining Startup Times before the Next Motor Maintenance	1
M86	3003-57 hex	Latest Light Alarm Factor	41
M87	3003-58 hex	Light Alarm Factor Last	41
M88	3003-59 hex	Light Alarm Factor 2nd Last	41
M89	3003-5A hex	Light Alarm Factor 3rd Last	41
M95	3003-60 hex	Cumulative Running Time at Tripping	1
M96	3003-61 hex	Fourth Last Alarm Contents	10
M97	3003-62 hex	Fifth Last Alarm Contents	10

Parameter No.	EtherCAT Object	Parameter	Communication data format (2 bytes)
M98	3003-63 hex	Warning status monitor	1
M114	3023-0F hex	Reserved	12
M115	3023-10 hex	PID Output Non Filter	4
W01	3010-02 hex	Running Status 1 Monitor	16
W02	3010-03 hex	Frequency Reference Monitor	22
W03	3010-04 hex	Output Frequency Monitor before Slip Compensation	22
W04	3010-05 hex	Output Frequency after Slip Compensation	22
W05	3010-06 hex	Output Current Monitor	24
W06	3010-07 hex	Output Voltage Monitor	3
W07	3010-08 hex	Output Torque Monitor	2
W08	3010-09 hex	Rotate Speed Monitor	37
W09	3010-0A hex	Load Shaft Speed	37
W10	3010-0B hex	Feed Speed	37
W11	3010-0C hex	PID Process Command	12
W12	3010-0D hex	PID Feedback Value Monitor	12
W13	3010-0E hex	Analog Torque Limit Value Monitor	2
W14	3010-0F hex	Reserved	2
W15	3010-10 hex	Ratio value Monitor	5
W16	3010-11 hex	Motor Speed Set Value	37
W17	3010-12 hex	Load Shaft Set Value	37
W18	3010-13 hex	Feed Speed Set Value	37
W19	3010-14 hex	Transport Time Set Value for Specified Length	37
W20	3010-15 hex	Transport Time for Specified Length	37
W21	3010-16 hex	Power Consumption Monitor	24
W22	3010-17 hex	Motor Output Power Monitor	24
W23	3010-18 hex	Load Rate Monitor	2
W24	3010-19 hex	Torque Current Value	2
W25	3010-1A hex	Output Current Monitor	3
W26	3010-1B hex	Magnetic Flux Command Value	2
W27	3010-1C hex	Timed Operation Remaining Time	1
W28	3010-1D hex	RUN Command Source Monitor	67
W29	3010-1E hex	Frequency and PID Command Source Monitor	68
W30	3010-1F hex	Speed in Percentage	5
W31	3010-20 hex	Speed Set Value in Percentage	5
W32	3010-21 hex	PID Output Monitor	6
W33	3010-22 hex	Analog Input Monitor	12
W40	3010-29 hex	Input Terminal Monitor	43
W41	3010-2A hex	Output Signal Monitor	15
W42	3010-2B hex	Communications Input Signal Monitor	14
W43	3010-2C hex	Communications Control Output Signal Monitor	15
W44	3010-2D hex	Input Terminal [AI1] Input Voltage Monitor	4
W55	3010-38 hex	Pulse Input (A/B Phase [PIA][PIB])	6
W56	3010-39 hex	Pulse Input (Z Phase [PIZ])	1
W67	3010-44 hex	Cumulative Run Time of Capacitors on Printed Circuit Boards	74

Parameter No.	EtherCAT Object	Parameter	Communication data format (2 bytes)
W68	3010-45 hex	Cumulative Run Time of Cooling Fan	74
W70	3010-47 hex	Total Power ON Time Monitor	1
W71	3010-48 hex	Reserved	3
W72	3010-49 hex	Internal Air Highest Temperature	2
W73	3010-4A hex	Heat Sink Maximum Temperature	2
W74	3010-4B hex	Maximum Effective Current Value	24
W75	3010-4C hex	Main Circuit Capacitor's Capacitor Monitor	3
W76	3010-4D hex	Cumulative Run Time of Electrolytic Capacitors on PC Board	1
W77	3010-4E hex	Cumulative Run Time of Cooling Fan	1
W78	3010-4F hex	Number of Startups	1
W79	3010-50 hex	Cumulative Operation Time of Motor	1
W81	3010-52 hex	Integrated Power Monitor	93
W82	3010-53 hex	Data Used Integrating Electric Power	45
W85	3010-56 hex	Number of RS-485 Errors	1
W86	3010-57 hex	Reserved	1
W87	3010-58 hex	Inverter ROM Version 1 Main	1
W88	3010-59 hex	Inverter ROM Version 2 Sub	1
W89	3010-5A hex	ROM Version Operator	1
W90	3010-5B hex	Reserved	1
W91	3010-5C hex	ROM Version ECT Terminal Board 2	1
W95	3010-60 hex	Reserved	1
W96	3010-61 hex	Reserved	1
W97	3010-62 hex	Contents of ECT Terminal Board error	1
W110	3017-0B hex	Motor Speed	37
W111	3017-0C hex	Load Shaft Speed	37
W115	3017-10 hex	Output Frequency after Slip Compensation	22
W116	3017-11 hex	PG Feedback Value	22
W118	3017-13 hex	Torque Bias Monitor	2
W131	3017-20 hex	PID Control PID Deviation (After Scale Transformation)	12
W132	3017-21 hex	PID Control PID Deviation (No Scale Transformation)	29
W135	3017-24 hex	Input Power Monitor	3
W136	3017-25 hex	Input Terminal [AI1] Input Voltage (AIV)	2
W139	3017-28 hex	Pulse Train Frequency Monitor	6
W142	3017-2B hex	Feedback Current Position Monitor (MSB)	2
W143	3017-2C hex	Feedback Current Position Monitor (LSB)	1
W144	3017-2D hex	Target Position Monitor (MSB)	2
W145	3017-2E hex	Target Position Monitor (LSB)	1
W146	3017-2F hex	Position Deviation Monitor (MSB)	2
W147	3017-30 hex	Position Deviation Monitor (LSB)	1
W148	3017-31 hex	Touch Probe 1 Positive Edge (MSB)	2
W149	3017-32 hex	Touch Probe 1 Positive Edge (LSB)	1
W150	3017-33 hex	Touch Probe 2 Positive Edge (MSB)	2
W151	3017-34 hex	Touch Probe 2 Positive Edge (LSB)	1
W152	3017-35 hex	Touch Probe Status	1

Parameter No.	EtherCAT Object	Parameter	Communication data format (2 bytes)
W153	3017-36 hex	Pulse Input Rate for A/B Phase of Reference Side	6
W154	3017-37 hex	Pulse Input Rate for Z Phase of Reference Side	1
W155	3017-38 hex	Pulse Input Rate for A/B Phase of Feedback Side	6
W156	3017-39 hex	Pulse Input Rate for Z Phase of Feedback Side	1
W161	3017-3E hex	Braking Resistor Thermal Monitor	3
W178	3017-4F hex	Number of Startups	5
W179	3017-50 hex	Total RUN Time Monitor	1
W180	3017-51 hex	Tuning Progress	1
W202	3018-03 hex	Reserved	12
W203	3018-04 hex	Reserved	12
X00	3011-01 hex	Latest Alarm History/Number of Consecutive Same Alarms	41
X01	3011-02 hex	Latest Multiple Alarm1	10
X02	3011-03 hex	Latest Multiple Alarm2	10
X03	3011-04 hex	Latest Alarm Sub Code 1	1
X04	3011-05 hex	Latest Multiple Alarm Sub Code 2	1
X05	3011-06 hex	Last Alarm History/Number of Consecutive Same Alarms	41
X06	3011-07 hex	Last Multiple Alarm 2	10
X07	3011-08 hex	Last Multiple Alarm 3	10
X08	3011-09 hex	Last Alarm Sub Code 1	1
X09	3011-0A hex	Last Multiple Alarm Sub Code	1
X10	3011-0B hex	Second Last Alarm History/Number of Consecutive Same Alarms	41
X11	3011-0C hex	Second last Multiple Alarm2	10
X12	3011-0D hex	Second Last Multiple Alarm3	10
X13	3011-0E hex	Second Last Alarm Sub Code	1
X14	3011-0F hex	Second Last Multiple Alarm Sub Code	1
X15	3011-10 hex	Third Last Alarm History/Number of Consecutive Same Alarms	41
X16	3011-11 hex	Third Last Multiple Alarm 2	10
X17	3011-12 hex	Third Last Multiple Alarm 3	10
X18	3011-13 hex	Third Last Alarm Sub Code 1	1
X19	3011-14 hex	Third Last Multiple Alarm Sub Code 2	1
X20	3011-15 hex	Latest Alarm Info. Output Frequency	22
X21	3011-16 hex	Latest Alarm Info. Output Current	24
X22	3011-17 hex	Latest Alarm Info. Output Voltage	1
X23	3011-18 hex	Latest Alarm Info. Torque Monitor	2
X24	3011-19 hex	Latest Alarm Info. Frequency Command	22
X25	3011-1A hex	Latest Alarm Info. Running Status 1	16
X26	3011-1B hex	Latest Alarm Info. Cumulative Ope. time	1
X27	3011-1C hex	Latest Alarm Info. Number of Startups	1
X28	3011-1D hex	Latest Alarm Info. Main Circuit DC Voltage	3
X29	3011-1E hex	Latest Alarm Info. Internal Air Temperature	2
X30	3011-1F hex	Latest Alarm Info. Heat Sink Temperature	2
X31	3011-20 hex	Latest Alarm Info. Input Terminal	43
X32	3011-21 hex	Latest Alarm Info. Output Terminal	15

Parameter No.	EtherCAT Object	Parameter	Communication data format (2 bytes)
X33	3011-22 hex	Latest Alarm Info. Input Terminal via Communication	14
X34	3011-23 hex	Latest Alarm Info. Output Terminal via Communication	15
X35	3011-24 hex	Latest Alarm Info. Input Power	24
X36	3011-25 hex	Latest Alarm Info. Running Status 2	76
X37	3011-26 hex	Latest Alarm Info. Speed Detection	29
X38	3011-27 hex	Latest Alarm Info. Running Status 3	44
X49	3011-32 hex	Fault Counter	1
X60	3011-3D hex	Last Info. Alarm Info. Output Frequency	22
X61	3011-3E hex	Last Alarm Info. Output Current	24
X62	3011-3F hex	Last Alarm Info. Output Voltage	1
X63	3011-40 hex	Last Alarm Info. Torque Monitor	2
X64	3011-41 hex	Last Alarm Info. Frequency Command	22
X65	3011-42 hex	Last Alarm Info. Running Status	16
X66	3011-43 hex	Last Alarm Info. Cumulative Ope. Time	1
X67	3011-44 hex	Last Alarm Info. Number of Startups	1
X68	3011-45 hex	Last Alarm Info. Main Circuit DC Voltage	3
X69	3011-46 hex	Last Alarm Info Internal Air Temperature	2
X70	3011-47 hex	Last Alarm Info. Heat Sink Temperature	2
X71	3011-48 hex	Last Alarm Info. Input Terminal	43
X72	3011-49 hex	Last Alarm Info. Output Terminal	15
X73	3011-4A hex	Last Alarm Info. Input Terminal via Communication	14
X74	3011-4B hex	Last Alarm Info. Output Terminal via Communication	15
X76	3011-4D hex	Last Alarm Info. Running Status 2	76
X77	3011-4E hex	Last Alarm Info. Speed Detection	29
X78	3011-4F hex	Last Alarm Info. Running Status 3	44
X97	3011-62 hex	Input Input Terminal [PTC] Input Voltage	4
X108	301A-09 hex	Latest Alarm Info. Cumulative Running Time	1
X118	301A-13 hex	Last Alarm Info. Cumulative Running Time	1
X128	301A-1D hex	Second last Alarm Info. Cumulative Running Time	1
X138	301A-27 hex	Third last Alarm Info. Cumulative Running Time	1
X140	301A-29 hex	4th last Alarm History/Number of Consecutive Same Alarms	41
X141	301A-2A hex	Fourth last Alarm Info. Output Frequency	22
X142	301A-2B hex	Fourth last Alarm Info. Output Current	24
X143	301A-2C hex	Fourth Last Alarm Info. Cumulative Ope. time	1
X144	301A-2D hex	Fourth Last Alarm Info. Main Circuit DC Voltage	3
X148	301A-31 hex	Fourth Last Alarm Info. Cumulative Running Time	1
X149	301A-32 hex	Fourth Last Alarm Info. Running Status	16
X150	301A-33 hex	5th last Alarm History/Number of Consecutive Same Alarms	41
X151	301A-34 hex	Fifth Last Alarm Info. Output Frequency	22
X152	301A-35 hex	Fifth Last Alarm Info. Output Current	24
X153	301A-36 hex	Fifth Last Alarm Info. Cumulative Ope. Time	1
X154	301A-37 hex	Fifth last Alarm Info. Main Circuit DC Voltage	3
X158	301A-3B hex	Fifth last Alarm Info. Cumulative Running time	1
X159	301A-3C hex	Fifth Last Alarm Info. Running Status	16

Parameter No.	EtherCAT Object	Parameter	Communication data format (2 bytes)
Z00	3012-01 hex	Second Last Alarm Info. Output Frequency	22
Z01	3012-02 hex	Second Last Alarm Info. Output Current	24
Z02	3012-03 hex	Second Last Alarm Info. Output Voltage	1
Z03	3012-04 hex	Second Last Alarm Info. Torque Monitor	2
Z04	3012-05 hex	Second Last Alarm Info. Frequency Command	22
Z05	3012-06 hex	Second Last Alarm Info. Running Status	16
Z06	3012-07 hex	Second Last Alarm Info. Cumulative Ope. Time	1
Z07	3012-08 hex	Second Last Alarm Info. Number of Startups	1
Z08	3012-09 hex	Second Last Alarm Info. Main Circuit DC Voltage	3
Z09	3012-0A hex	Second Last Alarm Info. Internal Air Temperature	2
Z10	3012-0B hex	Second Last Alarm Info. Heat Sink Temperature	2
Z11	3012-0C hex	Second Last Alarm Info. Input Terminal	43
Z12	3012-0D hex	Second Last Alarm Info. Output Terminal	15
Z13	3012-0E hex	Second Last Alarm Info. Input Terminal via Communication	14
Z14	3012-0F hex	Second Last Alarm Info. Output Terminal via Communication	15
Z16	3012-11 hex	Second Last Alarm Info. Running Status 2	76
Z17	3012-12 hex	Second Last Alarm Info. Speed Detection	29
Z18	3012-13 hex	Second Last Alarm Info. Running Status 3	44
Z40	3012-29 hex	1st Cumulative Run Time	74
Z41	3012-2A hex	2nd Cumulative Run Time of motor	74
Z44	3012-2D hex	2nd Number of Startups	1
Z50	3012-33 hex	Third Last Alarm Info. Output Frequency	22
Z51	3012-34 hex	Third Last Alarm Info. Output Current	24
Z52	3012-35 hex	Third Last Alarm Info. Output Voltage	1
Z53	3012-36 hex	Third Last Alarm Info. Torque Monitor	2
Z54	3012-37 hex	Third Last Alarm Info. Frequency Command	22
Z55	3012-38 hex	Third Last Alarm Info. Running Status	16
Z56	3012-39 hex	Third Last Alarm Info. Cumulative Ope. Time	1
Z57	3012-3A hex	Third Last Alarm Info. Number of Startups	1
Z58	3012-3B hex	Third Last Alarm Info. Main Circuit DC Voltage	3
Z59	3012-3C hex	Third Last Alarm Info. Internal Air Temperature	2
Z60	3012-3D hex	Third Last Alarm Info. Heat Sink Temperature	2
Z61	3012-3E hex	Third Last Alarm Info. Input Terminal	43
Z62	3012-3F hex	Third Last Alarm Info. Output Terminal	15
Z63	3012-40 hex	Third Last Alarm Info. Input Terminal via Communication	14
Z64	3012-41 hex	Third Last Alarm Info. Output Terminal via Communication	15
Z66	3012-43 hex	Third Last Alarm Info. Running Status 2	76
Z67	3012-44 hex	Third Last Alarm Info. Speed Detection	29
Z68	3012-45 hex	Third Last Alarm Info. Running Status 3	44
Z84	3012-55 hex	Output Current Monitor	24

A-5 Sysmac Error Status Codes

This section lists and describes the error event codes that you can see in Sysmac Studio.

A-5-1 Error List

The errors (events) that can occur in M1-series Inverters are given on the following pages.

Event levels are given in the table as follows:

Min: Minor fault level

Obs: Observation

Info: Information

Refer to the *NJ/NX-series Troubleshooting Manual (Cat. No. W503)* for all of the event codes that may occur in an NJ/NX-series Controller.

Event code	Event name	Description	Assumed cause	Level			Reference
				Min	Obs	Info	
08790000 hex	Overcurrent Protection (During Acceleration)	Overcurrent occurred during acceleration.	(1) The inverter output is short-circuited.	√			page A-220
			(2) There is a ground fault on the inverter output.				
			(3) The load is large.				
			(4) The torque boost is large (when 1st Torque Boost Selection (301F-0D hex) or 2nd Torque Boost Selection (301F-0E hex) = 0).				
			(5) The acceleration/deceleration time is short.				
			(6) Short-circuit detection was activated by the built-in braking transistor (22 kW or less).				
			(7) The inverter malfunctioned due to noise.				

Event code	Event name	Description	Assumed cause	Level			Reference
				Min	Obs	Info	
087A0000 hex	Overcurrent Protection (During Deceleration)	Overcurrent occurred during deceleration.	(1) The inverter output is short-circuited.	√			page A-223
			(2) There is a ground fault on the inverter output.				
			(3) The load is large.				
			(4) The torque boost is large (when 1st Torque Boost Selection (301F-0D hex) or 2nd Torque Boost Selection (301F-0E hex) = 0).				
			(5) The acceleration/deceleration time is short.				
			(6) Short-circuit detection was activated by the built-in braking transistor (22 kW or less).				
			(7) The inverter malfunctioned due to noise.				
087B0000 hex	Overcurrent Protection (During Constant Speed)	Overcurrent occurred during constant speed.	(1) The inverter output is short-circuited.	√			page A-226
			(2) There is a ground fault on the inverter output.				
			(3) The load is large.				
			(4) The torque boost is large (when 1st Torque Boost Selection (301F-0D hex) or 2nd Torque Boost Selection (301F-0E hex) = 0).				
			(5) The acceleration/deceleration time is short.				
			(6) Short-circuit detection was activated by the built-in braking transistor (22 kW or less).				
			(7) The inverter malfunctioned due to noise.				

Event code	Event name	Description	Assumed cause	Level			Reference
				Min	Obs	Info	
087C0000 hex	Overvoltage Protection (During Acceleration)	Overvoltage occurred during acceleration.	(1) The inverter's power supply voltage exceeds the specified range.	√			page A-229
			(2) A surge current occurred the input power supply.				
			(3) The deceleration time is short for the load's moment of inertia.				
			(4) The acceleration time is short.				
			(5) The braking load is large.				
			(6) There is a ground fault on the output side.				
			(7) A malfunction occurred due to noise.				
087D0000 hex	Overvoltage Protection (During Deceleration)	Overvoltage occurred during deceleration.	(1) The inverter's power supply voltage exceeds the specified range.	√			page A-232
			(2) A surge current occurred the input power supply.				
			(3) The deceleration time is short for the load's moment of inertia.				
			(4) The acceleration time is short.				
			(5) The braking load is large.				
			(6) There is a ground fault on the output side.				
			(7) A malfunction occurred due to noise.				
087E0000 hex	Overvoltage Protection (During Constant Speed)	Overvoltage occurred during constant speed.	(1) The inverter's power supply voltage exceeds the specified range.	√			page A-235
			(2) A surge current occurred the input power supply.				
			(3) The deceleration time is short for the load's moment of inertia.				
			(4) The acceleration time is short.				
			(5) The braking load is large.				
			(6) There is a ground fault on the output side.				
			(7) A malfunction occurred due to noise.				

Event code	Event name	Description	Assumed cause	Level			Reference
				Min	Obs	Info	
087F0000 hex	Undervoltage	The DC link bus voltage dropped below the undervoltage detection level.	(1) A momentary power interruption occurred.	√			page A-238
			(2) The inverter's power supply voltage is not within the specified range.				
			(3) There is a faulty device or incorrect wiring in the power circuit.				
			(4) Power supply voltage temporary drops due to a large starting current flowing to another load connected to the same power supply system.				
			(5) Power supply voltage drops due to the inrush current of the inverter caused by insufficient power transformer capacity.				
280F0000 hex	Input Phase Loss Error	There is an input phase loss, or the power supply has a large phase-to-phase imbalance.	(1) Wiring to the main power supply input terminals is disconnected.	√			page A-239
			(2) The main power input terminal is not firmly tightened.				
			(3) The 3-phase power supply has a large phase-to-phase imbalance.				
			(4) An excessive load is periodically applied.				
			(5) A single-phase power supply was connected to the product requiring a 3-phase power supply.				
28100000 hex	Output Phase Loss Error	There is an output phase loss.	(1) The inverter's output wiring is disconnected.	√			page A-240
			(2) The motor winding is broken.				
			(3) The inverter output terminals are not firmly tightened.				

Event code	Event name	Description	Assumed cause	Level			Reference
				Min	Obs	Info	
08800000 hex	Cooling Fin Overheat Error	The cooling fin temperature rose.	(1) The inverter's ambient temperature exceeds the specified range.	√			page A-241
			(2) The cooling air passage is blocked.				
			(3) The flow volume of the cooling fan dropped because it reached the end of life or failed.				
			(4) The load is large.				
08810000 hex	Inverter Overheat Error	The inverter's internal temperature exceeded the allowable range.	(1) The inverter's ambient temperature exceeds the specified range.	√			page A-242
08820000 hex	Inrush Current Prevention Resistor Overheat	The inverter's built-in inrush current prevention resistor overheated.	(1) The power supply to the inverter was frequently turned ON and OFF.	√			page A-243
			(2) The power supply to the inverter was not frequently turned ON and OFF.				
08830000 hex	Braking Resistor Overheat Error	The thermal for the braking resistor was activated.	(1) The braking load is large.	√			page A-244
			(2) The deceleration time is too short.				
			(3) There is an incorrect setting in Electronic thermal overload protection for braking resistor (3004-33 to 35 hex).				
08840000 hex	Inverter Overload Protection	The inverter's internal temperature became abnormally high.	(1) The inverter's ambient temperature exceeds the specified range.	√			page A-246
			(2) The value of Torque Boost Voltage (3004-0A hex, 3009-06 hex) is too high.				
			(3) The acceleration/deceleration time is short.				
			(4) The load is large.				
			(5) The cooling air passage is blocked.				
			(6) The flow volume of the cooling fan dropped because it reached the end of life or failed.				
			(7) There is a large leakage current due to long wiring.				

Event code	Event name	Description	Assumed cause	Level			Reference
				Min	Obs	Info	
088B0000 hex	Inrush Current Prevention Circuit Error	An error was detected in the inrush current prevention circuit.	(1) The inrush current prevention circuit is faulty.	√			page A-247
68430000 hex	External Trip	An external trip signal (<i>EXT</i>) was input.	(1) An alarm function is activated on an external device.	√			page A-248
			(2) There is an incorrect connection or contact failure on the external trip wiring.				
			(3) There is an incorrect parameter setting.				
08850000 hex	Breaking Transistor Error	An abnormal operation was detected in the braking transistor.	(1) The braking resistor connection terminals are incorrectly wired.	√			page A-249
			(2) The braking transistor is damaged.				
389C0000 hex	Overspeed	The motor rotated at excessive speed.	(1) There is an incorrect parameter setting.	√			page A-250
			(2) The gain of the speed controller is insufficient.				
			(3) Noise is superimposed on the PG signal.				
			(4) The output frequency, motor rotation speed, exceeded 590 Hz.				
08860000 hex	1st Motor Overload Protection	Motor 1 is overloaded.	(1) The characteristics of the electronic thermal and the overload characteristics of the motor do not match.	√			page A-252
			(2) The operation level of the electronic thermal is not appropriate.				
			(3) The acceleration/deceleration time is short.				
			(4) The load is large.				
			(5) The value of Torque Boost Voltage (3004-0A hex, 3009-06 hex) is too high.				

Event code	Event name	Description	Assumed cause	Level			Reference
				Min	Obs	Info	
08870000 hex	2nd Motor Overload Protection	Motor 2 is overloaded.	(1) The characteristics of the electronic thermal and the overload characteristics of the motor do not match.	√			page A-253
			(2) The operation level of the electronic thermal is not appropriate.				
			(3) The acceleration/deceleration time is short.				
			(4) The load is large.				
			(5) The value of Torque Boost Voltage (3004-0A hex, 3009-06 hex) is too high.				
08880000 hex	Thermistor Error	The motor's internal temperature became abnormally high.	(1) The motor's ambient temperature exceeds the specified range.	√			page A-255
			(2) The motor's cooling system failed.				
			(3) The load is large.				
			(4) The value of 1st Thermistor level (3008-1C hex) is not appropriate.				
			(5) The PTC thermistor settings are not appropriate.				
			(6) The value of Torque Boost Voltage (3004-0A hex, 3009-06 hex) is too high.				
			(7) The V/f settings are incorrect.				
			(8) There is an incorrect parameter setting.				

Event code	Event name	Description	Assumed cause	Level			Reference
				Min	Obs	Info	
183D0000 hex	EEPROM Error	A data write error, etc. occurred.	(1) The power supply was turned OFF when parameter data is written (especially during initialization or data copying), causing the control power supply voltage to drop.	√			page A-257
			(2) Strong ambient noise was received when parameter data is written (especially during initialization).				
			(3) An error occurred in the control circuit.				
			(4) The power supply was turned OFF when saving user set values by User preference dataset Registration (3020-5E hex), causing the control power supply voltage to drop.				
			(5) Strong ambient noise was received when saving user set values by User preference dataset Registration (3020-5E hex).				
28110000 hex	Operator Communications Error	An error occurred in communications between the operator and the inverter.	(1) The communications cable is broken or has a contact failure.	√			page A-258
			(2) The surface cover is not securely attached due to many control wires, causing the operator to be raised.				
			(3) Strong ambient noise was received.				
			(4) The operator is faulty.				
183E0000 hex	CPU Error	A CPU error such as runaway occurred.	(1) Strong ambient noise was received.	√			page A-259
389D0000 hex	Operation Error	Incorrect operation was performed without following the operating instructions.	(1) The forced stop signal <i>STOP</i> (digital input terminal) was turned OFF.	√			page A-260
			(2) The brake check signal <i>BRKE</i> and the brake signal <i>BRKS</i> mismatch.				

Event code	Event name	Description	Assumed cause	Level			Reference
				Min	Obs	Info	
389E0000 hex	Tuning Error	The auto-tuning failed.	(1) There is a phase loss in the connecting line between the inverter and the motor.	√			page A-261
			(2) The V/f setting, motor rated current value, is not correctly set.				
			(3) The wire length between the inverter and the motor is too long.				
			(4) There is a significant difference between the rated capacity of the inverter and the capacity of the connected motor.				
			(5) The motor is a high-speed motor or other special motor.				
			(6) Tuning operation (Parameter 3007-05 hex = 2) was performed to rotate the motor while the brake is applied to the motor.				
38A60000 hex	Magnetic Pole Position Detection Error	In synchronous motor vector control with sensor, a magnetic pole position detection error occurred.	(1) Inverter settings are not appropriate.	√			page A-263
			(2) There is a problem with the connection of speed/magnetic pole position sensor.				
			(3) The motor rotation direction does not match the sensor output.				
			(4) Strong ambient noise was received.				

Event code	Event name	Description	Assumed cause	Level			Reference
				Min	Obs	Info	
38A00000 hex	Step-out De- tection/ Magnetic Pole Position Detection Er- ror during Startup	Step-out of the PM motor was detected. Magnetic pole posi- tion detection failed at startup.	(1) The characteristics of the motor are different.	√			page A-265
			(2) The magnetic pole position detection method is not appro- priate.				
			(3) The value of 1st Starting frequency 1 Holding time (3004-19 hex) is insufficient.				
			(4) The starting torque is insuf- ficient.				
			(5) The load is small.				
			(6) There is a phase loss in the connecting line between the inverter and the motor.				
38A10000 hex	Speed Mis- match or Ex- cessive Speed Devi- ation	There is an excessive speed deviation be- tween the command speed and the detect- ed speed.	(1) There is an incorrect pa- rameter setting.	√			page A-267
			(2) The load is too large.				
			(3) The speed does not in- crease in current limiting oper- ation.				
			(4) The parameter settings dif- fer from the motor characteris- tics.				
			(5) Wiring to the motor is in- correct.				
			(6) The speed does not in- crease in torque limiting oper- ation.				
			(7) Wiring between the pulse generator and the option card is incorrect.				

Event code	Event name	Description	Assumed cause	Level			Reference
				Min	Obs	Info	
183F0000 hex	Data Save Error during Undervoltage	The frequency references set by the operator, PID commands, and commands set by <i>UP/DOWN</i> signals could not be correctly saved to memory at power OFF.	(1) The control power supply dropped abnormally quickly due to rapid discharge of the DC link bus voltage, etc. when data was stored at power OFF.	√			page A-269
			(2) Strong ambient noise was received when data was saved at power OFF.				
			(3) An error occurred in the control circuit.				
08890000 hex	Hardware Error	A combination error occurred between the power supply PCB and the control PCB.	(1) A combination error occurred between the power supply PCB and the control PCB.	√			page A-270
38A20000 hex	Positioning Control Error	A position deviation over error occurred in servo lock or position control.	(1) The servo lock gain of the position control system is insufficient.	√			page A-270
38A70000 hex	Excessive Position Deviation Error	Position deviation became excessive when position control is active.	(1) Encoder disconnection	√			page A-271
			(2) The encoder rotation direction, motor rotation direction in wiring phase sequence, or inverter output wiring phase sequence mismatched.				
			(3) Set value for excessive deviation is too small.				
			(4) The position control gain is too small.				
			(5) The speed control gain is too small.				
			(6) A torque limit is applied.				
38A30000 hex	Abnormal Setting Related to the PG Option Card	The pulse generator wiring is broken in the circuit.	(1) The wiring between the pulse generator and the pulse input terminal is disconnected.	√			page A-273
			(2) Strong ambient noise was received.				
68440000 hex	Mock Alarm	A Mock Alarm occurred.	(1) Mock Alarm (3008-2E hex) is set to 1.	√			page A-274

Event code	Event name	Description	Assumed cause	Level			Reference
				Min	Obs	Info	
088A0000 hex	Enable Circuit Failure	A circuit error was detected in the diagnosis of the enable circuit.	(1) There is a contact failure on the control terminal block board.	√			page A-275
			(2) Enable circuit logic error				
			(3) An enable circuit (safety stop circuit) failure (single failure) was detected.				
38A50000 hex	Locked by Password	An incorrect user password was entered more than the specified number of times.	(1) User password 1 or 2 was entered more than the specified number of times.	√			page A-276
68460000 hex	Motor Overload Warning	The current value reached the overload warning level.	(1) Motor overload warning		√		page A-277
68470000 hex	Cooling Fin Overheat Warning	The cooling fin temperature rose.	(1) The inverter's ambient temperature exceeds the specified range.	√			page A-278
			(2) The cooling air passage is blocked.				
			(3) The flow volume of the cooling fan dropped because it reached the end of life or failed.				
			(4) The load is large.				
68480000 hex	Life Warning	The main circuit capacitor, PCB electrolytic capacitor, or cooling fan reached the end of life.	(1) Life warning		√		page A-279
28130000 hex	EtherCAT Communications Error	An error occurred in EtherCAT communications.	(1) An EtherCAT communications cable is disconnected, broken, short-circuited, or has a contact failure in a daisy chain configuration.				page A-280
			(2) In a ring topology configuration, the ring disconnection status occurred or was fixed.				
			(3) Noise				
			(4) Failure in the EtherCAT physical layer of an inverter				
28140000 hex	Analog Input Reference Command Loss Detected	The frequency reference by analog input was rapidly reduced to 10% or less.	(1) Reference command loss detected		√		page A-281
68490000 hex	PID Warning Output	A warning (absolute value warning, deviation warning) occurred in PID control.	(1) PID warning output		√		page A-281

Event code	Event name	Description	Assumed cause	Level			Reference
				Min	Obs	Info	
684A0000 hex	Low Torque Detected	The output torque remained below the detection level for more than the detection time.	(1) Low torque detected		√		page A-282
684B0000 hex	Motor Run Time Over	The cumulative run time of the motor reached the set time for maintenance.	(1) Motor run time over		√		page A-282
684C0000 hex	Number of Startups Over	The cumulative number of startups of the motor reached the set count for maintenance.	(1) Number of Startups Over		√		page A-283
684D00000 hex	PTC Thermistor Error	The PTC thermistor detected a temperature not less than the set temperature.	(1) The motor's ambient temperature exceeds the specified range.				page A-284
			(2) The motor's cooling system failed.				
			(3) The load is large.				
			(4) The value of 1st Thermistor Error Detection Level (3008-1C hex) is not appropriate.				
			(5) The PTC thermistor settings are not appropriate.				
			(6) The value of 1st Manual Torque Boost Voltage (3004-0A hex) is too high.				
			(7) The V/f settings are incorrect.				
			(8) There is an incorrect parameter setting.				
96530000 hex	Communication Timeout with Sysmac Studio	A communication timeout occurred in the connection between Sysmac Studio and the Safety CPU Unit.	(1) A communications cable is broken.			√	page A-285

A-5-2 Error Descriptions

This section describes errors.

Error Table

The items that are used to describe individual errors (events) are described in the following copy of an error table.

Event name	Gives the name of the error (event).			Event code	Gives the code of the error (event).
Description	Gives a short description of the error (event).				
Source	Gives the source of the error (event).		Source details	Gives details on the source of the error.	Detection timing Tells when the error is detected.
Error attributes	Level	Tells the influence on control.*1	Recovery	Gives the recovery method.*2	Log category Tells which log the error is saved in.
Effects	User program	Tells what will happen to execution of the user program.**3	Operation	Provides special information on the operation that results from the error (event).	
Indicators	EtherCAT NET RUN		EtherCAT NET ERR		EtherCAT LINK/ACT
	Gives the status of the built-in EtherNet/IP port and built-in EtherCAT port indicators. Indicator status is given only for errors in the EtherCAT Master Function Module and the EtherNet/IP Function Module.				
System-defined variables	Variable	Data type		Name	
	Lists the variable names, data types, and meanings for system-defined variables that provide direct error notification, that are directly affected by the error, or that contain settings that cause the error.				
Cause and correction	Assumed cause		Correction		Prevention
	Lists the possible causes, corrections, and preventive measures for the error (event).				
Attached information	Provides the additional information that is displayed by the Sysmac Studio or an NS-series PT.				
Precautions/Remarks	Provides precautions, restrictions, and supplemental information.				

*1. One of the following:

- Minor fault: Minor fault level
- Observation
- Information

*2. One of the following:

- Automatic recovery: Normal status is restored automatically when the cause of the error is removed.
- Error reset: Normal status is restored when the error is reset after necessary measures are taken.
- Cycle the power supply: Normal status is restored when the power supply is turned OFF and then back ON after necessary measures are taken.
- Replace the inverter: Normal status is restored when the inverter is replaced with a new one.

*3. "Continues." indicates that execution of the user program will continue.

Error Descriptions

Event name	Overcurrent Protection (During Acceleration)		Event code	08790000 hex		
Meaning	Overcurrent occurred during acceleration.					
Source	EtherCAT Master Function Module		Source details	Slave	Detection timing	Continuously
Error attributes	Level	Minor fault	Recovery	Error reset	Log category	System log
Effects	User program	Continues.	Operation	Motor stops.		
Indicators	EtherCAT NET RUN		EtherCAT NET ERR		EtherCAT LINK/ACT	
	---		---		---	
System-defined variables	Variable		Data type		Name	
	None		None		None	
Cause and correction	Assumed cause		Correction		Prevention	
	(1) The inverter output is short-circuited.		<p>Disconnect the wires from the inverter output terminals (U, V, and W) and measure the phase-to-phase resistance of the motor wires. Check that there are no wires with extremely low phase-to-phase resistance.</p> <p>→ Remove the short-circuit. (This includes wire, relay terminal, and motor replacement.)</p> <p>If overcurrent is indicated when the inverter is operating with the wires disconnected from the inverter output terminals (U, V, and W)</p> <p>→ There is a possibility of an inverter failure.</p>		Confirm that the motor cables are not broken and connect them correctly.	
(2) There is a ground fault on the inverter output.		<p>Disconnect the wires from the inverter output terminals (U, V, and W) and perform a megger test.</p> <p>→ Remove the ground fault. (This includes wire, relay terminal, and motor replacement.)</p> <p>If overcurrent is indicated when the inverter is operating with the wires disconnected from the inverter output terminals (U, V, and W)</p> <p>→ There is a possibility of an inverter failure.</p>		Confirm that the motor cables are not broken and connect them correctly.		

<p>(3) The load is large.</p>	<p>Measure the current flowing in the motor, take a current trend, and determine if it is greater than the calculated load value in the system design. → If overloaded, reduce the load or increase the capacity of the inverter.</p> <p>Check the current trend to see if the current changes abruptly. → If the current changes abruptly, reduce the load fluctuation or increase the capacity of the inverter. → Set Instantaneous Overcurrent Limiting Function Selection to Enable (3008-0D hex) = 1.</p>	<p>Select a motor and an inverter according to the load.</p>
<p>(4) The torque boost is large (when 1st Torque Boost Selection (301F-0D hex) or 2nd Torque Boost Selection (301F-0E hex) = 0).</p>	<p>Check if the current decreases and the inverter does not stall when the value of Torque Boost Voltage (3004-0A hex, 3009-06 hex) is lowered. → If it is determined that the inverter does not stall, lower the value of Torque Boost Voltage (3004-0A hex, 3009-06 hex).</p>	<p>Set the value of Torque Boost Voltage (3004-0A hex, 3009-06 hex) appropriately.</p>
<p>(5) The acceleration/deceleration time is short.</p>	<p>Calculate the torque required for acceleration/deceleration based on the load's moment of inertia and acceleration/deceleration time, and determine if it is appropriate. → Increase the values of Acceleration Time (3004-08 hex, 3005-0B hex, 3005-0D hex, 3005-0F hex, and 3008-37 hex) and Deceleration Time (3004-09 hex, 3005-0C hex, 3005-0E hex, 3005-10 hex, and 3008-38 hex). → Enable the functions of Torque Limit 1 (Four-quadrant Mode Forward Power Running) (3004-29 hex), Torque Limit 2 (Four-quadrant Mode Reverse Regeneration) (3004-2A hex), Torque Limit 3 (Four-quadrant Mode Reverse Power Running) (3005-11 hex), and Torque Limit 4 (Four-quadrant Mode Forward Regeneration) (3005-12 hex). → Increase the capacity of the inverter.</p>	<p>Calculate the torque required for acceleration/deceleration based on the load's moment of inertia and acceleration/deceleration time, and set appropriate parameters.</p>

	(6) Short-circuit detection was activated by the built-in braking transistor (22 kW or less).	Check if the braking resistor connection terminals (P(+) and DB) are short-circuited. Check if the resistance value of the connected braking resistor is extremely low. → Connect an appropriate braking resistor.	Connect an appropriate braking resistor.
	(7) The inverter malfunctioned due to noise.	Check the measures against noise (grounding condition, control/main circuit wiring and installation). → Take measures against noise. → Enable the function of Auto-reset Count (3008-05 hex). → Connect a surge absorber to the coil, solenoid, etc. of the electromagnetic contactor, which is the noise source.	Excessive noise may be generated around the inverter. Consider taking measures against noise.
Attached information	None		
Precautions/Remarks	None		

A

Event name	Overcurrent Protection (During Deceleration)		Event code	087A0000 hex	
Meaning	Overcurrent occurred during deceleration.				
Source	EtherCAT Master Function Module		Source details	Slave	Detection timing Continuously
Error attributes	Level Minor fault		Recovery Error reset		Log category System log
Effects	User program Continues.		Operation Motor stops.		
Indicators	EtherCAT NET RUN ---		EtherCAT NET ERR ---		EtherCAT LINK/ACT ---
System-defined variables	Variable None		Data type None		Name None
Cause and correction	Assumed cause (1) The inverter output is short-circuited.		Correction Disconnect the wires from the inverter output terminals (U, V, and W) and measure the phase-to-phase resistance of the motor wires. Check that there are no wires with extremely low phase-to-phase resistance. → Remove the short-circuit. (This includes wire, relay terminal, and motor replacement.) If overcurrent is indicated when the inverter is operating with the wires disconnected from the inverter output terminals (U, V, and W) → There is a possibility of an inverter failure.		Prevention Confirm that the motor cables are not broken and connect them correctly.
	(2) There is a ground fault on the inverter output.		Disconnect the wires from the inverter output terminals (U, V, and W) and perform a megger test. → Remove the ground fault. (This includes wire, relay terminal, and motor replacement.) If overcurrent is indicated when the inverter is operating with the wires disconnected from the inverter output terminals (U, V, and W) → There is a possibility of an inverter failure.		Confirm that the motor cables are not broken and connect them correctly.

	<p>(3) The load is large.</p>	<p>Measure the current flowing in the motor, take a current trend, and determine if it is greater than the calculated load value in the system design.</p> <p>→ If overloaded, reduce the load or increase the capacity of the inverter.</p> <p>Check the current trend to see if the current changes abruptly.</p> <p>→ If the current changes abruptly, reduce the load fluctuation or increase the capacity of the inverter.</p> <p>→ Set Instantaneous Overcurrent Limiting Function Selection to Enable (3008-0D hex) = 1.</p>	<p>Select a motor and an inverter according to the load.</p>
	<p>(4) The torque boost is large (when 1st Torque Boost Selection (301F-0D hex) or 2nd Torque Boost Selection (301F-0E hex) = 0).</p>	<p>Check if the current decreases and the inverter does not stall when the value of Torque Boost Voltage (3004-0A hex, 3009-06 hex) is lowered.</p> <p>→ If it is determined that the inverter does not stall, lower the value of Torque Boost Voltage (3004-0A hex, 3009-06 hex).</p>	<p>Set the value of Torque Boost Voltage (3004-0A hex, 3009-06 hex) appropriately.</p>
	<p>(5) The acceleration/deceleration time is short.</p>	<p>Calculate the torque required for acceleration/deceleration based on the load's moment of inertia and acceleration/deceleration time, and determine if it is appropriate.</p> <p>→ Increase the values of Acceleration Time (3004-08 hex, 3005-0B hex, 3005-0D hex, 3005-0F hex, and 3008-37 hex) and Deceleration Time (3004-09 hex, 3005-0C hex, 3005-0E hex, 3005-10 hex, and 3008-38 hex).</p> <p>→ Enable the functions of Torque Limit 1 (Four-quadrant Mode Forward Power Running) (3004-29 hex), Torque Limit 2 (Four-quadrant Mode Reverse Regeneration) (3004-2A hex), Torque Limit 3 (Four-quadrant Mode Reverse Power Running) (3005-11 hex), and Torque Limit 4 (Four-quadrant Mode Forward Regeneration) (3005-12 hex).</p> <p>→ Increase the capacity of the inverter.</p>	<p>Calculate the torque required for acceleration/deceleration based on the load's moment of inertia and acceleration/deceleration time, and set appropriate parameters.</p>

	(6) Short-circuit detection was activated by the built-in braking transistor (22 kW or less).	Check if the braking resistor connection terminals (P(+)) and DB) are short-circuited. Check if the resistance value of the connected braking resistor is extremely low. → Connect an appropriate braking resistor.	Connect an appropriate braking resistor.
	(7) The inverter malfunctioned due to noise.	Check the measures against noise (grounding condition, control/main circuit wiring and installation). → Take measures against noise. → Enable the function of Auto-reset Count (3008-05 hex). → Connect a surge absorber to the coil, solenoid, etc. of the electromagnetic contactor, which is the noise source.	Excessive noise may be generated around the inverter. Consider taking measures against noise.
Attached information	None		
Precautions/Remarks	None		

Event name	Overcurrent Protection (During Constant Speed)		Event code	087B0000 hex	
Meaning	Overcurrent occurred during constant speed.				
Source	EtherCAT Master Function Module		Source details	Slave	Detection timing
		Continuously			
Error attributes	Level	Minor fault	Recovery	Error reset	Log category
					System log
Effects	User program	Continues.	Operation	Motor stops.	
Indicators	EtherCAT NET RUN		EtherCAT NET ERR		EtherCAT LINK/ACT
	---		---		---
System-defined variables	Variable		Data type		Name
	None		None		None
Cause and correction	Assumed cause		Correction		Prevention
	(1) The inverter output is short-circuited.		<p>Disconnect the wires from the inverter output terminals (U, V, and W) and measure the phase-to-phase resistance of the motor wires. Check that there are no wires with extremely low phase-to-phase resistance. → Remove the short-circuit. (This includes wire, relay terminal, and motor replacement.)</p> <p>If overcurrent is indicated when the inverter is operating with the wires disconnected from the inverter output terminals (U, V, and W) → There is a possibility of an inverter failure.</p>		Confirm that the motor cables are not broken and connect them correctly.
	(2) There is a ground fault on the inverter output.		<p>Disconnect the wires from the inverter output terminals (U, V, and W) and perform a megger test. → Remove the ground fault. (This includes wire, relay terminal, and motor replacement.)</p> <p>If overcurrent is indicated when the inverter is operating with the wires disconnected from the inverter output terminals (U, V, and W) → There is a possibility of an inverter failure.</p>		Confirm that the motor cables are not broken and connect them correctly.

<p>(3) The load is large.</p>	<p>Measure the current flowing in the motor, take a current trend, and determine if it is greater than the calculated load value in the system design. → If overloaded, reduce the load or increase the capacity of the inverter.</p> <p>Check the current trend to see if the current changes abruptly. → If the current changes abruptly, reduce the load fluctuation or increase the capacity of the inverter. → Set Instantaneous Overcurrent Limiting Function Selection to Enable (3008-0D hex) = 1.</p>	<p>Select a motor and an inverter according to the load.</p>
<p>(4) The torque boost is large (when 1st Torque Boost Selection (301F-0D hex) or 2nd Torque Boost Selection (301F-0E hex) = 0).</p>	<p>Check if the current decreases and the inverter does not stall when the value of Torque Boost Voltage (3004-0A hex, 3009-06 hex) is lowered. → If it is determined that the inverter does not stall, lower the value of Torque Boost Voltage (3004-0A hex, 3009-06 hex).</p>	<p>Set the value of Torque Boost Voltage (3004-0A hex, 3009-06 hex) appropriately.</p>
<p>(5) The acceleration/deceleration time is short.</p>	<p>Calculate the torque required for acceleration/deceleration based on the load's moment of inertia and acceleration/deceleration time, and determine if it is appropriate. → Increase the values of Acceleration Time (3004-08 hex, 3005-0B hex, 3005-0D hex, 3005-0F hex, and 3008-37 hex) and Deceleration Time (3004-09 hex, 3005-0C hex, 3005-0E hex, 3005-10 hex, and 3008-38 hex). → Enable the functions of Torque Limit 1 (Four-quadrant Mode Forward Power Running) (3004-29 hex), Torque Limit 2 (Four-quadrant Mode Reverse Regeneration) (3004-2A hex), Torque Limit 3 (Four-quadrant Mode Reverse Power Running) (3005-11 hex), and Torque Limit 4 (Four-quadrant Mode Forward Regeneration) (3005-12 hex). → Increase the capacity of the inverter.</p>	<p>Calculate the torque required for acceleration/deceleration based on the load's moment of inertia and acceleration/deceleration time, and set appropriate parameters.</p>

	(6) Short-circuit detection was activated by the built-in braking transistor (22 kW or less).	Check if the braking resistor connection terminals (P(+) and DB) are short-circuited. Check if the resistance value of the connected braking resistor is extremely low. → Connect an appropriate braking resistor.	Connect an appropriate braking resistor.
	(7) The inverter malfunctioned due to noise.	Check the measures against noise (grounding condition, control/main circuit wiring and installation). → Take measures against noise. → Enable the function of Auto-reset Count (3008-05 hex). → Connect a surge absorber to the coil, solenoid, etc. of the electromagnetic contactor, which is the noise source.	Excessive noise may be generated around the inverter. Consider taking measures against noise.
Attached information	None		
Precautions/Remarks	None		

Event name	Overvoltage Protection (During Acceleration)		Event code	087C0000 hex	
Meaning	Overvoltage occurred during acceleration.				
Source	EtherCAT Master Function Module	Source details	Slave	Detection timing	Continuously
Error attributes	Level	Minor fault	Recovery	Error reset	Log category System log
Effects	User program	Continues.	Operation	Motor stops.	
Indicators	EtherCAT NET RUN		EtherCAT NET ERR		EtherCAT LINK/ACT
	---		---		---
System-defined variables	Variable		Data type		Name
	None		None		None
Cause and correction	Assumed cause		Correction		Prevention
	(1) The inverter's power supply voltage exceeds the specified range.		Measure the input voltage. → Decrease the power supply voltage to within the specified range. → If the power supply voltage is within the specified range, there is a possibility of an inverter failure.		Input the correct voltage.
	(2) A surge current occurred the input power supply.		When the phase advance capacitor is turned ON or OFF in the same power supply system, or when the thyristor converter operates, the input voltage may transiently become abnormally high (i.e., surge). → Install a DC reactor.		Install a DC reactor.

	<p>(3) The deceleration time is short for the load's moment of inertia.</p>	<p>Recalculate the deceleration torque based on the load's moment of inertia and deceleration time.</p> <p>→ Increase the values of 1st Deceleration Time 1 (3004-09 hex), 2nd Deceleration Time 1 (3005-0C hex), 1st Deceleration Time 2 (3005-0E hex), and 2nd Deceleration Time 2 (3005-10 hex).</p> <p>→ Enable the function of Anti-regenerative control Mode selection (3008-46 hex) or Deceleration characteristics (3008-48 hex).</p> <p>→ Enable the functions of Torque Limit 1 (Four-quadrant Mode Forward Power Running) (3004-29 hex), Torque Limit 2 (Four-quadrant Mode Reverse Regeneration) (3004-2A hex), Torque Limit 3 (Four-quadrant Mode Reverse Power Running) (3005-11 hex), and Torque Limit 4 (Four-quadrant Mode Forward Regeneration) (3005-12 hex).</p> <p>→ Set the value of 1st rated voltage at base frequency (3004-06 hex) to 0 to improve the braking performance.</p> <p>→ Consider using a braking resistor.</p>	<p>Set an appropriate deceleration time for the load's moment of inertia.</p>
	<p>(4) The acceleration time is short.</p>	<p>Check if an overvoltage alarm occurs at the end of quick acceleration.</p> <p>→ Increase the values of 1st Acceleration Time 1 (3004-08 hex), 2nd Acceleration Time 1 (3005-0B hex), 1st Acceleration Time 2 (3005-0D hex), and 2nd Acceleration Time 2 (3005-0F hex).</p> <p>→ Use Acceleration/Deceleration Pattern Selection (3008-08 hex).</p> <p>→ Consider using a braking resistor.</p>	<p>Set the acceleration/deceleration time as long as possible to reduce the load. Or set a longer stop time to reduce the load.</p>

	(5) The braking load is large.	<p>Compare the load's braking torque with the braking torque of the inverter.</p> <p>→ Set the value of 1st rated voltage at base frequency (3004-06 hex) to 0 to improve the braking performance.</p> <p>→ Consider using a braking resistor.</p>	<p>Design the inverter so that the braking torque of the inverter can be secured for the load's braking torque.</p>
	(6) There is a ground fault on the output side.	<p>The inverter operates normally when operated with the wires disconnected from inverter output terminals (U, V, and W).</p> <p>→ Check if there is a ground fault on the output wires or the motor.</p> <p>If overvoltage is indicated when the inverter is operating with the wires disconnected from the inverter output terminals (U, V, and W).</p> <p>→ There is a possibility of an inverter failure.</p>	<p>Confirm that the motor cables are not broken and connect them correctly.</p>
	(7) A malfunction occurred due to noise.	<p>Check if the DC link bus voltage at occurrence of the overvoltage is below the set overvoltage detection level.</p> <p>→ Take measures against noise.</p> <p>→ Enable the function of Auto-reset Count (3008-05 hex).</p> <p>→ Connect a surge absorber to the coil, solenoid, etc. of the electromagnetic contactor, which is the noise source.</p>	<p>Excessive noise may be generated around the inverter. Consider taking measures against noise.</p>
Attached information	None		
Precautions/Remarks	None		

Event name	Overvoltage Protection (During Deceleration)		Event code	087D0000 hex	
Meaning	Overvoltage occurred during deceleration.				
Source	EtherCAT Master Function Module		Source details	Slave	Detection timing Continuously
Error attributes	Level	Minor fault	Recovery	Error reset	Log category System log
Effects	User program	Continues.	Operation	Motor stops.	
Indicators	EtherCAT NET RUN		EtherCAT NET ERR		EtherCAT LINK/ACT
	---		---		---
System-defined variables	Variable		Data type		Name
	None		None		None
Cause and correction	Assumed cause		Correction		Prevention
	(1) The inverter's power supply voltage exceeds the specified range.		Measure the input voltage. → Decrease the power supply voltage to within the specified range. → If the power supply voltage is within the specified range, there is a possibility of an inverter failure.		Input the correct voltage.
	(2) A surge current occurred the input power supply.		When the phase advance capacitor is turned ON or OFF in the same power supply system, or when the thyristor converter operates, the input voltage may transiently become abnormally high (i.e., surge). → Install a DC reactor.		Install a DC reactor.

	<p>(3) The deceleration time is short for the load's moment of inertia.</p>	<p>Recalculate the deceleration torque based on the load's moment of inertia and deceleration time.</p> <ul style="list-style-type: none"> → Increase the values of 1st Deceleration Time 1 (3004-09 hex), 2nd Deceleration Time 1 (3005-0C hex), 1st Deceleration Time 2 (3005-0E hex), and 2nd Deceleration Time 2 (3005-10 hex). → Enable the function of Anti-regenerative control Mode selection (3008-46 hex) or Deceleration characteristics (3008-48 hex). → Enable the functions of Torque Limit 1 (Four-quadrant Mode Forward Power Running) (3004-29 hex), Torque Limit 2 (Four-quadrant Mode Reverse Regeneration) (3004-2A hex), Torque Limit 3 (Four-quadrant Mode Reverse Power Running) (3005-11 hex), and Torque Limit 4 (Four-quadrant Mode Forward Regeneration) (3005-12 hex). → Set the value of 1st rated voltage at base frequency (3004-06 hex) to 0 to improve the braking performance. → Consider using a braking resistor. 	<p>Set an appropriate deceleration time for the load's moment of inertia.</p>
	<p>(4) The acceleration time is short.</p>	<p>Check if an overvoltage alarm occurs at the end of quick acceleration.</p> <ul style="list-style-type: none"> → Increase the values of 1st Acceleration Time 1 (3004-08 hex), 2nd Acceleration Time 1 (3005-0B hex), 1st Acceleration Time 2 (3005-0D hex), and 2nd Acceleration Time 2 (3005-0F hex). → Use Acceleration/Deceleration Pattern Selection (3008-08 hex). → Consider using a braking resistor. 	<p>Set the acceleration/deceleration time as long as possible to reduce the load. Or set a longer stop time to reduce the load.</p>

	(5) The braking load is large.	<p>Compare the load's braking torque with the braking torque of the inverter.</p> <p>→ Set the value of 1st rated voltage at base frequency (3004-06 hex) to 0 to improve the braking performance.</p> <p>→ Consider using a braking resistor.</p>	<p>Design the inverter so that the braking torque of the inverter can be secured for the load's braking torque.</p>
	(6) There is a ground fault on the output side.	<p>The inverter operates normally when operated with the wires disconnected from inverter output terminals (U, V, and W).</p> <p>→ Check if there is a ground fault on the output wires or the motor.</p> <p>If overvoltage is indicated when the inverter is operating with the wires disconnected from the inverter output terminals (U, V, and W).</p> <p>→ There is a possibility of an inverter failure.</p>	<p>Confirm that the motor cables are not broken and connect them correctly.</p>
	(7) A malfunction occurred due to noise.	<p>Check if the DC link bus voltage at occurrence of the overvoltage is below the set overvoltage detection level.</p> <p>→ Take measures against noise.</p> <p>→ Enable the function of Auto-reset Count (3008-05 hex).</p> <p>→ Connect a surge absorber to the coil, solenoid, etc. of the electromagnetic contactor, which is the noise source.</p>	<p>Excessive noise may be generated around the inverter. Consider taking measures against noise.</p>
Attached information	None		
Precautions/Remarks	None		

Event name	Overvoltage Protection (During Constant Speed)		Event code	087E0000 hex	
Meaning	Overvoltage occurred during constant speed.				
Source	EtherCAT Master Function Module		Source details	Slave	Detection timing Continuously
Error attributes	Level	Minor fault	Recovery	Error reset	Log category System log
Effects	User program	Continues.	Operation	Motor stops.	
Indicators	EtherCAT NET RUN		EtherCAT NET ERR		EtherCAT LINK/ACT
	---		---		---
System-defined variables	Variable		Data type		Name
	None		None		None
Cause and correction	Assumed cause		Correction		Prevention
	(1) The inverter's power supply voltage exceeds the specified range.		Measure the input voltage. → Decrease the power supply voltage to within the specified range. → If the power supply voltage is within the specified range, there is a possibility of an inverter failure.		Input the correct voltage.
	(2) A surge current occurred the input power supply.		When the phase advance capacitor is turned ON or OFF in the same power supply system, or when the thyristor converter operates, the input voltage may transiently become abnormally high (i.e., surge). → Install a DC reactor.		Install a DC reactor.

	<p>(3) The deceleration time is short for the load's moment of inertia.</p>	<p>Recalculate the deceleration torque based on the load's moment of inertia and deceleration time.</p> <p>→ Increase the values of 1st Deceleration Time 1 (3004-09 hex), 2nd Deceleration Time 1 (3005-0C hex), 1st Deceleration Time 2 (3005-0E hex), and 2nd Deceleration Time 2 (3005-10 hex).</p> <p>→ Enable the function of Anti-regenerative control Mode selection (3008-46 hex) or Deceleration characteristics (3008-48 hex).</p> <p>→ Enable the functions of Torque Limit 1 (Four-quadrant Mode Forward Power Running) (3004-29 hex), Torque Limit 2 (Four-quadrant Mode Reverse Regeneration) (3004-2A hex), Torque Limit 3 (Four-quadrant Mode Reverse Power Running) (3005-11 hex), and Torque Limit 4 (Four-quadrant Mode Forward Regeneration) (3005-12 hex).</p> <p>→ Set the value of 1st rated voltage at base frequency (3004-06 hex) to 0 to improve the braking performance.</p> <p>→ Consider using a braking resistor.</p>	<p>Set an appropriate deceleration time for the load's moment of inertia.</p>
	<p>(4) The acceleration time is short.</p>	<p>Check if an overvoltage alarm occurs at the end of quick acceleration.</p> <p>→ Increase the values of 1st Acceleration Time 1 (3004-08 hex), 2nd Acceleration Time 1 (3005-0B hex), 1st Acceleration Time 2 (3005-0D hex), and 2nd Acceleration Time 2 (3005-0F hex).</p> <p>→ Use Acceleration/Deceleration Pattern Selection (3008-08 hex).</p> <p>→ Consider using a braking resistor.</p>	<p>Set the acceleration/deceleration time as long as possible to reduce the load. Or set a longer stop time to reduce the load.</p>

	(5) The braking load is large.	<p>Compare the load's braking torque with the braking torque of the inverter.</p> <p>→ Set the value of 1st rated voltage at base frequency (3004-06 hex) to 0 to improve the braking performance.</p> <p>→ Consider using a braking resistor.</p>	<p>Design the inverter so that the braking torque of the inverter can be secured for the load's braking torque.</p>
	(6) There is a ground fault on the output side.	<p>The inverter operates normally when operated with the wires disconnected from inverter output terminals (U, V, and W).</p> <p>→ Check if there is a ground fault on the output wires or the motor.</p> <p>If overvoltage is indicated when the inverter is operating with the wires disconnected from the inverter output terminals (U, V, and W).</p> <p>→ There is a possibility of an inverter failure.</p>	<p>Confirm that the motor cables are not broken and connect them correctly.</p>
	(7) A malfunction occurred due to noise.	<p>Check if the DC link bus voltage at occurrence of the overvoltage is below the set overvoltage detection level.</p> <p>→ Take measures against noise.</p> <p>→ Enable the function of Auto-reset Count (3008-05 hex).</p> <p>→ Connect a surge absorber to the coil, solenoid, etc. of the electromagnetic contactor, which is the noise source.</p>	<p>Excessive noise may be generated around the inverter. Consider taking measures against noise.</p>
Attached information	None		
Precautions/Remarks	None		

Event name	Undervoltage		Event code	087F0000 hex	
Meaning	The DC link bus voltage dropped below the undervoltage detection level.				
Source	EtherCAT Master Function Module		Source details	Slave	Detection timing Continuously
Error attributes	Level	Minor fault	Recovery	Error reset	Log category System log
Effects	User program	Continues.	Operation	Motor stops.	
Indicators	EtherCAT NET RUN		EtherCAT NET ERR		EtherCAT LINK/ACT
	---		---		---
System-defined variables	Variable		Data type		Name
	None		None		None
Cause and correction	Assumed cause		Correction		Prevention
	(1) A momentary power interruption occurred.		Reset the alarm. To restart the inverter without alarm, set the value of Power Interruption Restart Mode selection (3004-0F hex) to 3, 4, or 5 depending on the type of load.		Remove the cause of the momentary voltage drop.
	(2) The inverter's power supply voltage is not within the specified range.		Measure the input voltage. → Increase the power supply voltage to within the specified range.		Apply a voltage that is appropriate for the inverter.
	(3) There is a faulty device or incorrect wiring in the power circuit.		Measure the input voltage to identify the faulty device or incorrect wiring. → Replace the faulty device, or correct the incorrect wiring.		Check the wiring of the main circuit power supply before use.
	(4) Power supply voltage temporarily drops due to a large starting current flowing to another load connected to the same power supply system.		Measure the input voltage to check for voltage fluctuations. → Review the power supply system.		Apply a voltage that is appropriate for the inverter.
	(5) Power supply voltage drops due to the inrush current of the inverter caused by insufficient power transformer capacity.		Check if an alarm occurs when the molded case circuit breaker, earth leakage circuit breaker (with overcurrent protection), or electromagnetic contactor is turned ON. → Review the power transformer capacity.		Select a power transformer with a capacity appropriate for the inverter.
Attached information	None				
Precautions/Remarks	None				

Event name	Input Phase Loss Error		Event code	280F0000 hex	
Meaning	There is an input phase loss, or the power supply has a large phase-to-phase imbalance.				
Source	EtherCAT Master Function Module	Source details	Slave	Detection timing	Continuously
Error attributes	Level	Minor fault	Recovery	Error reset	Log category System log
Effects	User program	Continues.	Operation	Motor stops.	
Indicators	EtherCAT NET RUN		EtherCAT NET ERR		EtherCAT LINK/ACT
	---		---		---
System-defined variables	Variable		Data type		Name
	None		None		None
Cause and correction	Assumed cause		Correction		Prevention
	(1) Wiring to the main power supply input terminals is disconnected.		Measure the input voltage. → Repair or replace the main power supply input wiring or input devices (molded case circuit breaker, electromagnetic contactor, etc.).		None
	(2) The main power input terminal is not firmly tightened.		Check if there are loose screws on the main power supply input terminals. → Retighten the screws to the recommended tightening torque.		Tighten the screws to the recommended tightening torque.
	(3) The 3-phase power supply has a large phase-to-phase imbalance.		Measure the input voltage. → Install an AC Reactor (ACR) to reduce phase-to-phase imbalance. → Increase the capacity of the inverter.		Install a DC reactor.
	(4) An excessive load is periodically applied.		Measure the ripple waveform of the DC link bus voltage. → If the ripple of the DC link bus voltage is large, increase the inverter capacity.		Select a motor and an inverter according to the load.
	(5) A single-phase power supply was connected to the product requiring a 3-phase power supply.		Recheck the inverter model. → Reselect an inverter according to the power supply specifications.		Select an inverter according to the power supply specifications.
Attached information	None				
Precautions/Remarks	None				

Event name	Output Phase Loss Error		Event code	28100000 hex	
Meaning	There is an output phase loss.				
Source	EtherCAT Master Function Module		Source details	Slave	Detection timing Continuously
Error attributes	Level	Minor fault	Recovery	Error reset	Log category System log
Effects	User program	Continues.	Operation	Motor stops.	
Indicators	EtherCAT NET RUN		EtherCAT NET ERR		EtherCAT LINK/ACT
	---		---		---
System-defined variables	Variable		Data type		Name
	None		None		None
Cause and correction	Assumed cause		Correction		Prevention
	(1) The inverter's output wiring is disconnected.		Measure the output current. → Replace the output wiring.		None
	(2) The motor winding is broken.		Measure the output current. → Replace the motor.		None
	(3) The inverter output terminals are not firmly tightened.		Check if there are loose screws on the inverter output terminals. → Retighten the screws to the recommended tightening torque.		Tighten the screws to the recommended tightening torque.
Attached information	None				
Precautions/Remarks	None				

Event name	Cooling Fin Overheat Error		Event code	08800000 hex	
Meaning	The cooling fin temperature rose.				
Source	EtherCAT Master Function Module	Source details	Slave	Detection timing	Continuously
Error attributes	Level	Minor fault	Recovery	Error reset	Log category System log
Effects	User program	Continues.	Operation	Motor stops.	
Indicators	EtherCAT NET RUN		EtherCAT NET ERR		EtherCAT LINK/ACT
	---		---		---
System-defined variables	Variable	Data type		Name	
	None	None		None	
Cause and correction	Assumed cause		Correction		Prevention
	(1) The inverter's ambient temperature exceeds the specified range.		Measure the ambient temperature. → Lower the ambient temperature, for example, by improving the ventilation in the panel.		Examine the ambient temperature of the inverter and provide the necessary cooling.
	(2) The cooling air passage is blocked.		Check if the installation space is secured. → Reinstall the inverter in a location where a sufficient installation space can be secured. Check if the fins are clogged. → Clean the fins.		Install the inverter in a location where a sufficient installation space can be secured. Do not use the product in an area surrounded by excessive foreign matter. Also, do not allow foreign matter to enter.
	(3) The flow volume of the cooling fan dropped because it reached the end of life or failed.		Check the cumulative run time of the cooling fan. → Replace the cooling fan. Visually check if the cooling fan is operating normally. → Replace the cooling fan.		None
	(4) The load is large.		Measure the output current. → Reduce the load. (Use Cooling Fin Overheat Warning (Terminal [DI] function selection) (3005-02 to 06 hex) and 1st Overload Early Warning Detection Level (3005-26 hex), 2nd Overload Warning Detection Level (3005-38 hex), and Overload early warning 2 Level (3005-23 hex) to reduce the load before overloading occurs.) → Lower the value of Carrier Frequency (3004-1B hex). → Enable the setting of Overload prevention control (3008-47 hex).		Select a motor and an inverter according to the load.
Attached information	None				

Precautions/Remarks	None				
Event name	Inverter Overheat Error		Event code	08810000 hex	
Meaning	The inverter's internal temperature exceeded the allowable range.				
Source	EtherCAT Master Function Module		Source details	Slave	Detection timing Continuously
Error attributes	Level	Minor fault	Recovery	Error reset	Log category System log
Effects	User program	Continues.	Operation	Motor stops.	
Indicators	EtherCAT NET RUN		EtherCAT NET ERR		EtherCAT LINK/ACT
	---		---		---
System-defined variables	Variable	Data type		Name	
	None	None		None	
Cause and correction	Assumed cause		Correction		Prevention
	(1) The inverter's ambient temperature exceeds the specified range.		Measure the ambient temperature. → Lower the ambient temperature of the inverter, for example, by improving the ventilation in the panel.		Examine the ambient temperature of the inverter and provide the necessary cooling.
Attached information	None				
Precautions/Remarks	None				

Event name	Inrush Current Prevention Resistor Overheat		Event code	08820000 hex	
Meaning	The inverter's built-in inrush current prevention resistor overheated.				
Source	EtherCAT Master Function Module	Source details	Slave	Detection timing	Continuously
Error attributes	Level	Minor fault	Recovery	Error reset	Log category System log
Effects	User program	Continues.	Operation	Motor stops.	
Indicators	EtherCAT NET RUN		EtherCAT NET ERR		EtherCAT LINK/ACT
	---		---		---
System-defined variables	Variable		Data type		Name
	None		None		None
Cause and correction	Assumed cause		Correction		Prevention
	(1) The power supply to the inverter was frequently turned ON and OFF.		Reduce the frequency of power ON/OFF. → Power ON/OFF should be performed less than once every 30 minutes.		None
	(2) The power supply to the inverter was not frequently turned ON and OFF.		An error occurs at every power ON/OFF. → The inrush current prevention circuit is faulty. Replace the inverter.		None
Attached information	None				
Precautions/Remarks	None				

Event name	Braking Resistor Overheat Error		Event code	08830000 hex	
Meaning	The thermal for the braking resistor was activated.				
Source	EtherCAT Master Function Module		Source details	Slave	Detection timing
		Continuously			
Error attributes	Level	Minor fault	Recovery	Error reset	Log category
					System log
Effects	User program	Continues.	Operation	Motor stops.	
Indicators	EtherCAT NET RUN		EtherCAT NET ERR		EtherCAT LINK/ACT
	---		---		---
System-defined variables	Variable	Data type		Name	
	None	None		None	
Cause and correction	Assumed cause		Correction		Prevention
	(1) The braking load is large.		Recalculate the relationship between the braking load and the capacity. → Reduce the braking load. → Review the braking resistor selection and increase the capacity (in Electronic thermal overload protection for braking resistor (3004-33 to 35 hex)).		Calculate the relationship between the braking load and the capacity, and select an appropriate braking resistor.
	(2) The deceleration time is too short.		Recalculate the required torque based on the load's moment of inertia and deceleration time. → Increase the values of 1st Deceleration Time 1 (3004-09 hex), 2nd Deceleration Time 1 (3005-0C hex), 1st Deceleration Time 2 (3005-0E hex), and 2nd Deceleration Time 2 (3005-10 hex). → Review the braking resistor selection and increase the capacity. (It is also required to set data again in Electronic thermal overload protection for braking resistor (3004-33 to 35 hex)).		Set the acceleration/deceleration time as long as possible to reduce the load. Or set a longer stop time to reduce the load.
	(3) There is an incorrect setting in Electronic thermal overload protection for braking resistor (3004-33 to 35 hex).		Recheck the specifications of the braking resistor. To use an optional braking resistor in a braking resistor built-in model (7.5 kW or less), check if the electronic thermal settings for the braking resistor are changed. → Review and change the values of Electronic thermal overload protection for braking resistor (3004-33 to 35 hex).		Consider and set the values of Electronic thermal overload protection for braking resistor (3004-33 to 35 hex) appropriately.
Attached information	None				

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Precautions/ Remarks	None
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Event name	Inverter Overload Protection		Event code	08840000 hex	
Meaning	The inverter's internal temperature became abnormally high.				
Source	EtherCAT Master Function Module		Source details	Slave	Detection timing Continuously
Error attributes	Level Minor fault		Recovery Error reset		Log category System log
Effects	User program Continues.		Operation Motor stops.		
Indicators	EtherCAT NET RUN ---		EtherCAT NET ERR ---		EtherCAT LINK/ACT ---
System-defined variables	Variable None		Data type None		Name None
Cause and correction	Assumed cause		Correction		Prevention
	(1) The inverter's ambient temperature exceeds the specified range.		Measure the ambient temperature. → Lower the ambient temperature, for example, by improving the ventilation in the panel.		Examine the ambient temperature of the inverter and provide the necessary cooling.
	(2) The value of Torque Boost Voltage (3004-0A hex, 3009-06 hex) is too high.		Check the value of Torque Boost Voltage (3004-0A hex, 3009-06 hex) to be sure that lowering the value does not cause a stall. → Adjust the value of Torque Boost Voltage (3004-0A hex, 3009-06 hex).		Set the value of Torque Boost Voltage (3004-0A hex, 3009-06 hex) appropriately.
	(3) The acceleration/deceleration time is short.		Recalculate the required acceleration/deceleration torque and acceleration/deceleration time based on the load's moment of inertia and acceleration/deceleration time. → Increase the values of 1st Acceleration Time 1 (3004-08 hex), 1st Deceleration Time 1 (3004-09 hex), 3005-0B hex to 3005-10 hex , and 3008-39 hex .		Set the acceleration/deceleration time as long as possible to reduce the load. Or set a longer stop time to reduce the load.
(4) The load is large.		Measure the output current. → Reduce the load. (Use 1st Overload Early Warning Detection Level (3005-26 hex), 2nd Overload Warning Detection Level (3005-38 hex), and Overload early warning 2 Level (3005-23 hex) to reduce the load before overloading occurs. In winter, the load may become larger.) → Reduce the value of Carrier Frequency (3004-1B hex). → Enable the setting of Overload prevention control (3008-47 hex).		Select a motor and an inverter according to the load.	

	(5) The cooling air passage is blocked.	Check if the installation space is secured. → Secure a sufficient installation space. Check if the fins are clogged. → Clean the fins.	Install the inverter in a location where a sufficient installation space can be secured. Do not use the product in an area surrounded by excessive foreign matter. Also, do not allow foreign matter to enter.
	(6) The flow volume of the cooling fan dropped because it reached the end of life or failed.	Check the cumulative run time of the cooling fan. → Replace the inverter. Visually check if the cooling fan is operating normally. → Replace the inverter.	None
	(7) There is a large leakage current due to long wiring.	Measure the leakage current. → Insert an output circuit filter (OFL).	→ Insert an output circuit filter.
Attached information	None		
Precautions/Remarks	None		

Event name	Inrush Current Prevention Circuit Error		Event code	088B0000 hex	
Meaning	An error was detected in the inrush current prevention circuit.				
Source	EtherCAT Master Function Module		Source details	Slave	Detection timing Continuously
Error attributes	Level	Minor fault	Recovery	Error reset	Log category System log
Effects	User program	Continues.	Operation	Motor stops.	
Indicators	EtherCAT NET RUN		EtherCAT NET ERR		EtherCAT LINK/ACT
	---		---		---
System-defined variables	Variable		Data type		Name
	None		None		None
Cause and correction	Assumed cause		Correction		Prevention
	(1) The inrush current prevention circuit is faulty.		Replace the inverter.		None
Attached information	None				
Precautions/Remarks	None				

Event name	External Trip		Event code	68430000 hex	
Meaning	An external trip signal (<i>EXT</i>) was input.				
Source	EtherCAT Master Function Module		Source details	Slave	Detection timing
					Continuously
Error attributes	Level	Minor fault	Recovery	Error reset	Log category
					System log
Effects	User program	Continues.	Operation	Motor stops.	
Indicators	EtherCAT NET RUN		EtherCAT NET ERR		EtherCAT LINK/ACT
	---		---		---
System-defined variables	Variable	Data type		Name	
	None	None		None	
Cause and correction	Assumed cause		Correction		Prevention
	(1) An alarm function is activated on an external device.		Inspect the operation of the external device. → Remove the cause of the alarm generated by the external device.		None
	(2) There is an incorrect connection or contact failure on the external trip wiring.		Check if the wiring is connected correctly to the terminal to which "External Trip" is assigned in Terminal [DI] function selection (3005-02 to 06 hex, 63 hex, and 64 hex). → Connect the External Trip wiring correctly.		Connect the External Trip wiring appropriately.
	(3) There is an incorrect parameter setting.		Check if "External Trip" is assigned to unused terminals in Terminal [DI] function selection (3005-02 to 06 hex, 63 hex, and 64 hex). → Change the assignment. Check if the logic of the "External Trip" set in Terminal [DI] function selection (3005-02 to 06 hex, 63 hex, and 64 hex) and the logic (positive or negative) of the external signal match. → Set the logic correctly.		Set the multi-function input terminals appropriately.
Attached information	None				
Precautions/Remarks	None				

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Event name	Braking Transistor Error		Event code	08850000 hex	
Meaning	An abnormal operation was detected in the braking transistor.				
Source	EtherCAT Master Function Module	Source details	Slave	Detection timing	Continuously
Error attributes	Level	Minor fault	Recovery	Error reset	Log category System log
Effects	User program	Continues.	Operation	Motor stops.	
Indicators	EtherCAT NET RUN		EtherCAT NET ERR		EtherCAT LINK/ACT
	---		---		---
System-defined variables	Variable		Data type		Name
	None		None		None
Cause and correction	Assumed cause		Correction		Prevention
	(1) The braking resistor connection terminals are incorrectly wired.		Check if the braking resistor is correctly wired to <i>P(+)</i> and <i>DB</i> of the main circuit terminals. Check if the motor wiring is incorrectly connected to the <i>DB</i> terminal. → If there is no incorrect wiring, replace the inverter.		Connect the braking resistor correctly wired to <i>P(+)</i> and <i>DB</i> of the main circuit terminals.
	(2) The braking transistor is damaged.		Check if the value of the braking resistor is appropriate or there is no incorrect connection. → If there is no problem, replace the inverter.		None
Attached information	None				
Precautions/Remarks	None				

Event name	Overspeed		Event code	389C0000 hex	
Meaning	The motor rotated at excessive speed.				
Source	EtherCAT Master Function Module		Source details	Slave	Detection timing Continuously
Error attributes	Level	Minor fault	Recovery	Error reset	Log category System log
Effects	User program	Continues.	Operation	Motor stops.	
Indicators	EtherCAT NET RUN		EtherCAT NET ERR		EtherCAT LINK/ACT
	---		---		---
System-defined variables	Variable		Data type		Name
	None		None		None
Cause and correction	Assumed cause		Correction		Prevention
	(1) There is an incorrect parameter setting.		<p>Check the setting of 1st Motor Pole Number (3007-02 hex). → Set 1st Motor Pole Number (3007-02 hex)* according to the motor.</p> <p>Check the setting of 1st Maximum Frequency (3004-04 hex). → Set 1st Maximum Frequency (3004-04 hex) according to the output frequency.</p> <p>Check the settings of Speed limit 1 in Forward (3014-21 hex) and Speed limit 2 in Reverse (3014-22 hex). → Disable the settings of Speed limit 1 in Forward (3014-21 hex) and Speed limit 2 in Reverse (3014-22 hex).</p> <p>Check the setting of Overspeed Error Detection Level (3014-24 hex). → Set Overspeed Error Detection Level (3014-24 hex) to 120%.</p>		Set the frequency reference so that the output frequency does not exceed the value of Overspeed Error Detection Level (3014-24 hex).
	(2) The gain of the speed controller is insufficient.		<p>Check if the speed overshoots in high-speed operation. → Increase the value of Speed control 1 P Gain (3014-04 hex) for the speed controller. (Review the filters and integration time settings depending on the situation.)</p>		Set the speed controller gain appropriately.
	(3) Noise is superimposed on the PG signal.		<p>Check the PG signal input monitor and determine measures against noise (grounding condition, signal line/main circuit wiring installation method, etc.). → Take measures against noise.</p>		Excessive noise may be generated around the inverter. Consider taking measures against noise.

	(4) The output frequency, motor rotation speed, exceeded 590 Hz.	If operating the inverter near 599 Hz, check that the acceleration time is not too short, that there are no load fluctuations, and that the speed controller proportional gain (3014-04 hex, 3009-2E hex) and speed control integral time (3014-05 hex, 3009-2F hex, 300C-2F hex, 3013-2F hex) are appropriate. → Decrease the frequency reference.	Set the frequency reference so that the output frequency does not exceed 599 Hz.
Attached information	None		
Precautions/Remarks	None		

Event name	1st Motor Overload Protection		Event code	08860000 hex	
Meaning	Motor 1 is overloaded.				
Source	EtherCAT Master Function Module		Source details	Slave	Detection timing
		Continuously			
Error attributes	Level	Minor fault	Recovery	Error reset	Log category
					System log
Effects	User program	Continues.	Operation	Motor stops.	
Indicators	EtherCAT NET RUN		EtherCAT NET ERR		EtherCAT LINK/ACT
	---		---		---
System-defined variables	Variable	Data type		Name	
	None	None		None	
Cause and correction	Assumed cause		Correction		Prevention
	(1) The characteristics of the electronic thermal and the overload characteristics of the motor do not match.		Check the motor characteristics. → Review the values of 1st motor electronic thermal overload protection mode (3004-0B hex) and 1st motor electronic thermal time constant (3004-0D hex). → Use an external thermal relay.		Set the parameters according to the motor characteristics.
	(2) The operation level of the electronic thermal is not appropriate.		Recheck the motor's continuous allowable current. → Review and change the value of 1st Motor Electronic Thermal Level (3004-0C hex).		Set the electronic thermal's operation level appropriately.
	(3) The acceleration/deceleration time is short.		Recalculate the required acceleration/deceleration torque and acceleration/deceleration time based on the load's moment of inertia and acceleration/deceleration time. → Increase the values of 1st Acceleration Time 1 (3004-08 hex), 1st Acceleration Time 2 (3005-0D hex), 1st Deceleration Time 1 (3004-09 hex), and 1st Deceleration Time 2 (3005-0E hex).		Set the acceleration/deceleration time as long as possible to reduce the load. Or set a longer stop time to reduce the load.
	(4) The load is large.		Measure the output current. → Reduce the load. (Use 1st Overload Early Warning Detection Level (3005-26 hex) and Overload early warning 2 Level (3005-23 hex) to reduce the load before overloading occurs. In winter, the load may become larger.)		Select a motor and an inverter according to the load.

	(5) The value of Torque Boost Voltage (3004-0A hex, 3009-06 hex) is too high.	Check and readjust the value of Torque Boost Voltage (3004-0A hex, 3009-06 hex) so that lowering the value does not cause a stall. → Adjust the value of Torque Boost Voltage (3004-0A hex, 3009-06 hex).	Set the value of Torque Boost Voltage (3004-0A hex, 3009-06 hex) appropriately.
Attached information	None		
Precautions/Remarks	None		

Event name	2nd Motor Overload Protection		Event code	08870000 hex	
Meaning	Motor 2 is overloaded.				
Source	EtherCAT Master Function Module		Source details	Slave	Detection timing Continuously
Error attributes	Level Minor fault		Recovery Error reset		Log category System log
Effects	User program Continues.		Operation Motor stops.		
Indicators	EtherCAT NET RUN ---		EtherCAT NET ERR ---		EtherCAT LINK/ACT ---
System-defined variables	Variable None		Data type None		Name None
Cause and correction	Assumed cause		Correction		Prevention
	(1) The characteristics of the electronic thermal and the overload characteristics of the motor do not match.		Check the motor characteristics. → Review the values of 2nd Motor Electronic Thermal Characteristic selection (3009-07 hex) and 2nd Motor Electronic Thermal Time Constant (3009-09 hex). → Use an external thermal relay.		Set the parameters according to the motor characteristics.
	(2) The operation level of the electronic thermal is not appropriate.		Recheck the motor's continuous allowable current. → Review and change the value of 2nd Motor Electronic Thermal Level (3009-08 hex).		Set the electronic thermal's operation level appropriately.
	(3) The acceleration/deceleration time is short.		Recalculate the required acceleration/deceleration torque and acceleration/deceleration time based on the load's moment of inertia and acceleration/deceleration time. → Increase the values of 2nd Acceleration Time 1 (3005-0B hex), 2nd Acceleration Time 2 (3005-0F hex), 2nd Deceleration Time 1 (3005-0C hex), and 2nd Deceleration Time 2 (3005-10 hex).		Set the acceleration/deceleration time as long as possible to reduce the load. Or set a longer stop time to reduce the load.

	(4) The load is large.	Measure the output current. → Reduce the load. (Use 2nd Overload Warning Detection Level (3005-38 hex) and Overload early warning 2 Level (3005-23 hex) to reduce the load before overloading occurs. In winter, the load may become larger.)	Select a motor and an inverter according to the load.
	(5) The value of Torque Boost Voltage (3004-0A hex, 3009-06 hex) is too high.	Check and readjust the value of Torque Boost Voltage (3004-0A hex, 3009-06 hex) so that lowering the value does not cause a stall. → Adjust the value of Torque Boost Voltage (3004-0A hex, 3009-06 hex).	Set the value of Torque Boost Voltage (3004-0A hex, 3009-06 hex) appropriately.
Attached information	None		
Precautions/Remarks	None		

Event name	Thermistor Error		Event code	08880000 hex	
Meaning	The motor's internal temperature became abnormally high.				
Source	EtherCAT Master Function Module	Source details	Slave	Detection timing	Continuously
Error attributes	Level	Minor fault	Recovery	Error reset	Log category System log
Effects	User program	Continues.	Operation	Motor stops.	
Indicators	EtherCAT NET RUN		EtherCAT NET ERR		EtherCAT LINK/ACT
	---		---		---
System-defined variables	Variable	Data type		Name	
	None	None		None	
Cause and correction	Assumed cause	Correction		Prevention	
	(1) The motor's ambient temperature exceeds the specified range.	Measure the ambient temperature. → Lower the ambient temperature.		Check the ambient temperature of the motor and set up the necessary cooling conditions.	
	(2) The motor's cooling system failed.	Check if the motor's cooling system is operating normally. → Repair or replace the motor's cooling system.		None	
	(3) The load is large.	Measure the output current. → Reduce the load. (Use 1st Overload Early Warning Detection Level (3005-26 hex), 2nd Overload Warning Detection Level (3005-38 hex), and Overload early warning 2 Level (3005-23 hex) to reduce the load before overloading occurs. In winter, the load may become larger.) → Lower the ambient temperature. → Increase the Carrier Frequency (3004-1B hex).		Select a motor and an inverter according to the load.	
	(4) The value of 1st Thermistor level (3008-1C hex) is not appropriate.	Check the specifications of the PTC thermistor and recalculate the detection voltage. → Change the parameter data.		Set the 1st Thermistor level (3008-1C hex) appropriately.	
	(5) The PTC thermistor settings are not appropriate.	Check the value of 1st Thermistor mode selection (3008-1B hex). → Change the setting of 1st Thermistor mode selection (3008-1B hex) to an appropriate value for the thermistor.		Set the PTC thermistor setting appropriately.	

	(6) The value of Torque Boost Voltage (3004-0A hex, 3009-06 hex) is too high.	Check and readjust the value of Torque Boost Voltage (3004-0A hex, 3009-06 hex) so that lowering the value does not cause a stall. → Adjust the value of Torque Boost Voltage (3004-0A hex, 3009-06 hex).	Set the value of Torque Boost Voltage (3004-0A hex, 3009-06 hex) appropriately.
	(7) The V/f settings are incorrect.	Check that the 1st Base Frequency (3004-05 hex) and 1st rated voltage at base frequency (3004-06 hex) match the values on the motor rating nameplate. → Match the data to the value on the motor rating nameplate.	Configure the V/f settings appropriately.
	(8) There is an incorrect parameter setting.	The function of 1st Thermistor mode selection (3008-1B hex) is enabled even though the PTC thermistor is not used. → Change the setting of 1st Thermistor mode selection (3008-1B hex) to 0 (Disable).	Set 1st Thermistor mode selection (3008-1B hex) appropriately.
Attached information	None		
Precautions/Remarks	None		

Event name	EEPROM Error		Event code	183D0000 hex	
Meaning	A data write error, etc. occurred.				
Source	EtherCAT Master Function Module		Source details	Slave	Detection timing At power ON
Error attributes	Level	Minor fault	Recovery	Error reset	Log category System log
Effects	User program	Continues.	Operation	Motor stops.	
Indicators	EtherCAT NET RUN		EtherCAT NET ERR		EtherCAT LINK/ACT
	---		---		---
System-defined variables	Variable		Data type		Name
	None		None		None
Cause and correction	Assumed cause		Correction		Prevention
	(1) The power supply was turned OFF when parameter data is written (especially during initialization or data copying), causing the control power supply voltage to drop.		Use Data initialization (3008-04 hex) to initialize the data and, after completion of the initialization, check if the alarm can be reset by executing Reset (Refer to <i>6-8-1 Reset Function</i> on page 6-43). → Undo the initialized parameter data and resume the operation.		None
	(2) Strong ambient noise was received when parameter data is written (especially during initialization).		Check the measures against noise (grounding condition, control/main circuit wiring and installation). Also, perform the same check as in (1). → Take measures against noise, undo the initialized parameters, and resume the operation.		Excessive noise may be generated around the inverter. Consider taking measures against noise.
	(3) An error occurred in the control circuit.		Use Data initialization (3008-04 hex) to initialize the data and, after completion of the initialization, check if the alarm persists even after an alarm resetting attempt by executing Reset (Refer to <i>6-8-1 Reset Function</i> on page 6-43). → This is an error on the PCB including the CPU. Replace the inverter.		None
	(4) The power supply was turned OFF when saving user set values by User preference dataset Registration (3020-5E hex), causing the control power supply voltage to drop.		Use User preference dataset Registration (3020-5E hex) to save the user set values and, after completion of the saving, check if the alarm persists even after an alarm resetting attempt by executing Reset (Refer to <i>6-8-1 Reset Function</i> on page 6-43). → This may be an error on the PCB including the CPU.		Do not interrupt the power while the parameter is saved.

	(5) Strong ambient noise was received when saving user set values by User preference dataset Registration (3020-5E hex).	Check the measures against noise (grounding condition, control/main circuit wiring and installation). Also, perform the same check as in (4). → This may be an error on the PCB including the CPU.	Excessive noise may be generated around the inverter. Consider taking measures against noise.
Attached information	None		
Precautions/Remarks	None		

Event name	Operator Communications Error		Event code	28110000 hex	
Meaning	An error occurred in communications between the operator and the inverter.				
Source	EtherCAT Master Function Module		Source details	Slave	Detection timing
					Continuously
Error attributes	Level	Minor fault	Recovery	Error reset	Log category
					System log
Effects	User program	Continues.	Operation	Motor stops.	
Indicators	EtherCAT NET RUN		EtherCAT NET ERR		EtherCAT LINK/ACT
	---		---		---
System-defined variables	Variable	Data type		Name	
	None	None		None	
Cause and correction	Assumed cause	Correction		Prevention	
	(1) The communications cable is broken or has a contact failure.	Check the cable for conductivity and connection, or for poor contact at the connector. → Insert the connector securely. → Replace the communications cable.		None	
	(2) The surface cover is not securely attached due to many control wires, causing the operator to be raised.	Check the installation of the surface cover. → Use the recommended wire size (0.75 mm ²) for wiring. → Reroute the wiring inside the unit to ensure that the surface cover is securely installed.		None	
	(3) Strong ambient noise was received.	Check the measures against noise (grounding condition, signal line or communications cable/main circuit wiring and installation method, etc.). → Improve the measures against noise.		Excessive noise may be generated around the inverter. Consider taking measures against noise.	
	(4) The operator is faulty.	Check if an error occurs in another operator. → Replace the operator.		None	
Attached information	None				
Precautions/Remarks	None				

Event name	CPU Error		Event code	183E0000 hex		
Meaning	A CPU error such as runaway occurred.					
Source	EtherCAT Master Function Module		Source details	Slave	Detection timing	Continuously
Error attributes	Level	Minor fault	Recovery	Error reset	Log category	System log
Effects	User program	Continues.	Operation	Motor stops.		
Indicators	EtherCAT NET RUN		EtherCAT NET ERR		EtherCAT LINK/ACT	
	---		---		---	
System-defined variables	Variable		Data type		Name	
	None		None		None	
Cause and correction	Assumed cause		Correction		Prevention	
	(1) Strong ambient noise was received.		Check the measures against noise (grounding condition, signal line or communications cable/main circuit wiring and installation method, etc.). → Improve the measures against noise.		Excessive noise may be generated around the inverter. Consider taking measures against noise.	
Attached information	None					
Precautions/Remarks	None					

Event name	Operation Error		Event code	389D0000 hex	
Meaning	Incorrect operation was performed without following the operating instructions.				
Source	EtherCAT Master Function Module		Source details	Slave	Detection timing Continuously
Error attributes	Level	Minor fault	Recovery	Error reset	Log category System log
Effects	User program	Continues.	Operation	Motor stops.	
Indicators	EtherCAT NET RUN		EtherCAT NET ERR		EtherCAT LINK/ACT
	---		---		---
System-defined variables	Variable		Data type		Name
	None		None		None
Cause and correction	Assumed cause		Correction		Prevention
	(1) The forced stop signal <i>STOP</i> (digital input terminal) was turned OFF.		Check if the forced stop signal <i>STOP</i> is turned OFF. → If the inverter performs unintended operation, review the settings of Terminal [DI] function selection (3005-02 to 06 hex, 63 hex, and 64 hex).		Set the forced stop signal <i>STOP</i> appropriately.
	(2) The brake check signal <i>BRKE</i> and the brake signal <i>BRKS</i> mismatch.		Check if the signal input to the multi-function input terminal to which the brake check signal <i>BRKE</i> is assigned matches the brake signal <i>BRKS</i> output from the multi-function output terminal. <ul style="list-style-type: none"> • Check if there are any broken signal wires. • Check if the logic is correct. • If there is a delay in operation, adjust the time set in Brake Error Detection Time (3020-51 hex). 		Appropriately wire and set the digital input terminal to which the brake check signal <i>BRKE</i> is assigned and the digital output terminal to which the brake signal <i>BRKS</i> is assigned.
Attached information	None				
Precautions/Remarks	None				

Event name	Tuning Error		Event code	389E0000 hex	
Meaning	The auto-tuning failed.				
Source	EtherCAT Master Function Module		Source details	Slave	Detection timing Continuously
Error attributes	Level	Minor fault	Recovery	Error reset	Log category System log
Effects	User program	Continues.	Operation	Motor stops.	
Indicators	EtherCAT NET RUN		EtherCAT NET ERR		EtherCAT LINK/ACT
	---		---		---
System-defined variables	Variable		Data type		Name
	None		None		None
Cause and correction	Assumed cause		Correction		Prevention
	(1) There is a phase loss in the connecting line between the inverter and the motor.		Correct the inverter and motor correctly.		Confirm the specifications, and perform the correct wiring.
	(2) The V/f setting, motor rated current value, is not correctly set.		Check if 1st Base Frequency (3004-05 hex), 1st rated voltage at base frequency (3004-06 hex), Free V/f Frequency and Voltage (3014-43 to 50 hex), and motor parameters (3007-03 to 04 hex and 3007-3D to 41 hex) are set according to the motor's specifications.		Confirm the specifications, and perform the correct setting.
	(3) The wire length between the inverter and the motor is too long.		Check if the wire length between the inverter and the motor is not more than 50 m. (The wire length has a significant impact if the inverter capacity is small.) → Review the layout to make the wire length between the inverter and the motor shorter. Or make the connection wire length as short as possible. → Do not use the auto-tuning and auto torque boost functions. (Set 1st Torque Boost Selection (301F-0D hex) and 2nd Torque Boost Selection (301F-0E hex) to 0.)		Review the layout to make the wire length between the inverter and the motor shorter. Or make the connection wire length as short as possible.

	(4) There is a significant difference between the rated capacity of the inverter and the capacity of the connected motor.	<p>Check if the capacity of the connected motor is at least 3 ranks lower or at least 2 ranks higher than the rated capacity of the inverter.</p> <p>→ Review the capacity of the inverter.</p> <p>→ Manually set 1st Motor Parameter Io (3007-07 hex), 1st Motor Parameter R1 (3007-08 hex), and 1st Motor Parameter L (3007-09 hex).</p> <p>→ Do not use the auto-tuning and auto torque boost functions. (Set 1st Torque Boost Selection (301F-0D hex) and 2nd Torque Boost Selection (301F-0E hex) to 0.)</p>	Use a motor that is suitable for the inverter.
	(5) The motor is a high-speed motor or other special motor.	Do not use the auto-tuning and auto torque boost functions. (Set 1st Torque Boost Selection (301F-0D hex) and 2nd Torque Boost Selection (301F-0E hex) to 0.)	To use a special motor, in addition to auto-tuning, consider setting the motor constants manually.
	(6) Tuning operation (Parameter 3007-05 hex = 2) was performed to rotate the motor while the brake is applied to the motor.	<p>Use the turning method that does not cause the motor to rotate (1st Auto tuning (3007-05 hex) = 1).</p> <p>Use the tuning method without applying the brake (1st Auto tuning (3007-05 hex) = 2).</p>	Check the brake condition before performing auto-tuning.
Attached information	None		
Precautions/Remarks	None		

Event name	Magnetic Pole Position Detection Error		Event code	38A60000 hex	
Meaning	In synchronous motor vector control with sensor, a magnetic pole position detection error occurred.				
Source	EtherCAT Master Function Module	Source details	Slave	Detection timing	Continuously
Error attributes	Level	Minor fault	Recovery	Error reset	Log category System log
Effects	User program	Continues.	Operation	Motor stops.	
Indicators	EtherCAT NET RUN		EtherCAT NET ERR		EtherCAT LINK/ACT
	---		---		---
System-defined variables	Variable		Data type		Name
	None		None		None
Cause and correction	Assumed cause		Correction		Prevention
	(1) Inverter settings are not appropriate.		<p>Confirm that the motor, and the presence/absence and type of speed/magnetic pole position sensor, are consistent with the settings of 1st Drive control selection (3004-2B hex), Terminal [PIA][PIB] Pulse input format (3014-0F hex), and Terminal [PIA][PIB] Encoder pulse resolution (3014-10 hex). → Confirm the machine configuration (the motor, and the type and specifications of and speed/magnetic pole position sensor) and correctly set 1st Drive control selection (3004-2B hex), Terminal [PIA][PIB] Pulse input format (3014-0F hex), and Terminal [PIA][PIB] Encoder pulse resolution (3014-10 hex).</p> <p>Check if 1st PM motor drive magnetic pole position detection mode (3007-1F hex) is set to 0 or 3 and 1st PM motor magnetic pole position sensor offset (3007-60 hex) is not 999 (<i>Offset not adjusted</i>). → Correctly set the 1st PM motor magnetic pole position sensor offset (3007-60 hex). (Auto-tuning is also possible. Refer to 7-8-1 <i>Motor Off-line Auto-tuning</i> on page 7-65.)</p>		Wire and set up the inverter appropriately.

	(2) There is a problem with the connection of speed/magnetic pole position sensor.	<p>Check the speed/magnetic pole position sensor output wiring for contact failure, and check the phase sequence (A and B phases, or U, V, and W phases). → Connect the inverter to the speed/magnetic pole position sensor correctly.</p> <p>Check the motor wiring for contact failure, and check the phase sequence. → Connect the inverter to the motor correctly.</p>	<p>Wire the inverter to the speed/magnetic pole position sensor correctly.</p> <p>Wire the output wiring of the inverter (U, V, and W).</p>
	(3) The motor rotation direction does not match the sensor output.	<p>Check the speed/magnetic pole position sensor output wiring for contact failure, and check the phase sequence (A and B phases, or U, V, and W phases). → Connect the inverter to the speed/magnetic pole position sensor correctly.</p> <p>Check the motor wiring for contact failure, and check the phase sequence. → Connect the inverter to the motor correctly.</p>	<p>Wire the inverter to the speed/magnetic pole position sensor correctly.</p> <p>Wire the output wiring of the inverter (U, V, and W).</p>
	(4) Strong ambient noise was received.	<p>Check the measures against noise (grounding condition, signal line or communications cable/main circuit wiring installation method, etc.). → Take measures against noise.</p>	<p>Excessive noise may be generated around the inverter. Consider taking measures against noise.</p>
Attached information	None		
Precautions/Remarks	None		

Event name	Step-out Detection/Magnetic Pole Position Detection Error during Startup		Event code	38A00000 hex	
Meaning	Step-out of the PM motor was detected. Magnetic pole position detection failed at startup.				
Source	EtherCAT Master Function Module	Source details	Slave	Detection timing	Continuously
Error attributes	Level	Minor fault	Recovery	Error reset	Log category System log
Effects	User program	Continues.	Operation	Motor stops.	
Indicators	EtherCAT NET RUN		EtherCAT NET ERR		EtherCAT LINK/ACT
	---		---		---
System-defined variables	Variable	Data type		Name	
	None	None		None	
Cause and correction	Assumed cause	Correction		Prevention	
	(1) The characteristics of the motor are different.	Confirm that the settings of 1st Base Frequency (3004-05 hex), 1st rated voltage at base frequency (3004-06 hex), and motor parameters (3007-02 to 04 hex, 3007-3D to 41 hex) are consistent with the motor constants. → Perform auto-tuning.		Set the motor constant parameters according to the motor characteristics and perform auto-tuning.	
	(2) The magnetic pole position detection method is not appropriate.	Confirm that the magnetic pole position detection method is suitable for the motor type. → Set 1st PM motor drive magnetic pole position detection mode (3007-1F hex) according to the motor type.		Set 1st PM motor drive magnetic pole position detection mode (3007-1F hex) appropriately.	
	(3) The value of 1st Starting frequency 1 Holding time (3004-19 hex) is insufficient.	Check if 1st Starting frequency 1 Holding time (3004-19 hex) is set optimally when 1st PM motor drive magnetic pole position detection mode (3007-1F hex) is set to 0 or 3. → Set a time that allows for at least one rotation of the motor. $F24^* \geq P01^* / 2 / F23^*$ (P01*: Number of poles, F23*: Starting frequency) $F24 = 1st\ Starting\ frequency\ 1\ Holding\ time$ (3004-19 hex) $F23 = 1st\ Starting\ Frequency$ (3004-18 hex) $P01 = 1st\ Motor\ Pole\ Number$ (3007-02 hex)		Set 1st Starting frequency 1 Holding time (3004-19 hex) to an appropriate value.	

	(4) The starting torque is insufficient.	<p>Check the values of 1st Acceleration Time 1 (3004-08 hex), 2nd Acceleration Time 1 (3005-0B hex), 1st Acceleration Time 2 (3005-0D hex), 2nd Acceleration Time 2 (3005-0F hex), 1st PM motor reference current at starting (3007-4B hex).</p> <p>→ Set an acceleration time according to the load.</p> <p>→ Increase the starting current command value.</p> <p>→ Set 1st PM motor control switching level (3007-5A hex) to a higher value.</p>	<p>Set the acceleration/deceleration time as long as possible to reduce the load. Or set a longer stop time to reduce the load.</p>
	(5) The load is small.	<p>Check the value of 1st PM motor reference current at starting (3007-48 hex).</p> <p>→ Lower the starting current command value. To operate the motor alone in a test run, set the value to 80% or less.</p>	<p>Select a motor and an inverter according to the load.</p>
	(6) There is a phase loss in the connecting line between the inverter and the motor.	<p>Correct the inverter and motor correctly.</p>	<p>Wire the output wiring of the inverter (U, V, and W).</p>
Attached information	None		
Precautions/Remarks	None		

A

Event name	Speed Mismatch or Excessive Speed Deviation		Event code	38A10000 hex	
Meaning	There is an excessive speed deviation between the command speed and the detected speed.				
Source	EtherCAT Master Function Module		Source details	Slave	Detection timing Continuously
Error attributes	Level	Minor fault	Recovery	Error reset	Log category System log
Effects	User program	Continues.	Operation	Motor stops.	
Indicators	EtherCAT NET RUN		EtherCAT NET ERR		EtherCAT LINK/ACT
	---		---		---
System-defined variables	Variable		Data type		Name
	None		None		None
Cause and correction	Assumed cause		Correction		Prevention
	(1) There is an incorrect parameter setting.		Check the setting of 1st Motor Pole Number (3007-02 hex). → Set 1st Motor Pole Number (3007-02 hex) according to the motor.		Set 1st Motor Pole Number (3007-02 hex) appropriately.
	(2) The load is too large.		Measure the output current. → Reduce the load. Check if the mechanical brake is activated. → Deactivate the mechanical brake.		Select a motor and an inverter according to the load.
	(3) The speed does not increase in current limiting operation.		Check the value of 1st Overload Limit Level (3004-2D hex). → Change the setting of 1st Overload Limit Level (3004-2D hex) to an appropriate value. Or, if current limiting operation is not required, change the value of 1st Overload Limit Selection (3004-2C hex) to 0 (Disable). Check if the V/f settings are correct. Or check the values of 1st Base Frequency (3004-05 hex), 1st Rated Voltage at Base Frequency (3004-06 hex), and motor parameters (3007-02 to 0D hex). → Set the V/f settings according to the motor rating. → Change the settings according to the motor.		Set 1st Overload Limit Level (3004-2D hex) appropriately.
	(4) The parameter settings differ from the motor characteristics.		Confirm that the motor parameters (3007-02 to 04 hex, 07 to 0B hex, 0D hex) match the motor constants. → Perform auto-tuning with the setting of 1st Online Tuning Function Selection (3007-06 hex).		Set the motor constant parameters according to the motor characteristics and perform auto-tuning.

	(5) Wiring to the motor is incorrect.	Check the wiring to the motor. → Wire the inverter output wires (U, V, and W) to the motor wires (U, V, and W), respectively.	Wire the output wiring of the inverter (U, V, and W).
	(6) The speed does not increase in torque limiting operation.	Check the values of Torque Limit 1 (Four-quadrant Mode Forward Power Running) (3004-29 hex), Torque Limit 2 (Four-quadrant Mode Reverse Regeneration) (3004-2A hex), Torque Limit 3 (Four-quadrant Mode Reverse Power Running) (3005-11 hex), and Torque Limit 4 (Four-quadrant Mode Forward Regeneration) (3005-12 hex). → Change the torque limit parameters to appropriate values. Or, if torque limit operation is not required, change it to Disable (300%).	Set the torque limit appropriately.
	(7) Wiring between the pulse generator and the option card is incorrect.	One of the wires is faulty between the pulse generator (PG) and the pulse input terminals. → Check and correct the wiring. Also, insert the wire into the terminal block securely. → Check if the wiring sheath is damaged. → Replace the wiring.	None
Attached information	None		
Precautions/Remarks	None		

A

Event name	Data Save Error during Undervoltage		Event code	183F0000 hex	
Meaning	The frequency references set by the operator, PID commands, and commands set by <i>UP/DOWN</i> signals could not be correctly saved to memory at power OFF.				
Source	EtherCAT Master Function Module		Source details	Slave	Detection timing At power ON
Error attributes	Level	Minor fault	Recovery	Error reset	Log category System log
Effects	User program	Continues.	Operation	Motor stops.	
Indicators	EtherCAT NET RUN		EtherCAT NET ERR		EtherCAT LINK/ACT
	---		---		---
System-defined variables	Variable		Data type		Name
	None		None		None
Cause and correction	Assumed cause		Correction		Prevention
	(1) The control power supply dropped abnormally quickly due to rapid discharge of the DC link bus voltage, etc. when data was stored at power OFF.		Check the time it took for the DC link bus voltage to drop at power OFF. → Remove the causes of the rapid discharge of the DC link bus voltage. After resetting the alarm by executing Reset (Refer to 6-8-1 <i>Reset Function</i> on page 6-43), undo the frequency reference set by the operator, PID command, and command set by <i>UP/DOWN</i> signal to the original settings, and resume the operation.		None
	(2) Strong ambient noise was received when data was saved at power OFF.		Check the measures against noise (grounding condition, control/main circuit wiring and installation). → Take measures against noise. After resetting the alarm by executing Reset (Refer to 6-8-1 <i>Reset Function</i> on page 6-43), undo the frequency reference set by the operator, PID command, and command set by <i>UP/DOWN</i> signal to the original settings, and resume the operation.		Excessive noise may be generated around the inverter. Consider taking measures against noise.
	(3) An error occurred in the control circuit.		Check if a Data Save Error during Undervoltage occurs every time at power ON. → Replace the inverter.		None
Attached information	None				
Precautions/Remarks	None				

Event name	Hardware Error		Event code	08890000 hex		
Meaning	A combination error occurred between the power supply PCB and the control PCB.					
Source	EtherCAT Master Function Module		Source details	Slave	Detection timing	At power ON
Error attributes	Level	Minor fault	Recovery	Cycling power	Log category	System log
Effects	User program	Continues.	Operation	Motor stops.		
Indicators	EtherCAT NET RUN		EtherCAT NET ERR		EtherCAT LINK/ACT	
	---		---		---	
System-defined variables	Variable		Data type		Name	
	None		None		None	
Cause and correction	Assumed cause		Correction		Prevention	
	(1) A combination error occurred between the power supply PCB and the control PCB.		Replace the inverter.		None	
Attached information	None					
Precautions/Remarks	None					

Event name	Positioning Control Error		Event code	38A20000 hex		
Meaning	A position deviation over error occurred in servo lock or position control.					
Source	EtherCAT Master Function Module		Source details	Slave	Detection timing	Continuously
Error attributes	Level	Minor fault	Recovery	Error reset	Log category	System log
Effects	User program	Continues.	Operation	Motor stops.		
Indicators	EtherCAT NET RUN		EtherCAT NET ERR		EtherCAT LINK/ACT	
	---		---		---	
System-defined variables	Variable		Data type		Name	
	None		None		None	
Cause and correction	Assumed cause		Correction		Prevention	
	(1) The servo lock gain of the position control system is insufficient.		Readjust the settings of Servo lock Gain (300E-62 hex) and Speed control 1 P Gain (3014-04 hex).		Adjust the settings of Servo lock Gain (300E-62 hex) and Speed control 1 P Gain (3014-04 hex) appropriately.	
Attached information	None					
Precautions/Remarks	None					

Event name	Excessive Position Deviation Error		Event code	38A70000 hex	
Meaning	Position deviation became excessive when position control is active.				
Source	EtherCAT Master Function Module	Source details	Slave	Detection timing	Continuously
Error attributes	Level	Minor fault	Recovery	Error reset	Log category System log
Effects	User program	Continues.	Operation	Motor stops.	
Indicators	EtherCAT NET RUN		EtherCAT NET ERR		EtherCAT LINK/ACT
	---		---		---
System-defined variables	Variable	Data type		Name	
	None	None		None	
Cause and correction	Assumed cause		Correction		Prevention
	(1) Encoder disconnection		Check if the encoder is disconnected.		None
	(2) The encoder rotation direction, motor rotation direction in wiring phase sequence, or inverter output wiring phase sequence mismatched.		Review the connections and settings so that the rotation direction is the same for all devices. Review the set values of Terminal [PIA][PIB] Pulse input format (3014-0F hex), Terminal [PIA][PIB] Encoder pulse resolution (3014-10 hex), Terminal [PIA][PIB] Pulse scaling factor 1 (3014-11 hex), and Terminal [PIA][PIB] Pulse scaling factor 2 (3014-12 hex).		Make connections and settings so that the rotation direction is the same.
	(3) Set value for excessive deviation is too small.		Review the set values of Detection level of excessive positioning deviation upper 4 digits (3037-18 hex) and Detection level of excessive positioning deviation lower 4 digits (3037-19 hex). Increase the set values if low.		Set Detection level of excessive positioning deviation upper 4 digits (3037-18 hex) and Detection level of excessive positioning deviation lower 4 digits (3037-19 hex) appropriately.
	(4) The position control gain is too small.		Review the set values of Position control Gain (3037-04 hex) and Position control Gain 2 (3037-05 hex). Increase the set values if low.		Set Position control Gain (3037-04 hex) and Position control Gain 2 (3037-05 hex) appropriately.
	(5) The speed control gain is too small.		Review the set values of Speed control 1 P Gain (3014-04 hex), Speed control 2 P Gain (3009-2E hex), Speed control 3 P Gain (3013-2E hex), and Speed control 4 P Gain (300C-2E hex). Increase the set values if low.		Set Speed control 1 P Gain (3014-04 hex), Speed control 2 P Gain (3009-2E hex), Speed control 3 P Gain (3013-2E hex), and Speed control 4 P Gain (300C-2E hex) appropriately.

	(6) A torque limit is applied.	<p>If the torque limit is activated, position control and speed control will not operate correctly.</p> <p>Take the following measures to avoid the torque limit.</p> <ul style="list-style-type: none"> • Reduce the load. • Review the acceleration/deceleration time. • Review the machine configuration, including reduction ratio and motor capacity, to reduce the load. 	Set the torque limit appropriately.
Attached information	None		
Precautions/Remarks	None		

A

Event name	Abnormal Setting Related to the PG Option Card		Event code	38A30000 hex	
Meaning	The pulse generator wiring is broken in the circuit.				
Source	EtherCAT Master Function Module	Source details	Slave	Detection timing	Continuously
Error attributes	Level	Minor fault	Recovery	Error reset	Log category System log
Effects	User program	Continues.	Operation	Motor stops.	
Indicators	EtherCAT NET RUN		EtherCAT NET ERR		EtherCAT LINK/ACT
	---		---		---
System-defined variables	Variable		Data type		Name
	None		None		None
Cause and correction	Assumed cause		Correction		Prevention
	(1) The wiring between the pulse generator and the pulse input terminal is disconnected.		Check if the pulse generator is correctly connected and there is no disconnection. → Check if the pulse generator is correctly connected. Or securely connect the wiring to the terminal block. → Check if the sheath is not caught in the connector. → Replace it with wire that is not broken.		None
	(2) Strong ambient noise was received.		Check the measures against noise (grounding condition, signal line or communications cable/main circuit wiring installation method, etc.). → Take measures against noise. → Install the main circuit wiring as far as possible from the control circuit wiring.		Excessive noise may be generated around the inverter. Consider taking measures against noise.
Attached information	None				
Precautions/Remarks	None				

Event name	Mock Alarm		Event code	68440000 hex	
Meaning	A Mock Alarm occurred.				
Source	EtherCAT Master Function Module		Source details	Slave	Detection timing Continuously
Error attributes	Level	Minor fault	Recovery	Error reset	Log category System log
Effects	User program	Continues.	Operation	Motor stops.	
Indicators	EtherCAT NET RUN		EtherCAT NET ERR		EtherCAT LINK/ACT
	---		---		---
System-defined variables	Variable		Data type		Name
	None		None		None
Cause and correction	Assumed cause		Correction		Prevention
	(1) Mock Alarm (3008-2E hex) is set to 1.		Reset the alarm by executing Reset (Refer to 6-8-1 <i>Reset Function</i> on page 6-43).		Do not set Mock Alarm (3008-2E hex) to 1 except where necessary.
Attached information	None				
Precautions/Remarks	None				

A

Event name	Enable Circuit Failure		Event code	088A0000 hex	
Meaning	A circuit error was detected in the diagnosis of the enable circuit.				
Source	EtherCAT Master Function Module	Source details	Slave	Detection timing	Continuously
Error attributes	Level	Minor fault	Recovery	Error reset	Log category System log
Effects	User program	Continues.	Operation	Motor stops.	
Indicators	EtherCAT NET RUN		EtherCAT NET ERR		EtherCAT LINK/ACT
	---		---		---
System-defined variables	Variable		Data type		Name
	None		None		None
Cause and correction	Assumed cause		Correction		Prevention
	(1) There is a contact failure on the control terminal block board.		Confirm that the control terminal block board is firmly installed on the inverter. → Cycle the power supply to reset the alarm.		Confirm that the control terminal block board is firmly installed on the inverter.
	(2) Enable circuit logic error		<ul style="list-style-type: none"> Confirm that the output from safety switches or other devices is input with the same logic (High/High or Low/Low) for both SF1 and SF2 terminals. Check that the two poles of SW9 on the control board are both ON/ON or OFF/OFF. → Reset the alarm by executing Reset (Refer to 6-8-1 Reset Function on page 6-43).		Set the output from the safety switches, etc. so that both SF1 and SF2 terminals have the same logic.
	(3) An enable circuit (safety stop circuit) failure (single failure) was detected.		If the problem cannot be solved with the above correction, the inverter is faulty.		None
Attached information	None				
Precautions/Remarks	None				

Event name	Locked by Password		Event code	38A50000 hex	
Meaning	An incorrect user password was entered more than the specified number of times.				
Source	EtherCAT Master Function Module		Source details	Slave	Detection timing Continuously
Error attributes	Level	Minor fault	Recovery	Error reset	Log category System log
Effects	User program	Continues.	Operation	Motor stops.	
Indicators	EtherCAT NET RUN		EtherCAT NET ERR		EtherCAT LINK/ACT
	---		---		---
System-defined variables	Variable		Data type		Name
	None		None		None
Cause and correction	Assumed cause		Correction		Prevention
	(1) User password 1 or 2 was entered more than the specified number of times.		Reset the alarm. → Turn OFF and then ON the power supply to the inverter again. If you have forgotten your password → Set Data Initialization (3008-04 hex) to 1 and initialize the parameters.		None
Attached information	None				
Precautions/Remarks	None				

Event name	Motor Overload Warning		Event code	68460000 hex	
Meaning	The current value reached the overload warning level.				
Source	EtherCAT Master Function Module	Source details	Slave	Detection timing	Continuously
Error attributes	Level	Observation	Recovery	Automatic recovery	Log category System log
Effects	User program	Continues.	Operation	Not affected.	
Indicators	EtherCAT NET RUN		EtherCAT NET ERR		EtherCAT LINK/ACT
	---		---		---
System-defined variables	Variable		Data type		Name
	None		None		None
Cause and correction	Assumed cause		Correction		Prevention
	(1) Motor overload warning		→ Check if the current flow is more than the current value set in 1st Overload Early Warning Detection Level (3005-26 hex), 2nd Overload Warning Detection Level (3005-38 hex), and Overload early warning 2 Level (3005-23 hex).		Set 1st Overload Early Warning Detection Level (3005-26 hex), 2nd Overload Warning Detection Level (3005-38 hex), and Overload early warning 2 Level (3005-23 hex) appropriately.
Attached information	None				
Precautions/Remarks	None				

Event name	Cooling Fin Overheat Warning		Event code	68470000 hex	
Meaning	The cooling fin temperature rose.				
Source	EtherCAT Master Function Module	Source details	Slave	Detection timing	Continuously
Error attributes	Level	Observation	Recovery	Automatic recovery	Log category System log
Effects	User program	Continues.	Operation	Not affected.	
Indicators	EtherCAT NET RUN		EtherCAT NET ERR		EtherCAT LINK/ACT
	---		---		---
System-defined variables	Variable	Data type		Name	
	None	None		None	
Cause and correction	Assumed cause		Correction		Prevention
	(1) The inverter's ambient temperature exceeds the specified range.		Measure the ambient temperature. → Lower the ambient temperature, for example, by improving the ventilation in the panel.		Examine the ambient temperature of the inverter and provide the necessary cooling.
	(2) The cooling air passage is blocked.		Check if the installation space is secured. → Reinstall the inverter in a location where a sufficient installation space can be secured. Check if the fins are clogged. → Clean the fins.		Install the inverter in a location where a sufficient installation space can be secured. Do not use the product in an area surrounded by excessive foreign matter. Also, do not allow foreign matter to enter.
	(3) The flow volume of the cooling fan dropped because it reached the end of life or failed.		Check the cumulative run time of the cooling fan. → Replace the inverter. Visually check if the cooling fan is operating normally. → Replace the inverter.		None
	(4) The load is large.		Measure the output current. → Reduce the load. (Use Cooling Fin Overheat Warning (Terminal [DI] function selection) (3005-02 to 06 hex) and 1st Overload Early Warning Detection Level (3005-26 hex), 2nd Overload Warning Detection Level (3005-38 hex), and Overload early warning 2 Level (3005-23 hex) to reduce the load before overloading occurs.) → Lower the value of Carrier Frequency (3004-1B hex). → Enable the setting of Overload prevention control (3008-47 hex).		Select a motor and an inverter according to the load.
Attached information	None				

Precautions/Remarks	None				
Event name	Life Warning		Event code	68480000 hex	
Meaning	The main circuit capacitor, PCB electrolytic capacitor, or cooling fan reached the end of life.				
Source	EtherCAT Master Function Module	Source details	Slave	Detection timing	Continuously
Error attributes	Level	Observation	Recovery	Automatic recovery	Log category System log
Effects	User program	Continues.	Operation	Not affected.	
Indicators	EtherCAT NET RUN		EtherCAT NET ERR		EtherCAT LINK/ACT
	---		---		---
System-defined variables	Variable	Data type		Name	
	None	None		None	
Cause and correction	Assumed cause		Correction		Prevention
	(1) Life warning		Check the main circuit capacitor, PCB electrolytic capacitor, and cumulative run time of cooling fan. → Replace the inverter.		None
Attached information	None				
Precautions/Remarks	None				

Event name	EtherCAT Communications Error		Event code	28130000 hex	
Meaning	An error occurred in EtherCAT communications.				
Source	EtherCAT Master Function Module	Source details	Slave	Detection timing	Continuously
Error attributes	Level	Observation	Recovery	Error reset	Log category System log
Effects	User program	Continues.	Operation	Not affected.	
Indicators	EtherCAT NET RUN		EtherCAT NET ERR		EtherCAT LINK/ACT
	---		---		---
System-defined variables	Variable	Data type		Name	
	None	None		None	
Cause and correction	Assumed cause	Correction		Prevention	
	(1) An EtherCAT communications cable is disconnected, broken, short-circuited, or has a contact failure in a daisy chain configuration.	Connect the EtherCAT communications cable securely. If the cable is broken, replace it.		Confirm that the EtherCAT communications cable is not broken before use, and connect it securely.	
	(2) In a ring topology configuration, the ring disconnection status occurred or was fixed.	Refer to <i>10-1-8 Method for Ring Disconnection Maintenance and Inspection</i> on page 10-9 and perform inspection.			
	(3) Noise	Take noise countermeasures so that the noise does not affect the EtherCAT communications cable.		Take noise countermeasures so that the noise does not affect the EtherCAT communications cable. Adjust the set value of Communications Error Setting (2200-00 hex).	
	(4) Failure in the EtherCAT physical layer of an inverter	If this event occurs again after you performed all corrections shown above, replace the inverter.		None	
Attached information	None				
Precautions/Remarks	None				

Event name	Analog Input Reference Command Loss Detected		Event code	28140000 hex	
Meaning	The frequency reference by analog input was rapidly reduced to 10% or less.				
Source	EtherCAT Master Function Module	Source details	Slave	Detection timing	Continuously
Error attributes	Level	Observation	Recovery	Automatic recovery	Log category System log
Effects	User program	Continues.	Operation	Not affected.	
Indicators	EtherCAT NET RUN		EtherCAT NET ERR		EtherCAT LINK/ACT
	---		---		---
System-defined variables	Variable		Data type		Name
	None		None		None
Cause and correction	Assumed cause		Correction		Prevention
	(1) Reference command loss detected		Check the wiring of analog input terminals. → Perform the wiring correctly.		Wire the analog input terminals appropriately.
Attached information	None				
Precautions/Remarks	None				

Event name	PID Warning Output		Event code	68490000 hex	
Meaning	A warning (absolute value warning, deviation warning) occurred in PID control.				
Source	EtherCAT Master Function Module	Source details	Slave	Detection timing	Continuously
Error attributes	Level	Observation	Recovery	Automatic recovery	Log category System log
Effects	User program	Continues.	Operation	Not affected.	
Indicators	EtherCAT NET RUN		EtherCAT NET ERR		EtherCAT LINK/ACT
	---		---		---
System-defined variables	Variable		Data type		Name
	None		None		None
Cause and correction	Assumed cause		Correction		Prevention
	(1) PID warning output		Check if the values of PID control Upper limit of warning (AH) (300E-0D hex) and PID control Lower limit of warning (AL) (300E-0E hex) are within the acceptable range for the feedback amount. → Change the settings of PID control Upper limit of warning (AH) (300E-0D hex) and PID control Lower limit of warning (AL) (300E-0E hex) to the correct values.		Set PID control Upper limit of warning (AH) (300E-0D hex) and PID control Lower limit of warning (AL) (300E-0E hex) appropriately.
Attached information	None				
Precautions/Remarks	None				

Event name	Low Torque Detected		Event code	684A0000 hex	
Meaning	The output torque remained below the detection level for more than the detection time.				
Source	EtherCAT Master Function Module		Source details	Slave	Detection timing Continuously
Error attributes	Level	Observation	Recovery	Automatic recovery	Log category System log
Effects	User program	Continues.	Operation	Not affected.	
Indicators	EtherCAT NET RUN		EtherCAT NET ERR		EtherCAT LINK/ACT
	---		---		---
System-defined variables	Variable		Data type		Name
	None		None		None
Cause and correction	Assumed cause		Correction		Prevention
	(1) Low torque detected		→ Check if the settings are appropriate for the motor. → Perform auto-tuning. → Check if the frequency reference is not less than the slip frequency of the motor.		Set the motor constant parameters according to the motor characteristics and perform auto-tuning.
Attached information	None				
Precautions/Remarks	None				

Event name	Motor Run Time Over		Event code	684B0000 hex	
Meaning	The cumulative run time of the motor reached the set time for maintenance.				
Source	EtherCAT Master Function Module		Source details	Slave	Detection timing Continuously
Error attributes	Level	Observation	Recovery	Automatic recovery	Log category System log
Effects	User program	Continues.	Operation	Not affected.	
Indicators	EtherCAT NET RUN		EtherCAT NET ERR		EtherCAT LINK/ACT
	---		---		---
System-defined variables	Variable		Data type		Name
	None		None		None
Cause and correction	Assumed cause		Correction		Prevention
	(1) Motor run time over		Check the cumulative run time in 1st cumulative motor run time (3008-5F hex). → After maintenance, reset the value of 1st cumulative motor run time (3008-5F hex) to 0.		None
Attached information	None				
Precautions/Remarks	None				

Event name	Number of Startups Over		Event code	684C0000 hex	
Meaning	The cumulative number of startups of the motor reached the set count for maintenance.				
Source	EtherCAT Master Function Module	Source details	Slave	Detection timing	Continuously
Error attributes	Level	Observation	Recovery	Automatic recovery	Log category System log
Effects	User program	Continues.	Operation	Not affected.	
Indicators	EtherCAT NET RUN		EtherCAT NET ERR		EtherCAT LINK/ACT
	---		---		---
System-defined variables	Variable		Data type		Name
	None		None		None
Cause and correction	Assumed cause		Correction		Prevention
	(1) Number of Startups Over		Check the cumulative startup count in 1st Startup count for motor (3008-2D hex). → After maintenance, reset the value of 1st Startup count for motor (3008-2D hex) to 0.		None
Attached information	None				
Precautions/Remarks	None				

Event name	PTC Thermistor Error		Event code	684D00000 hex	
Meaning	The PTC thermistor detected a temperature not less than the set temperature.				
Source	EtherCAT Master Function Module	Source details	Slave	Detection timing	Continuously
Error attributes	Level	Observation	Recovery	Error reset	Log category System log
Effects	User program	Continues.	Operation	Not affected.	
Indicators	EtherCAT NET RUN		EtherCAT NET ERR		EtherCAT LINK/ACT
	---		---		---
System-defined variables	Variable	Data type		Name	
	None	None		None	
Cause and correction	Assumed cause	Correction		Prevention	
	(1) The motor's ambient temperature exceeds the specified range.	Measure the ambient temperature. → Lower the ambient temperature.		Check the ambient temperature of the motor and set up the necessary cooling conditions.	
	(2) The motor's cooling system failed.	Check if the motor's cooling system is operating normally. → Repair or replace the motor's cooling system.		None	
	(3) The load is large.	Measure the output current. → Reduce the load. (Use 1st Overload Early Warning Detection Level (3005-26 hex), 2nd Overload Warning Detection Level (3005-38 hex), and Overload early warning 2 Level (OL2) (3005-23 hex) to reduce the load before overloading occurs. In winter, the load may become larger.) → Lower the ambient temperature. → Increase the value of Carrier Frequency (3004-1B hex).		Select a motor and an inverter according to the load.	
	(4) The value of 1st Thermistor Error Detection Level (3008-1C hex) is not appropriate.	Check the specifications of the PTC thermistor and recalculate the detection voltage. → Change the parameter data.		Set the value of 1st Thermistor Error Detection Level (3008-1C hex) appropriately.	
	(5) The PTC thermistor settings are not appropriate.	Check the value of Thermistor Function Selection (MOH) (3008-1B hex). → Change the setting of Thermistor Function Selection (MOH) (3008-1B hex) to an appropriate value for the thermistor.		Set the PTC thermistor setting appropriately.	

	(6) The value of 1st Manual Torque Boost Voltage (3004-0A hex) is too high.	Check and readjust the value of 1st Manual Torque Boost Voltage (3004-0A hex) so that lowering the value does not cause a stall. → Adjust the value of 1st Manual Torque Boost Voltage (3004-0A hex).	Set the value of 1st Manual Torque Boost Voltage (3004-0A hex) appropriately.
	(7) The V/f settings are incorrect.	Check that the 1st Base Frequency (3004-05 hex) and 1st Rated Voltage at Base Frequency (3004-06 hex) match the values on the motor rating nameplate. → Match the data to the value on the motor rating nameplate.	Configure the V/f settings appropriately.
	(8) There is an incorrect parameter setting.	The function of Thermistor Function Selection (MOH) (3008-1B hex) is enabled even though the PTC thermistor is not used. → Change the setting of Thermistor Function Selection (MOH) (3008-1B hex) to 0 (Disable).	Set the value of Thermistor Function Selection (MOH) (3008-1B hex) appropriately.
Attached information	None		
Precautions/Remarks	None		

Event name	Communication Timeout with Sysmac Studio		Event code	96530000 hex	
Meaning	A communication timeout occurred in the connection between Sysmac Studio and the Safety CPU Unit.				
Source	EtherCAT Master Function Module		Source details	Slave	Detection timing Continuously
Error attributes	Level	Information	Recovery	---	Log category System log
Effects	User program	Continues.	Operation	Not affected.	
Indicators	EtherCAT NET RUN		EtherCAT NET ERR		EtherCAT LINK/ACT
	---		---		---
System-defined variables	Variable		Data type		Name
	None		None		None
Cause and correction	Assumed cause		Correction		Prevention
	(1) A communications cable is broken.		Do not interrupt the communications with Sysmac Studio while the Safety CPU Unit is operating in DEBUG mode.		Perform debugging according to the corrections that are given on the left.
Attached information	None				
Precautions/Remarks	None				

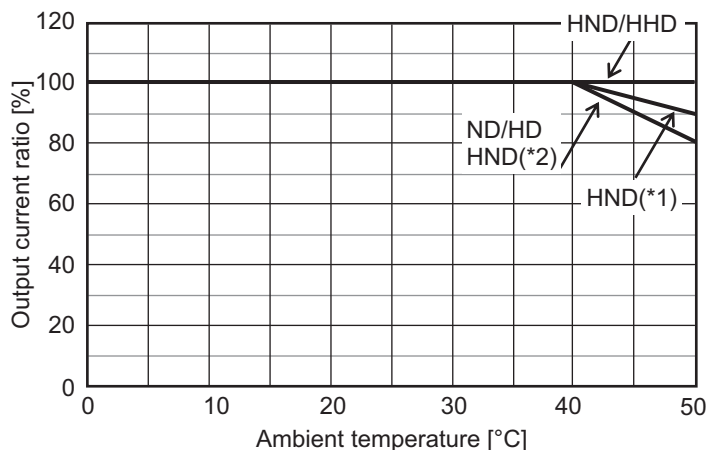
A-6 Communications Response Time

The table below lists the communications response time.

Meaning		Performance	Condition
Starting time		Approx. 5 to 15 ms	Time from when the inverter receives a PDO until it outputs a command
Data transmitting time	Write	Approx. 1.7 to 3.1 ms/pc	Time from when the inverter receives an SDO until it writes/reads parameters
	Read	Approx. 2.9 to 5.1 ms/pc	

A-7 Derating Table

If you intend to use the inverter models with HND/HD/ND modes at the temperature of 40°C or higher, derating is required. Refer to the following output current derating depending on ambient temperature.

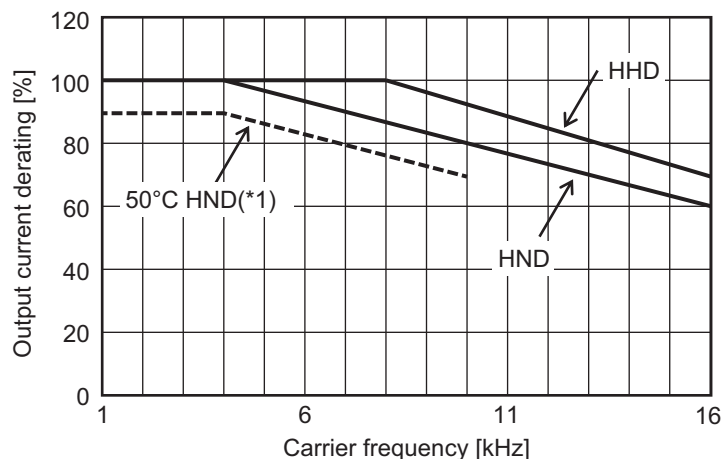


- *1. If using the 3G3M1-A2022/A2037/A4022/A4040-ECT at 50°C, refer to the following *When Changing the Carrier Frequency for Use* on page A-287.
- *2. If using the 3G3M1-A4022/AB004/AB007/AB015/AB022-ECT at 50°C, refer to the following *When Changing the Carrier Frequency for Use* on page A-287.

When Changing the Carrier Frequency for Use

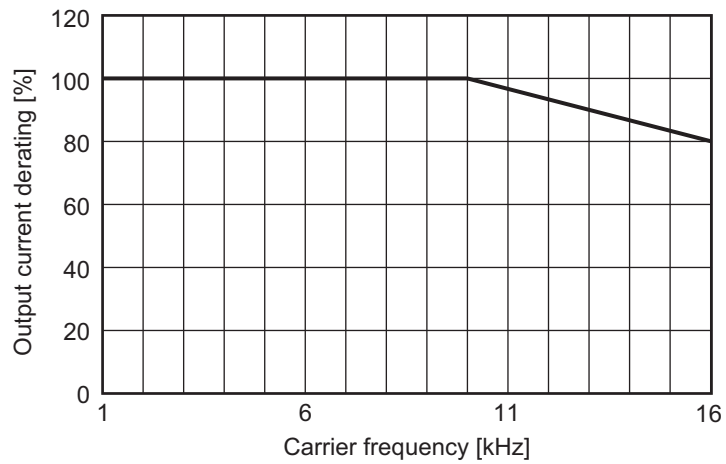
Refer to the following for derating output current when the carrier frequency is changed from the factory default. However, when using it side-by-side, the following derating is used in an ambient temperature of 40°C for HHD/HND and in an ambient temperature of 30°C for HD/ND.

● 3G3M1-A2001/A2002/A2004/A2007/A2015/A2022/A2037-ECT

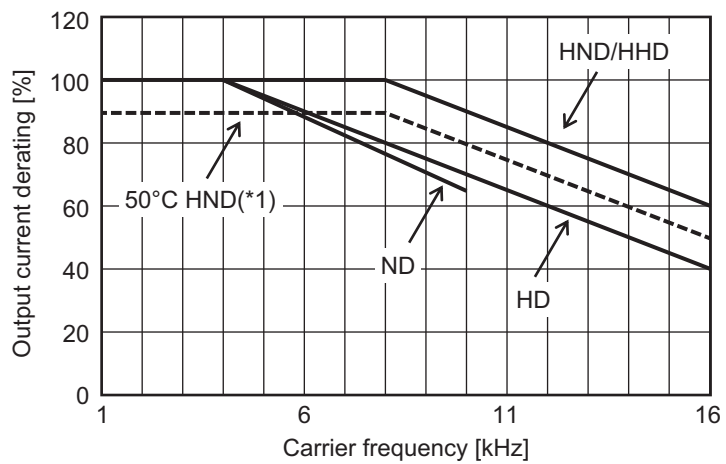


*1. When using 3G3M1-A2022/A2037-ECT at 50°C.

● 3G3M1-A2055/A2075/A2110/A2150/A2185-ECT

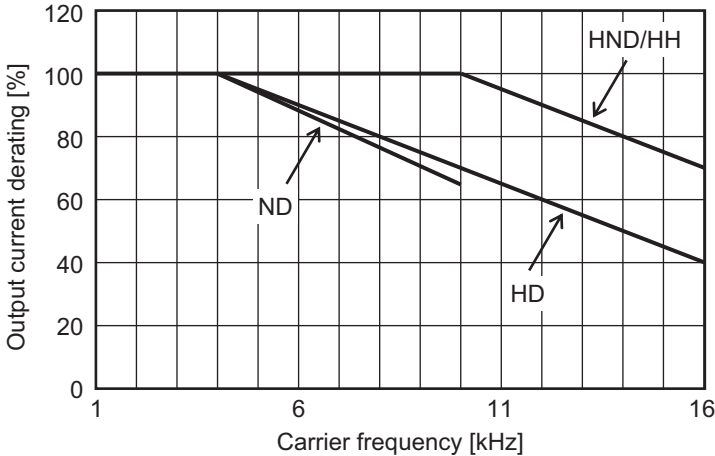


● 3G3M1-A4004/A4007/A4015/A4030/A4040/AB037-ECT

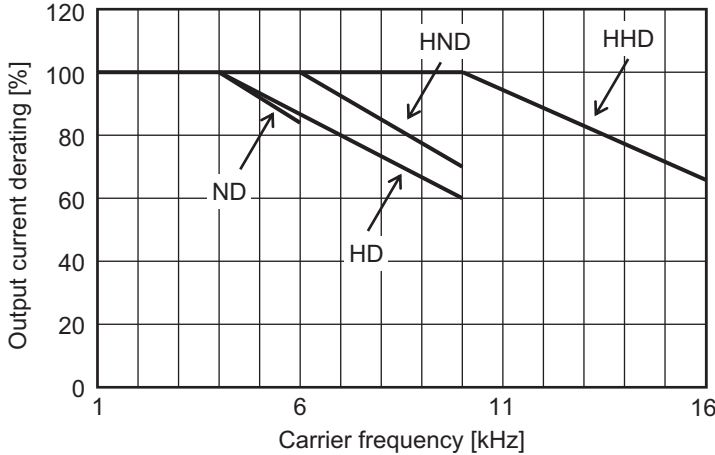


*1. When using 3G3M1-A4040-ECT at 50°C.

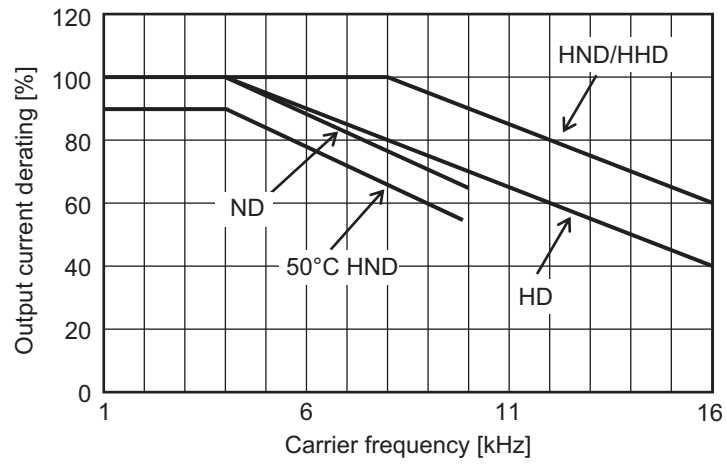
● 3G3M1-A4055/A4075/A4110/A4150/A4185-ECT



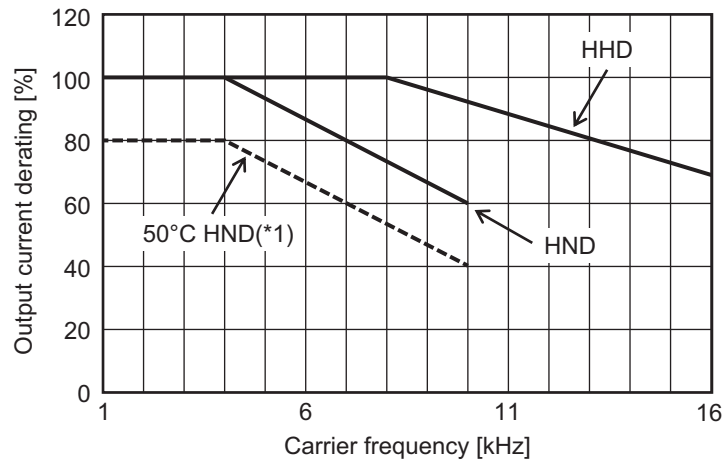
● 3G3M1-A4220-ECT



● 3G3M1-A4022-ECT

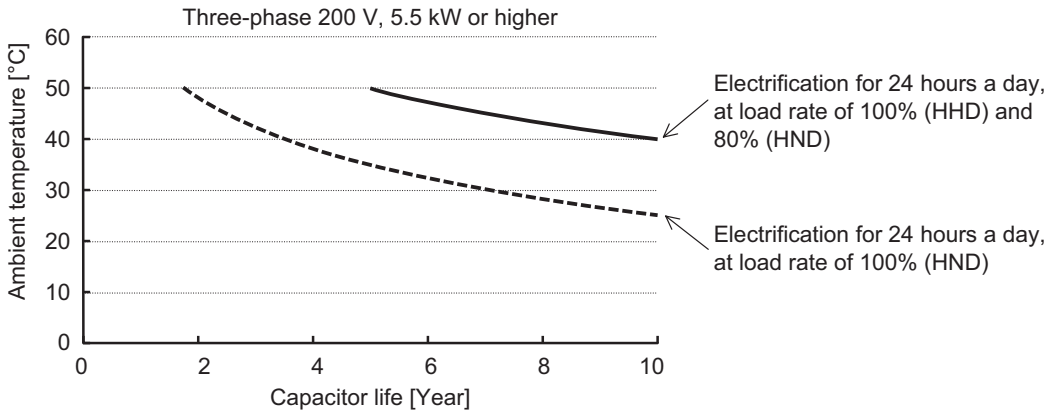
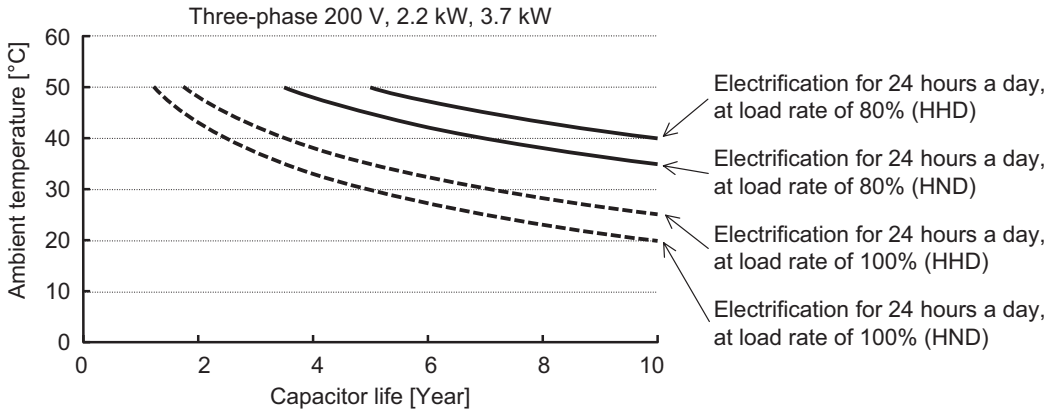
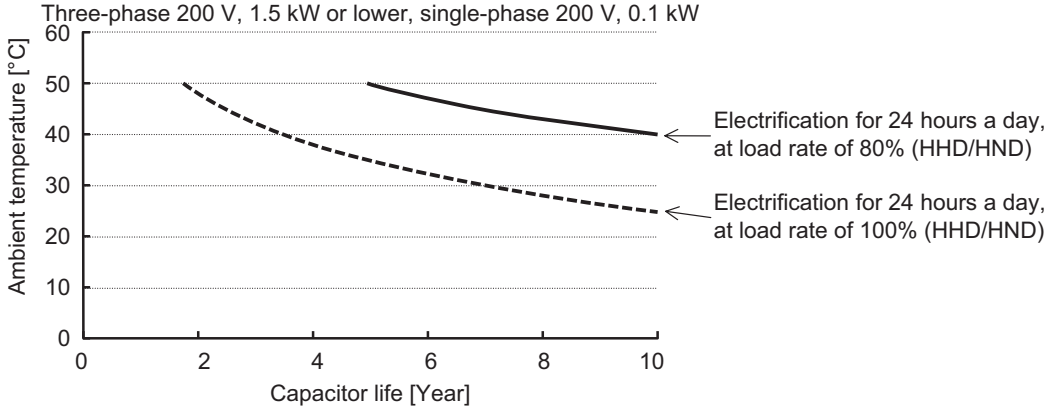


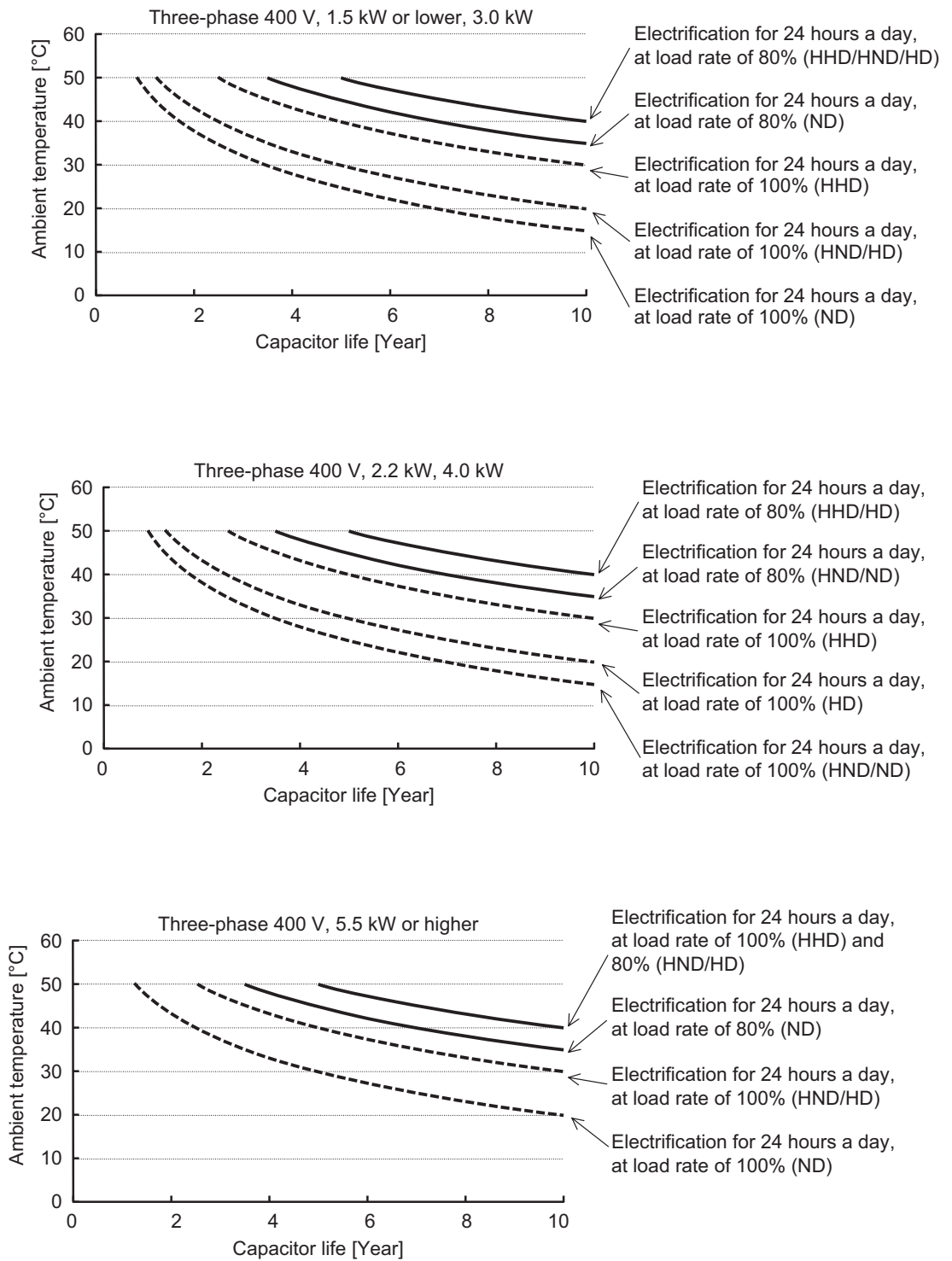
● 3G3M1-AB001/AB002/AB004/AB007/AB015/AB022-ECT

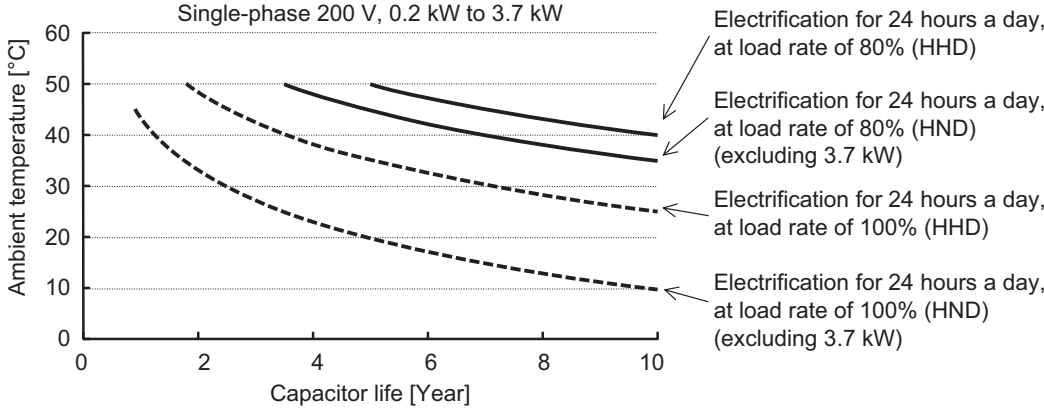


*1. When using 3G3M1-AB004/AB007/AB015/AB022-ECT at 50°C.

A-8 Smoothing Capacitor Life Curve







- Note 1.** “Ambient temperature” refers to the temperature measured at a distance of approximately 1 cm from the bottom center of the inverter (atmospheric temperature). It refers to an interior temperature if the inverter is stored in a cabinet.
- Note 2.** The smoothing capacitor has a limited life because it is subjected to chemical reaction inside the part and, as a guide, the inverter needs to be replaced once a decade approximately. (This period is an expected design life, and not the guaranteed value.) However, if the inverter is used at a high ambient temperature or in a heavy loaded environment, such as at the over-rated current, its life will be significantly shortened.



A-9 Life Alarm Output

The inverter can output an alarm by the self-diagnostic function when the service life of each consumable part incorporated in the inverter (main circuit capacitor, cooling fan, PC board electrolytic capacitor) comes close to the end. Use this as a guide to know the time for the parts replacement.

Note that this alarm is output by the self-diagnosis based on the expected design life (not guaranteed value). It has a margin of error depending on your environment or operation conditions.

For details, refer to *8-8-10 Capacitor Life Warning Signal (WAC)* on page 8-85, *8-8-13 Cooling Fan Life Warning Signal (WAF)* on page 8-88, and *8-8-14 Life Alarm (LIFE)* on page 8-88.

A-10 Overview of Inverter Selection

A-10-1 Motor Capacity Selection

Before selecting an inverter, first the motor should be chosen. In selecting the motor, calculate the load inertia appropriate to the application, and then calculate the required capacity and torque.

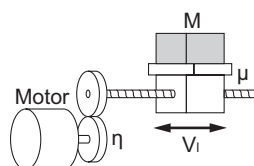
Simplified Selection Method (Required Output Calculation)

This method of calculation helps you select a motor by calculating the output (kW) required by the motor to maintain its steady rotations. To use this method for motor selection, make allowance for the calculated result because it does not include acceleration/deceleration and other transient state calculations. The simplified selection method is suitable for fan, conveyor, mixer and other applications where a constant state continues for a while.

Note The simplified selection method cannot be used for the following applications. For these applications, use the detailed selection method.

- Those requiring rapid startup (acceleration).
- Those that frequently repeat run and stop.
- Those that have a large inertia at the power transfer part.
- Those that have an inefficient power transfer part.

● For linear motion: Steady power P_0 [kW]



$$P_0 \text{ [kW]} = \frac{\mu \cdot Mg \cdot V_l}{60 \cdot \eta} \times 10^{-3}$$

μ : Friction coefficient

M : Mass of linear motion part [kg]

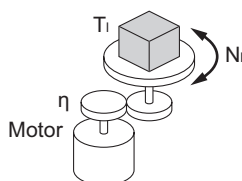
g : Acceleration of gravity ($g \approx 9.8$ [m/s²])

V_l : Speed of linear motion part [m/min]

η : Efficiency of transfer part ($\eta \leq 1$)

Note The same calculating formula is applicable to belt conveyors.

● For rotation motion: Steady power P_0 [kW]



$$P_0 \text{ [kW]} = \frac{2\pi \cdot T_l \cdot N_l}{60 \cdot \eta} \times 10^{-3}$$

T_l : Load torque (Load shaft) [N·m]

N_l : Rotation speed of load shaft [r/min]

η : Efficiency of transfer part ($\eta \leq 1$)

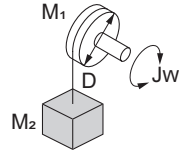
Detailed Selection Method (RMS Calculation)

This method helps you select a motor by calculating the effective torque and maximum torque values required to achieve a certain pattern of operation for the application. It selects a motor that is optimal for a particular operation pattern.

● **Calculation of load inertia and motor-shaft conversion inertia**

Depending on the type of the motor transfer system, calculate the inertia for all parts and convert it into the motor-shaft inertia.

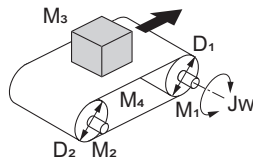
- Example in hoist application



$$J_w \text{ [kg}\cdot\text{m}^2] = J_1 + J_2 = \left(\frac{M_1 \cdot D^2}{8} + \frac{M_2 \cdot D^2}{4} \right) \times 10^{-6}$$

J_w : Shaft conversion inertia [kg·m²]
 J_1 : Inertia of cylinder (Shaft conversion) [kg·m²]
 J_2 : Inertia of workpiece (Shaft conversion) [kg·m²]
 M_1 : Mass of cylinder [kg]
 M_2 : Mass of workpiece [kg]
 D : Diameter of cylinder [mm]

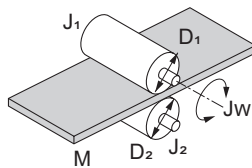
- Example in conveyor application



$$J_w \text{ [kg}\cdot\text{m}^2] = J_1 + J_2 + J_3 + J_4 = \left(\frac{M_1 \cdot D_1^2}{8} + \frac{M_2 \cdot D_2^2}{8} \cdot \frac{D_1^2}{D_2^2} + \frac{M_3 \cdot D_1^2}{4} + \frac{M_4 \cdot D_1^2}{4} \right) \times 10^{-6}$$

J_w : Shaft conversion inertia (Cylinder-1-shaft conversion) [kg·m²]
 J_1 : Inertia of cylinder 1 (Cylinder-1-shaft conversion) [kg·m²]
 J_2 : Inertia of cylinder 2 (Cylinder-1-shaft conversion) [kg·m²]
 J_3 : Inertia of workpiece (Cylinder-1-shaft conversion) [kg·m²]
 J_4 : Inertia of belt (Cylinder-1-shaft conversion) [kg·m²]
 M_1 : Mass of cylinder 1 [kg]
 M_2 : Mass of cylinder 2 [kg]
 M_3 : Mass of workpiece [kg]
 M_4 : Mass of belt [kg]
 D_1 : Diameter of cylinder 1 [mm]
 D_2 : Diameter of cylinder 2 [mm]

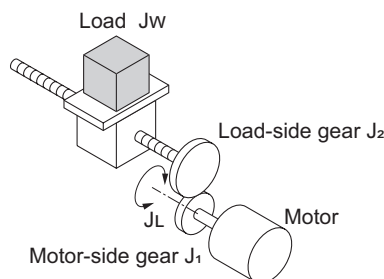
- Example in roller application



$$J_w \text{ [kg}\cdot\text{m}^2] = J_1 + \left(\frac{D_1^2}{D_2^2} \right) J_2 + \frac{M \cdot D_1^2}{4} \times 10^{-6}$$

J_w : Shaft conversion inertia (Roller-1-shaft conversion) [kg·m²]
 J_1 : Inertia of roller 1 (Roller-1-shaft conversion) [kg·m²]
 J_2 : Inertia of roller 2 (Roller-2-shaft conversion) [kg·m²]
 M : Mass of workpiece [kg]
 D_1 : Diameter of roller 1 [mm]
 D_2 : Diameter of roller 2 [mm]

- Example of conversion into motor-shaft inertia



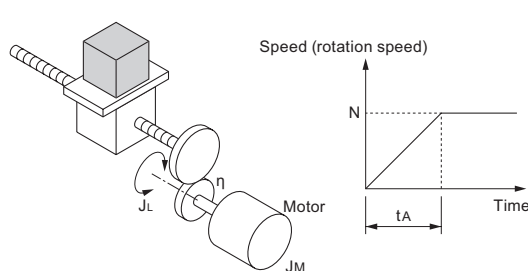
$$J_L \text{ [kg}\cdot\text{m}^2] = J_1 + G^2 (J_2 + J_w)$$

J_L : Motor-shaft conversion inertia [kg·m²]
 J_w : Load inertia (Load-side gear-shaft conversion) [kg·m²]
 J_1 : Inertia of motor-side gear [kg·m²]
 J_2 : Inertia of load-side gear [kg·m²]
 Z_1 : Number of motor-side gear teeth
 Z_2 : Number of load-side gear teeth
 G : Gear ratio (Speed reduction ratio) = Z_1 / Z_2

● **Calculation of motor-shaft conversion torque and effective torque**

Calculate the acceleration torque from the motor-shaft conversion load inertia, the motor-rotor inertia and the acceleration. Then, calculate the load torque from the external force (gravity and tension) and friction force applied to the load. Finally, combine these calculation results to calculate the torque required for the motor.

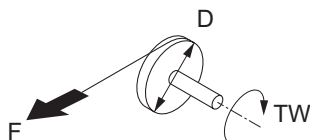
- Calculation of acceleration torque (T_A)



$$T_A[\text{N}\cdot\text{m}] = \frac{2\pi \cdot N}{60 \cdot t_A} \left(J_M + \frac{J_L}{\eta} \right)$$

T_A : Acceleration torque [N·m]
 J_L : Motor-shaft conversion load inertia [kg·m²]
 J_M : Motor-rotor inertia [kg·m²]
 η : Efficiency of transfer part ($\eta \leq 1$)
 t_A : Acceleration time [s]
 N : Motor rotation speed [r/min]

- Calculation of motor-shaft conversion load torque (T_L)



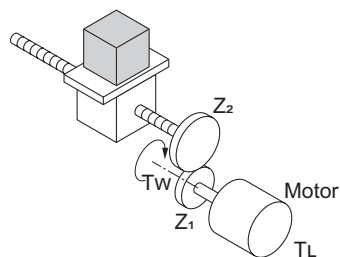
$$T_W[\text{N}\cdot\text{m}] = F \cdot \frac{D}{2} \times 10^{-3}$$

T_W : Load torque (Load-shaft conversion) [N·m]
 F : External force [N]
 D : Diameter of cylinder [mm]

(Generally, the friction force can be calculated as below:)

$$F = \mu Mg$$

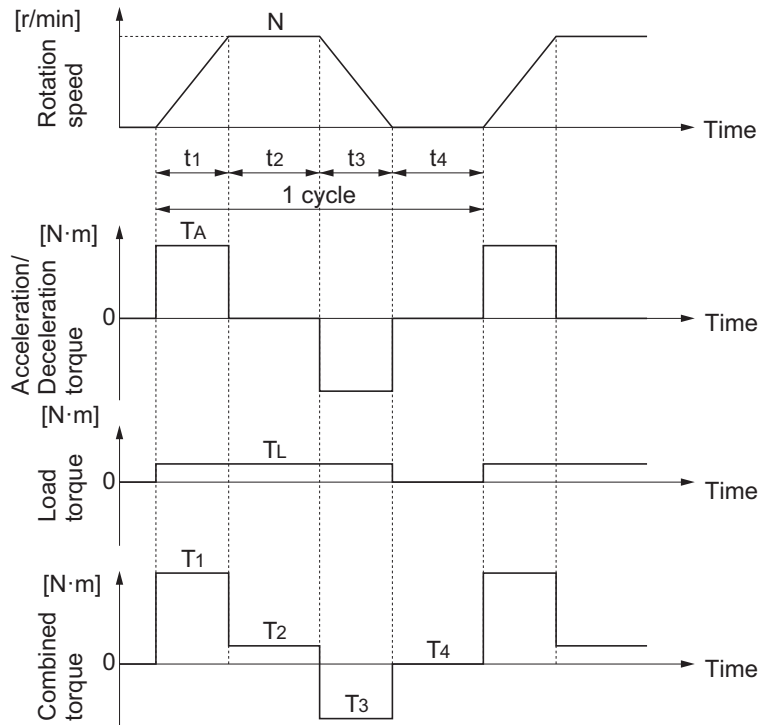
μ : Coefficient of friction
 M : Mass of motion part [kg]
 g : Acceleration of gravity ($g \approx 9.8$ [m/s²])



$$T_L[\text{N}\cdot\text{m}] = T_W \cdot \frac{G}{\eta}$$

T_L : Motor-shaft conversion load torque [N·m]
 T_W : Load torque (Load-shaft conversion) [N·m]
 Z_1 : Number of motor-side gear teeth
 Z_2 : Number of load-side gear teeth
 G : Gear ratio (Speed reduction ratio) = Z_1 / Z_2

- Calculation of combined torque and effective torque



- Effective torque T_{RMS} [N·m]

$$= \sqrt{\frac{\sum(T_i^2 \cdot t_i)}{\sum t_i}}$$

$$= \sqrt{\frac{T_1^2 \cdot t_1 + T_2^2 \cdot t_2 + T_3^2 \cdot t_3 + T_4^2 \cdot t_4}{t_1 + t_2 + t_3 + t_4}}$$

- Maximum torque T_{MAX} [N · m] = $T_1 = T_A + T_L$

● **Motor selection**

Based on the above calculation results, select the motor capacity by using the following formulae. Select the larger of the two calculated values as the motor capacity. Also, when selecting a motor, take into consideration the errors in calculation and modeling. Select a motor whose capacity is at least approximately 20% larger.

- Motor capacity conversion to effective torque

$$\text{Motor capacity [kW]} = \frac{2\pi \cdot T_{RMS} \cdot N}{60} \times 10^{-3} \quad N : \text{Maximum rotation speed [r/min]}$$

- Motor capacity required for maximum torque output

$$\text{Motor capacity [kW]} = \frac{2\pi \cdot T_{MAX} \cdot N}{60 \times 1.5} \times 10^{-3} \quad N : \text{Maximum rotation speed [r/min]}$$

Note The above calculation formulae assume that the maximum motor torque is 150% of the rated torque.

A-10-2 Inverter Capacity Selection

Select an inverter that can be used with the motor you selected based on the result of motor capacity selection.

Basically, select an inverter which fits the maximum applicable motor capacity of the selected motor. After selecting an inverter, check if it meets both of the following conditions. If not, select an inverter with one size larger in capacity and check again.

Rated motor current \leq Rated output current of inverter

Max. continuous torque output time for application \leq 1 min

Note 1. In the light load mode, the overload capacity of the inverter is 150% of the rated torque for 5 seconds. Use the 5-seconds rating when determining the maximum continuous torque.

Note 2. If you want to use 0 Hz sensorless vector control, need a holding torque at a rotation speed of 0 (r/min), or frequently require 150% of the rated torque or more, use an inverter with one size larger in capacity than the one selected by the above method.

A

A-10-3 Overview of Braking Resistor Selection

Requirement of Braking Resistor

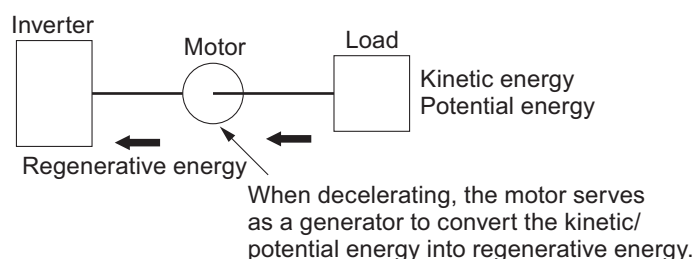
If the regenerative energy generated in deceleration or descent in an application is too large, the main circuit voltage in the inverter may increase, which results in damage to the inverter.

Normally, the inverter has a built-in overvoltage protection function, which detects an overvoltage (0 V) in the main circuit to prevent inverter damage. However, because it detects a fault to stop the motor, stable and continuous operation will be prevented.

Therefore, you need to use one or more braking resistors/regenerative braking units to absorb this regenerative energy outside the inverter.

● What is regenerative energy?

The load connected to a motor has kinetic energy when rotating, and potential energy when it is subject to the gravity. When the motor decelerates, or when the load descends, the energy is fed back to an inverter. This phenomenon is known as regeneration, and the energy is called regenerative energy.



● Preventing an overvoltage (0 V) in the main circuit without use of braking resistors

The following are methods to prevent the occurrence of an overvoltage (0 V) in the main circuit without connection of braking resistors.

Since these methods prolong the deceleration time, check that the selected method will not cause application problems.

- Enable the overvoltage suppression function during deceleration
The overvoltage suppression function during deceleration is enabled by default.

It automatically increases the deceleration time to prevent the occurrence of an overvoltage in the main circuit.

- Set a longer deceleration time

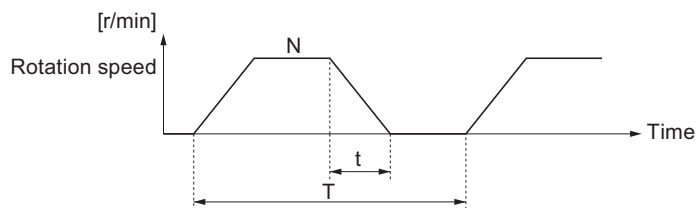
Increase the deceleration time to prevent the occurrence of an overvoltage in the main circuit. This decreases the amount of regenerative energy per unit time.

- Select free-run stop

This prevents the regenerative energy from being fed back to the inverter.

Simplified Braking Resistor Selection

This is a simple method to select an appropriate braking resistor based on the percentage of the time in which regenerative energy is produced in a normal operation pattern.



$$\text{Usage rate [\%ED]} = 100 \times t / T$$

t : Deceleration time (regenerative time) [s]
 T : 1cycle operation time [s]

All models of the 3G3M1 Series Inverter have built-in regenerative braking circuit.

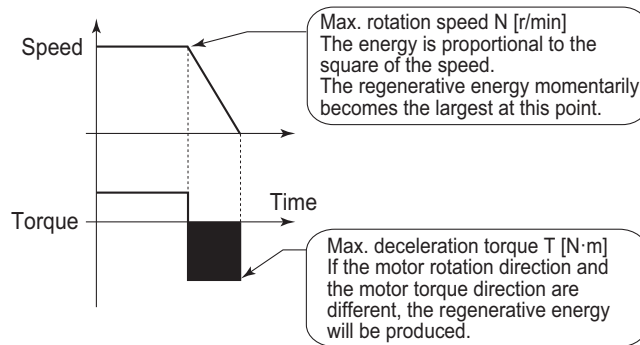
Select a braking resistor based on the usage rate calculated from the operation pattern.

Connect a braking resistor suitable for your inverter according to the braking resistor list provided in the inverter manual/catalog.

Detailed Braking Resistor Selection

When the usage rate of the braking resistor selected on the previous section exceeds 10% ED, or when an extremely large braking torque is required, use the method below to calculate a regenerative energy and make your selection.

● Calculation of Required Braking Resistance



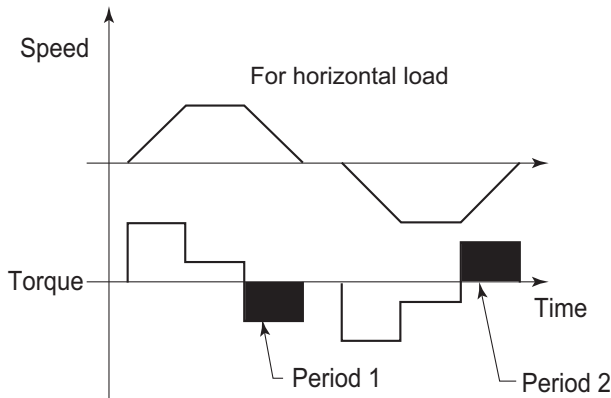
$$\text{Resistance of braking resistor : } R \leq \frac{60 \times V^2}{2\pi \cdot (T - 0.2 \times T_m) \cdot N}$$

- V : 200-V class inverter 362.5 [V]
400-V class inverter 725 [V]
- T : Maximum braking torque [N·m]
- T_m : Motor rating torque [N·m]
- N : Maximum rotation speed [r/min]

Note Calculate a braking torque according to Inverter Capacity Selection in the Motor Capacity Selection section.

● Calculation of average regenerative energy

Regenerative energy is produced when the motor rotation and the torque are opposite in direction. Use the following formula to calculate the regenerative energy for each period in a cycle.



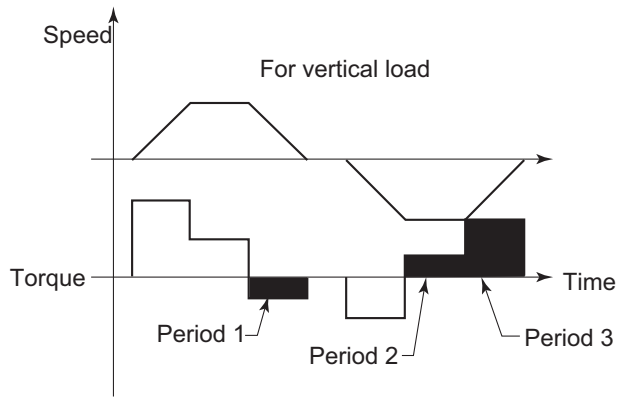
$$P_i = N \times T \times t \times 1.047 \times 10^{-1}$$

P_i : Regenerative energy in Period i [J]
N : Motor rotation speed [r/min]
When the number of rotations changes, take an average value.

ex. For linear deceleration
(N_{max}+N_{min})/2

T : Deceleration torque [N·m]
t : Deceleration time [s]

For the average regenerative energy, calculate the time average by adding the regenerative energy for all periods in a cycle and dividing it by the cycle time, as shown below.



$$\text{Average regenerative energy [W]} = \frac{(P1+P2 \dots +Pi)[J]}{1 \text{ cycle time [s]}}$$

Note 1. For Speed, the forward rotation direction is indicated as positive. For Torque, the torque in the forward rotation direction is indicated as positive.

Note 2. Calculate a braking torque according to Inverter Capacity Selection in the Motor Capacity Selection section.

● Braking Resistor Selection

Select a braking resistor from the required braking resistance and the average regenerative energy obtained in this calculation.

- Required braking resistance \geq Resistance of braking resistor \geq Min. connection resistance of inverter
- Average regenerative energy \leq Resistance capacity of braking resistor

Note 1. Connecting a braking resistor whose resistance is less than the minimum connection resistance value of the inverter results in damage to the internal braking transistor. If the required braking resistance is less than the minimum connection resistance, change the inverter to one having a larger capacity and ensure that the required braking resistance is not less than the minimum connection resistance.

Note 2. Make allowance for the resistance capacity of the braking resistor. Otherwise, it may be overheated. Select a braking resistor whose capacity is at least 20% larger than the calculated value.

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