Inverter

Multi-function Compact Inveter

MX2 Series Type V1

User's Manual

3G3MX2-A□□□□-V1

I585-E1-05

NOTE

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Introduction

Thank you for purchasing the Multi-function Compact Inverter (Model: 3G3MX2-☐-V1).

This manual describes the installation and wiring methods of the 3G3MX2-V1 Series Inverter, and parameter setting methods which are required for the operation, as well as troubleshooting and inspection methods.

Intended Readers

This manual is intended for the following personnel, who must also have knowledge of electrical systems (an electrical engineer or the equivalent).

- 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 (Model: 3G3MX2-☐-V1).

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

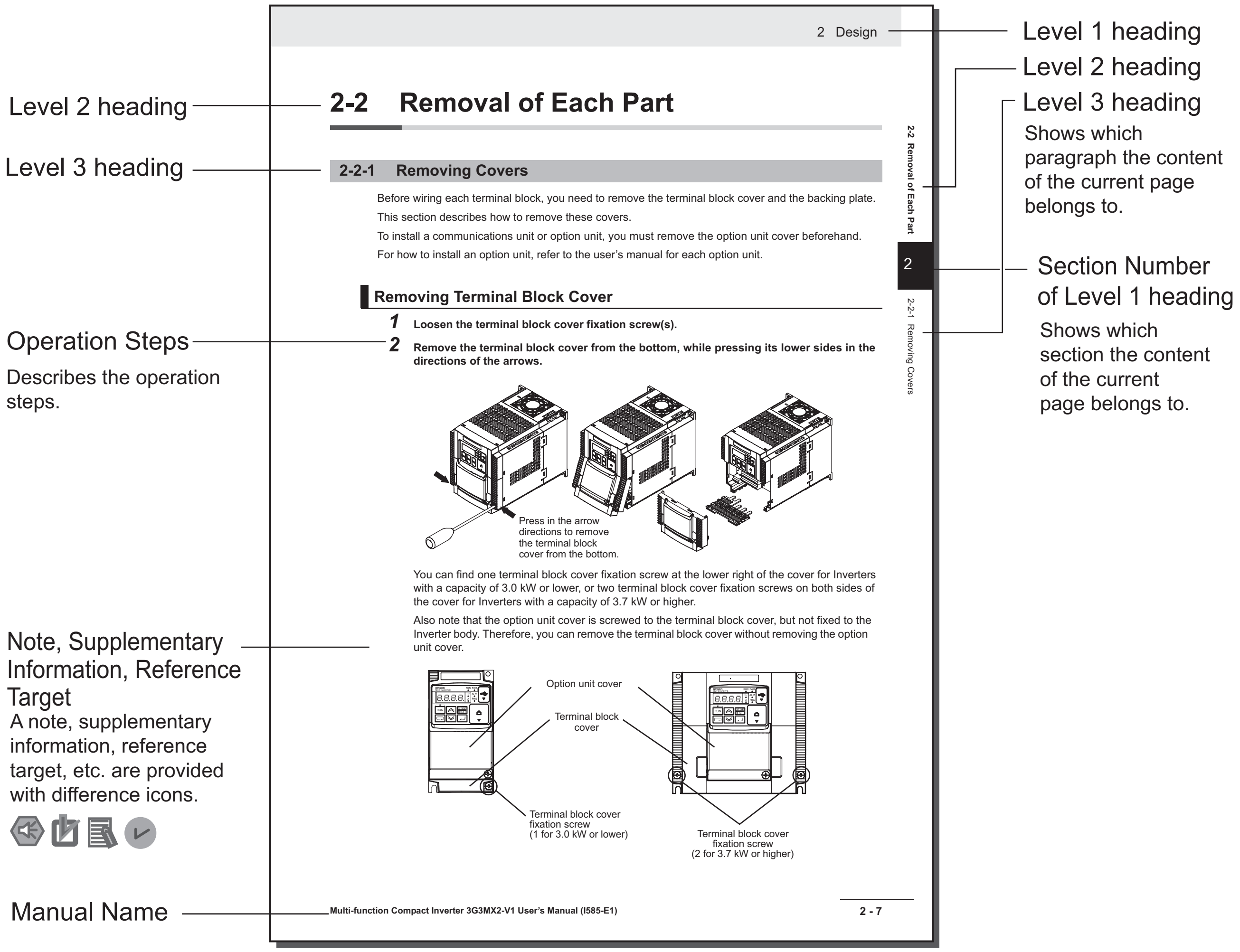
This manual is compiled section by section for user's convenience as follows.

Section	Overview
Section 1 Overview	This section provides an overview of the 3G3MX2-V1 Series features, standard specifications, and external dimensions by inverter capacity. It also shows the differences of this inverter from the conventional inverter for those who use the previous model.
Section 2 Design	This section describes the installation environment and wiring methods.
Section 3 Operation and Test Run	This section describes the part names and key operation of the Digital Operator, and the operation method of this product as well as the test run procedure.
Section 4 Parameter List	This section provides the parameter lists that show monitor functions and available parameters for this inverter.
Section 5 Basic Settings	This section describes the basic functions such as the Run command.
Section 6 Vector Control and Applied Functions	This section describes the vector control and applied functions characteristic of this inverter.
Section 7 Other Functions	This section describes the details of functions not described in *Section 5* or *Section 6*.
Section 8 Communications Functions	This section describes the general-purpose serial communications functions (Modbus communication).
Section 9 Overview of DriveProgramming	This section provides the features of the DriveProgramming.
Section 10 Troubleshooting	This section describes how to analyze the cause and take countermeasures if the inverter fails, and provides troubleshooting for possible troubles.
Section 11 Maintenance and Inspection	This section describes the maintenance and periodical inspection items.
Section 12 Options	This section describes the specifications and external dimension of optional equipment.
Appendices	This section provides information on derating, capacitor life curve, compliance with the UL/cUL Standards, and inverter selection.

Manual Structure

Page Structure and Symbol Icons

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



2 Design

2-2 Removal of Each Part

2-2-1 Removing Covers

Before wiring each terminal block, you need to remove the terminal block cover and the backing plate.
This section describes how to remove these covers.
To install a communications unit or option unit, you must remove the option unit cover beforehand.
For how to install an option unit, refer to the user's manual for each option unit.

Removing Terminal Block Cover

1 **Loosen the terminal block cover fixation screw(s).**

2 **Remove the terminal block cover from the bottom, while pressing its lower sides in the directions of the arrows.**

You can find one terminal block cover fixation screw at the lower right of the cover for Inverters with a capacity of 3.0 kW or lower, or two terminal block cover fixation screws on both sides of the cover for Inverters with a capacity of 3.7 kW or higher.

Also note that the option unit cover is screwed to the terminal block cover, but not fixed to the Inverter body. Therefore, you can remove the terminal block cover without removing the option unit cover.

Multi-function Compact Inverter 3G3MX2-V1 User's Manual (I585-E1) 2 - 7

2-2 Removal of Each Part
2
2-2-1 Removing Covers
Press in the arrow directions to remove the terminal block cover from the bottom.
Option unit cover
Terminal block cover
Terminal block cover fixation screw (1 for 3.0 kW or lower)
Terminal block cover fixation screw (2 for 3.7 kW or higher)
Level 1 heading
Level 2 heading
Level 3 heading
Shows which paragraph the content of the current page belongs to.
Section Number of Level 1 heading
Shows which section the content of the current page belongs to.
Level 2 heading
Level 3 heading
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

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.

Sections in this Manual

1 Overview
2 Design
3 Operation and Test Run
4 Parameter List
5 Basic Settings
6 Vector Control and Applied Functions
7 Other Functions
8 Communications Functions
9 Overview of DriveProgramming
10 Troubleshooting
11 Maintenance and Inspection
12 Options
A Appendices
I Index

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Warranty, Limitations of Liability

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Product specifications and accessories may be changed at any time based on improvements and other reasons. It is our practice to change part numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the Product may be changed without any notice. When in doubt, special part numbers may be assigned to fix or establish key specifications for your application. Please consult with your Omron's representative at any time to confirm actual specifications of purchased Product.

Errors and Omissions

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.

Safety Precautions

To ensure that the Multi-function Compact Inverter (Model: 3G3MX2-☐-V1) 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

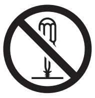
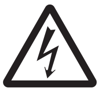
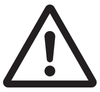
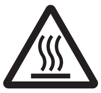
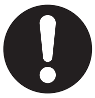
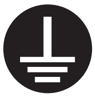
In this user's manual, the following precautions and signal words are used to provide information to ensure the safe use of the Multi-function Compact Inverter (Model: 3G3MX2-☐-V1).

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

Meanings of Signal Words

⚠ **WARNING**	Indicates a potentially hazardous situation which, if not avoided, will result in minor or moderate injury, or may result in serious injury or death. Additionally there may be significant property damage.
⚠ **CAUTION**	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or in property damage.

Explanation of Symbols

	⊘ 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.”
	△ This symbol indicates danger and caution. The specific instruction is indicated using an illustration or text inside or near △. The symbol shown to the left indicates “beware of electric shock.”
	△ This symbol indicates danger and caution. The specific instruction is indicated using an illustration or text inside or near △. The symbol shown to the left indicates “non-specific general danger.”
	△ This symbol indicates caution (warnings included). The specific instruction is indicated using an illustration or text inside or near △. The symbol shown to the left indicates “risk of hot surface.”
	The filled circle symbol indicates operations that you must do. The specific operation is shown in the circle and explained in text. This example shows a general precaution for something that you must do.
	● This symbol indicates a compulsory item (an item that must be done). The specific instruction is indicated using an illustration or text inside or near ●. The symbol shown to the left indicates “grounding required.”

⚠ WARNING

⚠	Turn off the power supply and implement wiring correctly. Not doing so may result in a serious injury due to an electric shock.
⚠	Wiring work must be carried out only by qualified personnel. Not doing so may result in a serious injury due to an electric shock.
⚠	Do not change wiring and slide switches, put on or take off Operator and optional devices, replace cooling fans while the input power is being supplied. Doing so may result in a serious injury due to an electric shock.
⏚	Be sure to ground the unit. Not doing so may result in a serious injury due to an electric shock or fire. (200-V class: type-D grounding, 400-V class: type-C grounding)
⚠	Do not remove the terminal cover during the power supply and 10 minutes after the power shut off. Doing so may result in a serious injury due to an electric shock.
⚠	Do not operate the Digital Operator or switches with wet hands. Doing so may result in a serious injury due to an electric shock.
⚠	Inspection of the inverter must be conducted after the power supply has been turned off. Not doing so may result in a serious injury due to an electric shock. The main power supply is not necessarily shut off even if the emergency shut off function is activated.
⚠	Do not touch the inverter cooling fins, braking resistors, and the motor, which become too hot during the power supply and for some time after the power shut off. Doing so may result in a burn.

Security Measures

⚠ WARNING	
❗	**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	
⚠	Do not connect resistors to the terminals (+1, P/+2, N/–) directly. Doing so might result in a small-scale fire, heat generation, or damage to the unit.
❗	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 use a specified type of braking resistor/regenerative braking unit. In case of a braking resistor, install a thermal relay that monitors the temperature of the resistor. Not doing so might result in a moderate burn due to the heat generated in the braking resistor/regenerative braking unit. Configure a sequence that enables the inverter power to turn off when unusual over eating is detected in the braking resistor/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.
❗	Take safety precautions such as setting up a molded-case circuit breaker (MCCB) that matches the inverter capacity on the power supply side. Not doing so might result in damage to property due to the short circuit of the load.
🛇	Do not dismantle, repair or modify the product. Doing so may result in an injury.

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 direct 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 hold by the front cover and terminal cover, but hold by the cooling fins during transportation.
- Confirm that the rated input voltage of the inverter is the same as AC power supply voltage.
- Do not connect an AC power supply voltage to the control input/output terminals. Doing so may result in damage to the product.
- Be sure to tighten the screws on the terminal block securely. Wiring work must be done after installing the unit body.
- Do not connect any load other than a three-phase inductive motor to the U, V, and W output terminals.
- 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 a parameter is set incorrectly when starting up, adjusting, maintaining, or replacing, an unexpected operation may occur. Perform the operation after enough confirmation.
- When using the DriveProgramming, check that program is downloaded normally before starting operation.

Operation and Adjustment

- Be sure to confirm the permissible range of motors and machines before operation because the inverter speed can be changed easily from low to high.
- Provide a separate holding brake if necessary.
- If the DriveProgramming stops during multi-function output, the output status is held. Take safety precautions such as stopping peripheral devices.
- 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 terminal block cover of the inverter until the PM motor stops.
- Be sure to confirm the RUN signal is turned off before resetting the alarm because the machine may abruptly start.

Maintenance and Inspection

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

Installation

Mount the product vertically on a wall with the product's longer sides upright.

The material of the wall must be noninflammable such as a metal plate.

Restart Selection Function

- Do not come close to the machine when using the restart selection function (b001, b008) because the machine may abruptly start when stopped by an alarm.

Deceleration Stop Function

Do not come close to the machine when selecting reset in Deceleration Stop Selection on Power Interruption (b050) because the machine may abruptly start after the power is turned on.

Operation Stop Command

- Provide a separate emergency stop switch because the STOP Key on the Operator is valid only when function settings are performed.
- 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.

Motor Overload Protection

- For the motor overload protection, be sure to set the rated current of your motor to the Electronic Thermal Level (b012/b212) and PM Motor Rated Current (H105).

Maintenance and Parts Replacement

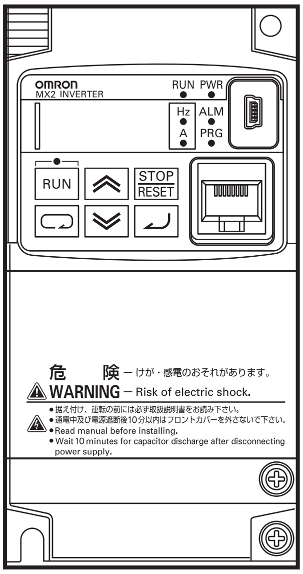
- Inverters contain components and will operate properly only when each component operates normally. Some of the electrical components require maintenance depending on application conditions. Periodic inspection and replacement are necessary to ensure proper long-term operation of inverters. (Quoted from The Recommendation for Periodic Maintenance of a General-purpose Inverter published by JEMA.)

Product Disposal

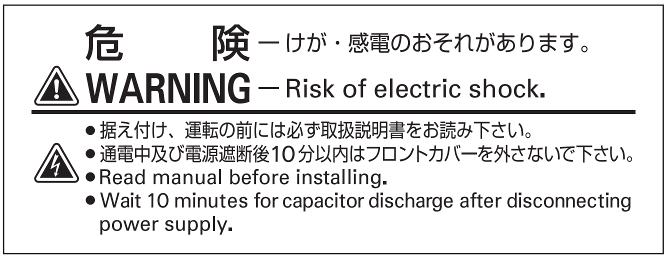
Comply with the local ordinance and regulations when disposing of the product.

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.


omron
MX2 INVERTER
RUN
PWR
Hz
A
ALM
PRG
RUN
STOP
RESET
危 険 ー けが・感電のおそれがあります。
WARNING ー Risk of electric shock.

Warning Description



危　険 ー けが・感電のおそれがあります。

WARNING ー Risk of electric shock.

- 据え付け、運転の前には必ず取扱説明書をお読み下さい。
- 通電中及び電源遮断後10分以内はフロントカバーを外さないで下さい。
- Read manual before installing.
- Wait 10 minutes for capacitor discharge after disconnecting power supply.

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.

EC Directives and UL/cUL Standards

The 3G3MX2-V1 Series complies as standard with both the EC Directives and UL/cUL Standards.

Standard		Applicable standard
EC Directives	Machinery Directives	EN ISO 13849-1: 2008 Pld EN 61800-5-2 EN 60204-1
	EMC Directive	EN 61800-3: 2004
	Low-voltage Directive	EN 61800-5-1: 2007
UL/cUL Standards		UL 508C

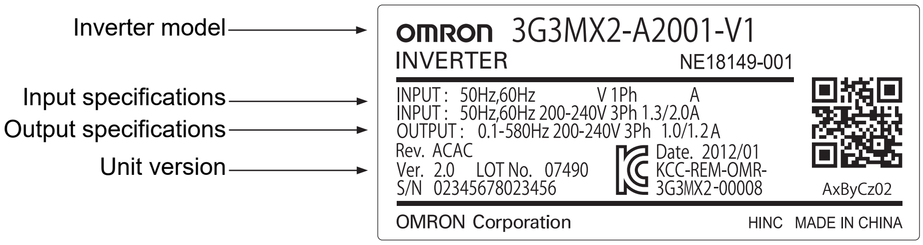
Items to Check after Unpacking

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.



OMRON 3G3MX2-A2001-V1
INVERTER NE18149-001
INPUT : 50Hz,60Hz V 1Ph A
INPUT : 50Hz,60Hz 200-240V 3Ph 1.3/2.0A
OUTPUT : 0.1-580Hz 200-240V 3Ph 1.0/1.2A
Rev. ACAC
Ver. 2.0 LOT No. 07490
S/N 02345678023456
Date. 2012/01
KCC-REM-OMR-
3G3MX2-00008
AxByCz02
OMRON Corporation HINC MADE IN CHINA

Checking the Model

3G3MX2-A2055-V1

Type V1

Maximum applicable motor capacity (CT rating)

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

Voltage class

B	Single phase 200 VAC (200-V class)
2	3-phase 200 VAC (200-V class)
4	3-phase 400 VAC (400-V class)

Enclosure rating

A	Panel-mounting (IP10 or higher) or closed wall-mounting models

Checking the Accessories

The instruction manual is the only accessory included in the Multi-function Compact Inverter (Model: 3G3MX2-☐-V1).

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

Related Manuals

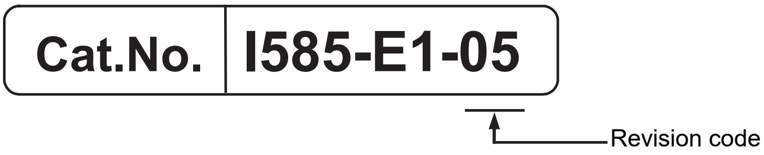
Please see the manuals below for related product information.

Name	Catalog No.
CX-Drive Operation Manual	W453
DriveProgramming User’s Manual	I580
Regenerative Braking Unit 3G3AX-RBU☐☐ User’s Manual	I563
MX2/RX Series EtherCAT® Communication Unit User's Manual	I574
MX2/RX Series CompoNet™ Communications Unit User’s Manual	I582
MX2/RX Series DeviceNet™ Communications Unit User’s Manual	I581

Revision History

The manual revision code is a number appended to the end of the catalog number found in the bottom right-hand corner of the front and back covers.

Example



Revision code	Revision date	Revised Content
01	May 2013	Original production
02	April 2014	• Added explanations. • Corrected mistakes.
03	January 2018	• Added explanations. • Corrected mistakes.
04	September 2019	Corrected mistakes.
05	September 2022	Revisions for adding safety precautions regarding security.

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1

Overview

This section provides an overview of the 3G3MX2-V1 Series features, standard specifications, and external dimensions by inverter capacity. It also shows the differences of this inverter from the conventional inverter for those who use the previous model.

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1-1 Overview of Functions

The Multi-function Compact Inverter (Model: 3G3MX2-☐-V1) provides a variety of functions such as PM motor control and simple position control. It is also designed for open field networks to extend application usability.

In addition, the 3G3MX2-V1 Series complies as standard with both the EC Directives and UL/cUL Standards. You can use this product as a world standard inverter.

1-1-1 Features of 3G3MX2-V1 Series Inverter

The 3G3MX2-V1 Series Inverter has the following features.

Enhanced Application Support

Although this inverter is compact, it provides high functionality for enhanced application support and addresses diverse needs with optimal performance.

● PM motors

In addition to conventional induction motors, this inverter provides the PM motor mode that supports highly efficient PM motors, which results in more efficient control than the conventional energy-saving control.

This is combined with the OMRON’s unique auto-tuning function and initial pole position estimation function that estimates the magnetic pole position of a PM motor during startup to enable its smooth start.

This control is suitable for applications with reduced torque characteristics (which do not require torque at low speeds) such as fans and pumps.

However, it cannot be used for applications with constant torque characteristics such as general transfer equipment and elevating axes, where the starting torque exceeds 50% of the rated motor torque.

● Implementation of the dual rating function

This inverter has the dual rating function that consists of the heavy load mode and the light load mode.

This enables the efficient utilization of the inverter depending on your application.

- Heavy load mode

  The heavy load mode is used for a transfer machine, elevator, or other device that temporarily requires a torque exceeding the rated torque. This mode enables high torque control similar to that achieved with the previous product.

  The overload capacity is 150% of the rated current for 1 minute.
- Light load mode

  The light load mode is used for a fan, pump, or other device that operates at the rated motor torque or lower.

  Setting the light load mode causes the rated current of the inverter to increase, enabling the inverter to drive a motor whose capacity is one size larger.

  However, check when selecting an inverter because this also decreases the current overload capacity to 120% of the rated current for 1 minute.

Precautions for Correct Use

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-1 Derating* on page A-2.

● Simple position control

This inverter provides simple position control that enables the control of up to 8 points with a single inverter unit.

With the standard pulse train input function, it realizes accurate position control based on the feedback of the pulse generator (PG) signal or the encoder's phase-A/B signal.

For enhancements, simple position control has the following additional functions this time. Moreover, it can be combined with control from the open field network to expand the control range of your system.

• Restarting Positioning	: Repositions the motor to the target position if it is out of the setting range.
• Position Store Selection at Power Off	: Stores the current position at power off and resume from the stored position at the next power-on.
• Preset Position	: Sets the current stop position as a preset position, for example, after completion of an origin search.

● Implementation of the programming function

The 3G3MX2-V1 Series has the buit-in simple sequence function (DriveProgramming), which enables a stand-alone inverter to perform simple sequence control.

You can create programs easily in flowchart or text language method by using the CX-Drive.

For details, refer to “DriveProgramming User's Manual (I580)”.

● Sensorless vector control

This inverter provides the sensorless vector function and the auto-tuning function to achieve a high starting torque of 200% at 0.5 Hz.

This enables powerful drive control even at low speeds.

In addition, sensorless vector control can be used in conjunction with the torque limit and torque control functions.

It is applicable to device contact stopper, load breakage protector, and other control applications.

● V/f control with speed feedback

With the standard pulse train input function, this inverter realizes accurate Vf control based on the feedback of the pulse generator (PG) signal or the encoder's phase-A/B signal.

The speed feedback capability ensures stable speed control at high accuracy.

● PID control function

The inverter provides PID control that adjusts the feedback value to match the target value.

This is available to the process control such as temperature, pressure, flow rate.

Open Field Network

This inverter is designed as standard to provide connectivity to open field networks. In addition to built-in Modbus communication functions, the inverter also supports various system designs.

● Open field network

Installing any of the following optional communications units enables the inverter to support the corresponding open network.

It means that the host of each communications unit can perform the inverter operations, stop control, status monitor, and functions to read and write various parameter settings.

- EtherCAT Communications Unit (Model: 3G3AX-MX2-ECT)
- CompoNet Communications Unit (Model: 3G3AX-MX2-CRT-E)
- DeviceNet Communications Unit (Model: 3G3AX-MX2-DRT-E)

● Modbus communication functions

This inverter has built-in Modbus communication functions as standard.

These Modbus communication functions of the inverter include sophisticated, convenient functions as listed below.

- Modbus mapping : Up to 10 register addresses can be set as desired. This is convenient, for example, when designing a replacement.
- Broadcasting to up to 5 groups (Simultaneous broadcast) : Broadcasting to up five inverter groups can be performed by dividing those located within a single network connected to this inverter. It is useful to reduce the variation in the startup timings within a group.
- High transmission speed : This inverter supports the maximum transmission speed of 115.2 kbps. This helps reduce the communications data processing time.
- Co-inverter communication : Mutual data exchange can be performed among inverters, without presence of the master in Modbus communication.

Environmental Consideration

OMRON gives consideration to not only the functions inherent to the inverter, but also its service life and energy efficiency.

This inverter, as a standard, complies with the RoHS directive and other international standards to realize an environmental-friendly inverter.

● Automatic energy-saving function

The automatic energy-saving function automatically adjusts the output power of the inverter operating at a constant speed to the minimum. It has an energy-saving effect in applications such as a fan or pump.

● Compliance with safety standards

The inverter complies as standard with the EC Directives and UL/cUL Standards.

Complies with RoHS Directive

This inverter, as a standard product, complies with the RoHS Directive that restricts the use of six hazardous substances.

Side-by-side installation

This inverter can be installed side by side, which contributes to the reduction of the installation space.

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 2-4 for details.

Ease of Use

This inverter is also designed for ease of use in terms of the parameter settings, protection, and operations.

This contributes to the reduction of man-hours in inverter-related work.

Password Function

This inverter has the password protection function to prevent unauthorized reading and changing of parameters.

Addition of the initial screen automatic return function

You can register the initial screen (data etc.) to display on its Digital Operator.

After operating the Digital Operator for adjustment or inverter monitoring, the screen will return to the initial screen unless you operate any key for 10 minutes.

Change of default parameter setting

Some default parameter data were changed from the conventional 3G3MX2 Series Inverter.

The default parameter data changed in the 3G3MX2-V1 Series are shown in *1-5 Comparison with Previous Model* on page 1-25 and *Section 4 Parameter List*. Check if these are appropriate for your application.

Simplified parameter setting by user parameters

You can register up to 32 user parameters.

It is possible to display only the registered parameters to improve the operability of equipment.

1-1-2 Classes of 3G3MX2-V1 Series Inverter

There are three voltage classes for 3G3MX2-V1 Series Inverters: Single-phase 200 VAC, 3-phase 200 VAC and 3-phase 400 VAC.

The maximum applicable motor capacity for this inverter is 0.1 to 15 kW for the heavy load mode and 0.2 to 18.5 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
		CT: Heavy load	VT: Light load	
3-phase 200 VAC	IP20	0.1 kW	0.2 kW	3G3MX2-A2001-V1
		0.2 kW	0.4 kW	3G3MX2-A2002-V1
		0.4 kW	0.75 kW	3G3MX2-A2004-V1
		0.75 kW	1.1 kW	3G3MX2-A2007-V1
		1.5 kW	2.2 kW	3G3MX2-A2015-V1
		2.2 kW	3.0 kW	3G3MX2-A2022-V1
		3.7 kW	5.5 kW	3G3MX2-A2037-V1
		5.5 kW	7.5 kW	3G3MX2-A2055-V1
		7.5 kW	11 kW	3G3MX2-A2075-V1
		11 kW	15 kW	3G3MX2-A2110-V1
		15 kW	18.5 kW	3G3MX2-A2150-V1
3-phase 400 VAC	IP20	0.4 kW	0.75 kW	3G3MX2-A4004-V1
		0.75 kW	1.5 kW	3G3MX2-A4007-V1
		1.5 kW	2.2 kW	3G3MX2-A4015-V1
		2.2 kW	3.0 kW	3G3MX2-A4022-V1
		3.0 kW	4.0 kW	3G3MX2-A4030-V1
		4.0 kW	5.5 kW	3G3MX2-A4040-V1
		5.5 kW	7.5 kW	3G3MX2-A4055-V1
		7.5 kW	11 kW	3G3MX2-A4075-V1
		11 kW	15 kW	3G3MX2-A4110-V1
		15 kW	18.5 kW	3G3MX2-A4150-V1
Single-phase 200 VAC	IP20	0.1 kW	0.2 kW	3G3MX2-AB001-V1
		0.2 kW	0.4 kW	3G3MX2-AB002-V1
		0.4 kW	0.55 kW	3G3MX2-AB004-V1
		0.75 kW	1.1 kW	3G3MX2-AB007-V1
		1.5 kW	2.2 kW	3G3MX2-AB015-V1
		2.2 kW	3.0 kW	3G3MX2-AB022-V1

Checking the Model

3G3MX2-A2055-V1

Type V1

Maximum applicable motor capacity (CT rating)

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

Voltage class

B	Single phase 200 VAC (200-V class)
2	3-phase 200 VAC (200-V class)
4	3-phase 400 VAC (400-V class)

Enclosure rating

A	Panel-mounting (IP10 or higher) or closed wall-mounting models

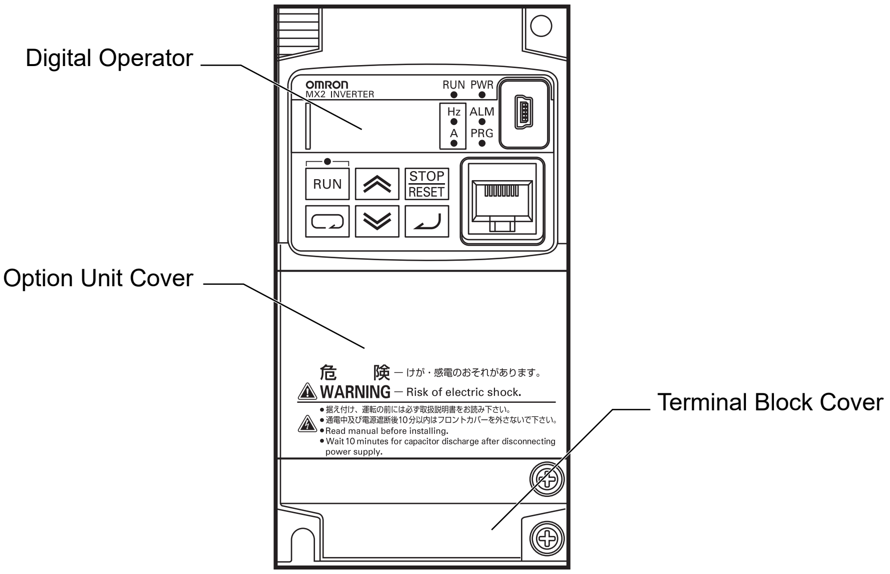
1-1-3 Compliance with International Standards (EC Directives and UL/cUL Standards)

The 3G3MX2-V1 Series complies as standard with both the EC Directives and UL/cUL Standards. You can use this product as a world standard inverter.

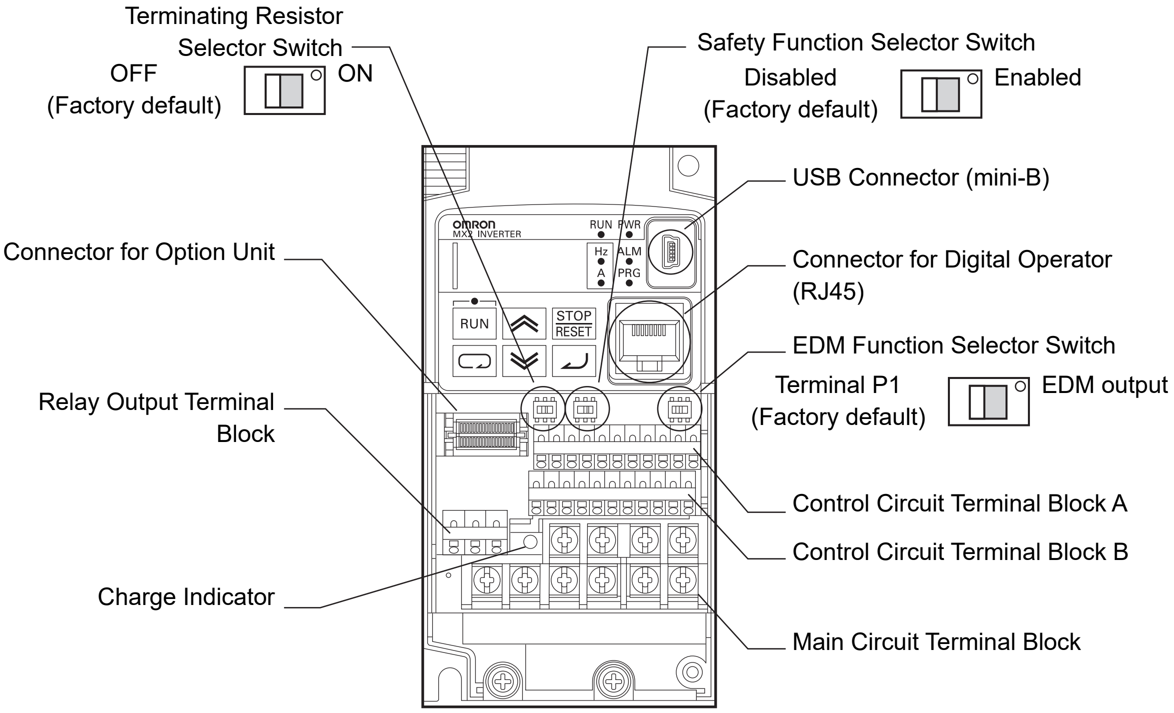
Standard		Applicable Standard
EC Directives	Machinery Directives	EN ISO 13849-1: 2008 Pld EN 61800-5-2 EN 60204-1
	EMC Directive	EN 61800-3: 2004
	Low-voltage Directive	EN 61800-5-1: 2007
UL/cUL Standards		UL 508C
		CSA-C22.2 No.14

1-2 Appearance and Part Names

The following shows the front view when the product is unpacked (an example of 3G3MX2-A2001-V1/A2002-V1/A2004-V1/A2007-V1/AB2001-V1/AB2002-V1/AB2004-V1).

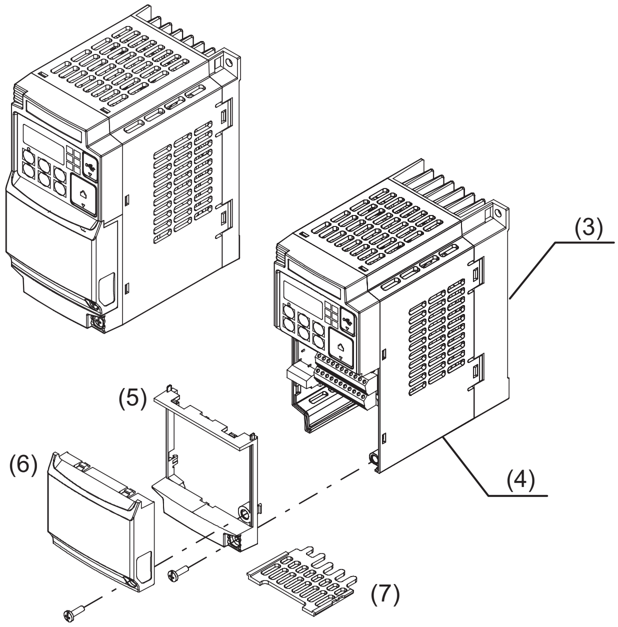

Digital Operator
Option Unit Cover
Terminal Block Cover
omron
MX2 INVERTER
RUN PWR
Hz ALM
A PRG
RUN
STOP RESET
危　険 ― けが・感電のおそれがあります。
WARNING ― Risk of electric shock.
● 据え付け、運転の前には必ず取扱説明書をお読み下さい。
● 通電中及び電源遮断後10分以内はフロントカバーを外さないで下さい。
● Read manual before installing.
● Wait 10 minutes for capacitor discharge after disconnecting power supply.

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

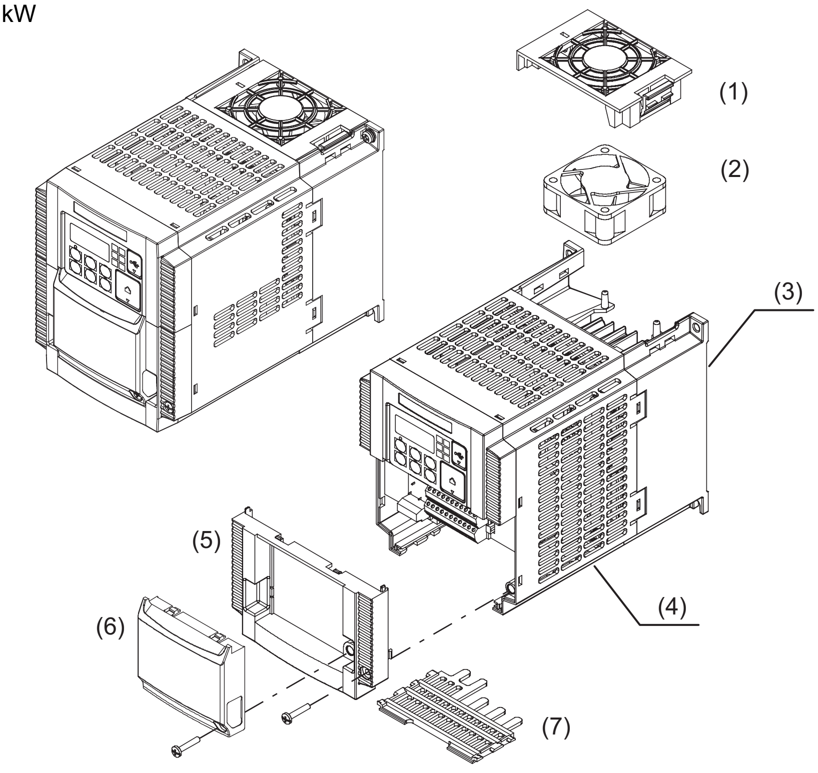

Terminating Resistor Selector Switch
OFF (Factory default)
ON
Safety Function Selector Switch
Disabled (Factory default)
Enabled
USB Connector (mini-B)
Connector for Option Unit
Connector for Digital Operator (RJ45)
EDM Function Selector Switch
Terminal P1 (Factory default)
EDM output
Relay Output Terminal Block
Control Circuit Terminal Block A
Control Circuit Terminal Block B
Charge Indicator
Main Circuit Terminal Block
omron
MX2 INVERTER
RUN PWR
Hz ALM
A PRG
RUN
STOP RESET

The figures below show the components of each Inverter model.

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



Single-phase 200 V, 0.75/1.5/2.2 kW
3-phase 200 V, 1.5/2.2 kW
3-phase 400 V, 0.4/0.75/1.5/2.2/3.0 kW

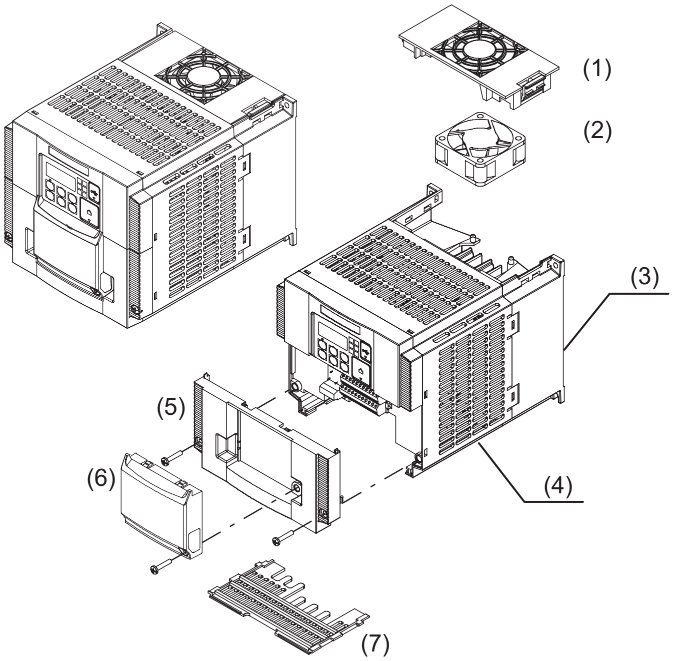


(1) Cooling Fan Cover	(5) Terminal Block Cover
(2) Cooling Fan	(6) Option Unit Cover
(3) Cooling Fin	(7) Backing Plate
(4) Inverter Case	

Note The 3-phase 200-V, 0.75-kW model has a cooling fan. The single-phase 200-V, 0.75-kW model and the 3-phase 400-V, 0.4/0.75 kW model, however, have no cooling fan.

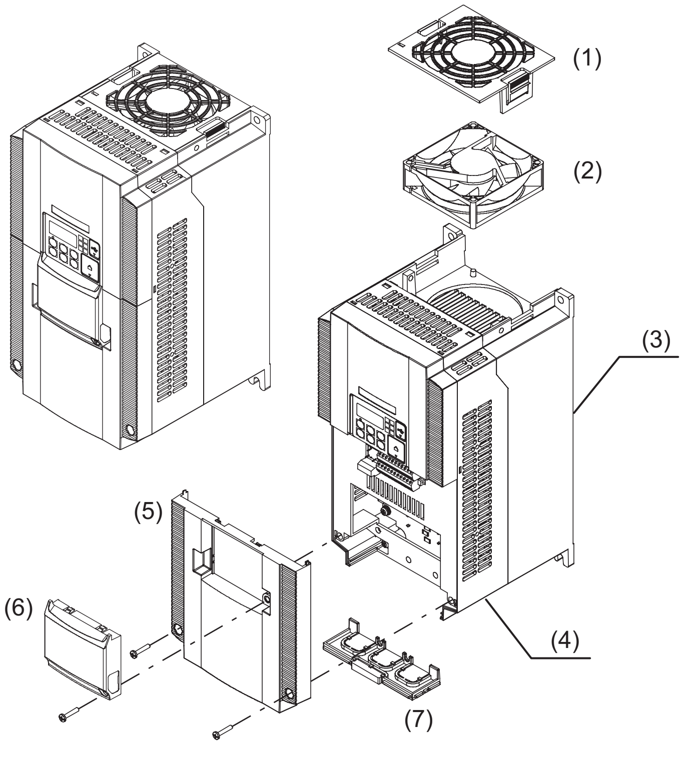
3-phase 200 V, 3.7 kW

3-phase 400 V, 4.0 kW



3-phase 200 V, 5.5/7.5 kW

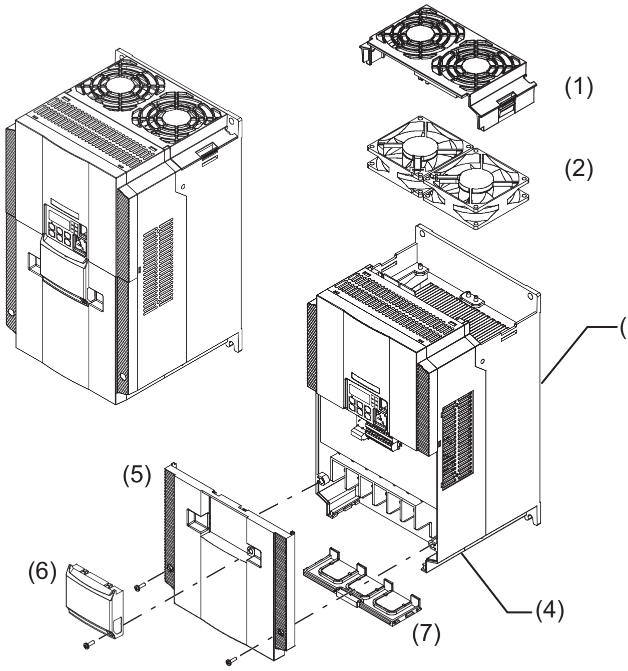
3-phase 400 V, 5.5/7.5 kW



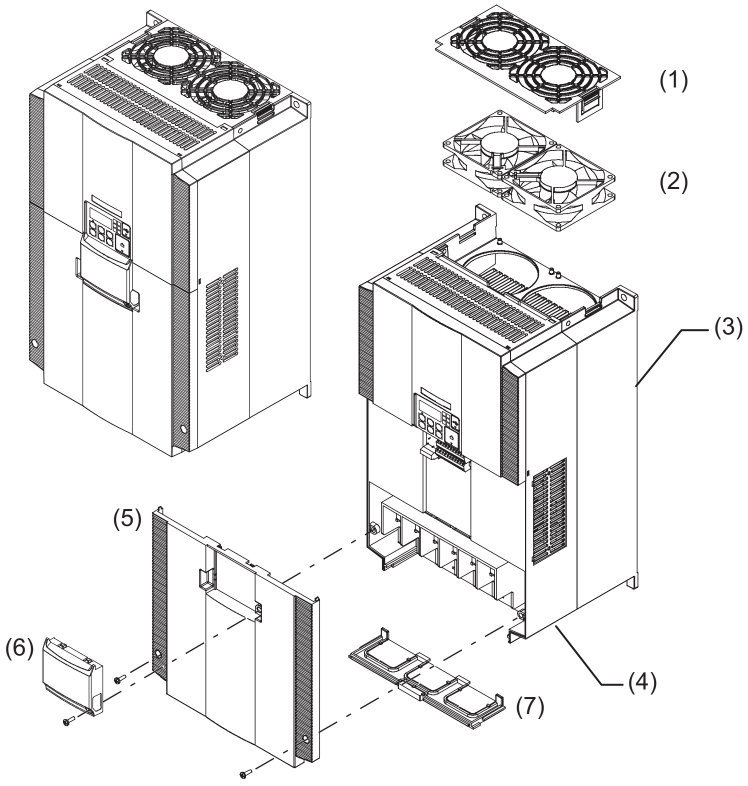
(1) Cooling Fan Cover	(5) Terminal Block Cover
(2) Cooling Fan	(6) Option Unit Cover
(3) Cooling Fin	(7) Backing Plate
(4) Inverter Case	

3-phase 200 V, 11 kW

3-phase 400 V, 11/15 kW



3-phase 200 V, 15 kW



(1) Cooling Fan Cover	(5) Terminal Block Cover
(2) Cooling Fan	(6) Option Unit Cover
(3) Cooling Fin	(7) Backing Plate
(4) Inverter Case	

1-3 Specifications

1-3-1 Standard Specifications

3-phase 200-V Class

CT: Heavy load, VT: Light load

Item			3-phase 200 V										
Model (3G3MX2-☐-V1)			A2001	A2002	A2004	A2007	A2015	A2022	A2037	A2055	A2075	A2110	A2150
Maximum applicable motor capacity[*1]	kW	CT	0.1	0.2	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11	15
		VT	0.2	0.4	0.75	1.1	2.2	3.0	5.5	7.5	11	15	18.5
	HP	CT	1/8	1/4	1/2	1	2	3	5	7 1/2	10	15	20
		VT	1/4	1/2	1	1 1/2	3	4	7 1/2	10	15	20	25
Rated output capacity [kVA]	200 V	CT	0.2	0.5	1.0	1.7	2.7	3.8	6.0	8.6	11.4	16.2	20.7
		VT	0.4	0.6	1.2	2.0	3.3	4.1	6.7	10.3	13.8	19.3	23.9
	240 V	CT	0.3	0.6	1.2	2.0	3.3	4.5	7.2	10.3	13.7	19.5	24.9
		VT	0.4	0.7	1.4	2.4	3.9	4.9	8.1	12.4	16.6	23.2	28.6
Rated input voltage			3-phase 200 V –15% to 240 V +10%, 50/60 Hz ±5%										
Rated input current [A]		CT	1.0	1.6	3.3	6.0	9.0	12.7	20.5	30.8	39.6	57.1	62.6
		VT	1.2	1.9	3.9	7.2	10.8	13.9	23.0	37.0	48.0	68.0	72.0
Rated output voltage[*2]			3-phase 200 to 240 V (Less than incoming voltage)										
Rated output current [A]		CT	1.0	1.6	3.0	5.0	8.0	11.0	17.5	25.0	33.0	47.0	60.0
		VT	1.2	1.9	3.5	6.0	9.6	12.0	19.6	30.0	40.0	56.0	69.0
Braking torque during short-time deceleration [%][*3] (discharge resistor not connected)			50	50	50	50	50	20	20	20	20	10	10
Braking resistor circuit[*4]	Regenerative braking		Built-in braking resistor circuit (discharge resistor separately mounted)										
	Minimum connection resistance [Ω]		100	100	100	50	50	35	35	20	17	17	10
Weight [kg]			1.0	1.0	1.1	1.2	1.6	1.8	2.0	3.3	3.4	5.1	7.4
Dimensions (Width × Height) [mm]			68 × 128				108 × 128		140 × 128	140 × 260		180 × 296	220 × 350
Dimensions (Depth) [mm]			109		122.5	145.5	170.5			155		175	

[*1] "Applicable motor" represents standard 3-phase motors. When using other types of motors, make sure that the rated current of the motor does not exceed that of the inverter.

[*2] The output voltage decreases as the input voltage drops.

[*3] The braking torque during capacitor feedback is the average deceleration torque applied when the motor decelerates in the shortest deceleration time (when stopped from 50 Hz), not the continuous regenerative torque. The average deceleration torque varies depending on the motor loss. This value will decrease in operation over 50 Hz.

[*4] The usage rate of the regenerative braking function is 10%.

3-phase 400-V Class

CT: Heavy load, VT: Light load

Item			3-phase 400 V									
Model (3G3MX2-☐-V1)			A4004	A4007	A4015	A4022	A4030	A4040	A4055	A4075	A4110	A4150
Maximum applicable motor capacity[*1]	kW	CT	0.4	0.75	1.5	2.2	3.0	4.0	5.5	7.5	11	15
		VT	0.75	1.5	2.2	3.0	4.0	5.5	7.5	11	15	18.5
	HP	CT	1/2	1	2	3	4	5	7 1/2	10	15	20
		VT	1	2	3	4	5	7 1/2	10	15	20	25
Rated output capacity [kVA]	380 V	CT	1.1	2.2	3.1	3.6	4.7	6.0	9.7	11.8	15.7	20.4
		VT	1.3	2.6	3.5	4.5	5.7	7.3	11.5	15.1	20.4	25.0
	480 V	CT	1.4	2.8	3.9	4.5	5.9	7.6	12.3	14.9	19.9	25.7
		VT	1.7	3.4	4.4	5.7	7.3	9.2	14.5	19.1	25.7	31.5
Rated input voltage			3-phase 380 V −15% to 480 V +10%, 50/60 Hz ±5%									
Rated input current [A]		CT	1.8	3.6	5.2	6.5	7.7	11.0	16.9	18.8	29.4	35.9
		VT	2.1	4.3	5.9	8.1	9.4	13.3	20.0	24.0	38.0	44.0
Rated output voltage[*2]			3-phase 380 to 480 V (Less than incoming voltage)									
Rated output current [A]		CT	1.8	3.4	4.8	5.5	7.2	9.2	14.8	18.0	24.0	31.0
		VT	2.1	4.1	5.4	6.9	8.8	11.1	17.5	23.0	31.0	38.0
Braking torque during short-time deceleration [%][*3] (discharge resistor not connected)			50	50	50	20	20	20	20	20	10	10
Braking resistor circuit[*4]	Regenerative braking		Built-in braking resistor circuit (discharge resistor separately mounted)									
	Minimum connection resistance [Ω]		180	180	180	100	100	100	70	70	70	35
Weight [kg]			1.5	1.6	1.8	1.9	1.9	2.1	3.5	3.5	4.7	5.2
Dimensions (Width × Height) [mm]			108 × 128					140 × 128	140 × 260		180 × 296	
Dimensions (Depth) [mm]			143.5	170.5					155		175	

*1. “Applicable motor” represents standard 3-phase motors. When using other types of motors, make sure that the rated current of the motor does not exceed that of the inverter.

*2. The output voltage decreases as the input voltage drops.

*3. The braking torque during capacitor feedback is the average deceleration torque applied when the motor decelerates in the shortest deceleration time (when stopped from 50 Hz), not the continuous regenerative torque. The average deceleration torque varies depending on the motor loss. This value will decrease in operation over 50 Hz.

*4. The usage rate of the regenerative braking function is 10%.

Single-phase 200-V Class

CT: Heavy load, VT: Light load

Item			Single-phase 200 V					
Model (3G3MX2-☐-V1)			AB001	AB002	AB004	AB007	AB015	AB022
Maximum applicable motor capacity*1	kW	CT	0.1	0.2	0.4	0.75	1.5	2.2
		VT	0.2	0.4	0.55	1.1	2.2	3.0
	HP	CT	1/8	1/4	1/2	1	2	3
		VT	1/4	1/2	3/4	1 1/2	3	4
Rated output capacity [kVA]	200 V	CT	0.2	0.5	1.0	1.7	2.7	3.8
		VT	0.4	0.6	1.2	2.0	3.3	4.1
	240 V	CT	0.3	0.6	1.2	2.0	3.3	4.5
		VT	0.4	0.7	1.4	2.4	3.9	4.9
Rated input voltage			Single-phase 200 V –15% to 240 V +10%, 50/60 Hz ±5%					
Rated input current [A]		CT	1.3	3.0	6.3	11.5	16.8	22.0
		VT	2.0	3.6	7.3	13.8	20.2	24.0
Rated output voltage*2			3-phase 200 to 240 V (Less than incoming voltage)					
Rated output current [A]		CT	1.0	1.6	3.0	5.0	8.0	11.0
		VT	1.2	1.9	3.5	6.0	9.6	12.0
Braking torque during short-time deceleration [%]*3 (discharge resistor not connected)			50	50	50	50	50	20
Braking resistor circuit*4	Regenerative braking		Built-in braking resistor circuit (discharge resistor separately mounted)					
	Minimum connection resistance [Ω]		100	100	100	50	50	35
Weight [kg]			1.0	1.0	1.1	1.6	1.8	1.8
Dimensions (Width × Height) [mm]			68 × 128			108 × 128		
Dimensions (Depth) [mm]			109		122.5	170.5		

*1. “Applicable motor” represents standard 3-phase motors. When using other types of motors, make sure that the rated current of the motor does not exceed that of the inverter.

*2. The output voltage decreases as the input voltage drops.

*3. The braking torque during capacitor feedback is the average deceleration torque applied when the motor decelerates in the shortest deceleration time (when stopped from 50 Hz), not the continuous regenerative torque. The average deceleration torque varies depending on the motor loss. This value will decrease in operation over 50 Hz.

*4. The usage rate of the regenerative braking function is 10%.

Common Specifications

Item		Specifications
Enclosure rating*1		Open type (IP20)
Control	Control method	Phase-to-phase sinusoidal modulation PWM
	Output frequency range*2	0.01 to 400 Hz (or 580 Hz in the high-frequency mode)
	Frequency precision*3	Digital command: ±0.01% of the maximum frequency, Analog command: ±0.2% of the maximum frequency (25±10°C)
	Frequency setting resolution	Digital setting: 0.01 Hz, Analog setting: Maximum frequency × 1/1000
	Voltage/Frequency characteristics	V/f characteristics (constant torque, reduced torque) Sensorless vector control, V/f control with speed feedback
	Overload current rating of inverter	Heavy load rating (CT): 150%/60 s Light load rating (VT): 120%/60 s
	Instantaneous overcurrent protection	200% of heavy load rating (CT) value
	Acceleration/ Deceleration time	0.00 to 3600 s (line/curve arbitrary setting), 2nd acceleration/deceleration setting provided
	Carrier frequency change range	2 to 15 kHz (Derating required)
	Starting torque	200%/0.5 Hz (Sensorless vector control)
	DC injection braking	Operates at operating frequency or less during deceleration via STOP command, at set frequency or less during operation, or via external input (level and time can be set).
Protective 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, Emergency shutoff, etc.
Input signal	Frequency settings	Digital Operator External analog input signal (variable resistor/0 to 10 VDC/4 to 20 mA), Modbus communication
	RUN/STOP command	Digital Operator External digital input signal (3-wire input available), Modbus communication
	Multi-function Input*4	7 points (Functions can be selected from among 68)
	Analog input*5	2 points (FV terminal for voltage: 10 bits/0 to 10 V, FI terminal for current: 10 bits/4 to 20 mA)
	Pulse input	1 point (RP terminal: 32 kHz max., 5 to 24 VDC)
Output signal	Multi-function output *4	2 points (P1 and P2, Functions can be selected from among 47)
	Relay output *4	1 point (SPDT contact (MC, MA, MB), Functions can be selected from among 47)
	Analog output (Frequency monitor)*6	1 point (AM terminal: 10 bits for voltage, 0 to 10 V) (Frequency or current can be selected)
	Pulse output	1 point (MP terminal: 32 kHz max., 0 to 10 V)
Communications	RS-422	RJ45 connector (for Digital Operator)
	RS-485	Control circuit terminal, Modbus communication
	USB	USB1.1, mini-B connector

Item		Specifications
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, Soft lock function, Frequency conversion display, USP function, 2nd control function, UP/DOWN, Overcurrent suppression function, etc.	
General specifications	Operating ambient temperature[*7]	–10 to 50°C (Derating required)
	Storage ambient temperature	–20 to 65°C (Short-time temperature during shipment)
	Operating ambient humidity	20% to 90% (with no condensation)
	Vibration resistance	5.9 m/s^2 (0.6 G), 10 to 55 Hz
	Location	At a maximum altitude of 1,000 m, indoors (without corrosive gases or dust)
Options	EtherCAT Communications Unit	3G3AX-MX2-ECT
	CompoNet Communications Unit	3G3AX-MX2-CRT-E
	DeviceNet Communications Unit	3G3AX-MX2-DRT-E
Other optional equipment		DC reactor, AC reactor, Radio noise filter, Input noise filter, Output noise filter, Regenerative braking unit, Braking resistor, etc.

*1. The enclosure rating complies with JEM1030.

*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. To achieve stable motor control, the output frequency may exceed the maximum frequency set in the 1st/2nd Maximum Frequency (A004/A204) by a maximum of 2 Hz.

*4. In the VT (light load) mode and the PM motor mode, the available functions are limited compared with the CV (heavy load) mode. For some parameters, the default data and setting range also differ.

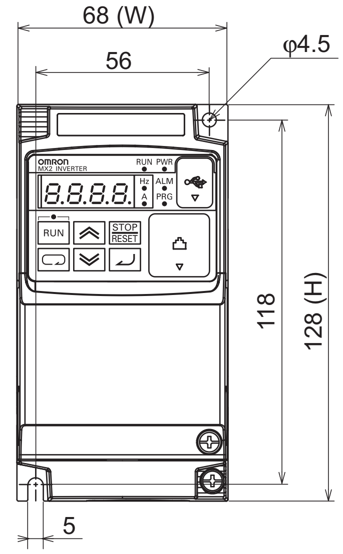
*5. By default, the maximum frequency is adjusted to 9.8 V for a voltage input of 0 to 10 VDC and to 19.8 mA for a current input of 4 to 20 mA, respectively. If necessary, adjust the default parameter settings.

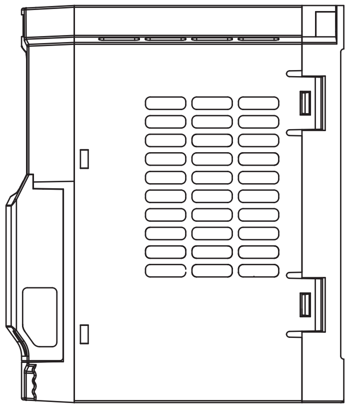
*6. The analog voltage and current values for the multi-function monitor output terminals show values that can only be used as a guide for analog meter connection. The maximum output value may differ from 10 V or 20 mA due to the variability of the analog output circuit. If necessary, adjust the default parameter settings.

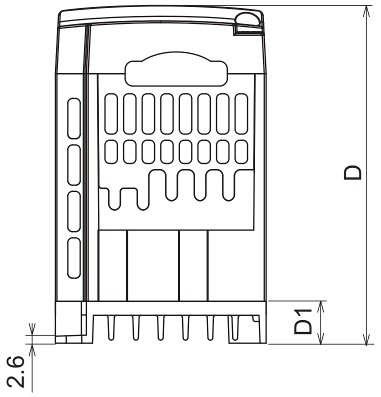
*7. Derating of the rated output current of the inverter may be required depending on the heavy/light load mode selection, operating ambient temperature, side-by-side installation, and carrier frequency setting.

Use the inverter in an appropriate environment according to *A-1 Derating* on page A-2.

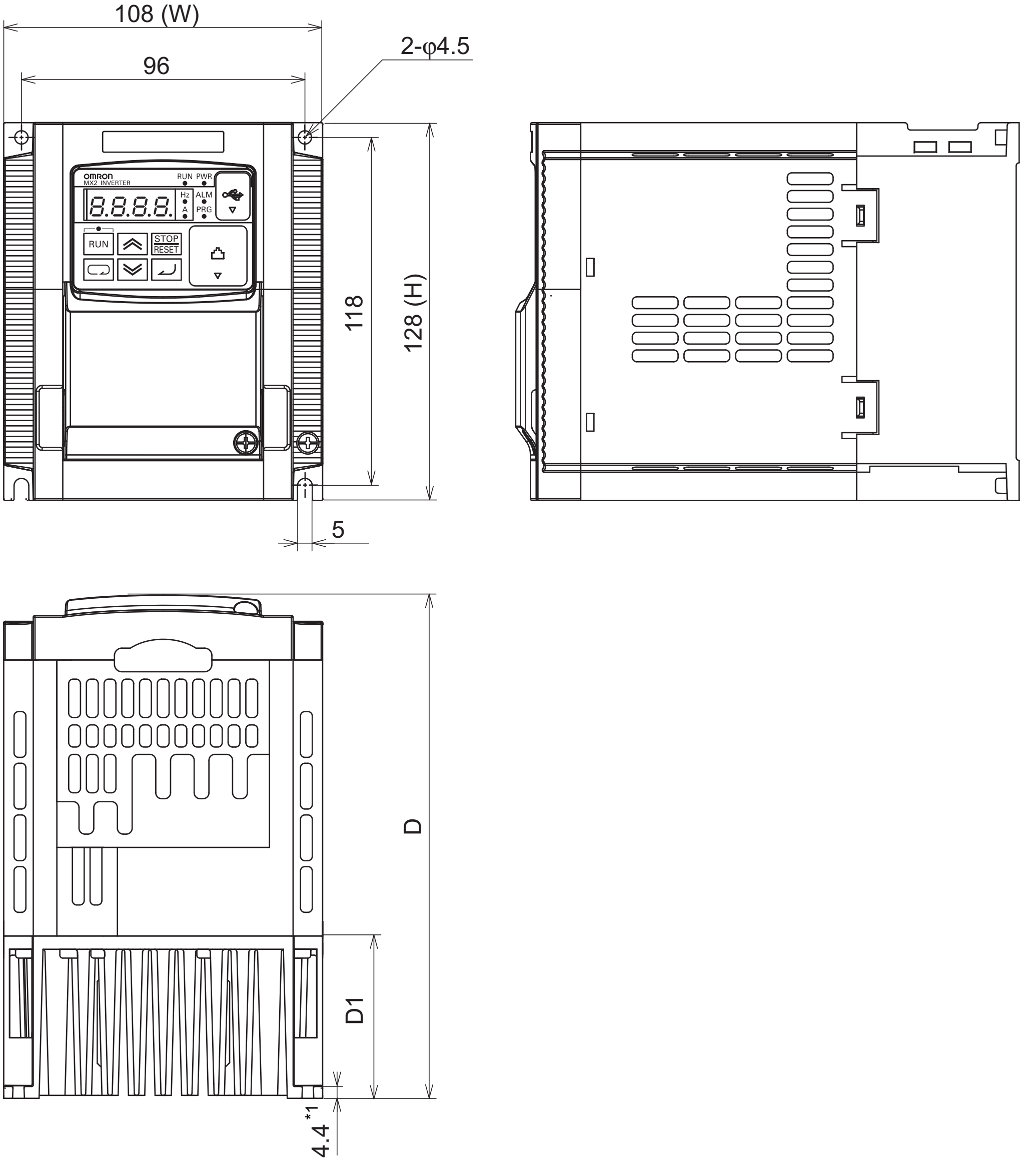
1-3-2 External Dimensions


68 (W)
56
φ4.5
omron
MX2 INVERTER
RUN PWR
8.8.8.8.
Hz
A
ALM
PRG
RUN
STOP
RESET
118
128 (H)
5



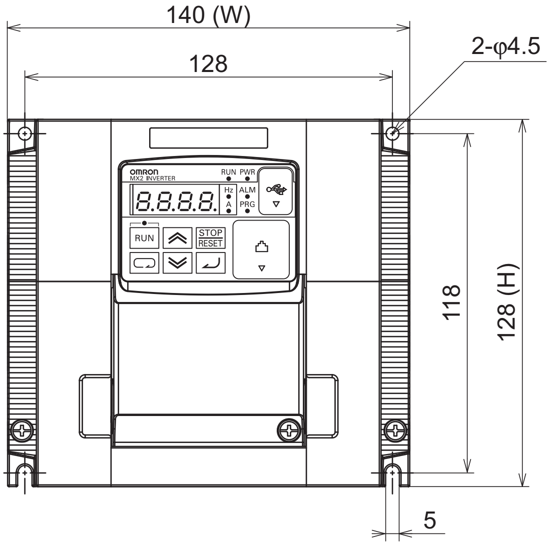


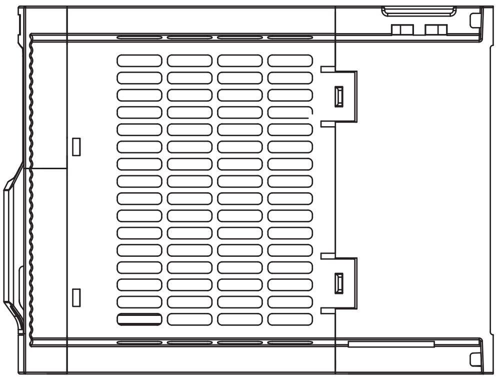
Power supply	Model	W [mm]	H [mm]	D [mm]	D1 [mm]
Single-phase 200 V	3G3MX2-AB001-V1 3G3MX2-AB002-V1	68	128	109	13.5
	3G3MX2-AB004-V1			122.5	27
3-phase 200 V	3G3MX2-A2001-V1 3G3MX2-A2002-V1			109	13.5
	3G3MX2-A2004-V1			122.5	27
	3G3MX2-A2007-V1			145.5	50

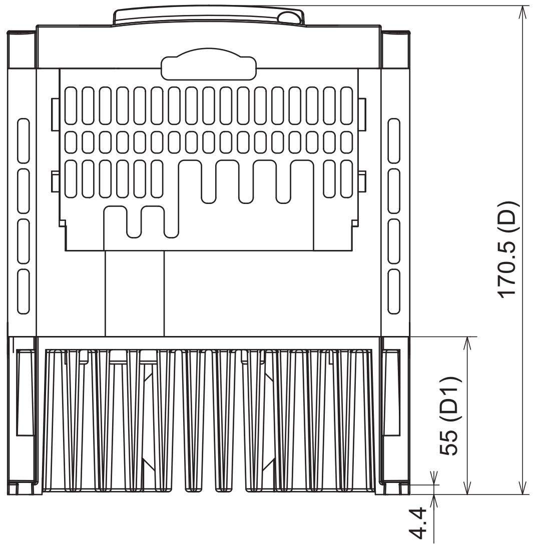

108 (W)
96
2-φ4.5
omron
MX2 INVERTER
RUN PWR
Hz
A
ALM
PRG
RUN
STOP RESET
118
128 (H)
5
D
D1
4.4*1

Power supply	Model	W [mm]	H [mm]	D [mm]	D1 [mm]
Single-phase 200 V	3G3MX2-AB007-V1	108	128	170.5	55
	3G3MX2-AB015-V1				
	3G3MX2-AB022-V1				
3-phase 200 V	3G3MX2-A2015-V1				
	3G3MX2-A2022-V1				
3-phase 400 V	3G3MX2-A4004-V1			143.5	28
	3G3MX2-A4007-V1			170.5	55
	3G3MX2-A4015-V1				
	3G3MX2-A4022-V1				
	3G3MX2-A4030-V1				

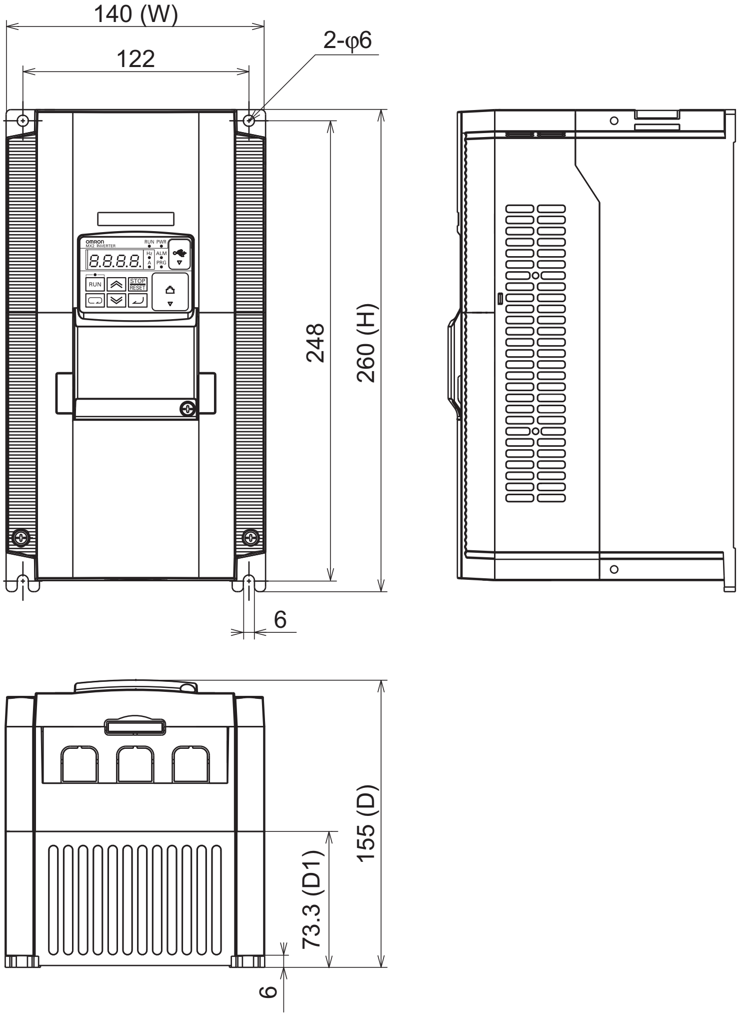
*1. For the 3G3MX2-A4004-V1, this dimension is 4.3 mm.


140 (W)
128
2-φ4.5
OMRON
MX2 INVERTER
RUN PWR
8.8.8.8.
Hz
A
ALM
PRG
RUN
STOP
RESET
118
128 (H)
5

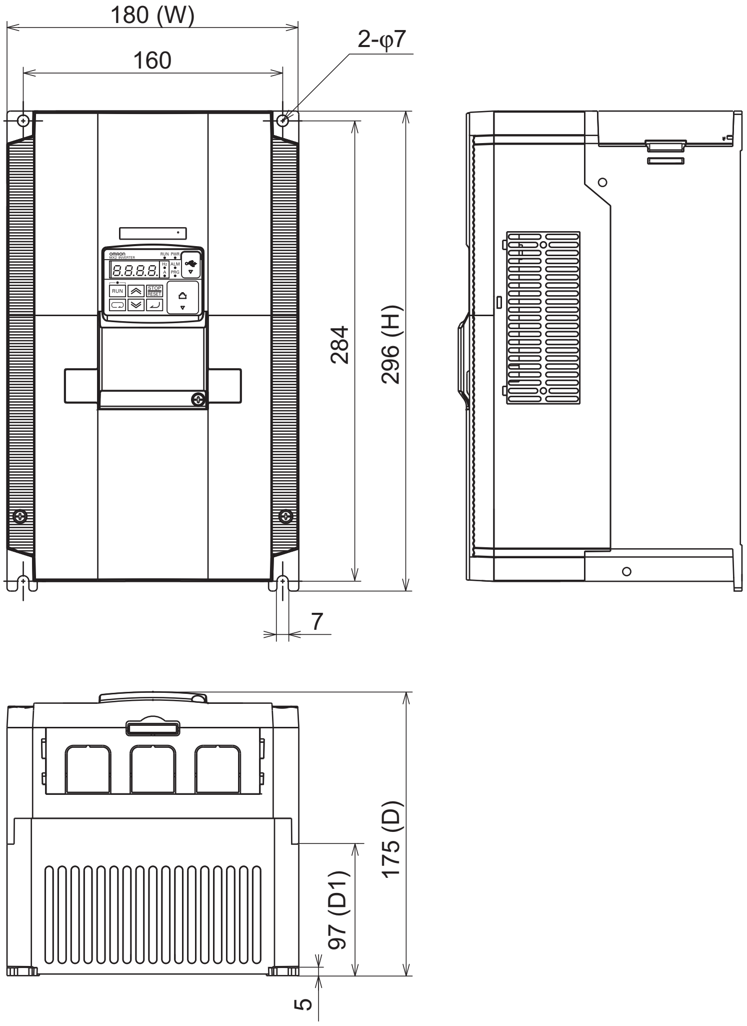



170.5 (D)
55 (D1)
4.4

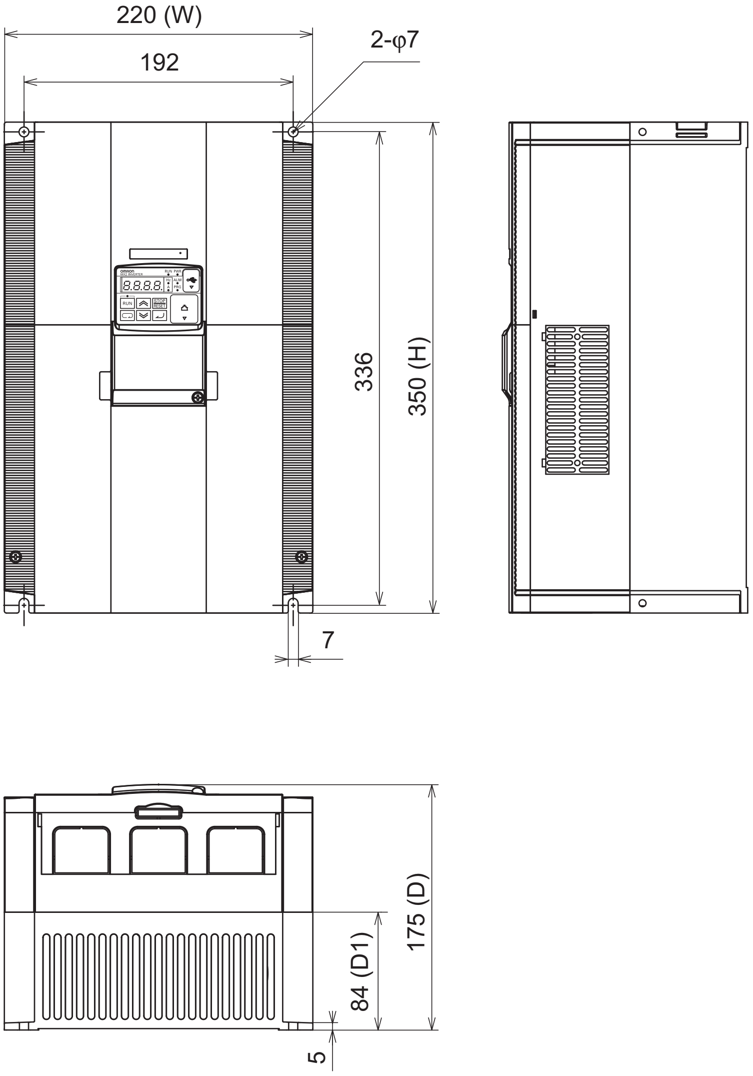
Power supply	Model	W [mm]	H [mm]	D [mm]	D1 [mm]
3-phase 200 V	3G3MX2-A2037-V1	140	128	170.5	55
3-phase 400 V	3G3MX2-A4040-V1				


140 (W)
122
2-φ6
248
260 (H)
6
155 (D)
73.3 (D1)
6

Power supply	Model	W [mm]	H [mm]	D [mm]	D1 [mm]
3-phase 200 V	3G3MX2-A2055-V1	140	260	155	73.3
	3G3MX2-A2075-V1				
3-phase 400 V	3G3MX2-A4055-V1				
	3G3MX2-A4075-V1				


180 (W)
160
2-φ7
284
296 (H)
7
175 (D)
97 (D1)
5

Power supply	Model	W [mm]	H [mm]	D [mm]	D1 [mm]
3-phase 200 V	3G3MX2-A2110-V1	180	296	175	97
3-phase 400 V	3G3MX2-A4110-V1				
	3G3MX2-A4150-V1				


220 (W)
192
2-φ7
336
350 (H)
7
175 (D)
84 (D1)
5

Power supply	Model	W [mm]	H [mm]	D [mm]	D1 [mm]
3-phase 200 V	3G3MX2-A2150-V1	220	350	175	84

1-4 Restrictions

Restriction on PM Motor Mode

Selecting the PM motor mode disables the following functions.

- 2nd control
- Torque control and torque limit functions
- Encoder feedback function
- Induction motor control function
- Automatic Voltage Regulator (AVR)
- Dual rating function (Heavy/Light load mode)
- Simple position control function, Energy-saving control, Brake control, Overcurrent suppression function, Jogging function, etc.

Therefore, unavailable parameters and the selection functions that cannot be selected in parameters, are not displayed on the Digital Operator. In addition, for some parameters, the default data are changed.

For details, refer to *6-8 PM Motor Mode* on page 6-53.

Restriction on Light Load (VT) Mode

Selecting the light load mode disables the following control.

- Sensorless vector control

Therefore, functions associated with this control such as auto-tuning/motor parameter setting, torque control, and torque limit functions are unavailable.

In addition, switching from the heavy load mode to the light load mode causes the inverter rated current and overload detection level to be changed, which also changes the default data and setting ranges of some parameters.

For details, refer to *5-2-2 Heavy Load/Light Load Selection* on page 5-12.

Precautions for Correct Use

- 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 setting.

  Use the inverter in an appropriate environment according to *A-1 Derating* on page A-2.
- In the light load (VT) mode, the PM motor mode cannot be used. Switching from the light load (VT) mode to the PM motor mode causes the rated current and overload detection settings to be changed to those for the heavy load mode.
- In the light load (VT) mode, the high-frequency mode cannot be used. Switching from the light load (VT) mode to the high-frequency mode causes the rated current and overload detection settings to be changed to those for the heavy load mode.

Restriction on High-frequency Mode

Selecting the high-frequency mode disables the following control.

- Sensorless vector control

Therefore, functions associated with this control such as auto-tuning, motor parameter setting, torque limit functions, overtorque/undertorque function, and torque control are unavailable.

In addition, switching from the heavy or light load mode to the high-frequency mode causes the default data and setting ranges of some parameters to be changed.

For details, *6-9 High-frequency Mode* on page 6-68.

Precautions for Correct Use

In the high-frequency mode, derating of the rated output current of the inverter is required if you use the inverter at an ambient temperature of 40°C or higher, or the inverter is installed side by side.

For details, refer to *A-1 Derating* on page A-2.

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-1 Derating* on page A-2.

Restriction on Modbus (RS-485) Communication

When the inverter is used with any of the following communications units, the inverter's RS-485 communications function cannot be used.

Control the inverter from the host of each communications unit.

- EtherCAT Communications Unit (Model: 3G3AX-MX2-ECT)
- CompoNet Communications Unit (Model: 3G3AX-MX2-CRT-E)
- DeviceNet Communications Unit (Model: 3G3AX-MX2-DRT-E)

1-5 Comparison with Previous Model

The following describes the changes and additions from the conventional 3G3MX2 Series.

Use this information when replacing the previous model.

Change in Colors of Digital Operator Keys

The 3G3MX2-V1 Series Inverter has a different color scheme for its Digital Operator keys, as shown below.

Key	Name	Previous model	3G3MX2-V1
RUN	RUN key	Gray	Green
STOP RESET	STOP/RESET key	Yellow	Red
↻	Mode key	Blue	Blue (No change)
↵	Enter key	Yellow	Yellow (No change)
︽	Increment key	Green	Gray
︾	Decrement key	Green	Gray

PM Motor Mode

In addition to conventional induction motors, this inverter provides the PM motor mode to be able to control PM motors, which results in more efficient control than the conventional energy-saving control.

This is combined with the OMRON’s unique auto-tuning function and initial pole position estimation function that estimates the magnetic pole position of a PM motor during startup to enable its smooth start.

This control is suitable for applications with reduced torque characteristics such as fans and pumps (which do not require torque at low speeds).

However, it cannot be used for applications with constant torque characteristics such as general transfer equipment and elevating axes, where the starting torque exceeds 50% of the motor rating.

Enhancements to Simple Position Control Function

The following functions are added to the conventional simple position control function for enhancement. Use these functions according to your application.

- Restarting Positioning : Repositions the motor to the target position if it is out of the range set in the parameter.
- Position Store Selection at Power Off : Stores the current position at power off and resume from the stored position at the next power-on.
- Preset Position : Sets the current stop position as a preset position, for example, after completion of an origin search.
- Creep Speed Moving Amount Adjustment : Adjusts the amount of movement at the creep speed, although it was fixed to “1 + 1/4 rotations” conventionally.

DriveProgramming Function

This inverter has the built-in DriveProgramming function as a simple sequence function.

This enables a stand-alone inverter to perform simple sequence control.

You can create programs easily in flowchart or text language method by using the CX-Drive.

For details, refer to “DriveProgramming User’s Manual (I580)”.

Modbus Mapping Function

This inverter has a function to be able to set up to 10 register addresses.

For example, when designing replacement, you can match the inverter-side register addresses without changing the communications program.

It is also possible to set the data type, scale, and endian (byte order) of communication data according to the application.

Changes of Electronic Thermal Function

The conventional electronic thermal function is used in common for both the inverter and the motor.

This time, the electric thermal function is separated for the motor and has additional functions to be able to set electronic thermal characteristics according to the characteristics of the motor in use.

Addition of Optional Equipment Restart Function at Initialization and Reset Input

The inverter has an additional function to restart the optional equipment when the inverter parameters are initialized or the reset signal is input.

Addition of Pulse Train Frequency Input Lower Limit Parameter

Although, the lower limit of the pulse train input function is conventionally fixed, it is modified so that the user can adjust this value according to the application. This is useful for the adjustment of the operating range by the pulse train input and as a countermeasure against noise.

High-frequency Mode

The maximum frequency of the conventional 3G3MX2 Series Inverter is 1000 Hz, however, that of the 3G3MX2-V1 Series Inverter (whose nameplate shows OUTPUT: 0.1-580Hz) is 580 Hz.

Additions/Changes of Monitor Function

The following monitor functions are added or improved to enhance the recognition of operations in your application.

Parameter No.	Parameter name	Previous model
d008	Real Frequency Monitor	Improved to be displayed always when the Pulse Train Input RP Selection (P003) is set to 01 (Feedback pulse).
d023	Program Counter (DriveProgramming)	Added as monitor functions for the DriveProgramming function.
d024	Program Number Monitor (DriveProgramming)	
d025	User Monitor 0 (DriveProgramming)	
d026	User Monitor 1 (DriveProgramming)	
d027	User Monitor 2 (DriveProgramming)	
d030	Current Position Monitor	Improved to be displayed always when the Pulse Train Input RP Selection (P003) is set to 01 (Feedback pulse).
d062	Frequency Reference Source Monitor	Added to monitor the enabled frequency reference.
d063	RUN Command Source Monitor	Added to monitor the enabled RUN command.
d130	Analog Voltage Input FV Monitor	Added to monitor the analog voltage input terminal FV.
d131	Analog Current Input FI Monitor	Added to monitor the analog current input terminal FI.
d133	Pulse Train Input RP Monitor	Added to monitor the pulse train input terminal RP.
d153	PID Deviation	Added to monitor the deviation in PID control.
d155	PID Output Monitor	Added to monitor the PID control operation output.

Changes of Default Parameter Setting

The default data of the following parameters are changed from the conventional 3G3MX2 Series. Check if these default values are appropriate for your application.

Parameter No.	Parameter name	Default data		Description
		Previous model	3G3MX2-V1	
A041	1st Torque Boost Selection	00	01	Changed to enable the automatic torque boost function.
A241	2nd Torque Boost Selection	00	01	
A047	1st Automatic Torque Boost Slip Compensation Gain	100	0	Changed to disable the automatic torque boost slip compensation function.
A247	2nd Automatic Torque Boost Slip Compensation Gain	100	0	
b027	Overcurrent Suppression Selection	00	01	Changed to enable the overcurrent suppression function.
b037	Display Selection	04	00	Changed to display all parameters.
b082	Starting Frequency	0.50	1.50	Changed to 1.5 Hz.
b130	Overvoltage Suppression Function Selection During Deceleration	00	01	Changed to enable the overvoltage suppression function
C102	Reset Selection	00	02	Changed to enable only when an error occurs.

Changes of Parameter Setting Range

For the following parameters, the setting range is changed to expand the range of supported applications.

Parameter No.	Parameter name	Data range	
		Previous model	3G3MX2-V1
F002	1st Acceleration Time 1	0.01 to 3600.00 s	0.00 to 3600.00 s
F202	2nd Acceleration Time 1		
F003	1st Deceleration Time 1		
F203	2nd Deceleration Time 2		
A092	1st Acceleration Time 2		
A292	2nd Acceleration Time 2		
A093	1st Deceleration Time 2		
A293	2nd Deceleration Time 2		
A001	1st Frequency Reference Selection	00 to 04, 06, 10	00 to 04, 06, 07, 10
A201	2nd Frequency Reference Selection	00 to 04, 06, 10	00 to 04, 06, 07, 10
b027	Overcurrent Suppression Selection	00, 01	00, 01, 02
b082	Starting Frequency	0.10 to 9.99 Hz (100.0 Hz)*1	0.01 to 9.99 Hz (100.0 Hz)*1
b084	Initialization Selection	00 to 03	00 to 03, 04
b120	Brake Control Function Selection	00, 01	00, 01, 02
b171	Inverter Mode Selection	00 to 02	00 to 33
C001 to C007	Multi-function Input S1 to S7 Selection	00 to 09, 11 to 16, 18 to 24, 27 to 29, 31 to 42, 44, 46, 47, 50 to 53, 65 to 70, 73, 77, 78, 81, 83 to 86 255: no	00 to 09, 11 to 16, 18 to 24, 27 to 29, 31 to 42, 44, 46, 47, 50 to 53, 56 to 62, 65 to 70, 73, 77, 78, 81, 82, 83 to 86, 91 255: no
C021, C022	Multi-function Output P1, P2 Selection	00 to 07, 09 to 13, 19 to 28, 31 to 35, 39 to 43, 50 to 55, 58 to 60, 62, 63 25: no	00 to 07, 09 to 13, 19 to 28, 31 to 35, 39 to 43, 44 to 46, 50 to 55, 58 to 60, 62, 63 255: no
C026	Multi-function Relay Output (MA, MB) Function Selection		
C027	MP Selection	00 to 08, 10, 15, 16	00 to 08, 10, 12, 15, 16
C028	AM Selection	00 to 02, 04 to 07, 10, 11, 16	00 to 02, 04 to 07, 10, 11, 13, 16
P003	Pulse Train Input RP Selection	00, 01	00, 01, 02
P031	Acceleration/Deceleration Time Input Type	00	00, 03

*1. In the high-frequency mode.

Changes of Parameter Name

Some parameter names were changed from the conventional 3G3MX2 Series.

The parameter number of each function is not changed, the same as before. Refer to *Section 4 Parameter List*. Some examples follow.

Parameter No.	Parameter name	
	Previous model	3G3MX2-V1
b050	Controlled Deceleration on Power Loss	Deceleration Stop Selection on Power Interruption
b150	Main Panel Display Selection	Inverter Display on Operator Connection
b160	d050 Monitor Target 1	User Monitor Selection 1
C038	Low Current Signal Output Mode Selection	Low Current Signal Output Selection

2

Design

This section describes the installation environment and wiring methods.

2-1 Installation 2-4
2-1-1 Inverter Installation 2-4
2-1-2 Installation Environment 2-4
2-2 Removal of Each Part 2-7
2-2-1 Removing Covers 2-7
2-2-2 Terminal Blocks 2-8
2-2-3 Preparing Backing Plate 2-9
2-3 Wiring 2-10
2-3-1 Standard Connection Diagram 2-10
2-3-2 Arrangement and Function of Main Circuit Terminal Block 2-11
2-3-3 Arrangement and Function of Control Circuit Terminal Block 2-12
2-3-4 Wiring for Main Circuit Terminals 2-15
2-3-5 Wiring for Control Circuit Terminals 2-33
2-3-6 Wiring for RS485 Communications Terminals 2-40
2-3-7 Wiring for Digital Operator 2-42
2-3-8 Safety Function 2-43
2-3-9 Compliance with EC Directives 2-44

⚠ WARNING

⚡	Turn off the power supply and implement wiring correctly. Not doing so may result in a serious injury due to an electric shock.
⚡	Wiring work must be carried out only by qualified personnel. Not doing so may result in a serious injury due to an electric shock.
⚡	Do not change wiring and slide switches, put on or take off Operator and optional devices, replace cooling fans while the input power is being supplied. Doing so may result in a serious injury due to an electric shock.
⏚	Be sure to ground the unit. Not doing so may result in a serious injury due to an electric shock or fire. (200-V class: type-D grounding, 400-V class: type-C grounding)

⚠ CAUTION

⚠	Do not connect resistors to the terminals (+1, P/+2, N/–) directly. Doing so might result in a small-scale fire, heat generation, or damage to the unit.
❗	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 use a specified type of braking resistor/regenerative braking unit. In case of a braking resistor, install a thermal relay that monitors the temperature of the resistor. Not doing so might result in a moderate burn due to the heat generated in the braking resistor/regenerative braking unit. Configure a sequence that enables the inverter power to turn off when unusual over eating is detected in the braking resistor/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.

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 direct 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 hold by the front cover and terminal cover, but hold by the cooling fins during transportation.
- Confirm that the rated input power voltage of the inverter is the same as AC power supply voltage.
- Do not connect an AC power supply voltage to the control input/output terminals. Doing so may result in damage to the product.
- Be sure to tighten the screws on the terminal block securely. Wiring work must be done after installing the unit body.
- Do not connect any load other than a three-phase inductive motor to the U, V, and W output terminals.
- 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 a parameter is set incorrectly when starting up, adjusting, maintaining, or replacing, an unexpected operation may occur. Perform the operation after enough confirmation.
- When using the DriveProgramming, confirm that the program data is downloaded normally before starting operation.

Precautions for Correct Use

Installation

Mount the product vertically on a wall with the product’s longer sides upright.

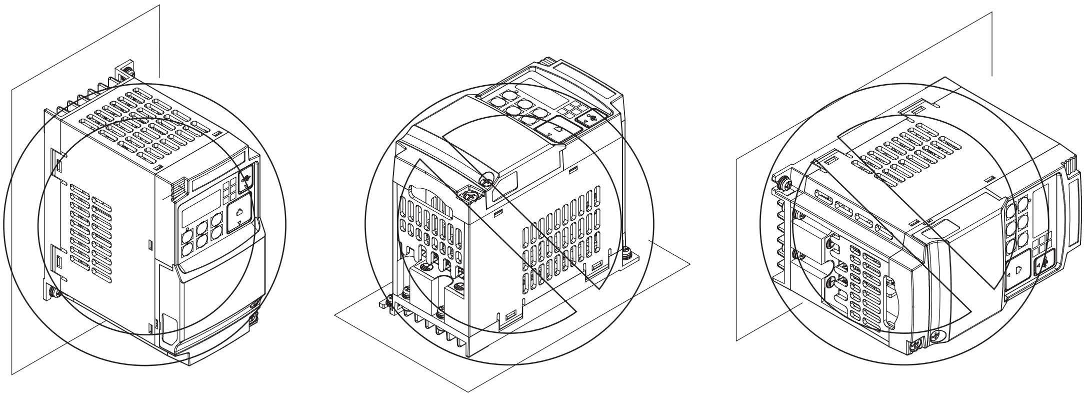
The material of the wall must be noninflammable such as a metal plate.

2-1 Installation

2-1-1 Inverter Installation

Mount the 3G3MX2-V1 Series Inverter vertically on a wall with the product's longer sides upright.

The material of the wall must be noninflammable such as a metal plate.



For the mounting dimensions, refer to *1-3-2 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**	20% to 90% (with no condensation)

- Measure and check the ambient temperature at a point approximately 5 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.

Precautions for Correct Use

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 setting.

Use the inverter in an appropriate environment according to *A-1 Derating* on page A-2.

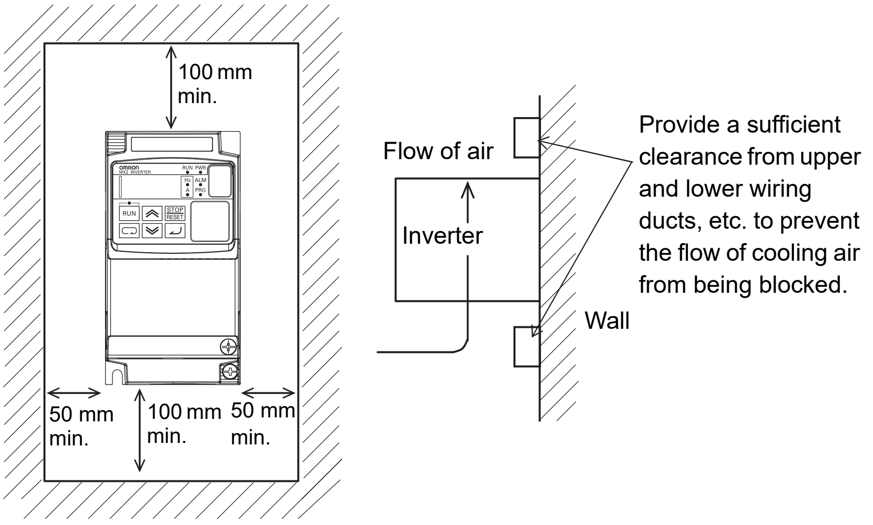
Installation Conditions

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

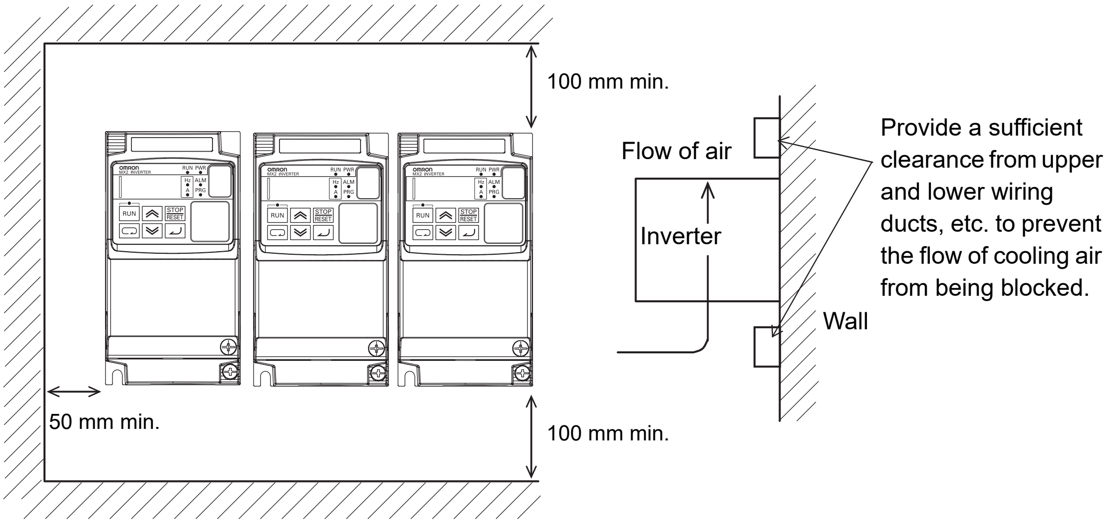
If the inverter is installed in a control panel, take into consideration dimensions and ventilation to keep the ambient temperature within the range of the specifications.

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

● Standard installation


100 mm min.
50 mm min.
100 mm min.
50 mm min.
Flow of air
Inverter
Wall
Provide a sufficient clearance from upper and lower wiring ducts, etc. to prevent the flow of cooling air from being blocked.

● Side-by-side installation

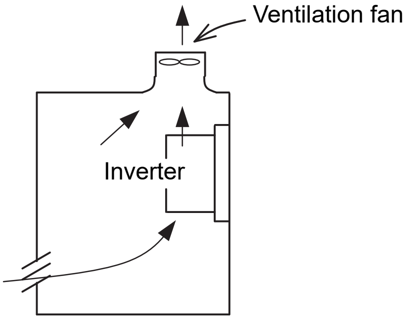

100 mm min.
50 mm min.
100 mm min.
Flow of air
Inverter
Wall
Provide a sufficient clearance from upper and lower wiring ducts, etc. to prevent the flow of cooling air from being blocked.

Ambient Temperature Control

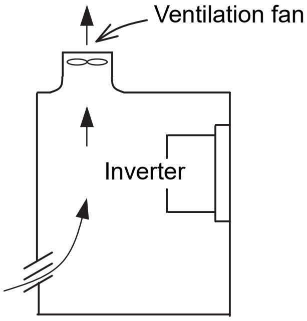
To ensure reliable operation, use the inverter in an environment subject to minimal temperature rise as much as possible.

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.



(Correct example)



(Incorrect example)

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.

Loss according to the Inverter Capacity

For the calculation of heat radiation from a cabinet, the following table shows the amount of heat generation (loss) from the inverter in the heavy load.

Single-phase/3-phase 200-V class			
Maximum applicable motor capacity [kW]	**Loss at 0% load of the rated current [W]**	**Loss at 100% load of the rated current [W]**	**Efficiency at 100% load of the rated current [%]**
0.1	10	12	89.5
0.2	10	22	90
0.4	10	30	93
0.75	12 (10) *1	48	94
1.5	12	79	95
2.2	12	104	95.5
3.7	12	154	96
5.5	14	229	96
7.5	14	313	96
11	19	458	96
15	19	625	96

3-phase 400-V class			
Maximum applicable motor capacity [kW]	**Loss at 0% load of the rated current [W]**	**Loss at 100% load of the rated current [W]**	**Efficiency at 100% load of the rated current [%]**
0.4	10	35	92
0.75	10	56	93
1.5	12	96	94
2.2	12	116	95
3.0	12	125	96
4.0	12	167	96
5.5	14	229	96
7.5	14	296	96.2
11	19	411	96.4
15	19	528	96.6

*1. The value in parentheses ( ) is for single-phase 200-V class inverters.

2-2 Removal of Each Part

2-2-1 Removing Covers

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

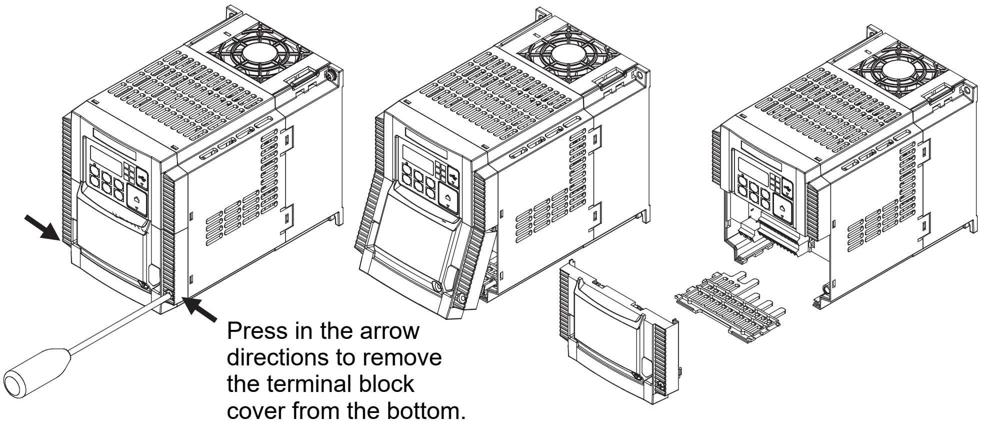
This section describes how to remove these covers.

To install a communications option unit, you must remove the option unit cover beforehand.

For how to install an option unit, refer to the user's manual for each option unit.

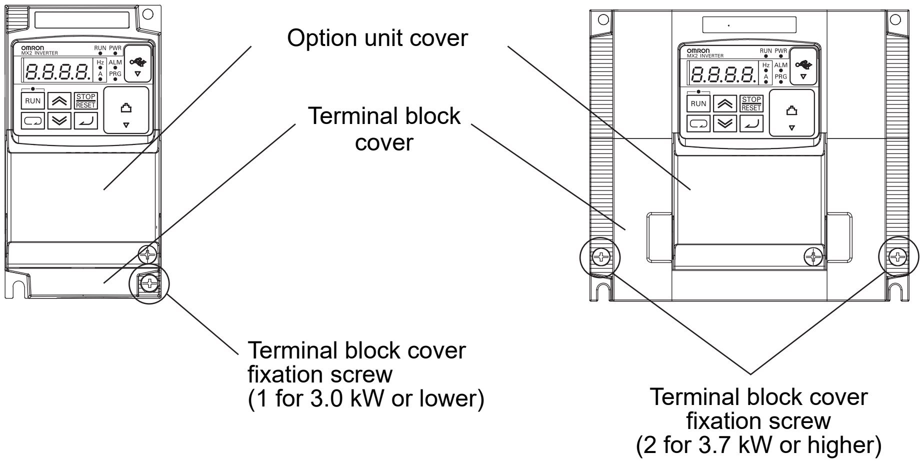
Removing Terminal Block Cover

1. **Loosen the terminal block cover fixation screw(s).**
2. **Remove the terminal block cover from the bottom, while pressing its lower sides in the directions of the arrows.**


Press in the arrow
directions to remove
the terminal block
cover from the bottom.

You can find one terminal block cover fixation screw at the lower right of the cover for inverters with a capacity of 3.0 kW or lower, or two terminal block cover fixation screws on both sides of the cover for inverters with a capacity of 3.7 kW or higher.

Also note that the option unit cover is screwed to the terminal block cover, but not fixed to the inverter body. Therefore, you can remove the terminal block cover without removing the option unit cover.


Option unit cover
Terminal block cover
Terminal block cover fixation screw (1 for 3.0 kW or lower)
Terminal block cover fixation screw (2 for 3.7 kW or higher)
omron
MX2 INVERTER
RUN PWR
Hz A ALM PRG
8.8.8.8.
RUN
STOP RESET

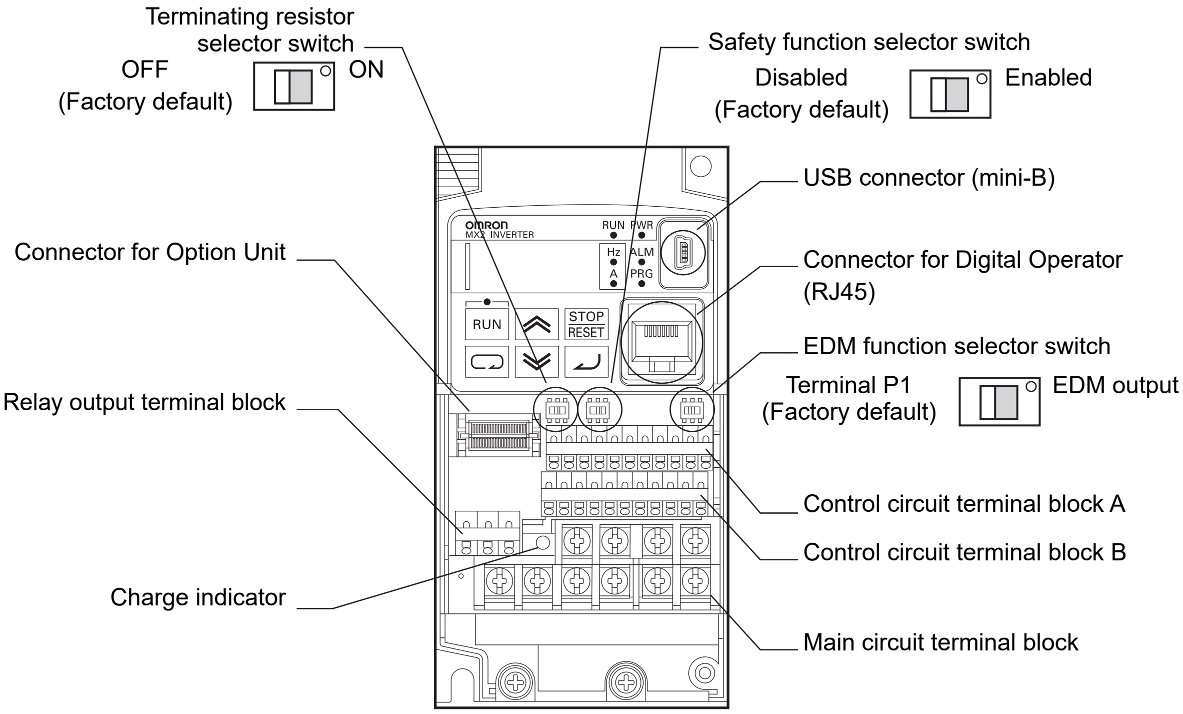
Installing Terminal Block Cover

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.

2-2-2 Terminal Blocks

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


Terminating resistor selector switch
OFF (Factory default)
ON
Safety function selector switch
Disabled (Factory default)
Enabled
USB connector (mini-B)
Connector for Option Unit
Connector for Digital Operator (RJ45)
EDM function selector switch
Terminal P1 (Factory default)
EDM output
Relay output terminal block
Control circuit terminal block A
Control circuit terminal block B
Charge indicator
Main circuit terminal block
omron
MX2 INVERTER
RUN
PWR
Hz
ALM
A
PRG
RUN
STOP RESET

Name	Description
Terminating resistor selector switch	The switch for switching ON/OFF the RS-485 terminal on the control circuit terminal block. When ON, the terminal is connected to the built-in 200-Ω terminating resistor.
Safety function selector switch	Turn this switch ON to use the safety function. Before you turn ON/OFF this switch, be sure to turn off the power supply. For details, refer to *7-10 Safety Function* on page 7-97.
EDM function selector switch	Turn this switch ON to use the EDM output of the safety function. Before you turn ON/OFF this switch, be sure to turn off the power supply. For details, refer to *7-10 Safety Function* on page 7-97.
USB connector	The mini-B type USB connector for connecting a computer. Use this connector to connect the inverter to the Inverter/Servo support tool CX-Drive.
Connector for Digital Operator	The connector for connecting the Digital Operator.
Connector for Option Unit	The connector for connecting an option unit. Use this connector to connect such as a communications option unit.
Control circuit terminal block A, B	The terminal block for connecting various digital/analog I/O devices used for inverter control.
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.

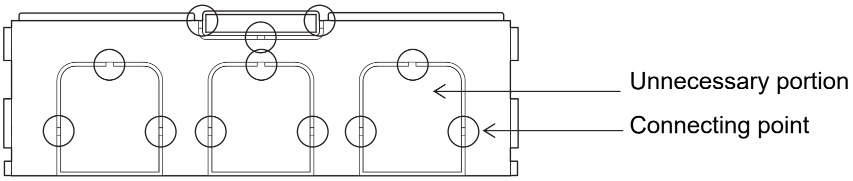
Name	Description
Charge Indicator	Lights up even after power supply shutoff if the main circuit DC voltage (between the terminal P/+2 and terminal N/–) is approximately 45 V or higher. Make sure the charge indicator is not lit before wiring etc.

Note For the description of the data display and operation keys, refer to *Section 3 Operation and Test Run*.

2-2-3 Preparing Backing Plate

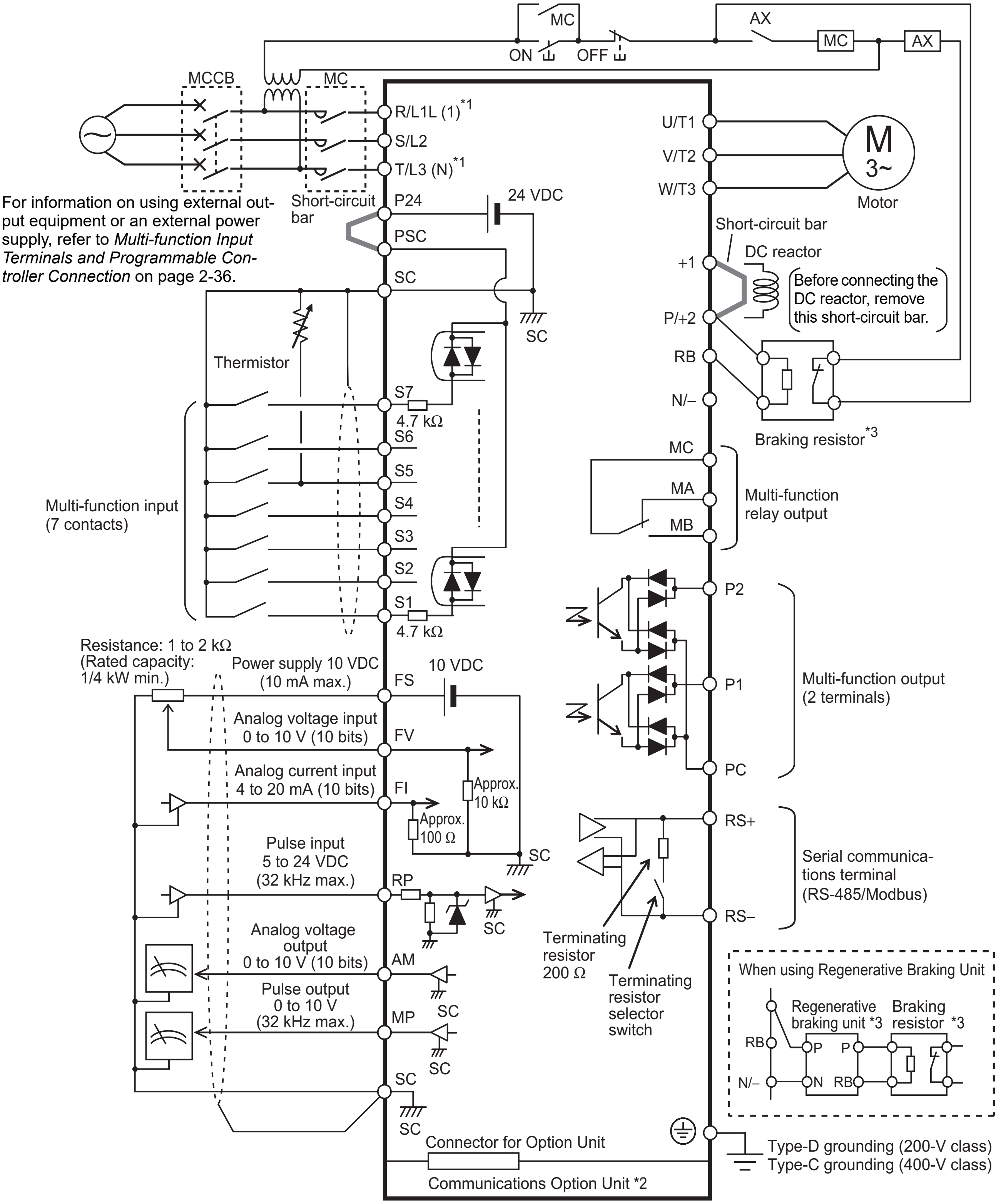
Inverter with 5.5 kW or Higher Capacity

For the inverters with 5.5 kW or higher capacity, before wiring, cut off the connecting points between the backing plate and unnecessary portions with nippers or a wire cutter.



2-3 Wiring

2-3-1 Standard Connection Diagram


MC
AX
ON
OFF
MC
AX
MCCB
MC
R/L1L (1)*1
S/L2
T/L3 (N)*1
Short-circuit bar
P24
24 VDC
PSC
SC
SC
Thermistor
S7
4.7 kΩ
S6
S5
S4
S3
S2
S1
4.7 kΩ
Multi-function input
(7 contacts)
U/T1
V/T2
W/T3
M
3~
Motor
Short-circuit bar
DC reactor
+1
P/+2
Before connecting the DC reactor, remove this short-circuit bar.
RB
N/–
Braking resistor*3
MC
MA
MB
Multi-function relay output
P2
P1
PC
Multi-function output
(2 terminals)
Resistance: 1 to 2 kΩ
(Rated capacity: 1/4 kW min.)
Power supply 10 VDC
(10 mA max.)
FS
10 VDC
Analog voltage input
0 to 10 V (10 bits)
FV
Analog current input
4 to 20 mA (10 bits)
FI
Approx. 10 kΩ
Approx. 100 Ω
SC
Pulse input
5 to 24 VDC
(32 kHz max.)
RP
SC
Analog voltage output
0 to 10 V (10 bits)
AM
Pulse output
0 to 10 V
(32 kHz max.)
MP
SC
SC
SC
SC
RS+
RS–
Serial communications terminal
(RS-485/Modbus)
Terminating resistor
200 Ω
Terminating resistor selector switch
When using Regenerative Braking Unit
Regenerative braking unit *3
Braking resistor *3
RB
P
P
N/–
N
RB
Connector for Option Unit
Communications Option Unit *2
Type-D grounding (200-V class)
Type-C grounding (400-V class)

For information on using external output equipment or an external power supply, refer to *Multi-function Input Terminals and Programmable Controller Connection* on page 2-36.

*1. Connect to the terminals L1 and N on the single-phase 200-VAC inverter (Model: 3G3MX2-AB☐☐☐-V1).

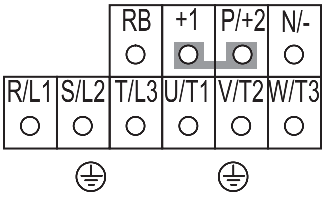
*2. For the connection to communications option units, refer to the user's manual for each option unit.

*3. For the connection to the braking resistor and regenerative braking unit, refer to *2-3-4 Wiring for Main Circuit Terminals* on page 2-15.

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



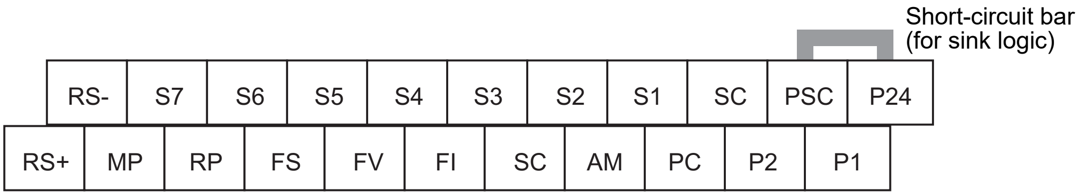
The terminal arrangement shown on the left is an example for the inverters with a capacity of 4.0 kW or lower.

Terminal symbol		Terminal name	Description
R/L1	L1	Main power supply input terminal	Connect the DC input power supply. For single-phase 200-V type Inverters (Model: 3G3MX2-AB☐☐☐-V1), connect these to the L1 and N terminals, respectively.
S/L2			
T/L3	N		
U/T1		Inverter output terminal	Connect a 3-phase motor.
V/T2			
W/T3			
+1		DC reactor connection terminal	Remove the short-circuit bar between the terminals +1 and P/+2, and connect an optional DC reactor.
P/+2			
P/+2		Braking resistor connection terminal	Connect an optional braking resistor (if a braking torque is required).
RB			
P/+2		Regenerative braking unit connection terminal	Connect optional regenerative braking units (if a braking torque is required and that produced by the built-in braking circuit is insufficient).
N/–			
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. For 200-V class models with a capacity of 3.7 kW or lower and 400-V class models with a capacity of 4.0 kW or lower, the ground terminal is located on the cooling fin.

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



Item		Terminal symbol	Terminal name	Description	Specifications
Analog	Power supply	SC	Input signal common	Common terminal for the internal power supply, digital input, and analog I/O terminals.	
		FS	Frequency reference power supply	This is 10 VDC power supply for the terminal FV.	Allowable current: 10 mA max.
	Frequency setting input	FV	Frequency reference input (Analog voltage input)	This is 0 to 10 VDC analog voltage input. By default, this is adjusted so that the frequency reaches the maximum at 9.8 V. (Adjustable in A012/A014)	Input impedance: Approx. 10 kΩ Allowable input voltage range: –0.3 to +12 VDC
		FI	Frequency reference input (Analog current input)	This is 4 to 20 mA analog DC input. By default, this is adjusted so that the frequency reaches the maximum at 19.8 mA. (Adjustable in A102/A104)	Input impedance: Approx. 100 Ω Allowable input range: 0 to 24 mA
	Sensor input	S5 (TH)	External thermistor input (Multi-function input terminal used in common)	Set the Multi-function Input S5 Selection (C005) to 19 (TH: PTC thermistor thermal protection) to enable this terminal. Connect an external thermistor between this terminal and SC, and the inverter will trip if a temperature error occurs. (The inverter trips when the resistance of the thermistor is approximately 3 kΩ or higher.)	PTC type
	Output	AM	Multi-function analog output (Voltage)	This terminal can output the specified signal as a 0 to 10-VDC voltage signal.	Allowable current: 2 mA max.

Item			Terminal symbol	Terminal name	Description	Specifications
Digital	Power supply		SC	Input signal common	Common terminal for the internal power supply, digital input, and analog I/O terminals.	
			P24	Input signal power supply	This is 24-VDC power supply for contact input signal. For source logic input, this terminal functions as the common terminal.	Allowable current: 100 mA max.
			PSC	Input terminal power supply	For sink logic input: Short-circuited to P24 For source logic input: Short-circuited to SC To activate contact input via an external power supply, remove the short-circuit bar. For details on the connection, refer to *Multi-function Input Terminals and Programmable Controller Connection* on page 2-36.	
	Input	Contact	S7 S6 S5 S4 S3 S2 S1	Multi-function input	Select seven functions from among 68 functions, and allocate them to terminals S1 to S7. These terminals support both the sink logic and the source logic. For details on the connection, refer to *Multi-function Input Terminals and Programmable Controller Connection* on page 2-36.	Voltage between each input terminal and the terminal PSC ON voltage: 18 V min. OFF voltage: 3 V max. Allowable voltage: 27 VDC max. Load current: 5 mA (at 24 V) Internal resistance: 4.7 kΩ
			S4 (GS1) S3 (GS2)	Safety input	Turn ON the safety function selector switch to enable this terminal. This automatically configures S3 and S4 as follows. S3: GS1 (Safety input 1) S4: GS2 (Safety input 2)	
		Pulse	RP	Pulse input - A	This is pulse input for frequency setting. This terminal accepts 5 to 24 VDC input signals. (Note that this terminal is connected to a different internal circuit from the input terminal S7.)	Input pulse: 32 kHz max. Internal resistance: 10 kΩ Voltage between this input terminal and the terminal SC: 5 to 24 VDC ON voltage: 4V min. OFF voltage: 1V max. Allowable voltage: 27 VDC max.
			S7 (EB)	Pulse input - B	Set the Multi-function Input S7 Selection (C007) to 85 (EB: Rotation direction detection) to enable this terminal. This is pulse input for frequency setting. (Note that this terminal is connected to a different internal circuit from the input terminal RP.)	Input pulse: 1.8 kHz max. Internal resistance: 4.7 kΩ ON voltage: 18 V min. OFF voltage: 3 V max. Allowable voltage: 27 VDC max. Load current: 5 mA (at 24 V)

Item			Terminal symbol	Terminal name	Description	Specifications
Digital	Output	Open collector	P1 P2	Multi-function output	Select two functions from among 47 functions, and allocate them to terminals P1 and P2. These terminals support both the sink logic and the source logic. For details on the connection, refer to *Multi-function Output Terminals and Programmable Controller Connection* on page 2-37.	Open collector output Between each terminal and PC Allowable voltage: 27 V max. Allowable current: 50 mA max. Voltage drop at power-on: 4 V max.
			P1 (EDM)	Safety monitor	Turn ON the EDM function selector switch to enable this terminal. This automatically sets this terminal to P1 (EDM: Safety monitor signal).	
			PC	Output signal common	Common terminal for multi-function output terminals P1 and P2.	Allowable current: 100 mA max.
		Relay	MA MB	Relay output terminal	Select the desired function from among 47 functions, and allocate it to these terminals. This is SPDT contact output. By default, Multi-function Relay Output (MA, MB) Operation Selection (C036) is set at NC contact between MA and MC, and NO contact between MB and MC.	Contact capacity Between MA and MC: 250 VAC, 2 A (Resistance)/0.2 A (Induction) Between MB and MC: 250 VAC, 1 A (Resistance)/0.2 A (Induction) Min. contact capacity 100 VAC, 10 mA 5 VDC, 100 mA
			MC	Relay output common		
		Pulses	MP	Pulse output	This terminal outputs pulses.	Output pulse: 32 kHz max. Output voltage: 10 VDC Allowable current: 2 mA max.
Serial communications			RS+ RS–	Modbus terminal (RS-485)	RS-485 terminal RS+: RS-485 differential (+) signal RS–: RS-485 differential (–) signal	Speed: 115.2 kbps max. Built-in terminating resistor: 200 Ω Switching via slide switch

Precautions for Correct Use

The Multi-function Relay Output (MA, MB) Function Selection (C026) is, by default, set to 05 (AL: Alarm signal). However, this default data is based on different alarm output specifications from those of the previous models (3G3☐V Series).

The table below shows the relationship between the relay output status when the inverter input power supply is ON/OFF and the Multi-function Relay Output (MA, MB) Operation Selection (C036) setting. Select the parameter setting appropriate to the sequence of your inverter according to this table.

Setting in C036	Input power supply	Inverter status	Relay output status	
			Between MA and MC	Between MB and MC
00	ON	Normal	Open	Closed
		Alarm output	Closed	Open
	OFF	—	Open	Closed
01 (Default data)	ON	Normal	Closed	Open
		Alarm output	Open	Closed
	OFF	—	Open	Closed

Note Set C036 to 00 to have the same relay output status as with the previous model (3G3☐V Series).

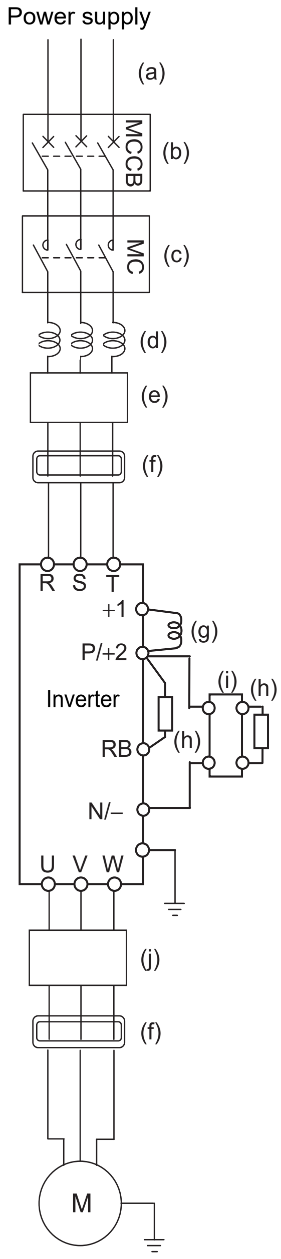
2-3-4 Wiring for Main Circuit Terminals

Precautions for Safe Use

- Before wiring, make sure that the charge indicator is not lit.
- Once the power supply is turned on, the capacitor in the inverter remains charged with a high voltage for a while after the power supply is shut off regardless of whether the inverter is running or not, which is dangerous.
- If you change cable connections after the power supply is shut off, wait for at least 10 minutes and, before wiring, check with a circuit tester etc. to be sure that there is no residual voltage between terminals P/+2 and N/–.

Main Circuit Configuration Diagram

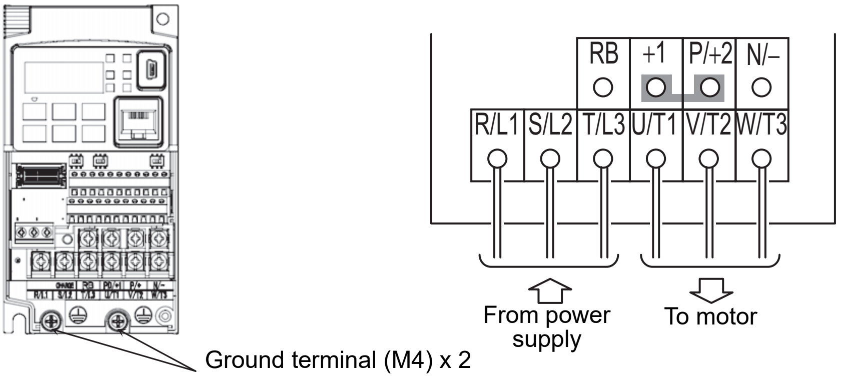
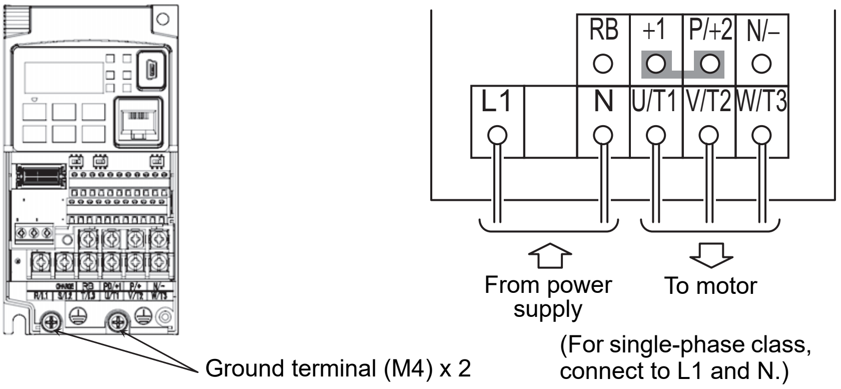
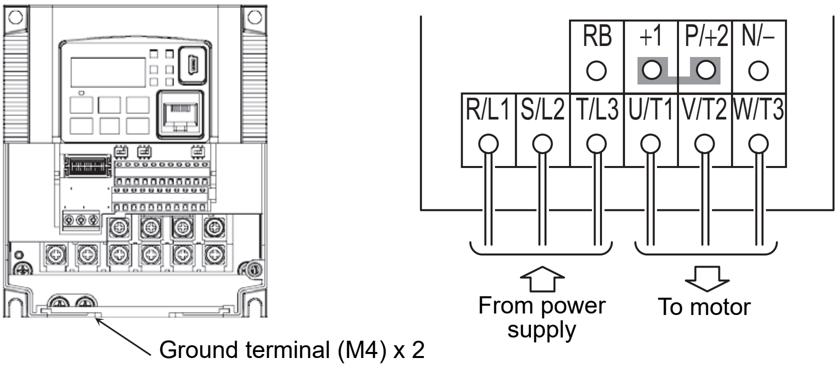
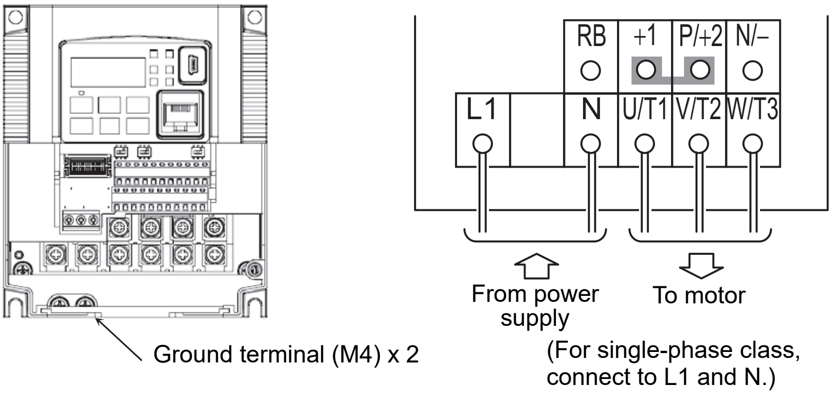
The diagram below shows the configuration of the inverter main circuit. The function of each peripheral component is also described.

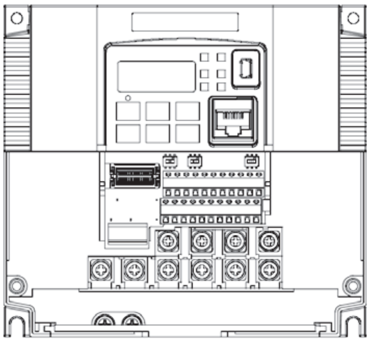
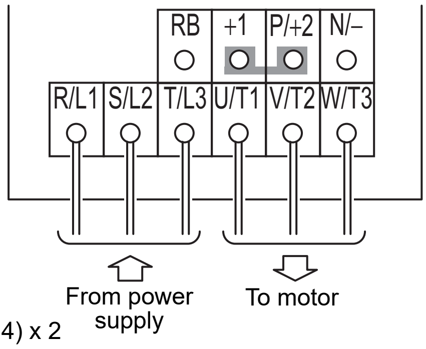
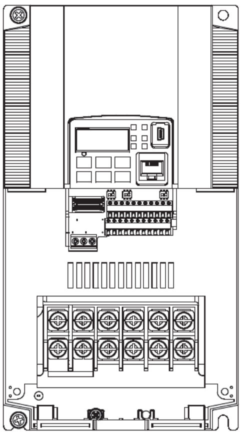
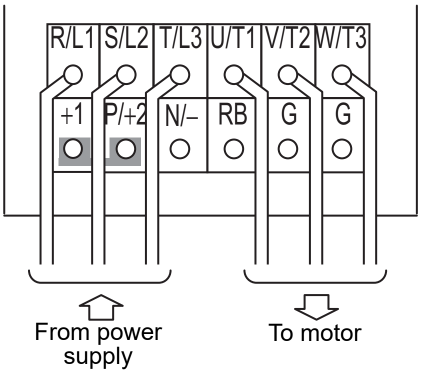
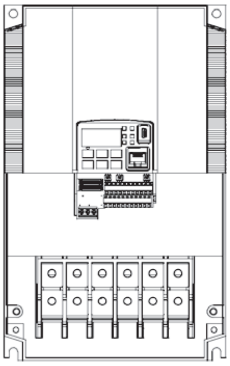
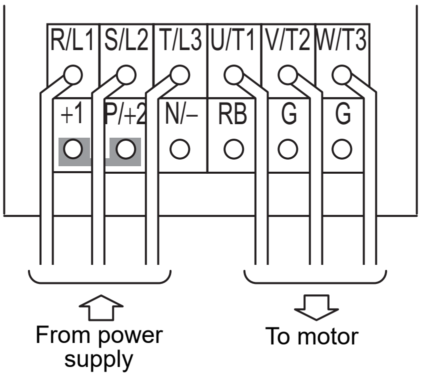
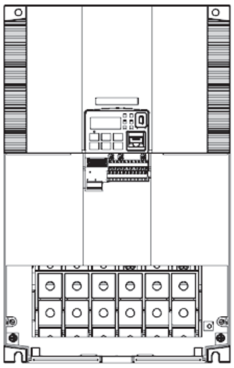
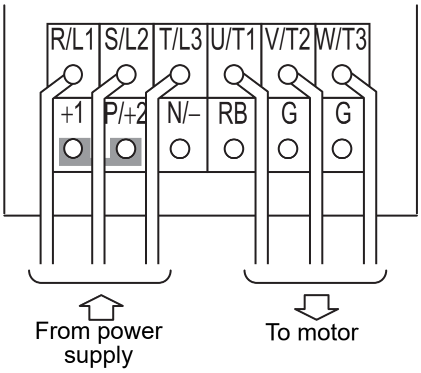


Name	Function
(a) (b) (c)	Refer to *Recommended Cable Size, Wiring Device, and Crimp Terminal* on page 2-19.
(d) AC reactor	This is used as a harmonic suppression measure. It also helps improve the power factor. The AC reactor is used when the power supply voltage unbalance factor is 3% or more, the 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 (i) Regenerative braking unit	These increase the amount of regenerative energy absorption when the inverter applies motor braking and are used to decrease the the speed of an elevator or load with a large moment of inertia. All models of the 3G3MX2-V1 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
3G3MX2-A2001-V1 to A2007-V1	 RB +1 P/+2 N/− R/L1 S/L2 T/L3 U/T1 V/T2 W/T3 From power supply To motor Ground terminal (M4) x 2
3G3MX2-AB001-V1 to AB004-V1	 RB +1 P/+2 N/− L1 N U/T1 V/T2 W/T3 From power supply To motor Ground terminal (M4) x 2 (For single-phase class, connect to L1 and N.)
3G3MX2-A2015-V1, A2022-V1 3G3MX2-A4004-V1 to A4030-V1	 RB +1 P/+2 N/− R/L1 S/L2 T/L3 U/T1 V/T2 W/T3 From power supply To motor Ground terminal (M4) x 2
3G3MX2-AB007-V1, AB015-V1, AB022-V1	 RB +1 P/+2 N/− L1 N U/T1 V/T2 W/T3 From power supply To motor Ground terminal (M4) x 2 (For single-phase class, connect to L1 and N.)

Applicable model	Terminal arrangement
3G3MX2-A2037-V1 3G3MX2-A4040-V1	 Ground terminal (M4) x 2  RB +1 P/+2 N/– R/L1 S/L2 T/L3 U/T1 V/T2 W/T3 From power supply To motor
3G3MX2-A2055-V1, A2075-V1 3G3MX2-A4055-V1, A4075-V1	  R/L1 S/L2 T/L3 U/T1 V/T2 W/T3 +1 P/+2 N/– RB G G From power supply To motor
3G3MX2-A2110-V1 3G3MX2-A4110-V1 to A4150-V1	  R/L1 S/L2 T/L3 U/T1 V/T2 W/T3 +1 P/+2 N/– RB G G From power supply To motor
3G3MX2-A2150-V1	  R/L1 S/L2 T/L3 U/T1 V/T2 W/T3 +1 P/+2 N/– RB G G From power supply To motor

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 3-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 *A-4 UL/cUL Standards Cautions* on page A-10, which includes the use of UL-compliant Class-J fuses.
- 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.

● 3-phase 200-V Class

Model	Heavy/ Light load mode	Maximum applicable motor capacity [kW]	Rated input current [A]	Power cable, ground cable [mm^2] *1*2*3	Terminal screw size	Tightening torque [N·m] *2	Molded case circuit breaker (MCCB)*2
3G3MX2-A2001-V1	Heavy load	0.1	1.0	AWG16 (1.25)	M3.5	1.0	5 A
	Light load	0.2	1.2	AWG16 (1.25)			5 A
3G3MX2-A2002-V1	Heavy load	0.2	1.6	AWG16 (1.25)	M3.5	1.0	5 A
	Light load	0.4	1.9	AWG16 (1.25)			5 A
3G3MX2-A2004-V1	Heavy load	0.4	3.3	AWG16 (1.25)	M3.5	1.0	5 A
	Light load	0.75	3.9	AWG16 (1.25)			10 A
3G3MX2-A2007-V1	Heavy load	0.75	6.0	AWG16 (1.25)	M3.5	1.0	10 A
	Light load	1.1	7.2	AWG16 (1.25)			10 A
3G3MX2-A2015-V1	Heavy load	1.5	9.0	AWG14 (2.0)	M4	1.4	15 A
	Light load	2.2	10.8	AWG14 (2.0)			20 A
3G3MX2-A2022-V1	Heavy load	2.2	12.7	AWG14 (2.0)	M4	1.4	20 A
	Light load	3.0	13.9	AWG12 (3.5)			20 A
3G3MX2-A2037-V1	Heavy load	3.7	20.5	AWG12 (3.5)	M4	1.4	30 A
	Light load	5.5	23.0	AWG10 (5.5)			50 A
3G3MX2-A2055-V1	Heavy load	5.5	30.8	AWG8 (8)	M5	3.0	50 A
	Light load	7.5	37.0	AWG6 (14)			60 A
3G3MX2-A2075-V1	Heavy load	7.5	39.6	AWG6 (14)	M5	3.0	60 A
	Light load	11	48.0	AWG6 (14)			75 A
3G3MX2-A2110-V1	Heavy load	11	57.1	AWG4 (22)	M6	3.9 to 5.1	100 A
	Light load	15	68.0	AWG4 (22)			100 A
3G3MX2-A2150-V1	Heavy load	15	62.6	AWG4 (22)	M8	5.9 to 8.8	100 A
	Light load	18.5	72.0	AWG2 (38)			100 A

*1. The wire size is based on H-IV wire (with a heat resistance of 75°C).

*2. For compliance with the UL standard requirements, be sure to perform wiring according to *A-4 UL/cUL Standards Cautions* on page A-10.

*3. The cable is applicable to wiring to the R/L1, S/L2, T/L3, U/T1, V/T2, W/T3, +1, P/+2, RB, N/-, and G (⏚) terminals.

3-phase 400-V class

Model	Heavy/ Light load mode	Maximum applicable motor capacity [kW]	Rated input current [A]	Power cable, ground cable [mm^2] *1*2*3	Terminal screw size	Tightening torque [N·m] *2	Molded case circuit breaker (MCCB)*2
3G3MX2-A4004-V1	Heavy load	0.4	1.8	AWG16 (1.25)	M4	1.4	5 A
	Light load	0.75	2.1	AWG16 (1.25)			5 A
3G3MX2-A4007-V1	Heavy load	0.75	3.6	AWG16 (1.25)	M4	1.4	5 A
	Light load	1.5	4.3	AWG16 (1.25)			10 A
3G3MX2-A4015-V1	Heavy load	1.5	5.2	AWG16 (1.25)	M4	1.4	10 A
	Light load	2.2	5.9	AWG16 (1.25)			10 A
3G3MX2-A4022-V1	Heavy load	2.2	6.5	AWG14 (2.0)	M4	1.4	10 A
	Light load	3.0	8.1	AWG14 (2.0)			15 A
3G3MX2-A4030-V1	Heavy load	3.0	7.7	AWG14 (2.0)	M4	1.4	15 A
	Light load	4.0	9.4	AWG14 (2.0)			15 A
3G3MX2-A4040-V1	Heavy load	4.0	11.0	AWG12 (3.5)	M4	1.4	20 A
	Light load	5.5	13.3	AWG12 (3.5)			20 A
3G3MX2-A4055-V1	Heavy load	5.5	16.9	AWG12 (3.5)	M5	3.0	30 A
	Light load	7.5	20.0	AWG10 (5.5)			30 A
3G3MX2-A4075-V1	Heavy load	7.5	18.8	AWG10 (5.5)	M5	3.0	30 A
	Light load	11	24.0	AWG10 (5.5)			50 A
3G3MX2-A4110-V1	Heavy load	11	29.4	AWG10 (5.5)	M6	3.9 to 5.1	50 A
	Light load	15	38.0	AWG6 (14)			60 A
3G3MX2-A4150-V1	Heavy load	15	35.9	AWG6 (14)	M6	3.9 to 5.1	60 A
	Light load	18.5	44.0	AWG6 (14)			75 A

*1. The wire size is based on H-IV wire (with a heat resistance of 75°C).

*2. For compliance with the UL standard requirements, be sure to perform wiring according to *A-4 UL/cUL Standards Cautions* on page A-10.

*3. The cable is applicable to wiring to the R/L1, S/L2, T/L3, U/T1, V/T2, W/T3, +1, P/+2, RB, N/-, and G (⏚) terminals.

Single-phase 200-V Class

Model	Heavy/ Light load mode	Maximum applicable motor capacity [kW]	Rated input current [A]	Power cable, ground cable [mm^2] *1*2*3	Terminal screw size	Tightening torque [N·m] *2	Molded case circuit breaker (MCCB)*2
3G3MX2-AB001-V1	Heavy load	0.1	1.3	AWG16 (1.25)	M3.5	1.0	5 A
	Light load	0.2	2.0	AWG16 (1.25)			5 A
3G3MX2-AB002-V1	Heavy load	0.2	3.0	AWG16 (1.25)	M3.5	1.0	5 A
	Light load	0.4	3.6	AWG16 (1.25)			5 A
3G3MX2-AB004-V1	Heavy load	0.4	6.3	AWG16 (1.25)	M3.5	1.0	10 A
	Light load	0.55	7.3	AWG16 (1.25)			15 A
3G3MX2-AB007-V1	Heavy load	0.75	11.5	AWG12 (3.5)	M4	1.4	15 A
	Light load	1.1	13.8	AWG12 (3.5)			20 A
3G3MX2-AB015-V1	Heavy load	1.5	16.8	AWG10 (5.5)	M4	1.4	20 A
	Light load	2.2	20.2	AWG10 (5.5)			30 A
3G3MX2-AB022-V1	Heavy load	2.2	22.0	AWG10 (5.5)	M4	1.4	30 A
	Light load	3.0	24.0	AWG10 (5.5)			50 A

*1. The wire size is based on H-IV wire (with a heat resistance of 75°C).

*2. For compliance with the UL standard requirements, be sure to perform wiring according to *A-4 UL/cUL Standards Cautions* on page A-10.

*3. The cable is applicable to wiring to the L1, N, U/T1, V/T2, W/T3, +1, P/+2, RB, N/-, and G (⏚) terminals.

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

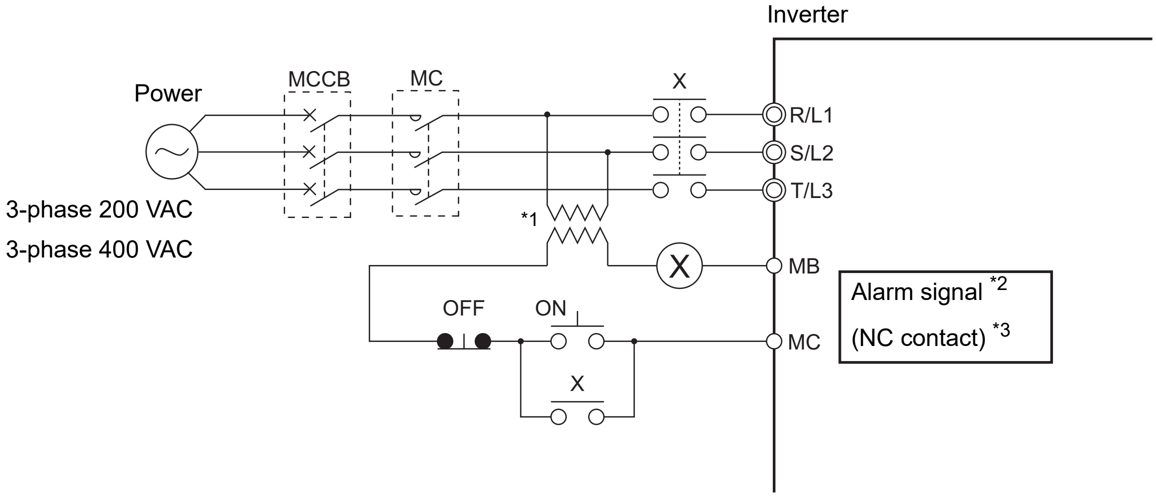
The following describes the wiring for the main power supply input terminals and for peripheral equipment.

● 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 (R/L1, S/L2, T/L3) 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 1 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 Multi-function Relay Output (MA, MB) Function Selection (C026) to 05 (AL: Alarm signal).

*3. Set the Multi-function Relay Output (MA, MB) Operation Selection (C036) to 00 (NO: NO contact) to configure the terminal MB as NC contact.

● Installing earth leakage breaker

When selecting the earth leakage breaker to use between the power supply and the main power supply input terminals (R/L1, S/L2, T/L3), 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 approximately 100 mA will flow for the power cable length of 1 m per inverter. Moreover, an additional leakage current of approximately 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 (Model: 3G3AX-NFI).

- OMRON currently plans to support the EMC noise filters for the 3G3MX2-V1 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.
- 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.

Precautions for Correct Use

Do not shut off the power supply more than once in 3 minutes. Doing so may cause an inverter damage.

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/3-phase 200-V class	
3G3MX2-□-V1	**Inrush current value (Ao-p)**
A2001 to A2037 AB001 to AB022	22
A2055 to A2110	34
A2150	40

3-phase 400-V class	
3G3MX2-□-V1	**Inrush current value (Ao-p)**
A4004 to A4040	43
A4055 to A4110	24
A4150	49

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 3-phase 200-V or 3-phase 400-V class inverter may cause damage to the inverter.

The inverter may also be damaged if phase loss occurs in the main power supply, because it does not have any function to detect main power supply phase loss.

Be sure to check that the 3-phase power supply is wired properly before using the inverter.

Precautions for Safe Use

Even when the inverter is in an input phase lost state, built-in capacitors are charged, which may result in an electric shock or injury.

Be sure to check the precautions provided in *Precautions for Safe Use* on page 2-3.

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 overvoltage or the rectifier may be damaged.

Installing input surge absorber

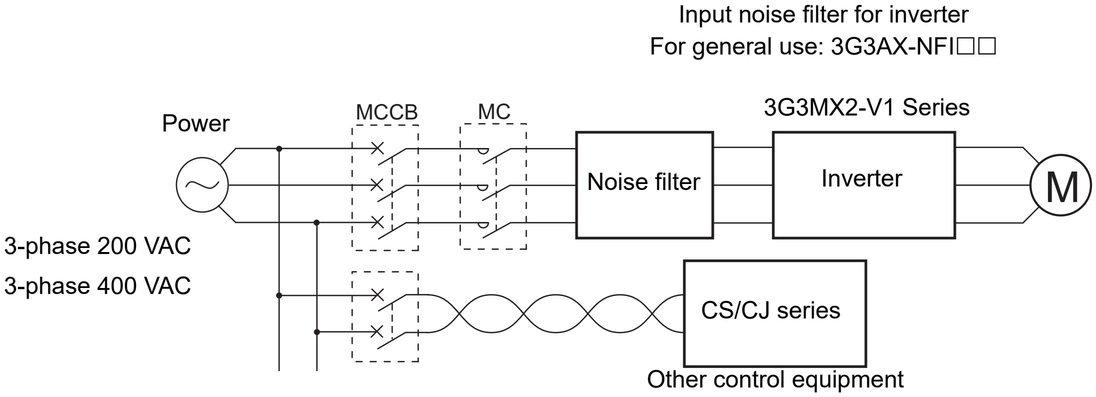
When using an inductive load (such as a magnetic contactor, magnetic relay, magnetic valve, solenoid, or electromagnetic brake), use a surge absorber or diode together.

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: 3G3AX-NFI□□
Power
MCCB
MC
3G3MX2-V1 Series
Noise filter
Inverter
M
3-phase 200 VAC
3-phase 400 VAC
CS/CJ series
Other control equipment

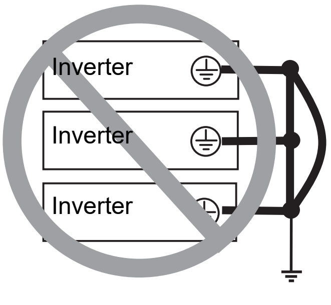
Wiring for Ground Terminal (G⏚)

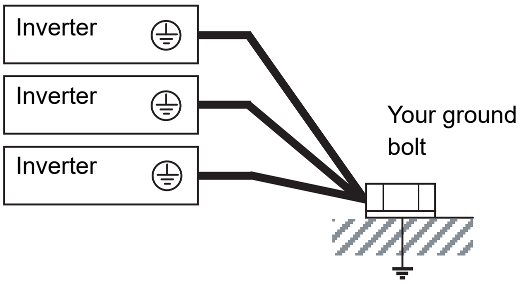
To prevent electric shock, be sure to ground the inverter and the motor.

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.


Inverter
Inverter
Inverter


Inverter
Inverter
Inverter
Your ground bolt

Harmonic Current Measures and DC/AC Reactor Wiring (+1, P/2)

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

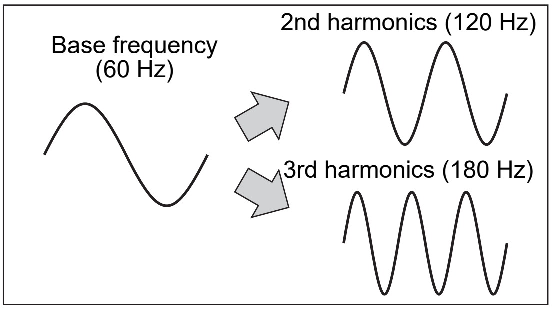
The following provides an overview of harmonics and measures against harmonics implemented in this inverter.

Harmonics

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

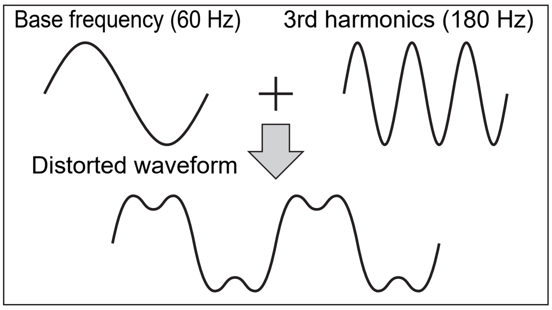
If a commercial power supply frequency of 60 Hz (50 Hz) is the reference frequency, the harmonics of that signal is:

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


Base frequency
(60 Hz)
2nd harmonics (120 Hz)
3rd harmonics (180 Hz)

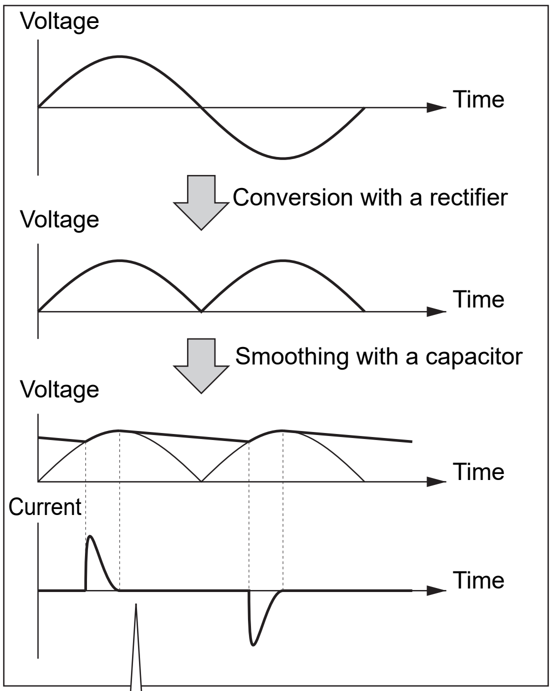
Reason why harmonics cause problems

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.


Base frequency (60 Hz)
3rd harmonics (180 Hz)
+
Distorted waveform

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 smoothened 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.



Current flows only during the charging of a capacitor.
The waveforms of current differs from those of voltage.

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 opertaion. Doing so may result in electric shock or burn injury.

By factory default, a short-circuit bar is connected between the terminals +1 and –P/+2. Before connecting the DC reactor, remove this short-circuit bar.

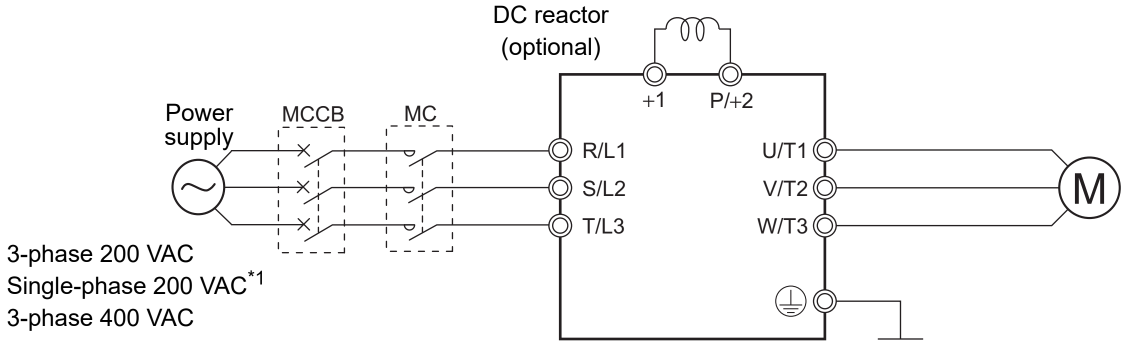
Note that the length of the DC reactor connection cable must be 5 m or shorter.

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.

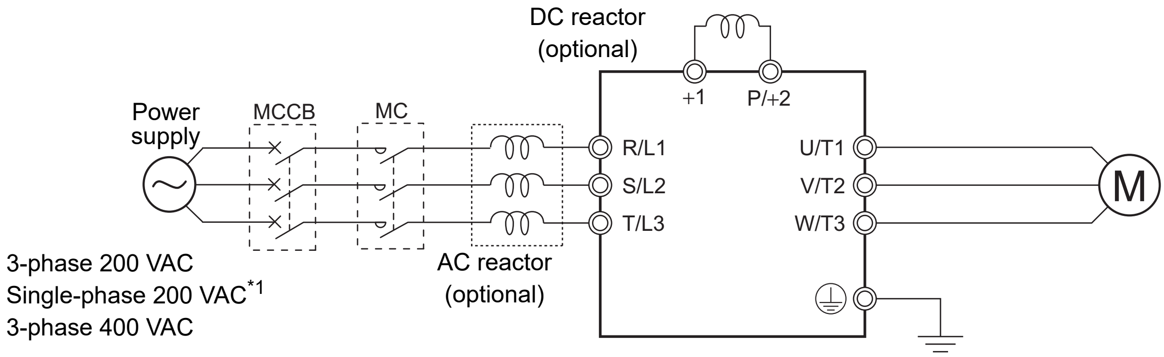
● Wiring method

With DC reactor


DC reactor
(optional)
+1
P/+2
Power supply
MCCB
MC
R/L1
S/L2
T/L3
U/T1
V/T2
W/T3
M
3-phase 200 VAC
Single-phase 200 VAC*1
3-phase 400 VAC

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

With DC reactor and AC reactor


DC reactor
(optional)
+1
P/+2
Power supply
MCCB
MC
R/L1
S/L2
T/L3
U/T1
V/T2
W/T3
M
AC reactor
(optional)
3-phase 200 VAC
Single-phase 200 VAC*1
3-phase 400 VAC

*1. Connect to the terminals L1 and 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 (excerpt from a JEMA document).

Measure against harmonics	Harmonic current occurrence rate [%]							
	5th	7th	11th	13th	17th	19th	23rd	25th
None (Inverter only)	65	41	8.5	7.7	4.3	3.1	2.6	1.8
With AC reactor	38	14.5	7.4	3.4	3.2	1.9	1.7	1.3
With 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. Then, 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/T1, V/T2, W/T3)

The following describes the wiring for the inverter output terminals (U/T1, V/T2, W/T3).

● Never connect power supply to output terminals

Never connect the power supply to the output terminals U/T1, V/T2, W/T3.

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

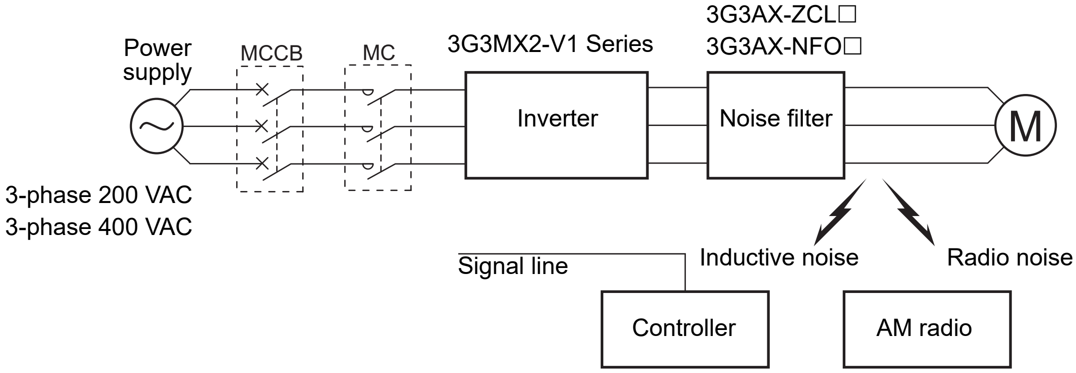
If connecting more than one motors to the output terminals of the inverter, note the following three points.

- 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.

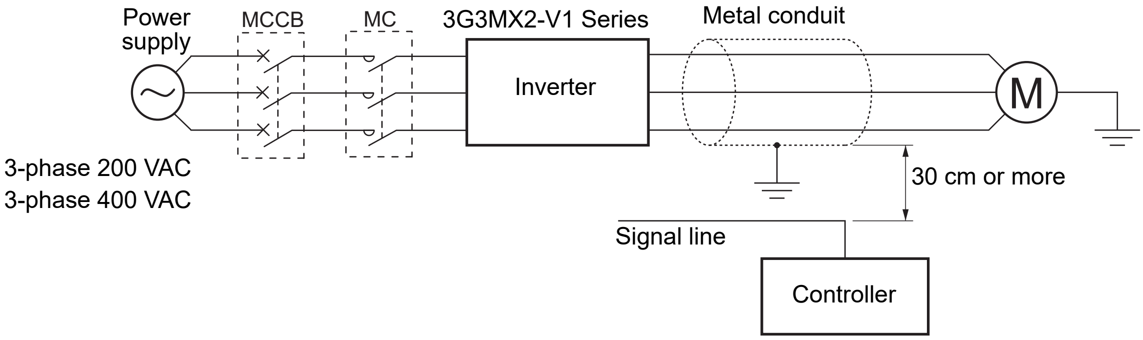

Power supply
MCCB
MC
3G3MX2-V1 Series
3G3AX-ZCL□
3G3AX-NFO□
Inverter
Noise filter
M
3-phase 200 VAC
3-phase 400 VAC
Signal line
Inductive noise
Radio noise
Controller
AM radio

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.

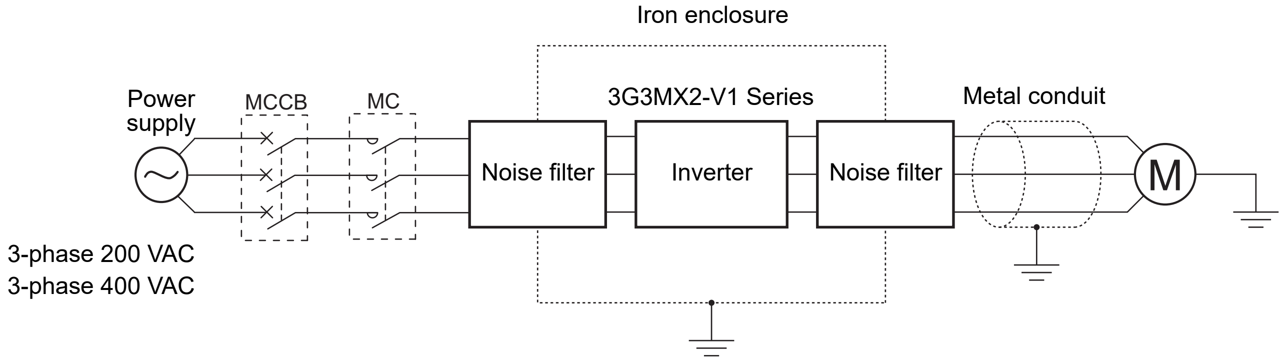

Power supply
MCCB
MC
3G3MX2-V1 Series
Metal conduit
Inverter
M
3-phase 200 VAC
3-phase 400 VAC
30 cm or more
Signal line
Controller

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 (approximately 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.

Wiring distance between inverter and motor	50 m max.	100 m max.	Over 100 m
Carrier frequency	10 kHz max.	5 kHz max.	2.5 kHz

External Braking Resistor Connection Terminal (P/+2, RB)/ Regenerative Braking Unit Connection Terminal (P/+2, N/–)

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 or regenerative braking units to prevent this.

● Using built-in regenerative braking circuit

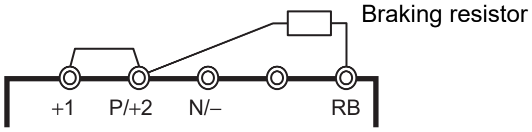
All models of the 3G3MX2-V1 Series Inverter have built-in regenerative braking circuit.

To improve the braking capacity, connect the optional external braking resistor to these terminals (P/+2, RB).

Precautions for Safe Use

- Be sure to install a circuit that detects overheating of the braking resistor via alarm contacts (thermal relay output terminals) and shuts off the input power supply of the inverter.
- Do not connect a resistor whose resistance is lower than the minimum connection resistance value specified in the standard specifications table. Doing so may result in damage to the regenerative braking circuit.
- When using the Braking Resistor (Model: 3G3AX-RBA/RBB/RBC) with a 400-V class inverter, be sure to connect two braking resistors of the same model in series. Using the Regenerative Braking Unit with only one braking resistor connected may cause damage to the braking resistor.

- Wiring diagram



● Using regenerative braking unit (Optional)

If a large braking torque is required and the built-in regenerative braking circuit cannot allow it, use the Regenerative Braking Unit (optional).

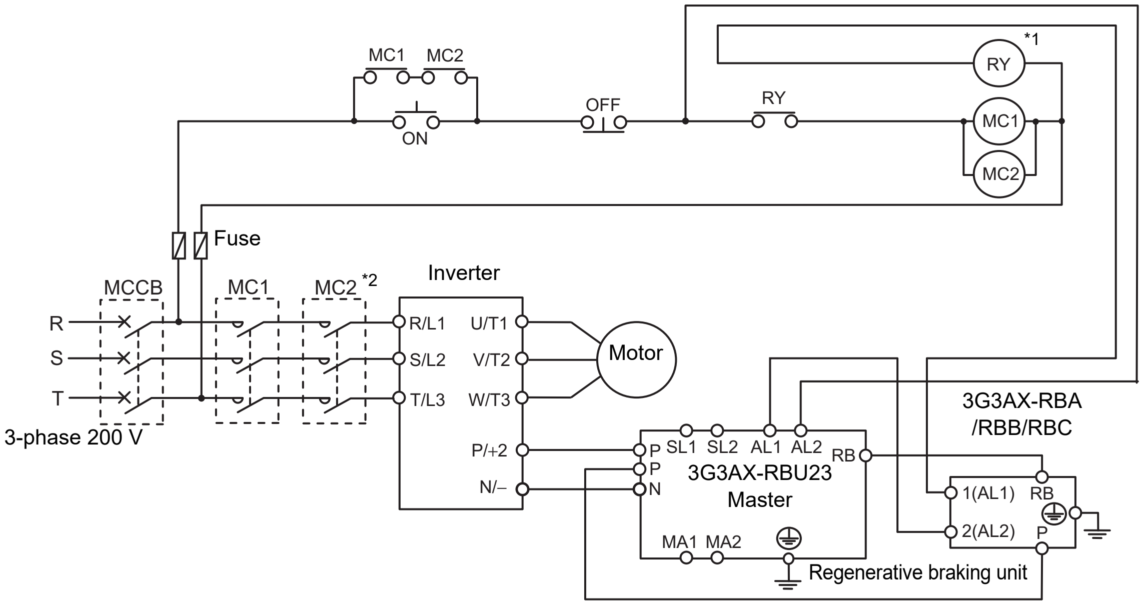
In this case, connect the terminals (P/+2, N/–) of the regenerative braking unit to the inverter's terminals (P, N).

Precautions for Safe Use

- Be sure to install a circuit that detects overheating of the regenerative braking unit(s) and braking resistor(s) via alarm contacts (thermal relay output terminals) and shuts off the input power supply of the inverter.
- Do not connect a resistor whose resistance is lower than the connection resistance value specified in the specifications table for that regenerative braking unit. Doing so may result in damage to the regenerative braking unit.
- When using the Braking Resistor (Model: 3G3AX-RBA/RBB/RBC) with a 400-V class Regenerative Braking Unit (Model: 3G3AX-RBU41/RBU42/RBU43), be sure to connect two braking resistors of the same model in series. Using the Regenerative Braking Unit with only one braking resistor connected may cause burnout of the braking resistor.

- When using the Regenerative Braking Unit (Model: 3G3AX-RBU21/RBU22/RBU41) with a built-in braking resistor with the Braking Resistor (Model: 3G3AX-RBA/RBB/RBC), remove the built-in resistor according to the “Regenerative Braking Unit 3G3AX-RBU□□ User’s Manual (I563)”. Using the Regenerative Braking Unit with the built-in resistor connected may cause damage to the built-in resistor.

- Wiring diagram for connecting one Regenerative Braking Unit (Model: 3G3AX-RBU23)



MC1
MC2
ON
OFF
RY
*1
RY
MC1
MC2
Fuse
MCCB
MC1
MC2 *2
Inverter
R
S
T
3-phase 200 V
R/L1
S/L2
T/L3
U/T1
V/T2
W/T3
P/+2
N/−
Motor
3G3AX-RBA
/RBB/RBC
P
P
N
SL1
SL2
AL1
AL2
RB
3G3AX-RBU23
Master
MA1
MA2
1(AL1)
2(AL2)
RB
P
Regenerative braking unit

*1. For RY, select the contact rating according to the ratings of the coils MC1 and MC2.

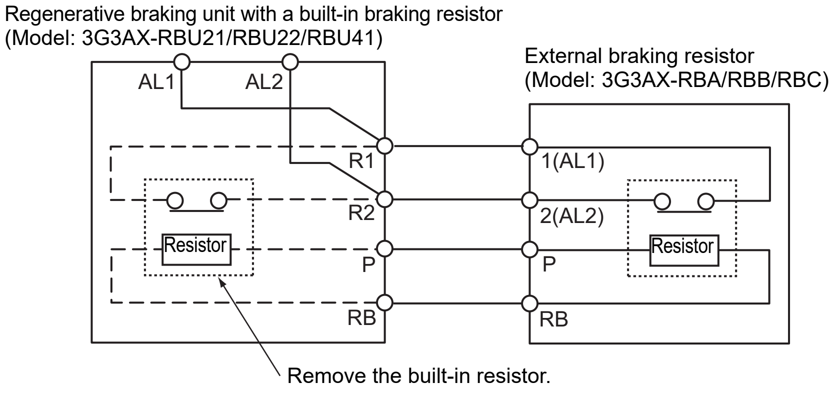
*2. MC1 and MC2 are used to provide redundancy.

Precautions for Correct Use

- Each braking resistor has alarm contact (thermal relay output) terminals as shown below. Be sure to perform wiring for these terminals.

Model	Alarm contact terminals
3G3AX-RBA□/RBB□	Between terminal 1 and terminal 2
3G3AX-RBC□	Between terminal AL1 and terminal AL2

- To remove the built-in resistor from the Regenerative Braking Unit Built-in Braking Resistor (Model: 3G3AX-RBU21/RBU22/RBU41) in order to use the Braking Resistor (Model: 3G3AX-RBA/RBB/RBC), remove the wiring of thermal relay for the built-in resistor and connect the alarm contact (thermal relay output) terminals of the braking resistor with the terminals R1 and R2.
  If the built-in resistor or its thermal relay is left connected, the built-in resistor may be overheated, or the alarm contact may not operate.



Regenerative braking unit with a built-in braking resistor
(Model: 3G3AX-RBU21/RBU22/RBU41)
AL1
AL2
R1
R2
P
RB
Resistor
External braking resistor
(Model: 3G3AX-RBA/RBB/RBC)
1(AL1)
2(AL2)
P
RB
Resistor
Remove the built-in resistor.

2-3-5 Wiring for Control Circuit Terminals

Wiring for Control Circuit Terminals

- Although two terminals SC are internally connected, the terminal PC is a common terminal for input and analog signals and mutually isolated from them.

  Do not short-circuit or ground these common terminals.

  In addition, do not ground these common terminals via external equipment.

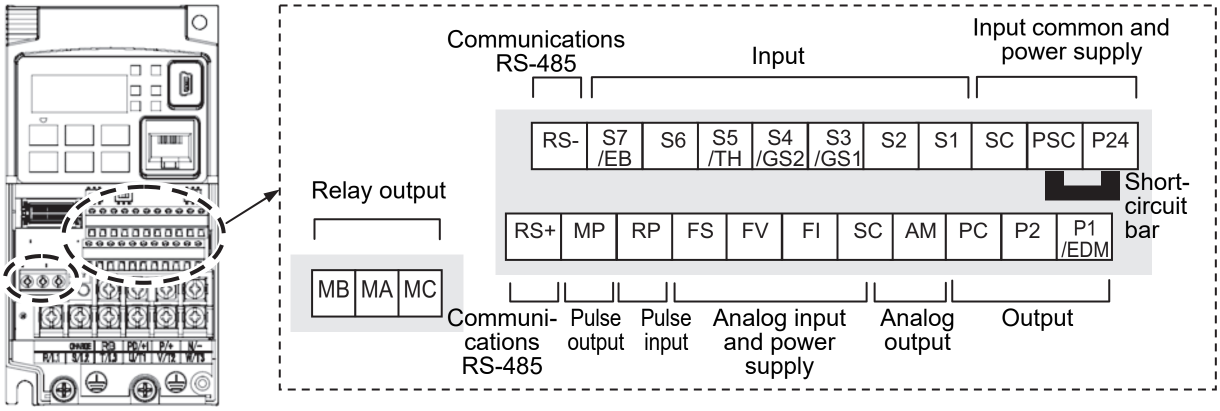
  When finished wiring, check the external equipment ground conditions.
- For wiring to the control circuit terminals, use twisted-pair shielded cables (recommended diameter: 0.75 mm^2). Connect the sheathed shielded cable to each common terminal. The cable length should be 20 m or shorter.
- Twist a cable connected to the terminal TH (thermistor input) with a cable of the terminal SC individually, and separate them from other SC 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 multi-function output terminal, connect a surge-absorbing diode in parallel with the coil.
- The control circuit terminal block has two rows of terminals. Start wiring from the lower terminals. Wiring from the upper terminals makes it difficult to wire the lower terminals.

Precautions for Correct Use

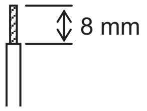
- Wiring the I/O signal lines for more than one inverter results in creating a sneak path in the circuit. Connect a diode for sneak current prevention. For wiring instructions, refer to *Precaution for Wiring Control Circuit Terminals* on page 2-38.
- The control circuit connection cables should be 20 m or shorter.
- Separate the cables for control circuit terminal connection from the main circuit cable (power cables) and the relay control circuit cable. If you cannot avoid crossing two types of cables, keep them at right angles to each other. Not doing so may result in the inverter malfunction. Separate signal lines from power supply lines when wiring.
- Do not short-circuit the terminals FS and SC of the analog power supply, and the terminals P24 and SC of the power supply for input signal. Doing so may result in failure of the inverter.
- After wiring, lightly pull the wire to confirm that it is connected properly.

Arrangement of Control Circuit Terminals

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


Communications
RS-485
Input
Input common and power supply
RS-
S7 /EB
S6
S5 /TH
S4 /GS2
S3 /GS1
S2
S1
SC
PSC
P24
Short-circuit bar
Relay output
RS+
MP
RP
FS
FV
FI
SC
AM
PC
P2
P1 /EDM
MB
MA
MC
Communi-cations RS-485
Pulse output
Pulse input
Analog input and power supply
Analog output
Output

	Applicable wire		
	Solid wire mm^2 (AWG)	Stranded wire mm^2 (AWG)	Ferrule mm^2 (AWG)
Control circuit terminal block	0.2 to 1.5 (AWG24 to 16)	0.2 to 1.0 (AWG24 to 17)	0.25 to 0.75 (AWG24 to 18)
Relay output terminal block	0.2 to 1.5 (AWG24 to 16)	0.2 to 1.0 (AWG24 to 17)	0.25 to 0.75 (AWG24 to 18)

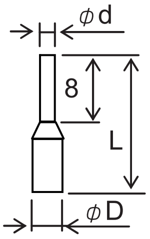


Sheath strip length should be approximately 8 mm for solid/stranded wire.

Recommended Terminal

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

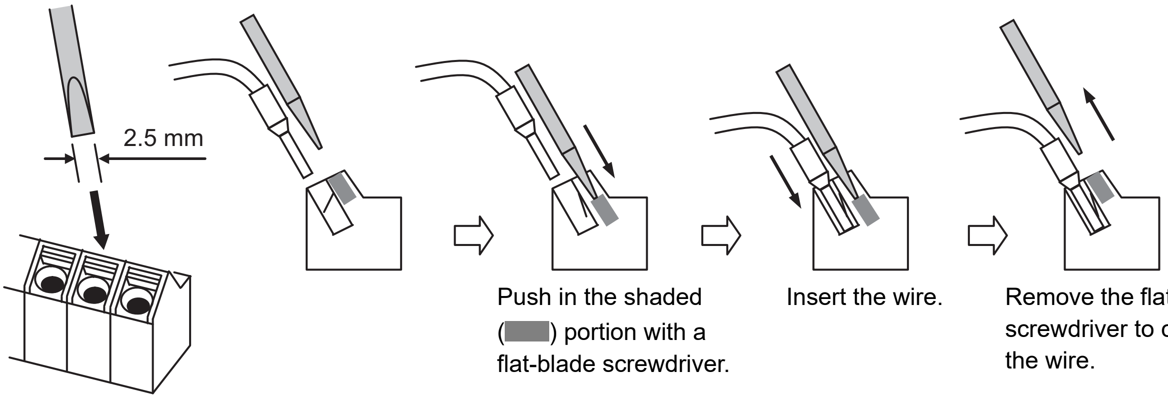
Wire size mm^2 (AWG)	Ferrule type [*1]	L [mm]	ϕd [mm]	ϕD [mm]
0.25 (24)	AI 0.25-8YE	12.5	0.8	2.0
0.34 (22)	AI 0.34-8TQ	12.5	0.8	2.0
0.5 (20)	AI 0.5-8WH	14	1.1	2.5
0.75 (18)	AI 0.75-8GY	14	1.3	2.8



*1. Manufacturer : PHOENIX CONTACT
Crimping tool: CRIPMFOX UD 6-4 or CRIMPFOX ZA 3

Wiring Method

1. **Push in the orange colored portion of the terminal 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.**



Push in the shaded (■) portion with a flat-blade screwdriver.

Insert the wire.

Remove the flat-blade screwdriver to clamp the wire.

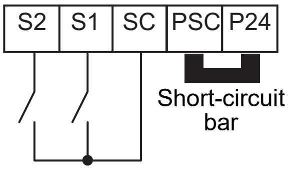
Note To disconnect, pull out the wire with the shaded (■) portion pushed in with a flat-blade screwdriver.

Selecting Input Control Logic

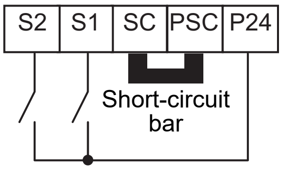
By factory default, the multi-function input terminals are set to sink logic (NPN).

To change the input control logic to source logic (PNP), remove the short-circuit bar between the terminals P24 and PSC on the control circuit terminal block, and connect it between the terminals PSC and SC.

(a) Sink logic

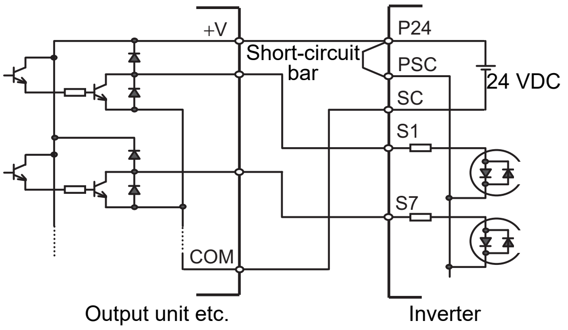
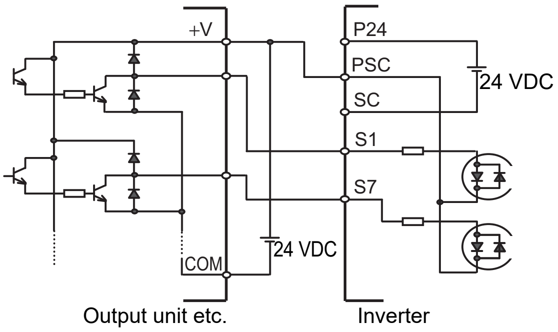


(b) Source logic

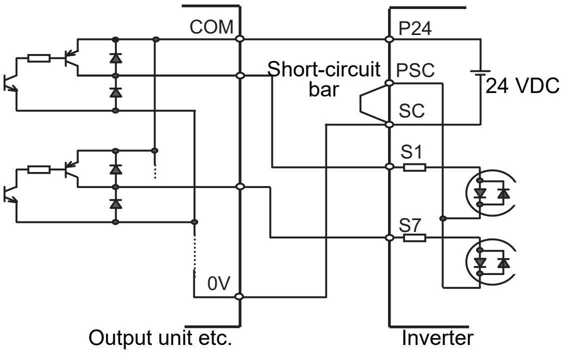
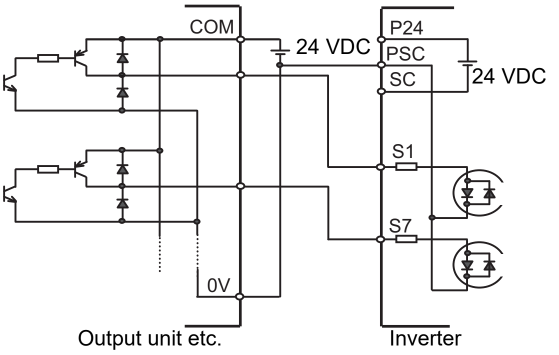


Multi-function Input Terminals and Programmable Controller Connection

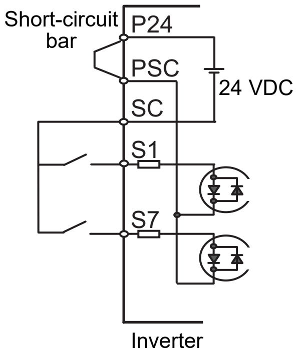
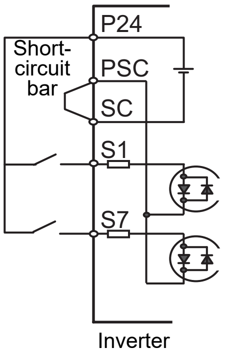
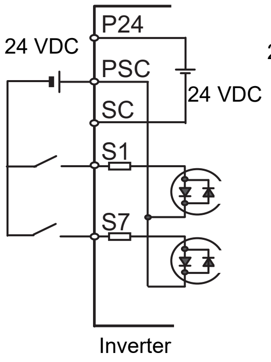
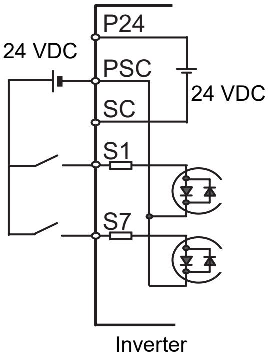
● Sink logic

When inverter's internal power supply for input signal is used	When external power supply is used (Remove the short-circuit bar from the control terminal block.)
 +V P24 Short-circuit bar PSC 24 VDC SC S1 S7 COM Output unit etc. Inverter	 +V P24 PSC 24 VDC SC S1 S7 24 VDC COM Output unit etc. Inverter

● Source logic

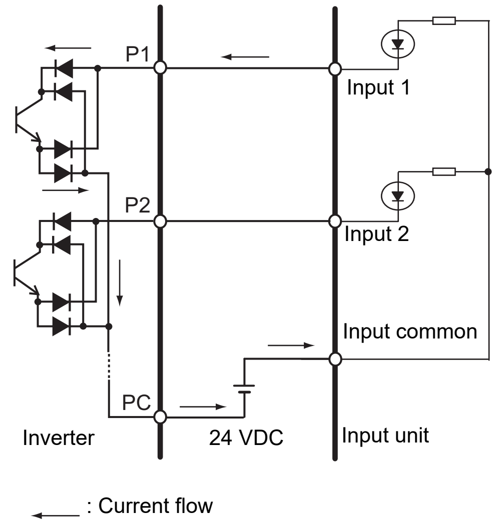
When inverter's internal power supply for input signal is used	When external power supply is used (Remove the short-circuit bar from the control terminal block.)
 COM P24 Short-circuit bar PSC 24 VDC SC S1 S7 0V Output unit etc. Inverter	 COM 24 VDC P24 PSC SC 24 VDC S1 S7 0V Output unit etc. Inverter

● No-voltage switch

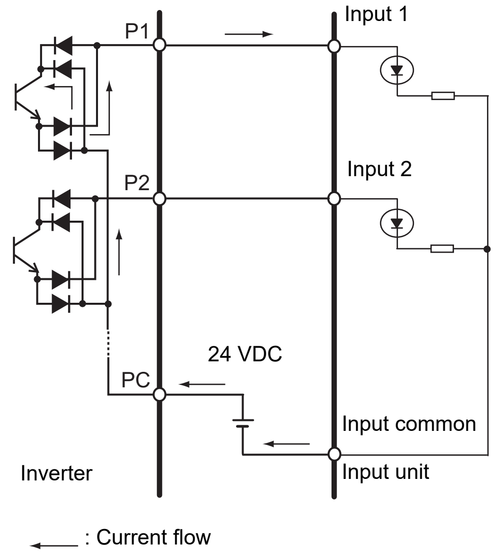
When inverter's internal power supply for input signal is used	When external power supply is used (Remove the short-circuit bar from the control terminal block.)
 Short-circuit bar P24 PSC 24 VDC SC S1 S7 Inverter  Short-circuit bar P24 PSC SC S1 S7 Inverter	 24 VDC P24 PSC 24 VDC SC S1 S7 Inverter  24 VDC P24 PSC 24 VDC SC S1 S7 Inverter

Multi-function Output Terminals and Programmable Controller Connection

● Sink logic


P1
Input 1
P2
Input 2
Input common
PC
Inverter
24 VDC
Input unit
: Current flow

● Source logic

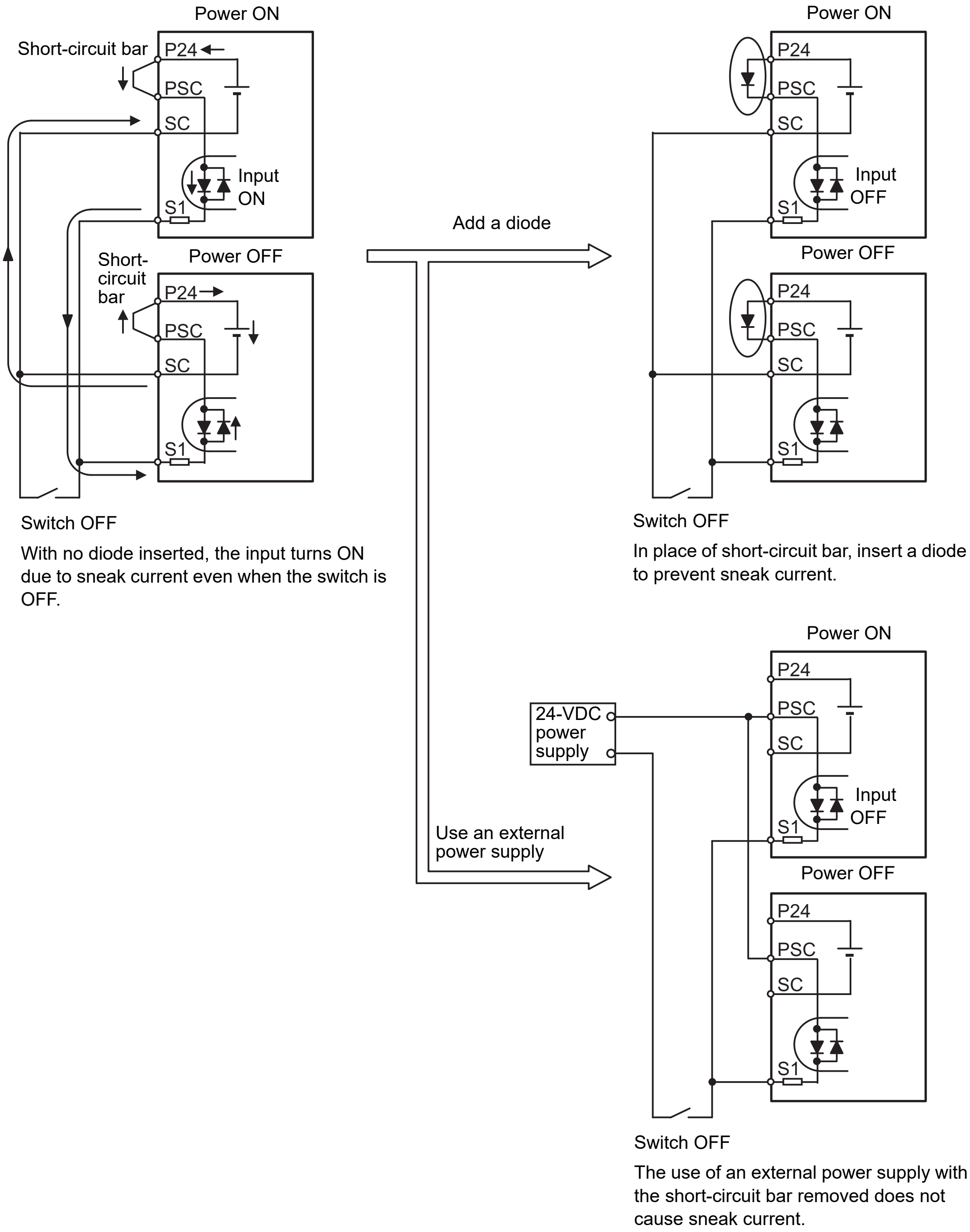

P1
Input 1
Input 2
P2
24 VDC
PC
Input common
Inverter
Input unit
: Current flow

Precaution for Wiring Control Circuit Terminals

Precaution for using more than one inverter

If more than one inverter uses a common input (such as a switch), and their power-on timing is different, a sneak current will flow in the circuit as shown below. This may cause the inverters to falsely recognize the input signal is ON even if it is OFF. If this occurs, insert a diode (rating: 50 V/0.1 A) in the position shown in the diagram or redesign the circuit to use an external power supply to prevent sneak current.

For sink logic

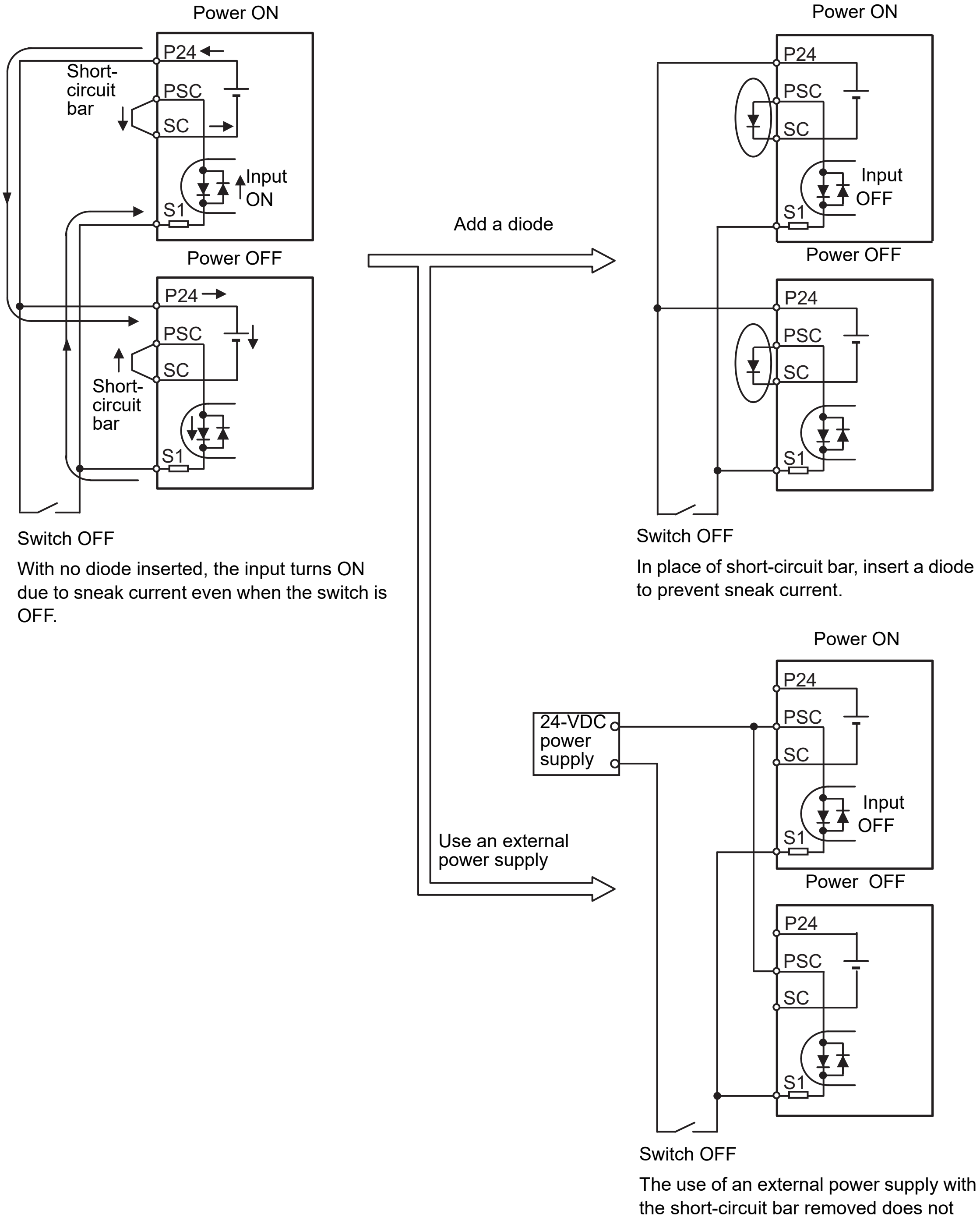

Power ON
Short-circuit bar
P24
PSC
SC
Input
ON
S1
Short-
circuit
bar
Power OFF
P24
PSC
SC
S1
Switch OFF
Add a diode
Power ON
P24
PSC
SC
Input
OFF
S1
Power OFF
P24
PSC
SC
S1
Switch OFF
Use an external
power supply
24-VDC
power
supply
Power ON
P24
PSC
SC
Input
OFF
S1
Power OFF
P24
PSC
SC
S1
Switch OFF

With no diode inserted, the input turns ON due to sneak current even when the switch is OFF.

In place of short-circuit bar, insert a diode to prevent sneak current.

The use of an external power supply with the short-circuit bar removed does not cause sneak current.

For source logic


Power ON
P24
PSC
SC
S1
Short-circuit bar
Input ON
Power OFF
P24
PSC
SC
S1
Short-circuit bar
Switch OFF
Add a diode
Power ON
P24
PSC
SC
S1
Input OFF
Power OFF
Switch OFF
Use an external power supply
24-VDC power supply
Power ON
P24
PSC
SC
S1
Input OFF
Power OFF
Switch OFF

With no diode inserted, the input turns ON due to sneak current even when the switch is OFF.

In place of short-circuit bar, insert a diode to prevent sneak current.

The use of an external power supply with the short-circuit bar removed does not cause sneak current.

2-3-6 Wiring for RS485 Communications Terminals

This inverter has RS485 communications terminals on its control circuit terminal block.

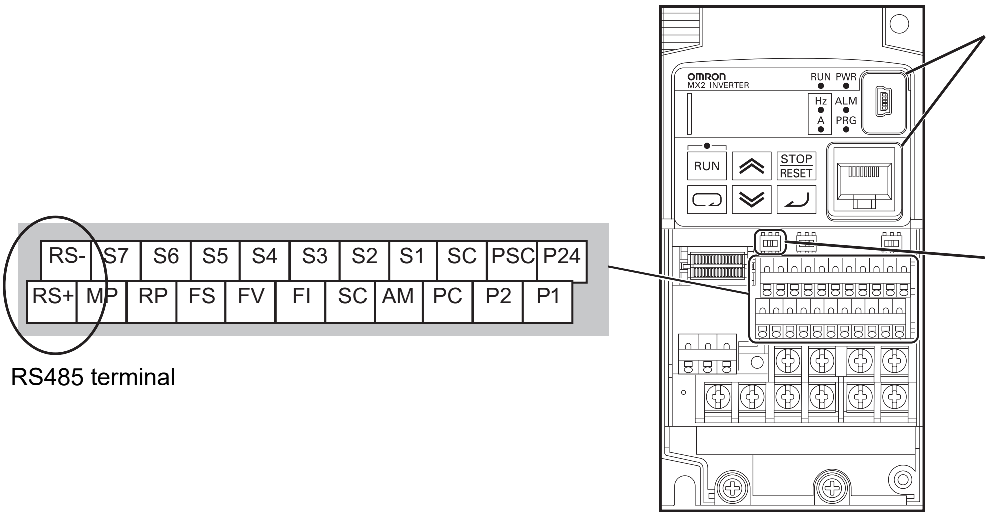
It uses the Modbus communication protocol to establish communications with external controllers.

This section describes the wiring procedure for the RS485 communications terminal block and the installation of the terminating resistor.

Wiring for RS485 Communications Terminal Block

On the control circuit terminal block, the following RS485 communications terminals are provided.

Terminal symbol	Terminal name	Function
RS–	RS485 communications send/receive terminal, negative side	Negative-side send/receive terminal for RS485 communications.
RS+	RS485 communications send/receive terminal, positive side	Positive-side send/receive terminal for RS485 communications.



USB port is for computer use only. RS422 (RJ45 modular connector) port is for Digital Operator use only.

Terminating resistor selector switch

RS485 terminal

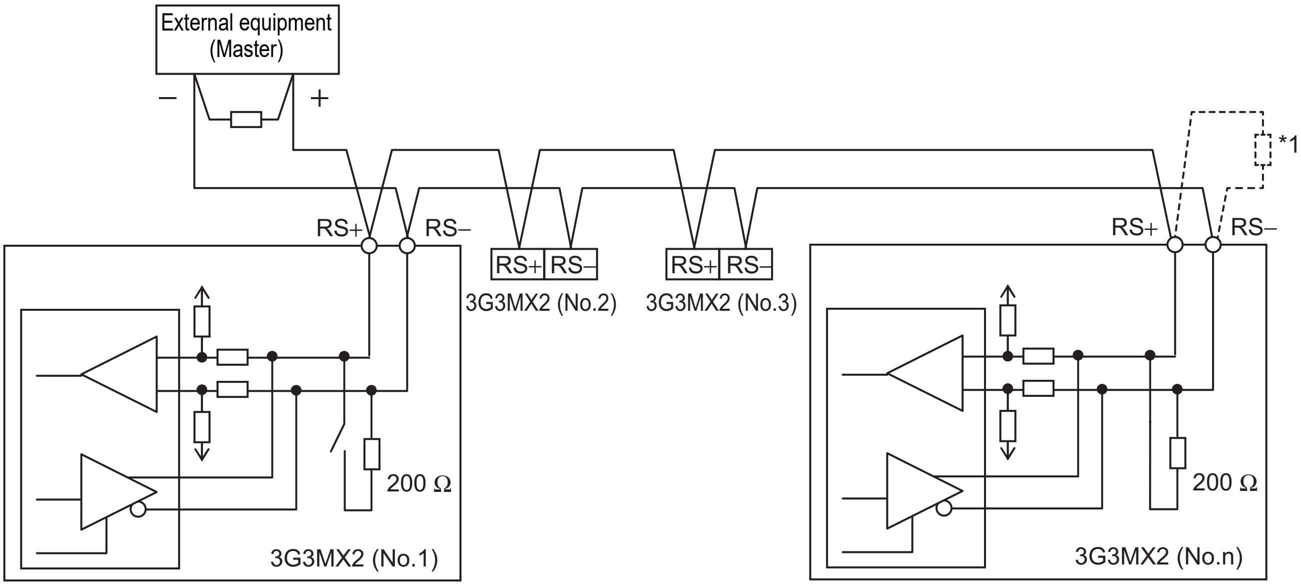
Terminating Resistor Setting

Connect the inverters parallel to each other as shown below and, only on the terminal Inverter, turn ON the terminating resistor selector switch.

Even if you have only one inverter connected, turn ON the terminating resistor selector switch.

Selecting a terminating resistor appropriate to the cable impedance improves the terminating effect.

For this inverter, however, turning ON the terminating resistor selector switch enables the built-in terminating resistor (200 Ω).


External equipment (Master)
–
+
*1
RS+
RS–
RS+
RS–
3G3MX2 (No.2)
RS+
RS–
3G3MX2 (No.3)
RS+
RS–
200 Ω
3G3MX2 (No.1)
200 Ω
3G3MX2 (No.n)

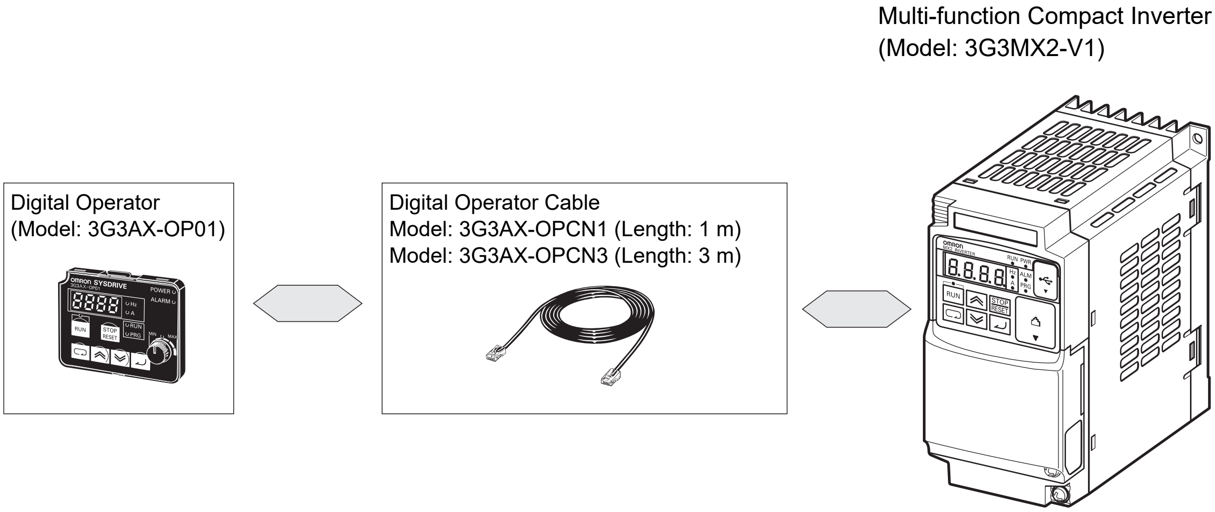
*1. If the communications are unstable, install a terminating resistor appropriate to the impedance of the cable to each cable end. The resistance of the terminating resistor built into this inverter is 200 Ω.

2-3-7 Wiring for Digital Operator

In addition to the standard Digital Operator, this inverter can be operated via the optional Digital Operator (Model: 3G3AX-OP01).

To use the 3G3AX-OP01, you need the optional Digital Operator Cable (Model: 3G3AX-OPCN1 (1 m) or 3G3AX-OPCN3 (3 m)).

Note that the maximum length of these optional cables is 3 m. Exceeding 3 m may result in malfunction.


Multi-function Compact Inverter
(Model: 3G3MX2-V1)
Digital Operator
(Model: 3G3AX-OP01)
Digital Operator Cable
Model: 3G3AX-OPCN1 (Length: 1 m)
Model: 3G3AX-OPCN3 (Length: 3 m)

2-3-8 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 PLd under ISO 13849-1.

The safety input function allows the inverter output when current flows in both the terminals GS1 and GS2.

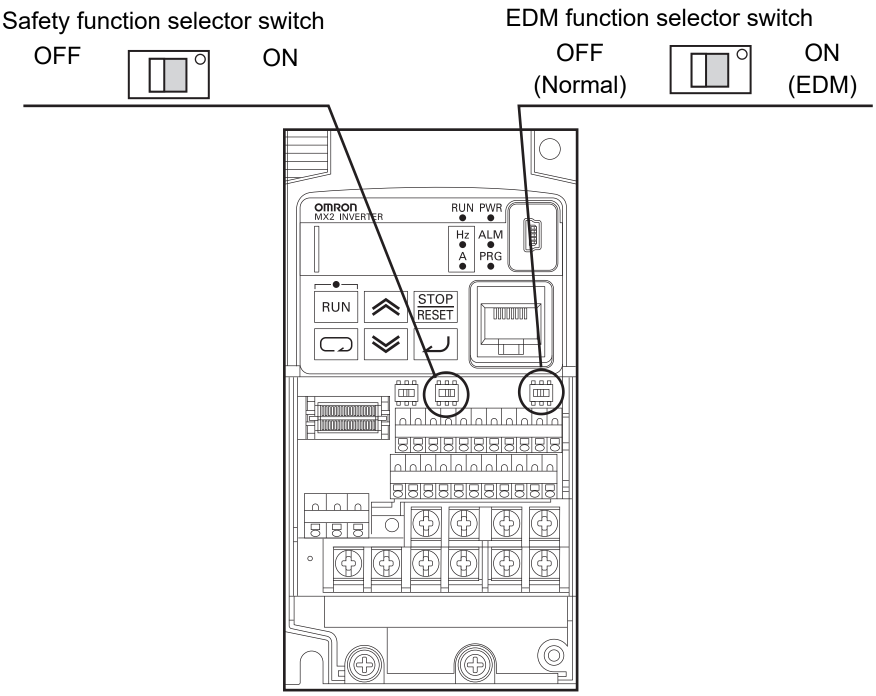
When the safety input function is activated, in compliance with the above standards, the output transistor operation of the inverter is stopped safely (by shutting off its output). As a result, the motor stops with free run.

For details, refer to *7-10 Safety Function* on page 7-97.

Note This inverter meets ISO13849-1 PLc when the EDM function is disabled.

Safety Function Settings

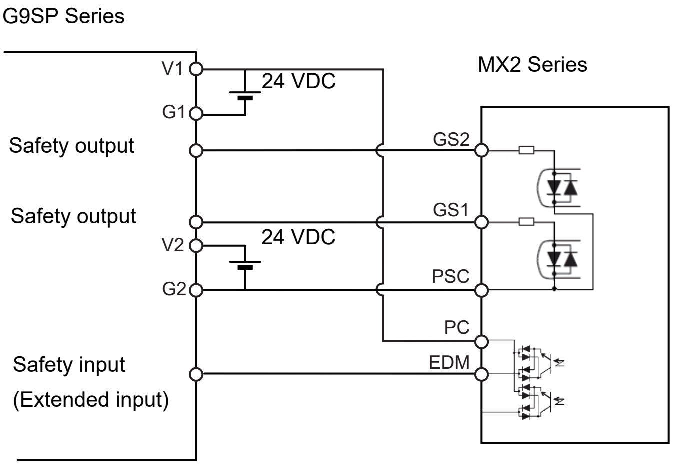
With the inverter power supply turned off, turn ON the safety function selector switch. This automatically allocates the Multi-function Input S3/S4 Selection (C003/C004) to 77 (GS1) and 78 (GS2). To enable the EDM output (safety monitor output), turn ON the EDM function selector switch. This automatically allocates the Multi-function Output P1 Selection (C021) to 62 (EDM).



Note When the safety function selector switch or EDM function selector switch is turned from ON to OFF, the input/output terminals allocated to GS1/GS2 or EDM are reset to 255 (no: No allocation) and the input/output operation selection settings keep NC contact.

Wiring Example

Wiring example when EDM is enabled (for compliance with ISO13849-1 PLd)



When connecting to multiple inverters or safety devices, be sure to use the equipment within its guaranteed operating range, according to the above figure.

2-3-9 Compliance with EC Directives

This section provides conditions that must be met for compliance with European EC 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.

Applicable Standards

The 3G3MX2-V1 Series complies with the following standards.

Standard	Applicable standard
EMC Directive	EN61800-3
Low-voltage Directive	EN61800-5-1

Concepts of Compliance

EMC Directive

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 3G3MX2-V1 Series Inverter complies with the EMC Directive EN61800-3 when installed and wired to equipment according to the methods described below. However, your machines and equipment vary in type, and in addition, EMC performance depends on the configuration, wiring, and location of the device or control panel in which EC Directive compliant products are incorporated. This does not allow OMRON to verify the compliance under your 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

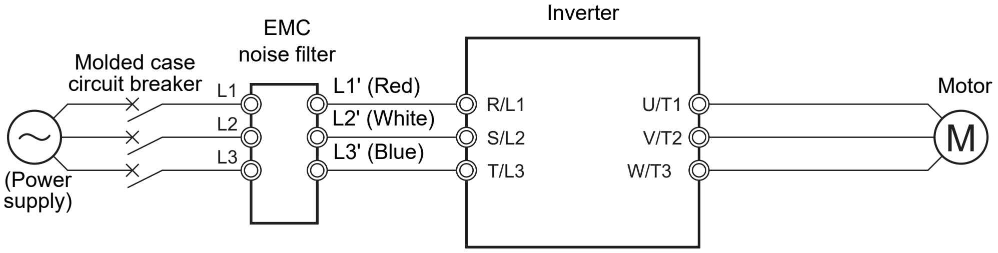
Keep the ground cable as short as possible.

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

Always connect the power supply input terminals (R/L1, S/L2, T/L3) 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.

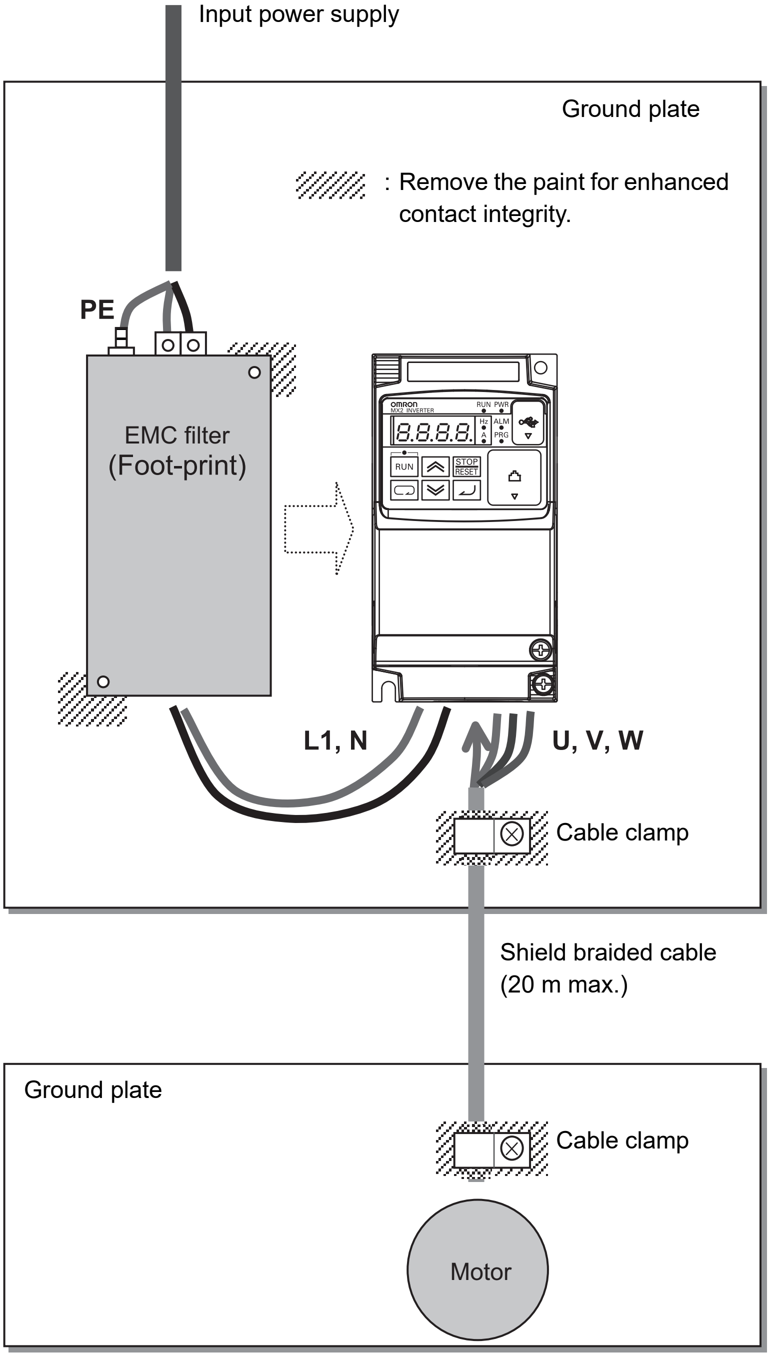
Measures against noise for compliance with EMC Directive

- 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 terminals 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


Input power supply
Ground plate
▨ : Remove the paint for enhanced contact integrity.
PE
EMC filter
(Foot-print)
omron
MX2 INVERTER
RUN
PWR
Hz
A
ALM
PRG
8.8.8.8.
RUN
STOP RESET
L1, N
U, V, W
Cable clamp
Shield braided cable
(20 m max.)
Ground plate
Cable clamp
Motor

● Low-voltage directive

The 3G3MX2-V1 Series Inverter complies with EN61800-5-1 when installed and wired to equipment according to the methods described below.

- The 3G3MX2-V1 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 requirements of the LVD (Low Voltage Directive), 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 *A-4 UL/cUL Standards Cautions* on page A-10.
- 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.

3

Operation and Test Run

This section describes the part names and key operation of the Digital Operator, and the operation method of this product as well as the test run procedure.

3-1 Operation of Digital Operator 3-4

3-1-1 Part Names and Descriptions 3-4

3-1-2 Key Operation Method 3-6

3-2 Connections and Functions of CX-Drive 3-13

3-2-1 CX-Drive Connection Method 3-13

3-2-2 Overview of CX-Drive Functions 3-17

3-3 Flow of Test Run 3-21

3-4 Operation Items for Test Run 3-22

⚠ **WARNING**	
⚠	Do not change wiring and slide switches, put on or take off Operator and optional devices, replace cooling fans while the input power is being supplied. Doing so may result in a serious injury due to an electric shock.
⚠	Do not remove the terminal cover during the power supply and 10 minutes after the power shut off. Doing so may result in a serious injury due to an electric shock.
⚠	Do not operate the Operator or switches with wet hands. Doing so may result in a serious injury due to an electric shock.
⚠	Inspection of the inverter must be conducted after the power supply has been turned off. Not doing so may result in a serious injury due to an electric shock. The main power supply is not necessarily shut off even if the emergency shut off function is activated.
♨	Do not touch the inverter cooling fins, braking resistors, and the motor, which become too hot during the power supply and for some time after the power shut off. Doing so may result in a burn.

⚠ **CAUTION**	
❗	Take safety precautions such as setting up a molded-case circuit breaker (MCCB) that matches the inverter capacity on the power supply side. Not doing so might result in damage to property due to the short circuit of the load.

Precautions for Safe Use

Operation and Adjustment

- Be sure to confirm the permissible range of motors and machines before operation because the inverter speed can be changed easily from low to high.
- Provide a separate holding brake if necessary.
- If the DriveProgramming stops during multi-function output, the output status is held. Take safety precautions such as stopping peripheral devices.
- 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 terminal block cover of the inverter until the motor stops.
- Be sure to confirm the RUN signal is turned off before resetting the alarm because the machine may abruptly start.

Precautions for Correct Use

Restart Selection Function

Do not come close to the machine when using the Restart Selection function (b001, b008) because the machine may abruptly start when stopped by an alarm.

Deceleration Stop Function

Do not come close to the machine when selecting reset in Deceleration Stop Selection on Power Interruption (b050) because the machine may abruptly start after the power is turned on.

Operation Stop Command

- Provide a separate emergency stop switch because the STOP Key on the Operator is valid only when function settings are performed.
- 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.

Motor Overload Protection

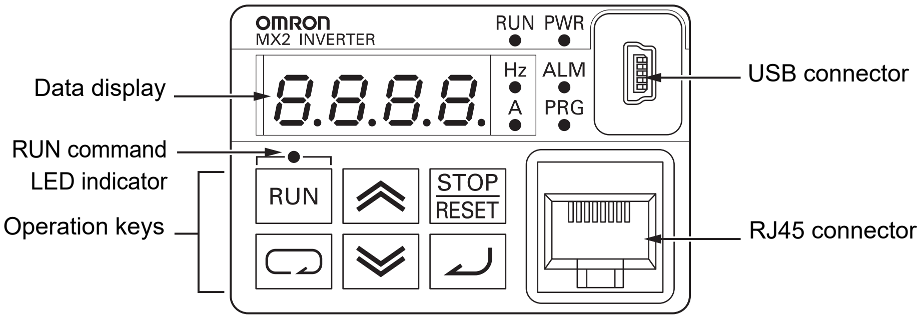
For the motor overload protection, be sure to set the rated current of your motor to the Electronic Thermal Level (b012/b212) and PM Motor Rated Current (H105).

3-1 Operation of Digital Operator

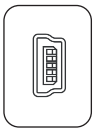
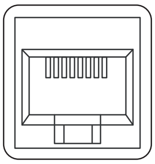
The Digital Operator is a display operation panel for the 3G3MX2-V1 Series Inverter.

3-1-1 Part Names and Descriptions

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



Display	Name	Description
PWR ●	POWER LED	Lights (green) when the inverter power is turned on.
ALM ●	ALARM LED	Lights (red) when the inverter trips. For how to reset a trip error state, refer to *How to Reset a Trip State* on page 10-3.
PRG ●	Program LED	Lights (green) when editable data (set value) is displayed on the display. Blinks when there is inconsistency among the set values. Refer to *10-1-4 Warning Display* on page 10-12.
RUN ●	RUN LED	Lights (green) when the inverter is running. (Because this LED is designed to light based on the result of logical OR operation between the conditions “RUN command present” and “Inverter output in progress,” it also lights when the RUN command is input with the frequency set to 0 Hz, or during deceleration after the RUN command turns OFF.)
Hz ●	Monitor LED (Hz)	Lights (green) when a frequency value is displayed on the display.
A ●	Monitor LED (A)	Lights (green) when a current value is displayed on the display.
┌─●─┐	RUN command LED indicator	Lights (green) when the RUN command is set to Digital Operator. (This indicates that the RUN key is enabled on the Digital Operator.)
8.8.8.8.	Data display	Displays (in red) various data such as a parameter value, frequency value, or set value.
RUN	RUN key	Starts inverter operation. Note that this key is enabled when the RUN command is set to Digital Operator.
STOP RESET	STOP/RESET key	Stops the inverter (deceleration stop). (Although the STOP/RESET key is enabled even when the RUN command is set to other than Digital Operator, you can disable it by setting the parameter b087.) When the inverter is in a trip error state, pressing this key causes a reset (and the inverter recovers from the trip error state).

Display	Name	Description
⟲	Mode key	When parameter is displayed: Moves to the beginning of the next parameter group. When data is displayed: Cancels the setting and returns to the parameter display. In individual input mode: Moves the blinking position one digit to the left, if not located at the leftmost digit. At the leftmost digit, moves the blinking position to the rightmost digit. Regardless of the display, if you press the Mode key for 3 seconds or more, the data of Output Frequency Monitor (d001) is displayed.
↵	Enter key	In parameter display mode: Switches to the data display. In data display mode: Enters and stores the set value (into the EEPROM) and returns to the parameter display. In individual input mode: Enters the value in the blinking position and moves it one digit to the right.
︽	Increment key	Increases the parameter number or the set data value. Press and hold the key to quickly increase the number or value. Press the increment key and the decrement key simultaneously to enter the individual input mode, where you can edit the value in each digit independently.
︾	Decrement Key	Decreases the parameter number or the set data value. Press and hold the key to quickly decrease the number or value. Press the increment key and the decrement key simultaneously to enter the individual input mode, where you can edit the value in each digit independently.
	USB connector	The connector (mini-B type) for connecting a computer. Used to connect to the Inverter/Servo support tool CX-Drive
	RJ45 connector	The connector (RS-422) for connecting the optional remote Digital Operator. When the inverter is connected with a remote Digital Operator, its Digital Operator keys are disabled. In this case, set the data displayed on the display in b150.

Precautions for Correct Use

- The color scheme of the Digital Operator keys was changed.
  Operate the keys correctly according to the following information on the displays and colors.

Display	Name	Previous model	3G3MX2-V1 Series
RUN	RUN key	Gray	Green
STOP RESET	STOP/RESET key	Yellow	Red
⟲	Mode key	Blue	Blue (No change)
↵	Enter key	Yellow	Yellow (No change)
︽	Increment key	Green	Gray
︾	Decrement Key	Green	Gray

3-1-2 Key Operation Method

This section explains how to use the Digital Operator keys in a typical operation (when the Display Selectionis “Complete display”) and in the extended function mode U as operation examples.

This operation will be the same even if you select a setting other than Complete display in the Display Selection (b037), although the number of parameters that you will see on the display differs.

Precautions for Correct Use

- You can change the parameter display on the Digital Operator by the Display Selection (b037). For details, refer to *5-1-1 Display Selection* on page 5-3.
- In the 3G3MX2-V1 Series, the default data for the Display Selection (b037) was changed from the previous default 04 (Basic display) to 00 (Complete display). You can see and set all parameters when you turn on the power supply for the first time.

Additional Information

- You can set the initial screen displayed after turning on the power supply by the Initial Screen Selection (b038). For details, refer to *7-6-5 Initial Screen Selection (Initial Screen after Power-on)* on page 7-56.
- You can display only the parameters registered as user parameters. It is also possible to automatically register changed parameters, or directly set specific parameters. For details, refer to *7-6-11 User Parameter Automatic Setting Function* on page 7-60.

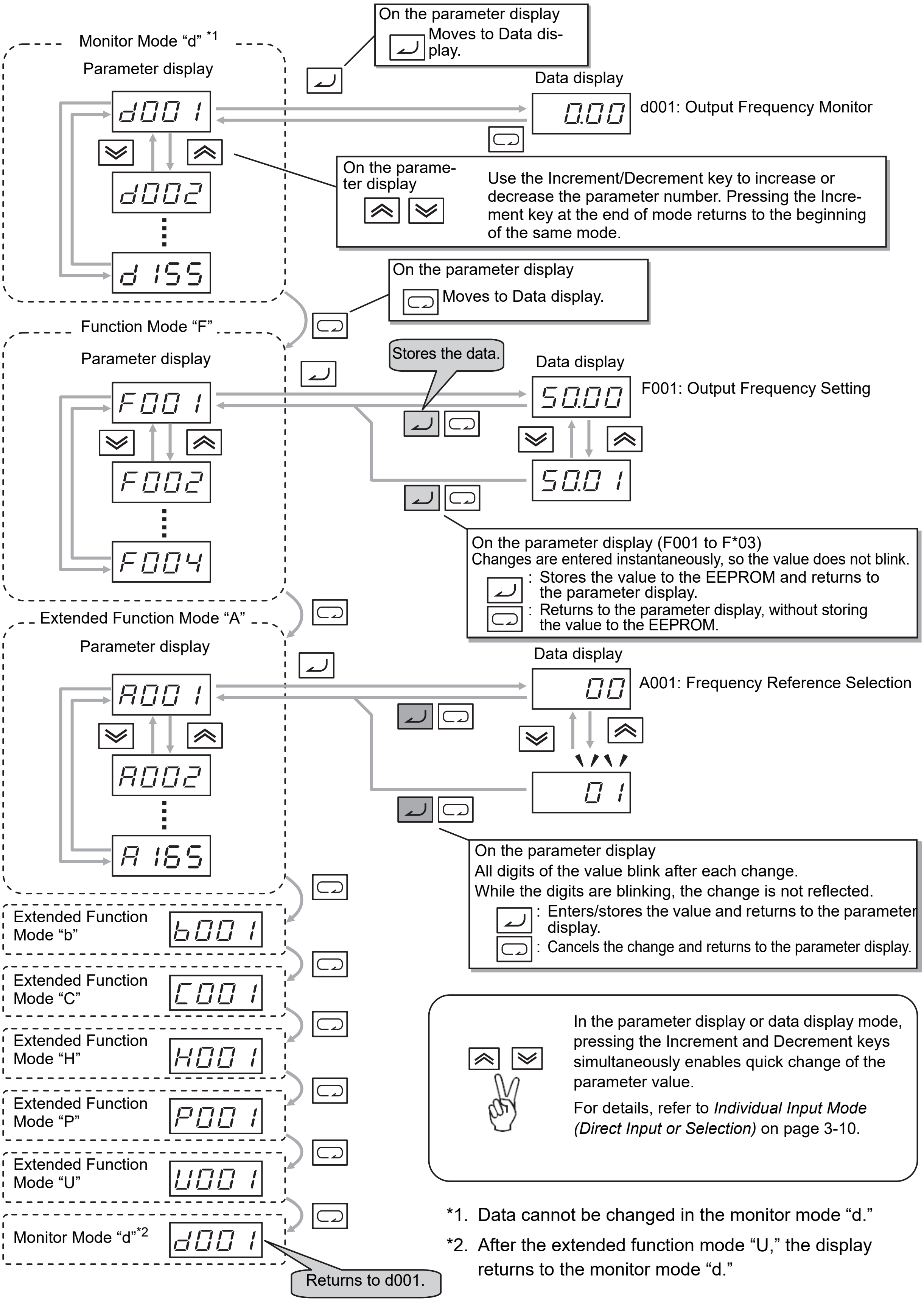
Item	Parameter No.	Data	Description
Display Selection	b037	00	Complete display (Factory default)
		01	Individual display of functions
		02	User setting + d001, F001, b037
		03	Data comparison display
		04	Basic display
		05	Monitor display + b037
Initial Screen Selection (Initial screen after power-on)	b038	000	Screen on which the Enter key was last pressed
		001 to 060	d001 to d060 (001: Factory default)
		201	F001
		202	Do not set.
User Parameter Automatic Setting Function	b039	00	Disabled (Factory default)
		01	Enabled

Additional Information

Regardless of the display mode of the Digital Operator, if you press the Mode key for 3 seconds or more, the data of Output Frequency Monitor (d001) is displayed. However, the Digital Operator continues to display the function group parameters in sequence as the normal operation if you press the Mode key for less than 3 seconds. (Example: F001 → A001 → b001 → C001 ⋯ after 3 seconds, “0.00 (data of Output Frequency Monitor)” appears)

Transition of Parameter Display

The following figure shows how to operate the Digital Operator to reach the intended parameter display.


Monitor Mode "d" *1
Parameter display
d001
d002
d155
Data display
0.00
d001: Output Frequency Monitor
Function Mode "F"
Parameter display
F001
F002
F004
Stores the data.
Data display
50.00
50.01
F001: Output Frequency Setting
Extended Function Mode "A"
Parameter display
A001
A002
A165
Data display
00
01
A001: Frequency Reference Selection
Extended Function Mode "b"
b001
Extended Function Mode "C"
C001
Extended Function Mode "H"
H001
Extended Function Mode "P"
P001
Extended Function Mode "U"
U001
Monitor Mode "d"*2
d001
Returns to d001.

On the parameter display
Moves to Data display.

On the parameter display
Use the Increment/Decrement key to increase or decrease the parameter number. Pressing the Increment key at the end of mode returns to the beginning of the same mode.

On the parameter display
Moves to Data display.

On the parameter display (F001 to F*03)
Changes are entered instantaneously, so the value does not blink.
: Stores the value to the EEPROM and returns to the parameter display.
: Returns to the parameter display, without storing the value to the EEPROM.

On the parameter display
All digits of the value blink after each change.
While the digits are blinking, the change is not reflected.
: Enters/stores the value and returns to the parameter display.
: Cancels the change and returns to the parameter display.

In the parameter display or data display mode, pressing the Increment and Decrement keys simultaneously enables quick change of the parameter value.

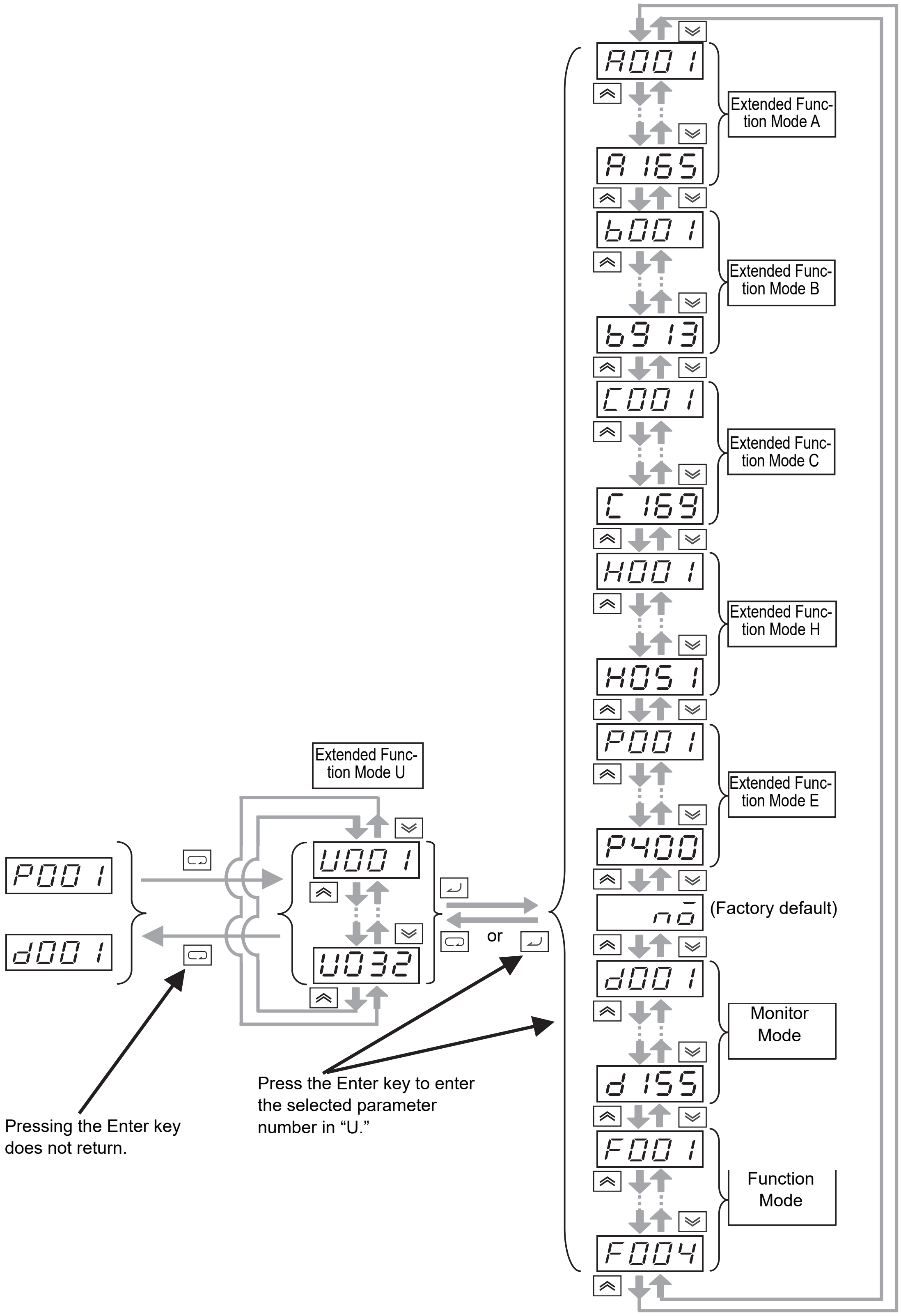
For details, refer to *Individual Input Mode (Direct Input or Selection)* on page 3-10.

*1. Data cannot be changed in the monitor mode "d."

*2. After the extended function mode "U," the display returns to the monitor mode "d."

Transition of Parameter Display and Key Operation in Extended Function Mode U

In the extended function mode U, you can operate the Digital Operator in the same way as in other modes. However, do not be confused although each parameter number is displayed again for the set value. Press the Enter key to enter the selected parameter number. Then the display returns to the parameter display in the extended function mode U.
To display only the user set parameters, set the Display Selection (b037) to 02 (User setting).


A001
A165
Extended Function Mode A
b001
b913
Extended Function Mode B
C001
C169
Extended Function Mode C
H001
H051
Extended Function Mode H
P001
P400
Extended Function Mode E
no
(Factory default)
d001
d155
Monitor Mode
F001
F004
Function Mode
Extended Function Mode U
U001
U032
P001
d001
or

Pressing the Enter key does not return.

Press the Enter key to enter the selected parameter number in “U.”

Parameter Initialization

You can initialize the changed parameters and also clear the fault monitor data.

As a measure to prevent inadvertent parameter initialization, the inverter is designed to force the user to set several parameters before execute initialization.

For details on parameter initialization, refer to *5-1-2 Parameter Initialization* on page 5-6.

Precautions for Correct Use

- The following parameters are not initialized: Total RUN Time Monitor (d016), Total Power ON Time Monitor (d017), Heavy Load/Light Load Selection (b049), Initialization Data Selection (b085), Initialization Target Setting (b094), FV/FI Adjustment (C081/C082), Thermistor Adjustment (C085), and Position Data at Power Off (P082).

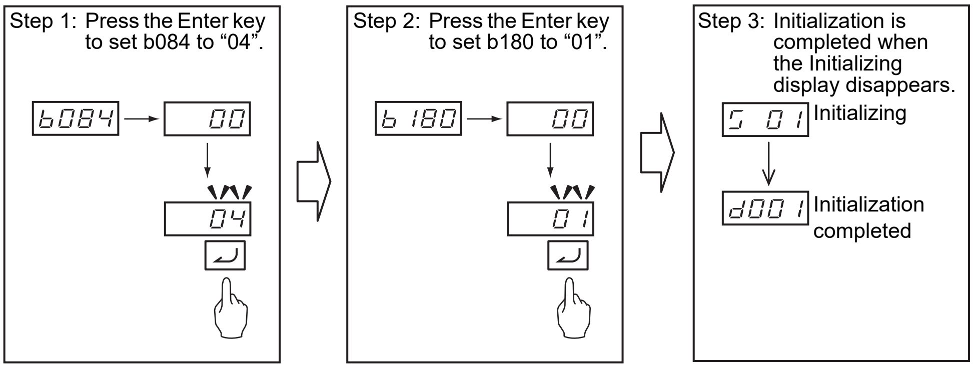
  The DriveProgramming User Parameters U00 to U31 (P100 to P131) are not initialized unless the Initialization Selection (b084) is set to 04.
- The inverter does not display the initialization-related parameters (b084, b094, b180) depending on the Display Selection (b037) setting. If they are not displayed, change b037 to 00 (Complete display).
- When the Soft Lock Selection (b031) is set to prohibit changes of the initialization-related parameters (b084, b094, b180), the initialization cannot be executed. Change the Soft Lock Selection (b031) to enable the initialization.
- For details on Soft Lock Selection, refer to *7-6-1 Soft Lock Function (SFT)* on page 7-54.
- Remember that you will not be able to revert to the previous settings once you press the Enter key to execute parameter initialization, with the Initialization Execution (b180) set to 01.

The following figure shows the steps of parameter initialization.

To initialize all the parameters, set the Initialization Target Setting (b094) to 00 (All data).

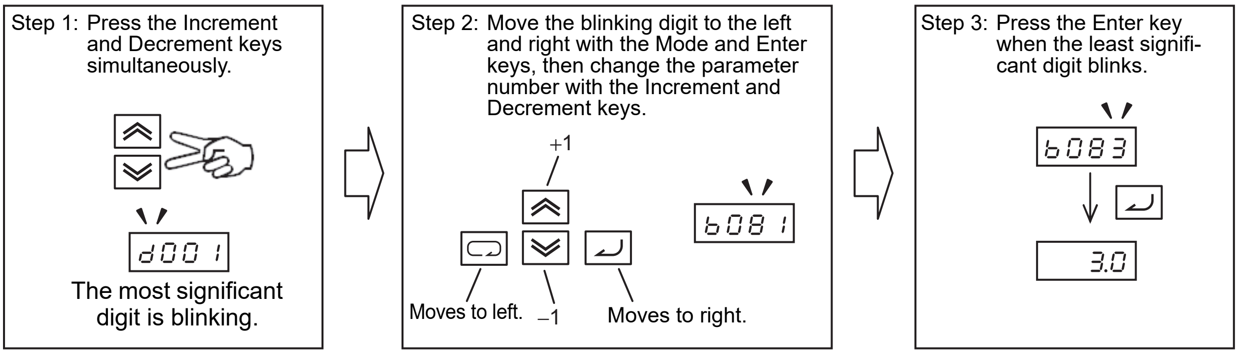
To initialize the fault monitor and DriveProgramming data in addition to the parameter data, set the Initialization Selection (b084) to 04.

Set the Initialization Execution (b180) to 01 (Execute initialization) to execute parameter initialization.


Step 1: Press the Enter key to set b084 to “04”.
b084
00
04
Step 2: Press the Enter key to set b180 to “01”.
b 180
00
0 1
Step 3: Initialization is completed when the Initializing display disappears.
5 0 1
Initializing
d00 1
Initialization completed

Individual Input Mode (Direct Input or Selection)

If the parameter number or data is far away from the current value on the display, using the individual input mode is efficient for changing the parameter data.
In the individual input mode, you can change the parameter number or data by selecting and entering a value digit by digit.



Step 1: Press the Increment and Decrement keys simultaneously.

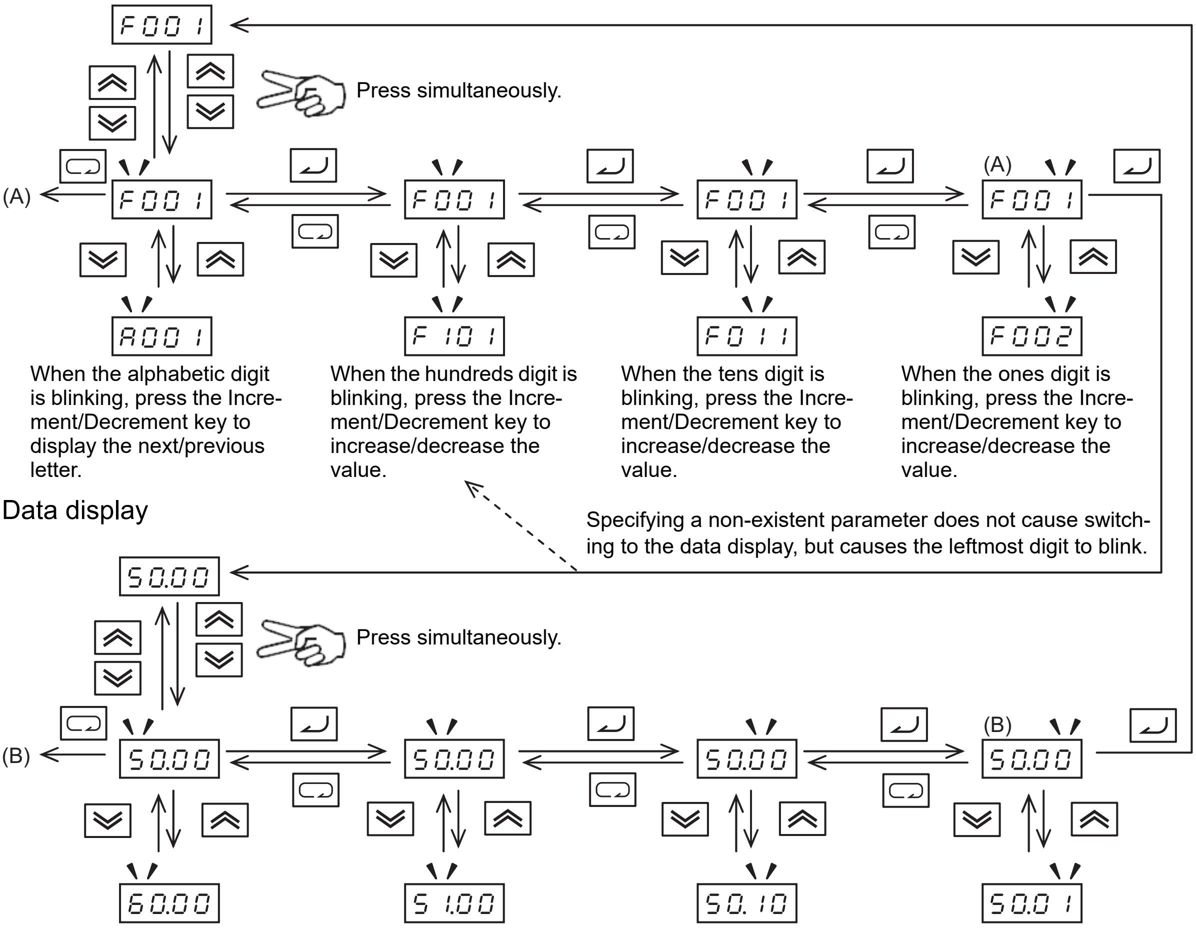
Step 2: Move the blinking digit to the left and right with the Mode and Enter keys, then change the parameter number with the Increment and Decrement keys.

Step 3: Press the Enter key when the least significant digit blinks.

d001
The most significant digit is blinking.
+1
Moves to left.
−1
Moves to right.
b081
b083
3.0

The individual input mode is available on both the parameter display and the data display.

Parameter display



F001
Press simultaneously.
(A)
F001
F001
F001
(A)
F001
A001
F101
F011
F002
Data display
50.00
Press simultaneously.
(B)
50.00
50.00
50.00
(B)
50.00
60.00
51.00
50.10
50.01

When the alphabetic digit is blinking, press the Increment/Decrement key to display the next/previous letter.

When the hundreds digit is blinking, press the Increment/Decrement key to increase/decrease the value.

When the tens digit is blinking, press the Increment/Decrement key to increase/decrease the value.

When the ones digit is blinking, press the Increment/Decrement key to increase/decrease the value.

Specifying a non-existent parameter does not cause switching to the data display, but causes the leftmost digit to blink.

When the tens digit is blinking, press the Increment/Decrement key to increase/decrease the value.

When the ones digit is blinking, press the Increment/Decrement key to increase/decrease the value.

When the tenth digit is blinking, press the Increment/Decrement key to increase/decrease the value.

When the hundredth digit is blinking, press the Increment/Decrement key to increase/decrease the value.

Note 1. If you press the Mode key when the cursor (blinking digit) is at the leftmost digit, the cursor moves to the rightmost digit.

2. If you press the Increment and the Decrement keys simultaneously in the individual input mode, the mode returns to the normal input mode.
3. Changes are not reflected to the data when the data diplay blinks even if the data belong to the parameter group F.

Returning Display to d001

Regardless of the display mode of the Digital Operator, if you press ↺ (Mode key) for 3 seconds or more, the data of Output Frequency Monitor (d001) is displayed. However, the Digital Operator continues to display the function mode and extended function mode in sequence as the normal operation if you press the Mode key for less than 3 seconds.

Changes in Operation Method from Previous Models (3G3JX Series etc.)

For the 3G3MX2 Series, the operation method was changed from the previous models (3G3JX Series etc.).

The 3G3MX2-V1 Series uses the same operation method as that of the previous 3G3MX2 Series.

Below are the differences of this inverter in the operation method from the previous models (3G3JX Series etc).

The optional Digital Operator (Model: 3G3AX-OP01) also uses the same operation method as the Digital Operator built into this inverter.

● Elimination of the top display layer (Overall display of each parameter group)

The top display layer A - - - in the operation was eliminated, although the concept of the parameter groups remains as before.

● Change of scroll behavior in each parameter group

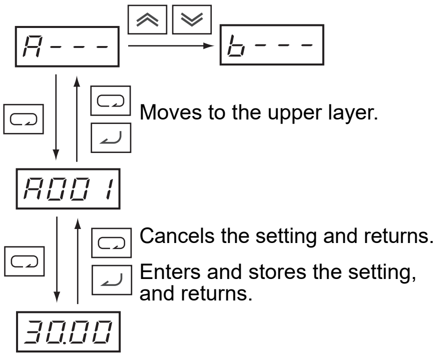
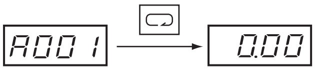
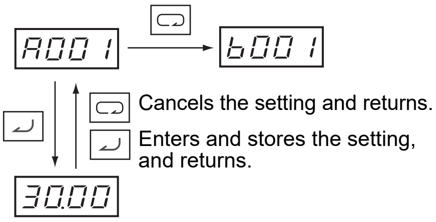
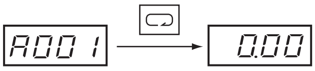
The parameter numbers loop in each parameter group when scrolled.

In the previous model, when the highest parameter number in a group appears, the display switches to display the first parameter number in the next group.

● Functions of Mode key and Enter key

The functions of the Mode key and Enter key were changed as follows for consistency and simplicity in operation.

Name	Previous model: 3G3JX Series etc.	This model: 3G3MX2 Series (both the previous 3G3MX2 and Type V1)
Enter key ↵	• Moves to the upper layer. • Enters or stores the value and returns to the parameter display.	• Moves to the data display. • Enters and stores the setting and returns to the parameter display.
Mode key ↺	• Moves to the upper layer. • Moves to the parameter display. • Moves to the data display. • Cancels the setting and returns to the parameter display. • Displays the data of Output Frequency Monitor (d001) if you press the Mode key for 3 seconds or more.	• Moves to the beginning of the next parameter group. • Cancels the setting and returns to the parameter display. • Displays the data of Output Frequency Monitor (d001) if you press the Mode key for 3 seconds or more.

Name	Previous model: 3G3JX Series etc.	This model: 3G3MX2 Series (both the previous 3G3MX2 and Type V1)
Difference in key operation	 A - - - b - - - Moves to the upper layer. A001 Cancels the setting and returns. Enters and stores the setting, and returns. 30.00  Displays the data of Output Frequency Monitor (d001) if you press the Mode key for 3 seconds or more.	 A001 b001 Cancels the setting and returns. Enters and stores the setting, and returns. 30.00  Displays the data of Output Frequency Monitor (d001) if you press the Mode key for 3 seconds or more.

3-2 Connections and Functions of CX-Drive

The Inverter/Servo support tool CX-Drive is support software to edit the inverter parameter settings.

Installing the OMRON CX-One software on your PC also installs the CX-Drive simultaneously.

The 3G3MX2-V1 Series Inverter is supported in the following or higher versions of the CX-Drive product:

- CX-Drive: Ver. 2.8

This section describes how to connect the CX-Drive to an inverter and provides an overview of its functions.

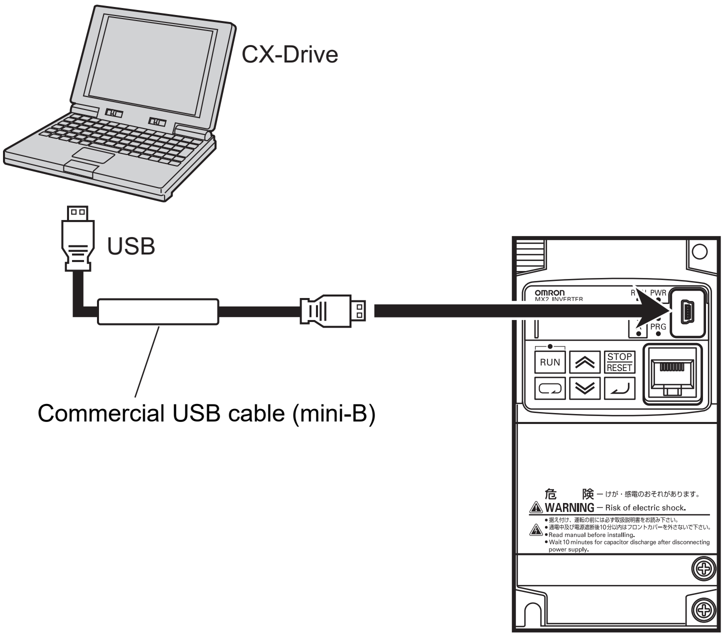
For details on the functions of the CX-Drive, refer to the "CX-Drive Operation Manual (W453)".

3-2-1 CX-Drive Connection Method

The following figure shows how to connect the 3G3MX2-V1 Series with the Inverter/Servo support tool CX-Drive.

Direct Connection via Serial Communications

Connect the CX-Drive directly to the serial communications port of the inverter.


CX-Drive
USB
Commercial USB cable (mini-B)
omron
MX2 INVERTER
PWR
PRG
RUN
STOP RESET
WARNING – Risk of electric shock.

CX-Drive Connection Procedure

There are two methods to connect the CX-Drive with the inverter.

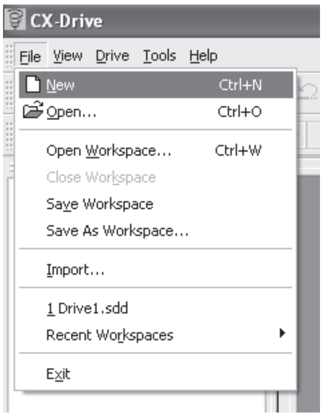
The step-by-step procedure for each method is provided below.

● Connecting by registering inverter connection method beforehand

Create a new inverter project, set the connecting method, and connect with the inverter.

Follow the steps below.

1 **Start the CX-Drive and, from the [File] menu, select [New].**

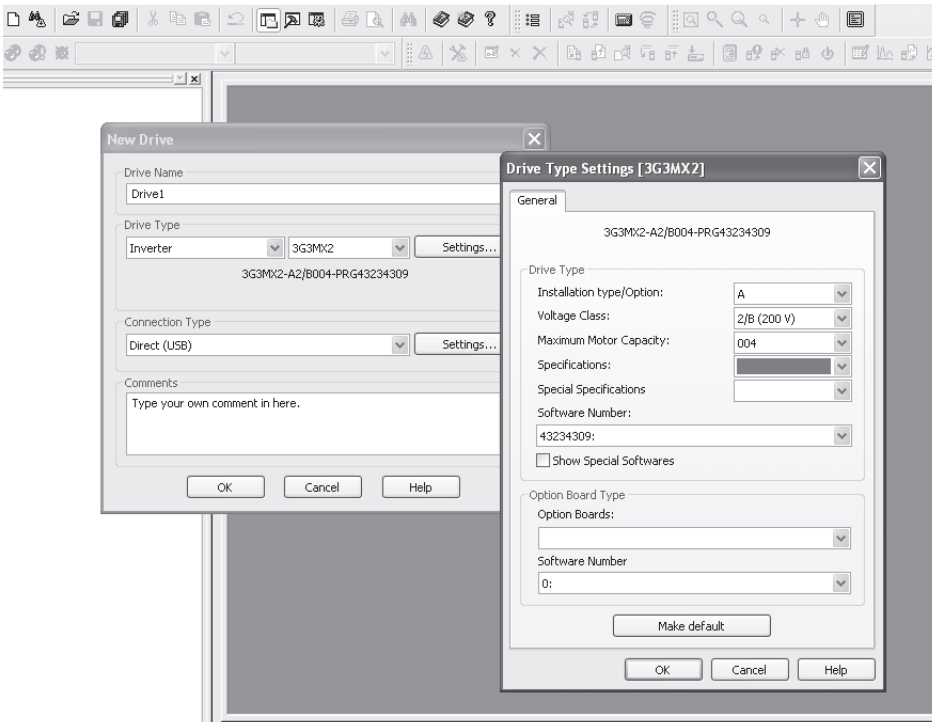

CX-Drive
File View Drive Tools Help
New Ctrl+N
Open... Ctrl+O
Open Workspace... Ctrl+W
Close Workspace
Save Workspace
Save As Workspace...
Import...
1 Drive1.sdd
Recent Workspaces
Exit

2 **In the [New Drive] window, set the drive type of the target inverter.**

Under [Drive Type], select the inverter series name and click the [Settings] button to the right.

In the [Drive Type Settings] window, set the Installation Type/Option, Voltage Class, and Maximum Motor Capacity and select [V1] in Specifications.

After setting these items, click the [OK] button to close the [Drive Type Settings] window.


New Drive

Drive Name: Drive1

Drive Type: Inverter, 3G3MX2

3G3MX2-A2/B004-PRG43234309

Connection Type: Direct (USB)

Comments: Type your own comment in here.

Drive Type Settings [3G3MX2]

3G3MX2-A2/B004-PRG43234309

Installation type/Option: A

Voltage Class: 2/B (200 V)

Maximum Motor Capacity: 004

Software Number: 43234309:

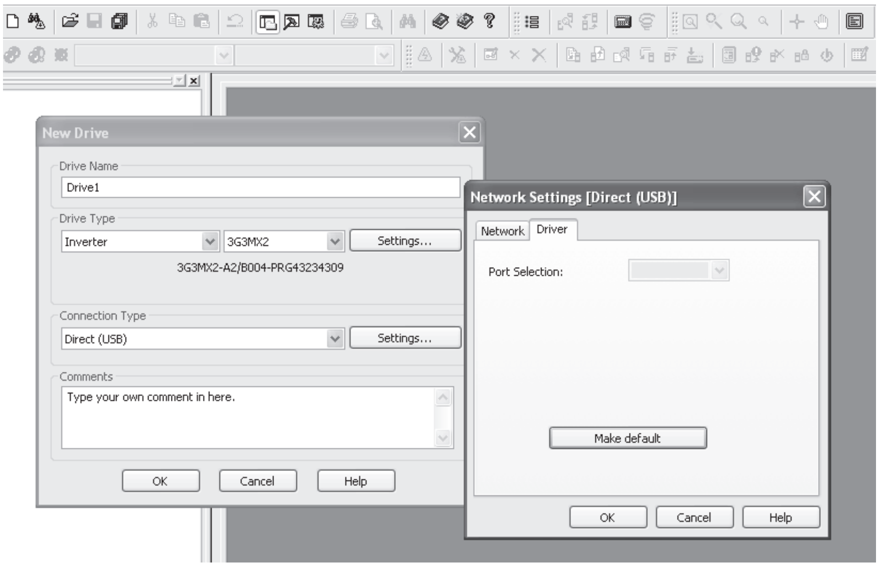
Option Boards Software Number: 0:

Settings...
Settings...
OK
Cancel
Help
General
Drive Type
Specifications:
Special Specifications
☐ Show Special Softwares
Option Board Type
Option Boards:
Make default
OK
Cancel
Help

3 **In the [New Drive] window, set the type of connection to the inverter.**

Under [Connection Type], select [Direct] and click the [Settings] button to the right.

On the [Driver] tab, in [Port Selection], select the port name of the computer on which the CX-Drive is installed.



Drive Name: Drive1

Drive Type: Inverter, 3G3MX2

3G3MX2-A2/B004-PRG43234309

Connection Type: Direct (USB)

Comments: Type your own comment in here.

New Drive
Settings...
Settings...
OK
Cancel
Help
Network Settings [Direct (USB)]
Network
Driver
Port Selection:
Make default
OK
Cancel
Help

4 **After setting these items, click the [OK] button and close all windows.**

The new project is registered in the workspace.

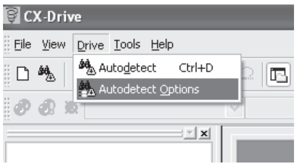
Click the (Work Online) icon to connect to the inverter.

● Automatically detecting the connected inverter

Set the [Autodetect Options] in the CX-Drive and use the Autodetect function to automatically connect to the inverter.

Follow the steps below.

1 **Start the CX-Drive and, from the [Drive] menu, select [Autodetect Options] to open the Options window.**



CX-Drive
File
View
Drive
Tools
Help
Autodetect Ctrl+D
Autodetect Options

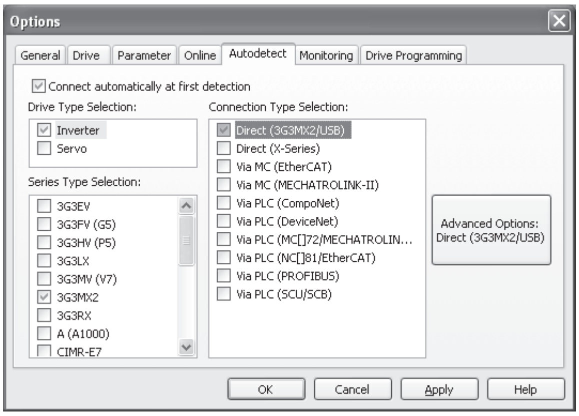
2 **On the [Autodetect] tab, set the [Drive Type Selection], [Series Type Selection] and [Connection Type Selection].**

Under [Drive Type Selection], select the [Inverter] box and click the [Inverter].

Then, under [Series Type Selection], select the [3G3MX2] box.

Next, under [Connection Type Selection], select the [Direct] box and click the [Direct].

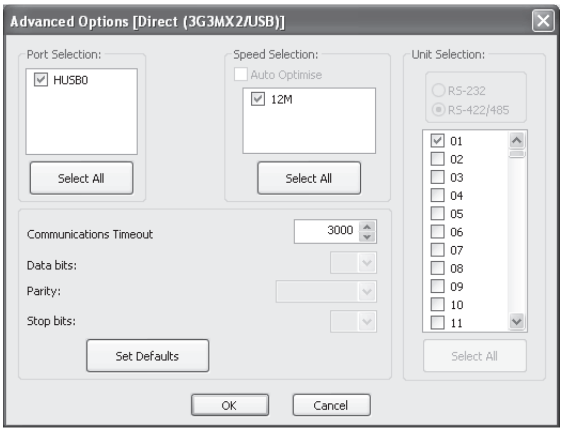
Then, click the [Advanced Options: Direct] button to the right.


Options
General
Drive
Parameter
Online
Autodetect
Monitoring
Drive Programming
☑ Connect automatically at first detection
Drive Type Selection:
☑ Inverter
☐ Servo
Series Type Selection:
☐ 3G3EV
☐ 3G3FV (G5)
☐ 3G3HV (P5)
☐ 3G3LX
☐ 3G3MV (V7)
☑ 3G3MX2
☐ 3G3RX
☐ A (A1000)
☐ CIMR-E7
Connection Type Selection:
☑ Direct (3G3MX2/USB)
☐ Direct (X-Series)
☐ Via MC (EtherCAT)
☐ Via MC (MECHATROLINK-II)
☐ Via PLC (CompoNet)
☐ Via PLC (DeviceNet)
☐ Via PLC (MC[]72/MECHATROLIN...
☐ Via PLC (NC[]81/EtherCAT)
☐ Via PLC (PROFIBUS)
☐ Via PLC (SCU/SCB)
Advanced Options: Direct (3G3MX2/USB)
OK
Cancel
Apply
Help

Additional Information

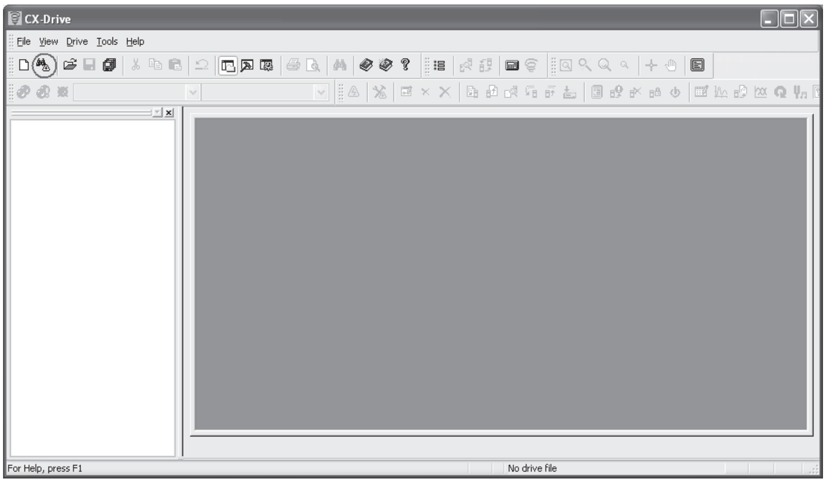
For the reduction of the automatic search time, deselect unnecessary check boxes to narrow down the scope of autodetection.

3 **In the [Advanced Options [Direct]] window, set communications options.**


Advanced Options [Direct (3G3MX2/USB)]
Port Selection:
☑ HUSB0
Select All
Speed Selection:
☐ Auto Optimise
☑ 12M
Select All
Unit Selection:
○ RS-232
● RS-422/485
☑ 01
☐ 02
☐ 03
☐ 04
☐ 05
☐ 06
☐ 07
☐ 08
☐ 09
☐ 10
☐ 11
Select All
Communications Timeout
3000
Data bits:
Parity:
Stop bits:
Set Defaults
OK
Cancel

4 **After setting communications options, click the [OK] button and close all open windows. Then, click [Autodetect].**

The Autodetect function starts to create new drive projects automatically.


CX-Drive
File View Drive Tools Help
For Help, press F1
No drive file

3-2-2 Overview of CX-Drive Functions

The Inverter/Servo support tool CX-Drive enables you edit the inverter parameters and monitor the inverter status.

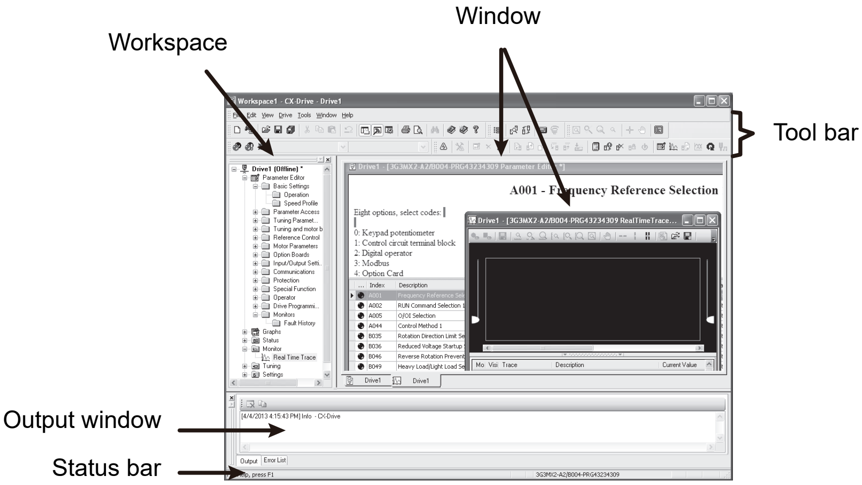
This section provides an overview of the CX-Drive functions.

Screen Structure of CX-Drive

The screen structure of the CX-Drive is as shown below.

The workspace shows a list of registered drive projects. Double-clicking a project displays the functions contained in it.

Then, double-clicking each function opens a window corresponding to that function.


Window
Workspace
Tool bar
Output window
Status bar

Precautions for Correct Use

The CX-Drive, by default, does not allow connection to the inverter unless the software versions match.

- Software number of the inverter set in the CX-Drive project
- Software number of inverter actually connected

If you cannot connect to the inverter due to a software number mismatch, select [Tools] - [Options] in the menu bar and, in the [Online] tab, deselect the [Check Drive Software Compatibility] check box. This allows CX-Drive to connect to the inverter operate normally, although a warning display appears.
To match the software numbers, right-click on the project, select [Properties], and click the [Settings] button in the [Drive Type] section. In the [Drive Type Settings] window, set the Software Number that matches that of the inverter. If you cannot find the applicable software number in the CX-Drive's Software Number list, please upgrade the CX-Drive version.

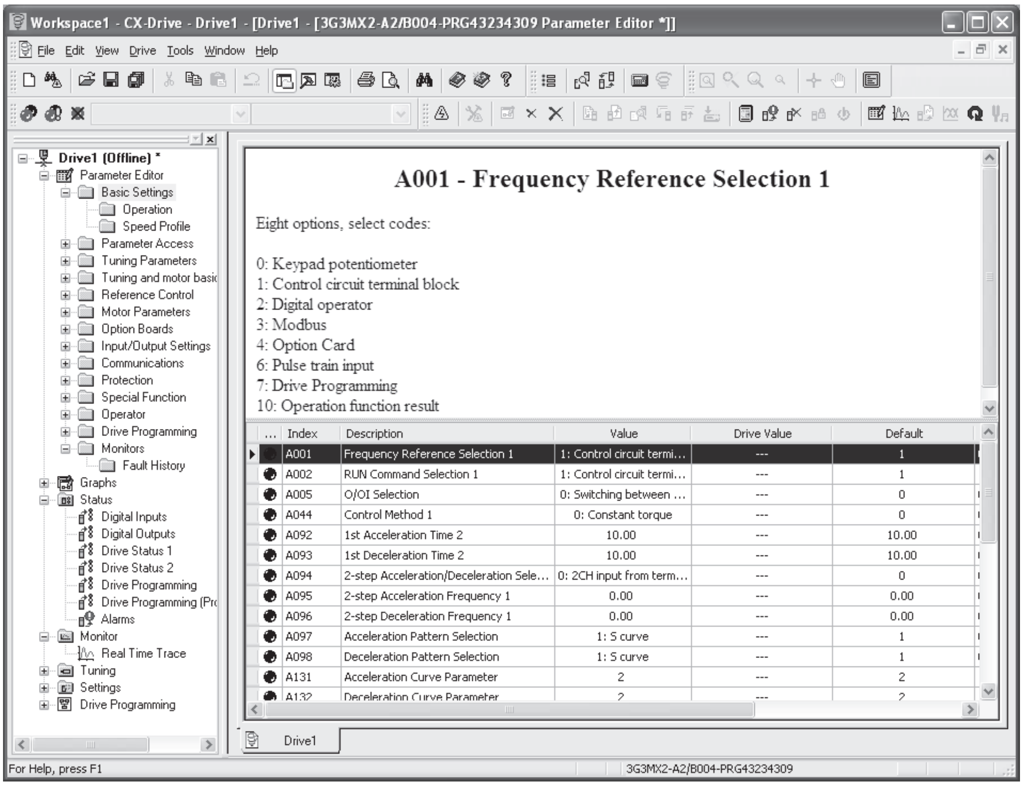
Editing Parameter Data in CX-Drive

Among the projects in the workspace, double-click [Parameter Editor] to open the [Parameter Editor Window] that shows a list of all inverter parameters (in numeric order).

In this window, you can edit the inverter parameter.

To upload/download parameters from the inverter, use the [Transfer] button in the tool bar.

- Double-click one of the folders under Parameter Editor to narrow down the parameter list to only those parameters associated with it.
- Edit the value set for each parameter in the Value field of the parameter list.
- When you select a parameter, the explanation of the parameter appears above the parameter list.
- At the left end of the list, icons that represent the status of parameter data are displayed: Not default, Not default and different from the inverter, or Invalid. You can display only parameters with the same icon.
- You can select specific parameters and transfer data for only those selected parameters to the inverter.


Workspace1 - CX-Drive - Drive1 - [Drive1 - [3G3MX2-A2/B004-PRG43234309 Parameter Editor *]]
File
Edit
View
Drive
Tools
Window
Help
Drive1 (Offline) *
Parameter Editor
Basic Settings
Operation
Speed Profile
Parameter Access
Tuning Parameters
Tuning and motor basic
Reference Control
Motor Parameters
Option Boards
Input/Output Settings
Communications
Protection
Special Function
Operator
Drive Programming
Monitors
Fault History
Graphs
Status
Digital Inputs
Digital Outputs
Drive Status 1
Drive Status 2
Drive Programming
Drive Programming (Pro
Alarms
Monitor
Real Time Trace
Tuning
Settings
Drive Programming
Drive1
For Help, press F1
3G3MX2-A2/B004-PRG43234309

A001 - Frequency Reference Selection 1

Eight options, select codes:

0: Keypad potentiometer
1: Control circuit terminal block
2: Digital operator
3: Modbus
4: Option Card
6: Pulse train input
7: Drive Programming
10: Operation function result

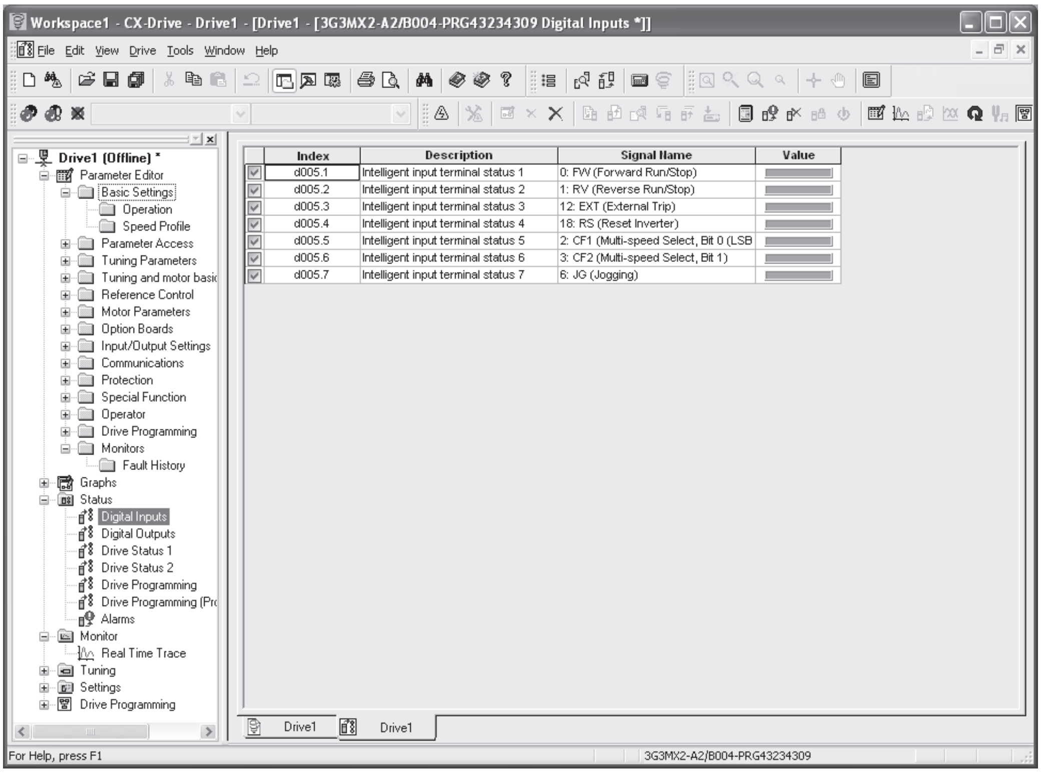
...	Index	Description	Value	Drive Value	Default
●	A001	Frequency Reference Selection 1	1: Control circuit termi...	---	1
●	A002	RUN Command Selection 1	1: Control circuit termi...	---	1
●	A005	O/OI Selection	0: Switching between ...	---	0
●	A044	Control Method 1	0: Constant torque	---	0
●	A092	1st Acceleration Time 2	10.00	---	10.00
●	A093	1st Deceleration Time 2	10.00	---	10.00
●	A094	2-step Acceleration/Deceleration Sele...	0: 2CH input from term...	---	0
●	A095	2-step Acceleration Frequency 1	0.00	---	0.00
●	A096	2-step Deceleration Frequency 1	0.00	---	0.00
●	A097	Acceleration Pattern Selection	1: S curve	---	1
●	A098	Deceleration Pattern Selection	1: S curve	---	1
●	A131	Acceleration Curve Parameter	2	---	2
●	A132	Deceleration Curve Parameter	2	---	2

Status Function of CX-Drive

Open the Status folder in the project and double-click the status information.

The window corresponding to the selected status information opens.

Display	Description
[Digital Inputs]	Displays the current ON/OFF status information and function set to each input terminal.
[Digital Outputs]	Displays the current ON/OFF status information and function set to each output terminal.
[Monitor Mode]	Displays the internal status values of the inverter. These status values are similar to those displayed in the monitor mode (dxxx) of the inverter.
[Alarms]	Displays an alarm history of the current and past alarms.



Workspace1 - CX-Drive - Drive1 - [Drive1 - [3G3MX2-A2/B004-PRG43234309 Digital Inputs *]]

	Index	Description	Signal Name	Value
☑	d005.1	Intelligent input terminal status 1	0: FW (Forward Run/Stop)	
☑	d005.2	Intelligent input terminal status 2	1: RV (Reverse Run/Stop)	
☑	d005.3	Intelligent input terminal status 3	12: EXT (External Trip)	
☑	d005.4	Intelligent input terminal status 4	18: RS (Reset Inverter)	
☑	d005.5	Intelligent input terminal status 5	2: CF1 (Multi-speed Select, Bit 0 (LSB	
☑	d005.6	Intelligent input terminal status 6	3: CF2 (Multi-speed Select, Bit 1)	
☑	d005.7	Intelligent input terminal status 7	6: JG (Jogging)	

For Help, press F1

3G3MX2-A2/B004-PRG43234309

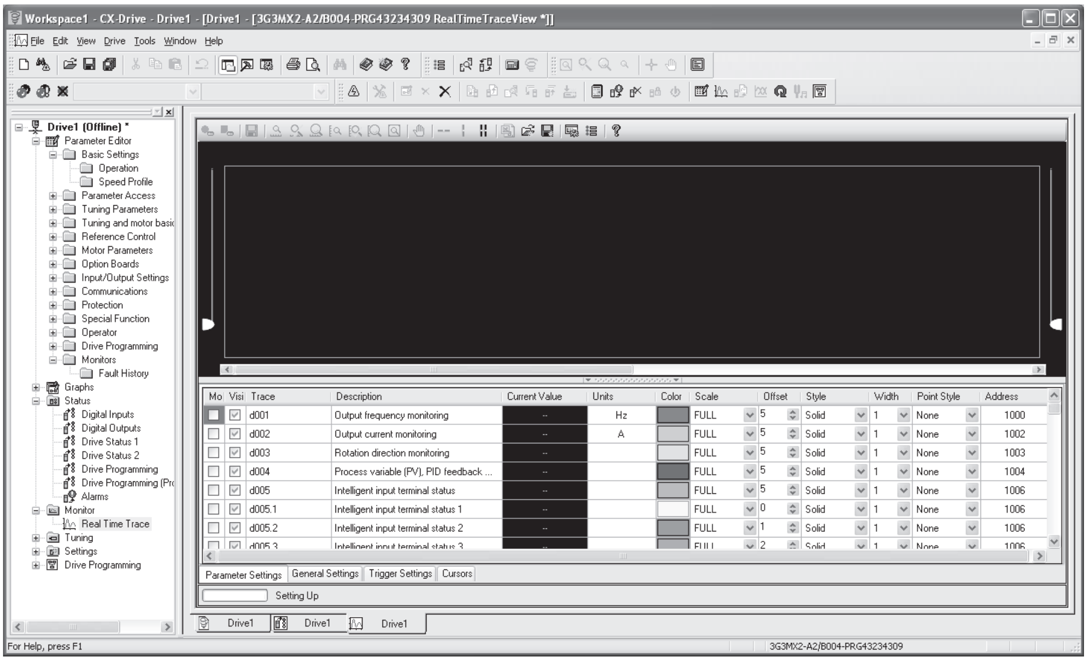
File
Edit
View
Drive
Tools
Window
Help
Drive1 (Offline) *
Parameter Editor
Basic Settings
Operation
Speed Profile
Parameter Access
Tuning Parameters
Tuning and motor basic
Reference Control
Motor Parameters
Option Boards
Input/Output Settings
Communications
Protection
Special Function
Operator
Drive Programming
Monitors
Fault History
Graphs
Status
Digital Inputs
Digital Outputs
Drive Status 1
Drive Status 2
Drive Programming
Drive Programming (Pr
Alarms
Monitor
Real Time Trace
Tuning
Settings
Drive Programming
Drive1
Drive1

Monitor Function of CX-Drive

Open the Monitor folder in the project and double-click Real Time Trace.

The Real Time Trance window opens, in which you can monitor the operation status of the inverter.

- Up to 8 signals can be traced.
- Triggers can be set to the ON/OFF timing of the inverter's internal status, or numerically.


Workspace1 - CX-Drive - Drive1 - [Drive1 - [3G3MX2-A2/B004-PRG43234309 RealTimeTraceView *]]
File Edit View Drive Tools Window Help
Drive1 (Offline) *
Parameter Editor
Basic Settings
Operation
Speed Profile
Parameter Access
Tuning Parameters
Tuning and motor basic
Reference Control
Motor Parameters
Option Boards
Input/Output Settings
Communications
Protection
Special Function
Operator
Drive Programming
Monitors
Fault History
Graphs
Status
Digital Inputs
Digital Outputs
Drive Status 1
Drive Status 2
Drive Programming
Drive Programming (Pr
Alarms
Monitor
Real Time Trace
Tuning
Settings
Drive Programming
Parameter Settings
General Settings
Trigger Settings
Cursors
Setting Up
Drive1
Drive1
Drive1
For Help, press F1
3G3MX2-A2/B004-PRG43234309

Mo	Visi	Trace	Description	Current Value	Units	Color	Scale	Offset	Style	Width	Point Style	Address
☐	☑	d001	Output frequency monitoring	--	Hz	▨	FULL	5	Solid	1	None	1000
☐	☑	d002	Output current monitoring	--	A	▨	FULL	5	Solid	1	None	1002
☐	☑	d003	Rotation direction monitoring	--		▨	FULL	5	Solid	1	None	1003
☐	☑	d004	Process variable (PV), PID feedback ...	--		▨	FULL	5	Solid	1	None	1004
☐	☑	d005	Intelligent input terminal status	--		▨	FULL	5	Solid	1	None	1006
☐	☑	d005.1	Intelligent input terminal status 1	--		□	FULL	0	Solid	1	None	1006
☐	☑	d005.2	Intelligent input terminal status 2	--		▨	FULL	1	Solid	1	None	1006
☐	☑	d005.3	Intelligent input terminal status 3	--		▨	FULL	2	Solid	1	None	1006

3-3 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.	Section 2, 2-1
Wiring and connections	Connect the inverter to the power supply and peripheral equipment.	Section 2, 2-10
Power-on	Check the points mentioned in the next page before turning on the power supply.	Section 3, 3-4
Display Status Checks	Check that there is no error in the inverter.	Section 10
Parameter Initialization	Initialize the inverter parameters.	Section 5, 5-1
Parameter Setting	Set the parameters required for the test run.	Section 5, 5-3, 5-4
No-load Run	Run the motor with no-load via the Digital Operator.	Section 3, 3-1
Load Run	Run the motor via Digital Operator, with the mechanical system connected.	Section 3, 3-1
Operation	Basic settings (operation with the basic settings required to operate and stop the inverter.)	Section 5
	Vector control (operation with the vector control and other functions.)	Section 6

3-4 Operation Items for Test Run

The following describes the operation items for test run.

Installation

Check that the inverter meets the installation conditions.

For details on installing the inverter, refer to *2-1 Installation* on page 2-4.

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.

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 (R/L1, S/L2, T/L3) are securely wired.

The rated input voltage of the 3G3MX2-V1 Series Inverter is as follows.

Model	Power supply voltage
3G3MX2-A2☐-V1	3-phase 200 to 240 VAC
3G3MX2-A4☐-V1	3-phase 380 to 480 VAC
3G3MX2-AB☐-V1	Single-phase 200 to 240 VAC

Check that the motor is securely connected to the motor output terminals (U/T1, V/T2, W/T3).

Check that the controller is securely connected to the control circuit terminals. In addition, turn off the control terminals.

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

● Power-on

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

Display Status Checks

If no problem is found at power-on, the display status will be as follows.

Name	Display status
POWER LED	Lit
ALARM LED	Not lit
RUN LED	Not lit (Lit during RUN)
RUN command LED indicator	Lit
Data display LED (Hz)	Lit
Data display	Displays d001 setting.

If any problem is found, the display status will be as follows.

Refer to *Section 10 Troubleshooting* for countermeasures.

Name	Display status
POWER LED	Lit
ALARM LED	Lit
RUN LED	Not lit
RUN command LED indicator	Lit
Data display LED (Hz)	Lit
Data display	Displays alarm code such as E01 on data display. (Displayed alarm code differ depending on error condition.)

Parameter Initialization

You can initialize the changed parameters and also clear the fault monitor data.

As a measure to prevent inadvertent parameter initialization, the inverter is designed to force the user to set several parameters to execute initialization.

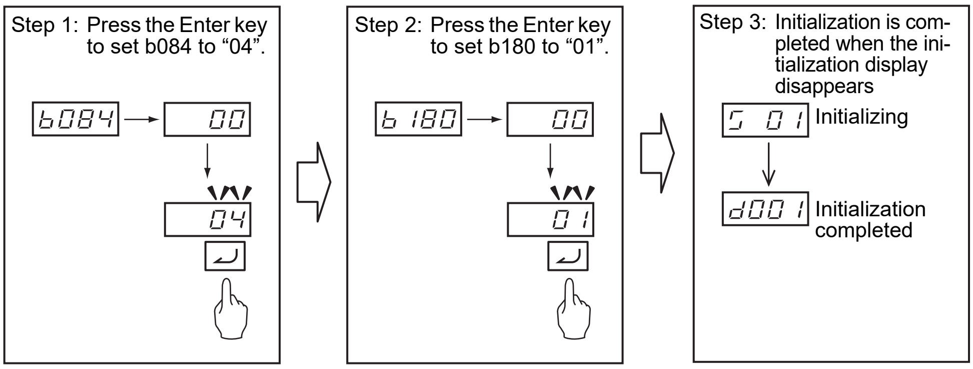
The following figure shows the steps of complete parameter initialization.

To initialize all the parameters, set the Initialization Target Setting (b094) to 00 (All data).

To initialize the fault monitor and DriveProgramming data in addition to the parameter data, set the Initialization Selection (b084) to 04.

Set the Initialization Execution (b180) to 01 (Execute initialization) to execute parameter initialization.

For details on parameter initialization, refer to *5-1 Parameter Display and Parameter Initialization* on page 5-3.



Step 1: Press the Enter key to set b084 to "04".

Step 2: Press the Enter key to set b180 to "01".

Step 3: Initialization is completed when the initialization display disappears

Precautions for Correct Use

- The following parameters are not initialized: Total RUN Time Monitor (d016), Total Power ON Time Monitor (d017), Heavy Load/Light Load Selection (b049), Initialization Data Selection (b085), Initialization Target Setting (b094), FV/FI Adjustment (C081/C082), Thermistor Adjustment (C085), and Position Data at Power Off (P082).

  The DriveProgramming User Parameters U00 to U31 (P100 to P131) are not initialized unless the Initialization Selection (b084) is set to 04.
- The inverter does not display the initialization-related parameters (b084, b094, b180) depending on the Display Selection (b037) setting. If they are not displayed, change b037 to 00 (Complete display).
- When the Soft Lock Selection (b031) is set to prohibit changes of the initialization-related parameters (b084, b094, b180), the initialization cannot be executed. Change the Soft Lock Selection (b031) to enable the initialization.
- For details on Soft Lock Selection, refer to *7-6-1 Soft Lock Function (SFT)* on page 7-54.
- Remember that you will not be able to revert to the previous settings once you press the Enter key to execute parameter initialization, with the Initialization Execution (b180) set to 01.

Parameter Setting

To operate the inverter, two commands are required: the RUN command and the frequency reference.

First, set the sources of these commands in the 1st Frequency Reference Selection (A001) and 1st RUN Command Selection (A002). For Test Run, set these parameter to 02 (Digital Operator) so as to operate the inverter via the Digital Operator.

Next, set the 1st Motor Capacity (H003) and the 1st Motor Pole Number (H004). These values will be used as the reference values for the automatic torque boost, motor protection, and torque limit functions.

Then, in the 1st Electronic Thermal Level (b012), set the rated current of your motor.

Set the value correctly according to the motor.

Parameter No.	Function name	Set value	Default data	Unit
A001	1st Frequency Reference Selection	02: Digital Operator	02	–
A002	1st RUN Command Selection	02: Digital Operator	02	–
H003	1st Motor Capacity	0.1/0.2/0.4/0.55/0.75/1.1/1.5/2.2/3.0/3.7/4.0/5.5/7.5/11.0/15.0/18.5	Maximum applicable motor capacity	kW
H004	1st Motor Pole Number	2/4/6/8 10 to 48: Do not set.	4	pole
b012	1st Electronic Thermal Level	0.20 × Rated current to 1.00 × Rated current	Rated current	A
b087	STOP Key Selection	00: Enabled	00	—

Precautions for Correct Use

The STOP/RESET key on the Digital Operator is enabled when the STOP Key Selection parameter is set to Enabled. Make sure that this parameter is set correctly, although the STOP/RESET key enabled by default.

No-load Run

Rotate the motor with no-load (in a state not connected to the mechanical system) via the Digital Operator.

● Forward/reverse rotation via Digital Operator

Follow the steps below to the motor in the forward or reverse rotation.

(1) Set the Output Frequency Setting/Monitor (F001).

It is recommended to initially set this to approximately 10 Hz or slower for safety reasons (Factory default: F001 = 6.00).

(2) Set the RUN Direction Selection (F004).

In the RUN Direction Selection (F004), select 00 (Forward) or 01 (Reverse).

Press the Mode key for 3 seconds or more to display the data of Output Frequency Monitor (d001).
Make sure that the displayed value is 0.00 (Hz).

(3) Press the RUN key.

The motor starts rotating with the RUN LED lit.

(4) Check that there is no problem with the output frequency, motor rotation direction or inveter operation displayed on the Digital Operator.

For the rotation direction of motor, refer to the explanation for the RUN Direction Monitor (d003).

Parameter No.	Function name	Data range	Default data	Unit
F001	Output Frequency Setting/ Monitor	0.00, Starting Frequency to 1st Maximum Frequency	6.0	Hz
F004	RUN Direction Selection	00: Forward 01: Reverse	00	–
d001	Output Frequency Monitor	0.00 to 99.99 100.0 to 400.0 (580.0)[*1]	–	Hz
d003	RUN Direction Monitor	F: Forward o: Stop r: Reverse	–	–

*1. In the high-frequency mode.

Key	Data display example	Description
⟲	0.00	Press the Mode key for 3 seconds or more to display the d001 data “0.00”.
RUN	6.0	Press the RUN key. The RUN command LED indicator lights and the frequency reference monitor value is displayed on the data display.

● Stopping Motor

After rotating the motor with no-load in the forward or reverse rotation via the Digital Operator, press the STOP/RESET key STOP RESET. The motor stops rotating.

Load Run

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

● Mechanical system connection

Make sure that the motor stopped completely before connecting the mechanical system.

Then, connect the mechanical system with the motor securely to prevent the screws from loosening.

● Operation via Digital Operator

In case of abnormal inverter run, be prepared to press the STOP/RESET key STOP RESET on the Digital Operator.

In the same way as you did during no-load run, stop the machine via the Digital Operator.

● RUN mode checks

Start with a low speed and, while checking that the machine moves smoothly in a correct direction, increase the Output Frequency Setting/Monitor (F001) value.

Check that there is no mechanical vibration and noise by varying the Output Frequency Setting/ Monitor (F001) and RUN Direction Selection (F004) settings.

Also, check a current, load rate, and voltage by the Output Current Monitor (d002), Electronic Thermal Load Rate Monitor (d104), and DC Voltage Monitor (d102).

Check that the output current is up to 150% of the motor rated current.

Also, check that the electronic thermal load rate is sufficiently low to reach 100%.

Check that the DC voltage for 200-V class and for 400-V class is sufficiently low to reach 390 VDC and 780 VDC, respectively.

Operation

To operate the inverter with only basic parameters, refer to *Section 5 Basic Settings*.

To use applied functions such as sensorless vector control, V/f control with speed feedback, torque control, and simple position control, in addition to *Section 5 Basic Settings*, refer to *Section 6 Vector Control and Applied Functions*.

4

Parameter List

This section provides the parameter lists that show monitor functions and available parameters for this inverter.

4-1 Monitor Mode 4-2
4-1-1 Group d 4-2

4-2 Function Mode 4-5
4-2-1 Group F: Basic Function Parameters 4-5

4-3 Extended Function Mode 4-6
4-3-1 Group A: Standard Function Parameters 4-7
4-3-2 Group b: Detailed Function Parameters 4-14
4-3-3 Group C: Multi-function Terminal Function Parameters 4-24
4-3-4 Group H: Motor Control Parameters 4-32
4-3-5 Group P: Option/Applied Function Parameters 4-35
4-3-6 Group U: User Parameters 4-41

4-1 Monitor Mode

The inverter by default displays the data of the parameter d001 after power-on. To monitor the desired parameter at power-on, change this default setting in the Initial Screen Selection (b038).

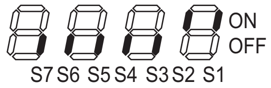
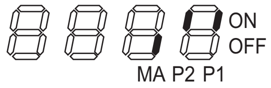
The displayed parameters vary with the Display Selection (b037) setting. To display all parameters, set this parameter to 00 (Complete display).

In the 3G3MX2-V1 Series, the default data for the Display Selection (b037) is 00 (Complete display), so all parameters are displayed when you turn on the power supply for the first time after purchase.

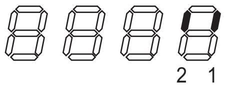
The Monitor or data range column of the parameter list shows the range of parameters you can monitor or set on the Digital Operator (4-digit LED display) of the inverter. For the actual internal data range for this inverter, refer to *8-9 Modbus Communication Data Lists* on page 8-37.

To monitor or set detailed parameter data over the upper 4 digits, please use the Inverter/Servo support tool CX-Drive.

4-1-1 Group d

Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Changes during RUN	Unit	Page
d001	Output Frequency Monitor	0.00 to 99.99 100.0 to 400.0 (580.0) [*1]	–	Enabled	Enabled	Hz	P. 7-4
d002	Output Current Monitor	0.0 to 655.3 Minimal unit depends on inverter capacity.	–	–	–	A	P. 7-4
d003	RUN Direction Monitor	F: Forward o: Stop r: Reverse	–	–	–	–	P. 7-5
d004	PID Feedback Value Monitor	0.00 to 99.99 100.0 to 999.9 1000. to 9999. 1000 (10000)	–	–	–	–	P. 7-5
d005	Multi-function Input Monitor	 (Example) Terminals S1, S2: ON Terminals S3 to S7: OFF	–	–	–	–	P. 7-5
d006	Multi-function Output Monitor	 (Example) Terminals P1, P2: ON Terminal MA: OFF	–	–	–	–	P. 7-6
d007	Output Frequency Monitor (After Conversion)	0.00 to 99.99 100.0 to 999.9 1000. to 9999. 1000 to 3999 (5799)[*1] (10000 to 57994) [*1]	–	Enabled	Enabled	–	P. 7-6

[*1] In the high-frequency mode.

Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Changes during RUN	Unit	Page
d008	Real Frequency Monitor	(–580.)[*1] –400. to –100. –99.9 to –10.0 –9.99 to 99.99 100.0 to 400.0 (400.1 to 580.0)[*1]	–	–	–	Hz	P. 7-7
d009	Torque Reference Monitor	–200. to 200.	–	–	–	%	P. 7-7
d010	Torque Bias Monitor	–200. to 200.	–	–	–	%	P. 7-8
d012	Output Torque Monitor	–200. to 200.	–	–	–	%	P. 7-8
d013	Output Voltage Monitor	0.0 to 600.0	–	–	–	V	P. 7-8
d014	Input Power Monitor	0.0 to 100.0	–	–	–	kW	P. 7-9
d015	Integrated Power Monitor	0.0 to 999.9 1000. to 9999. 1000 to 9999 (10000 to 99990) Γ100 to Γ999 (100000 to 999000)	–	–	–	–	P. 7-9
d016	Total RUN Time Monitor	0. to 9999. 1000 to 9999 (10000 to 99990) Γ100 to Γ999 (100000 to 999000)	–	–	–	h	P. 7-10
d017	Total Power ON Time Monitor	0. to 9999. 1000 to 9999 (10000 to 99990) Γ100 to Γ999 (100000 to 999000)	–	–	–	h	P. 7-10
d018	Fin Temperature Monitor	–20.0 to 150.0	–	–	–	°C	P. 7-10
d022	Life Assessment Monitor	 1: Capacitor on main circuit board 2: Cooling fan	–	–	–	–	P. 7-11
d023	Program Counter[*2] (DriveProgramming)	0. to 1024.	–	–	–	–	P. 7-11
d024	Program Number Monitor [*2] (DriveProgramming)	Always displays 1	–	–	–	–	–
d025	User Monitor 0[*2] (DriveProgramming)	Displays DriveProgramming execution result. –2147483647 to 2147483647 (Displays upper 4digits including “–”)	–	–	–	–	P. 7-11
d026	User Monitor 1[*2] (DriveProgramming)						
d027	User Monitor 2[*2] (DriveProgramming)						
d029	Position Command Monitor	–268435455 to 268435455 (×1 multiplication) (Displays upper 4digits including “–”)	–	–	–	pulse	P. 7-12
d030	Current Position Monitor	–268435455 to 268435455 (×1 multiplication) (Displays upper 4digits including “–”)	–	–	–	pulse	P. 7-12
d050	Dual User Monitor (2 types of data)	Displays data set in b160 and b161.	–	–	–	–	P. 7-13
d060	Inverter Mode Monitor	Displays the currently set mode. I-C (IM motor heavy load) I-V (IM motor light load) H-I (IM motor high frequency) P (PM motor mode)	–	–	–	–	P. 7-13

[*1] In the high-frequency mode.

[*2] These parameters are newly added to the 3G3MX2-V1 Series.

Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Changes during RUN	Unit	Page
d062	Frequency Reference Source Monitor [*1]	00: Digital Operator (F001) 01 to 15: Multi-step speed frequency 1 to 15 16: Jogging frequency 18: Modbus communication 19: Option 21: Volume 22: Pulse train frequency 23: Operation function output 24: DriveProgramming 25: Analog voltage input (FV) 26: Analog current input (FI) 27: Analog Input (FV) + (FI)	–	–	–	–	P. 7-14
d063	RUN Command Source Monitor[*1]	1: Control circuit terminal block 2: Digital Operator 3: Modbus communication 4: Option	–	–	–	–	P. 7-14
d080	Fault Counter	0. to 9999. 1000 to 6553 (10000 to 65530)	–	–	–	time	P. 7-14
d081	Fault Monitor 1 (Latest)	Fault Factor • Frequency [Hz] • Output Current [A] • DC Voltage [V] • Total RUN Time [h] • Total Power ON Time [h]	–	–	–	–	P. 7-15
d082	Fault Monitor 2						
d083	Fault Monitor 3						
d084	Fault Monitor 4						
d085	Fault Monitor 5						
d086	Fault Monitor 6						
d090	Warning Monitor	Warning code	–	–	–	–	P. 7-15
d102	DC Voltage Monitor	0.0 to 999.9 1000.	–	–	–	V	P. 7-15
d103	Regenerative Braking Load Rate Monitor	0.0 to 100.0	–	–	–	%	P. 7-16
d104	Electronic Thermal Load Rate Monitor	0.0 to 100.0	–	–	–	%	P. 7-16
d130	Analog Voltage Input FV Monitor[*1]	0 to 1023 (1023= Equivalent to A/D converter output of 10.9 V)	–	–	–	bit	P. 7-16
d131	Analog Current Input FI Monitor[*1]	0 to 1023 (1023= Equivalent to A/D converter output of 23.3 mA)	–	–	–	bit	P. 7-16
d133	Pulse Train Input RP Monitor[*1]	0.00 to 99.99 100.0	–	–	–	%	P. 7-17
d153	PID Deviation[*1]	–100. –99.9 to –10.0 –9.99 to 99.99 100.0	–	–	–	%	P. 7-17
d155	PID Output Monitor[*1]	–100. –99.9 to –10.0 –9.99 to 99.99 100.0	–	–	–	%	P. 7-17

[*1] These parameters are newly added to the 3G3MX2-V1 Series.

4-2 Function Mode

The table below lists the function mode parameters.

The Monitor or data range column of the parameter list shows the range of parameters you can monitor or set on the Digital Operator (4-digit LED display) of the inverter. For the actual internal data range for this inverter, refer to *8-9 Modbus Communication Data Lists* on page 8-37.

To monitor or set detailed parameter data over the upper 4 digits, please use the Inverter/Servo support tool CX-Drive.

4-2-1 Group F: Basic Function Parameters

Parameter No.	Function name	Monitor or data range	Default data	Setting during RUN	Changes during RUN	Unit	Page
F001	Output Frequency Setting/ Monitor	0.0, Starting Frequency to 1st/ 2nd Maximum Frequency When the PID function is enabled: 0.0 to 100.0	6.00	Enabled	Enabled	Hz %	P. 5-24
F002	1st Acceleration Time 1	0.00 to 99.99 100.0 to 999.9 1000. to 3600.	10.00 (30.00) *1	Enabled	Enabled	s	P. 5-33
F202	2nd Acceleration Time 1	0.00 to 99.99 100.0 to 999.9 1000. to 3600.	10.00 (30.00) *1	Enabled	Enabled	s	
F003	1st Deceleration Time 1	0.00 to 99.99 100.0 to 999.9 1000. to 3600.	10.00 (30.00) *1	Enabled	Enabled	s	
F203	2nd Deceleration Time 1	0.00 to 99.99 100.0 to 999.9 1000. to 3600.	10.00 (30.00) *1	Enabled	Enabled	s	
F004	RUN Direction Selection	00: Forward 01: Reverse	00	Disabled	Disabled	–	P. 5-22

*1. In the high-frequency mode.

4-3 Extended Function Mode

In the extended function mode, inverter parameters are categorized in six groups: A, b, C, H, P, and U.

This section provides the parameter list for each group.

Note that the parameters displayed on the Digital Operator vary with the setting in the Display Selection (b037). To display all parameters, set this parameter to 00 (Complete display).

The Monitor or data range column of the parameter list shows the range of parameters you can monitor or set on the Digital Operator (4-digit LED display) of the inverter. For the actual internal data range for this inverter, refer to *8-9 Modbus Communication Data Lists* on page 8-37.

To monitor or set detailed parameter data over the upper 4 digits, please use the Inverter/Servo support tool CX-Drive.

Precautions for Correct Use

- You can change the parameter display on the Digital Operator by the Display Selection (b037). For details, refer to *5-1-1 Display Selection* on page 5-3.
- In the 3G3MX2-V1 Series, the default data for the Display Selection (b037) was changed from the previous default 04 (Basic display) to 00 (Complete display). You can see and set all parameters when you turn on the power supply for the first time.

Additional Information

- You can set the initial screen displayed after turning on the power supply by the Initial Screen Selection (b038). For details, refer to *7-6-5 Initial Screen Selection (Initial Screen after Power-on)* on page 7-56.
- You can display only the parameters registered as user parameters. It is also possible to automatically register changed parameters, or directly set specific parameters. For details, refer to *7-6-11 User Parameter Automatic Setting Function* on page 7-60.

4-3-1 Group A: Standard Function Parameters

Parameter No.		Function name	Monitor or data range	Default data	Set data	Setting during RUN	Changes during RUN	Unit	Page
Basic operation settings	A001	1st Frequency Reference Selection	00: Digital Operator (Volume) [*1] 01: Control circuit terminal block (Analog input) 02: Digital Operator (F001) 03: Modbus communication 04: Option 06: Pulse train frequency 07: DriveProgramming 10: Operation function output	02		Disabled	Disabled	–	P. 5-24
	A201	2nd Frequency Reference Selection		02		Disabled	Disabled		
	A002	1st RUN Command Selection	01: Control terminal block (DriveProgramming) 02: Digital Operator 03: Modbus communication 04: Option	02		Disabled	Disabled	–	P. 5-22
	A202	2nd RUN Command Selection		02		Disabled	Disabled		
	A003	1st Base Frequency	30.0 to 1st Maximum Frequency (A004)	60.0 (580.0) [*2]		Disabled	Disabled	Hz	P. 5-21
	A203	2nd Base Frequency	30.0. to 2nd Maximum Frequency (A204)	60.0 (580.0) [*2]		Disabled	Disabled	Hz	
	A004	1st Maximum Frequency	1st Base Frequency (A003) to 400.0 [*2]	60.0 (580.0) [*2]		Disabled	Disabled	Hz	P. 5-21
	A204	2nd Maximum Frequency	2nd Base Frequency (A203) to 400.0 [*2]	60.0 (580.0) [*2]		Disabled	Disabled	Hz	
Analog input	A005	FV/FI Selection	00: Switch between FV (Voltage) and FI (Current) 02: Switch between FV (Voltage) and volume[*1] 03: Switch between FI (Current) and volume[*1]	00		Disabled	Disabled	–	P. 7-22
	A011	FV Start Frequency	0.00 to 99.99 100.0 to 400.0 [*2]	0.00		Disabled	Enabled	Hz	P. 7-25
	A012	FV End Frequency	0.00 to 99.99 100.0 to 400.0 [*2]	0.00		Disabled	Enabled	Hz	
	A013	FV Start Ratio	0. to FV End Ratio	0.		Disabled	Enabled	%	
	A014	FV End Ratio	FV Start Ratio to 100.	100.		Disabled	Enabled	%	
	A015	FV Start Selection	00: FV Start Frequency (A011) 01: 0 Hz	01		Disabled	Enabled	–	
	A016	Analog Input Filter	1. to 30. 31. (500-ms filter with ±0.1-Hz hysteresis)	8.		Disabled	Enabled	–	P. 7-24
DriveProgramming	A017	DriveProgramming Function Selection [*3]	00: Disabled 01: Enabled (Start/stop via multi-function input PRG terminal) 02: Enabled (Start/stop via power on/off)	00		Enabled	Enabled	–	P. 7-102

*1. This setting is enabled when the Digital Operator with the volume control (Model: 3G3AX-OP01) is connected.

*2. In the high-frequency mode.

*3. These parameters are newly added to the 3G3MX2-V1 Series.

Parameter No.		Function name	Monitor or data range	Default data	Set data	Setting during RUN	Changes during RUN	Unit	Page
Multi-step speed, jogging	A019	Multi-step Speed Selection	00: Binary (16-step selection with 4 terminals) 01: Bit (8-step selection with 7 terminals)	00		Disabled	Disabled	–	P. 5-49
	A020	1st Multi-step Speed Reference 0	0.00 Starting Frequency to 1st Maximum Frequency	6.00		Enabled	Enabled	Hz	
	A220	2nd Multi-step Speed Reference 0	0.00 Starting Frequency to 2nd Maximum Frequency	6.00		Enabled	Enabled	Hz	
	A021	Multi-step Speed Reference 1	0.00 Starting Frequency to Maximum Frequency	0.00		Enabled	Enabled	Hz	
	A022	Multi-step Speed Reference 2							
	A023	Multi-step Speed Reference 3							
	A024	Multi-step Speed Reference 4							
	A025	Multi-step Speed Reference 5							
	A026	Multi-step Speed Reference 6							
	A027	Multi-step Speed Reference 7							
	A028	Multi-step Speed Reference 8							
	A029	Multi-step Speed Reference 9							
	A030	Multi-step Speed Reference 10							
	A031	Multi-step Speed Reference 11							
	A032	Multi-step Speed Reference 12							
	A033	Multi-step Speed Reference 13							
	A034	Multi-step Speed Reference 14							
	A035	Multi-step Speed Reference 15							
	A038	Jogging Frequency	Starting Frequency to 9.99 (100.00)	6.00		Enabled	Enabled	Hz	P. 5-52
	A039	Jogging Stop Selection	00: Free-running on jogging stop/Disabled during operation 01: Deceleration stop on jogging stop/Disabled during operation 02: DC injection braking on jogging stop/Disabled during operation 03: Free-running on jogging stop/Enabled during operation 04: Deceleration stop on jogging stop/Enabled during operation 05: DC injection braking on jogging stop/Enabled during operation	04		Disabled	Enabled	–	

*1. In the high-frequency mode.

Parameter No.		Function name	Monitor or data range	Default data	Set data	Setting during RUN	Changes during RUN	Unit	Page
V/f characteristics	A041	1st Torque Boost Selection	00: Manual torque boost 01: Automatic torque boost	01 *1		Disabled	Disabled	–	P. 5-60
	A241	2nd Torque Boost Selection	00: Manual torque boost 01: Automatic torque boost	01 *1		Disabled	Disabled	–	
	A042	1st Manual Torque Boost Voltage	0.0 to 20.0 (Percentage of 1st Motor Rated Voltage Selection (A082))	1.0		Enabled	Enabled	%	
	A242	2nd Manual Torque Boost Voltage	0.0 to 20.0 (Percentage of 2nd Motor Rated Voltage Selection (A282))	1.0		Enabled	Enabled	%	
	A043	1st Manual Torque Boost Frequency	0.0 to 50.0 (Percentage of 1st Base Frequency (A003))	5.0		Enabled	Enabled	%	
	A243	2nd Manual Torque Boost Frequency	0.0 to 50.0 (Percentage of 2nd Base Frequency (A203))	5.0		Enabled	Enabled	%	
	A044	1st Control Method	00: Constant torque characteristics (VC) 01: Reduced torque characteristics (VP 1.7th power (VC at low speed)) 02: Free V/f setting 03: Sensorless vector control *2	00		Disabled	Disabled	–	P. 5-9
	A244	2nd Control Method	00: Constant torque characteristics (VC) 01: Reduced torque characteristics (VP 1.7th power (VC at low speed)) 02: Free V/f setting 03: Sensorless vector control *2	00		Disabled	Disabled	–	
	A045	1st Output Voltage Gain	20. to 100.	100.		Enabled	Enabled	%	P. 7-41
	A245	2nd Output Voltage Gain	20. to 100.	100.		Enabled	Enabled	%	
	A046	1st Automatic Torque Boost Voltage Compensation Gain	0. to 255.	100.		Enabled	Enabled	–	P. 5-60
	A246	2nd Automatic Torque Boost Voltage Compensation Gain	0. to 255.	100.		Enabled	Enabled	–	
	A047	1st Automatic Torque Boost Slip Compensation Gain	0. to 255.	0. *1		Enabled	Enabled	–	
	A247	2nd Automatic Torque Boost Slip Compensation Gain	0. to 255.	0. *1		Enabled	Enabled	–	
DC injection braking	A051	DC Injection Braking Selection	00: Disabled 01: Enabled 02: Enabled (Operates only at set frequency)	00		Disabled	Enabled	–	P. 7-91
	A052	DC Injection Braking Frequency	0.00 to 60.00	0.50		Disabled	Enabled	Hz	
	A053	DC Injection Braking Delay Time	0.0 to 5.0	0.0		Disabled	Enabled	s	
	A054	DC Injection Braking Power	0. to 100./70. (Heavy load/Light load)	50.		Disabled	Enabled	%	
	A055	DC Injection Braking Time	0.0 to 60.0	0.5		Disabled	Enabled	s	
	A056	DC Injection Braking Edge/Level Selection	00: Edge operation 01: Level operation	01		Disabled	Enabled	–	

*1. The default data was changed from the previous model.

*2. Sensorless vector control can be set in the heavy load mode only.

Parameter No.		Function name	Monitor or data range	Default data	Set data	Setting during RUN	Changes during RUN	Unit	Page
DC injection braking	A057	Startup DC Injection Braking Power	0. to 100./70. (Heavy load/Light load)	0.		Disabled	Enabled	%	P. 7-91
	A058	Startup DC Injection Braking Time	0.0 to 60.0	0.0		Disabled	Enabled	s	
	A059	DC Injection Braking Carrier Frequency	2.0 to 15.0/10.0 (Heavy load/Light load)	5.0/ 2.0		Disabled	Enabled	kHz	
Limit, jump	A061	1st Frequency Upper Limit	0.00 1st Frequency Lower Limit to 1st Maximum Frequency	0.00		Disabled	Enabled	Hz	P. 5-31
	A261	2nd Frequency Upper Limit	0.00 2nd Frequency Lower Limit to 2nd Maximum Frequency	0.00		Disabled	Enabled	Hz	
	A062	1st Frequency Lower Limit	0.00 Starting Frequency to 1st Frequency Upper Limit	0.00		Disabled	Enabled	Hz	
	A262	2nd Frequency Lower Limit	0.00 Starting Frequency to 2nd Frequency Upper Limit	0.00		Disabled	Enabled	Hz	
	A063	Jump Frequency 1	0.00 to 99.99 100.0 to 400.0 (580.0) [*1]	0.00		Disabled	Enabled	Hz	P. 7-36
	A064	Jump Frequency Width 1	0.00 to 10.00 (100.0) [*1]	0.50		Disabled	Enabled	Hz	
	A065	Jump Frequency 2	0.00 to 99.99 100.0 to 400.0 (580.0) [*1]	0.00		Disabled	Enabled	Hz	
	A066	Jump Frequency Width 2	0.00 to 10.00 (100.0) [*1]	0.50		Disabled	Enabled	Hz	
	A067	Jump Frequency 3	0.00 to 99.99 100.0 to 400.0 (580.0) [*1]	0.00		Disabled	Enabled	Hz	
	A068	Jump Frequency Width 3	0.00 to 10.00 (100.0) [*1]	0.50		Disabled	Enabled	Hz	
Acceleration stop	A069	Acceleration Stop Frequency	0.00 to Starting Frequency: Disabled Frequency above Starting Frequency to 99.99 100.0 to 400.0 (580.0) [*1]	0.00		Disabled	Enabled	Hz	P. 7-37
	A070	Acceleration Stop Time	0.0: Disabled 0.1 to 60.0	0.0		Disabled	Enabled	s	
PID Braking	A071	PID Selection	00: Disabled 01: Enabled 02: Enabled (Reverse output enabled)	00		Disabled	Enabled	–	P. 7-44
	A072	PID P Gain	0.00 to 25.00	1.00		Enabled	Enabled	–	
	A073	PID I Gain	0.0 to 999.9 1000. to 3600.	1.0		Enabled	Enabled	s	
	A074	PID D Gain	0.00 to 99.99 100.0	0.00		Enabled	Enabled	s	
	A075	PID Scale	0.01 to 99.99	1.00		Disabled	Enabled	time	
	A076	PID Feedback Selection	00: FI (Current) 01: FV (Voltage) 02: Modbus communication 03: Pulse train frequency 10: Operation function output	00		Disabled	Enabled	–	

[*1] In the high-frequency mode.

Parameter No.		Function name	Monitor or data range	Default data	Set data	Setting during RUN	Changes during RUN	Unit	Page
PID Braking	A077	PID Deviation Reverse Output	00: Disabled (Deviation = Target value – Feedback value) 01: Enabled (Deviation = Feedback value – Target value)	00		Disabled	Enabled	–	P. 7-44
	A078	PID Variable Range Limit	0.0 to 100.0	0.0		Disabled	Enabled	%	
	A079	PID Feedforward Selection	00: Disabled 01: FV (Voltage) 02: FI (Current)	00		Disabled	Enabled	–	
AVR	A081	1st AVR Selection	00: Always ON 01: Always OFF 02: OFF during deceleration	02		Disabled	Disabled	–	P. 7-42
	A281	2nd AVR Selection		02		Disabled	Disabled	–	
	A082	1st Motor Rated Voltage Selection	200-V class: 200/215/220/230/240 400-V class: 380/400/415/440/460/480	200/ 400		Disabled	Disabled	V	P. 5-21
	A282	2nd Motor Rated Voltage Selection		200/ 400		Disabled	Disabled	V	
	A083	AVR Filter Time Constant	0.000 to 9.999 10.00	0.300		Disabled	Enabled	s	P. 7-42
	A084	AVR Gain at Deceleration	50. to 200.	100.		Disabled	Enabled	%	
Operation mode, acceleration/deceleration function	A085	Operation Mode Selection	00: Normal operation 01: Energy-saving operation	00		Disabled	Disabled	–	P. 7-50
	A086	Energy-saving Response/Accuracy Adjustment	0.0 to 100.0	50.0		Enabled	Enabled	%	
	A092	1st Acceleration Time 2	0.00 to 99.99 100.0 to 999.9 1000. to 3600.	10.0 (15.00) *1		Enabled	Enabled	s	P. 5-37
	A292	2nd Acceleration Time 2		10.0 (15.00) *1		Enabled	Enabled		
	A093	1st Deceleration Time 2		10.0 (15.00) *1		Enabled	Enabled		
	A293	2nd Deceleration Time 2		10.0 (15.00) *1		Enabled	Enabled		
	A094	1st 2-step Acceleration/ Deceleration Selection	00: Switch via 2CH terminal (multi-function input: 09) 01: Switch by setting (A095/A295/ A096/A296) 02: Switch only during forward/ reverse switching	00		Disabled	Disabled	–	
	A294	2nd 2-step Acceleration/ Deceleration Selection		00		Disabled	Disabled		
	A095	1st 2-step Acceleration Frequency	0.00 to 99.99 100.0 to 400.0 (580.0) *1	0.00		Disabled	Disabled	Hz	
	A295	2nd 2-step Acceleration Frequency		0.00		Disabled	Disabled		
	A096	1st 2-step Deceleration Frequency		0.00		Disabled	Disabled		
	A296	2nd 2-step Deceleration Frequency		0.00		Disabled	Disabled		
	A097	Acceleration Pattern Selection	00: Line 01: S-shape curve 02: U-shape curve 03: Inverted U-shape curve 04: EL-S-shape curve	01		Disabled	Disabled	–	P. 5-34
	A098	Deceleration Pattern Selection		01		Disabled	Disabled		

*1. In the high-frequency mode.

Parameter No.		Function name	Monitor or data range	Default data	Set data	Setting during RUN	Changes during RUN	Unit	Page
Frequency adjustment	A101	FI Start Frequency	0.00 to 99.99 100.0 to 400.0 (580.0) [*1]	0.00		Disabled	Enabled	Hz	P. 7-25
	A102	FI End Frequency		0.00		Disabled	Enabled		
	A103	FI Start Ratio	0. to FI End Ratio	20.		Disabled	Enabled	%	
	A104	FI End Ratio	FI Start Ratio to 100	100.		Disabled	Enabled	%	
	A105	FI Start Selection	00: FI Start Frequency (A101) 01: 0 Hz	00		Disabled	Enabled	–	
Acceleration/Deceleration	A131	Acceleration Curve Parameter	01 (Small curve) to 10 (Large curve)	02		Disabled	Enabled	–	P. 5-34
	A132	Deceleration Curve Parameter		02		Disabled	Enabled		
Calculation frequency	A141	Calculation Frequency Selection 1	00: Digital Operator (A020/A220) 01: Digital Operator (Volume) [*2] 02: Input FV (Voltage) 03: Input FI (Current) 04: Modbus communication 05: Option 07: Pulse train frequency	02		Disabled	Enabled	–	P. 7-39
	A142	Calculation Frequency Selection 2		03		Disabled	Enabled		
	A143	Calculation Function Operator Selection	00: Addition (A141 + A142) 01: Subtract ion (A141 – A142) 02: Multiplication (A141 × A142)	00		Disabled	Enabled	–	
	A145	Frequency Addition Amount Setting	0.00 to 99.99 100.0 to 400.0 (580.0) [*1]	0.00		Disabled	Enabled	Hz	P. 7-39
	A146	Frequency Addition Sign Selection	00: Frequency reference + A145 01: Frequency reference – A145	00		Disabled	Enabled	–	
Acceleration/Deceleration	A150	EL-S Shape Acceleration Curve Ratio 1	0. to 50.	10.		Disabled	Disabled	%	P. 5-34
	A151	EL-S Shape Acceleration Curve Ratio 2		10.		Disabled	Disabled		
	A152	EL-S Shape Deceleration Curve Ratio 1		10.		Disabled	Disabled		
	A153	EL-S Shape Deceleration Curve Ratio 2		10.		Disabled	Disabled		
Deceleration stop	A154	Deceleration Stop Frequency	0.00 to Starting Frequency: Disabled Frequency above Starting Frequency to 99.99 100.0 to 400.0 (580.0) [*1]	0.00		Disabled	Enabled	Hz	P. 7-37
	A155	Deceleration Stop Time	0.0: Disabled 0.1 to 60.0	0.0		Disabled	Enabled	s	
PID	A156	PID Sleep Operation Level	0.00 to 99.99 100.0 to 400.0 (580.0) [*1]	0.00		Disabled	Enabled	Hz	P. 7-44
	A157	PID Sleep Operation Delay Time	0.0 to 25.5	0.0		Disabled	Enabled	s	

*1. In the high-frequency mode.

*2. This setting is enabled when the Digital Operator with the volume control (Model: 3G3AX-OP01) is connected.

Parameter No.		Function name	Monitor or data range	Default data	Set data	Setting during RUN	Changes during RUN	Unit	Page
Frequency adjustment	A161	VR Start Frequency	0.00 to 99.99 100.0 to 400.0 (580.0) *1	0.00		Disabled	Enabled	Hz	P. 7-25
	A162	VR End Frequency	0.00 to 99.99 100.0 to 400.0 (580.0) *1	0.00		Disabled	Enabled	Hz	
	A163	VR Start Ratio	0. to VR End Ratio	0.		Disabled	Enabled	%	
	A164	VR End Ratio	VR Start Ratio to 100	100.		Disabled	Enabled	%	
	A165	VR Start Selection	00: VR Start Frequency (A161) 01: 0 Hz	01		Disabled	Enabled	Hz	

*1. In the high-frequency mode.

4-3-2 Group b: Detailed Function Parameters

Parameter No.		Function name	Monitor or data range	Default data	Set data	Setting during RUN	Changes during RUN	Unit	Page
Momentary power interruption/Trip restart	b001	Power Interruption/ Undervoltage Restart Selection	00: Trip 01: 0-Hz restart 02: Frequency matching restart 03: Trip after frequency matching deceleration stop 04: Frequency pull-in restart	00		Disabled	Enabled	–	P. 7-61
	b002	Allowable Power Interruption Time	0.3 to 25.0	1.0		Disabled	Enabled	s	
	b003	Restart Standby Time	0.3 to 100.0	1.0		Disabled	Enabled	s	
	b004	Power Interruption/ Undervoltage Trip Selection During Stop	00: Disabled 01: Enabled 02: Disabled during stop and deceleration stop by turning off the RUN command	00		Disabled	Enabled	–	
	b005	Power Interruption Restart Count	00: 16 times 01: No limit	00		Disabled	Enabled	–	
	b007	Frequency Matching Lower Limit Frequency	0.00 to 99.99 100.0 to 400.0 (580.0) [*1]	0.00		Disabled	Enabled	Hz	
	b008	Overvoltage/ Overcurrent Restart Selection	00: Trip 01: 0-Hz restart 02: Frequency matching restart 03: Trip after frequency matching deceleration stop 04: Frequency pull-in restart	00		Disabled	Enabled	–	
	b010	Overvoltage/ Overcurrent Restart Count	1 to 3	3		Disabled	Enabled	time	
	b011	Overvoltage/ Overcurrent Restart Standby Time	0.3 to 100.0	1.0		Disabled	Enabled	s	

[*1] In the high-frequency mode.

Parameter No.		Function name	Monitor or data range	Default data	Set data	Setting during RUN	Changes during RUN	Unit	Page
Electronic thermal	b012	1st Electronic Thermal Level	0.20 × Rated current to 1.00 × Rated current	Rated current of inverter		Disabled	Enabled	A	P. 5-16
	b212	2nd Electronic Thermal Level		Rated current of inverter		Disabled	Enabled	A	
	b013	1st Electronic Thermal Characteristics Selection	00: Reduced torque characteristics 01: Constant torque characteristics 02: Free setting	01		Disabled	Enabled	–	
	b213	2nd Electronic Thermal Characteristics Selection		01		Disabled	Enabled		
	b015	Free-electronic Thermal Frequency 1	0. to Free-electronic Thermal Frequency 2	0.		Disabled	Enabled	Hz	P. 7-72
	b016	Free-electronic Thermal Current 1	0.00 to 1.00 × Rated current	0.00		Disabled	Enabled	A	
	b017	Free-electronic Thermal Frequency 2	Free-electronic Thermal Frequency 1 to Free-electronic Thermal Frequency 3	0.		Disabled	Enabled	Hz	
	b018	Free-electronic Thermal Current 2	0.00 to 1.00 × Rated current	0.00		Disabled	Enabled	A	
	b019	Free-electronic Thermal Frequency 3	Free-electronic Thermal Frequency 2 to 400. (580.0) [*1]	0.		Disabled	Enabled	Hz	
	b020	Free-electronic Thermal Current 3	0.00 to 1.00 × Rated current	0.00		Disabled	Enabled	A	

*1. In the high-frequency mode.

Parameter No.		Function name	Monitor or data range	Default data	Set data	Setting during RUN	Changes during RUN	Unit	Page
Overload limit, overcurrent protection	b021	1st Overload Limit Selection	00: Disabled 01: Enabled during acceleration and constant speed 02: Enabled during constant speed 03: Enabled during acceleration and constant speed (Accelerated during regeneration)	01		Disabled	Enabled	–	P. 7-76
	b221	2nd Overload Limit Selection		01		Disabled	Enabled		
	b022	1st Overload Limit Level	0.20 × Rated current to 2.00 × Rated current (Heavy load) 0.20 × Rated current to 1.50 × Rated current (Light load)	Rated current × 1.50 (Heavy) 1.20 (Light)		Disabled	Enabled	A	
	b222	2nd Overload Limit Level				Disabled	Enabled	A	
	b023	1st Overload Limit Parameter	0.1 to 999.9 1000. to 3000.	1.0		Disabled	Enabled	s	
	b223	2nd Overload Limit Parameter		1.0		Disabled	Enabled		
	b024	1st Overload Limit Selection 2	00: Disabled 01: Enabled during acceleration and constant speed 02: Enabled during constant speed 03: Enabled during acceleration and constant speed (Accelerated during regeneration)	01		Disabled	Enabled	–	
	b025	1st Overload Limit Level 2	0.20 × Rated current to 2.00 × Rated current (Heavy load) 0.20 × Rated current to 1.50 × Rated current (Light load)	Rated current × 1.50 (Heavy) 1.20 (Light)		Disabled	Enabled	A	
	b026	1st Overload Limit Parameter 2	0.1 to 999.9 1000. to 3000.	1.0		Disabled	Enabled	s	
	b027	Overcurrent Suppression Selection	00: Disabled 01: Enabled 02: Enabled (at reduced voltage startup)	01 [*1]		Disabled	Enabled	–	P. 7-79
	b028	Frequency Pull-in Restart Level	0.20 × Rated current to 2.00 × Rated current (Heavy load) 0.20 × Rated current to 1.50 × Rated current (Light load)	Rated current of inverter		Disabled	Enabled	A	P. 5-45 P. 7-61
	b029	Frequency Pull-in Restart Parameter	0.1 to 999.9 1000. to 3000.	0.5		Disabled	Enabled	s	
	b030	Starting Frequency Selection at Frequency Pull-in Restart	00: Frequency at interruption 01: Maximum frequency 02: Set frequency (Frequency reference)	00		Disabled	Enabled	–	

[*1] The default data was changed from the previous model.

Parameter No.		Function name	Monitor or data range	Default data	Set data	Setting during RUN	Changes during RUN	Unit	Page
Lock	b031	Soft Lock Selection	00: Data other than b031 cannot be changed when terminal SFT is ON. 01: Data other than b031 and the set frequency cannot be changed when terminal SFT is ON. 02: Data other than b031 cannot be changed. 03: Data other than b031 and specified frequency parameter cannot be changed. 10: Data can be changed during RUN.	01		Disabled	Enabled	–	P. 7-54
Auxiliary function	b033	Motor Cable Length	5. to 20.	10.		Enabled	Enabled	m	P. 6-4
	b034	RUN Time/Power ON Time Detection Level	0: Disabled (Function does not activate) 1. to 9999. (1 to 9999) 1000 to 6553 (10000 to 65530)	0.		Disabled	Enabled	10 h	P. 7-82
	b035	RUN Direction Limit Selection	00: No direction limit 01: Only Forward is enabled (Reverse is limited) 02: Only Reverse is enabled (Forward is limited)	00		Disabled	Disabled	–	P. 7-38
	b036	Reduced Voltage Startup Selection	0: Reduced voltage startup disabled 1 (Reduced voltage startup time: short) to 255 (Reduced voltage startup time: long)	2		Disabled	Enabled	–	P. 7-36
	b037	Display Selection	00: Complete display 01: Individual display of functions 02: User setting + d001, F001, b037 03: Data comparison display 04: Basic display 05: Monitor display + b037	00[1]		Disabled	Enabled	–	P. 5-3
	b038	Initial Screen Selection	000: Screen on which the Enter key was last pressed 001 to 060: d001 to d060 201: F001 202: Do not set.	001		Disabled	Enabled	–	P. 7-56
	b039	User Parameter Automatic Setting Function	00: Disabled 01: Enabled	00		Disabled	Enabled	–	P. 7-60

[1] The default data was changed from the previous model.

Parameter No.		Function name	Monitor or data range	Default data	Set data	Setting during RUN	Changes during RUN	Unit	Page
Torque limit	b040	Torque Limit Selection	00: Four-quadrant separate setting 01: Terminal switching 02: Analog voltage input 03: Option (No applicable Option)	00		Disabled	Enabled	–	P. 6-12
	b041	Torque Limit 1 (Four-quadrant Mode Forward Power Running)	0. to 200. 255: no (Torque limit disabled)	200.		Disabled	Enabled	%	
	b042	Torque Limit 2 (Four-quadrant Mode Reverse Regeneration)		200.		Disabled	Enabled		
	b043	Torque Limit 3 (Four-quadrant Mode Reverse Power Running)		200.		Disabled	Enabled		
	b044	Torque Limit 4 (Four-quadrant Mode Forward Regeneration)		200.		Disabled	Enabled		
	b045	Torque LADSTOP Selection	00: Disabled 01: Enabled	00		Disabled	Enabled	–	P. 6-14
	b046	Reverse Rotation Prevention Selection	00: Disabled 01: Enabled	00		Disabled	Enabled	–	P. 6-11
Mode	b049	Heavy Load/Light Load Selection	00: Heavy load mode (CT) 01: Light load mode (VT)	00		Disabled	Disabled	–	P. 5-12
Deceleration Stop on Power Interruption	b050	Deceleration Stop Selection on Power Interruption	00: Disabled 01: Enabled (Deceleration stop) 02: Enabled (Constant voltage, without recovery) 03: Enabled (Constant voltage, with recovery)	00		Disabled	Disabled	–	P. 7-68
	b051	Starting Voltage on Power Interruption	0.0 to 999.9 1000.	220.0/ 440.0		Disabled	Disabled	V	
	b052	Deceleration Hold Level on Power Interruption	0.0 to 999.9 1000.	360.0/ 720.0		Disabled	Disabled	V	
	b053	Deceleration Time on Power Interruption	0.01 to 99.99 100.0 to 999.9 1000. to 3600.	1.00		Disabled	Disabled	s	
	b054	Deceleration Starting Width on Power Interruption	0.00 to 10.00 (100.0) [*1]	0.00		Disabled	Disabled	Hz	

[*1] In the high-frequency mode.

	Parameter No.	Function name	Monitor or data range	Default data	Set data	Setting during RUN	Changes during RUN	Unit	Page
Window comparator	b060	Window Comparator FV Upper Limit Level	Set an upper limit level. Setting range: 0. to 100. Lower limit: Lower limit level + Hysteresis width × 2	100.		Enabled	Enabled	%	P. 7-88
	b061	Window Comparator FV Lower Limit Level	Set a lower limit level. Setting range: 0. to 100. Upper limit: Upper limit level – Hysteresis width × 2	0.		Enabled	Enabled	%	
	b062	Window Comparator FV Hysteresis Width	Set a hysteresis width for the upper and lower limit levels. Setting range: 0. to 10. Upper limit: (Upper limit level – Lower limit level) / 2	0.		Enabled	Enabled	%	
	b063	Window Comparator FI Upper Limit Level	Set an upper limit level. Setting range: 0. to 100. Lower limit: Lower limit level + Hysteresis width × 2	100.		Enabled	Enabled	%	
	b064	Window Comparator FI Lower Limit Level	Set a lower limit level. Setting range: 0. to 100. Upper limit: Upper limit level – Hysteresis width × 2	0.		Enabled	Enabled	%	
	b065	Window Comparator FI Hysteresis Width	Set a hysteresis width for the upper and lower limit levels. Setting range: 0. to 10. Upper limit: (Upper limit level – Lower limit level) / 2	0.		Enabled	Enabled	%	
	b070	Analog Operation Level at FV Disconnection	0. to 100. 255: no (Disabled)	no		Disabled	Enabled	–	
	b071	Analog Operation Level at FI Disconnection	0. to 100. 255: no (Disabled)	no		Disabled	Enabled	–	

Parameter No.		Function name	Monitor or data range	Default data	Set data	Setting during RUN	Changes during RUN	Unit	Page
Auxiliary function	b075	Ambient Temperature	–10 to 50	40		Enabled	Enabled	°C	P. 7-85
	b078	Integrated Power Clear	00: Clear disabled 01: Clear with the Enter key	00		Enabled	Enabled	–	P. 7-9
	b079	Integrated Power Display Scale	1. to 1000.	1.		Enabled	Enabled	–	
	b082	Starting Frequency	0.01 to 9.99 (100.0) *1	1.50*2		Disabled	Enabled	Hz	P. 7-35
	b083	Carrier Frequency	2.0 to 15.0 or 10.0 (Heavy load/Light load) (2.0 to 10.0) *1 This parameter requires derating.	10.0/ 2.0 (5.0) *1		Disabled	Enabled	kHz	P. 7-31
	b084	Initialization Selection	00: Initialization disabled 01: Clearing Fault Monitor 02: Initialize data 03: Clear fault monitor + Initialize data 04: Clear fault monitor + Initialize data + Clear DriveProgramming	00		Disabled	Disabled	–	P. 5-6
	b085	Initialization Data Selection	Do not change from 00.	00		Disabled	Disabled	–	
	b086	Frequency Conversion Coefficient	0.01 to 99.99	1.00		Enabled	Enabled	–	P. 7-6
	b087	STOP Key Selection	00: Enabled 01: Disabled 02: Only RESET enabled	00		Disabled	Enabled	–	P. 5-42
	b088	Free-run Stop Selection	00: 0-Hz restart 01: Frequency matching restart 02: Frequency pull-in restart	00		Disabled	Enabled	–	P. 5-39
	b089	Automatic Carrier Reduction	00: Disabled 01: Enabled (dependent on current) 02: Enabled (dependent on cooling fin temperature)	01		Disabled	Disabled	–	P. 7-32
	b090	Usage Rate of Regenerative Braking	0.0: Regenerative braking not active 0.1 to 100.0 (limited by setting in b097)	0.0		Disabled	Enabled	%	P. 5-65
	b091	Stop Selection	00: Deceleration stop 01: Free-run stop	00		Disabled	Enabled	–	P. 5-39
	b092	Cooling Fan Operation	00: Always enabled 01: Enabled only during operation (including 5 minutes after power on/stop) 02: Dependent on fin temperature	01		Disabled	Enabled	–	P. 7-84
	b093	Total Fan Operation Time Clear	00: Clear disabled 01: Clear with the Enter key	00		Disabled	Disabled	–	
	b094	Initialization Target Setting	00: All data 01: All data other than terminals/communications 02: U*** registration function only 03: Other than U*** registration function and b37	00		Disabled	Disabled	–	P. 5-6

*1. In the high-frequency mode.

*2. The default data was changed from the previous model.

Parameter No.		Function name	Monitor or data range	Default data	Set data	Setting during RUN	Changes during RUN	Unit	Page
Auxiliary function	b095	Regenerative Braking Selection	00: Disabled (Function not active) 01: Enabled (Disabled during stop) 02: Enabled (Enabled during operation and stop)	00		Disabled	Enabled	–	P. 5-65
	b096	Regenerative Braking ON Level	200-V class: 330. to 380. 400-V class: 660. to 760.	360./ 720.		Disabled	Enabled	V	
	b097	Braking Resistor Value	Minimum connection resistance to 600.0	Minimum resistance		Disabled	Enabled	Ω	
V/f free function	b100	Free V/f Frequency 1	0.: Disabled 1. to Free V/f Frequency 2	0.		Disabled	Disabled	Hz	P. 5-10
	b101	Free V/f Voltage 1	0.0 to 800.0	0.0		Disabled	Disabled	V	
	b102	Free V/f Frequency 2	0.: Disabled Free V/f Frequency 1 to Free V/f Frequency 3	0.		Disabled	Disabled	Hz	
	b103	Free V/f Voltage 2	0.0 to 800.0	0.0		Disabled	Disabled	V	
	b104	Free V/f Frequency 3	0.: Disabled Free V/f Frequency 2 to Free V/f Frequency 4	0.		Disabled	Disabled	Hz	
	b105	Free V/f Voltage 3	0.0 to 800.0	0.0		Disabled	Disabled	V	
	b106	Free V/f Frequency 4	0.: Disabled Free V/f Frequency 3 to Free V/f Frequency 5	0.		Disabled	Disabled	Hz	
	b107	Free V/f Voltage 4	0.0 to 800.0	0.0		Disabled	Disabled	V	
	b108	Free V/f Frequency 5	0.: Disabled Free V/f Frequency 4 to Free V/f Frequency 6	0.		Disabled	Disabled	Hz	
	b109	Free V/f Voltage 5	0.0 to 800.0	0.0		Disabled	Disabled	V	
	b110	Free V/f Frequency 6	0.: Disabled Free V/f Frequency 5 to Free V/f Frequency 7	0.		Disabled	Disabled	Hz	
	b111	Free V/f Voltage 6	0.0 to 800.0	0.0		Disabled	Disabled	V	
	b112	Free V/f Frequency 7	0.: Disabled Free V/f Frequency 6 to 400. (580.0) [*1]	0.		Disabled	Disabled	Hz	
	b113	Free V/f Voltage 7	0.0 to 800.0	0.0		Disabled	Disabled	V	

[*1] In the high-frequency mode.

Parameter No.		Function name	Monitor or data range	Default data	Set data	Setting during RUN	Changes during RUN	Unit	Page
Brake control	b120	Brake Control Function Selection	00: Disabled 01: Enabled (DC Injection Braking enabled during stop) 02: Enabled (DC Injection Braking disabled during stop)	00		Disabled	Enabled	–	P. 6-26
	b121	Brake Release Wait Time	0.00 to 5.00	0.00		Disabled	Enabled	s	
	b122	Acceleration Wait Time on Brake Control	0.00 to 5.00	0.00		Disabled	Enabled	s	
	b123	Stop Wait Time on Brake Control	0.00 to 5.00	0.00		Disabled	Enabled	s	
	b124	Brake Error Detection Time	0.00 to 5.00	0.00		Disabled	Enabled	s	
	b125	Brake Release Frequency	0.00 to 99.99 100.0 to 400.0	0.00		Disabled	Enabled	Hz	
	b126	Brake Release Current	0.00 to 2.00 × Inverter rated current	Rated current of inverter		Disabled	Enabled	A	
	b127	Brake Force Frequency	0.00 to 99.99 100.0 to 400.0	0.00		Disabled	Enabled	Hz	
Overvoltage suppression during deceleration	b130	Overvoltage Suppression Function Selection During Deceleration	00: Disabled 01: Enabled (DC voltage kept constant) 02: Enabled (Acceleration enabled)	01 [*1]		Disabled	Enabled	–	P. 5-63
	b131	Overvoltage Suppression Level During Deceleration	200-V class: 330. to 395. 400-V class: 660. to 790.	380./760.		Disabled	Enabled	V	
	b132	Overvoltage Protection Parameter During Deceleration	0.10 to 30.00	1.00		Disabled	Enabled	s	
	b133	Overvoltage Suppression Proportional Gain During Deceleration	0.00 to 5.00	0.20		Enabled	Enabled	–	
	b134	Overvoltage Suppression Integral Time During Deceleration	0.0 to 150.0	1.0		Enabled	Enabled	s	

*1. The default data was changed from the previous model.

Parameter No.		Function name	Monitor or data range	Default data	Set data	Setting during RUN	Changes during RUN	Unit	Page
Auxiliary function	b145	GS Input Operation Selection	00: No trip (shut off by hardware) 01: Trip	00		Disabled	Enabled	–	P. 7-98
	b150	Inverter Display on Operator Connection	001 to 060 (Corresponding to d001 to d060)	001		Enabled	Enabled	–	P. 7-57
	b160	User Monitor Selection 1	001 to 030 (Corresponding to d001 to d030)	001		Enabled	Enabled	–	P. 7-13
	b161	User Monitor Selection 2	001 to 030 (Corresponding to d001 to d030)	002		Enabled	Enabled	–	
	b163	d001/d007 Data Setting Selection	00: Disabled 01: Enabled	00		Enabled	Enabled	–	P. 7-4 P. 7-6
	b164	Initial Screen Automatic Return Function	00: Disabled 01: Enabled	00		Enabled	Enabled	–	P. 7-56
	b165	Operation Selection at External Operator Disconnection	00: Trip 01: Trip after deceleration stop 02: Ignore 03: Free-run stop 04: Deceleration stop	02		Enabled	Enabled	–	P. 7-56
	b166	(Reserved)	Do not change the default 00.	00		–	–	–	–
Mode	b171	Inverter Mode Selection	00: Selection disabled 01: Induction motor mode 02: Induction motor high-frequency mode 03: PM motor mode	00		Disabled	Disabled	–	P. 6-57
Auxiliary function	b180	Initialization Execution	00: Function disabled 01: Execute initialization	00		Disabled	Disabled	–	P. 5-6
	b190	Password A Setting	0000: Function disabled 0001 to FFFF: Password	0000		Disabled	Disabled	–	P. 7-57
	b191	Password A for Authentication	0000 to FFFF	0000		Disabled	Disabled	–	
	b192	Password B Setting	0000: Function disabled 0001 to FFFF: Password	0000		Disabled	Disabled	–	
	b193	Password B for Authentication	0000 to FFFF	0000		Disabled	Disabled	–	
Electronic thermal	b910	Motor Electronic Thermal Selection [*1]	00: Disabled 01: Enabled (Fixed subtraction ratio) 02: Enabled (b911 subtraction ratio) 03: Enabled (b912 time parameter subtraction)	03		Disabled	Enabled	–	P. 7-73
	b911	Motor Electronic Thermal Subtraction Ratio [*1]	0.10 to 100000.00 (Displays upper 4 digits)	600.00		Disabled	Enabled	s	
	b912	Motor Electronic Thermal Subtraction Time Constant [*1]	0.10 to 100000.00 (Displays upper 4 digits)	120.00		Disabled	Enabled	s	
	b913	Motor Electronic Thermal Integration Gain [*1]	1.0 to 200.0	100.0		Disabled	Enabled	%	

[*1] These parameters are newly added to the 3G3MX2-V1 Series.

4-3-3 Group C: Multi-function Terminal Function Parameters

Parameter No.		Function name	Monitor or data range	Default data	Set data	Setting during RUN	Changes during RUN	Unit	Page
Multi-function input terminals	C001	Multi-function Input S1 Selection	00: FW (Forward) 01: RV (Reverse) 02: CF1 (Multi-step speed setting binary 1) 03: CF2 (Multi-step speed setting binary 2) 04: CF3 (Multi-step speed setting binary 3) 05: CF4 (Multi-step speed setting binary 4) 06: JG (Jogging) 07: DB (External DC injection braking) 08: SET (2nd control) 09: 2CH (2-step acceleration/deceleration) 11: FRS (Free-run stop) 12: EXT (External trip) 13: USP (Power recovery restart prevention function) 14: CS (Commercial switching) 15: SFT (Soft lock) 16: AT (Analog input switching) 18: RS (Reset) 19: TH (PTC thermistor thermal protection, C005 only) 20: STA (3-wire start) 21: STP (3-wire stop) 22: F/R (3-wire forward/reverse) 23: PID (PID disabled) 24: PIDC (PID integral reset) 27: UP (Remote operation accelerated) 28: DWN (Remote operation decelerated) 29: UDC (Remote operation data clear) 31: OPE (Forced operator function) 32: SF1 (Multi-step speed setting bit 1) 33: SF2 (Multi-step speed setting bit 2) 34: SF3 (Multi-step speed setting bit 3) 35: SF4 (Multi-step speed setting bit 4) 36: SF5 (Multi-step speed setting bit 5) 37: SF6 (Multi-step speed setting bit 6) 38: SF7 (Multi-step speed setting bit 7) 39: OLR (Overload limit switching) 40: TL (Torque limit enabled) 41: TRQ1 (Torque limit switching 1) 42: TRQ2 (Torque limit switching 2) 44: BOK (Brake confirmation) 46: LAC (LAD cancel) 47: PCLR (Current position clear) 50: ADD (Set frequency A145 addition) 51: F-TM (Forced terminal block) 52: ATR (Torque command input permission) 53: KHC (Integrated power clear) 56: MI1 (General-purpose input 1) 57: MI2 (General-purpose input 2) 58: MI3 (General-purpose input 3) 59: MI4 (General-purpose input 4) 60: MI5 (General-purpose input 5) 61: MI6 (General-purpose input 6) 62: MI7 (General-purpose input 7) 65: AHD (Analog command held) 66: CP1 (Position command selection 1) 67: CP2 (Position command selection 2) 68: CP3 (Position command selection 3) 69: ORL (Origin search limit signal) 70: ORG (Origin search startup signal) 73: SPD (Speed/Position switching) 77: GS1 (GS1 input, C003 only) 78: GS2 (GS2 input, C004 only) 81: 485 (Start co-inverter communication) 82: PRG (DriveProgramming start) 83: HLD (Retain output frequency) 84: ROK (Permission of RUN command) 85: EB (Rotation direction detection, C007 only) 86: DISP (Display fixed) 91: PSET (Preset position) 255: no (No allocation)	00 (FW)		Disabled	Enabled	–	P. 5-48 P. 7-18
	C002	Multi-function Input S2 Selection		01 (RV)		Disabled	Enabled		
	C003	Multi-function Input S3 Selection *1		18 (RS)		Disabled	Enabled		
	C004	Multi-function Input S4 Selection *1		12 (EXT)		Disabled	Enabled		
	C005	Multi-function Input S5 Selection		02 (CF1)		Disabled	Enabled		
	C006	Multi-function Input S6 Selection		03 (CF2)		Disabled	Enabled		
	C007	Multi-function Input S7 Selection		06 (JG)		Disabled	Enabled		

*1. When the safety function selector switch is ON, C003 and C004 are forcibly allocated to 77 (GS1) and 78 (GS2), respectively. You cannot set 77(GS1) and 78(GS2) manually. If you turn ON and then OFF the safety function selector switch, C003 and C004 are set to 255 (no: No allocation).

Parameter No.		Function name	Monitor or data range	Default data	Set data	Setting during RUN	Changes during RUN	Unit	Page
Multi-function input terminals	C011	Multi-function Input S1 Operation Selection	00: NO (NO contact) 01: NC (NC contact)	00		Disabled	Enabled	–	P. 5-48
	C012	Multi-function Input S2 Operation Selection		00		Disabled	Enabled		
	C013	Multi-function Input S3 Operation Selection		00		Disabled	Enabled		
	C014	Multi-function Input S4 Operation Selection		00		Disabled	Enabled		
	C015	Multi-function Input S5 Operation Selection		00		Disabled	Enabled		
	C016	Multi-function Input S6 Operation Selection		00		Disabled	Enabled		
	C017	Multi-function Input S7 Operation Selection		00		Disabled	Enabled		
Multi-function output terminals	C021	Multi-function Output P1 Selection	00: RUN (Signal during RUN) 01: FA1 (Constant speed arrival signal) 02: FA2 (Set frequency exceeded signal) 03: OL (Overload warning) 04: OD (Excessive PID deviation) 05: AL (Alarm signal) 06: FA3 (Set-frequency only signal) 07: OTQ (Overtorque/Undertorque signal) 09: UV (Signal during undervoltage) 10: TRQ (Torque limit) 11: RNT (RUN time over) 12: ONT (Power ON time over) 13: THM (Electronic thermal warning) 19: BRK (Brake release) 20: BER (Brake error) 21: ZS (0-Hz detection signal) 22: DSE (Excessive speed deviation) 23: POK (Position ready) 24: FA4 (Set frequency exceeded signal 2) 25: FA5 (Set-frequency only signal 2) 26: OL2 (Overload warning 2) 27: FVDc (Analog FV disconnection detection) 28: FIDc (Analog FI disconnection detection) 31: FBV (PID feedback comparison signal) 32: NDc (Communications disconnection detection) 33: LOG1 (Logic operation output 1) 34: LOG2 (Logic operation output 2) 35: LOG3 (Logic operation output 3) 39: WAC (Capacitor life warning signal) 40: WAF (Cooling fan life warning signal) 41: FR (Starting contact signal) 42: OHF (Cooling fin overheat warning) 43: LOC (Low current signal) 44: MO1 (General-purpose output 1) 45: MO2 (General-purpose output 2) 46: MO3 (General-purpose output 3) 50: IRDY (Operation ready) 51: FWR (Forward run signal) 52: RVR (Reverse run signal) 53: MJA (Fatal fault signal) 54: WCFV (Window comparator FV) 55: WCFI (Window comparator FI) 58: FREF (Frequency reference source) 59: REF (RUN command source) 60: SETM (Motor 2 selection) 62: EDM (Safety device monitor)[1] 63: OPO (Option) 255: no (No allocation)	00 (RUN)		Disabled	Enabled	–	P. 5-55 P. 7-20
	C022	Multi-function Output P2 Selection		01 (FA1)		Disabled	Enabled		
	C026	Multi-function Relay Output (MA, MB) Function Selection		05 (AL)		Disabled	Enabled		

[1] When the EDM function selector switch is ON, C021 is forcibly allocated to 62 (EDM). You cannot set 62 (EDM) manually. If you turn ON and then OFF the EDM function selector switch, C021 is set to 255 (no: No allocation).

Parameter No.		Function name	Monitor or data range	Default data	Set data	Setting during RUN	Changes during RUN	Unit	Page
Analog monitor	C027	MP Selection	00: Output frequency 01: Output current 02: Output torque (Only in the sensorless vector control) 03: Digital output frequency 04: Output voltage 05: Input power 06: Electronic thermal load rate 07: LAD frequency 08: Digital current monitor 10: Cooling fin temperature 12: DriveProgramming (YA(0)) 15: Pulse train input monitor 16: Option (No applicable Option)	07		Disabled	Enabled	–	P. 7-27
	C028	AM Selection	00: Output frequency 01: Output current 02: Output torque (Only in the sensorless vector control) 04: Output voltage 05: Input power 06: Electronic thermal load rate 07: LAD frequency 10: Cooling fin temperature 11: Output torque (signed) (Only in the sensorless vector control) 13: DriveProgramming (YA(1)) 16: Option (No applicable Option)	07		Disabled	Enabled	–	P. 7-29
	C030	Digital Current Monitor Reference Value	0.20 × Rated current to 2.00 × Rated current (In the heavy mode) 0.20 × Rated current to 1.50 × Rated current (In the light mode) (Current value at digital current monitor output 1440 Hz)	Rated current		Enabled	Enabled	A	P. 7-28
Multi-function output terminals	C031	Multi-function Output P1 Operation Selection	00: NO (NO contact) 01: NC (NC contact)	00		Disabled	Enabled	–	P. 5-55
	C032	Multi-function Output P2 Operation Selection		00		Disabled	Enabled		
	C036	Multi-function Relay Output (MA, MB) Operation Selection		01		Disabled	Enabled		

Parameter No.		Function name	Monitor or data range	Default data	Set data	Setting during RUN	Changes during RUN	Unit	Page
Level and output terminal status	C038	Low Current Signal Output Selection	00: Enabled during acceleration/ deceleration and constant speed 01: Enabled during constant speed	01		Disabled	Enabled	–	P. 7-87
	C039	Low Current Detection Level	0.00 × Rated current to 2.00 × Rated current (In the heavy mode) 0.00 × Rated current to 1.50 × Rated current (In the light mode)	Rated current		Enabled	Enabled	A	
	C040	Overload Warning Signal Output Selection	00: Enabled during acceleration/ deceleration and constant speed 01: Enabled during constant speed	01		Disabled	Enabled	–	P. 7-78
	C041	1st Overload Warning Level	0.00: Overload warning disabled 0.01 × Rated current to 2.00 × Rated current (In the heavy mode) 0.01 × Rated current to 1.50 × Rated current (In the light mode)	Rated current × 1.15		Enabled	Enabled	A	
	C241	2nd Overload Warning Level		Rated current × 1.15		Enabled	Enabled		

Parameter No.		Function name	Monitor or data range	Default data	Set data	Setting during RUN	Changes during RUN	Unit	Page
Level and output terminal status	C042	Arrival Frequency During Acceleration 1	0.00: Not output arrival signal during acceleration. 0.01 to 99.99 100.0 to 400.0 (580.0)*1	0.00		Disabled	Enabled	Hz	P. 7-81
	C043	Arrival Frequency During Deceleration 1	0.00: Not output arrival signal during deceleration. 0.01 to 99.99 100.0 to 400.0 (580.0)*1	0.00		Disabled	Enabled	Hz	
	C044	PID Deviation Excessive Level	0.0 to 100.0	3.0		Disabled	Enabled	%	P. 7-44
	C045	Arrival Frequency During Acceleration 2	0.00: Not output arrival signal during acceleration. 0.01 to 99.99 100.0 to 400.0 (580.0)*1	0.00		Disabled	Enabled	Hz	P. 7-81
	C046	Arrival Frequency During Deceleration 2	0.00: Not output arrival signal during deceleration. 0.01 to 99.99 100.0 to 400.0 (580.0)*1	0.00		Disabled	Enabled	Hz	
	C047	Pulse Train Output MP Scale	0.01 to 99.99	1.00		Enabled	Enabled	–	P. 7-28
	C052	Feedback Comparison Signal Off Level	0.0 to 100.0	100.0		Disabled	Enabled	%	P. 7-44
	C053	Feedback Comparison Signal On Level	0.0 to 100.0	0.0		Disabled	Enabled	%	
	C054	Overtorque/Undertorque Selection	00: Overtorque 01: Undertorque	00		Disabled	Enabled	–	P. 6-15
	C055	Overtorque/Undertorque Level (Forward Power Running)	0. to 200.	100.		Disabled	Enabled	%	
	C056	Overtorque/Undertorque Level (Reverse Regeneration)		100.		Disabled	Enabled		
	C057	Overtorque/Undertorque Level (Reverse Power Running)		100.		Disabled	Enabled		
	C058	Overtorque/Undertorque Level (Forward Regeneration)		100.		Disabled	Enabled		
	C059	Overtorque/Undertorque Signal Operation	00: Enabled during acceleration/deceleration and constant speed 01: Enabled only during constant speed	01		Disabled	Enabled	–	
	C061	Electronic Thermal Warning Level	0. to 100.	90.		Disabled	Enabled	%	P. 7-75
	C063	0 Hz Detection Level	0.00 to 99.99 100.0	0.00		Disabled	Enabled	Hz	P. 5-58
	C064	Cooling Fin Overheat Warning Level	0. to 110.	100.		Disabled	Enabled	°C	P. 7-86

*1. In the high-frequency mode.

Parameter No.		Function name	Monitor or data range	Default data	Set data	Setting during RUN	Changes during RUN	Unit	Page
Communications Function	C071	Communication Speed Selection (Baud Rate Selection)	03: 2400 bps 04: 4800 bps 05: 9600 bps 06: 19.2 kbps 07: 38.4 kbps 08: 57.6 kbps 09: 76.8 kbps 10: 115.2 kbps	05		Disabled	Enabled	–	P. 8-5
	C072	Communication Station No. Selection	1. to 247.	1.		Disabled	Enabled	–	P. 8-5
	C074	Communication Parity Selection	00: No parity 01: Even parity 02: Odd parity	00		Disabled	Enabled	–	
	C075	Communication Stop Bit Selection	1: 1 bit 2: 2 bits	1		Disabled	Enabled	–	
	C076	Operation Selection on Communication Error	00: Trip 01: Trip after deceleration stop 02: Ignore 03: Free-run stop 04: Deceleration stop	02		Disabled	Enabled	–	
	C077	Communication Error Timeout Time	0.00: Timeout disabled 0.01 × Rated current to 2.00 × Rated current (In the heavy mode) 0.01 × Rated current to 1.50 × Rated current (In the light mode)	0.00		Disabled	Enabled	s	
	C078	Communication Wait Time	0. to 1000.	0.		Disabled	Enabled	ms	
Adjustment	C081	FV Adjustment	0.0 to 200.0	100.0		Enabled	Enabled	%	P. 7-25
	C082	FI Adjustment	0.0 to 200.0	100.0		Enabled	Enabled	%	
	C085	Thermistor Adjustment	0.0 to 200.0	100.0		Enabled	Enabled	%	P. 7-80
	C091	(Reserved)	Do not change the default 00.	00		Enabled	Enabled	–	–
Communications Functions	C096	Communication Selection	00: Modbus communication 01: Co-inverter communication 02: Co-inverter communication (management inverter)	00		Disabled	Disabled	–	P. 8-31
	C098	Co-inverter Communication Starting Station Number	1. to 8.	1.		Disabled	Disabled	–	
	C099	Co-inverter Communication Ending Station Number	1. to 8.	1.		Disabled	Disabled	–	
	C100	Co-inverter Communication Start Selection	00: Start via 485 terminal 01: Constant communication	00		Disabled	Disabled	–	

Parameter No.		Function name	Monitor or data range	Default data	Set data	Setting during RUN	Changes during RUN	Unit	Page
Auxiliary function	C101	UP/DWN Storage Selection	00: Not store frequency data 01: Store frequency data	00		Disabled	Enabled	–	P. 7-40
	C102	Reset Selection	00: Trip reset at power-on 01: Trip reset at power-off 02: Enabled only during trip (Reset at power-on) 03: Trip reset only	02 *1		Enabled	Enabled	–	P. 5-43
	C103	Reset Restart Selection	00: 0-Hz restart 01: Frequency matching restart 02: Frequency pull-in restart	00		Disabled	Enabled	–	
	C104	UP/DWN Clear Selection	00: 0 Hz 01: EEPROM data at power-on	00		Disabled	Enabled	–	P. 7-40
	C105	MP Gain Setting	50. to 200.	100.		Enabled	Enabled	%	P. 7-28
	C106	AM Gain Setting	50. to 200.	100.		Enabled	Enabled	%	P. 7-29
	C109	AM Bias Setting	0. to 100.	0.		Enabled	Enabled	%	P. 7-29
	C111	1st Overload Warning Level 2	0.00: Overload warning disabled 0.01 × Rated current to 2.00 × Rated current (In the heavy mode) 0.01 × Rated current to 1.50 × Rated current (In the light mode)	Rated current × 1.15		Enabled	Enabled	A	P. 7-78
I/O terminal function	C130	Multi-function Output P1 ON Delay Time	0.0 to 100.0	0.0		Disabled	Enabled	s	P. 5-56
	C131	Multi-function Output P1 OFF Delay Time		0.0		Disabled	Enabled		
	C132	Multi-function Output P2 ON Delay Time		0.0		Disabled	Enabled		
	C133	Multi-function Output P2 OFF Delay Time		0.0		Disabled	Enabled		
	C140	Multi-function Relay Output ON Delay Time		0.0		Disabled	Enabled		
	C141	Multi-function Relay Output OFF Delay Time		0.0		Disabled	Enabled		
	C142	Logic Output Signal 1 Selection 1	Same as options for C021 (33 to 35: LOG1 to LOG3, 63: OPO, and 255: no cannot be selected.)	00		Disabled	Enabled	–	P. 7-83
	C143	Logic Output Signal 1 Selection 2	Same as options for C021 (33 to 35: LOG1 to LOG3, 63: OPO, and 255: no cannot be selected.)	00		Disabled	Enabled	–	
	C144	Logic Output Signal 1 Operator Selection	00: AND 01: OR 02: XOR	00		Disabled	Enabled	–	
	C145	Logic Output Signal 2 Selection 1	Same as options for C021 (33 to 35: LOG1 to LOG3, 63: OPO, and 255: no cannot be selected.)	00		Disabled	Enabled	–	

[1] The default data was changed from the previous model.

Parameter No.		Function name	Monitor or data range	Default data	Set data	Setting during RUN	Changes during RUN	Unit	Page
I/O terminal function	C146	Logic Output Signal 2 Selection 2	Same as options for C021 (33 to 35: LOG1 to LOG3, 63: OPO, and 255: no cannot be selected.)	00		Disabled	Enabled	–	P. 7-83
	C147	Logic Output Signal 2 Operator Selection	00: AND 01: OR 02: XOR	00		Disabled	Enabled	–	
	C148	Logic Output Signal 3 Selection 1	Same as options for C021 (33 to 35: LOG1 to LOG3, 63: OPO, and 255: no cannot be selected.)	00		Disabled	Enabled	–	
	C149	Logic Output Signal 3 Selection 2	Same as options for C021 (33 to 35: LOG1 to LOG3, 63: OPO, and 255: no cannot be selected.)	00		Disabled	Enabled	–	
	C150	Logic Output Signal 3 Operator Selection	00: AND 01: OR 02: XOR	00		Disabled	Enabled	–	
	C160	Multi-function Input S1 Response Time	0. to 200. (× 2 ms)	1.		Disabled	Enabled	ms	P. 5-48
	C161	Multi-function Input S2 Response Time		1.		Disabled	Enabled		
	C162	Multi-function Input S3 Response Time		1.		Disabled	Enabled		
	C163	Multi-function Input S4 Response Time		1.		Disabled	Enabled		
	C164	Multi-function Input S5 Response Time		1.		Disabled	Enabled		
	C165	Multi-function Input S6 Response Time		1.		Disabled	Enabled		
	C166	Multi-function Input S7 Response Time		1.		Disabled	Enabled		
	C169	Multi-step Speed/ Position Determination Time	0. to 200. (× 10 ms)	0.		Disabled	Enabled	ms	P. 6-45

4-3-4 Group H: Motor Control Parameters

Parameter No.		Function name	Monitor or data range	Default data	Set data	Setting during RUN	Changes during RUN	Unit	Page
Control parameters	H001	Auto-tuning Selection	00: Disabled 01: Enabled (No motor rotation) 02: Enabled (Motor rotation)	00		Disabled	Disabled	–	P. 6-4
	H002	1st Motor Parameter selection	00: Standard motor parameter 02: Auto-tuning data	00		Disabled	Disabled	–	P. 6-4
	H202	2nd Motor Parameter Selection		00		Disabled	Disabled		
	H003	1st Motor Capacity	0.1/0.2/0.4/0.55/0.75/1.1/1.5/2.2/3.0/3.7/4.0/5.5/7.5/11.0/15.0/18.5	Maximum applicable motor capacity		Disabled	Disabled	kW	
	H203	2nd Motor Capacity				Disabled	Disabled	kW	
	H004	1st Motor Pole Number	2/4/6/8 10 to 48: Do not set.	4		Disabled	Disabled	pole	
	H204	2nd Motor Pole Number Selection		4		Disabled	Disabled		
	H005	1st Speed Response	1. to 1000.	100.		Enabled	Enabled	–	
	H205	2nd Speed Response		100.		Enabled	Enabled		
	H006	1st Stabilization Parameter	0. to 255.	100.		Enabled	Enabled	–	P. 7-52
	H206	2nd Stabilization Parameter		100.		Enabled	Enabled		
	H020	1st Motor Parameter R1	0.001 to 9.999 10.00 to 65.53	Dependent on capacity		Disabled	Disabled	Ω	P. 6-9
	H220	2nd Motor Parameter R1		Dependent on capacity		Disabled	Disabled		
	H021	1st Motor Parameter R2	0.001 to 9.999 10.00 to 65.53	Dependent on capacity		Disabled	Disabled		
	H221	2nd Motor Parameter R2		Dependent on capacity		Disabled	Disabled		
	H022	1st Motor Parameter L	0.01 to 99.99 100.0 to 655.3	Dependent on capacity		Disabled	Disabled	mH	
	H222	2nd Motor Parameter L		Dependent on capacity		Disabled	Disabled		
	H023	1st Motor Parameter Io	0.01 to 99.99 100.0 to 655.3	Dependent on capacity		Disabled	Disabled	A	
	H223	2nd Motor Parameter Io		Dependent on capacity		Disabled	Disabled		
	H024	1st Motor Parameter J	0.001 to 9.999 10.00 to 99.99 100.0 to 999.9 1000. to 9999.	Dependent on capacity		Disabled	Disabled	kgm^2	
	H224	2nd Motor Parameter J		Dependent on capacity		Disabled	Disabled		
	H030	1st Motor Parameter R1 (Auto-tuning Data)	0.001 to 9.999 10.00 to 65.53	Dependent on capacity		Disabled	Disabled	Ω	P. 6-4
	H230	2nd Motor Parameter R1 (Auto-tuning Data)		Dependent on capacity		Disabled	Disabled	Ω	
	H031	1st Motor Parameter R2 (Auto-tuning Data)	0.001 to 9.999 10.00 to 65.53	Dependent on capacity		Disabled	Disabled	Ω	
	H231	2nd Motor Parameter R2 (Auto-tuning Data)		Dependent on capacity		Disabled	Disabled		

Parameter No.		Function name	Monitor or data range	Default data	Set data	Setting during RUN	Changes during RUN	Unit	Page
Control parameters	H032	1st Motor Parameter L (Auto-tuning Data)	0.01 to 99.99 100.0 to 655.3	Dependent on capacity		Disabled	Disabled	mH	P. 6-4
	H232	2nd Motor Parameter L (Auto-tuning Data)		Dependent on capacity		Disabled	Disabled		
	H033	1st Motor Parameter Io (Auto-tuning Data)	0.01 to 99.99 100.0 to 655.3	Dependent on capacity		Disabled	Disabled	A	
	H233	2nd Motor Parameter Io (Auto-tuning Data)		Dependent on capacity		Disabled	Disabled		
	H034	1st Motor Parameter J (Auto-tuning Data)	0.001 to 9.999 10.00 to 99.99 100.0 to 999.9 1000. to 9999.	Dependent on capacity		Disabled	Disabled	kgm^2	
	H234	2nd Motor Parameter J (Auto-tuning Data)		Dependent on capacity		Disabled	Disabled		
	H050	V/f Control With Speed Feedback Slip Compensation Proportional Gain	0.00 to 10.00	0.20		Enabled	Enabled	time	P. 6-24
	H051	V/f Control With Speed Feedback Slip Compensation Integral Gain	0. to 1000.	2.		Enabled	Enabled	s	
	H102	PM Motor Parameter Selection [*1]	00: Standard PM motor parameter 01: Auto-tuning parameter	00		Disabled	Disabled	–	P. 6-61
	H103	PM Motor Capacity [*1]	0.1/0.2/0.4/0.55/0.75/1.1/1.5/2.2/3.0/3.7/4.0/5.5/7.5/11.0/15.0/18.5	Maximum applicable motor capacity		Disabled	Disabled	kW	
	H104	PM Motor Pole Number [*1]	2/4/6/8 10 to 488: Do not set.	Dependent on capacity		Disabled	Disabled	pole	
	H105	PM Motor Rated Current [*1]	0.00 to 1.00× Rated current	Dependent on capacity		Disabled	Disabled	A	
	H106	PM Motor Parameter R [*1]	0.001 to 9.999 10.00 to 65.53	Dependent on capacity		Disabled	Disabled	Ω	
	H107	PM motor Parameter Ld [*1]	0.01 to 99.99 100.0 to 655.3	Dependent on capacity		Disabled	Disabled	mH	
	H108	PM motor Parameter Lq [*1]	0.01 to 99.99 100.0 to 655.3	Dependent on capacity		Disabled	Disabled	mH	
	H109	PM motor Parameter Ke [*1]	0001 to 9999 (0.0001 to 0.9999) 1.000 to 6.553	Dependent on capacity		Disabled	Disabled	Vp/(rad/s)	
	H110	PM motor Parameter J [*1]	0.001 to 9.999 10.00 to 99.99 100.0 to 999.9 1000. to 9999.	Dependent on capacity		Disabled	Disabled	kgm^2	

*1. These parameters are newly added to the 3G3MX2-V1 Series.

Parameter No.		Function name	Monitor or data range	Default data	Set data	Setting during RUN	Changes during RUN	Unit	Page
Control parameters	H111	PM Motor Parameter R (Auto-tuning Data) *1	0.001 to 9.999 10.00 to 65.53	Dependent on capacity		Disabled	Disabled	Ω	P. 6-57
	H112	PM Motor Parameter Ld *1 (Auto-tuning Data)	0.01 to 99.99 100.0 to 655.3	Dependent on capacity		Disabled	Disabled	mH	
	H113	PM motor Parameter Lq *1 (Auto-tuning Data)	0.01 to 99.99 100.0 to 655.3	Dependent on capacity		Disabled	Disabled	mH	
	H116	PM Motor Speed Response *1	1 to 1000	100		Enabled	Enabled	%	P. 6-63
	H117	PM Motor Starting Current *1	20.00 to 99.99 100.0	70.00		Disabled	Disabled	%	
	H118	PM Motor Starting Time *1	0.01 to 60.00	1.00		Disabled	Disabled	s	
	H119	PM Motor Stabilization Parameter *1	0 to 120	100		Enabled	Enabled	%	
	H121	PM Motor Minimum Frequency *1	0.0 to 25.5	8.0		Enabled	Enabled	%	
	H122	PM Motor No-Load Current *1	0.00 to 99.99 100.0	10.00		Enabled	Enabled	%	
	H123	PM Motor Starting Method Selection *1	00: Disabled 01: Initial pole position estimation enabled	00		Disabled	Disabled	–	
	H131	PM Motor Initial Pole Position Estimation 0V Waiting Times *1	0 to 255	10		Disabled	Disabled	time	
	H132	PM Motor Initial Pole Position Estimation Detection Waiting Times *1	0 to 255	10		Disabled	Disabled	time	
	H133	PM Motor Initial Pole Position Estimation Detection Times *1	0 to 255	30		Disabled	Disabled	time	
	H134	PM Initial Pole Position Estimation Voltage Gain *1	0 to 200	100		Disabled	Disabled	%	

*1. These parameters are newly added to the 3G3MX2-V1 Series.

4-3-5 Group P: Option/Applied Function Parameters

	Parameter No.	Function name	Monitor or data range	Default data	Set data	Setting during RUN	Changes during RUN	Unit	Page
Auxiliary function	P001	Operation Selection on Option Error	00: Trip 01: Continue operation	00		Disabled	Enabled	–	P. 7-101
	P003	Pulse Train Input RP Selection	00: Frequency setting (including PID) 01: Feedback pulse (enabled only when 1st control is selected) 02: MI8 (General-purpose input 8 for DriveProgramming)	00		Disabled	Disabled	–	P. 6-18 P. 7-52
Simple position control	P004	Pulse Train Input Type Selection	00: Single-phase pulse train 01: Phase A and B 90°phase difference pulse train 02: Do not set. 03: Single-phase pulse train + direction	00		Disabled	Disabled	–	P. 6-18 P. 6-28
	P011	Number of Encoder Pulses	32. to 1024.	512.		Disabled	Disabled	pulse	
	P012	Simple Position Control Selection	00: Simple position control disabled 02: Simple position control enabled	00		Disabled	Disabled	–	P. 6-34 P. 6-49
	P014	Creep Speed Moving Amount *2	0.0 to 400.0	125.0		Disabled	Disabled	%	
	P015	Creep Speed Setting	Starting Frequency to 10.00 (100.0) *1	5.00		Disabled	Enabled	Hz	
	P017	Positioning Completion Range Setting *2	0. to 9999. 1000 (10000)	50.		Disabled	Disabled	pulse	P. 6-45
	P026	Overspeed Error Detection Level	0.0 to 150.0	115.0		Disabled	Enabled	%	P. 6-23
	P027	Speed Deviation Excessive Level	0.00 to 99.99 100.0 to 120.0	10.00		Disabled	Enabled	Hz	
Auxiliary function	P031	Acceleration/ Deceleration Time Input Type	00: Digital Operator 03: DriveProgramming	00		Disabled	Disabled	–	P. 5-33
Torque control	P033	Torque Reference Input Selection	00: Terminal FV 01: Terminal FI 03: Digital Operator 06: Option (No applicable Option)	00		Disabled	Disabled	–	P. 6-16
	P034	Torque Reference Setting	0. to 200.	0.		Enabled	Enabled	%	
	P036	Torque Bias Selection	00: Disabled 01: Digital Operator 05: Option (No applicable Option)	00		Disabled	Disabled	–	P. 6-17
	P037	Torque Bias Value	–200. to 200.	0.		Enabled	Enabled	%	
	P038	Torque Bias Polarity Selection	00: As per sign 01: Dependent on RUN direction	00		Disabled	Disabled	–	
	P039	Speed Limit Value in Torque Control (Forward)	0.00 to 99.99 100.0 to 120.0	0.00		Disabled	Disabled	Hz	P. 6-16
	P040	Speed Limit Value in Torque Control (Reverse)	0.00 to 99.99 100.0 to 120.0	0.00		Disabled	Disabled	Hz	
	P041	Speed/Torque Switching Time	0. to 1000.	0.		Disabled	Disabled	ms	

*1. In the high-frequency mode.

*2. These parameters are newly added to the 3G3MX2-V1 Series.

Parameter No.		Function name	Monitor or data range	Default data	Set data	Setting during RUN	Changes during RUN	Unit	Page
Communications option	P044	Communications Error Detection Timer Setting	0.00 to 99.99	1.00		Disabled	Disabled	s	P. 7-101
	P045	Operation Selection at Host Communications Error	00: Trip 01: Trip after deceleration stop 02: Ignore 03: Free-run stop 04: Deceleration stop	00		Disabled	Disabled	–	
	P046	Assembly Instance Number	0 to 20	1		Disabled	Disabled		
	P048	Operation Selection at Idle Mode Detection	00: Trip 01: Trip after deceleration stop 02: Ignore 03: Free-run stop 04: Deceleration stop	00		Disabled	Disabled		
	P049	Number of Poles for Rotation Speed Setting	0/2/4/6/8 10 to 48: Do not set.	0		Disabled	Disabled		
Pulse train input	P055	Pulse Train Frequency Scale	1.0 to 32.0	25.0		Disabled	Enabled	kHz	P. 7-52
	P056	Pulse Train Frequency Filter Time Parameter	0.01 to 2.00	0.10		Disabled	Enabled	s	
	P057	Pulse Train Frequency Bias Amount	–100. to 100.	0.		Disabled	Enabled	%	
	P058	Pulse Train Frequency Upper Limit	0. to 100.	100.		Disabled	Enabled	%	
	P059	Pulse Train Frequency Lower Limit [2]	0.01 to 20.00	1.00		Disabled	Enabled	%	
Simple position control	P060	Multi-step Position Command 0	Position Limit Setting (Reverse Side) (P073) to Position Limit Setting (Forward Side) (P072) (×1 multiplication) (Displays upper 4digits including "–")	0		Enabled	Enabled	pulse	P. 6-45
	P061	Multi-step Position Command 1		0		Enabled	Enabled		
	P062	Multi-step Position Command 2		0		Enabled	Enabled		
	P063	Multi-step Position Command 3		0		Enabled	Enabled		
	P064	Multi-step Position Command 4		0		Enabled	Enabled		
	P065	Multi-step Position Command 5		0		Enabled	Enabled		
	P066	Multi-step Position Command 6		0		Enabled	Enabled		
	P067	Multi-step Position Command 7		0		Enabled	Enabled		
	P068	Origin Search Mode	00: Origin search mode 1 01: Origin search mode 2	00		Enabled	Enabled	–	P. 6-40
	P069	Origin Search Direction Selection	00: Forward side 01: Reverse side	01		Enabled	Enabled	–	
	P070	Origin Search Mode 1 Frequency	0.00 to 10.00 (100.0) [1]	5.00		Enabled	Enabled	Hz	
	P071	Origin Search Mode 2 Frequency	0.00 to 1st Maximum Frequency	5.00		Enabled	Enabled	Hz	
	P072	Position Limit Setting (Forward Side)	0 to 268435455 (Displays upper 4digits)	268435455		Enabled	Enabled	pulse	P. 6-34
	P073	Position Limit Setting (Reverse Side)	–268435455 to 0 (Displays upper 4digits including "–")	–268435455		Enabled	Enabled	pulse	
	P075	Position Control Mode Selection	00: Limit 01: No limit	00		Disabled	Disabled	–	

[1] In the high-frequency mode.

[2] These parameters are newly added to the 3G3MX2-V1 Series.

Parameter No.		Function name	Monitor or data range	Default data	Set data	Setting during RUN	Changes during RUN	Unit	Page
Simple position control	P077	Encoder Disconnection Detection Time	0.0: Disconnection detection disabled 0.1 to 10.0	1.0		Enabled	Enabled	s	P. 6-34
	P080	Restarting Positioning Range Setting [*1]	0. to 9999. 1000 (10000)	0.		Disabled	Disabled	pulse	P. 6-45
	P081	Position Store Selection at Power Off [*1]	00: Not store 01: Store	00		Disabled	Disabled	–	P. 6-44
	P082	Position Data at Power Off [*1]	Position Limit Setting (Reverse Side) (P073) to Position Limit Setting (Forward Side) (P072) (× 1 multiplication)	0		Disabled	Disabled	pulse	P. 6-44
	P083	Preset Position Data [*1]	Position Limit Setting (Reverse Side) (P073) to Position Limit Setting (Forward Side) (P072) (× 1 multiplication)	0		Disabled	Disabled	pulse	P. 6-43
DriveProgramming	P100	DriveProgramming User Parameter U00 to U31 [*1]	0. to 9999. 1000 to 6553 (10000 to 65530)	0.		Enabled	Enabled	–	P. 7-102
	P101								
	P102								
	P103								
	P104								
	P105								
	P106								
	P107								
	P108								
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	P126								
	P127								
	P128								
	P129								
	P130								
	P131								

[*1] These parameters are newly added to the 3G3MX2-V1 Series.

	Parameter No.	Function name	Monitor or data range	Default data	Set data	Setting during RUN	Changes during RUN	Unit	Page
Co-inverter communication	P140	Number of Sent Data of All Stations in Co-inverter Communication	1 to 5	5		Enabled	Enabled	–	P. 8-31
	P141	Recipient Station Number of All Stations in Co-inverter Communication 1	1 to 247	1		Enabled	Enabled	–	
	P142	Recipient Register of All Stations in Co-inverter Communication 1	0000 to FFFF hex	0000		Enabled	Enabled	–	
	P143	Sender Register of All Stations in Co-inverter Communication 1	0000 to FFFF hex	0000		Enabled	Enabled	–	
	P144	Recipient Station Number of All Stations in Co-inverter Communication 2	1 to 247	2		Enabled	Enabled	–	
	P145	Recipient Register of All Stations in Co-inverter Communication 2	0000 to FFFF hex	0000		Enabled	Enabled	–	
	P146	Sender Register of All Stations in Co-inverter Communication 2	0000 to FFFF hex	0000		Enabled	Enabled	–	
	P147	Recipient Station Number of All Stations in Co-inverter Communication 3	1 to 247	3		Enabled	Enabled	–	
	P148	Recipient Register of All Stations in Co-inverter Communication 3	0000 to FFFF hex	0000		Enabled	Enabled	–	
	P149	Sender Register of All Stations in Co-inverter Communication 3	0000 to FFFF hex	0000		Enabled	Enabled	–	
	P150	Recipient Station Number of All Stations in Co-inverter Communication 4	1 to 247	4		Enabled	Enabled	–	
	P151	Recipient Register of All Stations in Co-inverter Communication 4	0000 to FFFF hex	0000		Enabled	Enabled	–	
	P152	Sender Register of All Stations in Co-inverter Communication 4	0000 to FFFF hex	0000		Enabled	Enabled	–	
	P153	Recipient Station Number of All Stations in Co-inverter Communication 5	1 to 247	5		Enabled	Enabled	–	
	P154	Recipient Register of All Stations in Co-inverter Communication 5	0000 to FFFF hex	0000		Enabled	Enabled	–	
	P155	Sender Register of All Stations in Co-inverter Communication 5	0000 to FFFF hex	0000		Enabled	Enabled	–	

Parameter No.		Function name	Monitor or data range	Default data	Set data	Setting during RUN	Changes during RUN	Unit	Page
Option	P160 P161 P162 P163 P164 P165 P166 P167 P168 P169	Option I/F Flexible Format Output Register 1 to 10	0000 to FFFF hex	0000		Enabled	Enabled	–	P. 7-101
	P170 P171 P172 P173 P174 P175 P176 P177 P178 P179	Option I/F Flexible Format Input Register 1 to 10	0000 to FFFF hex	0000		Enabled	Enabled	–	P. 7-101
	P180	(Reserved)	Do not change the default 0.	0.		–	–	–	–
	P181	(Reserved)	Do not change the default 00.	00		–	–	–	–
	P182	(Reserved)	Do not change the default 00.	00		–	–	–	–
	P185	(Reserved)	Do not change the default 0.	0		–	–	–	–
	P186	(Reserved)	Do not change the default 06.	06		–	–	–	–
	P190	CompoNet Node Address	0 to 63	0		Disabled	Disabled	–	P. 7-101
	P192	DeviceNet MAC ID	0 to 63	63		Disabled	Disabled	–	P. 7-101
	P195	(Reserved)	Do not change the default 00.	00		–	–	–	–
	P196	(Reserved)	Do not change the default 21.	21		–	–	–	–

Parameter No.		Function name	Monitor or data range	Default data	Set data	Setting during RUN	Changes during RUN	Unit	Page
Modbus mapping	P200	Modbus Mapping Function Selection *1	00: Standard Modbus address 01: Modbus mapping enabled	00		Disabled	Disabled	–	P. 8-25
	P201	Modbus Mapping External Register 1 to 10 *1	0000 to FFFF hex	0000		Disabled	Disabled	–	P. 8-25
	P202								
	P203								
	P204								
	P205								
	P206								
	P207								
	P208								
	P209								
	P210								
	P211	Modbus Mapping External Register Type 1 to 10 *1	00: Unsigned 01: Signed	00		Disabled	Disabled	–	P. 8-25
	P212								
	P213								
	P214								
	P215								
	P216								
	P217								
	P218								
	P219								
	P220								
	P221	Modbus Mapping Scaling 1 to 10 *1	0.001 to 9.999 10.00 to 65.53	1.000		Disabled	Disabled	–	P. 8-25
	P222								
	P223								
	P224								
	P225								
	P226								
	P227								
	P228								
	P229								
	P230								
	P301	Modbus Mapping Internal Register 1 to 10 *1	0000 to FFFF hex	0000		Disabled	Disabled	–	P. 8-25
	P302								
	P303								
	P304								
	P305								
	P306								
	P307								
	P308								
	P309								
	P310								
	P400	Modbus Mapping Endian Selection *1	00: Big endian 01: Little endian 02: Special endian	00		Disabled	Disabled	–	P. 8-29

*1. These parameters are newly added to the 3G3MX2-V1 Series.

4-3-6 Group U: User Parameters

Parameter No.		Function name	Monitor or data range	Default data	Set data	Setting during RUN	Changes during RUN	Unit	Page
User parameters	U001	User Selection 1 to 32	no: No registration d001 to P196	no		Enabled	Enabled	–	P. 7-60
	U002								
	U003								
	U004								
	U005								
	U006								
	U007								
	U008								
	U009								
	U010								
	U011								
	U012								
	U013								
	U014								
	U015								
	U016								
	U017								
	U018								
	U019								
	U020								
	U021								
	U022								
	U023								
	U024								
	U025								
	U026								
	U027								
	U028								
	U029								
	U030								
	U031								
	U032								

5

Basic Settings

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

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5-1 Parameter Display and Parameter Initialization

5-1-1 Display Selection

- You can select the parameters to be displayed on the Digital Operator.
- To display all parameters, set this parameter to 00 (Complete display).

Parameter No.	Function name	Data	Default data	Unit
b037	Display Selection	00: Complete display 01: Individual display of functions 02: User setting + d001, F001, b037 03: Data comparison display 04: Basic display 05: Monitor (d***) display only + b037	00 [*1]	–
U001 to U032	User Selection 1 to User Selection 32	no: No registration d001 to P196: Select the parameter number you want to display.	no	–

[*1] The default data was changed from the previous model.

Complete Display (b037 =00)

Displays all inverter parameters.

Individual Display of Functions (b037 =01)

If a specific function is not selected, its related parameter is not displayed.

For details on the display conditions, refer to the following table.

No.	Display condition		Parameters displayed when condition is met
1	To display parameters when 2nd control (SET terminal) is selected	C001 to C007 = 08	F202, F203, A201 to A204, A220, A241 to A247, A261, A262, A281, A282, A292 to A296, b212, b213, b221 to b223, C241, H202 to H206, H220 to H224, H230 to H234
2	To display parameters when 1st Control Method is set to Sensorless vector control	A044 = 03	d009, d010, d012, b040 to b046, C054 to C059, H001, H005, H020 to H024, H030 to H034, P033, P034, P036 to P040
3	To display parameters when 2nd Control Method is set to Sensorless vector control	C001 to C007 = 08 and A244 = 03	d009, d010, d012, b040 to b046, C054 to C059, H001, H205, H220 to H224, H230 to H234, P033, P034, P036 to P040
4	To display parameters when 1st/2nd Control Method is set to Free V/f setting function	A044 = 02, or C001 to C007 = 08 and A244 = 02	b100 to b113
5	To display parameters when free-electronic thermal function is enabled	b013 = 02, or C001 to C007 = 08 and b213 = 02	b015 to b020
6	To display parameters when 1st Control Method is set to V/f control (constant torque or reduced torque)	A044 = 00 or 01	A041 to A043, A046, A047

No.	Display condition		Parameters displayed when condition is met
7	To display parameters when 2nd Control Method is set to V/f control (constant torque or reduced torque)	C001 to C007 = 08 and A244 = 00 or 01	A241 to A243, A246, A247
8	To display parameters when DC injection braking is active	A051 = 00 or 01, or C001 to C007 = 07	A052 to A059
9	To display parameters when PID function is enabled	A071 = 01 or 02	d004, A072 to A079, A156, A157, C044, C052, C053
10	To display parameters when the co-inverter communication is enabled	C096 = 01 or 02	C098 to C100, P140 to P155
11	To display parameters when curve acceleration/deceleration function is enabled	A097, A098 = 01 to 04	A131, A132, A150 to A153
12	To display parameters when deceleration stop on power interruption function is enabled	b050 = 01 to 03	b051 to b054
13	To display parameters when brake control function is enabled	b120 = 01	b121 to b127
14	To display parameters when overvoltage suppression function during deceleration is enabled	b130 = 01 or 02	b131 to b134
15	To display parameters when simple position control is enabled	P003 = 01	d008, P004, P011, P012, P014 to P017, P026, P027, P060 to P073, P075, P077, P080 to P083, H050, H051

User Setting (b037 = 02)

- Displays only the parameters set in U001 to U032.
- In addition to U001 to U032, the parameter d001, F001, b037, b190, and b191 will also be displayed.

Data Comparison Display (b037 = 03)

- Displays only the changed parameters from the factory default settings.
- All monitor display parameters (d***), F001, b190, and b191 will be always displayed.

Basic Display (b037 = 04)

- Displays only the basic parameters.
- When this setting is selected, the following parameters are displayed.

No.	Parameter No.	Function name
1	d001 to d155	Monitor function
2	F001	Output Frequency Setting/Monitor
3	F002	1st Acceleration Time 1
4	F003	1st Deceleration Time 1
5	F004	RUN Direction Selection
6	A001	1st Frequency Reference Selection
7	A002	1st RUN Command Selection
8	A003	1st Base Frequency
9	A004	1st Maximum Frequency
10	A005	FV/FI Selection
11	A020	1st Multi-step Speed Reference 0
12	A021	Multi-step Speed Reference 1
13	A022	Multi-step Speed Reference 2
14	A023	Multi-step Speed Reference 3
15	A044	1st Control Method
16	A045	1st Output Voltage Gain
17	A085	Operation Mode Selection
18	b001	Power Interruption/Undervoltage Restart Selection
19	b002	Allowable Power Interruption Time
20	b008	Overvoltage/Overcurrent Restart Selection
21	b011	Overvoltage/Overcurrent Restart Standby Time
22	b037	Display Selection
23	b083	Carrier Frequency
24	b084	Initialization Selection
25	b130	Overvoltage Suppression Function Selection During Deceleration
26	b131	Overvoltage Suppression Level During Deceleration
27	b180	Initialization Execution
28	b190	Password A Setting
29	b191	Password A for Authentication
30	C021	Multi-function Output P1 Selection
31	C022	Multi-function Output P2 Selection
32	C036	Multi-function Relay Output (MA, MB) Operation Selection

Monitor Display Only (b037 = 05)

Only monitor display parameters (d***), b037, b190, and b191 will be displayed.

5-1-2 Parameter Initialization

- The parameter initialization function restores the changed parameters to the factory default settings.
- It also can clear the fault monitor data.
- As a measure to prevent inadvertent parameter initialization, you need to set several parameters to execute initialization.
- The following parameters are not initialized: Total RUN Time Monitor (d016), Total Power ON Time Monitor (d017), Heavy Load/Light Load Selection (b049), Initialization Data Selection (b085), Initialization Target Setting (b094), FV/FI Adjustment (C081/C082), Thermistor Adjustment (C085), and Position Data at Power Off (P082).

  The DriveProgramming User Parameters U00 to U31 (P100 to P131) are not initialized unless the Initialization Selection (b084) is set to 04.
- When you newly set 3G3MX2-series V1 type after restoring the parameters to the factory default settings, execute parameter initialization with the Initialization Selection (b084) set to 04 (Clear fault monitor + Initialize data + Clear DriveProgramming) in advance.

Parameter No.	Function name	Data	Default data	Unit
b084	Initialization Selection	00: Initialization disabled 01: Clear fault monitor 02: Initialize data 03: Clear fault monitor + Initialize data 04: Clear fault monitor + Initialize data + Clear DriveProgramming	00	–
b085	Initialization Data Selection	Do not change the default 00.	00	–
b094	Initialization Target Setting	00: All data (Complete initialization) 01: All data other than terminals/communications[*1] 02: Only User Selection 1 to 32 (U001 to U032)[*2] 03: Other than User Selection 1 to 32 (U001 to U032) and Display Selection (b037)	00	–
b180	Initialization Execution	00: Function disabled 01: Execute initialization	00	–

[*1] The table below shows the I/O terminal and basic communications settings when the Initialization Target Setting (b094) is set to 01.

[*2] This setting initializes only the data of parameters registered by the user. User registered parameters are not initialized.

I/O terminal data	
Parameter No.	**Description**
C001 to C007	Multi-function Input Selection
C011 to C017	Multi-function Input Operation Selection
C021, C022	Multi-function Output Selection
C026	Multi-function Relay Output (MA, MB) Function Selection
C031, C032	Multi-function Output Operation Selection
C036	Multi-function Relay Output (MA, MB) Operation Selection

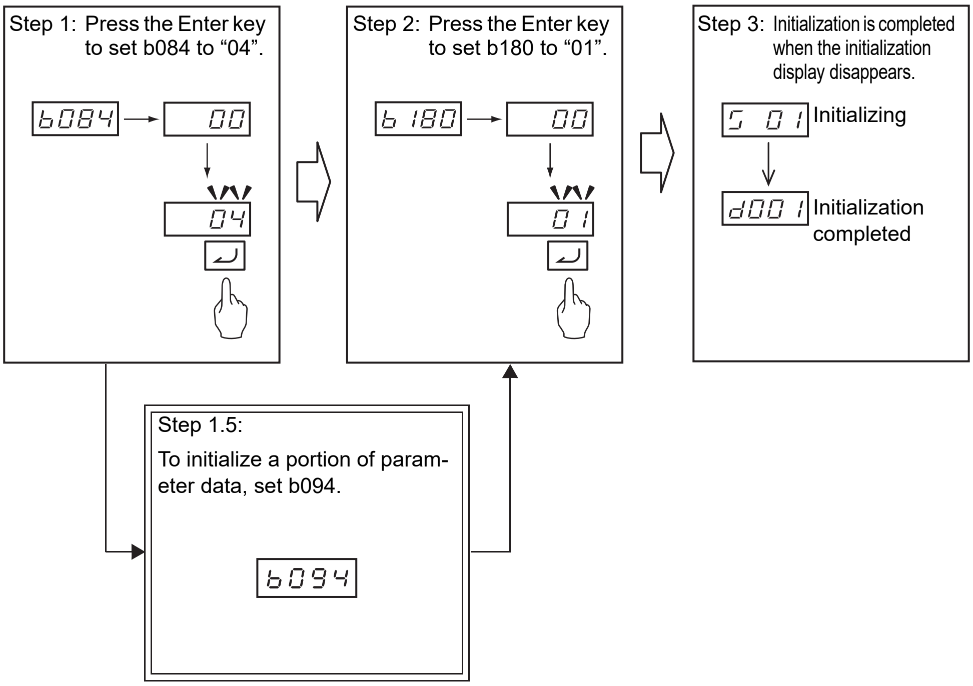
Basic communications setting data	
Parameter No.	**Description**
C071	Communication Speed Selection
C072	Communication Station No. Selection
C074	Communication Parity Selection
C075	Communication Stop Bit Selection
C076	Operation Selection on Communication Error
C077	Communication Error Timeout Time
C078	Communication Wait Time

Precautions for Correct Use

- Remember that it is impossible to undo the initialization once you press the Enter key (↵) to execute parameter initialization, with the Initialization Execution (b180) set to 01.
- When the Soft Lock Selection (b031) is set to prohibit changes of the initialization-related parameters (b084, b094, b180), the initialization cannot be executed. Change the Soft Lock Selection (b031) to enable the initialization. For details on Soft Lock Selection, refer to *7-6-1 Soft Lock Function (SFT)* on page 7-54.
- When parameter initialization is in progress, the inverter will ignore the RUN command even if it is ON.

  Enter the RUN command again after completion of the initialization process.

Initializing the Parameter Settings (Clear Fault Monitor + Initialize Data + Clear DriveProgramming)

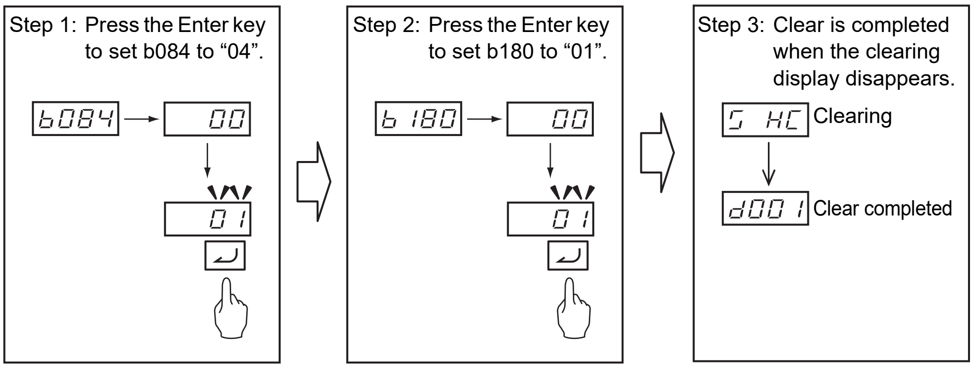

Step 1: Press the Enter key to set b084 to “04”.
b084
00
04
Step 2: Press the Enter key to set b180 to “01”.
b 180
00
0 1
Step 3: Initialization is completed when the initialization display disappears.
5 0 1
Initializing
d00 1
Initialization completed
Step 1.5:
To initialize a portion of parameter data, set b094.
b094

Precautions for Correct Use

- As a measure to prevent inadvertent parameter initialization, the Initialization Selection (b084) and Initialization Execution (b180) settings are designed to be reset to 00 when the initialization is completed or after power cycle. Be sure to set these parameters each time when you need to initialize the parameter settings.
- The following parameters are not initialized: Total RUN Time Monitor (d016), Total Power ON Time Monitor (d017), Heavy Load/Light Load Selection (b049), Initialization Data Selection (b085), Initialization Target Setting (b094), FV/FI Adjustment (C081/C082), Thermistor Adjustment (C085), and Position Data at Power Off (P082).

  The DriveProgramming User Parameters U00 to U31 (P100 to P131) are not initialized unless the Initialization Selection (b084) is set to 04.
- Remember that you cannot restore the initialized data to the previous settings once you execute parameter initialization.

Clearing Fault Monitor Data



Step 1: Press the Enter key to set b084 to “04”.

Step 2: Press the Enter key to set b180 to “01”.

Step 3: Clear is completed when the clearing display disappears.

Switching between 1st and 2nd Controls

- The 3G3MX2-V1 Series Inverter provides two controls that can be switched as required.
- Even with a single motor, you can use the 2nd control to configure the control and settings suitable for your application.
- The 2nd control is allocated in the 200s parameter number (e.g. A201 relative to A001).

For the explanation of the 2nd control, refer to *7-4-3 2nd Control Function (SET)* on page 7-33.

5-2 V/f Control Settings

5-2-1 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, which is effective for using the inverter easily.
- To set V/f characteristics (output voltage and output frequency), set the 1st/2nd Control Method to 00 to 02.

Parameter No.	Function name	Data	Default data	Unit
A044/A244	1st/2nd Control Method [*2][*3]	00: Constant torque characteristics (VC) 01: Reduced torque characteristics (VP 1.7th power (VC at low speed)) 02: Free V/f setting 03: Sensorless vector control [*1]	00	–

[*1] Sensorless vector control can be set in the heavy load mode only. For details on sensorless vector control, refer to *6-1 Sensorless Vector Control* on page 6-3.

[*2] Setting the Inverter Mode Selection (b171) to 03 (PM motor mode) does not cause the parameters A044/A244 to be displayed after initialization.

[*3] To enable the switching to the 2nd control, allocate one of the Multi-function Input S1 to S7 Selection (C001 to C007) to 08 (SET) and then turn ON that terminal.

Constant Torque Characteristics (VC)

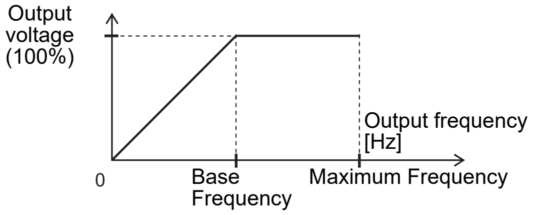
This setting is suitable for cart, conveyor, overhead traveling crane, and other applications where a torque is required, independent of the motor rotation speed.

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.

However, the output voltage is proportional from 0 Hz to the base frequency, it is constant independent of the frequency, from the base frequency to the maximum frequency.

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

For the maximum frequency, set the highest frequency required for your application, within the maximum frequency of the motor.

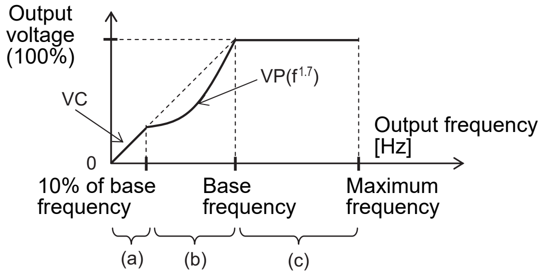


Reduced Torque Characteristics (VP 1.7th Power (VC at low speed))

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, because the output voltage is reduced in the low speed range.

In the low speed range at 10% of the base frequency or lower, the setting provides constant torque characteristics (VC) to secure a sufficient starting torque.



Range (a): Constant torque characteristics are provided within the range from 0 Hz to 10% of the base frequency.
(Example) If the base frequency is 60 Hz, the setting provides constant torque characteristics within the range from 0 to 6 Hz.

Range (b): Reduced torque characteristics are provided within the range from 10% to 100% of the base frequency.
The inverter outputs voltage based on a curve of the 1.7th power of the frequency.

Range (c): A constant voltage is output within the range from the base frequency to the maximum frequency.

Free V/f Function

- The free V/f function is suitable for the applications listed below.
  The output voltage of the inverter can be adjusted according to your application.

Application	Adjustment method
Motor integrated with a brake (that uses a shared power supply for the motor and the brake)	If the motor and the brake share the same power supply, a large voltage is required at low frequencies to release the brake. The release timing of the brake can be adjusted by setting the frequency at which you want to release the brake and adjusting the voltage at that frequency.
Applications subject to significant load variation at different motor speeds	When the load value changes significantly depending on the motor speed, the output torque of the inverter can be adjusted by setting the frequency at which the load value becomes large and adjusting the voltage at that frequency.

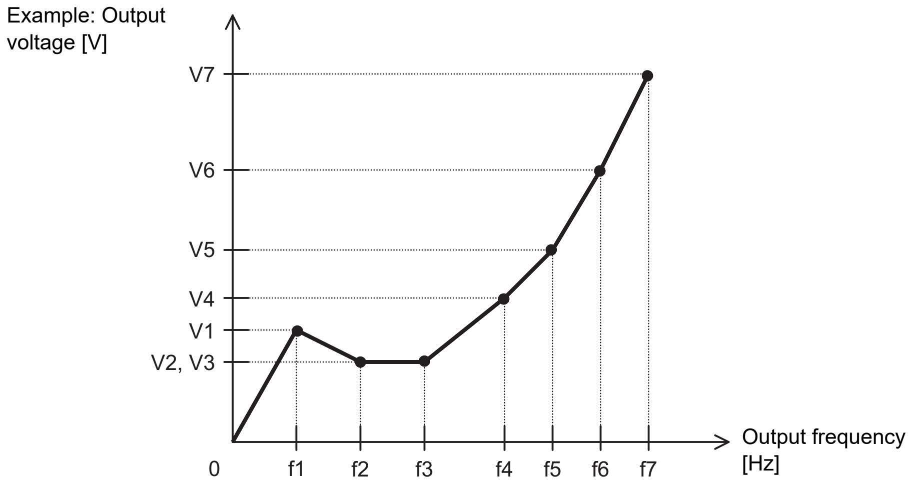
- With the free V/f function, you can configure V/f characteristics by setting the voltage and frequency values at seven points. For any unused points, set the corresponding Free V/f Frequency 1 to 7 to 0 (Disabled).
- The set values of the Free V/f Frequency 1 to 7 must satisfy the following relationship:
  $1 \leq 2 \leq 3 \leq 4 \leq 5 \leq 6 \leq 7$.

  All of the default data are set to 0 Hz. Start by setting the Free V/f Frequency 7 (b112) and Free V/f Voltage 7 (b113).

- The free V/f function is disabled by default. Even if you set 02 (Free V/f setting) in the 1st/2nd Control Method (A044/A244), the inverter cannot operate with the free V/f function.
- If the free V/f function is enabled, the torque boost function (A041/A241, A042/A242, A043/A243), Base Frequency (A003/A203), and Maximum Frequency (A004/A204) settings are disabled. The Free V/f Frequency 7 data is regarded as the maximum frequency.

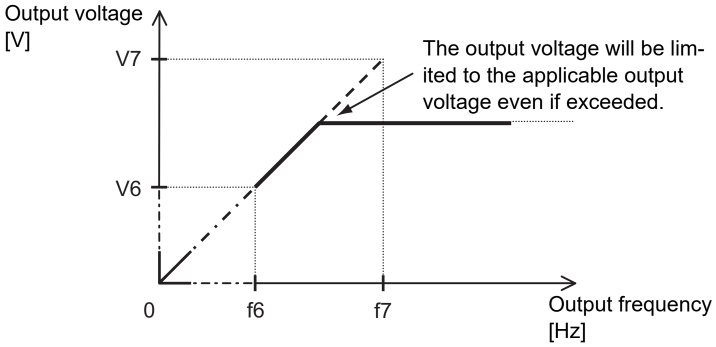
Parameter No.	Function name	Data	Description	Default data	Unit
b100	Free V/f Frequency 1 (f1)	0.: Disabled 1. to Free V/f Frequency 2	Set the frequency at each break point.	0	Hz
b102	Free V/f Frequency 2 (f2)	0.: Disabled Free V/f Frequency 1 to Free V/f Frequency 3			
b104	Free V/f Frequency 3 (f3)	0.: Disabled Free V/f Frequency 2 to Free V/f Frequency 4			
b106	Free V/f Frequency 4 (f4)	0.: Disabled Free V/f Frequency 3 to Free V/f Frequency 5			
b108	Free V/f Frequency 5 (f5)	0.: Disabled Free V/f Frequency 4 to Free V/f Frequency 6			
b110	Free V/f Frequency 6 (f6)	0.: Disabled Free V/f Frequency 5 to Free V/f Frequency 7			
b112	Free V/f Frequency 7 (f7)	0.: Disabled Free V/f Frequency 6 to 400. (580.) [*1]			
b101	Free V/f Voltage 1 (V1)	0.0 to 800.0	Set the voltage at each break point.	0.0	V
b103	Free V/f Voltage 2 (V2)				
b105	Free V/f Voltage 3 (V3)				
b107	Free V/f Voltage 4 (V4)				
b109	Free V/f Voltage 5 (V5)				
b111	Free V/f Voltage 6 (V6)				
b113	Free V/f Voltage 7 (V7)				
Related functions		A044, A244			

[*1] In the high-frequency mode.



Precautions for Correct Use

Even if the Free V/f Frequency 1 to 7 are set to 800 V, the inverter cannot produce output voltage higher than the input voltage or the value of the 1st/2nd Motor Rated Voltage Selection (A082/A282).
Be sure to check that the output characteristic setting is proper. An improper setting causes overcurrent during acceleration or deceleration, or vibration of the motor and/or machine.



5-2-2 Heavy Load/Light Load Selection

This enables the efficient utilization of the inverter according to your application.

- According to your application, select one of the two modes: heavy load mode and light load mode.
- The heavy load mode provides the same load rating as the previous inverters, which means that the overload capacity is 150% of the rated current of the inverter for 1 minute.
- For loads (such as fan and pumps) that do not require frequent use of the inverter above the rated torque, you can select the light load mode.

  Setting the light load mode causes the rated current of the inverter to increase, which enables the inverter to drive a motor one size larger. However, the overload capacity is 120% of the rated current of the inverter for 1 minute.
- Use the Heavy Load/Light Load Selection (b049) to switch between the heavy load mode and the light load mode.

  It is not necessary to cycle the power supply after changing this setting.

Precautions for Correct Use

The high-frequency mode is supported only in the heavy load rating setting. For the high-frequency mode, refer to *6-9 High-frequency Mode* on page 6-68.

Parameter No.	Function name	Data	Default data	Unit
b049	Heavy Load/Light Load Selection	00: Heavy load mode (CT) 01: Light load mode (VT)	00	–

The inverter features of the heavy load mode and the light load mode are as shown below.

Item	Heavy load (CT)	Light load (VT)
Feature	Loads that require a high torque during acceleration/deceleration etc.	Loads that do not require frequent use of the inverter above rated torque
Application example	Elevator, crane, conveyor, etc.	Fan pump, air conditioner, etc.
Rated output current (Example)	3.0 A (3-phase 200-V, 0.4-kW inverter)	3.5 A (3-phase 200-V, 0.4-kW inverter)
Overload current rating	150%, 60 s	120%, 60 s

Changing the Heavy Load/Light Load Selection (b049) setting switches the setting ranges and default data of some parameters.

Doing so also causes some parameter settings to be initialized at the same time.

For these parameters, you must set data again after changing the b049 setting even if you configured them beforehand.

- Changing from heavy load mode to light load mode:
  Basically causes the parameter settings to be initialized. For details, refer to the Initialization at mode switching column in the following table.
- Changing from light load mode to heavy load mode:
  Basically does NOT cause the parameter settings to be initialized. For details, refer to the Initialization at mode switching column in the following table.

● Parameters whose setting ranges and default data are switched between heavy load and light load mode

Parameter No.	Function name	Setting range		Default data		Initialization at mode switching	
		Heavy load (CT)	Light load (VT)	Heavy load (CT)	Light load (VT)	Heavy to Light	Light to Heavy
A044	1st Control Method	00: Constant torque characteristics 01: Reduced torque characteristics 02: Free V/f setting 03: Sensorless vector control	00: Constant torque characteristics 01: Reduced torque characteristics 02: Free V/f setting	00	No switching	Enabled	Disabled
A244	2nd Control Method	00: Constant torque characteristics 01: Reduced torque characteristics 02: Free V/f setting 03: Sensorless vector control	00: Constant torque characteristics 01: Reduced torque characteristics 02: Free V/f setting	00	No switching		
A054	DC Injection Braking Power	Percentage of heavy-load rated current 0. to 100. [%]	Percentage of light-load rated current 0. to 70. [%]	50. [%]	No switching	Enabled	Disabled
A057	Startup DC Injection Braking Power			0. [%]	No switching		
A059	DC Injection Braking Carrier Frequency	2.0 to 15.0 [kHz]	2.0 to 10.0 [kHz]	5.0 [kHz]	2.0 [kHz]	Enabled	Disabled
b012	1st Electronic Thermal Level	0.20 to 1.00 × Heavy-load rated current [A]	0.20 to 1.00 × Light-load rated current [A]	Heavy-load rated current [A]	Light-load rated current [A]	Conversion[1]	Conversion[1]
b212	2nd Electronic Thermal Level						
b016	Free-electronic Thermal Current 1	0.00 to 1.00 × Heavy-load rated current [A]	0.00 to 1.00 × Light-load rated current [A]	0.00 [A]	No switching	Conversion[1]	Conversion[1]
b018	Free-electronic Thermal Current 2						
b020	Free-electronic Thermal Current 3						
b022/ b222	1st/2nd Overload Limit Level	0.20 × Heavy-load rated current to 2.00 × Heavy-load rated current [A]	0.20 × Light-load rated current to 1.50 × Light-load rated current [A]	1.50 × Heavy-load rated current [A]	1.20 × Light-load rated current [A]	Enabled	Conversion[1]
b025	1st Overload Limit Level 2						
b028	Frequency Pull-in Restart Level	0.20 × Heavy-load rated current to 2.00 × Heavy-load rated current [A]	0.20 × Light-load rated current to 1.50 × Light-load rated current [A]	Heavy-load rated current [A]	Light-load rated current [A]	Enabled	Conversion[1]

Parameter No.	Function name	Setting range		Default data		Initialization at mode switching	
		Heavy load (CT)	Light load (VT)	Heavy load (CT)	Light load (VT)	Heavy to Light	Light to Heavy
b083	Carrier Frequency	2.0 to 15.0 [kHz]	2.0 to 10.0 [kHz]	10.0 [kHz]	2.0 [kHz]	Enabled	Disabled
C030	Digital Current Monitor Reference Value	0.20 × Heavy-load rated current to 2.00 × Heavy-load rated current [A]	0.20 × Light-load rated current to 1.50 × Light-load rated current [A]	Heavy-load rated current [A]	Light-load rated current [A]	Conversion *1	Conversion *1
C039	Low Current Detection Level	0.00 to 2.00 × Heavy-load rated current [A]	0.00 to 1.50 × Light-load rated current [A]	Heavy-load rated current [A]	Light-load rated current [A]	Conversion *1	Conversion *1
C041	1st Overload Warning Level	0.00: Overload warning detection disabled 0.01 to 2.00 × Heavy-load rated current [A]	0.00: Overload warning detection disabled 0.01 to 1.50 × Heavy-load rated current [A]	1.15 × Heavy-load rated current [A]	1.15 × Light-load rated current [A]	Conversion *1	Conversion *1
C241	2nd Overload Warning Level						
C111	1st Overload Warning Level 2	0.00: Overload warning detection disabled 0.01 to 2.00 × Heavy-load rated current [A]	0.00: Overload warning detection disabled 0.01 to 1.50 × Light-load rated current [A]	1.15 × Heavy-load rated current [A]	1.15 × Light-load rated current [A]	Conversion *1	Conversion *1
H003	1st Motor Capacity	0.1 to 18.5 [kW] Setting in steps *2	Same as the setting range for heavy load mode	Max. applicable motor capacity for heavy load [kW]	Max. applicable motor capacity for light load [kW]	Disabled	Disabled
H203	2nd Motor Capacity						

*1. Conversion: The set current value will be converted at the ratio of the rated current for the heavy load/light load mode.

(Example) If you change from a light load mode setting of 5 A (rated current: 10 A) to the heavy load mode (rated current: 8 A), the current value will be converted as follows: Rated current 8A × 50% (5 A/10 A) = 4 A.

*2. Setting in steps: Steps of 0.1/0.2/0.4/0.55/0.75/1.1/1.5/2.2/3.0/3.7/4.0/5.5/7.5/11.0/15.0/18.5 [kW] can be selected.

In the light load mode, the following parameters are not displayed.

Parameter No.	Function name	Parameter No.	Function name
d009	Torque Reference Monitor	H005/H205	1st/2nd Speed Response
d010	Torque Bias Monitor	H020/H220	1st/2nd Motor Parameter R1
d012	Output Torque Monitor	H021/H221	1st/2nd Motor Parameter R2
b040	Torque Limit Selection	H022/H222	1st/2nd Motor Parameter L
b041	Torque Limit 1 (Four-quadrant Mode Forward Power Running)	H023/H223	1st/2nd Motor Parameter Io
b042	Torque Limit 2 (Four-quadrant Mode Reverse Regeneration)	H024/H224	1st/2nd Motor Parameter J
b043	Torque Limit 3 (Four-quadrant Mode Reverse Power Running)	H030/H230	1st/2nd Motor Parameter R1 (Auto-tuning Data)
b044	Torque Limit 4 (Four-quadrant Mode Forward Regeneration)	H031/H231	1st/2nd Motor Parameter R2 (Auto-tuning Data)
b045	Torque LADSTOP Selection	H032/H232	1st/2nd Motor Parameter L (Auto-tuning Data)
b046	Reverse Rotation Prevention Selection	H033/H233	1st/2nd Motor Parameter Io (Auto-tuning Data)
C054	Overtorque/Undertorque Selection	H034/H234	1st/2nd Motor Parameter J (Auto-tuning Data)
C055	Overtorque/Undertorque Level (Forward Power Running)	P033	Torque Reference Input Selection
C056	Overtorque/Undertorque Level (Reverse Regeneration)	P034	Torque Reference Setting

Parameter No.	Function name	Parameter No.	Function name
C057	Overtorque/Undertorque Level (Reverse Power Running)	P036	Torque Bias Selection
C058	Overtorque/Undertorque Level (Forward Regeneration)	P037	Torque Bias Value
C059	Overtorque/Undertorque Signal Operation	P038	Torque Bias Polarity Selection
H001	Auto-tuning Selection	P039	Speed Limit Value in Torque Control (Forward)
H002/H202	1st/2nd Motor Parameter Selection	P040	Speed Limit Value in Torque Control (Reverse)

Similarly, in the light load mode, the following function options are not displayed.

Multi-function Input S1 to S7 Selection		Multi-function Output P1 Selection, Multi-function Output P2 Selection, Multi-function Relay Output (MA, MB) Function Selection	
40: TL	Torque limit enabled	07: OTQ	Overtorque/Undertorque signal
41: TRQ1	Torque limit switching 1	10: TRQ	Torque limit
42: TRQ2	Torque limit switching 2	–	–
52: ATR	Torque reference input permission	–	–

5-3 Motor Parameter Settings

5-3-1 Motor Capacity/Pole Number Selection

Set the following parameters according to your motor.

Parameter No.	Function name	Data	Default data	Unit
H003	1st Motor Capacity	0.1/0.2/0.4/0.55/0.75/1.1/1.5/2.2/3.0/3.7/4.0/5.5/7.5/11.0/15.0/18.5	Maximum applicable motor capacity	kW
H203	2nd Motor Capacity	0.1/0.2/0.4/0.55/0.75/1.1/1.5/2.2/3.0/3.7/4.0/5.5/7.5/11.0/15.0/18.5	Maximum applicable motor capacity	kW
H004	1st Motor Pole Number	2/4/6/8 10 to 48: Do not set.	4	pole
H204	2nd Motor Pole Number	2/4/6/8 10 to 48: Do not set.	4	pole

5-3-2 Electronic Thermal Function

The electronic thermal function prevents the motor from overloading and burning.

Set the rated current of your motor in the Electronic Thermal Level parameters.

In the Electronic Thermal Characteristics Selection parameters, set the motor torque characteristics as follows, according to the motor specifications.

Characteristics	Description
Reduced torque characteristics	Use this setting for general-purpose motors. In an air-cooled motor that uses the rear fan coupled directly to the motor shaft, the cooling effect degrades as the motor rotation speed decreases. This characteristics setting enables overload detection that takes into account such degradation of the cooling effect at low speeds.
Constant torque characteristics	Use this setting for dedicated inverter motors. Dedicated inverter motors are designed to prevent degradation of the cooling effect that arises as the motor speed increases. This characteristics setting provides overload detection independent of the motor rotation speed.

Derating of the output current is required depending on the installation environment and the Carrier Frequency (b083). For derating of each inverter model, refer to *A-1 Derating* on page A-2.

In the Electronic Thermal Level, set the output current value to be derated.

This setting is, however, unnecessary if the Electronic Thermal Level is already set to the derating value or lower.

Precautions for Correct Use

- In the 3G3MX2-V1 Series Inverter, the electric thermal function is separated for the inverter and for the motor. This enables you to change the operation characteristics of the motor electronic thermal function according to the thermal time constant of the motor in use. For how to change these characteristics, refer to *7-8-2 Motor Electronic Thermal Function* on page 7-73.
- To set the electronic thermal function to work as with the conventional 3G3MX2 Series, set the Motor Electronic Thermal Selection (b910) to 00 (Disabled).
- To connect several motors to a single inverter, set the Electronic Thermal Level to the rated output current of the inverter and install a thermal relay etc. for each motor.
- Before setting the electronic thermal function, set the 1st/2nd Motor Capacity (H003/H203) and the 1st/2nd Motor Pole Number (H004/H204) correctly according to your motor.

Parameter No.	Function name	Data	Default data	Unit
b012	1st Electronic Thermal Level	0.20 × Rated current to 1.00 × Rated current [1]	Rated current of inverter	A
b212	2nd Electronic Thermal Level [2]			
b013	1st Electronic Thermal Characteristics Selection	00: Reduced torque characteristics (for general-purpose motor) 01: Constant torque characteristics (for dedicated inverter motor) 02: Free setting[3]	01	–
b213	2nd Electronic Thermal Characteristics Selection [2]			

[1] Set according to the rated current of your motor.

[2] To enable the switching to the 2nd control, allocate one of the Multi-function Input S1 to S7 Selection (C001 to C007) to 08 (SET) and then turn ON that terminal.

[3] When 02 (Free setting) is set, the inverter performs overload detection based on the free-electronic thermal function setting described in *7-8-1 Free-electronic Thermal Function* on page 7-72.

Additional Information

- To check the status of the electronic thermal function, use the Electronic Thermal Load Rate Monitor (d104). An Overload trip (E05) error will occur if the value reaches 100%.
- This inverter has the free-electronic thermal function. The free-electronic thermal function allows you to set the reduction factor for overload detection based on your application.

  For details, refer to *7-8-1 Free-electronic Thermal Function* on page 7-72.
- The electronic thermal function can output a warning signal before the inverter is stopped by an overload detection.

  The use of a warning signal is effective to reduce the system down time because it enables you to solve problems previously.

  For details, refer to *7-8-3 Electronic Thermal Warning* on page 7-75.

Electronic Thermal Characteristics

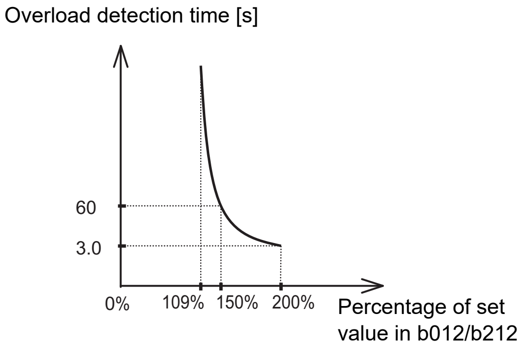
The electronic thermal function enables you to change the overload detection characteristics by setting the 1st/2nd Electronic Thermal Characteristics Selection (b013/b213) according to the motor in use.

The reduced torque characteristics and the constant torque characteristics are achieved by setting the reduction factor for each output frequency of the inverter in the basic electronic thermal characteristics.

This section first describes the basic electronic thermal characteristics and then explains the reduction factor for each detection characteristic.

● Basic characteristics

The electronic thermal characteristics of a motor are as shown in the following graph independent of the heavy load/light load mode setting.



● Reduced torque characteristics

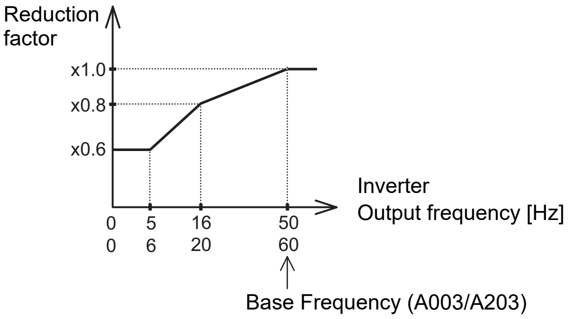
Use the reduced torque characteristics setting for general-purpose (standard) motors.

In an air-cooled motor that uses the rear fan coupled directly to the motor shaft, the cooling effect degrades as the motor rotation speed decreases.

This characteristics setting enables overload detection that takes into account such degradation of the cooling effect at low speeds.

Specifically, the following reduction factor is applied to the current value set in the 1st/2nd Electronic Thermal Level (b012/b212) to calculate a reduced current value, which is equivalent to 100% of the basic characteristics.

Reduction Factor Characteristics



Constant torque characteristics

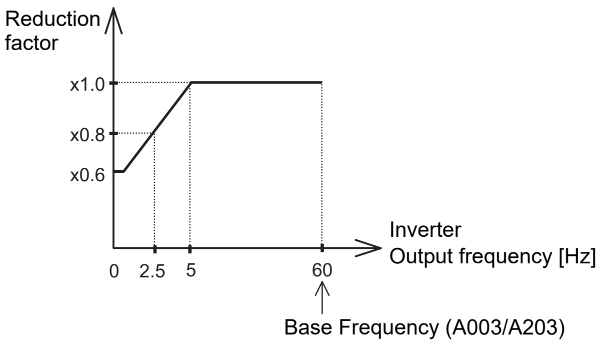
Use the torque characteristics setting for dedicated inverter motors.

Dedicated inverter motors are designed to prevent degradation of the cooling effect that arises as the motor speed increases, except at 5 Hz or less.

For constant torque characteristics, the reduction factor is not defined for frequencies of 5 Hz or more.

Specifically, the following reduction factor is applied to the current value set in the 1st/2nd Electronic Thermal Level (b012/b212) to calculate a reduced current value, which is equivalent to 100% of the basic characteristics.

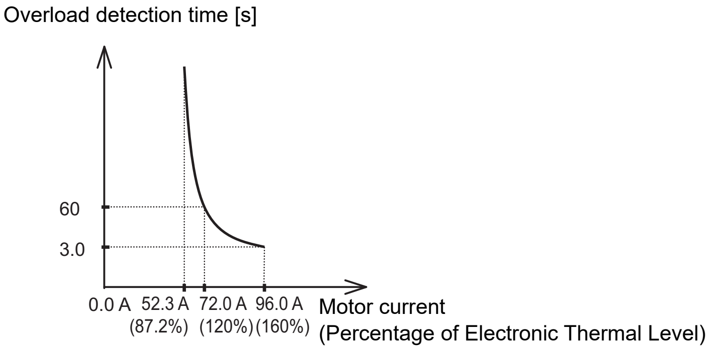
Reduction Factor Characteristics



Examples of actual electronic thermal characteristics

Under the following four conditions, electronic thermal characteristics are shown in the graph below, where the reduction factor at 20 Hz is ×0.8 according to the reduction factor in the reduced torque characteristics, which is reflected on the basic electronic thermal characteristics.

- 1st Electronic Thermal Level (b012) is set to 60 A.
- 1st Electronic Thermal Characteristics Selection (b013) is set to 00 (Reduced torque characteristics).
- 1st Base Frequency (A003) is set to 60 Hz.
- 20-Hz output frequency is output (Reduction factor: ×0.8)



Electronic thermal detection of the inverter

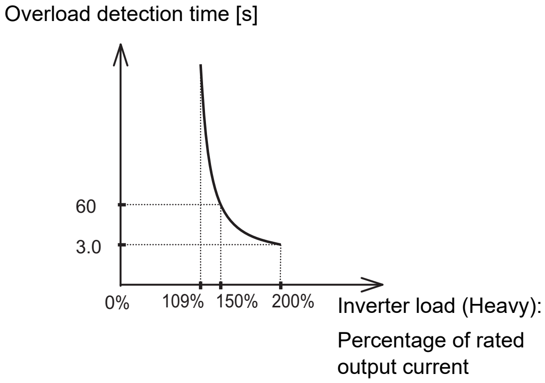
In the 3G3MX2-V1 Series Inverter, the electric thermal function is separated for the inverter and for the motor.

The electronic thermal function for the inverter is fixed to the rated current value of the inverter, independent of the b012/b212 setting.

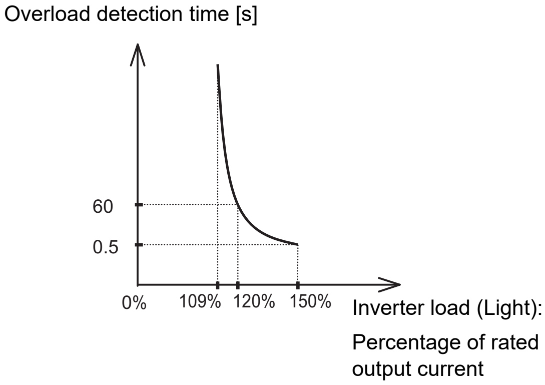
However, the characteristics of the inverter change because the rated current of the inverter varies with the heavy and light load mode settings.

Below are the electronic thermal characteristics of the inverter.

Basic Characteristics in Heavy Load Mode



Basic Characteristics in Light Load Mode



Precautions for Correct Use

The inverter will trip if an overload is detected by either the inverter or motor electronic thermal function.

The motor electronic thermal function detects E05.□, and the inverter thermal function detects E38.□.

5-3-3 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).

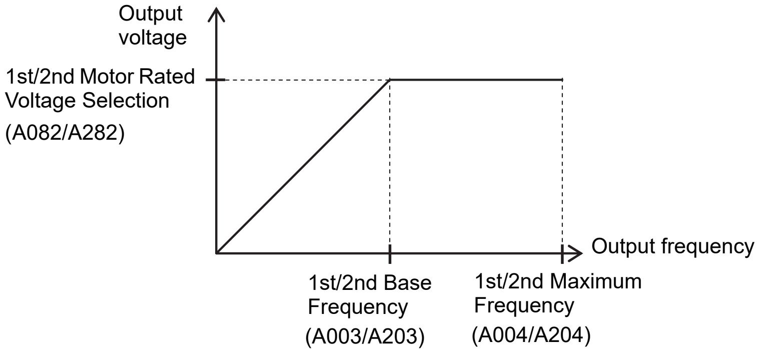
For the maximum frequency, set the highest frequency required for your application. However, do not exceed the maximum rotation speed of the motor.

Then, set the 1st/2nd Motor Rated Voltage Selection (A082/A282) to the rated voltage of the motor.

Parameter No.	Function name	Data	Default data	Unit
A003	1st Base Frequency	30.0 to 1st Maximum Frequency (A004)	60.0 (580.0) [*2]	Hz
A203	2nd Base Frequency	30.0 to 2nd Maximum Frequency (A204)	60.0 (580.0) [*2]	Hz
A004	1st Maximum Frequency	1st Base Frequency (A003) to 400.0	60.0 (580.0) [*2]	Hz
A204	2nd Maximum Frequency [*1]	2nd Base Frequency (A203) to 400.0	60.0 (580.0) [*2]	Hz
A082/A282	1st/2nd Motor Rated Voltage Selection	200-V class: 200/215/220/230/240 400-V class: 380/400/415/440/460/480	200/400	V

*1. To enable the switching to the 2nd control, set one of the Multi-function Input S1 to S7 Selection (C001 to C007) to 08 (SET) and turn ON that terminal.

*2. In the high-frequency mode.



Precautions for Correct Use

- Motors whose rated frequency exceed 60 Hz are regarded as special motors.

  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 set the motor rated voltage to the motor rated frequency or higher. Doing so may cause an overload or motor burnout.

5-4 RUN Command Settings

5-4-1 RUN Command Selection

Select the input method for the RUN command.

Parameter No.	Function name	Data	Default data	Unit
A002/A202	1st/2nd RUN Command Selection	01: Control circuit terminal block (DriveProgramming) 02: Digital Operator 03: Modbus communication 04: Option	02	–
F004	RUN Direction Selection	00: Forward 01: Reverse	00	–
Related functions		F004, C001 to C007		

Below are the details of the parameter settings.

Data	RUN command source
01	Inputs the RUN command via the ON/OFF of the FW/RV signal allocated to the control circuit terminal block. It will be regarded as the STOP command if both the forward and reverse commands are input simultaneously.
02	Inputs the RUN command via the RUN key and the STOP/RESET key on the Digital Operator.
03	Inputs the RUN command via Modbus communication.
04	Inputs the RUN command via the mounted communications option unit.

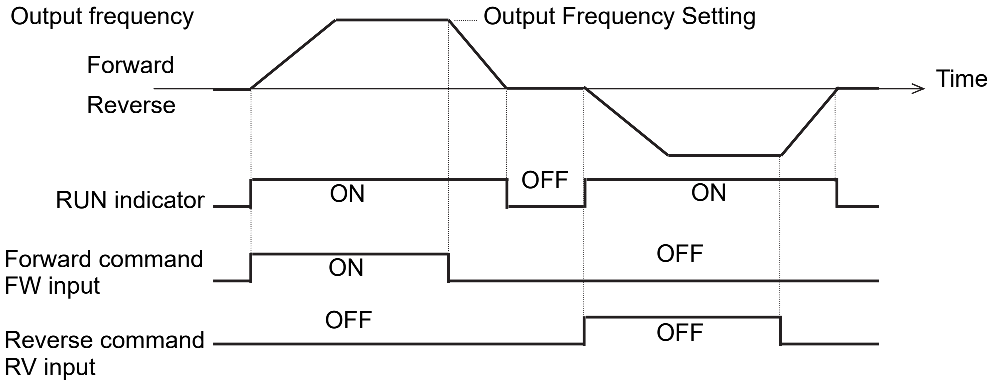
- If you select 01 (Control circuit terminal block) in the RUN Command Selection, set any two of the Multi-function Input S1 to S7 Selection (C001 to C007) to 00 (FW: Forward) and 01 (RV: Reverse).
- Also, when using the 3-wire input function, set the RUN Command Selection to 01 (Control circuit terminal block).

  For details on the 3-wire input function, refer to *5-9-9 3-wire Input Function (STA, STP, F/R)* on page 5-54.
- When the Multi-function Input S1 to S7 Selection is set to 31 (OPE: Forced operator function) or 51 (F-TM: Forced terminal block), the setting has priority over the 1st/2nd Frequency Reference Selection (A001/A201) and 1st/2nd RUN Command Selection (A002/A202).

  When each terminal is input, the frequency reference and RUN command from the Digital Operator or the control terminal block are enabled.
- When using the DriveProgramming function to input the RUN command, set the RUN Command Selection to 01 (Control circuit terminal block).

  For details, refer to “DriveProgramming User’s Manual (I580)”.
- To use the Digital Operator to input the RUN command, set the RUN direction in the RUN Direction Selection (F004).

- An example of inverter operation with forward command (FW) input and reverse command (RV) input is shown below.


Output frequency
Output Frequency Setting
Forward
Reverse
Time
RUN indicator
ON
OFF
ON
Forward command FW input
ON
OFF
Reverse command RV input
OFF
OFF

5-5 Frequency Reference Settings

5-5-1 Frequency Reference Selection

- Select the input method for the frequency reference in 1st/2nd Frequency Reference Selection (A001/A201).
- When the multi-step speed reference function is used (by setting the multi-function input terminals for the Multi-step Speed Reference 0 to 15), the setting in A001/A201 is enabled only for the Multi-step Speed Reference 0.

  The values set in the Multi-step Speed Reference 1 to 15 (A021 to A035) are used as the frequency references for the multi-step speed reference 1 to15.
- The frequency reference value selected in the 1st/2nd Frequency Reference Selection can be checked in the Output Frequency Setting/Monitor (F001). In addition, when A001/A201 is set to 02 (Digital Operator (F001)), the frequency reference can be changed in F001.
- When the Multi-function Input S1 to S7 Selection is set to 31 (OPE: Forced operator function) or 51 (F-TM: Forced terminal block), the setting has priority over the 1st/2nd Frequency Reference Selection (A001/A201) and 1st/2nd RUN Command Selection (A002/A202).

  When each terminal is input, the frequency reference and RUN command from the Digital Operator or the control terminal are enabled.

  The values set in the Multi-step Speed Reference 1 to 15 have priority over the forced operator function and forced terminal block.

Parameter No.	Function name	Data	Default data	Unit
A001/A201	1st/2nd Frequency Reference Selection [*1]	00: Digital Operator (Volume) [*2] 01: Control circuit terminal block (Analog input) 02: Digital Operator (F001) 03: Modbus communication 04: Option 06: Pulse train frequency 07: DriveProgramming 10: Operation function output [*3]	02	–
F001	Output Frequency Setting/Monitor	0.00, Starting Frequency to 1st/2nd Maximum Frequency When the PID function is enabled: 0.0 to 100.0	6.00	Hz %
Related functions		A005, A141 to A143, A145, A146		

*1. To enable the switching to the 2nd control, set one of the Multi-function Input S1 to S7 Selection (C001 to C007) to 08 (SET) and turn ON that terminal.

*2. This setting is enabled when the Digital Operator with the volume control (Model: 3G3AX-OP01) is connected.

*3. Refer to *7-5-7 Frequency Calculation Function* on page 7-39.

Below are the details of the data of A001/A201.

Data	Frequency reference source
00	Sets the frequency reference via the volume control on the external Digital Operator (Model: 3G3AX-OP01).
01	Sets the frequency reference via the control circuit terminal block (analog input signals). (FV-SC, FI-SC)
02	Sets the frequency reference via the Digital Operator. (Output Frequency Setting/Monitor: F001)
03	Sets the frequency via Modbus communication.
04	Sets the frequency reference via the mounted communications option unit.
06	Sets the frequency reference based on the pulse train frequency input to the pulse input RP terminal.
07	Sets the frequency reference via the DriveProgramming. *1
10	Sets the calculation result of the frequency operation function as the frequency reference. *2

*1. Refer to “DriveProgramming User’s Manual (I580)”.

*2. Refer to *7-5-7 Frequency Calculation Function* on page 7-39.

Precautions for Correct Use

The Output Frequency Setting/Monitor (F001) shows the frequency reference in the internal memory (RAM).

F001 displays the frequency reference value selected at that time.

If you change the frequency reference value displayed in F001 and save it (by pressing the Enter key), the data will be stored with the multi-step speed reference selected at that time.

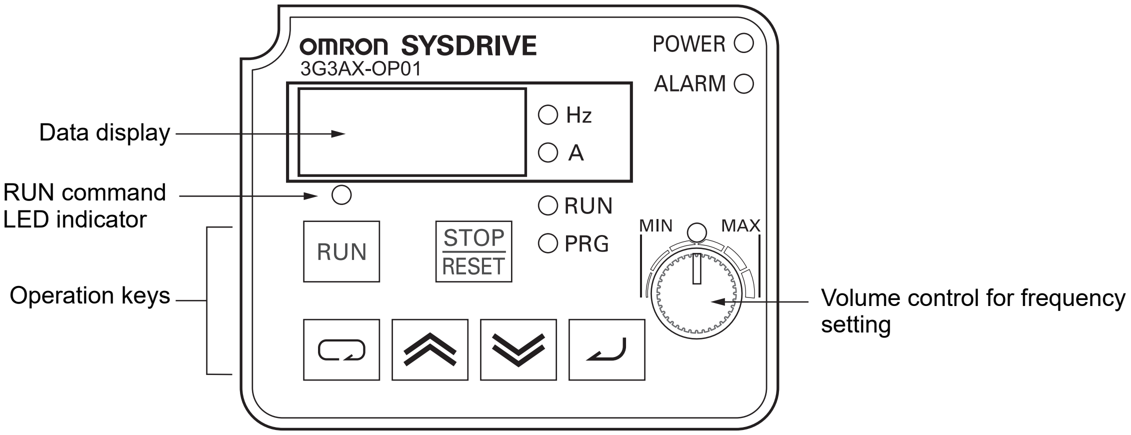
- For the multi-step speed reference 0, the data will be stored with the 1st Multi-step Speed Reference 0 (A020)/2nd Multi-step Speed Reference 0 (A220) according to the 1st/2nd Control Method selection.
- For the multi-step speed reference 1 to 15, the data will be stored with the corresponding Multi-step Speed Reference 1 to 15 (A021 to A035).

* The frequency reference of Digital Operator (Volume), Control circuit terminal block (Analog input), Modbus communication, Option, DriveProgramming, and Operation function output cannot be changed in F001.

The frequency reference methods that are used generally are shown below.

Using Digital Operator (Volume)

Set the frequency reference via the volume control for frequency setting on the Digital Operator (Model: 3G3AX-OP01).


OMRON SYSDRIVE
3G3AX-OP01
POWER
ALARM
Hz
A
RUN
PRG
MIN
MAX
RUN
STOP
RESET
Data display
RUN command
LED indicator
Operation keys
Volume control for frequency setting

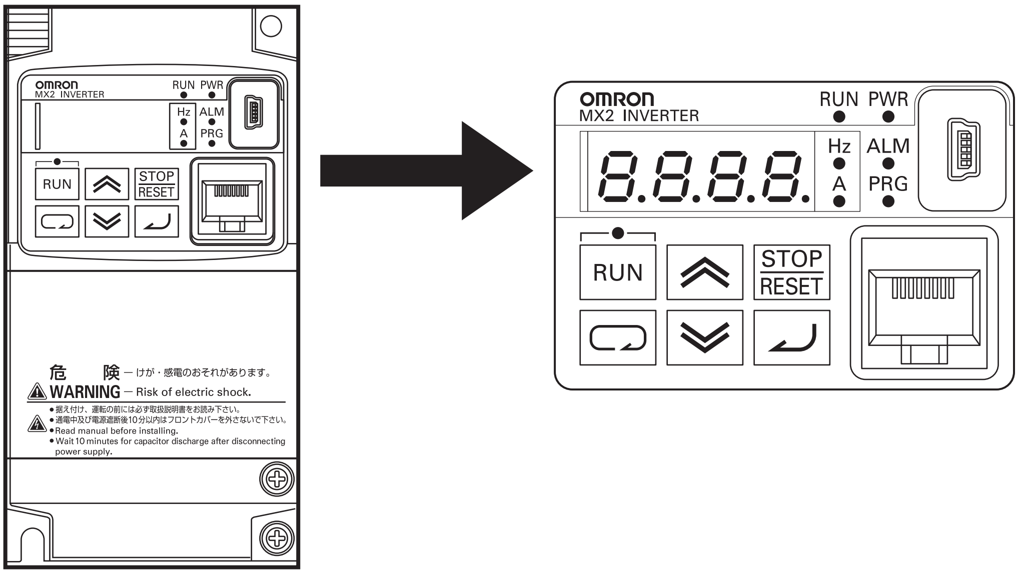
Parameter No.	Function name	Data	Default data	Unit
A001/A201	1st/2nd Frequency Reference Selection	00: Digital Operator (Volume) *1	02	–

*1. This setting is enabled when the Digital Operator with the volume control (Model: 3G3AX-OP01) is connected.

Using Digital Operator

Set the frequency reference via the built-in Digital Operator.

To do so, set the Output Frequency Setting/Monitor (F001) and 1st/2nd Multi-step Speed Reference 0 (A020/A220).


OMRON
MX2 INVERTER
RUN PWR
Hz
A
ALM
PRG
RUN
STOP
RESET
8.8.8.8.
危 険 − けが・感電のおそれがあります。
WARNING − Risk of electric shock.
●据え付け、運転の前には必ず取扱説明書をお読み下さい。
●通電中及び電源遮断後10分以内はフロントカバーを外さないで下さい。
●Read manual before installing.
●Wait 10 minutes for capacitor discharge after disconnecting power supply.

Parameter No.	Function name	Data	Default data	Unit
A001/A201	1st/2nd Frequency Reference Selection	02: Digital Operator (F001)	02	–

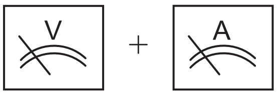
Using an Analog Voltage Input or Analog Current Input

To use an analog voltage input or analog current input to set the frequency reference, set the parameters as shown in the table below. This enables the frequency reference input (voltage reference) or frequency reference input (current directive) terminal.

If input is made to both the frequency reference input (voltage reference) and frequency reference input (current reference) terminals, the sum of the two analog input values will be set as the inverter frequency reference.

However, do not set the Multi-function Input S1 to S7 Selection (C001 to C007) to 16 (AT: Analog input switching). The terminal AT, when set, performs switching based on whether it is ON/OFF, without adding the frequency reference (voltage reference) and the frequency reference input (current reference).

The frequency reference input (current reference) cannot be input unless the set terminal AT is input.



- Frequency reference input (Voltage reference), between FV and SC: 0 o 10 VDC
- Frequency reference input (Current reference), between FI and SC: 4 to 20 mA

Note By default, each analog input signal is set to reach the maximum frequency at 9.8 V or 19.8 mA.

Parameter No.	Function name	Data	Default data	Unit
A001/A201	1st/2nd Frequency Reference Selection	01: Control circuit terminal block (Analog input)	02	–
A005	FV/FI Selection	00: Switch between FV (Voltage) and FI (Current) via terminal AT	00	–
C001 to C007	Multi-function Input S1 to S7 Selection	Do not set C001 to C007 to 16 (AT: Analog input switching). [1]	–	–

[1] If the terminal AT is not set, FV input and FI input reference values will be added.

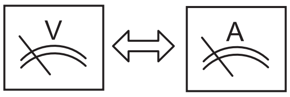
Using an Analog Voltage Input or Analog Current Input by Switching

To switch between the analog voltage and analog current inputs to set the frequency reference, set the parameters as shown in the table below.

This enables switching between the frequency reference input (voltage reference) and frequency reference input (current reference) terminals.

To switch between these analog input signals, use the terminal AT (Analog input switching) allocated to a multi-function input terminal.

When the terminal AT is input, the frequency reference input (current reference) terminal is enabled.



- Frequency reference input (Voltage reference), between FV and SC: 0 to 10 VDC
- Frequency reference input (Current reference), between FI and SC: 4 to 20 mA

Note By default, each analog input signal is set to reach the maximum frequency at 9.8 V or 19.8 mA.

Parameter No.	Function name	Data	Default data	Unit
A001/A201	1st/2nd Frequency Reference Selection	01: Control circuit terminal block (Analog input)	02	–
A005	FV/FI Selection	00: Switch between FV (Voltage) and FI (Current)	00	–
C001 to C007	Multi-function Input S1 to S7 Selection	16: AT (Analog input switching)	–	–

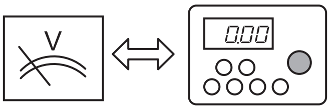
Using an Analog Voltage Input and Volume Control by Switching

To switch between an analog voltage input and the volume control on the Digital Operator (Model: 3G3AX-OP01) to set the frequency reference, set the parameters as shown in the table below.

This enables switching between the frequency reference input (voltage reference) and the volume control on the 3G3AX-OP01.

To switch the reference input, use the terminal AT (Analog input switching) allocated to a multi-function input terminal.

When the terminal AT is input, the volume control on Digital Operator (Model: 3G3AX-OP01) is enabled.



- Frequency reference input (Voltage reference), between FV and SC: 0 to 10 VDC
- Volume control on Digital Operator (Model: 3G3AX-OP01)

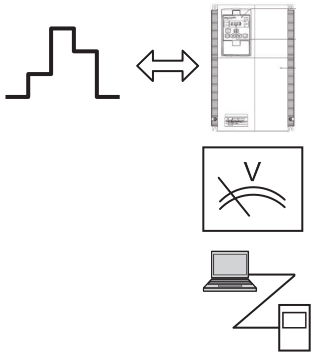
Note By default, each analog input signal is set to reach the maximum frequency at 9.8 V or 19.8 mA.

Parameter No.	Function name	Data	Default data	Unit
A001/A201	1st/2nd Frequency Reference Selection	01: Control circuit terminal block (Analog input)	02	–
A005	FV/FI Selection	02: Switch between FV (Voltage) and volume via terminal AT (Enabled only when 3G3AX-OP01 is used.)	00	–
C001 to C007	Multi-function Input S1 to S7 Selection	16: AT (Analog input switching)	–	–

Using Multi-step Speed Reference

Allocate one of the Multi-function Input S1 to S7 Selection (C001 to C007) to 02 to 05 or 32 to 38 (Multi-step speed) and turn ON that terminal. This enables the inverter to perform multi-step speed operation, independent of Frequency Reference Selection (A001/A201) settings.

The frequency depends on the value set in the Multi-step Speed Reference 1 to 15 (A021 to A035). However, at the 0th speed where multi-step input signals are all OFF, the frequency depends on the 1st/2nd Frequency Reference Selection (A001/A002) setting.



Communications etc.

Set value in A001/A201

Parameter No.	Function name	Data	Default data	Unit
A001/A201	1st/2nd Frequency Reference Selection	02: Digital Operator (F001) [*1]	02	–
A019	Multi-step Speed Selection	00: Binary (16-step selection with 4 terminals) 01: Bit (8-step selection with 7 terminals)	00	–
C001 to C007	Multi-function Input S1 to S7 Selection	02 to 05: CF1 to CF4 Binary 15-step	–	–
		32 to 38: SF1 to SF7 Bit 7-step		
A020	1st Multi-step Speed Reference 0 [*1]	0.00 Starting Frequency to 1st Maximum Frequency	6.00	Hz
A220	2nd Multi-step Speed Reference 0[*2]	0.00 Starting Frequency to 2nd Maximum Frequency		
A021 to A035	Multi-step Speed Reference 1 to 15	0.00 Starting Frequency to Maximum Frequency	0.00	Hz

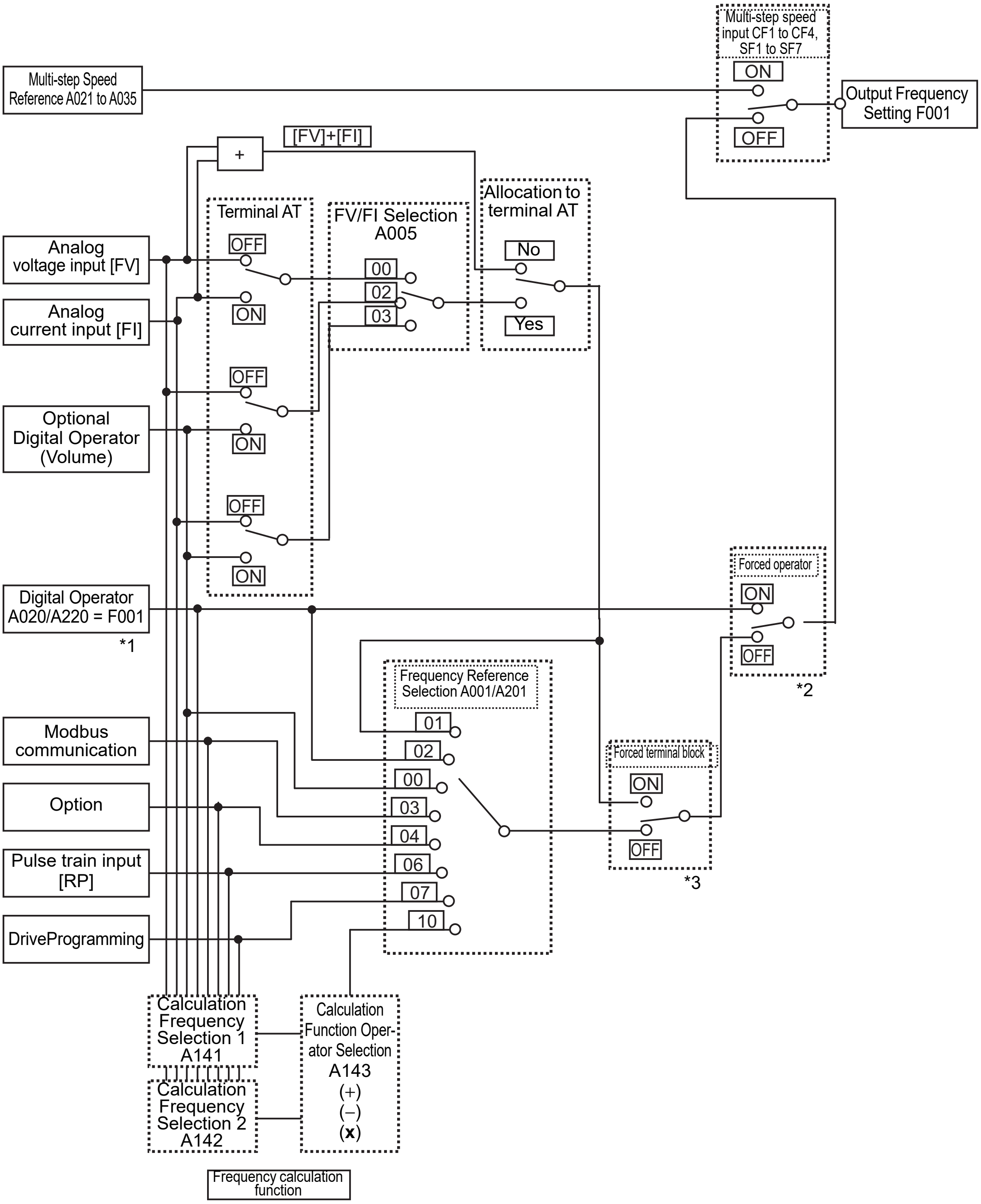
*1. Only the frequency reference at the 0th speed depends on the 1st/2nd Frequency Reference Selection (A001/A002) setting.

*2. To enable the switching to the 2nd control, allocate one of the Multi-function Input Terminal S1 to S7 Selection (C001 to C007) to 08 (SET) and turn ON that terminal.

5-5-2 Frequency Reference Correlation Chart

To set the frequency reference, you need to set the 1st/2nd Frequency Reference Selection (A001/A201).

Alternatively, you can switch the frequency reference via multi-function input or from a communications option unit. Below is a correlation chart among the priority, related parameters, and related multi-function input terminals when the frequency reference is switched.


Multi-step speed input CF1 to CF4, SF1 to SF7
ON
OFF
Multi-step Speed Reference A021 to A035
Output Frequency Setting F001
[FV]+[FI]
+
Terminal AT
OFF
ON
OFF
ON
OFF
ON
FV/FI Selection A005
00
02
03
Allocation to terminal AT
No
Yes
Analog voltage input [FV]
Analog current input [FI]
Optional Digital Operator (Volume)
Digital Operator A020/A220 = F001
*1
Forced operator
ON
OFF
*2
Frequency Reference Selection A001/A201
01
02
00
03
04
06
07
10
Forced terminal block
ON
OFF
*3
Modbus communication
Option
Pulse train input [RP]
DriveProgramming
Calculation Frequency Selection 1 A141
Calculation Frequency Selection 2 A142
Calculation Function Operator Selection A143
(+)
(−)
(x)
Frequency calculation function

*1. Setting the d001/d007 Data Setting Selection (b163) to 01 (Enabled) enables the d001 and d007 settings to be changed and then reflected on the F001 setting.

*2. For details on the forced operator, refer to *7-6-2 Forced Operator Function (OPE)* on page 7-55.

*3. For details on the forced terminal block, refer to *7-6-3 Forced Terminal Block Function (F-TM)* on page 7-55.

Precautions for Correct Use

The Output Frequency Setting/Monitor (F001) shows the frequency reference in the internal memory (RAM).

F001 displays the frequency reference value selected at that time.

If you change the frequency reference value displayed in F001 and save it (by pressing the Enter key), the data will be stored with the multi-step speed reference selected at that time.

- For the multi-step speed reference 0, the data will be stored with the 1st Multi-step Speed Reference 0 (A020)/2nd Multi-step Speed Reference 0 (A220) according to the 1st/2nd Control Method selection.
- For the multi-step speed reference 1 to 15, the data will be stored with the corresponding Multi-step Speed Reference 1 to 15 (A021 to A035).

* The frequency reference of Digital Operator (Volume), Control circuit terminal block (Analog input), Modbus communication, Option, DriveProgramming, and Operation function output cannot be changed in F001.

5-5-3 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).
- Set the upper limit first. Be sure that the value set in the 1st/2nd Frequency Upper Limit (A061/A261) must be larger than the value set in the 1st/2nd Frequency Lower Limit (A062/A262).
- Set the upper and lower limit values so that they do not exceed the 1st/2nd Maximum Frequency (A004/A204).
- The Output Frequency Setting/Monitor (F001) and the Multi-step Speed Reference 1 to 15 (A021 to A035) must be within the range defined by the upper limit and lower limit settings.
- The upper/lower limit setting is disabled when set to 0 Hz.

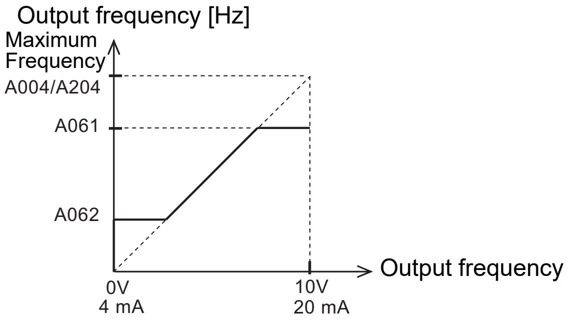
Parameter No.	Function name	Data	Default data	Unit
A061	1st Frequency Upper Limit	0.00: Disabled (Function not active) 1st Frequency Lower Limit to 1st Maximum Frequency	0.00	Hz
A261	2nd Frequency Upper Limit[*1]	0.00: Disabled (Function not active) 2nd Frequency Lower Limit to 2nd Maximum Frequency		
A062	1st Frequency Lower Limit	0.00: Disabled (Function not active) Starting Frequency (b082) to 1st Frequency Upper Limit		
A262	2nd Frequency Lower Limit [*1]	0.00: Disabled (Function not active) Starting Frequency (b082) to 2nd Frequency Upper Limit		
Related functions		C001 to C007		

[*1] To enable the switching to the 2nd control, allocate one of the Multi-function Input Terminal S1 to S7 Selection (C001 to C007) to 08 (SET) and turn ON that terminal.

Using an Analog Voltage Input or Analog Current Input (FV-SC, FI-SC)

Setting the lower limit causes the inverter to output the frequency set in the 1st/2nd Frequency Lower Limit (A062/A262) when 0V (4 mA) is input to the frequency reference.

The graph below shows the FV/FI characteristics with the default analog input start/end function settings (FV: A011 to A015, FI: A101 to A105). For details on the analog input start/end function, refer to *7-3-5 Analog Input Start/End Function Settings* on page 7-25.



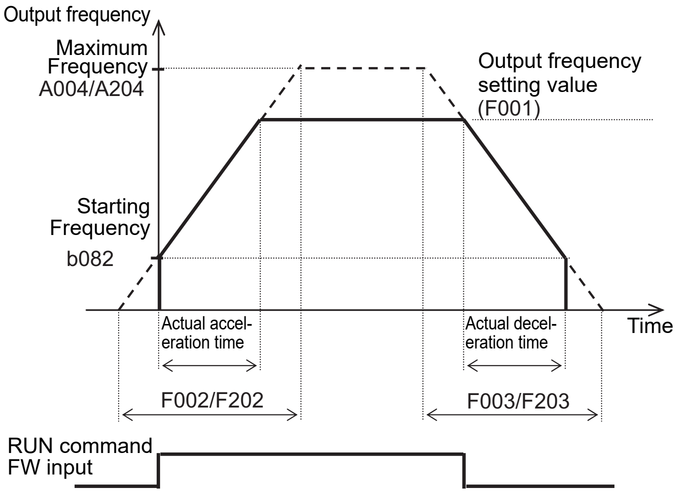
5-6 Acceleration/Deceleration Time Settings

5-6-1 Acceleration/Deceleration Time Settings

- Set the motor acceleration/deceleration time.

  To accelerate/decelerate slowly, set a large value. To accelerate/decelerate quickly, set a small value.
- The set time here indicates the acceleration/deceleration time from 0 Hz to the maximum frequency.

  The actual acceleration/deceleration time varies depending on the frequency reference value.


Output frequency
Maximum Frequency A004/A204
Output frequency setting value (F001)
Starting Frequency b082
Time
Actual accel-eration time
Actual decel-eration time
F002/F202
F003/F203
RUN command FW input

- The acceleration/deceleration time settings will be ignored and the output frequency will instantaneously follow the frequency reference if you set the Multi-function Input S1 to S7 Selection (C001 to C007) to 46 (LAC: LAD cancel) and input the signal to the corresponding terminal.
- To enable the switching to the 1st/2nd Acceleration Time 1 (F002/F202) and to the 1st/2nd Deceleration Time 1 (F003/F203), set one of the Multi-function Input S1 to S7 Selection parameters to 08 (SET) and turn ON the corresponding terminal.

  For the Multi-function Input Selection parameters, refer to *7-2-1 Multi-function Input Selection* on page 7-18.
- The Acceleration/Deceleration Time Input Type (P031) sets the input type of the acceleration/deceleration type.

  Select 00 (Digital Operator) to input via an inverter parameter or 03 (DriveProgramming) to input via the DriveProgramming function.
- The actual motor acceleration/deceleration time cannot be shorter than the minimum acceleration/deceleration time, which is determined by the mechanical inertia moment and the motor torque.

  Setting a time shorter than the minimum acceleration/deceleration time may cause an overcurrent/overvoltage trip.
- These acceleration/deceleration pattern settings are enabled also for frequency reference input via analog input terminals.

Parameter No.	Function name	Data	Default data	Unit
F002	1st Acceleration Time 1	Acceleration time from 0 to maximum frequency 0.00 to 99.99 100.0 to 999.9 1000. to 3600.	10.00 (30.00) [*2]	s
F202	2nd Acceleration Time 1 [*1]			
F003	1st Deceleration Time 1	Deceleration time from maximum frequency to 0 0.00 to 99.99 100.0 to 999.9 1000. to 3600.	10.00 (30.00) [*2]	s
F203	2nd Deceleration Time 1 [*1]			
P031	Acceleration/Deceleration Time Input Type	00: Digital Operator 03: DriveProgramming	00	–
Related functions		A004, A204, C001 to C007		

*1. To enable the switching to the 2nd Acceleration/Deceleration Time 1, set one of the Multi-function Input S1 to S7 Selection (C001 to C007) to 08 (SET) and turn ON that terminal.

*2. In the high-frequency mode.

Additional Information

If a short deceleration time is set, the amount of regeneration fed back during deceleration becomes large. If the amount of regeneration exceeds the amount allowable for the inverter, the deceleration time will be extended according to the Overvoltage Suppression Function Selection During Deceleration (b130) setting, or an overvoltage protection (E07.☐) is detected. In such a case, use the regenerative braking function to shorten the deceleration time below the set value.
For the regenerative braking function, refer to *5-12-2 Regenerative Braking Function* on page 5-65.

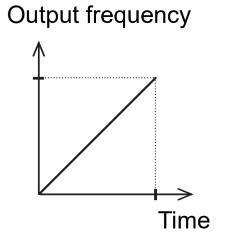
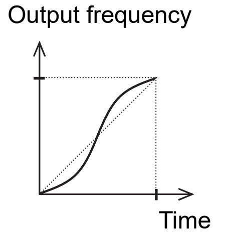
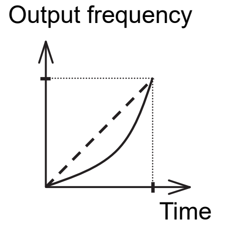
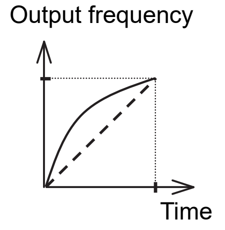
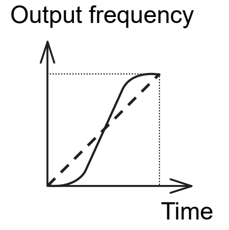
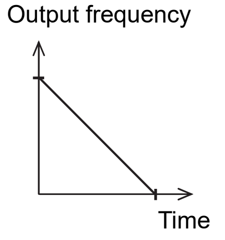
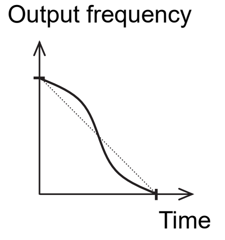
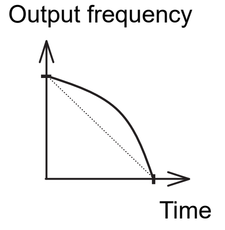
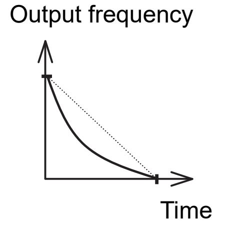
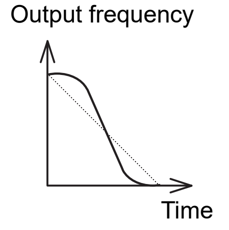
5-6-2 Acceleration/Deceleration Pattern

- Use this function to set the acceleration/deceleration pattern for each system.
- Select the acceleration/deceleration pattern in the Acceleration Pattern Selection (A097) and Deceleration Pattern Selection (A098).
- The acceleration pattern and the deceleration pattern can be set independently.
- These acceleration/deceleration pattern settings are enabled also for frequency reference input via analog input terminals.
- When the acceleration/deceleration pattern is set to EL-S-shape curve, do not change the frequency reference during acceleration/deceleration. Even if the frequency reference is changed during acceleration/deceleration, the inverter operates with the EL-S-shape curve before the change, however the frequency reaches the changed frequency reference.
- In the high-frequency mode, the Acceleration Pattern Selection (A097) and Deceleration Pattern Selection (A098) are fixed to 00 (Line) and thus A097 and A098 are not displayed.

Parameter No.	Function name	Data	Default data	Unit
A097	Acceleration Pattern Selection	00: Line 01: S-shape curve 02: U-shape curve 03: Inverted U-shape curve 04: EL-S-shape curve	01	–
A098	Deceleration Pattern Selection			
A131	Acceleration Curve Parameter	01 (Small curve) to 10 (Large curve)	02	–
A132	Deceleration Curve Parameter			
A150	EL-S Shape Acceleration Curve Ratio 1	0. to 50.	10	%
A151	EL-S Shape Acceleration Curve Ratio 2			
A152	EL-S Shape Deceleration Curve Ratio 1	0. to 50.	10	%
A153	EL-S Shape Deceleration Curve Ratio 2			

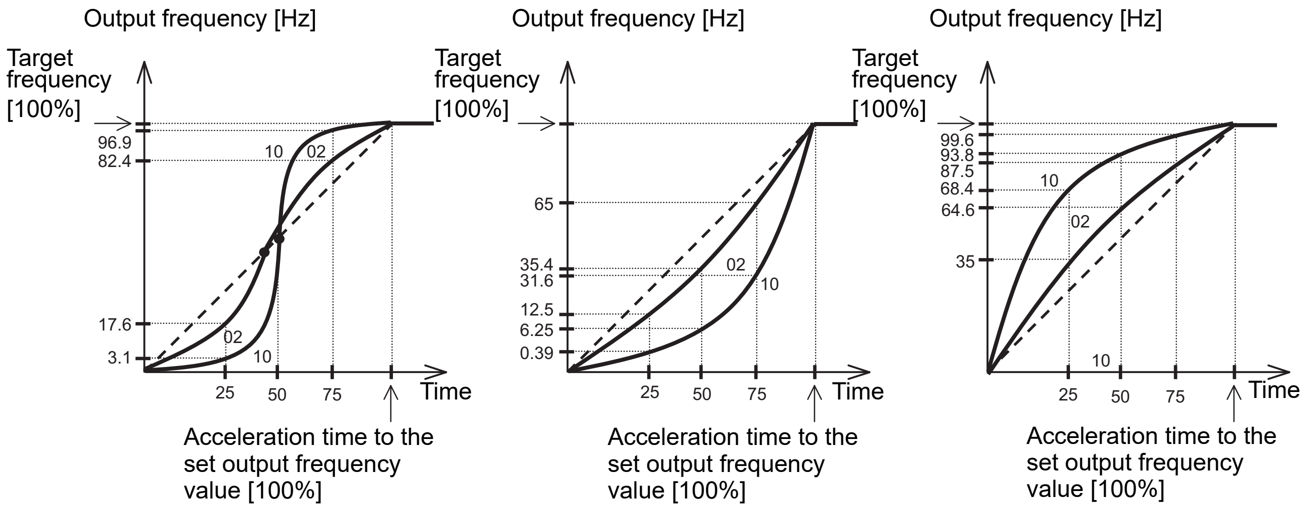
Pattern Selection

Set the Acceleration Pattern Selection/Deceleration Pattern Selection (A097/A098) according to the following table.

Parameter No.	Set value				
	00	01	02	03	04
	Line	S shape	U shape	Inverted U shape	EL-S shape
A097 (Acceleration)					
A098 (Deceleration)					
Description	The motor accelerates/decelerates linearly until the set output frequency value is reached.	This pattern is effective to prevent the collapse of load on an elevator, conveyor, etc.	These patterns are effective for tension control and roll-break prevention applications for winding equipment etc.		This pattern provides shockless start/stop as with the S shape, but the intermediate section is linear.

Pattern Curve Parameter (Curve Factor)

Set the Acceleration Curve Parameter/Deceleration Curve Parameter (A131/A132) according to the following table.



S shape (A097/A098=01)

U shape (A097/A098=02)

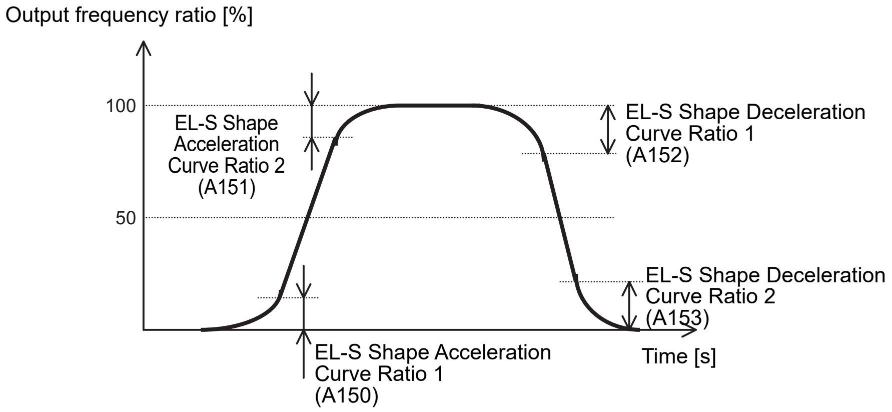
Inverted U shape (A097/A098=03)

- The S-shape pattern has a portion where acceleration/deceleration time is faster in the middle of the curve.
- If the LAD cancel (LAC) function is allocated to a multi-function input terminal and that terminal is input, the acceleration/deceleration pattern is ignored and the output frequency follows the frequency reference.

EL-S-shape Curve Ratio

With the EL-S-shape pattern, you can set the EL-S Shape Acceleration/Deceleration Curve Ratio (A150 to A153) independently.

Setting all of these parameters to 50 (%) is equivalent to selecting the S-shape pattern.



5-6-3 2-step Acceleration/Deceleration Function

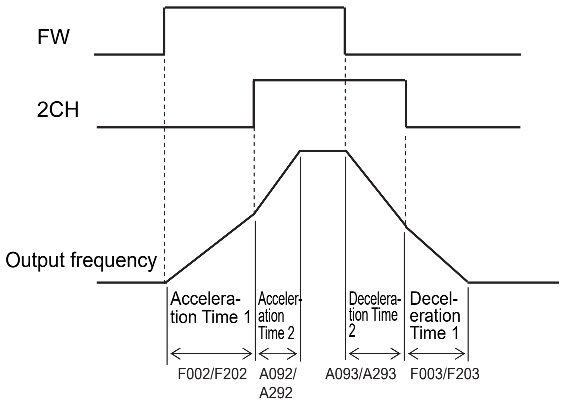
- Use the 2-step acceleration/deceleration function to switch between two acceleration/deceleration time settings or change the acceleration/deceleration time on the way during acceleration/deceleration.
- The acceleration/deceleration time switching method can be selected from the following three.
  - A094/A294 = 00: Switch via 2CH terminal (multi-function input set to 09) (Example 1)
  - A094/A294 = 01: Switch by 2-step Acceleration/Deceleration Frequency (A095/A295/A096/A296) (Example 2)
  - A094/A294 = 02: Switch only during forward/reverse switching (Example 3)
- To switch via a multi-function input terminal, set one of the parameters C001 to C007 to 09 (2CH).

Parameter No.	Function name	Data	Default data	Unit
A092	1st Acceleration Time 2	0.00 to 99.99 100.0 to 999.9 1000. to 3600.	10.00 (15.00) [*2]	s
A292	2nd Acceleration Time 2 [*1]			
A093	1st Deceleration Time 2	0.00 to 99.99 100.0 to 999.9 1000. to 3600.	10.00 (15.00) [*2]	s
A293	2nd Deceleration Time 2 [*1]			
A094	1st 2-step Acceleration/Deceleration Selection	00: Switch via 2CH terminal (multi-function input: 09) (Example 1) 01: Switch by setting (A095/A295/A096/A296) (Example 2) 02: Switch only during forward/reverse switching (Example 3)	00	–
A294	2nd 2-step Acceleration/Deceleration Selection [*1]			
A095	1st 2-step Acceleration Frequency	0.00 to 99.99 100.0 to 400.0 (580.0) [*2]	0.00	Hz
A295	2nd 2-step Acceleration Frequency [*1]			
A096	1st 2-step Deceleration Frequency	0.00 to 99.99 100.0 to 400.0 (580.0) [*2]	0.00	Hz
A296	2nd 2-step Deceleration Frequency [*1]			
Related functions		F002, F202, F003, F203, C001 to C007		

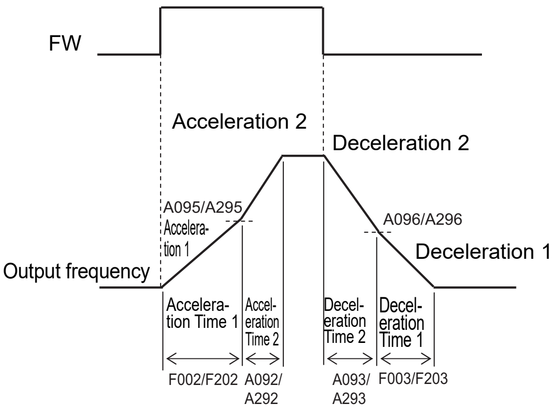
[*1] To enable the switching to the 2nd Acceleration/Deceleration Time 2 and to 2nd 2-step Acceleration/Deceleration Frequency, set one of the Multi-function Input S1 to S7 Selection (C001 to C007) to 08 (SET) and turn ON that terminal.

[*2] In the high-frequency mode.

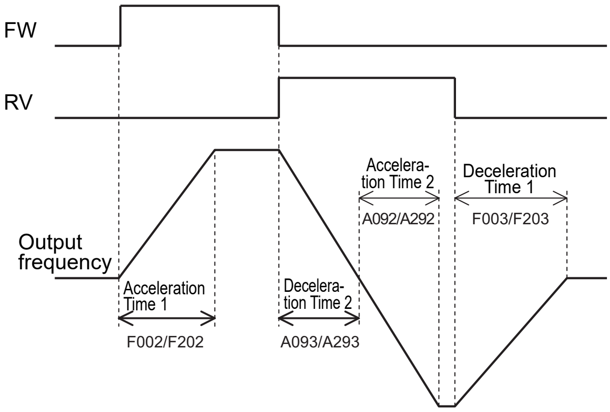
(Example 1) When 1st/2nd 2-step Acceleration/Deceleration Selection (A094/A294) is set to 00 Switch via 2CH terminal


FW
2CH
Output frequency
Accelera-tion Time 1
Acceler-ation Time 2
Decelera-tion Time 2
Decel-eration Time 1
F002/F202
A092/A292
A093/A293
F003/F203

(Example 2) When 1st/2nd 2-step Acceleration/Deceleration Selection (A094/A294) is set to 01 Switch by setting


FW
Acceleration 2
Deceleration 2
A095/A295
Accelera-tion 1
A096/A296
Deceleration 1
Output frequency
Accelera-tion Time 1
Accel-eration Time 2
Decel-eration Time 2
Decel-eration Time 1
F002/F202
A092/A292
A093/A293
F003/F203

(Example 3) When 1st/2nd 2-step Acceleration/Deceleration Selection (A094/A294) is set to 02 Switch only during forward/reverse switching


FW
RV
Output frequency
Accelera-tion Time 2
A092/A292
Deceleration Time 1
F003/F203
Acceleration Time 1
F002/F202
Decelera-tion Time 2
A093/A293

5-7 Stop Method Settings

5-7-1 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 Digital Operator or the control circuit terminal block.
- To use external braking, select Free-run stop.

  Using external braking during deceleration stop may cause an overload or overcurrent.
- If you start the RUN command again during free run, the inverter will restart according to the Free-run Stop Selection (b088) setting.

Parameter No.	Function name	Data	Default data	Unit
b091	Stop Selection	00: Deceleration stop 01: Free-run stop	00	–

5-7-2 Free-run Stop Selection

- Free-run stop is a method of shutting off the inverter output to stop the motor rotation.

  Executing the free-run stop function causes the motor to fall a free-run state, in which it decelerates due to the load and friction forces exerted on the motor and/or machine and comes to a stop.
- In the Free-run Stop Selection (b088), set how to restart the motor rotating in a free-run state after the execution of the free-run stop.
- The Free-run Stop Selection (b088) setting is enabled for the following cases.

  When Stop Selection (b091) is set to 01 (Free-run stop)

  Restarting the motor in a free-run stop state when the When Stop Selection (b091) is set to 01 (Free-run stop) causes the motor to restart according to the Free-run Stop Selection (b088) setting.

  When free-run stop (FRS) function is used via a multi-function input terminal

  Setting the Multi-function Input S1 to S7 Selection (C001 to C007) to 11 (FRS) and turning ON the corresponding input terminal causes the motor to fall in a free-run stop state (with the inverter output shut off).

  Then, when the FRS terminal turns OFF, the motor restarts according to the Free-run Stop Selection (b088) setting.

  However, the motor does not restart when the 1st/2nd RUN Command Selection (A002/A202) is set to 02 (Digital Operator).
- Set the Free-run Stop Selection (b088) as follows.

  00: 0-Hz restart

  Forces the inverter to restart at 0 Hz. Note that the inverter restarts suddenly while in a free-run state. Use this setting if the motor stops shortly due to the load.

  01: Frequency matching restart

  Causes the inverter to restart by recognizing the frequency from the voltage between the motor terminals during free-run stop and adjusting to it. The inverter restarts at 0 Hz if the voltage between the motor terminals is not sufficient.

  Use this setting if the inverter is in a free-run stop for a few seconds.

02: Frequency pull-in restart

Causes the inverter to restart by outputting the starting frequency set in the Starting Frequency Selection at Frequency Pull-in Restart (b030) to the motor in a free-run stop state and re-accelerating when the Frequency Pull-in Restart Level (b028) is reached.

This enables a smooth restart independently 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.

- When the Frequency Matching Lower Limit Frequency (b007) is set, executing the frequency pull-in restart function causes the inverter to restart at 0 Hz if the set frequency or less is detected.
- Immediately after a free-run stop, a large residual voltage remains between motor terminals.

  If the inverter restarts the output, an overcurrent may occur. In this case, set the Restart Standby Time (b003) to a long time.
- While in a free-run stop state, the motor is not subject to external influence because the inverter output is shut off.

  Even if the motor is stopped by external brake or the effect of other equipment, the inverter can still be used without detecting any overcurrent.

  However, if the motor in a free-run state is rotated externally, the regenerated energy may be fed back to the inverter and an overvoltage may be detected. In this case, use the regenerative braking function.

Parameter No.	Function name	Data		Default data	Unit
b088	Free-run Stop Selection	00: 0-Hz restart (Example 1) 01: Frequency matching restart (Example 2) 02: Frequency pull-in restart (Example 3)		00	–
b003	Restart Standby Time	0.3 to 100.0		1.0	s
b007	Frequency Matching Lower Limit Frequency	0.00 to 99.99 100.0 to 400.0 (580.0) *1		0.00	Hz
b028	Frequency Pull-in Restart Level	Heavy load (CT)	0.20 × Rated current to 2.00 × Rated current	Rated current value	A
		Light load (VT)	0.20 × Rated current to 1.50 × Rated current		
b029	Frequency Pull-in Restart Parameter	0.1 to 999.9 1000. to 3000. Set the deceleration rate for the output frequency during frequency pull-in restart. Set the deceleration time from the maximum frequency to 0 Hz.		0.5	s
b030	Starting Frequency Selection at Frequency Pull-in Restart	00: Frequency at interruption 01: Maximum Frequency 02: Set frequency (Frequency reference)		00	–
C001 to C007	Multi-function Input S1 to S7 Selection	11: FRS (Free-run stop)		–	–

*1. In the high-frequency mode.

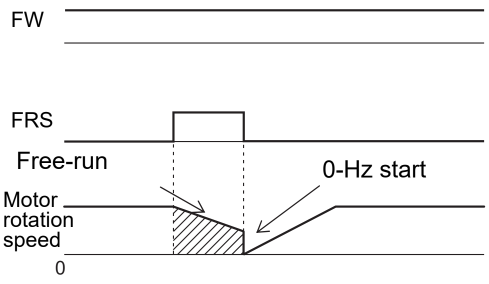
- The details of the Starting Frequency Selection at Frequency Pull-in Restart (b030) are shown below.

Set value	Content	Description
00	Frequency at interruption	Executes pull-in restart from frequency at which inverter output is shut off.
01	Maximum Frequency	Executes pull-in restart from maximum frequency.
02	Set frequency	Executes pull-in restart from set frequency reference.

- The examples below assume that the FRS terminal is used.

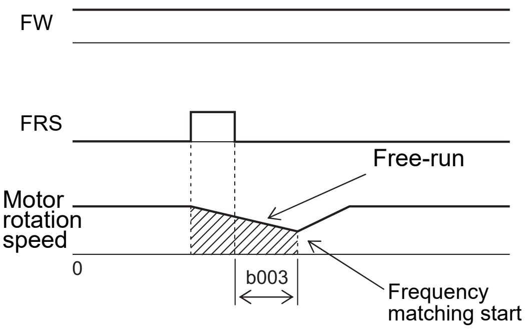
  When the motor is stopped in a free-run state by the STOP command, restarting of the inverter occurs in the same timing as when the FRS terminal turns OFF.

(Example 1) 0-Hz restart (b088 = 00)


FW
FRS
Free-run
0-Hz start
Motor rotation speed
0

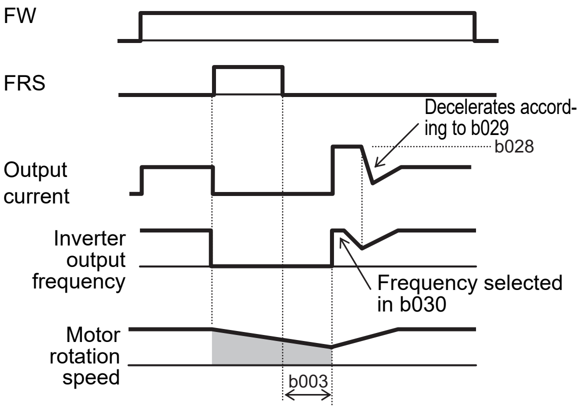
- The inverter restarts at 0 Hz independent of the motor rotation speed. The Restart Standby Time setting will be ignored during 0-Hz restart.
- If the inverter starts at 0 Hz at a high motor rotation speed, an overcurrent trip may occur.

(Example 2) Frequency matching start (b088 = 01)


FW
FRS
Free-run
Motor rotation speed
0
b003
Frequency matching start

- When the restart standby time elapses after the FRS terminal is turned OFF, the inverter detects the motor frequency and executes the frequency matching restart function without stopping the motor rotation. If an overcurrent trip occurs during a frequency matching restart, increase the restart standby time.
- Even when the Free-run Stop Selection is set to 01 (Frequency matching start), the inverter may restart at 0 Hz in the following cases.
    - The motor rotation speed is equal to or lower than 1/2 of the base frequency.
    - The motor induction voltage decays quickly and the motor rotation speed cannot be detected.
    - The inverter recognizes that the detected frequency is equal to or less than the value set in the Frequency Matching Lower Limit Frequency (b007).

(Example 3) Frequency pull-in restart (b088 = 02)


FW
FRS
Decelerates according to b029
b028
Output current
Inverter output frequency
Frequency selected in b030
Motor rotation speed
b003

- When the set Restart Standby Time (b003) elapses, the inverter starts output at the frequency set in the Starting Frequency Selection at Frequency Pull-in Restart (b030).
  Then, the inverter decelerates the motor according to the Frequency Pull-in Restart Parameter (b029) setting, while suppressing the output current to the value set in the Frequency Pull-in Restart Level (b028).
- When the current decreases to or below the Frequency Pull-in Restart Level (b028), the inverter accelerates again to return to the original frequency.
- If an overcurrent trip occurs with this method, reduce the Frequency Pull-in Restart Level (b028).

5-7-3 STOP Key Selection

- Enable/disable the STOP/RESET key on the Digital Operator.
- This setting is enabled when the 1st/2nd RUN Command Selection (A002/A202) is not set to 02 (Digital Operator).

  However, when the 1st/2nd RUN Command Selection (A002/A202) is set to 02 (Digital Operator), the STOP/RESET key is enabled independent of this setting.

Parameter No.	Function name	Data	Default data	Unit
b087	STOP Key Selection	00: Enabled 01: Disabled 02: Only RESET enabled	00	–

Data	STOP command via STOP/RESET key on Digital Operator	Trip reset via STOP/RESET key on Digital Operator
00	Enabled	Enabled
01	Disabled	Disabled
02	Disabled	Enabled

Precautions for Safe Use

The STOP/RESET key on the Digital Operator is enabled only when the STOP Key Selection (b087) is set to 00: Enabled (default data).

Be sure to provide a separate emergency stop switch.

5-8 Reset Method Settings

5-8-1 Reset

- Use the reset function to reset the trip status of the inverter. This function is used also when the inverter is running normally to shut off the inverter output.

  To prevent the reset function from being activated when the Inverter is running normally, set the Reset Selection (C102) to 02 (Enabled only during trip) or 03 (Reset only during trip).
- If the reset signal is input to the inverter, calculated electronic thermal function data, calculated regenerative braking usage rate data, multi-function pulse counter data, current position monitor data, and internal counter data used for the protective function are cleared. To prevent these data from being cleared, set the Reset Selection (C102) to 03 (Reset only during trip).
- Setting the STOP Key Selection (b087) to 00 (Enabled) or 02 (Only RESET enabled) enables the input of the reset signal via the STOP/RESET key on the Digital Operator.
- To input the reset signal via the control circuit terminal block, set the Multi-function Input S1 to S7 Selection (C001 to C007) to 18 (RS: Reset).
- The terminal RS (Reset) only supports NO (normally open contact) as the input method. The Multi-function Input S1 to S7 Operation Selection (C011 to C017) cannot be set to 01 (NC: Normally closed contact). Be sure to set the NO contact.
- Setting the Reset Selection (C102) to 01 (Trip reset at power-off) enables the reset function to be activated at the falling edge of the signal.
- In the Reset Restart Selection (C103), select the restart method after reset is executed.

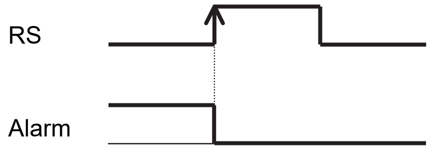
  When the Reset Restart Selection (C103) is set to 00 (0-Hz restart), the inverter restarts from 0 Hz.

  In addition, when the Reset Selection (C102) is set to 03 (Trip reset only), the inverter restarts from 0 Hz independently of the C103 setting.

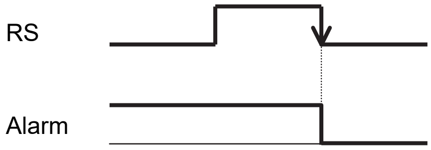
Parameter No.	Function name	Data	Default data	Unit
C102	Reset Selection	00: Trip reset at power-on (Example 1) 01: Trip reset at power-off (Example 2) 02: Enabled only during trip (Reset at power-on) (Example 1) 03: Reset only during trip (Example 1)	02 [*1]	–
C103	Reset Restart Selection	00: 0-Hz restart 01: Frequency matching restart 02: Frequency pull-in restart	00	–
C001 to C007	Multi-function Input S1 to S7 Selection	18: RS (Reset)	–	–

*1. The default data was changed from the previous model.

(Example 1)Trip reset at power-on
(C102 = 00, 02, or 03)



(Example 2)Trip reset at power-off
(C102 = 01)



Precautions for Safe Use

Be sure to confirm the RUN signal is not input before resetting the alarm because the machine may abruptly start.

Precautions for Correct Use

- The reset function clears the data of calculated electronic thermal function and calculated usage rate of regenerative braking.

  Therefore, frequent use of the reset function causes the motor overload protection and braking resistor overheat protection functions of the inverter to malfunction.

  If you execute the reset function continuously, wait until the motor and braking resistor temperatures drop.

  To shut off the inverter output, use the free-run stop function, instead of the reset function.
- When a trip occurs, the inverter will ignore the RUN command even if it is ON.

  Enter the RUN command again after inputting the reset signal.

5-8-2 Restart after Resetting

- In the Reset Restart Selection (C103), select the restart method after trip reset is executed.

  However, when the Reset Selection (C102) is set to 03 (Trip reset only), the inverter restarts from 0 Hz independently of the C103 setting.
- To reset via the control circuit terminal block, set the Multi-function Input S1 to S7 Selection (C001 to C007) to 18 (RS: Reset).
- After the reset signal is input and the motor falls in a free-run state, a large residual voltage remains between motor terminals.

  If the inverter restarts the output in this condition, an overcurrent may occur.

  To avoid this, set the Restart Standby Time (b003) to a large value.
- When the Reset Restart Selection (C103) is set to 00 (0-Hz restart), the inverter ignores the Restart Standby Time (b003) and restarts from 0 Hz.
- Setting Reset Restart Selection (C103) to 01 (Frequency matching restart) causes the inverter to perform frequency matching restart also after power cycle.

<table>
<tr><th>Parameter No.</th><th>Function name</th><th colspan="2">Data</th><th>Default data</th><th>Unit</th></tr>
<tr><td>b003</td><td>Restart Standby Time</td><td colspan="2">0.3 to 100.0</td><td>1.0</td><td>s</td></tr>
<tr><td>b007</td><td>Frequency Matching Lower Limit Frequency</td><td colspan="2">0.00 to 99.99
100.0 to 400.0 (580.0) [*1]</td><td>0.00</td><td>Hz</td></tr>
<tr><td rowspan="2">b028</td><td rowspan="2">Frequency Pull-in Restart Level</td><td>Heavy load (CT)</td><td>0.20 × Rated current to 2.00 × Rated current</td><td rowspan="2">Rated current value</td><td rowspan="2">A</td></tr>
<tr><td>Light load (VT)</td><td>0.20 × Rated current to 1.50 × Rated current</td></tr>
<tr><td>b029</td><td>Frequency Pull-in Restart Parameter</td><td colspan="2">0.1 to 999.9
1000. to 3000.
Set the deceleration rate for the output frequency during frequency pull-in restart.
Set the deceleration time from the maximum frequency to 0 Hz.</td><td>0.5</td><td>s</td></tr>
<tr><td>b030</td><td>Starting Frequency Selection at Frequency Pull-in Restart</td><td colspan="2">00: Frequency at interruption
01: Maximum Frequency
02: Set frequency (Frequency reference)</td><td>00</td><td>–</td></tr>
<tr><td>C103</td><td>Reset Restart Selection</td><td colspan="2">00: 0-Hz restart
01: Frequency matching restart (Example 1)
02: Frequency pull-in restart (Example 2)</td><td>00</td><td>–</td></tr>
</table>

*1. In the high-frequency mode.

- The details of the Starting Frequency Selection at Frequency Pull-in Restart (b030) are shown below.

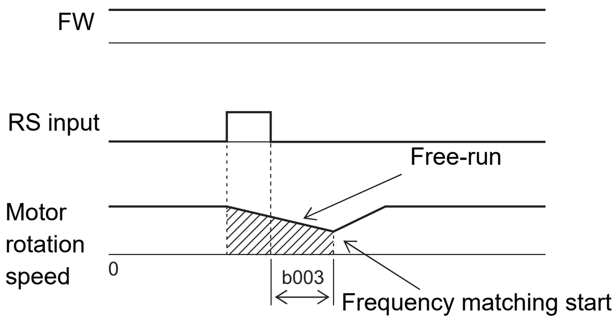
Set value	Content	Description
00	Frequency at interruption	Executes pull-in restart from frequency at which inverter output is shut off.
01	Maximum Frequency	Executes pull-in restart from maximum frequency.
02	Set frequency	Executes pull-in restart from set frequency reference.

(Example 1) Frequency matching restart

When the Restart Standby Time (b003) elapses, the inverter detects the motor frequency and executes the frequency matching restart function without stopping the motor rotation. If an overcurrent trip occurs during a frequency matching restart, increase the restart standby time.

Even when the Free-run Stop Selection is set to 01 (Frequency matching start), the inverter may restart at 0 Hz in the following cases.

- The motor rotation speed is equal to or lower than 1/2 of the base frequency.
- The motor induction voltage decays quickly and the motor rotation speed cannot be detected.
- The inverter recognizes that the detected frequency is equal to or less than the value set in the Frequency Matching Lower Limit Frequency (b007).

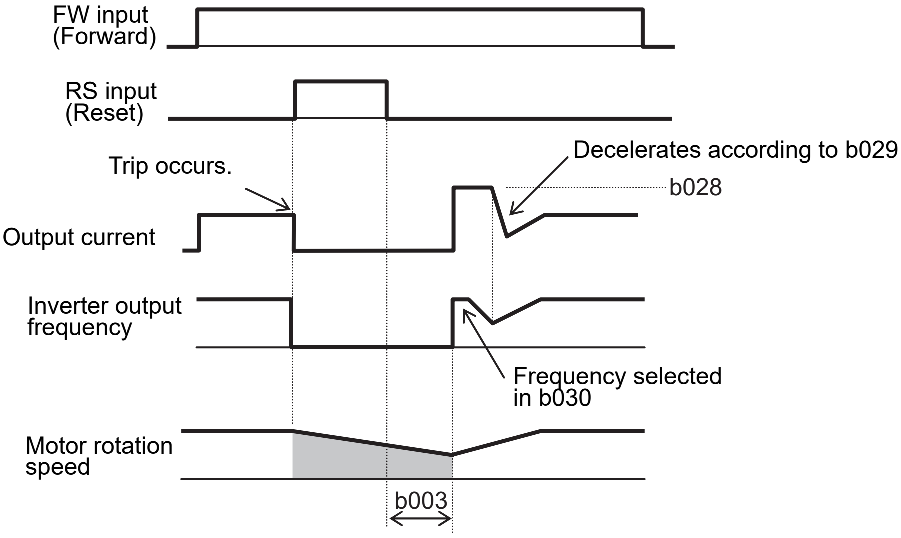

FW
RS input
Free-run
Motor rotation speed
0
b003
Frequency matching start

(Example 2) Frequency pull-in restart

When the set Restart Standby Time (b003) elapses, the inverter starts output at the frequency set in the Starting Frequency Selection at Frequency Pull-in Restart (b030). Then, the inverter decelerates the motor according to the Frequency Pull-in Restart Parameter (b029) setting, while suppressing the output current to the value set in the Frequency Pull-in Restart Level (b028).

When the current decreases to or below the Frequency Pull-in Restart Level (b028), the inverter accelerates again to return to the original frequency.

If this method causes an overcurrent trip, decrease the value set in the Frequency Pull-in Restart Level (b028).


FW input
(Forward)
RS input
(Reset)
Trip occurs.
Decelerates according to b029
b028
Output current
Inverter output frequency
Frequency selected in b030
Motor rotation speed
b003

Additional Information

If the reset signal is input during the restart standby time, the “frequency at shutoff” data stored in the inverter will be cleared, as a result the inverter restarts from 0 Hz after the reset is cleared.

5-9 Multi-function Input Settings

5-9-1 Multi-function Input Selection

- You can allocate the functions shown in the following table to the multi-function input terminals S1 to S7 to use them.
- This section describes seven types of primary functions. For other functions, refer to *7-2 Multi-function Input/Output Functions* on page 7-18.

  To allocate the functions, set the values shown in the Data column of the following table in the Multi-function Input S1 to S7 Selection (C001 to C007).
- Do not allocate the same function to more than one multi-function input terminal. If you allocate the same function to more than one multi-function input terminal by mistake, the function will be set only for the terminal to which you allocated last and the previously allocated terminal will be reset to 255 (no: No allocation).

Parameter No.	Data	Function name	Reference item	Page
Multi-function Input S1 to S7 Selection (C001 toC007)	00	FW: Forward	Forward run command	P. 5-48
	01	RV: Reverse	Reverse run command	P. 5-48
	02	CF1: Multi-step speed setting binary 1	Multi-step speed operation function	P. 5-49
	03	CF2: Multi-step speed setting binary 2		
	04	CF3: Multi-step speed setting binary 3		
	05	CF4: Multi-step speed setting binary 4		
	06	JG: Jogging	Jogging	P. 5-52
	09	2CH: 2-step acceleration/deceleration	2-step acceleration/deceleration	P. 5-53
	18	RS: Reset	Reset	P. 5-53
	20	STA: 3-wire start	3-wire input function	P. 5-54
	21	STP: 3-wire stop		
	22	F/R: 3-wire forward/reverse		
	32	SF1: Multi-step speed setting bit 1	Multi-step speed operation function	P. 5-49
	33	SF2: Multi-step speed setting bit 2		
	34	SF3: Multi-step speed setting bit 3		
	35	SF4: Multi-step speed setting bit 4		
	36	SF5: Multi-step speed setting bit 5		
	37	SF6: Multi-step speed setting bit 6		
	38	SF7: Multi-step speed setting bit 7		

5-9-2 Multi-function Input Operation Selection

The multi-function input terminals can be set to either NO (NO contact) or NC (NC contact) individually. This manual describes each function with the Multi-function Input S1 to S7 Operation Selection (C011 to C017) set to 00 (NO: NO contact). Note that the operations of set signals are reversed when you set them to 01 (NC: NC contact).

Parameter No.	Function name	Data	Default data	Unit
C011	Multi-function Input S1 Operation Selection	00: NO (NO contact) 01: NC (NC contact) • Each multi-function input terminal S1 to S7 can be set independently to either an NO contact or NC contact input terminal. [*1] • The terminal allocated to 18 (RS: Reset) cannot be set to NC contact. Be sure to set the NO contact.	00	–
C012	Multi-function Input S2 Operation Selection			
C013	Multi-function Input S3 Operation Selection			
C014	Multi-function Input S4 Operation Selection			
C015	Multi-function Input S5 Operation Selection			
C016	Multi-function Input S6 Operation Selection			
C017	Multi-function Input S7 Operation Selection			
Related functions		C001 to C007		

*1. NO contact: ON when closed, OFF when open
NC contact: ON when open, OFF when closed

5-9-3 Input Terminal Response Time

- Set the response time for each multi-function input S1 to S7 terminal independently.
  This function is effective for removing noise caused by chattering etc.
- If the terminal input becomes unstable because of chattering, increase the set value.
  However, increasing the set value results in a slow response.
  The setting range is 0 to 200, which provides a response time of approximately 2 to 400 ms.

Parameter No.	Function name	Data	Default data	Unit
C160 to C166	Multi-function Input S1 to S7 Response Time	0. to 200. (× 2 ms) [*1]	1.	ms

*1. When 0 is set, the response time is 2 ms.

5-9-4 Forward RUN Command (FW) and Reverse RUN Command (RV)

- To input the forward and reverse RUN commands via the control circuit terminals, set the Multi-function Input S1 to S7 Selection (C001 to C007) to 00 (FW) and 01 (RV).
- By default, the Multi-function Input S1 Selection (C001) is set to 00 (FW) and the Multi-function Input S2 Selection (C002) is set to 01 (RV), respectively.
- To input the RUN command via these control circuit terminals, set the 1st/2nd RUN Command Selection (A002/A202) to 01 (Control circuit terminal block).
- If the terminals FW and RV turn ON simultaneously, the inverter will stop without displaying any alarm. It will start operating again when either of these terminals turns OFF.

Parameter No.	Function name	Data	Default data	Unit
C001 to C007	Multi-function Input S1 to S7 Selection	00: FW (Forward) 01: RV (Reverse)	–	–

5-9-5 Multi-step Speed Operation Function

- Use this function to switch the frequency reference set in the Multi-step Speed Reference 0 to 15 based on the combination of inputs to multi-function input terminals.
- For multi-step speed operation, you can select either 4-terminal binary operation (in 16 steps maximum) or 7-terminal bit operation (in 8 steps maximum).

Parameter No.	Function name	Data	Default data	Unit
A019	Multi-step Speed Selection	00: Binary (16-step selection with 4 terminals) 01: Bit (8-step selection with 7 terminals)	00	–
A020	1st Multi-step Speed Reference 0	0.00 Starting Frequency (b082) to 1st Maximum Frequency (A004)	6.00	Hz
A220	2nd Multi-step Speed Reference 0[*1]	0.00 Starting Frequency (b082) to 2nd Maximum Frequency (A204)		
A021	Multi-step Speed Reference 1	0.00 Starting Frequency (b082) to 1st/2nd Maximum Frequency (A004/204)	0.00	
A022	Multi-step Speed Reference 2			
A023	Multi-step Speed Reference 3			
A024	Multi-step Speed Reference 4			
A025	Multi-step Speed Reference 5			
A026	Multi-step Speed Reference 6			
A027	Multi-step Speed Reference 7			
A028	Multi-step Speed Reference 8			
A029	Multi-step Speed Reference 9			
A030	Multi-step Speed Reference 10			
A031	Multi-step Speed Reference 11			
A032	Multi-step Speed Reference 12			
A033	Multi-step Speed Reference 13			
A034	Multi-step Speed Reference 14			
A035	Multi-step Speed Reference 15			

[*1] To enable the switching to the 2nd control, allocate one of the Multi-function Input Terminal S1 to S7 Selection (C001 to C007) to 08 (SET) and turn ON that terminal.

Precautions for Correct Use

Use the 1st/2nd Frequency Reference Selection (A001/A201) to set the 1st/2nd Multi-step Speed Reference 0 (A020/A220).

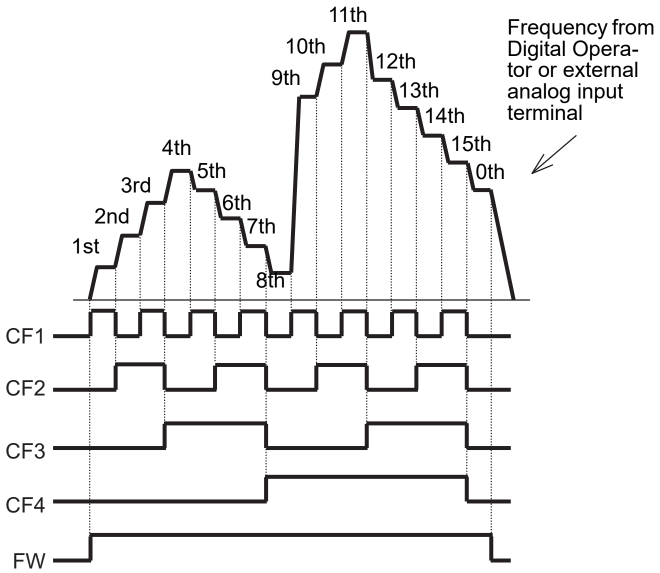
Set the 1st/2nd Frequency Reference Selection (A001/A201) to 02 (Digital Operator: F001) to enable the 1st/2nd Multi-step Speed Reference 0 (A020/A220).

Binary Operation

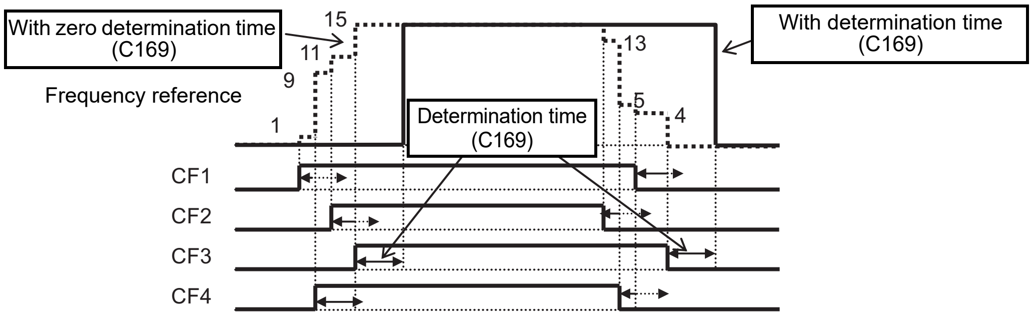
- Setting the Multi-function Input S1 to S7 Selection (C001 to C007) to 02 (CF1) to 05 (CF4) enables the selection of the multi-step speed 0 to 15.
- Use the Multi-step Speed Reference 1 to 15 (A021 to A035) to set the frequency for the multi-step speed 1 to 15.
- Use the 1st/2nd Frequency Reference Selection (A001/A201) to set the 1st/2nd Multi-step Speed Reference 0 (A020/A220).
  Set the 1st/2nd Frequency Reference Selection (A001/A201) to 02 (Digital Operator: F001) to enable the 1st/2nd Multi-step Speed Reference 0 (A020/A220).
  If A001/A201 are set to 01 (Control circuit terminal block: Analog input), the analog input is used as the frequency reference to set the 1st/2nd Multi-step Speed Reference 0.

Parameter No.	Function name	Data	Default data	Unit
C001 to C007	Multi-function Input S1 to S7 Selection	02: CF1 (Multi-step speed setting binary 1) 03: CF2 (Multi-step speed setting binary 2) 04: CF3 (Multi-step speed setting binary 3) 05: CF4 (Multi-step speed setting binary 4)	–	–
C169	Multi-step Speed/Position Determination Time	0. to 200. (× 10 ms)	0.	ms

Multi-step speed	CF4	CF3	CF2	CF1
0th	OFF	OFF	OFF	OFF
1st				ON
2nd			ON	OFF
3rd				ON
4th		ON	OFF	OFF
5th				ON
6th			ON	OFF
7th				ON
8th	ON	OFF	OFF	OFF
9th				ON
10th			ON	OFF
11th				ON
12th		ON	OFF	OFF
13th				ON
14th			ON	OFF
15th				ON


11th
10th
9th
12th
13th
14th
15th
0th
4th
5th
3rd
6th
2nd
7th
1st
8th
Frequency from Digital Operator or external analog input terminal
CF1
CF2
CF3
CF4
FW

- For multi-step speed binary operation, the wait time until the inverter recognizes terminal input can be set in the Multi-step Speed/Position Determination Time (C169). This prevents the transitional status before terminal input is recognized from being accepted.
- Input data will be determined if it remains unchanged for the time set in the Multi-step Speed/Position Determination Time (C169). Note that setting a long determination time results in a slow input response.


With zero determination time (C169)
15
11
9
1
Frequency reference
Determination time (C169)
13
5
4
With determination time (C169)
CF1
CF2
CF3
CF4

Bit Operation

- Setting the Multi-function Input S1 to S7 Selection (C001 to C007) to 32 (SF1) to 38 (SF7) enables the selection of the multi-step speed 0 to 7.
- Use the Multi-step Speed Reference 1 to 7 (A021 to A027) to set the frequency for SF1 to SF7.
- Use the 1st/2nd Frequency Reference Selection (A001/A201) to set the 1st/2nd Multi-step Speed Reference 0 (A020/A220).

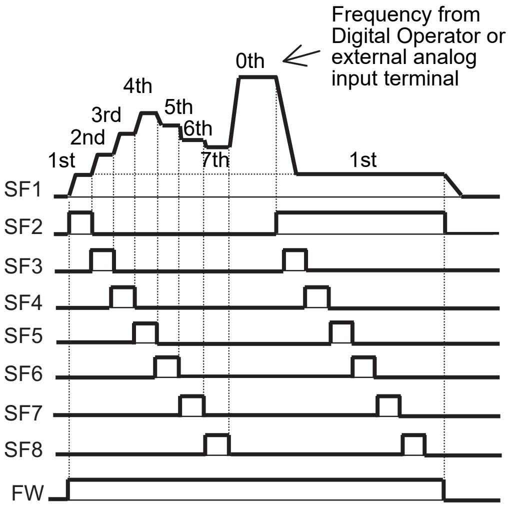
  Set the 1st/2nd Frequency Reference Selection (A001/A201) to 02 (Digital Operator: F001) to enable the 1st/2nd Multi-step Speed Reference 0 (A020/A220).

  If A001/A201 are set to 01 (Control circuit terminal block: Analog input), the analog input is used as the frequency reference to set the 1st/2nd Multi-step Speed Reference 0.

Parameter No.	Function name	Data	Default data	Unit
C001 to C007	Multi-function Input S1 to S7 Selection	32: SF1 (Multi-step speed setting bit 1) 33: SF2 (Multi-step speed setting bit 2) 34: SF3 (Multi-step speed setting bit 3) 35: SF4 (Multi-step speed setting bit 4) 36: SF5 (Multi-step speed setting bit 5) 37: SF6 (Multi-step speed setting bit 6) 38: SF7 (Multi-step speed setting bit 7)	–	–

Multi-step speed	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

Note When several terminals simultaneously turn ON, priority is given to the terminal with the smallest number. "Disabled" in the above table indicates that speed is selected regardless of the ON/OFF status.


Frequency from Digital Operator or external analog input terminal
0th
4th
3rd
5th
2nd
6th
1st
7th
1st
SF1
SF2
SF3
SF4
SF5
SF6
SF7
SF8
FW

5-9-6 Jogging (JG)

- When the jogging function is enabled, jogging operation starts when the RUN command is input.
- To enable the jogging function, set the Multi-function Input S1 to S7 Selection (C001 to C007) to 06 (JG: Jogging).
- Then, set the frequency reference for jogging operation in the Jogging Frequency (A038).

  Because, in jogging operation, the frequency reference is output without acceleration time, setting a high jogging frequency value may cause an overload or trip error. Be sure to set a frequency value that does not cause tripping.
- Use the Jogging Stop Selection (A039) to set the jogging stop method and whether to enable or disable the jogging function during operation.

Parameter No.	Function name	Data	Default data	Unit
C001 to C007	Multi-function Input S1 to S7 Selection	06: JG (Jogging)	–	–
A038	Jogging Frequency	0.00 Starting Frequency to 9.99	6.00	Hz
A039	Jogging Stop Selection	00: Free-running on jogging stop/Disabled during operation 01: Deceleration stop on jogging stop/Disabled during operation 02: DC injection braking on jogging stop[*1]/Disabled during operation 03: Free-running on jogging stop/Enabled during operation 04: Deceleration stop on jogging stop/Enabled during operation 05: DC injection braking on jogging stop[*1]/Enabled during operation	04	–

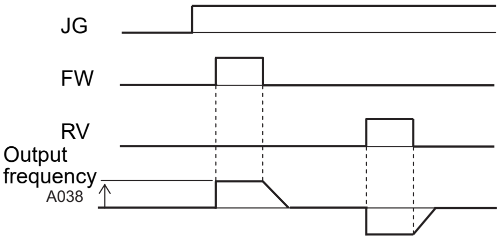
*1. If the Jogging Stop Selection(A039) is set to 02 or 05, set the DC Injection Braking Selection (A051).
Refer to *7-9-1 DC Injection Braking (DB)* on page 7-91.

● Disabled during operation

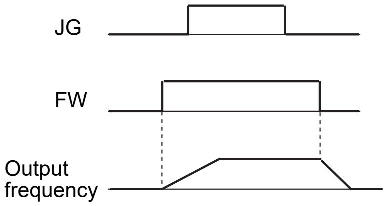
When the Jogging Stop Selection (A039) is set to 00, 01, or 02, jogging operation is not performed if the FW signal turns ON first.

To perform jogging operation, turn ON the JG terminal and then turn ON the terminal FW or RV.

Jogging Operation Enabled



Jogging Operation Disabled

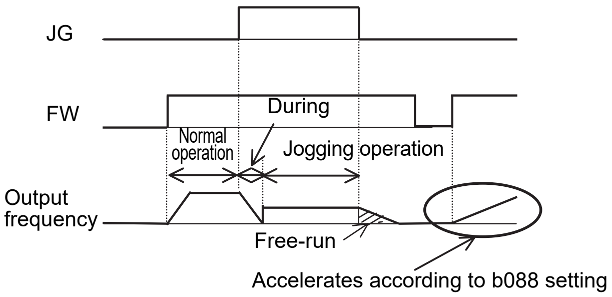


Inverter ignores input to JG and continues normal operation.

Enabled during operation

When the Jogging Stop Selection (A039) is set to 03, 04, or 05, jogging operation is performed even if the FW signal turns ON first.

However, if the JG signal turns OFF first, the motor falls in a free-run stop state.



5-9-7 2-step Acceleration/Deceleration (2CH)

- Use this function to switch between two acceleration/deceleration time settings or change the acceleration/deceleration time on the way during acceleration/deceleration.
- Allocate one of the Multi-function Input S1 to S7 Selection (C001 to C007) to 09 (2CH).
- For the 2-step acceleration/deceleration function, refer to *5-6-3 2-step Acceleration/Deceleration Function* on page 5-37.

Parameter No.	Function name	Data	Default data	Unit
C001 to C007	Multi-function Input S1 to S7 Selection	09: 2CH (2-step acceleration/deceleration)	–	–

5-9-8 Reset (RS)

- This function resets an inverter trip error.
- Allocate one of the Multi-function Input S1 to S7 Selection (C001 to C007) to 18 (RS).
- For the reset function, refer to *5-8 Reset Method Settings* on page 5-43.

Parameter No.	Function name	Data	Default data	Unit
C001 to C007	Multi-function Input S1 to S7 Selection	18: RS (Reset)	–	–

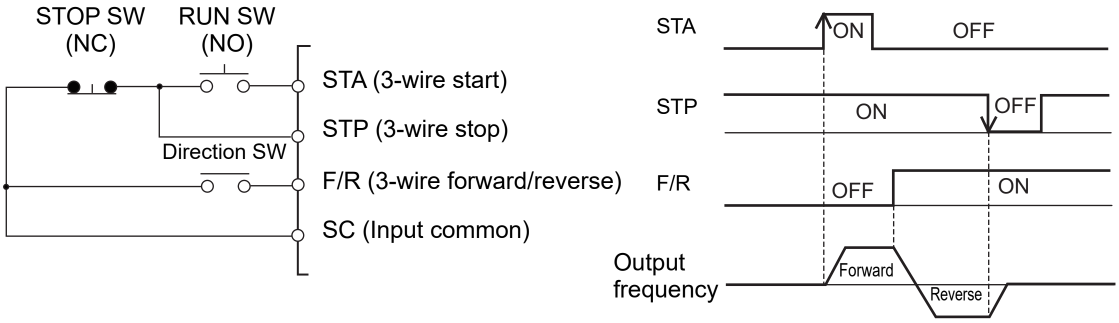
5-9-9 3-wire Input Function (STA, STP, F/R)

- Use this function to start and stop the inverter via an automatic reset contact such as a pushbutton switch.
- Allocate the Multi-function Input S1 to S7 Selection (C001 to C007) to 20 (STA), 21 (STP), and 22 (F/R).
- Set the 1st/2nd RUN Command Selection (A002/A202) to 01 (Control circuit terminal block).
- Allocating the terminal STP disables the terminals FW and RV.

Parameter No.	Function name	Data	Default data	Unit
A002/A202	1st/2nd RUN Command Selection	01: Control circuit terminal block (DriveProgramming)	02	–
C001 to C007	Multi-function Input S1 to S7 Selection	20: STA (3-wire start) 21: STP (3-wire stop) 22: F/R (3-wire forward/reverse)	–	–

Data	Symbol	Function name	Status	Description
20	STA	3-wire start	ON	Start via automatic reset contact
			OFF	Independent of motor operation
21	STP	3-wire stop	ON	Motor operation enabled
			OFF	Stop via automatic reset contact
22	F/R	3-wire forward/reverse	ON	Reverse
			OFF	Forward

- The operation timing is as follows.


STOP SW
(NC)
RUN SW
(NO)
Direction SW
STA (3-wire start)
STP (3-wire stop)
F/R (3-wire forward/reverse)
SC (Input common)
STA
ON
OFF
STP
ON
OFF
F/R
OFF
ON
Output frequency
Forward
Reverse

5-10 Multi-function Output Settings

5-10-1 Multi-function Output Selection

- You can allocate the functions shown in the following table to the multi-function output P1 and P2 terminals, and the multi-function relay output (MA, MB) terminals.
- This section describes seven types of primary functions. For other functions, refer to *7-2 Multi-function Input/Output Functions* on page 7-18.
- Set the functions in the Multi-function Output P1/P2 Selection (C021/C022) and the Multi-function Relay Output (MA, MB) Function Selection (C026) to use them.
- The multi-function output P1 and P2 terminals are for open collector output and the multi-function relay output (MA, MB) terminals are for relay output.
- The default data of Multi-function Relay Output (MA, MB) Function Selection (C026) is 05 (AL: Alarm signal). Therefore, the Multi-function Relay Output (MA, MB) Operation Selection (C036) is set to 01 (NC: NC contact) by default.
  This manual describes each function with the Multi-function Output Operation Selection set to 00 (NO: NO contact). Note that the operations of the Multi-function Relay Output (MA, MB) are reversed.

Parameter No.	Data	Function name	Reference item	Page
Multi-function Output P1/P2 Selection (C021/C022) Multi-function Relay Output (MA, MB) Function Selection (C026)	00	RUN: Signal during RUN	Signal during RUN	P. 5-56
	01	FA1: Constant speed arrival signal	Constant speed arrival signal	P. 5-57
	05	AL: Alarm signal	Alarm signal	P. 5-57
	21	ZS: 0 Hz detection signal	0 Hz detection signal	P. 5-58
	50	IRDY: Operation ready	Operation ready signal	P. 5-59
	51	FWR: Forward run signal	Forward run signal	P. 5-59
	52	RVR: Reverse run signal	Reverse run signal	P. 5-59

5-10-2 Multi-function Output Operation Selection

- Set the multi-function output P1/P2 terminals and the multi-function relay output (MA, MB) terminals to either NO (NO contact) or NC (NC contact) individually.
- This manual describes each function with the Multi-function Output Operation Selection set to 00 (NO: NO contact). Note that the signal operations are reversed when you set them to 01 (NC: NC contact).

Parameter No.	Function name	Data	Default data	Unit
C031	Multi-function Output P1 Operation Selection	00: NO (NO contact) 01: NC (NC contact)	00	–
C032	Multi-function Output P2 Operation Selection			
C036	Multi-function Relay Output (MA, MB) Operation Selection	00: NO contact between MA and MC, NC contact between MB and MC 01: NC contact between MA and MC, NO contact between MB and MC	01	–

5-10-3 Multi-function Output ON/OFF Delay Time

- Each multi-function output terminal can be allocated with the ON/OFF delay time independently.
- Because all output signals turn ON/OFF immediately when the set conditions are met, depending on the selected signal, chattering may occur. In such a case, use this function to hold or delay the signal.
- Set the parameter independently for each output terminal.

  For the output terminal, multi-function output terminals P1 and P2 and a multi-function relay output (MA, MB) terminal are provided.

  The correspondence between each output terminal and the related ON/OFF delay parameter is shown in the table below.

Parameter No.	Function name	Data	Default data	Unit
C130	Multi-function Output P1 ON Delay Time	0.0 to 100.0	0.0	s
C132	Multi-function Output P2 ON Delay Time			
C140	Multi-function Relay Output ON Delay			
C131	Multi-function Output P1 OFF Delay Time	0.0 to 100.0	0.0	s
C133	Multi-function Output P2 OFF Delay Time			
C141	Multi-function Relay Output OFF Delay			

5-10-4 Signal during RUN (RUN)

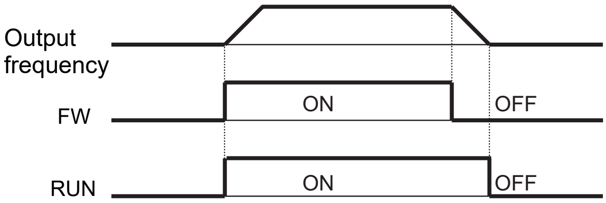
- The RUN signal is output during inverter operation.
- Allocate one of the Multi-function Output P1 Selection or Multi-function Output P2 Selection (C021/C022), or Multi-function Relay Output (MA, MB) Function Selection (C026), to 00 (RUN).
- The RUN signal is also output when the inverter is decelerating after the RUN command turns OFF or DC injection braking is active.
- The RUN signal will not be output even if the RUN command is input when the frequency reference is 0 Hz and the output reference reaches 0 Hz.

  (Note that on the Digital Operator, the RUN LED is lit when the RUN command is ON.)

Parameter No.	Function name	Data	Default data	Unit
C021, C022	Multi-function Output P1/P2 Selection	00: RUN (Signal during RUN)	–	–
C026	Multi-function Relay Output (MA, MB) Function Selection		05	–

The timing diagram is as follows.

The inverter outputs the RUN (during RUN) signal until the motor is stopped even if the RUN command (FW) turns OFF.



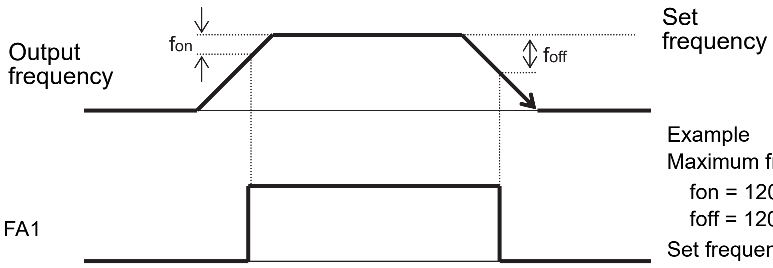
5-10-5 Constant Speed Arrival Signal (FA1)

- This signal is output when the output frequency reaches the frequency set in the Output Frequency Setting/Monitor.

  In F001, the frequency reference selected at that time is displayed.
- Allocate one of the Multi-function Output P1/P2 Selection (C021/C022), or Multi-function Relay Output (MA, MB) Function Selection (C026), to 01 (FA1).
- The hysteresis of this frequency arrival signal is calculated as follows.

ON (fon) : Set frequency – 1% of maximum frequency) [Hz]
OFF (foff) : Set frequency – 2% of maximum frequency) [Hz]

Parameter No.	Function name	Data	Default data	Unit
C021, C022	Multi-function Output P1/P2 Selection	01: FA1 (Constant speed arrival signal)	–	–
C026	Multi-function Relay Output (MA, MB) Function Selection		05	–



fon: 1% of maximum frequency
foff: 2% of maximum frequency

Example
Maximum frequency = 120 [Hz]
fon = 120 × 0.01 = 1.2 [Hz]
foff = 120 × 0.02 = 2.4 [Hz]
Set frequency = 60 [Hz]
During acceleration: FA1 is ON at 60 - 1.2 = 58.8 [Hz]
During deceleration: FA1 is OFF at 60 - 2.4 = 57.6 [Hz]

5-10-6 Alarm Signal (AL)

- If an overcurrent, overvoltage, or some other error occurs, the inverter shuts off its output and outputs an alarm signal (AL). This is called a “trip.”
- A trip state can be canceled by resetting the inverter, by which the alarm signal is also turned OFF.

  To reset the inverter, press the STOP/RESET key on the Digital Operator or turn ON the reset terminal. However, you cannot reset some trip factors by using these methods. In such cases, cycle the power supply.
- Allocate one of the Multi-function Output P1/P2 Selection (C021/C022), or Multi-function Relay Output (MA, MB) Function Selection (C026), to 05 (AL).

  By default, the Multi-function Relay Output (MA, MB) Function Selection (C026) is set to 05 (AL: Alarm signal).

Parameter No.	Function name	Data	Default data	Unit
C021, C022	Multi-function Output P1/P2 Selection	05: AL (Alarm signal)	–	–
C026	Multi-function Relay Output (MA, MB) Function Selection		05	–

Precautions for Correct Use

The Multi-function Relay Output (MA, MB) Function Selection (C026) is, by default, set to 05 (AL: Alarm output). However, this default data is based on different alarm output specifications from those of the previous models (3G3☐V Series).

The table below shows the relationship between the relay output status when the inverter input power supply is ON/OFF and the Multi-function Relay Output (MA, MB) Operation Selection (C036) setting. Select the parameter setting appropriate to the sequence of your inverter according to this table.

Setting in C036	Input power supply	Inverter status	Relay output status	
			Between MA and MC	Between MB and MC
00	ON	Normal	Open	Closed
		Alarm output	Closed	Open
	OFF	–	Open	Closed
01 (Default data)	ON	Normal	Closed	Open
		Alarm output	Open	Closed
	OFF	–	Open	Closed

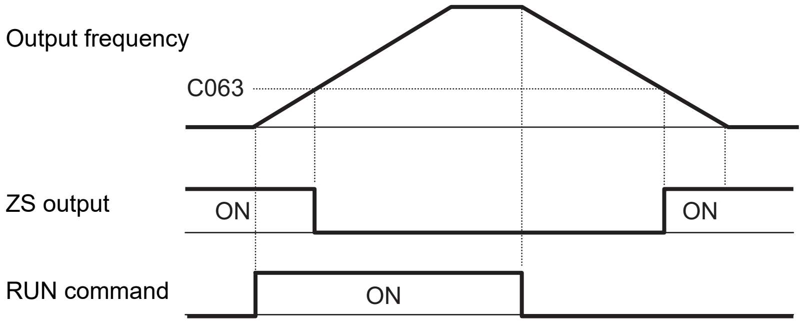
Note Set C036 to 00 to have the same relay output status as with the previous model (3G3☐V Series).

5-10-7 0-Hz Detection Signal (ZS)

- This signal is output when the output frequency of the inverter falls below the 0 Hz Detection Level (C063).
- Allocate one of the Multi-function Output P1/P2 Selection (C021/C022), or the Multi-function Relay Output (MA, MB) Function Selection (C026), to 21 (ZS).

  When the Pulse Train Input RP Selection (P003) is set to 01 (Feedback pulse), this function works according to the motor rotation speed (feedback value).

Parameter No.	Function name	Data	Default data	Unit
C021, C022	Multi-function Output P1/P2 Selection	21: ZS (0 Hz detection signal)	–	–
C026	Multi-function Relay Output (MA, MB) Function Selection		05	
C063	0 Hz Detection Level	0.00 to 99.99 100.0	0.00	Hz
Related functions		A044, A244, P003		



5-10-8 Operation Ready (IRDY)

- This signal is output when the inverter becomes ready to operate (ready to accept the RUN command).
- When this command 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 (R, S, T) is within the specified range.
- Allocate one of the Multi-function Output P1/P2 Selection (C021/C022), or the Multi-function Relay Output (MA, MB) Function Selection (C026), to 50 (IRDY).

Parameter No.	Function name	Data	Default data	Unit
C021, C022	Multi-function Output P1/P2 Selection	50: IRDY (Operation ready)	–	–
C026	Multi-function Relay Output (MA, MB) Function Selection		05	

5-10-9 Forward Run Signal (FWR)

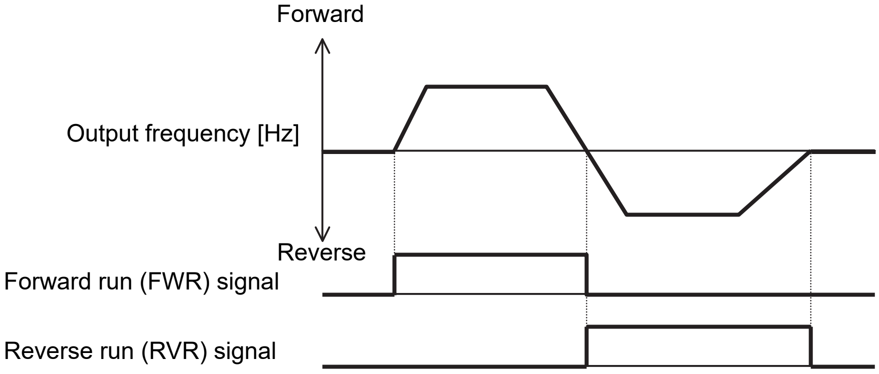
- This signal is output while the inverter performs the forward operation.
- While the inverter performs the reverse operation or when stopped, this signal is not output.
- Allocate one of the Multi-function Output P1/P2 Selection (C021/C022), or the Multi-function Relay Output (MA, MB) Function Selection (C026), to 51 (FWR).

Parameter No.	Function name	Data	Default data	Unit
C021, C022	Multi-function Output P1/P2 Selection	51: FWR (Forward run signal)	–	–
C026	Multi-function Relay Output (MA, MB) Function Selection		05	

5-10-10 Reverse Run Signal (RVR)

- This signal is output while the inverter performs the reverse operation.
- While the inverter performs the forward operation or when stopped, this signal is not output.
- Allocate one of the Multi-function Output P1/P2 Selection (C021/C022), or the Multi-function Relay Output (MA, MB) Function Selection (C026), to 52 (RVR).

Parameter No.	Function name	Data	Default data	Unit
C021, C022	Multi-function Output P1/P2 Selection	52: RVR (Reverse run signal)	–	–
C026	Multi-function Relay Output (MA, MB) Function Selection		05	



5-11 Torque Boost Function Settings

5-11-1 Torque Boost

- Use the torque boost function to raise the output torque if it is not sufficient at low speeds.
- This inverter provides two torque boost options: Manual torque boost for manual torque adjustment and Automatic torque boost for automatic torque adjustment.
- In the 3G3MX2-V1 Series, the default data for A041/A241 were changed to Automatic torque boost. (A041/A241 = 01)
- To use the automatic torque boost function effectively, be sure to set the 1st/2nd Motor Capacity (H003/H203) and the 1st/2nd Motor Pole Number (H004/H204) according to your motor.

Parameter No.	Function name	Data	Default data	Unit
A041	1st Torque Boost Selection	00: Manual torque boost 01: Automatic torque boost	01 [*4]	–
A241	2nd Torque Boost Selection [*1]			
A042	1st Manual Torque Boost Voltage	0.0 to 20.0 [*2]	1.0	%
A242	2nd Manual Torque Boost Voltage [*1]			
A043	1st Manual Torque Boost Frequency	0.0 to 50.0 [*3]	5.0	%
A243	2nd Manual Torque Boost Frequency [*1]			
H003	1st Motor Capacity	0.1/0.2/0.4/0.55/0.75/1.1/1.5/2.2/3.0/3.7/4.0/5.5/7.5/11.0/15.0/18.5	Maximum applicable motor capacity	kW
H203	2nd Motor Capacity [*1]			
H004	1st Motor Pole Number	2/4/6/8 10 to 48: Do not set.	4	pole
H204	2nd Motor Pole Number [*1]			
A046	1st Automatic Torque Boost Voltage Compensation Gain	0. to 255.	100.	%
A246	2nd Automatic Torque Boost Voltage Compensation Gain [*1]			
A047	1st Automatic Torque Boost Slip Compensation Gain	0. to 255.	0. [*4]	
A247	2nd Automatic Torque Boost Slip Compensation Gain [*1]			

[*1] To enable the switching to the 2nd control, allocate one of the Multi-function Input S1 to S7 Selection (C001 to C007) to 08 (SET) and turn ON that terminal.

[*2] Set data as a percentage (%) of the 1st/2nd Motor Rated Voltage Selection (A082/A282).

[*3] Set data as a percentage (%) of the 1st/2nd Maximum Frequency (A004/A204).

[*4] The default data was changed from the previous model.

Automatic Torque Boost

- In the 3G3MX2-V1 Series Inverter, the default data for A041/A241 were changed to Automatic torque boost (A041/A241 = 01).

  With this setting, the inverter increases the output voltage automatically depending on the load condition. In other words, the output voltage generated when the automatic torque boost is enabled is the sum of manual torque boost voltage and the automatic torque boost voltage.
- To use the automatic torque boost function effectively, set the 1st/2nd Motor Capacity (H003/H203) and the 1st/2nd Motor Pole Number (H004/H204) correctly according to your motor.
- To avoid possible overcurrent tripping during deceleration, set the AVR Selection (A081) to 00 (Always ON).
- To enable the slip compensation function in addition to the voltage compensation provided by the automatic torque boost function, first set the 1st/2nd Automatic Torque Boost Slip Compensation Gain (A047/A247) to 100%.
- If the automatic torque boost does not provide the intended performance characteristics, adjust it for each adjustment item shown in the following table.

Phenomenon	Adjustment method	Adjustment item
Torque is insufficient at low speeds. (Motor does not rotating at low speeds.)	(1) Gradually increase the Automatic Torque Boost Voltage Compensation Gain.	A046/A246
	(2) Set the Automatic Torque Boost Slip Compensation Gain to 100. Then, increase the set value gradually.	A047/A247
	(3) Gradually increase the Manual Torque Boost Voltage.	A042/A242
	(4) Decrease the Carrier Frequency.	b083
Overcurrent trip occurs when load is applied.	(1) Gradually decrease the Automatic Torque Boost Voltage Compensation Gain.	A046/A246
	(2) Set the Automatic Torque Boost Slip Compensation Gain to 100. Then, decrease the set value gradually.	A047/A247
	(3) Gradually decrease the Manual Torque Boost Voltage.	A042/A242
	(4) Gradually decrease the Overload Limit Parameter.	b023/b223/b026

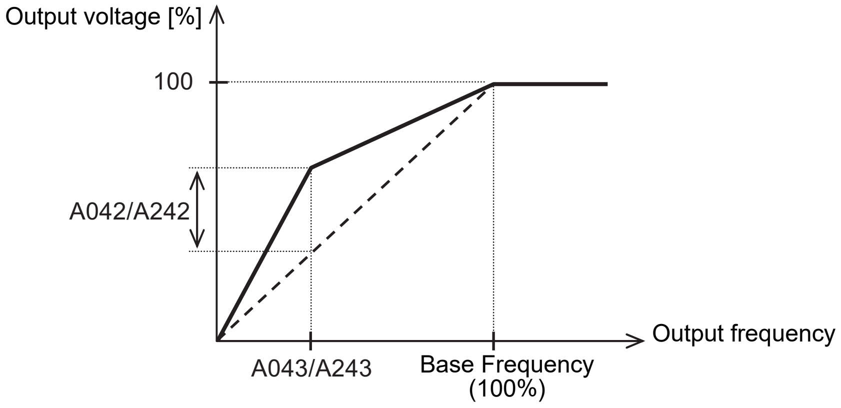
Phenomenon	Adjustment method	Adjustment item
Rotation speed decreases when load is applied.	Set the Automatic Torque Boost Slip Compensation Gain to 100 and gradually increase the value.	A047/A247
Rotation speed increases when load is applied.	Set the Automatic Torque Boost Slip Compensation Gain to 100 and gradually decrease the value.	A047/A247

Manual Torque Boost

- In the manual torque boost function, set the output voltage and output frequency characteristics of the inverter.
- The automatic torque boost function automatically adds the output voltage and output frequency to the characteristics set in the manual torque boost function.
- Adjust the manual torque boost function when the automatic boost function is disabled or if the motor stalls at low speeds.
- Set the 1st/2nd Manual Torque Boost Frequency (A043/A243) to the rotation speed that provides the required output torque.

  While observing the movement of the load, gradually increase the 1st/2nd Manual Torque Boost Voltage (A042/A242) value so that the motor speed does not decrease.

  Check the output current of the inverter and adjust it to 150% of the rated current of the motor or less.
- Set A042/A242 as 100% of the 1st/2nd Motor Rated Voltage Selection (A082/A282) value.
- Set A043/A243 as 100% of the 1st/2nd Base Frequency (A003/A203) value.
- Setting the Manual Torque Boost Voltage data too high may cause motor overexcitation. An overexcited motor is inefficient, and causes overload or overcurrent conditions easily.



5-12 Measures against Overvoltage

5-12-1 Overvoltage Suppression Function during Deceleration

- Use this function to prevent overvoltage trip caused by the regenerative energy from the motor during deceleration.
- Enable or disable the function in the Overvoltage Suppression Function Selection During Deceleration (b130). For the 3G3MX2-V1 Series, this function is set by default to 01 (Enabled: DC voltage kept constant).
- If the Overvoltage Suppression Function Selection During Deceleration (b130) is set to 01 (Enabled: DC voltage constant control), the inverter decelerates automatically while keeping the main circuit DC voltage rise due to deceleration start at the Overvoltage Suppression Level During Deceleration (b131).
- If the Overvoltage Suppression Function Selection During Deceleration (b130) is set to 02 (Enabled: Acceleration enabled), the inverter starts accelerating according to the Overvoltage Suppression Parameter During Deceleration (b132) setting when the main circuit DC voltage increases due to the start of deceleration to exceed the Overvoltage Suppression Level During Deceleration (b131). After that, when the main circuit DC voltage falls below the value set in b131, the inverter starts deceleration again.
- To use this function, set the Usage Rate of Regenerative Braking (b090) to 0.0 (Regenerative braking not active) and the Regenerative Braking Selection (b095) to 00 (Disabled).

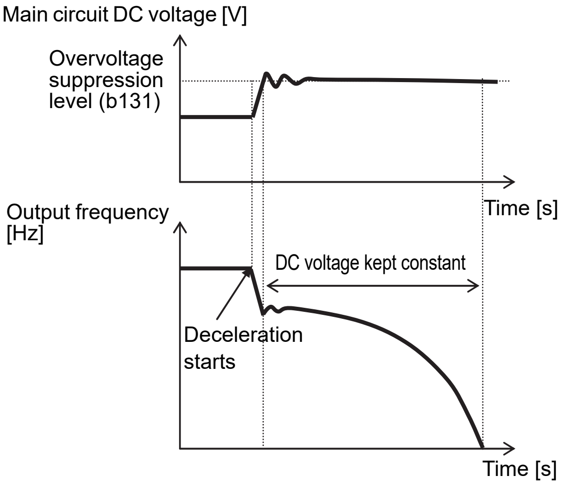
Parameter No.	Function name	Data	Default data	Unit
b130	Overvoltage Suppression Function Selection During Deceleration	00: Disabled 01: Enabled (DC voltage kept constant) (Example 1) [*1] 02: Enabled (Acceleration enabled) (Example 2)	01 [*3]	–
b131	Overvoltage Suppression Level During Deceleration [*2]	200-V class: 330. to 395. 400-V class: 660. to 790.	380./760.	V
b132	Overvoltage Suppression Parameter During Deceleration	0.10 to 30.00: Set the acceleration rate for the output frequency when the overvoltage suppression during deceleration function is enabled. Set the acceleration time from 0 Hz to the maximum frequency.	1.00	s
b133	Overvoltage Suppression Proportional Gain During Deceleration	0.00 to 5.00: Proportional gain for DC voltage constant control (b130 = 01 only)	0.20	–
b134	Overvoltage Suppression Integral Time During Deceleration	0.0 to 150.0: Integral time when DC voltage is kept constant (b130 = 01 only)	1.0	s
b090	Usage Rate of Regenerative Braking	0.0: Regenerative braking not active	0.0	%
b095	Regenerative Braking Selection	00: Disabled	0.0	–

[*1] When b130 is set to 01, PI control works to keep the internal DC voltage constant.
Although increasing the Overvoltage Suppression Proportional Gain During Deceleration (b133) provides a faster response, setting it to an excessive large value may cause an overcurrent trip.
Increasing the Overvoltage Suppression Integral Time During Deceleration (b134) also provides a faster response, but setting it to an excessive small value may cause an overcurrent trip.

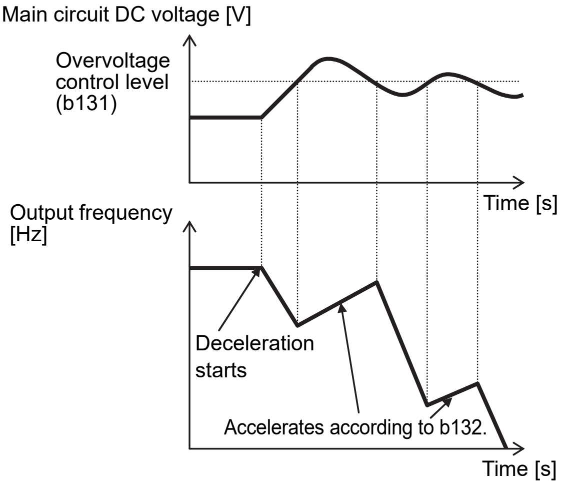
[*2] If b131 is set to a value less than the input voltage, the inverter may not be able to stop the motor. Normally, do not set this value to 350 V or less for 200-V class and 700 V or less for 400-V class.

[*3] The default data was changed from the previous model.

(Example 1)
When DC voltage is kept constant (b130 = 01)



(Example 2)
When acceleration is enabled (b130 = 02)



Precautions for Correct Use

- When the overvoltage suppression function during Deceleration function is enabled, the actual deceleration time is longer than the set time.

  If the motor load inertia is large, the motor may take a long time to stop.

  To shorten the time until the motor stops, change to the deceleration stop method according to *5-12-2 Regenerative Braking Function* on page 5-65.
- Setting the Overvoltage Suppression Level During Deceleration (b131) to a value less than the input power supply voltage prevents deceleration. Be sure to set this to a value higher than the input power supply voltage multiplied by the square root of 2.

  Normally, do not set this value to 350 V or less for 200-V class and 700 V or less for 400-V class.
- Even when the overvoltage suppression function during deceleration function is enabled, rapid deceleration may cause a trip if the motor cannot respond in time.

  In this case, change to the deceleration stop method according to *5-12-2 Regenerative Braking Function* on page 5-65.

5-12-2 Regenerative Braking Function

- When the motor decelerates, moves downward, or is rotated by an external load (that is, when the output torque direction and the rotation direction are opposite), it serves as a generator and the regenerated energy is fed back to the inverter.

  However, if the motor load inertia is large, the amount of regeneration may become large, which causes an overvoltage during rapid deceleration or when driving an elevating axis.
- The regenerative braking function uses the built-in or an external regenerative braking circuit to decrease the internal DC voltage of the inverter by converting the regenerated energy from the motor into heat via external braking resistors.
- Connect external braking resistors or external regenerative braking units according to the description of External Braking Resistor Connection Terminal/Regenerative Braking Unit Connection Terminal in *2-3-4 Wiring for Main Circuit Terminals* on page 2-15.

  The regenerative braking function is enabled only when the inverter is connected with one or more external braking resistors/external regenerative braking units.
- The 3G3MX2-V1 Series has a built-in regenerative braking circuit. Connect external braking resistors only.
- If a large braking torque is required or if a large regenerative energy must be processed, the built-in regenerative braking processing circuit may not be sufficient, forcing you to use the Regenerative Braking Unit.
- To use the built-in regenerative braking function of the inverter, set the Regenerative Braking Selection (b095) to 01 or 02 (Enabled).

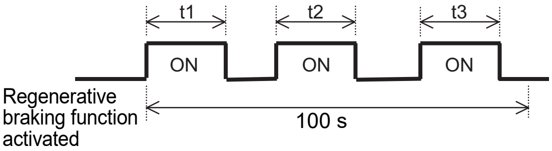
  Normally, this parameter is set to 01 (Enabled: Disabled during stop). Set this parameter to 02 (Enabled: Enabled during operation and stop) when regenerative braking is required due to external force, for example, when using a PM motor.

  At this time, set the usage rate (%) of the braking resistor in use in the Usage Rate of Regenerative Braking (b090).

  Note that the regenerative braking function is enabled only when both b090 and b095 are set.
- Be sure to set the resistance of the braking resistor connected to the inverter in the Braking Resistor Value (b097).

  This setting, together with the Usage Rate of Regenerative Braking (b090) data, is used by the regenerative braking protective function.
- For the Regenerative Braking ON Level (b096), you need not change the default data normally.

  This parameter is used for adjusting the level at which the regenerative braking function turns ON according to the input power supply voltage to the inverter.
- When the external regenerative braking unit is used, regenerative braking is performed in the external regenerative braking unit. Therefore, set the inverter parameter, Regenerative Braking Selection (b095) to 00 (Disabled). In this case, the b090, b096, and b097 settings are ignored.
- To use the regenerative braking function, set the Overvoltage Suppression Function Selection During Deceleration (b130) to 00 (Disabled).

Parameter No.	Function name	Data	Default data	Unit
b090	Usage Rate of Regenerative Braking	0.0: Regenerative braking not active 0.1 to 100.0 (Limited by b097) The usage rate must be set as a percentage (%) as follows: Allowable braking frequency [%] of the connected braking resistor or lower. Exceeding the set usage rate causes the protective function to be activated, which results in a trip.  t1 t2 t3 ON ON ON Regenerative braking function activated 100 s $\text{Usage rate [\%]} = \frac{(t1 + t2 + t3)}{100\text{ s}} \times 100$	0.0	%
b095	Regenerative Braking Selection	00: Disabled 01: Enabled (Disabled during stop) 02: Enabled (Enabled during operation and stop)	00	–
b096	Regenerative Braking ON Level	200-V class: 330 to 380 VDC *1	200-V class: 360 V	V
		400-V class: 660 to 760 VDC *1	400-V class: 720 V	
b097	Braking Resistor Value	Minimum connection resistance to 600.0 Set the resistance of the braking resistor actually connected to the inverter. Then, the inverter automatically calculates the upper limit value allowable in b090. This allows you to consider only the allowable braking frequency (%) of the braking resistor when setting b090.	Minimum connection resistance for capacity	Ω

*1. For the Regenerative Braking ON Level, set the internal main circuit DC voltage of the inverter.

Precautions for Correct Use

- To use the built-in regenerative braking function of the inverter, be sure to set the Usage Rate of Regenerative Braking (b090) and the Regenerative Braking Selection (b095) to 01 or 02. If you do not set both parameters, the function cannot work.
- Setting the Regenerative Braking ON Level (b096) to the incoming voltage or lower causes the built-in regenerative braking function to be always active, which results in overheating or burning of the braking resistor. Be sure to set this to a value higher than the incoming voltage multiplied by the square root of 2.

  Set b096 to 380 VDC or higher for 240 VAC of the incoming voltage and to 750 VDC or higher for 480 VAC of the incoming voltage, respectively.
- To use the regenerative braking function, connect external braking resistor(s) or external regenerative braking unit(s) according to the description of External Braking Resistor Connection Terminal/Regenerative Braking Unit Connection Terminal in *2-3-4 Wiring for Main Circuit Terminals* on page 2-15.

  Be sure to install a circuit that detects overheating of the braking resistor(s) and the regenerative braking unit(s) via alarm contacts (thermal relay output terminals) and shuts off the input power supply of the inverter.

6

Vector Control and Applied Functions

This section describes the vector control and applied functions characteristic of this inverter.

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6-1 Sensorless Vector Control

The rotation speed of an induction motor, by its characteristic, decreases as the output torque increases.

Selecting sensorless vector control improves this relationship between the output torque and the rotation speed of an induction motor, which results in a high output torque even at low speeds.

With sensorless vector control enabled, this inverter can output a high starting torque, 200% of the motor rating, at 0.5Hz.

Moreover, this inverter also has a built-in auto-tuning function (rotation/stop method) that automatically sets motor parameters.

6-1-1 Sensorless Vector Control Parameter Settings

- Set the 1st/2nd Control Method (A044/A244) to 03 (Sensorless vector control).
- Set the 1st/2nd Motor Capacity (H003/H203) and the 1st/2nd Motor Pole Number (H004/H204) according to your motor.
- Set the rated frequency of the motor in the 1st/2nd Base Frequency (A003/A203) and set the rated voltage of the motor in the 1st/2nd Motor Rated Voltage Selection (A082/A282).
- To use this function, set motor parameters for your motor according to *6-1-2 Offline Auto-tuning for Motor Parameters* on page 6-4 and *6-1-3 Motor Parameter Settings* on page 6-9.
- In the light load mode and the PM motor mode, sensorless vector control cannot be selected.

Parameter No.	Function name	Data	Default data	Unit
A044/A244	1st/2nd Control Method [*1]	03: Sensorless vector control	00	–
H003/H203	1st/2nd Motor Capacity [*1]	0.1/0.2/0.4/0.55/0.75/1.1/1.5/2.2/3.0/3.7/4.0/5.5/7.5/11.0/15.0/18.5	Maximum applicable motor capacity	kW
H004/H204	1st/2nd Motor Pole Number [*1]	2/4/6/8 10 to 488: Do not set.	4	pole
A003/A203	1st/2nd Base Frequency [*1]	30.0 to 1st/2nd Maximum Frequency (A004/A204)	60.0	Hz
A082/A282	1st/2nd Motor Rated Voltage Selection [*1]	200-V class: 200 V/215 V/220 V/230 V/240 V	200	V
		400-V class: 380 V/400 V/415 V/440 V/460 V/480 V	400	V

[*1] To enable the switching to the 2nd control, allocate one of the Multi-function Input S8 Selection (C008) to 08 (SET) and turn ON that terminal.

Precautions for Correct Use

- The inverter may not provide sufficient performance characteristics due to the current accuracy if your motor is two or more sizes lower than its maximum applicable motor capacity.
- The motor may rotate in reverse at low frequencies (a few Hz), depending on the current accuracy.

  In this case, use the Reverse Rotation Prevention Selection (b046) function or refer to *6-1-4 Adjustments for Sensorless Vector Control* on page 6-10 to adjust the motor parameter settings.
- If the incoming voltage to the inverter is higher than the rated voltage of the drive motor, setting the 1st/2nd AVR Selection (A081/A281) to 01 (Always OFF) or 02 (OFF during deceleration) may prevent normal operation as the current increases. In this case, set the 1st/2nd AVR Selection to 00 (Always ON).

6-1-2 Offline Auto-tuning for Motor Parameters

- Use this function to measure and automatically set the motor parameters required for sensorless vector control.
- To use the sensorless vector control method, perform auto-tuning to measure the motor parameter values.
- The measured motor parameter values will be set as 50-Hz converted data for one phase in Y-connection.

Parameter No.	Function name	Data	Default data	Unit
H001	Auto-tuning Selection	00: Disabled 01: Enabled (No motor rotation) 02: Enabled (Motor rotation)	00	–
H002/H202	1st/2nd Motor Parameter Selection	00: Standard motor parameter 02: Auto-tuning parameter (Applies H030/H230 to H034/H234 data to motor parameters.)	00	–
H003/H203	1st/2nd Motor Capacity	0.1/0.2/0.4/0.55/0.75/1.1/1.5/2.2/3.0/3.7/4.0/5.5/7.5/11.0/15.0/18.5	Maximum applicable motor capacity	kW
H004/H204	1st/2nd Motor Pole Number	2/4/6/8 10 to 488: Do not set.	4	pole
H030/H230	1st/2nd Motor Parameter R1 (Auto-tuning Data)	0.001 to 9.999 10.00 to 65.53	Dependent on motor capacity	Ω
H031/H231	1st/2nd Motor Parameter R2 (Auto-tuning Data)			
H032/H232	1st/2nd Motor Parameter L (Auto-tuning Data)	0.01 to 99.99 100.0 to 655.3		mH
H033/H233	1st/2nd Motor Parameter Io (Auto-tuning Data)	0.01 to 99.99 100.0 to 655.3		A
H034/H234	1st/2nd Motor Parameter J (Auto-tuning Data)	0.001 to 9.999 10.00 to 99.99 100.0 to 999.9 1000. to 9999.		kgm^2
A003/A203	1st/2nd Base Frequency	30.0 to 1st/2nd Maximum Frequency (A004/A204)	60.0	Hz
A051	DC Injection Braking Selection	00: Disabled 01: Enabled 02: Enabled (Operates only at set frequency)	00	–
A082/A282	1st/2nd Motor Rated Voltage Selection	200-V class: 200/215/220/230/240 400-V class: 380/400/415/440/460/480	200/400	V
b033	Motor Cable Length	5. to 20.	10.	m

Offline Auto-Tuning Steps

Offline auto-tuning consists of the following five steps:

- Presetting of parameters
- Selection of motor rotation during auto-tuning
- Auto-tuning
- Operations after auto-tuning
- Operations in case of error

1 **Presetting of parameters**

(1) Set the 1st/2nd Motor Capacity (H003/H203) and the 1st/2nd Motor Pole Number (H004/H204) according to your motor.

(2) Set the rated frequency of the motor in the 1st/2nd Base Frequency (A003/A203) and set the rated voltage in the 1st/2nd Motor Rated Voltage Selection (A082/A282).

If the 1st/2nd Motor Rated Voltage Selection parameter does not provide data appropriate to the rated voltage of your motor, select a slightly larger value than required and set the following value in the 1st/2nd Output Voltage Gain (A045/A245):

> [1st/2nd Output Voltage Gain (A045/A245)] = 100% × [motor rated voltage]/[1st/2nd Motor Rated Voltage Selection (A082/A282)]

(3) Set the DC Injection Braking Selection (A051) and Simple Position Control Selection (P012) to 00 (Disabled).

If the DC Injection Braking Selection (A051) or Simple Position Control Selection (P012) is set to 02 (Enabled), change it to 00 (Disabled). If either of these parameters is set to 02 (Enabled), auto-tuning will not be completed.

(4) Set the motor cable length in the Motor Cable Length (b033).

In the Motor Cable Length (b033), set the length of your motor cable.

(5) Do not to turn ON the torque reference input permission terminal (52: ATR).

Setting one of the Multi-function Input S1 to S7 Selection (C001 to C007) to 52 (ATR: Torque reference input permission) prevents correct tuning data measurement if the corresponding terminal is ON.

Parameter No.	Function name	Data	Default data	Unit
H003/H203	1st/2nd Motor Capacity	0.1/0.2/0.4/0.55/0.75/1.1/1.5/2.2/3.0/3.7/4.0/5.5/7.5/11.0/15.0/18.5	Maximum applicable motor capacity	kW
H004/H204	1st/2nd Motor Pole Number	2/4/6/8 10 to 488: Do not set.	4	pole
A003/A203	1st/2nd Base Frequency	30.0 to 1st/2nd Maximum Frequency (A004/A204)	60.0	Hz
A045/A245	1st/2nd Output Voltage Gain	20. to 100.	100.	%
A051	DC Injection Braking Selection	00: Disabled	00	–
A082/A282	1st/2nd Motor Rated Voltage Selection	200-V class: 200 V/215 V/220 V/230 V/240 V 400-V class: 380 V/400 V/415 V/440 V/460 V/480 V	200/400	V
P012	Simple Position Control Selection	00: Simple position control disabled	00	–
b033	Motor Cable Length	5. to 20.	10.	m

2 Selection of motor rotation during auto-tuning

In the Auto-tuning Selection (H001), select whether or not to rotate the motor during auto-tuning.

Parameter No.	Function name	Data	Default data	Unit
H001	Auto-tuning Selection	00: Disabled 01: Enabled (No motor rotation) 02: Enabled (Motor rotation)	00	–

Set value	Description
01	Motor does not rotate during auto-tuning.
02	Motor rotates during auto-tuning.

Motor rotation selection	Description
Motor does not rotate (01)	Measures motor parameter values without rotating the motor. Use this setting if you do not rotate the motor. Because the motor does not rotate, the Motor Parameter Io (No-load current) and Motor Parameter J (Moment of inertia) values cannot be measured.
Motor rotates (02)	Measures motor parameter values with the motor rotating. Use this setting if you can rotate the motor without any problem.

3 Auto-tuning

Select the target control for auto-tuning in the 1st/2nd Control Method. To switch to the 2nd control, allocate one of Multi-function Input S1 to S7 Selection (C001 to C007) to 08 (SET).
Then, turn ON the RUN command based on the setting in the 1st/2nd RUN Command Selection (A002/A202). The inverter starts auto-tuning operation.
If auto-tuning is completed successfully, the auto-tuning result will be set to the parameters H030/H230 to H034/H234.

1) **1st AC excitation (Motor does not rotate.[*1])**

↓

2) **2nd AC excitation (Motor does not rotate.[*1])**

↓

3) **1st DC excitation (Motor does not rotate.[*1])**

↓

4) **V/f control operation (Motor rotates up to 80% of base frequency.)[*2]**

↓

5) **Sensorless vector control operation (Motor rotates up to X%[*3] of base frequency.)[*2]**

↓

6) **2nd DC excitation (Motor does not rotate.[*1])**

↓

7) **Auto-tuning result is displayed.[*4]**

*1. However, the 4-pole motor, for example, may rotate by approximately up to 1/8 of a rotation (half the inverse of poles).

*2. Steps 4 and 5 will be skipped in auto-tuning without motor rotation (H001 = 01).

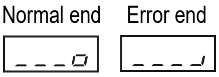
*3. The motor speed X in step 5 is given as follows, where T is the acceleration or deceleration time in step 4, whichever is greater.

0 s < T < 50 s: X = 40%

50 s ≤ T < 100 s: X = 20%

100 s ≤ T: X = 10%

*4. The auto-tuning result will be displayed as follows.



If auto-tuning is aborted due to an error, retry it.
To clear the display, press the STOP/RESET key.

Precautions for Correct Use

- Even if you set H001 to 01 (Auto-tuning without motor rotation), for example, the 4-pole motor may rotate by approximately up to 1/8 of a rotation (half the inverse of poles).
- To perform auto-tuning for a motor one size smaller in capacity than the inverter, set the 1st/2nd Overload Limit Selection (b021/b221) to 01 (Enabled during acceleration and constant speed) and set the 1st/2nd Overload Limit Level (b022/b222) to 150% of the rated current of the motor.
- If the Overvoltage Suppression Integral Time During Deceleration (b134) is too small, an Overvoltage trip (E07.□) may occur during auto-tuning. In this case, increase the b134 value and retry auto-tuning.
- Make sure the following points before starting auto-tuning with motor rotation enabled.

There is no problem even if the motor rotates up to approximately 80% of the base frequency.
The motor is not driven by external equipment.
The brake is released.
During auto-tuning, the inverter does not provide sufficient torque, which could result in a slip-and-fall accident in elevating or other applications. To prevent this, remove the motor from the load and perform the auto-tuning with the single motor. In this case, because the moment of inertia J is given for the single motor, calculate the motor-shaft conversion of the moment of inertia of the load machine and add it to this value.
In applications such as an elevator or ball screw where the amount of motor shaft rotation is limited, the motor may rotate over the allowable rotation amount, which may result in a mechanical damage. Be sure to perform auto-tuning with the single motor, or select the no motor rotation mode (H001 = 01).

- Adequate auto-tuning may not be performed if a motor cable is long (longer than 20 m).

4 Operations after auto-tuning

- After normal termination of auto-tuning, set the 1st/2nd Motor Parameter Selection (H002/H202) to 02 (Auto-tuning parameter).

  This enables the 1st/2nd Motor parameters (H030 to H034/H230 to H234) set by the auto-tuning function.
- During auto-tuning without motor rotation, the Motor Parameter Io (No-load current) and Motor Parameter J (Moment of inertia J) values are not measured. Set the following parameters after completion of auto-tuning.

  1st/2nd Motor Parameter Io (H033/H233): Measure and set in advance the no-load current of the single motor at 50 Hz. Alternatively, check the no-load current of the motor at 50 Hz with the motor manufacturer and set it.

  1st/2nd Motor Parameter J (H034/H234): Calculate and set the motor-shaft conversion of the moment of inertia of the load machine.
- At the end of auto-tuning, the inverter automatically resets the Auto-tuning Selection (H001) to 00 (Disabled).

  To retry auto-tuning, set H001 again to enable auto-tuning.

Precautions for Correct Use

Set again the DC Injection Braking Selection (A051), 1st/2nd Output Voltage Gain (A045/A245), and Simple Position Control Selection (P012) values which you set to Disabled in “1. Presetting of parameters” according to your operating environment.

Parameter No.	Function name	Data	Default data	Unit
H002/H202	1st/2nd Motor Parameter Selection	00: Standard motor parameter 02: Auto-tuning parameter (Applies H030/H230 to H034/H234 data to motor parameters.)	00	–
H030/H230	1st/2nd Motor Parameter R1 (Auto-tuning Data)	0.001 to 9.999 10.00 to 65.53	Dependent on motor capacity	Ω
H031/H231	1st/2nd Motor Parameter R2 (Auto-tuning Data)			
H032/H232	1st/2nd Motor Parameter L (Auto-tuning Data)	0.01 to 99.99 100.0 to 655.3		mH
H033/H233	1st/2nd Motor Parameter Io (Auto-tuning Data)	0.01 to 99.99 100.0 to 655.3		A
H034/H234	1st/2nd Motor Parameter J (Auto-tuning Data)	0.001 to 9.999 10.00 to 99.99 100.0 to 999.9 1000. to 9999.		kgm^2
A045/A245	1st/2nd Output Voltage Gain	20. to 100.	100.	%
A051	DC Injection Braking Selection	00: Disabled 01: Enabled 02: Enabled (Operates only at set frequency)	00	–
P012	Simple Position Control Selection	00: Simple position control disabled 02: Simple position control enabled	00	–

5 Operations in case of error

If auto-tuning is aborted due to an error, review the preset parameters according to “1. Presetting of parameters” and check that the rated torque of the motor is at least 50% of the rated output current of the inverter. If the load is too heavy, disconnect it and retry auto-tuning.

If the error persists or auto-tuning is still aborted, enter the motor parameter values directly.

For details, refer to *6-1-3 Motor Parameter Settings* on page 6-9.

Precautions for Correct Use

- If a trip occurs during auto-tuning, the auto-tuning process will be force-terminated and the inverter displays a trip. In this case, refer to *10-1-2 Alarm Code List* on page 10-4.
- If the auto-tuning process is not ended, press the STOP/RESET key or reset the RUN command. This causes the process to be forcibly ended. In this case, the auto-tuning result will not be displayed. Then, review the preset parameters in “1. Presetting of parameters”.
- If the rated current of the motor is 50% of the rated output current of the inverter or lower, auto-tuning may not work.

  The inverter may not provide sufficient performance characteristics due to the current accuracy if your motor is two or more sizes lower than the maximum applicable motor capacity.
- If the auto-tuning process is aborted, or if you interrupt the process by pressing the STOP/RESET key or by resetting the RUN command, the auto-tuning settings may be left in the parameters H030/H230 to H034/H234.

6-1-3 Motor Parameter Settings

- Normally, you perform offline auto-tuning to set motor parameters.
  However, if the offline auto-tuning process is aborted, for example, when the inverter does not reach 50% of its rated current during auto-tuning, you need to set the motor parameters manually.
- To configure the motor parameters manually, set the 1st/2nd Motor Parameter Selection (H002/H202) to 00 (Standard motor parameter).
  To maximize the performance of vector control, adjust the parameter values according to your motor.
- Obtain your motor's datasheet from the motor manufacturer and set each motor parameter.
  The following values must be set as 50-Hz converted data for one phase in Y-connection.

  Winding resistance on primary side of motor (H020/H220) : Set the wiring resistance (in Ω) on the primary side of the motor for one phase in Y-connection.

  Winding resistance on secondary side of motor (H021/H221): Set the wiring resistance (in Ω) on the secondary side of the motor for one phase in Y-connection.

  Motor leakage inductance (H022/H222): Set the leakage inductance (in mH) of the motor for one phase in Y-connection.

  Motor no-load current (H023/H223) : Set the no-load current of the motor, or set the current value measured when the motor is in isolated no-load run at 50 Hz.

  Moment of inertia (H024/H224) : Calculate the motor-shaft conversion of the moment of inertia of the load machine, add the moment of inertia of the motor to it, and set the sum.
- After setting each motor parameter, adjust the parameter values according to *6-1-4 Adjustments for Sensorless Vector Control* on page 6-10.
- 1st/2nd Speed Response (H005/H205) are parameters to adjust the speed response of sensorless vector control. Increase the set value to enhance the responsiveness and decrease it if motor hunting occurs.

Parameter No.	Function name	Data	Default data	Unit
H002/H202	1st/2nd Motor Parameter Selection	00: Standard motor parameter (Applies H020/H220 to H024/H224 data to motor parameters.) 02: Auto-tuning parameter	00	–
H003/H203	1st/2nd Motor Capacity	0.1/0.2/0.4/0.55/0.75/1.1/1.5/2.2/3.0/3.7/4.0/5.5/7.5/11.0/15.0/18.5	Maximum applicable motor capacity	kW
H004/H204	1st/2nd Motor Pole Number	2/4/6/8 10 to 48: Do not set.	4	pole
H005/H205	1st/2nd Speed Response	1. to 1000.	100.	–
H020/H220	1st/2nd Motor Parameter R1 (Winding resistance on primary side)	0.001 to 9.999 10.00 to 65.53	Dependent on motor capacity	Ω
H021/H221	1st/2nd Motor Parameter R2 (Winding resistance on secondary side)			
H022/H222	1st/2nd Motor Parameter L (Leakage inductance)	0.01 to 99.99 100.0 to 655.3		mH
H023/H223	1st/2nd Motor Parameter Io (No-load current)	0.01 to 99.99 100.0 to 655.3		A
H024/H224	1st/2nd Motor Parameter J (Moment of inertia)	0.001 to 9.999 10.00 to 99.99 100.0 to 999.9 1000. to 9999.		kgm^2

6-1-4 Adjustments for Sensorless Vector Control

- To use sensorless vector control method, perform offline auto-tuning.

  If you cannot perform offline auto-tuning, set motor parameters appropriately according to *6-1-3 Motor Parameter Settings* on page 6-9.
- The inverter may not provide sufficient performance characteristics if your 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 the sensorless vector control method does not provide the intended performance characteristics, adjust the appropriate motor parameter depending on the phenomenon, as shown in the following table.

Operation status	Phenomenon	Adjustment method	Adjustment item
Power running	Actual motor speed is lower than target speed.	Increase the Motor Parameter R2 value gradually, up to 120% of the set value.	H021/H221/H031/ H231
	Actual motor speed is higher than target speed.	Decrease the Motor Parameter R2 value gradually, up to 80% of the set value.	H021/H221/H031/ H231
Regeneration	Torque is insufficient at low frequencies (a few Hz).	Increase the Motor Parameter R1 value gradually, up to 120% of the set value.	H020/H220/H030/ H230
		Increase the Motor Parameter Io value gradually, up to 120% of the set value.	H023/H223/H033/ H233
During startup	Shock occurs during startup.	Decrease the Speed Response value.	H005/H205
		Decrease the Motor Parameter J value gradually, relative to the set value.	H024/H224/ H034/H234
	Motor rotates momentarily in opposite direction to specified rotation direction.	Set the Reverse Rotation Prevention Selection (b046) to 01 (Enabled).	b046
During deceleration	Motor is hunting.	Decrease the Speed Response value.	H005/H205
		Decrease the Motor Parameter J value gradually, relative to the set value.	H024/H224/ H034/H234
During torque limit	Torque becomes insufficient at low frequencies when torque limit is enabled.	Decrease the torque limit.	b021/b221/ b040 to b044
Low-frequency operation	Rotation is unstable.	Increase the Speed Response value.	H005/H205
		Increase the Motor Parameter J value gradually, relative to the set value.	H024/H224/ H034/H234

Precautions for Correct Use

- Before adjusting the 1st/2nd Speed Response (H005/H205), calculate the motor-shaft conversion of the moment of load inertia, add the moment of inertia of the motor to it, and set the sum in the 1st/2nd Motor Parameter J (H024/H224/H034/H234).
  For 1st/2nd Speed Response (H005/H205), the larger the set value, the higher the response speed, which results in a steep torque rise; the smaller the set value, the lower the response speed, which results in gradual torque rise.
- If you use a motor one size lower than the maximum applicable motor capacity for the inverter, to prevent motor burnout, set the Torque Limit 1 to 4 (b041 to b044) to limit values less than the value calculated from the following formula, then enable the torque limit function. For details on the torque limit function, refer to *6-2-1 Torque Limit Function Settings* on page 6-12.
  Torque Limit set value (max.) = 200% × [Rated motor current] / [Rated output current of inverter]

  (Example) If the Inverter capacity and the motor capacity are 0.75 kW (rated output current = 5.0 A) and 0.4 kW (rated current = 2.3 A), respectively, set the torque limit values below the following:
  Torque Limit set value (max.) = 200% × (2.3 A) / (5.0 A) = 92%

Reverse Rotation Prevention Function

This function is enabled only when the 1st/2nd Control Method (A044/A244) is set to 03 (Sensorless vector control).

When sensorless vector control is enabled, the inverter may output a rotation signal opposite to the RUN command direction at low speeds, depending on the current accuracy. To prevent the motor from rotating in the reverse direction, set the Reverse Rotation Prevention Selection (b046) to 01 (Enabled).

Parameter No.	Function name	Data	Default data	Unit
b046	Reverse Rotation Prevention Selection	00: Disabled 01: Enabled (Motor does not rotate in reverse.)	00	–

Output Torque Monitor Function (d012)

Use this function to monitor the motor output torque estimated by the sensorless vector control function.

This function is enabled only when the 1st/2nd Control Method (A044/A244) is set to 03 (Sensorless vector control).

To monitor the motor output torque via the Digital Operator, display the Output Torque Monitor (d012).

For details on Output Torque Monitor, refer to *7-1-11 Output Torque Monitor [d012]* on page 7-8.

For how to monitor the motor output torque via the control terminal block signal, refer to *7-3-6 Terminal MP (Pulse/PWM Output)* on page 7-27 or *7-3-7 Terminal AM (Analog Output)* on page 7-29.

The output torque monitor function estimates the torque value equivalent to the rated current of the inverter as 100%.

To convert it to the rated motor torque ratio, use the following formula:

> Rated motor torque ratio = [Output Torque Monitor (d012) value] × [Rated output current of inverter] / [Rated motor current]

Parameter No.	Function name	Data	Default data	Unit
A044/A244	1st/2nd Control Method	03: Sensorless vector control	00	–
d012	Output Torque Monitor	–200. to 200.	–	%
C027 C028	MP Selection AM Selection	02: Output torque 11: Output torque (signed)[1]	07	–

[1] This setting is available for C028 only.

6-2 Torque Limit Function

6-2-1 Torque Limit Function Settings

Use the torque limit function to limit the output torque of motor.

This function is enabled only when the 1st/2nd Control Method (A044/A244) is set to 03 (Sensorless vector control).

- The Torque Limit Selection (b040) provides four modes as shown below.

Mode	Description
Four-quadrant separate setting mode (b040 = 00)	Use this mode to set the four-quadrant (Forward Power Running, Reverse Regeneration, Reverse Power Running, and Forward Regeneration) torque limits in the Torque Limit 1 to 4 (b041 to b044).
Terminal switching mode (b040 = 01)	Use this mode to switch the Torque Limit 1 to 4 (b041 to b044) setting based on the combination of the torque limit switching functions 1 and 2 (TRQ1 and TRQ2) allocated to multi-function input terminals. The selected torque limit value is enabled for all RUN modes.
Analog input mode (b040 = 02)	Use this mode to set the torque limit value based on the analog voltage applied to the terminal FV of the control terminal block. 0 to 10 V is equivalent to the torque limit value of 0% to 200%. The torque limit value set via the analog input terminal is enabled for all RUN modes.
Option mode (b040 = 03)	Use this mode to set the torque limit value from optional equipment. At present, OMRON provides no options that support this mode.

- Setting one of the Multi-function Input S1 to S7 Selection (C001 to C007) to 40 (TL: Torque limit enabled) enables the torque limit function set in the Torque Limit Selection (b040) only when the terminal TL is input.

  When this terminal is reset, the torque limit setting is disabled and the inverter uses the maximum value (200%) as the torque limit value.

  When the Torque limit enabled (TL) function is not allocated to any of the multi-function input terminals, the torque limit function set in the Torque Limit Selection (b040) is always enabled.
- The torque limit function regards the torque value equivalent to the rated output current of the inverter as 100%.

  To convert it to the rated motor torque ratio, use the following formula:

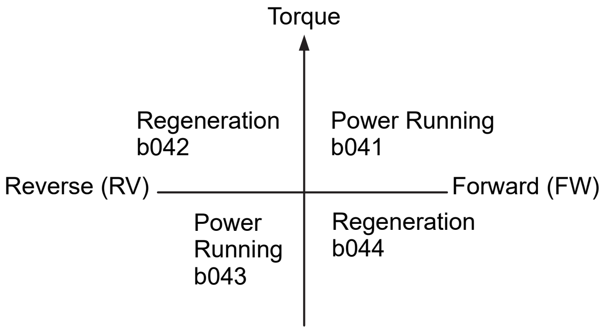
  Rated motor torque ratio = [Torque limit set value] × [Rated output current of Inverter] / [Rated motor current]
- When the Multi-function Output P1/P2 Selection (C021/C022), or Multi-function Relay Output (MA, MB) Function Selection (C026) is set to 10 (TRQ: Torque limit), you can check if the torque limit function is activated with the status of the torque limit signal.

Parameter No.	Function name	Data	Default data	Unit
b040	Torque Limit Selection	00: Four-quadrant separate setting 01: Terminal switching 02: Analog voltage input 03: Option (No applicable Option)	00	–
b041	Torque Limit 1 (Four-quadrant Mode Forward Power Running)	0. to 200. 255: no (Torque limit disabled) Forward Power Running torque limit when b040 = 00	200.	%

Parameter No.	Function name	Data	Default data	Unit
b042	Torque Limit 2 (Four-quadrant Mode Reverse Regeneration)	0. to 200. 255: no (Torque limit disabled) Reverse Regeneration torque limit when b040 = 00	200.	%
b043	Torque Limit 3 (Four-quadrant Mode Reverse Power Running)	0. to 200. 255: no (Torque limit disabled) Reverse Power Running torque limit when b040 = 00	200.	%
b044	Torque Limit 4 (Four-quadrant Mode Forward Regeneration)	0. to 200. 255: no (Torque limit disabled) Forward Regeneration torque limit when b040 = 00	200.	%
C001 to C007	Multi-function Input S1 to S7 Selection	40: TL (Torque limit enabled) 41: TRQ1 (Torque limit switching 1) 42: TRQ2 (Torque limit switching 2)	–	–
C021, C022	Multi-function Output P1/P2 Selection	10: TRQ (Torque limit)	–	–
C026	Multi-function Relay Output (MA, MB) Function Selection			

- **Details of Four-quadrant Separate Setting Mode (b040 = 00)**

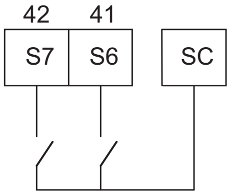
The following figure shows the Torque Limit 1 to 4 (b041 to b044) when the Torque Limit Selection (b040) is set to 00 (Four-quadrant separate setting).



- **Details of Terminal Switching Mode (b040 = 01)**

When the Torque Limit Selection (b040) is set to 01 (Terminal switching), the Torque Limit 1 to 4 (b041 to b044) switched by the torque limit switching 1 and 2 functions allocated to two of the multi-function input terminals are defined as follows.

(Example) When torque limit switching 1 (TRQ1) and torque limit switching 2 (TRQ2) are allocated to multi-function input terminals S6 and S7, respectively (C006 = 41, C007 = 42)



41: TRQ1	42: TRQ2	
OFF	OFF	→ b041
ON	OFF	→ b042
OFF	ON	→ b044
ON	ON	→ b043

Precautions for Correct Use

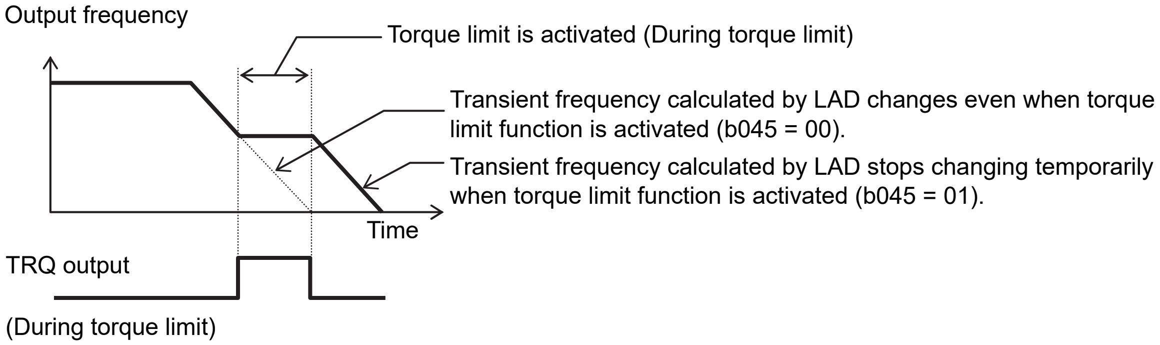
When the torque limit function is used in a low speed range, the inverter may fail to start the motor and detect an overload. In this case, use this function in conjunction with the overload limit selection (b021/b221/b024).

6-2-2 Torque LADSTOP Function Settings

Use this function to stop temporarily the frequency acceleration/deceleration function (LAD) when the torque limit function is activated. This function, as well as the torque limit function, is enabled when the 1st/2nd Control Method (A044/A244) is set to 03 (Sensorless vector control).

- LAD functions to calculate the transient frequency reference value to enable the motor to reach the reference frequency in the set acceleration/deceleration time.
- This function stops the frequency reference temporarily at the transient value calculated by LAD when the torque limit function is activated and restarts at that frequency when the torque limit is reset.
- To stabilize the motor operation after resetting the torque limit, enable this function.

Parameter No.	Function name	Data	Default data	Unit
b045	Torque LADSTOP Selection	00: Disabled 01: Enabled	00	–
Related functions		A044, A244, b040, b041 to b044		


Output frequency
Torque limit is activated (During torque limit)
Transient frequency calculated by LAD changes even when torque limit function is activated (b045 = 00).
Transient frequency calculated by LAD stops changing temporarily when torque limit function is activated (b045 = 01).
Time
TRQ output
(During torque limit)

6-3 Overtorque/Undertorque Function

6-3-1 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.

- This function is enabled only when the 1st/2nd Control Method (A044/A244) is set to 03 (Sensorless vector control).
- To enable the detection of the overtorque/undertorque state, set the Multi-function Output P1/P2 Selection (C021/C022), or Multi-function Relay Output (MA, MB) Function Selection (C026), to 07 (OTQ: Overtorque/Undertorque signal).
- The overtorque/undertorque function regards the torque level equivalent to the rated output current of the inverter as 100%.

  To convert it to the rated motor torque ratio, use the following formula:

  Rated motor torque ratio = [Overtorque/Undertorque level set value] × [Rated output current of Inverter] / [Rated motor current]
- 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
C054	Overtorque/Undertorque Selection	00: Overtorque 01: Undertorque	00	–
C055	Overtorque/Undertorque Level (Forward Power Running)	0. to 200. OTQ signal output level during Forward Power Running	100.	%
C056	Overtorque/Undertorque Level (Reverse Regeneration)	0. to 200. OTQ signal output level during Reverse Regeneration	100.	%
C057	Overtorque/Undertorque Level (Reverse Power Running)	0. to 200. OTQ signal output level during Reverse Power Running	100.	%
C058	Overtorque/Undertorque Level (Forward Regeneration)	0. to 200. OTQ signal output level during Forward Regeneration	100.	%
C059	Overtorque/Undertorque Signal Operation	00: Enabled during acceleration/deceleration and constant speed 01: Enabled during constant speed	01	–
C021, C022	Multi-function Output P1/P2 Selection	07: OTQ (Overtorque/Undertorque signal)	–	–
C026	Multi-function Relay Output (MA, MB) Function Selection			

6-4 Torque Control

The 3G3MX2-V1 Series Inverter provides the torque control mode.

This section describes the torque control settings and functions.

6-4-1 Torque Control Settings

The inverter provides torque control that controls the output torque of the motor.

- This function is enabled when the 1st/2nd Control Method (A044/A244) is set to 03 (Sensorless vector control).
- To use torque control, allocate one of the Multi-function Input S1 to S7 Selection (C001 to C007) to 52 (ATR: Torque reference input permission).

  The torque reference input is enabled when the terminal ATR is input.
- The torque reference input source can be selected in the Torque Reference Input Selection (P033). Select whether to input the torque reference in the Torque Reference Setting (P034), or via an analog input terminal.

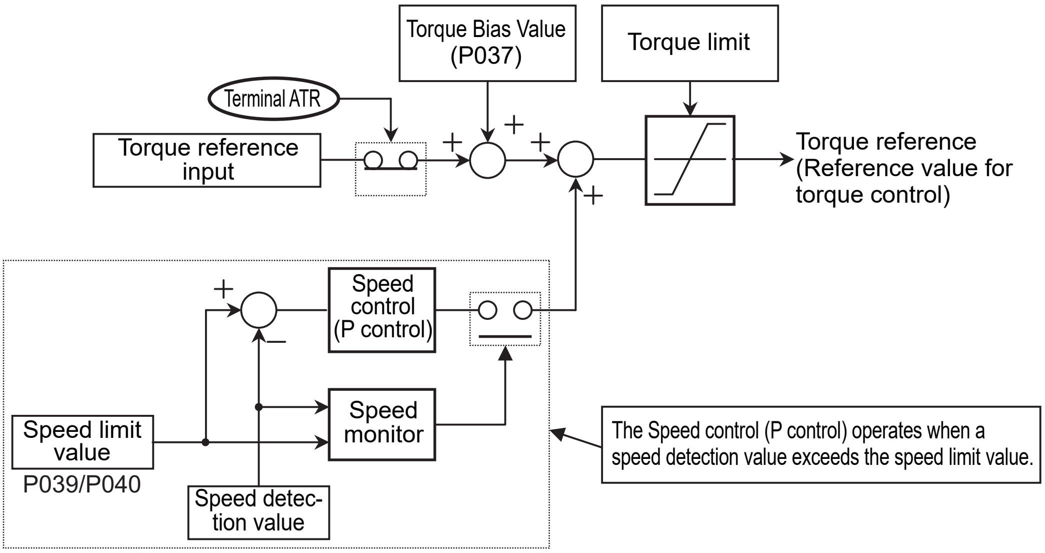
  When the torque reference is input via an analog input terminal, the torque range is 0 to 200% at 0 to 10 V (4 to 20 mA).
- The torque control function regards the torque reference value equivalent to the rated output current of the inverter as 100%.

  To convert it to the rated motor torque ratio, use the following formula:

  > Rated motor torque ratio = [Torque reference set value] × [Rated output current of inverter] / [Rated motor current]
- 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 Value in Torque Control (Forward/Reverse) (P039 and P040).
- Switching between normal frequency control to torque control may cause a shock on the motor operation because the control is different. To reduce the shock during switching, adjust the Speed/Torque Switching Time (P041).

  Increasing the set time reduces the shock.

Parameter No.	Function name	Data	Default data	Unit
P033	Torque Reference Input Selection	00: Terminal FV (10 V = 200%) 01: Terminal FI (20 mA = 200%) 03: Digital Operator (P034 setting) 06: Option (No applicable Option)	00	–
P034	Torque Reference Setting	0. to 200. (Torque reference when P033 = 03)	0.	%
P039	Speed Limit Value in Torque Control (Forward)	0.00 to 99.99/100.0 to 120.0	0.00	Hz
P040	Speed Limit Value in Torque Control (Reverse)	0.00 to 99.99/100.0 to 120.0	0.00	Hz
P041	Speed/Torque Switching Time	0. to 1000.	0.	ms
C001 to C007	Multi-function Input S1 to S7 Selection	52: ATR (Torque reference input permission)	–	–


Torque Bias Value (P037)
Torque limit
Terminal ATR
Torque reference input
+
+
+
+
Torque reference (Reference value for torque control)
+
–
Speed control (P control)
Speed monitor
Speed limit value
P039/P040
Speed detection value
The Speed control (P control) operates when a speed detection value exceeds the speed limit value.

6-4-2 Torque Bias Function Settings

Use this function to apply bias to the torque reference in the torque control mode.

- This function is enabled when the 1st/2nd Control Method (A044/A244) is set to 03 (Sensorless vector control).
- Set the Torque Bias Selection (P036) to 01 (Input via Digital Operator).
- The torque control function regards the torque reference value equivalent to the rated output current of the inverter as 100%.

  To convert it to the rated motor torque ratio, use the following formula:

  Rated motor torque ratio = [Torque bias set value] × [Rated output current of inverter] / [Rated motor current]
- In the Torque Bias Polarity Selection (P038), set the polarity of the torque bias value.

  00: As per sign

  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 RUN direction.

  01: Dependent on RUN direction

  The direction in which the torque bias function 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 (–).

Parameter No.	Function name	Data	Default data	Unit
P036	Torque Bias Selection	00: Disabled 01: Digital Operator 05: Option (No applicable Option)	00	–
P037	Torque Bias Value	–200. to 200. (Enabled when P036 = 01)	0.	%
P038	Torque Bias Polarity Selection	00: As per sign 01: Dependent on RUN direction	00	–

6-5 V/f Control with Speed Feedback

The 3G3MX2-V1 Series Inverter can perform V/f control with speed feedback with the pulse train input function included 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 signal from the encoder.

This section describes the settings and functions of V/f control with speed feedback.

6-5-1 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.

- The V/f control with speed feedback function is available only for the 1st control. It will not work if you switch to the 2nd control.
- To use this function, set the 1st Control Method (A044) to 00 (Constant torque characteristics), 01 (Reduced torque characteristics), or 02 (Free V/f setting).
- Set the Pulse Train Input RP Selection (P003) to 01 (Feedback pulse).
- Set the type of the input pulse train signal in the Pulse Train Input Type Selection (P004) and the number of pulses per motor rotation (×1 multiplication) in the Number of Encoder Pulses (P011), respectively.
- If you set the Pulse Train Input Type Selection (P004) to 01 or 03, also set the Multi-function Input S7 Selection (C007) to 85 (EB: Rotation direction detection). The setting “85 (EB: Rotation direction detection)” only is available only in the Multi-function Input S7 Selection (C007).

  When C007 is set to 85 (EB: Rotation direction detection), the Multi-function Input S7 Operation Selection (C017) is disabled.

  The terminal EB, once set, serves as the phase-B input for Phase A and B 90°phase difference pulse train (P004 = 01), or the direction signal for Single-phase pulse train + direction (P004 = 03).

  If C007 is not set to 85 (EB: Rotation direction detection) when P004 is 01 or 03, the inverter cannot recognize the feedback information correctly, which causes the V/f control with speed feedback to malfunction.

Parameter No.	Function name	Data	Default data	Unit
A044	1st Control Method	00: Constant torque characteristics 01: Reduced torque characteristics (VP 1.7th power (VC at low speed)) 02: Free V/f setting	00	–
P003	Pulse Train Input RP Selection	01: Feedback pulse (enabled only when 1st control is selected)	00	–
P004	Pulse Train Input Type Selection	00: Single-phase pulse train 01: Phase A and B 90°phase difference pulse train 02: Do not set. 03: Single-phase pulse train + direction	00	–
P011	Number of Encoder Pulses	32. to 1024.	512.	pulse
C007	Multi-function Input S7 Selection	85: EB (Rotation direction detection)	06	–

- **Details of Pulse Train Input Type Selection (P004)**

The Pulse Train Input Type Selection (P004) setting causes the inverter to recognize the feedback rotation direction as shown below.

Pulse Train Input Type Selection (P004) setting	RUN command[*1]		Multi-function Input S7 Terminal EB	Recognized feedback rotation direction
	Forward	Reverse		
00 (Phase A and B 90°phase difference pulse train)	ON	OFF	–	Forward[*2]
	OFF	ON	–	Reverse [*2]
01 (Phase-A/B 90° phase difference pulse train)	Forward or Reverse is ON		Lower than 1.8 kHz[*3]	Detects encoder rotation (90° phase difference).
			1.8 kHz min. [*3]	Retains rotation direction at lower than 1.8 kHz via the terminal EB.
03 (Single-phase pulse train + direction)	Forward or Reverse is ON		OFF	Forward rotation (Follows terminal EB)
			ON	Reverse rotation (Follows terminal EB)

*1. When both the forward RUN command and the reverse RUN command are ON or OFF, the inverter does not start its output.

*2. The inverter recognizes the rotation direction via RUN command input because it cannot recognize the rotation direction by the single-phase pulse train.

However, if the RUN command is switched during operation, the inverter retains the rotation direction before the switching until its output frequency causes a deceleration stop and then switches to the rotation direction recognized via RUN command input.

*3. For the multi-function Input S7 terminal, the maximum frequency is 1.8 kHz. Therefore, the inverter cannot recognize the rotation direction from the Phase A and B 90°phase difference pulse train at over 1.8 kHz via the terminal EB.

At 1.8 kHz or higher, the inverter retains the rotation direction at lower than 1.8 kHz.

6-5-2 Recommended Encoder and Its Wiring

For the pulse train input function of the 3G3MX2-V1 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 terminal SC 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.

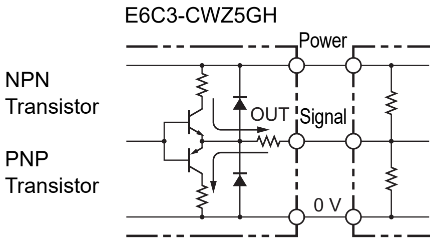
- **Complementary output**

Complementary output is a method to output 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 with the case of open-collector output encoders.

Therefore, this provides a stable output from the encoder.



- **Recommended product**

E6C3-CWZ5GH (Manufacturer: OMRON)

Additional Information

Crosstalk : A phenomenon by which signals are erroneously transmitted between different phases. Specifically, the rising/falling edge signal from phase A is superimposed on the signal from phase B and the rising/falling edge signal from phase B is superimposed on the signal from phase A, respectively.

Encoder Input

For pulse train input, use the pulse train input RP terminal and the multi-function Input S7 terminal of the control circuit terminals.

Be sure to use a complementary-output type encoder.

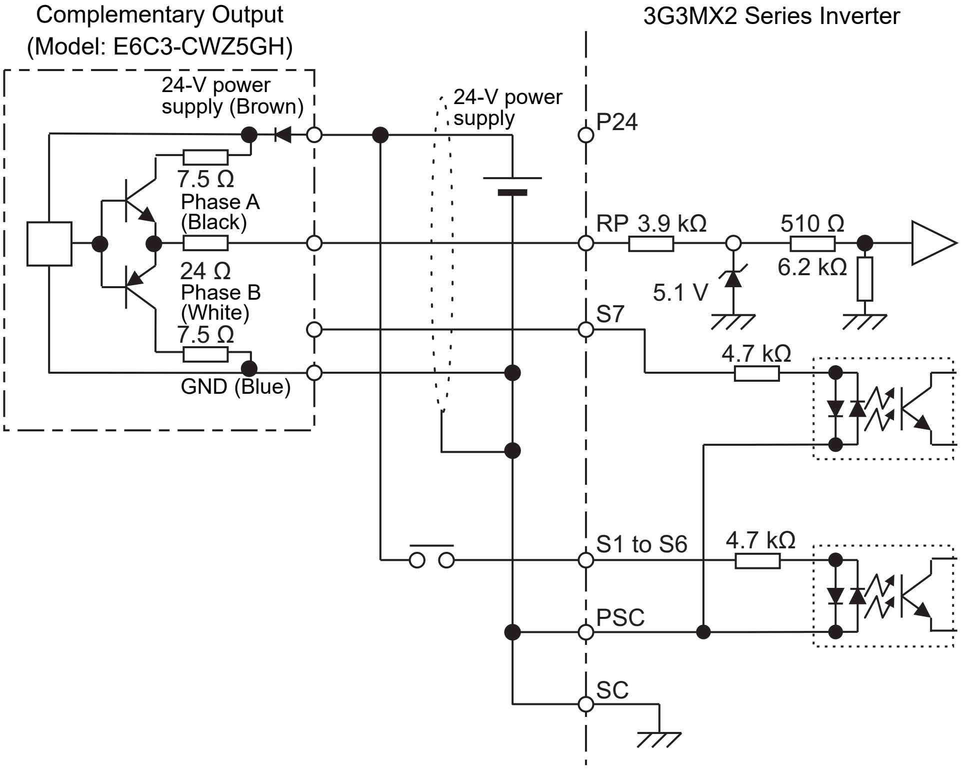
Input signal type	Maximum Frequency	Terminal RP (5 to 24 VDC, 32 kHz max.)	Terminal S7/EB (24 VDC, 1.8 kHz max.)
Single-phase pulse train (P004 = 00)	Terminal RP: 32 kHz Terminal S7 (Terminal EB): 1.8 kHz	Single-phase pulse train	–
Phase A and B 90°phase difference pulse train (P004 = 01)		Phase-A pulse train	Phase-B pulse train
Single-phase pulse train + direction (P004 = 03)		Single-phase pulse train	Direction signal[*1]

[*1] Direction signal can be input in favor of the sink or source logic, independent of the output method of the encoder signal.

Wiring for Phase A and B 90°Phase Difference Pulse Train (P004 = 01)

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

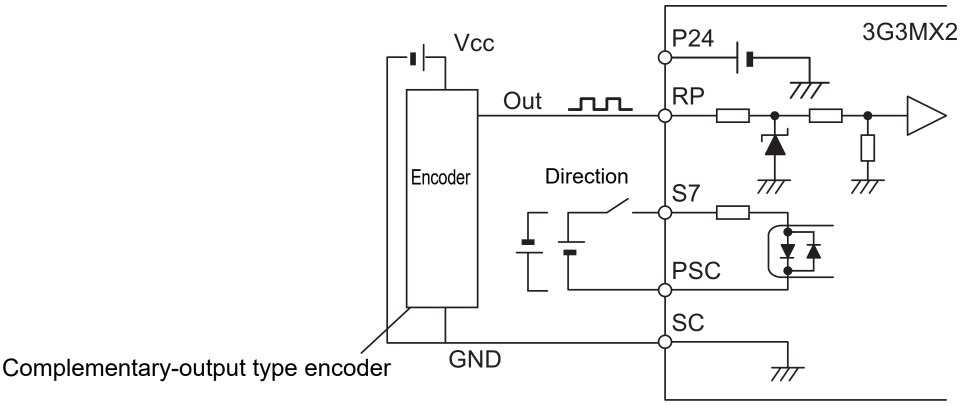
- Connect the phase-A signal to the pulse train input terminal RP.
- Connect the phase-B signal to the multi-function Input S7 terminal and set the Multi-function Input S7 Selection (C007) to 85 (EB: Rotation direction detection).
- If the encoder signal is connected, you need to complete wiring for other multi-input terminals S1 to S6 in the source logic (PNP).
- The control circuit terminal P24 of the inverter is for a 24-V, 100-mA max. power supply. It 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, this terminal must be isolated from any 24-V system power supply for other than the encoder and inverter.

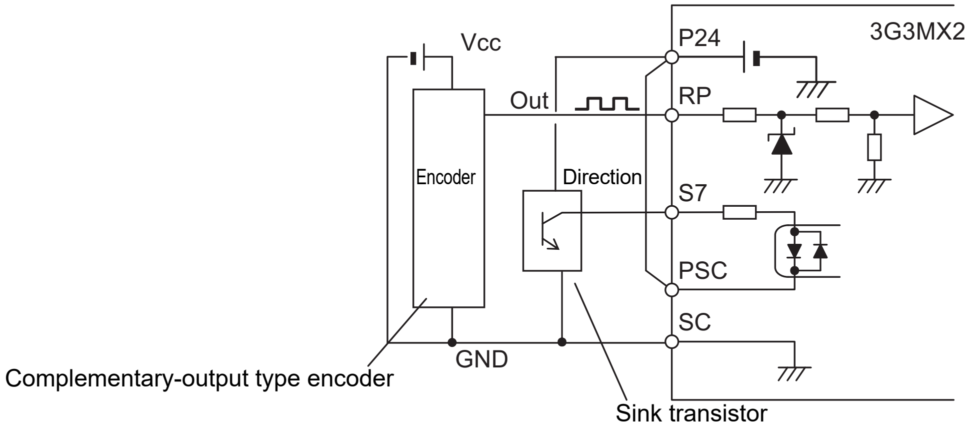

Complementary Output
(Model: E6C3-CWZ5GH)
3G3MX2 Series Inverter
24-V power supply (Brown)
24-V power supply
P24
7.5 Ω
Phase A (Black)
RP
3.9 kΩ
510 Ω
24 Ω
Phase B (White)
6.2 kΩ
5.1 V
S7
7.5 Ω
4.7 kΩ
GND (Blue)
S1 to S6
4.7 kΩ
PSC
SC

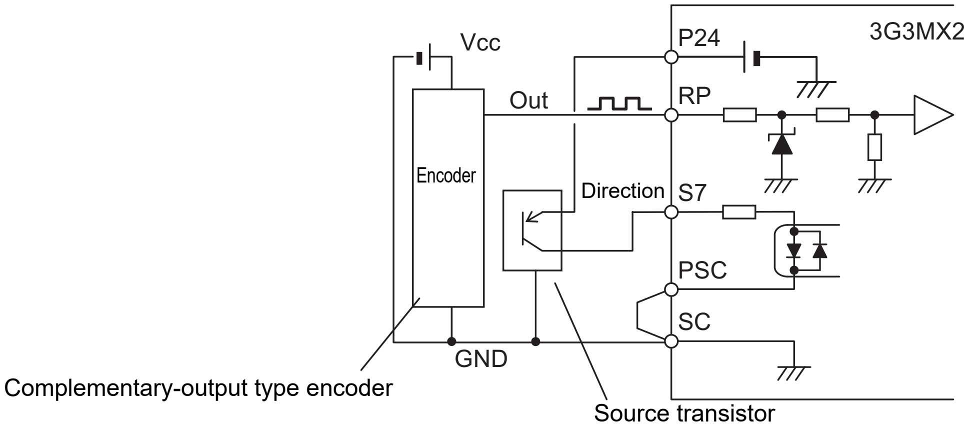
Wiring for Single-phase Pulse Signal and Direction Signal (P004 = 01 or 03)

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

- Connect the single-phase pulse signal to the pulse train input RP terminal.
- Input the direction signal to the multi-function Input S7 terminal and set the Multi-function Input S7 Selection (C007) to 85 (EB: Rotation direction detection). Select the sink logic (NPN) or source (PNP) by properly positioning the short-circuit bar.
- The control circuit terminal P24 of the inverter is for a 24-V, 100-mA max. power supply. It 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, this terminal must be isolated from any 24-V system power supply for other than the encoder and inverter.


Vcc
Encoder
Out
Direction
GND
Complementary-output type encoder
P24
RP
S7
PSC
SC
3G3MX2


Vcc
Out
Encoder
Direction
P24
RP
S7
PSC
SC
3G3MX2
GND
Complementary-output type encoder
Sink transistor


Vcc
Out
Encoder
Direction
P24
RP
S7
PSC
SC
3G3MX2
GND
Complementary-output type encoder
Source transistor

6-5-3 Protective Detection under V/f Control with Speed Feedback

The V/f control with speed feedback performs the following protective detection based on the speed feedback data.

Use these functions according to your application.

● Overspeed error detection

If the speed feedback value exceeds the value set in the Overspeed Error Detection Level (P026), the inverter detects the E81.□ (Overspeed error) and shuts off the output (trip). Set the detection level appropriately depending on the maximum speed allowable for your application.

● Speed deviation excessive detection

If the deviation of the actual frequency from the frequency reference value exceeds the value set in the Speed Deviation Excessive Level (P027), the inverter outputs the excessive speed deviation signal (DSE). Although the inverter outputs this signal, it does not shut off its output (trip).

In this case, set the Multi-function Output P1/P2 Selection (C021/C022), or the Multi-function Relay Output (MA, MB) Function Selection (C026), to 22 (DSE: Excessive speed deviation). In addition, construct such a sequence that stops the control if the inverter outputs the excessive speed deviation signal (DSE).

● Encoder disconnection detection

When the inverter outputs the frequency set in the Creep Speed Setting (P015) or higher, if the speed feedback value does not reach the Starting Frequency (b082) within the Encoder Disconnection Detection Time (P077), the inverter detects the E80.□ (Encoder disconnection error) and shuts off the output (trip).

If the inverter falsely detects this error, for example, when it operates with a heavy load and is slow to start, some adjustment is required. Use the Creep Speed Setting (P015) and Encoder Disconnection Detection Time (P077) to set speed and time values that allow the inverter to start stably in your application.

Parameter No.	Function name	Data	Default data	Unit
P015	Creep Speed Setting	Starting Frequency to 10.00 (100.0) [*2]	5.00	Hz
P026	Overspeed Error Detection Level	0.0 to 150.0 [*1]	115.0	%
P027	Speed Deviation Excessive Level	0.00 to 99.99 100.0 to 120.0	10.00	Hz
P077	Encoder Disconnection Detection Time	0.0: Disconnection detection disabled 0.1 to 10.0	1.0	s
C021, C022	Multi-function Output P1, P2 Selection	22: DSE (Excessive speed deviation)	–	–
C026	Multi-function Relay Output (MA, MB) Function Selection		05	–

*1. Set this in units of percentage as 100% of the 1st Maximum Frequency (A004).

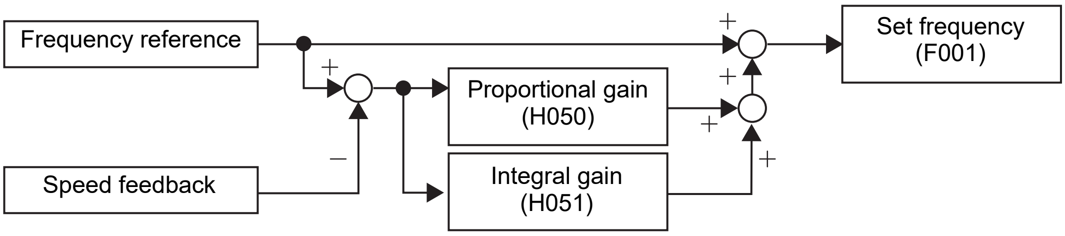
*2. In the high-frequency mode.

6-5-4 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
H050	V/f Control With Speed Feedback Slip Compensation Proportional Gain	0.00 to 10.00	0.20	Time
H051	V/f Control with Speed Feedback Slip Compensation Integral Time	0. to 1000.	2.	s



● V/f Control With Speed Feedback Slip Compensation Proportional Gain

At first, adjust the proportional gain for speed feedback.

- In the Real Frequency Monitor (d008), check and gradually increase the set value.
- While checking the Real Frequency Monitor (d008), 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 responsiveness if the load is actually activated, increase the set value to improve it, or decrease the set value to make it stable.

● V/f Control With Speed Feedback Slip Compensation Integral Gain

Next, adjust the integral time for speed feedback.

- In the Real Frequency Monitor (d008), check and gradually decrease the set value.
- Decrease the value in the Real Frequency Monitor (d008) 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 responsiveness if the load is actually activated, decrease the set value to improve it, or increase the set value to make it stable.

Additional Information

Before adjusting V/f Control with Speed Feedback, first disable the automatic torque boost function (A041 = 00).

The automatic torque boost function also responds to increased current that results from speed feedback, so it may not be possible to correctly adjust V/f Control With Speed Feedback Slip Compensation Proportional Gain/Integral Gain (H050/H051).

6-6 Brake Control Function

The 3G3MX2-V1 Series Inverter has a built-in brake control function for an elevating system etc.

Use this function to control the external brake used in an elevating system etc. from the inverter.

The brake control function can be used independently of the 1st/2nd Control Method (A044/A244) Selection.

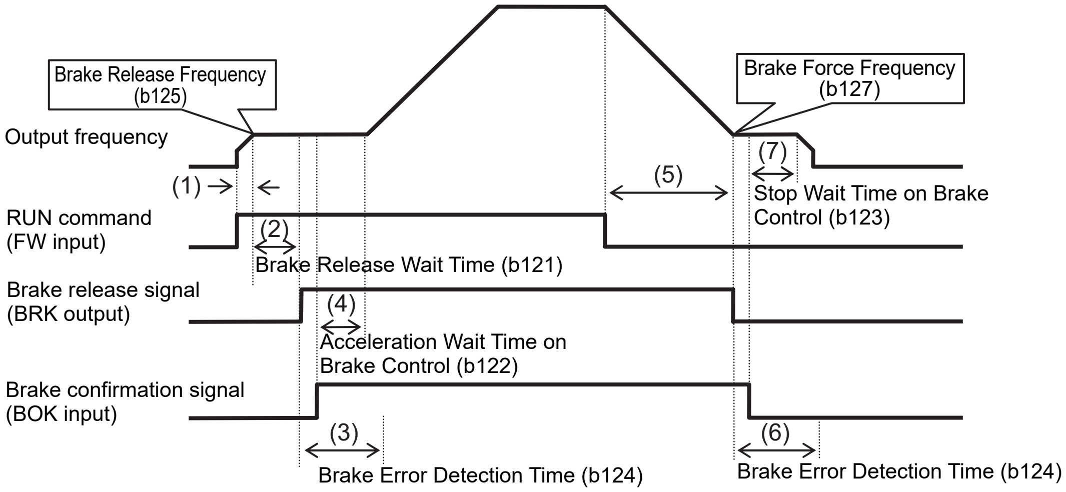
In the 3G3MX2-V1 Series, you can combine this function with the simple position control function.

For how to combine this function with simple position control, refer to *6-7-9 Interlock Function with Simple Position Control and Brake Control* on page 6-49.

This section describes the operation sequence and settings of the brake control function.

6-6-1 Operation Sequence of Brake Control Function

Below is the sequence chart for the brake control function, followed by the description of each operation in the sequence.


Brake Release Frequency (b125)
Brake Force Frequency (b127)
Output frequency
(1)
(5)
(7)
Stop Wait Time on Brake Control (b123)
RUN command (FW input)
(2)
Brake Release Wait Time (b121)
Brake release signal (BRK output)
(4)
Acceleration Wait Time on Brake Control (b122)
Brake confirmation signal (BOK input)
(3)
Brake Error Detection Time (b124)
(6)
Brake Error Detection Time (b124)

Note The above sequence chart shows an example where one of the Multi-function Input S1 to S7 Selection (C001 to C007) is set to 44 (BOK: Brake confirmation).

● During acceleration

(1) When the RUN command turns ON, the inverter starts output and accelerate to the Brake Release Frequency (b125).

(2) After reaching the Brake Release Frequency, the inverter waits until the Brake Release Wait Time (b121) elapses and outputs the brake release signal (C021, C022, C026 = 19: BRK).

However, if the output current does not reach the Brake Release Current (b126) when outputting the brake release signal, the inverter outputs the brake error signal (C021, C022, C026 = 20: BER) without releasing the brake, and detects the E36.☐ (Brake error).

(3) After outputting the brake release signal, the inverter waits for the brake confirmation signal (C001 to C007 = 44: BOK) to turn ON during the time set in the Brake Error Detection Time (b124).

If the brake confirmation signal does not turn ON within the time set in b124, the inverter outputs the brake error signal (C021, C022, C026 = 20: BER) and detects the E36.☐ (Brake error).

If any of the Multi-function Input S1 to S7 Selection (C001 to C007) is set to 44 (BOK: Brake confirmation), the Brake Error Detection Time (b124) setting is disabled and the inverter proceeds to step (4) after outputting the brake release signal.

(4) **After the brake confirmation signal turns ON (after releasing the brake), the inverter waits until the Acceleration Wait Time on Brake Control (b122) elapses and accelerates again to the set frequency.**

- **During deceleration**

(5) **After the RUN command turns OFF, the inverter decelerates to the Brake Force Frequency (b127) and turns OFF the brake release signal (C021, C022, C026 = 19: BRK).**

(6) **After turning OFF the brake release signal, the inverter waits for the brake confirmation signal (C001 to C007 = 44: BOK) to turn OFF during the time set in the Brake Error Detection Time (b124).**

If the brake confirmation signal does not turn OFF within the time set in b124, the inverter outputs the brake error signal (C021, C022, C026 = 20: BER) and detects the E36.☐ (Brake error).

If any of the Multi-function Input S1 to S7 Selection (C001 to C007) is set to 44 (BOK: Brake confirmation), the Brake Error Detection Time (b124) setting is disabled and the inverter proceeds to step (7) after the brake release signal turns OFF.

(7) **After the brake confirmation signal turns OFF (after applying the brake), the inverter waits until the Stop Wait Time on Brake Control (b123) elapses and decelerates again to an output frequency of 0 Hz.**

6-6-2 Brake Control Function Settings

To enable the brake control function, set the Brake Control Function Selection (b120) to 02 (Enabled: DC Injection Braking disabled during stop).

If the interlock function with simple position control and brake control is used, the setting “01: Enabled (DC Injection Braking enabled during stop)” is enabled. The DC injection braking is disabled only with brake control. For details, refer to *6-7-9 Interlock Function with Simple Position Control and Brake Control* on page 6-49.

The brake control function can be used independently of the 1st/2nd Control Method (A044/A244) Selection.

In the 3G3MX2-V1 Series, you can combine this function with the simple position control function.

For how to combine this function with simple position control, refer to *6-7-9 Interlock Function with Simple Position Control and Brake Control* on page 6-49.

- Allocate one of the Multi-function Output P1/P2 Selection (C021/C022), or Multi-function Relay Output (MA, MB) Function Selection (C026), to the following output signals.

  Brake control output : 19 (BRK: Brake release)
  Brake error output : 20 (BER: Brake error)

- As required, set one of the Multi-function Input S1 to S7 Selection (C001 to C007) to 44 (BOK: Brake confirmation).
- According to your system, set the parameters used for the operation sequence.
- It is recommended to use sensorless vector control (A044 = 03) that generates a high torque during startup. For details on sensorless vector control, refer to *6-1 Sensorless Vector Control* on page 6-3.
- Set a frequency higher than the Brake Release Frequency (b125). If the set frequency is equal to or lower than the b125 value, the inverter will detect an overload because the brake cannot be released.

Parameter No.	Function name	Data	Default data	Unit
b120	Brake Control Function Selection	00: Disabled 01: Enabled (DC Injection Braking enabled during stop) 02: Enabled (DC Injection Braking disabled during stop)	00	–
b121	Brake Release Wait Time	0.00 to 5.00 The time from when the inverter reaches the Brake Release Frequency until it outputs the brake release signal. Set the time until the output current reaches the Brake Release Current value.	0.00	s
b122	Acceleration Wait Time on Brake Control	0.00 to 5.00 Set the mechanical delay time from when the brake confirmation signal (or brake release signal) turns ON until the brake is activated actually.	0.00	s
b123	Stop Wait Time on Brake Control	0.00 to 5.00 Set the mechanical delay time from when the brake release signal turns OFF until the brake is forced actually.	0.00	s
b124	Brake Error Detection Time	0.00 to 5.00 Set this to equal to or longer than the time until the brake confirmation signal turns ON after the brake release signal is output.	0.00	s
b125	Brake Release Frequency[*1]	0.00 to 400.0 Set the frequency at which the brake release signal is output.	0.00	Hz
b126	Brake Release Current[*2]	0.00 to 2.00 × Rated current of inverter Set an output current value sufficient enough to support the load and output the brake release signal.	Rated current of inverter	A
b127	Brake Force Frequency [*1]	0.00 to 400.0 Set the frequency at which the brake release signal turns OFF and forces the brake during stop.	0.00	Hz
C001 to C007	Multi-function Input S1 to S7 Selection	44: BOK (Brake confirmation)	–	–
C021, C022	Multi-function Output P1/P2 Selection	19: BRK (Brake release) 20: BER (Brake error)	–	–
C026	Multi-function Relay Output (MA, MB) Function Selection			

[*1] Set this to a value larger than the Starting Frequency (b082).

[*2] If the set value is too low, the inverter may not output a sufficient torque when the brake is released.

6-7 Simple Position Control

The 3G3MX2-V1 Series Inverter can perform simple position control with the pulse train input function included as standard.

This control mode enables positioning to a maximum of eight target positions based on the feedback of the Phase A and B 90°phase difference pulse train from the encoder etc.

Using the communications functions to specify the target position realizes more extensive control.

The 3G3MX2-V1 Series Inverter provides additional functions such as current position preset, position store selection at power off, restarting positioning, and interlock function with simple position control and brake control.

This section describes the wiring, settings, and functions of the simple position control.

6-7-1 Feedback Settings for Simple Position Control

Set the position feedback data necessary for simple position control.

- The simple position control function is available only for the 1st control. It will not work if you switch to the 2nd control.
- Set the Pulse Train Input RP Selection (P003) to 01 (Feedback pulse).
- Set the type of the input pulse train signal in the Pulse Train Input Type Selection (P004) and the number of pulses per motor rotation (×1 multiplication) in the Number of Encoder Pulses (P011), respectively.
- If you set the Pulse Train Input Type Selection (P004) to 01 or 03, also set the Multi-function Input S7 Selection (C007) to 85 (EB: Rotation direction detection). The setting “85 (EB: Rotation direction detection)” is available only in the Multi-function Input S7 Selection (C007).

  When C007 is set to 85 (EB: Rotation direction detection), the Multi-function Input S7 Operation Selection (C017) is disabled.

  The terminal EB, once set, serves as the phase-B input for Phase A and B 90°phase difference pulse train (P004 = 01), or the direction signal for Single-phase pulse train + direction (P004 = 03).

  If C007 is not set to 85 (EB: Rotation direction detection) when P004 is 01 or 03, the inverter cannot recognize the feedback information correctly, which causes the simple position control to malfunction.

Parameter No.	Function name	Data	Default data	Unit
P003	Pulse Train Input RP Selection	01: Feedback pulse (enabled only when 1st control is selected)	00	–
P004	Pulse Train Input Type Selection	00: Single-phase pulse train 01: Phase A and B 90°phase difference pulse train 02: Do not set. 03: Single-phase pulse train + direction	00	–
P011	Number of Encoder Pulses	32. to 1024. (×1 multiplication)	512.	pulse
C007	Multi-function Input S7 Selection	85: EB (Rotation direction detection)	06	–

Details of Pulse Train Input Type Selection (P004)

The Pulse Train Input Type Selection (P004) setting causes the inverter to recognize the feedback rotation direction as shown below.

Pulse Train Input Type Selection (P004) setting	RUN command[*1]		Multi-function Input S7 Terminal EB	Recognition of feedback rotation direction
	Forward	Reverse		
00 (Single-phase pulse train)	ON	OFF	–	Forward[*2]
	OFF	ON		Reverse [*2]
01 (Phase A and B 90°phase difference pulse train)	Forward or Reverse is ON		Lower than 1.8 kHz[*3]	Detects encoder rotation (90° phase difference).
			1.8 kHz min. [*3]	Retains rotation direction at lower than 1.8 kHz via the terminal EB.
03 (Single-phase pulse train + direction)	Forward or Reverse is ON		OFF	Forward rotation (Follows terminal EB)
			ON	Reverse rotation (Follows terminal EB)

*1. When both the forward RUN command and the reverse RUN command are ON or OFF, the inverter does not start output.

*2. The inverter recognizes the rotation direction via RUN command input because it cannot recognize the rotation direction by the single-phase pulse train.

However, if the RUN command is switched during operation, the inverter retains the rotation direction before the switching until its output frequency causes a deceleration stop and then switches to the rotation direction recognized via RUN command input.

In this case, position error may occur due to the difference between the output frequency and the actual operating frequency of the motor.

Under single-phase pulse position control, be sure to stop the motor once before you change the direction of motor rotation.

*3. For the multi-function Input S7 terminal, the maximum frequency is 1.8 kHz. Therefore, the inverter cannot recognize the rotation direction from the Phase A and B 90° phase difference pulse train at over 1.8 kHz via the terminal EB.

At 1.8 kHz or higher, the inverter retains the rotation direction at lower than 1.8 kHz.

6-7-2 Recommended Encoder for Simple Position Control and Its Wiring

The type of encoder recommended for simple position control and the wiring method for the encoder signal are described below.

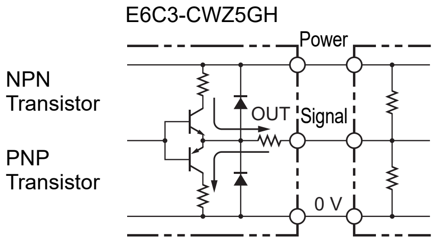
Recommended Encoder

For the pulse train input function of the 3G3MX2-V1 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 terminal SC 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 to output 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 a high impedance) as with the case of open-collector output encoders.

Therefore, this provides a stable output from the encoder.

Recommended product

E6C3-CWZ5GH (Manufacturer: OMRON)

Additional Information

Crosstalk : A phenomenon by which signals are erroneously transmitted between different phases. Specifically, the rising/falling edge signal from phase A is superimposed on the signal from phase B and the rising/falling edge signal from phase B is superimposed on the signal from phase A, respectively.

Encoder Input

For pulse train input, use the pulse train input RP terminal and the multi-function Input S7 terminal of the control circuit terminals.

Be sure to use a complementary-output type encoder.

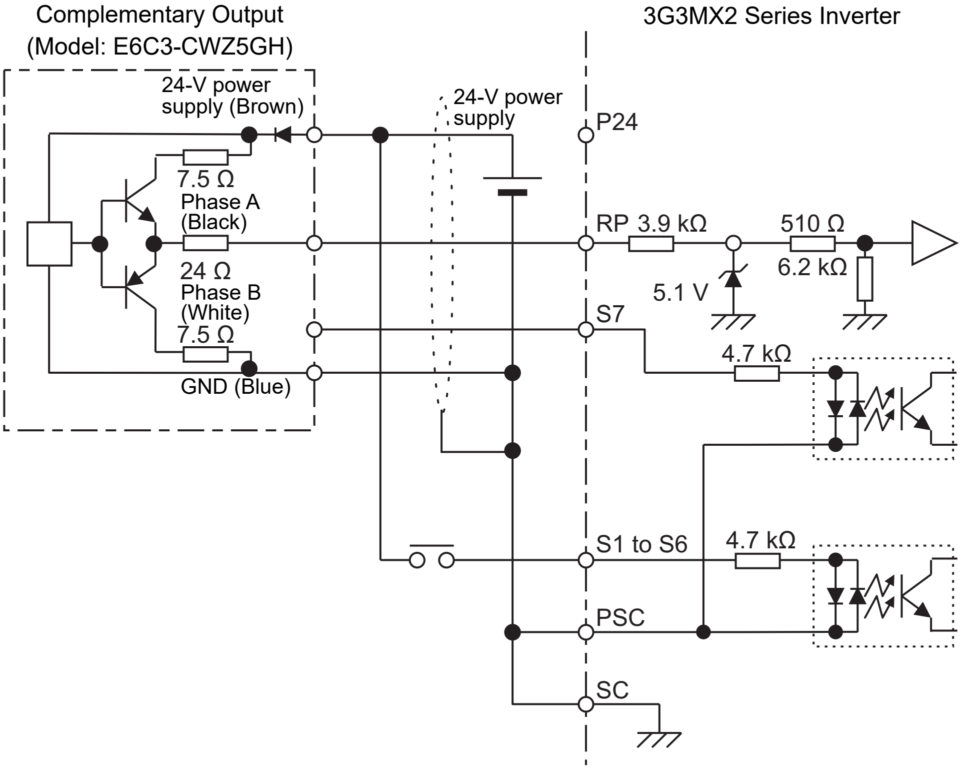
Input signal type	Maximum Frequency	Terminal RP (5 to 24 VDC, 32 kHz max.)	Terminal S7/EB (24 VDC, 1.8 kHz max.)
Single-phase pulse train (P004 = 00)	Terminal RP: 32 kHz Terminal S7 (Terminal EB): 1.8 kHz	Single-phase pulse train	–
Phase A and B 90°phase difference pulse train (P004 = 01)		Phase-A pulse train	Phase-B pulse train
Single-phase pulse train + direction (P004 = 03)		Single-phase pulse train	Direction signal[*1]

[*1] Direction signal can be input in favor of the sink or source logic, independent of the output method of the encoder signal.

Wiring for Phase A and B 90°Phase Difference Pulse Train (P004 = 01)

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

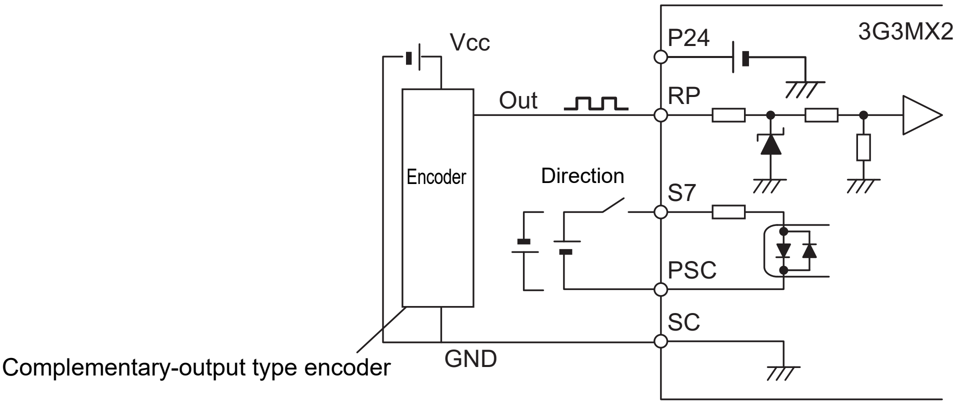
- Connect the phase-A signal to the pulse train input terminal RP.
- Connect the phase-B signal to the multi-function Input S7 terminal and set the Multi-function Input S7 Selection (C007) to 85 (EB: Rotation direction detection).
- If the encoder signal is connected, you need to complete wiring for other multi-input terminals S1 to S6 in the source logic (PNP).
- The control circuit terminal P24 of the inverter is for a 24-V, 100-mA max. power supply. It 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, this terminal must be isolated from any 24-V system power supply for other than the encoder and inverter.

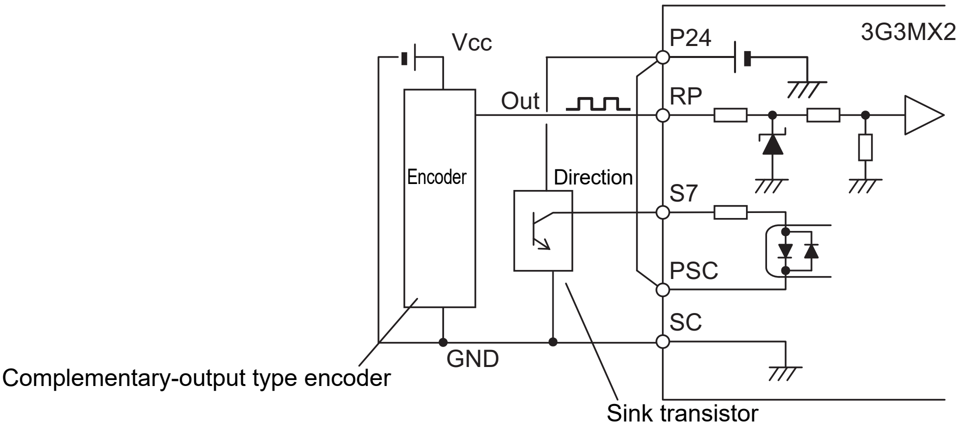

Complementary Output
(Model: E6C3-CWZ5GH)
3G3MX2 Series Inverter
24-V power supply (Brown)
24-V power supply
P24
7.5 Ω
Phase A (Black)
RP
3.9 kΩ
510 Ω
6.2 kΩ
24 Ω
Phase B (White)
5.1 V
7.5 Ω
S7
4.7 kΩ
GND (Blue)
S1 to S6
4.7 kΩ
PSC
SC

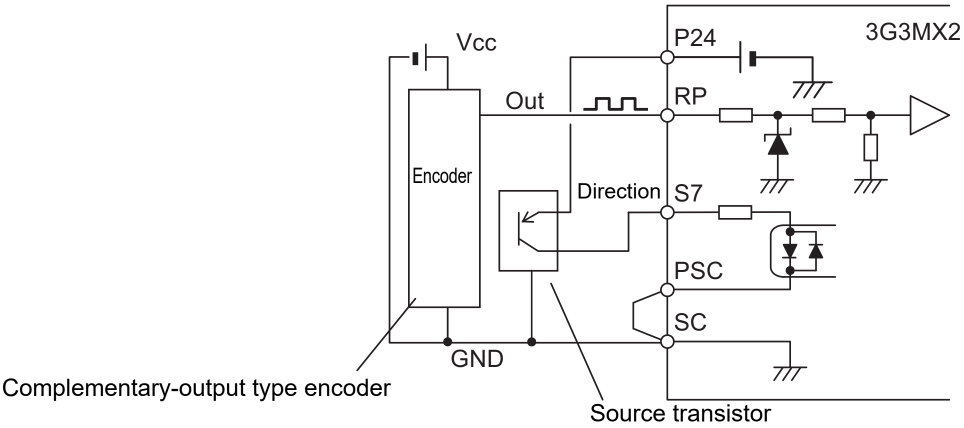
Wiring for Single-phase Pulse Signal and Direction Signal (P004 = 01 or 03)

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

- Connect the single-phase pulse signal to the pulse train input RP terminal.
- Input the direction signal to the multi-function Input S7 terminal and set the Multi-function Input S7 Selection (C007) to 85 (EB: Rotation direction detection). Select the sink logic (NPN) or source (PNP) by properly positioning the short-circuit bar.
- The control circuit terminal P24 of the inverter is for a 24-V, 100-mA max. power supply. It 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, this terminal must be isolated from any 24-V system power supply for other than the encoder and inverter.


Vcc
P24
3G3MX2
Out
RP
Encoder
Direction
S7
PSC
SC
GND
Complementary-output type encoder


Vcc
P24
3G3MX2
Out
RP
Encoder
Direction
S7
PSC
SC
GND
Complementary-output type encoder
Sink transistor


Vcc
P24
3G3MX2
Out
RP
Encoder
Direction
S7
PSC
SC
GND
Complementary-output type encoder
Source transistor

Encoder Wiring Check

When you finish wiring the encoder, follow the steps below to check the encoder wiring.

(1) Turn ON the power supplies for both the inverter and the encoder.

(2) Set the parameter data according to *6-7-1 Feedback Settings for Simple Position Control* on page 6-28.

(3) Display the Current Position Monitor (d030).

(4) Check that the Current Position Monitor (d030) value increases when the motor rotates in the forward direction and decreases when the motor rotates in the reverse direction. In general, the forward/reverse rotation of a motor/encoder is defined as follows.

Rotation direction	Motor	Encoder
Forward	Clockwise when viewed from rear of motor shaft[*1]	Clockwise when viewed from encoder shaft[*2]
Reverse	Counterclockwise when viewed from rear of motor shaft [*1]	Counterclockwise when viewed from encoder shaft

*1. This shows the rotation direction when the U-, V-, and W-phases of the inverter are wired in a correct order to the U-, V-, and W-phases of the motor.

*2. In the output of the encoder during forward rotation, phase A leads phase B by 90°.

(5) Disable the simple position control function and perform forward operation and reverse operation with a single inverter. Check, as described in step (4), that the monitor value increases during forward operation and decreases during reverse operation.

- **If problem occurs during wiring check**

If any problem occurs during the wiring check, refer to the following table to take corrective action.

Problem	Cause	Check/Remedy
The motor/encoder rotates in opposite directions during forward and reverse rotations.	The motor/encoder wiring for forward or reverse rotation is connected the other way around.	Reverse the wiring for the phase-A and phase-B signals.
The Current Position Monitor (d030) value does not increase/decrease.	The phase-A or phase-B signal, or both, is not input correctly.	Check the phase-A and phase-B signals with a tester etc. • Are they connected correctly? • Is the power supplied? • Is there any disconnected cable?
		Check if the encoder's output circuit is not damaged.
		If the voltage waveform of the encoder is normal, the inverter's input circuit is damaged. (Ask for repair.)
The Current Position Monitor (d030) value does not increase/decrease during either forward or rotation.	The inverter cannot recognize the rotation direction due to the effects of crosstalk on the encoder signal.	Take the following measures: • Use a complementary-output type encoder. • Use a shielded cable and connect it to the terminal SC.

6-7-3 Simple Position Control Operation and Settings

The operation and settings of the simple position control function are described below.

Simple Position Control Operation

The simple position control is performed based on the following three settings after the RUN command turns ON.

When the motor reaches the target position, the inverter outputs the positioning completion signal to stop the motor by applying DC injection braking.

Target position : The motor moves to the target based on the Multi-step Position Command 0 to 7 (P060 to P067) settings.
Target speed : The motor moves according to the frequency reference setting.
Acceleration/Deceleration time : The motor runs according to the acceleration and deceleration time settings.

(1) Simple position control starts when the RUN command (forward or reverse) turns ON.

(2) The inverter judges the direction of movement based on the current position and the target position, regardless of the RUN command.

(3) The inverter accelerates according to the acceleration and deceleration time settings to reach the target speed.

If the amount of movement to the target position is small, the inverter decelerates before the target speed is reached and makes a triangular movement.

Or, if the current position is within the range set in the Positioning Completion Range Setting (P017), the inverter switches to the DC injection braking mode at that position.

(4) The inverter starts decelerating when the motor reaches the position short of the target position by the sum of the amount of decelerating movement for the acceleration/deceleration set time and the Creep Speed Moving Amount (P014).

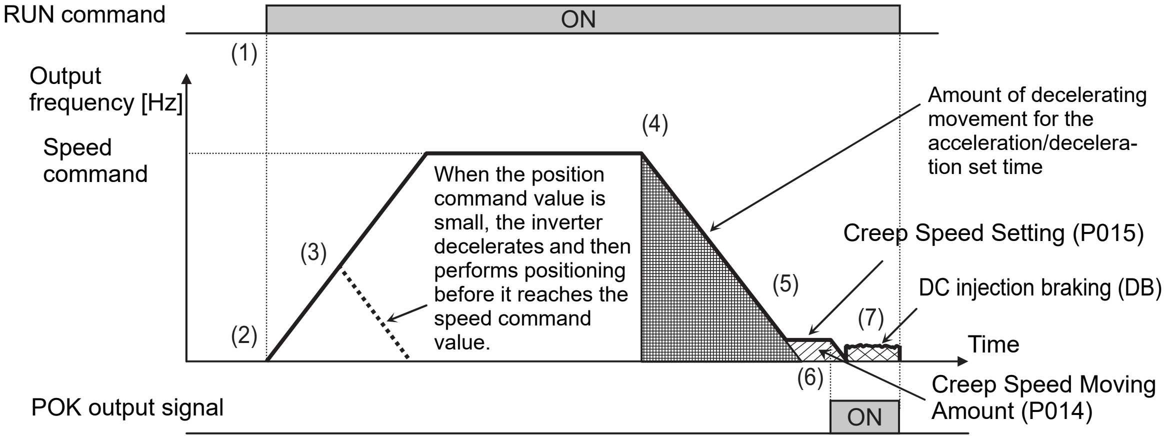
(5) When the frequency set in the Creep Speed Setting (P015) is reached during deceleration, the motor moves at the creep speed.

(6) When the motor reaches the position set in the Positioning Completion Range Setting (P017) from the target position, the inverter outputs the positioning completion signal (C021, C022, C026 = 23: POK) and decelerates according to the acceleration/deceleration time settings.

(7) After the motor stops, the output status of the inverter switches to DC injection braking. The DC injection braking mode is reset when the RUN command turns OFF.

Note that this DC injection braking after stop causes the motor to move out of the stop position due to external force because it has no position retention mechanism. If position retention is required, use external braking.

If using external braking to enable position retention, turn OFF the RUN command to release the DC injection braking mode.



● Precautions for use of single-phase pulse position control (P004 = 00)

When Pulse Train Input Type Selection (P004) is set to 00 (Single-phase pulse input), the direction of motor rotation is judged based on RUN command input.

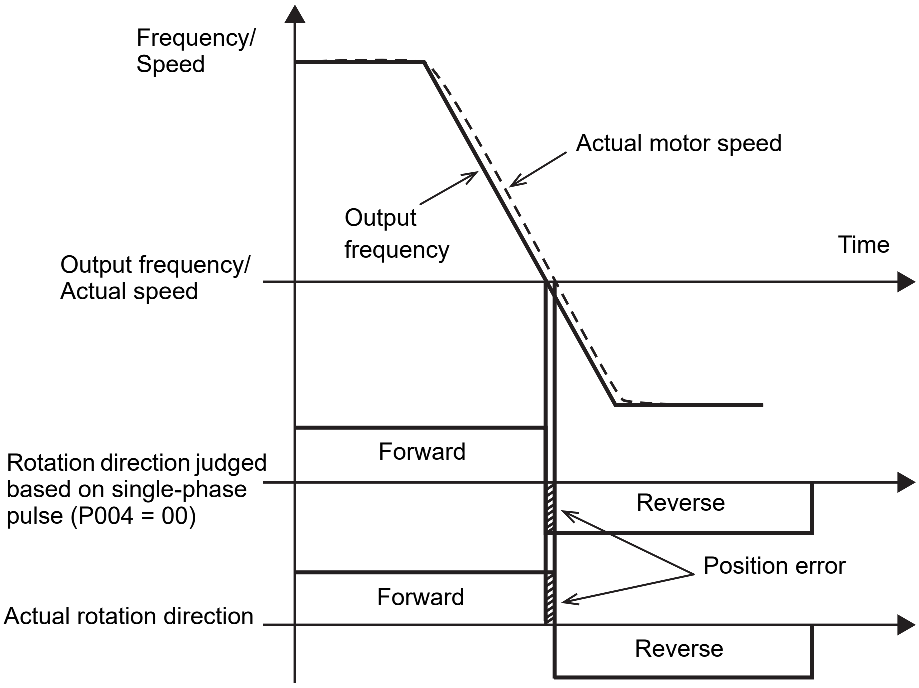
- If the motor rotates from a stop state where the RUN command is not input, the Current Position Monitor does not work.

  To prevent the motor from moving out of position during stop, consider a method to suppress rotation during stop, such as a brake, or change the P004 to 01 (Phase A and B 90°phase difference pulse train) to perform the Current Position Monitor during stop.

- If the RUN command is switched during operation, the inverter retains the rotation direction before the switching until its output frequency causes a deceleration stop and then switches to the rotation direction by the RUN command input.

  In this case, position error may occur due to the difference between the output frequency and the actual operating frequency of the motor.

  Under single-phase pulse position control, be sure to stop the motor once before you change the direction of motor rotation.


Frequency/
Speed
Actual motor speed
Output
frequency
Time
Output frequency/
Actual speed
Forward
Rotation direction judged
based on single-phase
pulse (P004 = 00)
Reverse
Position error
Forward
Actual rotation direction
Reverse

Precautions for Correct Use

- The actual load may not follow the output frequency during deceleration if, for example, the load inertia is large. If this occurs, the speed becomes higher than the creep speed around the target position, and the stopping accuracy degrades.

  When the speed decelerates from the creep speed, also the stopping accuracy degrades.

  Use the following methods to improve the stopping accuracy.

  1. Set a longer deceleration time or increase the Creep Speed Moving Amount (P014).
  2. Set the Creep Speed Setting to the lowest possible value.
  3. For V/f control, adjust the V/f Control With Speed Feedback Slip Compensation Proportional Gain / Integral Gain (H050/H051) to improve the speed following performance.
  4. Switch to sensorless vector control.

- DC injection braking does not work during stop if the simple position control function is used to control the motor via the RUN command from the Digital Operator (A002 = 02).

  To perform DC injection braking after the motor stops, set A002 to other than 02 (Digital Operator).

- Under position control, the Creep Speed Moving Amount (P014) setting will be ignored if the amount of movement is smaller than the set value and the motor moves to the target position at the creep speed.

  If the amount of movement is too small to reach the creep speed, the motor makes a triangular movement.

Simple Position Control Settings

The simple position control is a function only available for the 1st control. It does not work if you switch to the 2nd control.

In addition, when the simple position control is set, the torque control is disabled. The terminal ATR (Torque reference input permission) is disabled.

In the PM motor mode, the simple position control is not available (the parameter P012 is not displayed).

To enable the simple position control, set parameters as follows.

- Set the Simple Position Control Selection (P012) to 02 (Simple position control enabled).
- Set the Creep Speed Moving Amount (P014) and Creep Speed Setting (P015) according to the operation pattern.

  Set the Creep Speed Moving Amount as a percentage of the amount of movement per motor rotation.
- Set the Multi-function Output P1/P2 Selection (C021/C022), or Multi-function Relay Output (MA, MB) Function Selection (C026), to 23 (POK: Position ready), then set the Positioning Completion Range Setting (P017). This value must be set as ×4 multiplication pulses (the number of pulses obtained by dividing each phase-A pulse by 4).

  If the current value reaches in the range of the target position ± P017, the POK signal will be output.
- To enable the position limit settings, set the Position Control Mode Selection (P075) to 00 (Limit). Then, in the Position Limit Setting (Forward Side) (P072)/Position Limit Setting (Reverse Side) (P073), set the upper/lower limit of the position control range. This value must be set as ×1 multiplication pulses (equivalent the number of phase-A pulses).
  If the current position moves out of the range specified in the Position Limit Setting (Forward Side/Reverse Side), the inverter detects the E83.□ (Position control range trip) and shuts off the output.
- The Digital Operator of this inverter has a 4-digit LED display, therefore you can set only the upper 4 digits.

  To set a value over 4 digits, use the computer tool CX-Drive.
- Set the actual control target position in the Multi-step Position Command 0 (P060).

  This value must be set as ×1 multiplication pulses (equivalent the number of phase-A pulses).

  For how to enable positioning to up to eight points, refer to *6-7-6 Multi-step Position Control Settings* on page 6-45.
- It is recommended to set the 1st Control Method (A044) to 03 (Sensorless vector control).
  Before you use sensorless vector control, set the motor parameters as described in *6-1 Sensorless Vector Control* on page 6-3.
- When 1st Control Method (A044) is set to any option other than 03, i.e. V/f control, both position feedback and speed feedback are enabled. Refer to *6-5 V/f Control with Speed Feedback* on page 6-18 for details on V/f control with speed feedback, and adjust the parameters.

Note If operation is not smooth during startup due to insufficient torque, disable the automatic torque boost function (A041 = 00) and adjust the manual torque boost parameters.
If this does not improve operation, it is recommended to use sensorless vector control (A044 = 03), which generates high torque during startup.

- When the simple position control is enabled, the DC injection braking function works even if the DC Injection Braking Selection (A051) is set to 00 (Disabled).

  Do not set the DC Injection Braking Selection (A051) to Enabled. Doing so causes the simple position control to malfunction.

  To obtain the required level of braking power without overload detection, set the DC Injection Braking Power (A054).

Parameter No.	Function name	Data	Default data	Unit
P012	Simple Position Control Selection	00: Simple position control disabled 02: Simple position control enabled	00	–
P014	Creep Speed Moving Amount	0.0 to 400.0	125.0	%
P015	Creep Speed Setting	Starting Frequency to 10.00 (100.0) *2	5.00	Hz
P017	Positioning Completion Range Setting	0. to 9999. 1000 (10000) (×4 multiplication)	50.	pulse

Parameter No.	Function name	Data	Default data	Unit
P060	Multi-step Position Command 0	Position range setting (reverse side) (P073) to position range setting (forward side) (P072) (Displays upper 4 digits including “–”) (×1 multiplication)	0	pulse
P072	Position Limit Setting (Forward Side)	0 to 268435455 (Displays upper 4 digits) (×1 multiplication)	268435455	pulse
P073	Position Limit Setting (Reverse Side)	–268435455 to 0 (Displays upper 4 digits including “–”) (×1 multiplication)	–268435455	pulse
P075	Position Control Mode Selection	00: Limit 01: No limit [1]	00	–
A044	1st Control Method	00: Constant torque characteristics 01: Reduced torque characteristics 02: Free V/f setting 03: Sensorless vector control	00	–
A051	DC Injection Braking Selection	00: Disabled	00	–
C021, C022	Multi-function Output P1/P2 Selection	23: POK (Positioning ready)	–	–
C026	Multi-function Relay Output (MA, MB) Function Selection		05	–

*1. Refer to *6-7-7 Turntable Control* on page 6-47.

*2. In the high-frequency mode.

Protective Functions under Simple Position Control

Simple position control has protective functions. Set these functions according to your application.

If the Reset Selection (C102) is set to 02 (Enabled only during trip, default), 00 (Trip reset at power-on), or 01 (Trip reset at power-off), the current position data is cleared when a trip is reset.

Set the Reset Selection (C102) to 03 (Trip reset only) so as not to clear the current position data.

● Position control range trip

If the Current Position Monitor (d030) value is out of the position control range specified in the Position Limit Setting (P072 and P073), the inverter detects the E83.□ (Position control range trip) and shuts off the output. Set the parameter value according to the moving range for your application.

Because the Digital Operator of this inverter has a 4-digit display, you can set only the upper 4 digits.

To set a value over 4 digits, use the computer tool CX-Drive.

● Overspeed error detection

If the speed feedback value exceeds the value set in the Overspeed Error Detection Level (P026), the inverter detects the E81.□ (Overspeed error) and shuts off the output.

Set the detection level according to the maximum speed allowable for your application.

● Speed deviation excessive level detection

If the deviation of the actual frequency from the frequency reference value exceeds the value set in the Speed Deviation Excessive Level (P027), the inverter outputs the excessive speed deviation signal (DSE). Although the inverter outputs this signal, it does not shut off its output (trip).

In this case, set the Multi-function Output P1/P2 Selection (C021/C022), or the Multi-function Relay Output (MA, MB) Function Selection (C026), to 22 (DSE: Excessive speed deviation). In addition, construct such a sequence that stops the control if the inverter outputs the excessive speed deviation signal (DSE).

● Encoder disconnection detection

When the inverter outputs the frequency set in the Creep Speed Setting (P015) or higher, if the speed feedback value does not reach the Starting Frequency (b082) within the Encoder Disconnection Detection Time (P077), the inverter detects the E80.☐ (Encoder disconnection error) and shuts off the output.

If the inverter falsely detects this error, for example, when it operates with a heavy load and is slow to start, some adjustment is required. Use the Creep Speed Setting (P015) and Encoder Disconnection Detection Time (P077) to set speed and time values that allow the inverter to start stably in your application.

Parameter No.	Function name	Data	Default data	Unit
C102	Reset Selection	03: Trip reset only	02 [*1]	–
P072	Position Limit Setting (Forward Side)	0 to 268435455 (Displays upper 4 digits) (×1 multiplication)	268435455	pulse
P073	Position Limit Setting (Reverse Side)	–268435455 to 0 (Displays upper 4 digits including “–”) (×1 multiplication)	–268435455	pulse
P026	Overspeed Error Detection Level	0.0 to 150.0 [*2]	115.0	%
P027	Speed Deviation Excessive Level	0.00 to 99.99 100.0 to 120.0	10.00	Hz
P015	Creep Speed Setting	Starting Frequency to 10.00 (100.0) [*3]	5.00	Hz
P077	Encoder Disconnection Detection Time	0.0: Disconnection detection disabled 0.1 to 10.0	1.0	s
C021, C022	Multi-function Output P1, P2 Selection	22: DSE (Excessive speed deviation)	–	–
C026	Multi-function Relay Output (MA, MB) Function Selection		05	–

[*1] The default data was changed from the previous model.

[*2] Set this as a percentage of the 1st Control Method (A004).

[*3] In the high-frequency mode.

Monitor Functions under Simple Position Control

When the Pulse Train Input RP Selection (P003) is set to 01 (Feedback pulse), the monitor functions listed below are always enabled.
Use these monitor functions for checking the operation of the simple position control function, monitoring device position, or other purposes.
Because the Digital Operator of this inverter has a 4-digit display, you can monitor only the upper 4 digits.
To monitor a value over 4 digits, use the computer tool CX-Drive.

Parameter No.	Function name	Data	Default data	Unit
d008	Real Frequency Monitor [*1]	(–580.00) [*4] –400.00 to 400.00 (580.00) [*4]	–	Hz
d029	Position Command Monitor [*2]	–268435455 to 268435455 (×1 multiplication) (Displays upper 4 digits including “–”)	–	pulse
d030	Current Position Monitor [*3]	–268435455 to 268435455 (×1 multiplication) (Displays upper 4 digits including “–”)	–	pulse

[*1] For details, refer to *7-1-8 Real Frequency Monitor [d008]* on page 7-7.

[*2] For details, refer to *7-1-21 Position Command Monitor [d029]* on page 7-12.

[*3] For details, refer to *7-1-22 Current Position Monitor [d030]* on page 7-12.

[*4] In the high-frequency mode.

6-7-4 Origin Search Function, Current Position Preset, Position Data Storage at Power Shutoff

When the power supply is turned on, the inverter clears the current position data to zero before startup.

Therefore, you need to establish the origin for position control before performing simple position control.

This section describes the current position clear and origin search functions to establish this origin.

It also describes the current position preset and position data storage at power shutoff functions associated with the origin search function.

Origin Search by Current Position Clear

When the Multi-function Input S1 to S7 Selection (C001 to C007) is set to 47 (PCLR: Current position clear) and that input terminal is turned ON, the current position data is cleared. The position at that time is set as the origin.

- Move to the position to set the origin and turn ON the current position clear signal to establish the origin.
- The current position clear signal is enabled when the Pulse Train Input RP Selection (P003) is set to 01 (Feedback pulse), independent of the Simple Position Control Selection (P012).

Parameter No.	Function name	Data	Default data	Unit
C001 to C007	Multi-function Input S1 to S7 Selection	47: PCLR (Current position clear)	–	–

Operation of Origin Search Function

The origin search function starts when the origin search start signal turns ON, and establishes the origin at the point when the origin search limit signal turns ON. The origin search function has two origin search modes as shown below.

Select one that is suited to your application.

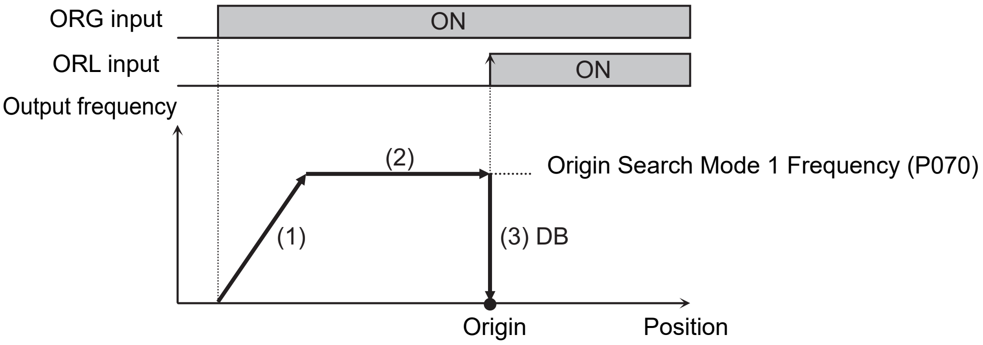
The origin search function does not work when the Position Control Mode Selection (P075) is set to 01 (No limit).

Be sure to set the Position Control Mode Selection (P075) to 00 (Limit).

● Origin search mode 1

Use this mode to establish the origin simply by using sensors.

1. **When the origin search startup signal (C001 to C007 = 70: ORG) turns ON, the inverter accelerates in the direction set in the Origin Search Direction Selection (P069) for the set acceleration time. Do not input the RUN command. Doing so activates the simple position control function.**
2. **The inverter operates at the Origin Search Mode 1 Frequency (P070).**
3. **When the origin search limit signal (C001 to C007 = 69: ORL) turns ON, the inverter switches to the DC injection braking mode.**
4. **Turn OFF the origin search startup signal (C001 to C007 = 70: ORG). The Current Position Monitor (d030) is cleared to zero and starts counting the current position again.**



Origin search mode 2

This mode provides a method to improve the processing time and accuracy of origin search by switching between two frequency settings in the origin search mode.

In the Origin Search Mode 2 Frequency (P071), set a high frequency to move to the proximity of the origin in a short time.

In the Origin Search Mode 1 Frequency (P070), set a low frequency to improve the accuracy of the stop position.

The figure below shows the operation of the origin search mode 2, where the horizontal axis of the upper graph represents the position and the lower graph represents the time, respectively.

(1) When the origin search startup signal (C001 to C007 = 70: ORG) turns ON, the inverter accelerates in the direction set in the Origin Search Direction Selection (P069) for the set acceleration time. Do not input the RUN command. Doing so activates the simple position control function.

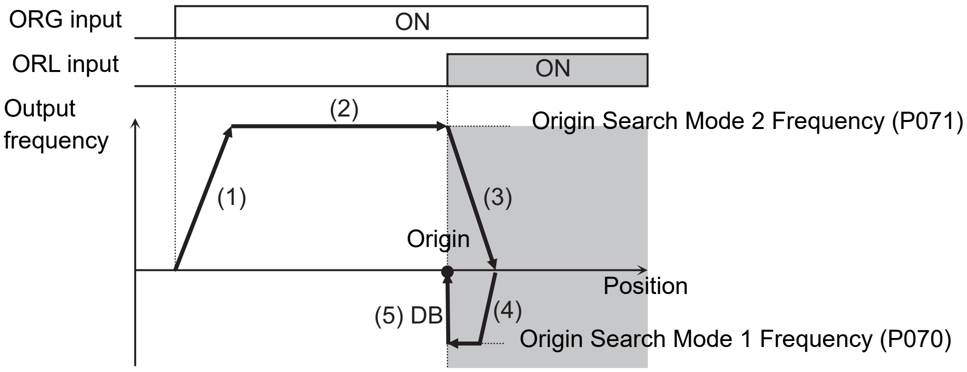
(2) The inverter operates at the Origin Search Mode 2 Frequency (P071).

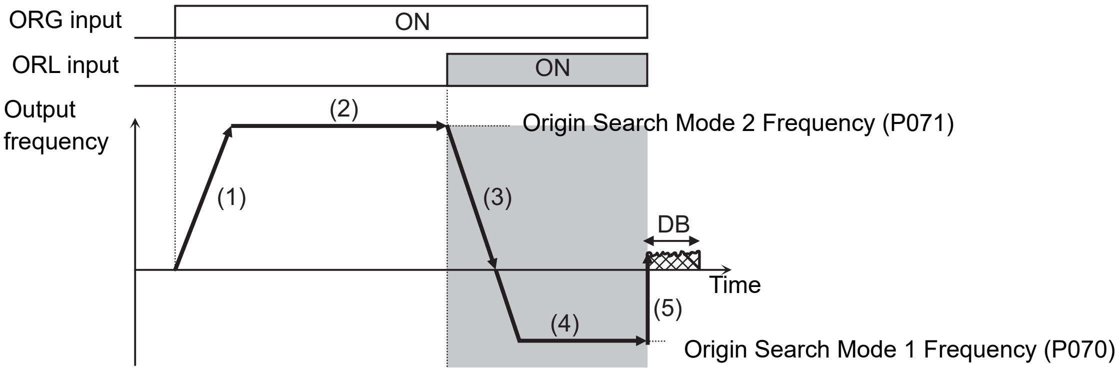
(3) When the origin search limit signal (C001 to C007 = 69: ORL) turns ON, the inverter decelerates for the set deceleration time.

(4) The inverter operates in a direction opposite to that set in the Origin Search Direction Selection (P069) at the Origin Search Mode 1 Frequency (P070).

(5) When the origin search limit signal (C001 to C007 = 69: ORL) turns OFF, the inverter switches to the DC injection braking mode.

(6) Turn OFF the origin search startup signal (C001 to C007 = 70: ORG). The Current Position Monitor (d030) is cleared to zero and starts counting the current position again.


ORG input
ON
ORL input
ON
Output frequency
(2)
Origin Search Mode 2 Frequency (P071)
(1)
(3)
Origin
Position
(5) DB
(4)
Origin Search Mode 1 Frequency (P070)


ORG input
ON
ORL input
ON
Output frequency
(2)
Origin Search Mode 2 Frequency (P071)
(1)
(3)
DB
Time
(5)
(4)
Origin Search Mode 1 Frequency (P070)

Origin Search Function Settings

Configure the origin search function settings as shown below based on the required operation.

- In the Origin Search Mode (P068), set the origin search mode to use.
- In the Origin Search Direction Selection (P069), set the direction in which to start the origin search function according to your application.
- Set the Origin Search Mode 1 Frequency (P070) when the Origin Search Mode (P068) is set to 00 (Origin search mode 1), and set the Origin Search Mode 1 Frequency (P070) and Origin Search Mode 2 Frequency (P071) when P068 is set to 01 (Origin search mode 2).
- Set any two of the Multi-function Input S1 to S7 Selection (C001 to C007) to 69 (ORL: Origin search limit signal) and 70 (ORG: Origin search startup signal).
- The origin search function does not work when the Position Control Mode Selection (P075) is set to 01 (No limit).

  Be sure to set the Position Control Mode Selection (P075) to 00 (Limit).

Parameter No.	Function name	Data	Default data	Unit
P068	Origin Search Mode	00: Origin search mode 1 01: Origin search mode 2	00	–
P069	Origin Search Direction Selection	00: Forward 01: Reverse	01	–
P070	Origin Search Mode 1 Frequency	0.00 to 10.00 (100.0) [*1]	5.00	Hz
P071	Origin Search Mode 2 Frequency	0.00 to 1st Maximum Frequency	5.00	Hz
P075	Position Control Mode Selection	00: Limit	00	–
C001 to C007	Multi-function Input S1 to S7 Selection	69: ORL (Origin search limit signal) 70: ORG (Origin search startup signal)	–	–

[*1] In the high-frequency mode.

Current Position Preset Function

The current position preset function presets the current position to another position.

Use this function when the origin established by the origin search function is different from the actual origin in the application.

- In the Preset Position Data (P083), set any position that you want to define as the origin of your application. This value must be set as ×1 multiplication pulses (equivalent the number of phase-A pulses).

  Because the Digital Operator of this inverter has a 4-digit display, you can set only the upper 4 digits.

  To set a value over 4 digits, use the computer tool CX-Drive.
- When the Multi-function Input S1 to S7 Selection (C001 to C007) is set to 91 (PSET: Preset position) and that input terminal is turned ON, the Preset Position Data (P083) value is set in the Current Position Monitor (d030).
- The current position preset function is enabled when the Pulse Train Input RP Selection (P003) is set to 01 (Feedback pulse), independent of the Simple Position Control Selection (P012) setting.
- The current position preset function does not work when the Position Control Mode Selection (P075) is set to 01 (No limit). Be sure to set the Position Control Mode Selection (P075) to 00 (Limit).

Parameter No.	Function name	Data	Default data	Unit
P075	Position Control Mode Selection	00: Limit	00	–
P003	Pulse Train Input RP Selection	01: Feedback pulse (Enabled only when 1st control is selected)	00	–
P083	Preset Position Data	Position Limit Setting (Reverse Side) (P073) to Position Limit Setting (Forward Side) (P072) (×1 multiplication)	0	pulse
C001 to C007	Multi-function Input S1 to S7 Selection	91: PSET (Preset position)	–	–

Position Data Storage at Power Shutoff

The position data storage at power shutoff function enables the inverter to store the data of the Current Position Monitor (d030) into the EEPROM at power shutoff so that the data can be set in the Current Position Monitor at the next power-on.

This allows you to use the origin position once established by the origin search function continuously even after turning on the power supply again.

However, to use this function, observe the following precautions:

- To store the Current Position Monitor data at power shutoff, set the Position Store Selection at Power Off (P081) to 01 (Store).
- The position data storage at power shutoff function stores the position data into the Position Data at Power Off (P082) when the power supply is shut off. This data will be set in the Current Position Monitor at the next power-on.

  Although you can set data in the Position Data at Power Off (P082), the operation is ineffective because it will be overwritten at the next power shutoff.

  Because the Digital Operator of this inverter has a 4-digit display, you can monitor only the upper 4 digits.

  To monitor a value over 4 digits, use the computer tool CX-Drive.
- If the motor rotates when the power supply is shut off, the inverter cannot recognize the rotation amount, which causes position error.

  Take measures to prevent motor rotation at power shutoff, for example, by using the brake.

  If the motor rotated after power shutoff, perform origin search operation to establish the origin in advance.
- Even if the brake is applied at power shutoff, the position error may occur due to backlash. Because this positional error is accumulated, perform origin search once per several startups to eliminate it.

Parameter No.	Function name	Data	Default data	Unit
P081	Position Store Selection at Power Off	00: Not store 01: Store	00	–
P082	Position Data at Power Off	Position Limit Setting (Reverse Side) (P073) to Position Limit Setting (Forward Side) (P072) (×1 multiplication)	0	pulse

6-7-5 Restarting Positioning

If the motor moves out of the restarting positioning range after position control is executed by the simple position control function, the inverter automatically starts repositioning it again.

To enable the restarting positioning function, set parameters as follows:

- In the Restarting Positioning Range Setting (P080), set the position range in which to start restarting positioning.

  If the current position is deviated by more than “±P080” (including the set value) from the target position, the restarting positioning function is activated automatically to reposition the motor to the target position.

  Because the Digital Operator of this inverter has a 4-digit display, you can set only the upper 4 digits.

  To set a value over 4 digits, use the computer tool CX-Drive.
- The RUN command must remain ON while using the restarting positioning function.
- Even if the motor is out of the set pulse input (P080), the restarting positioning function does not work when it is within the range set in the Positioning Completion Range Setting (P017).
- The restarting positioning function may start and stop repeatedly depending on the Restarting Positioning Range Setting (P080) and Positioning Completion Range Setting (P017). In this case, adjust either of these settings.
- Do not use the restarting positioning function in applications where a brake is used to hold an elevating axis, or keep equipment in the stop position. Doing so causes frequent force/release of the brake, which may result in a load fall accident or an overload trip.

Parameter No.	Function name	Data	Default data	Unit
P080	Restarting Positioning Range Setting	0. to 9999. 1000 (10000) (×4 multiplication)	0.	pulse
P017	Positioning Completion Range Setting	0. to 9999. 1000 (10000) (×4 multiplication)	50.	pulse

6-7-6 Multi-step Position Control Settings

Use the multi-function input S1 to S7 terminals to set up to eight target positions.

- Set any three of the Multi-function Input S1 to S7 Selection (C001 to C007) to 66 (CP1: Position command selection 1) to 68 (CP3: Position command selection 3).
- In the Multi-step Position Command 0 to 7 (P060 to P067), set the target positions.

  These values must be set as ×1 multiplication pulses (equivalent the number of phase-A pulses).

  Because the Digital Operator of this inverter has a 4-digit display, you can set only the upper 4 digits.

  To set a value over 4 digits, use the computer tool CX-Drive.
- To provide an interval between each input to the Position command selection 1 to 3 terminals to prevent false recognition, set the wait time until the inverter recognizes input to these terminals in the Multi-step Speed/Position Determination Time (C169).

  Be sure to set these parameters appropriately. Note that increasing the determination time setting lowers the responsiveness.

Parameter No.	Function name	Data	Default data	Unit
P060	Multi-step Position Command 0	Position Limit Setting (Reverse Side) (P073) to Position Limit Setting (Forward Side) (P072) (Displays upper 4 digits including "–") (× 1 multiplication)	0	pulse
P061	Multi-step Position Command 1		0	
P062	Multi-step Position Command 2		0	
P063	Multi-step Position Command 3		0	
P064	Multi-step Position Command 4		0	
P065	Multi-step Position Command 5		0	
P066	Multi-step Position Command 6		0	
P067	Multi-step Position Command 7		0	
C001 to C007	Multi-function Input Selection	66: CP1 (Position command selection 1) 67: CP2 (Position command selection 2) 68: CP3 (Position command selection 3)	–	–
C169	Multi-step Speed/Position Determination Time	0 to 200 (× 10 ms) Time until terminal input is recognized.	0	ms

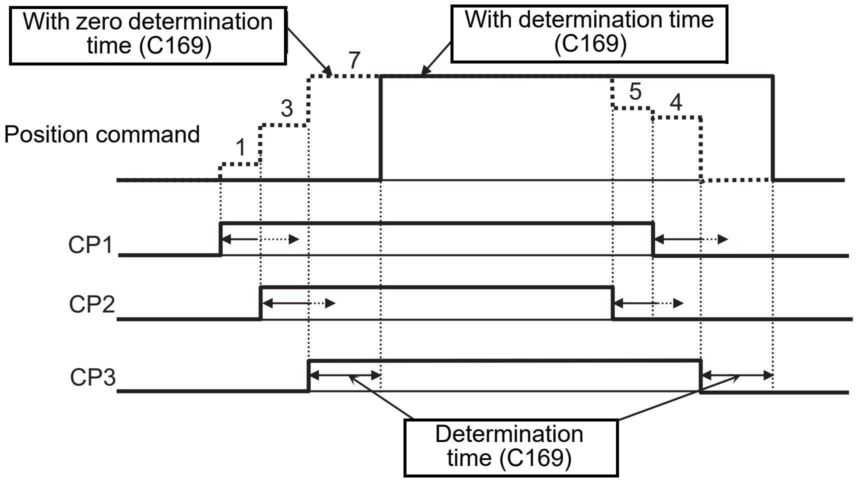
● Relationship between Multi-step Position Command 0 to 7 and CP1 to CP3 (Position Command Selection 1 to 3)

Position command	CP3	CP2	CP1
Multi-step position 0	0	0	0
Multi-step position 1	0	0	1
Multi-step position 2	0	1	0
Multi-step position 3	0	1	1

Position command	CP3	CP2	CP1
Multi-step position 4	1	0	0
Multi-step position 5	1	0	1
Multi-step position 6	1	1	0
Multi-step position 7	1	1	1

● Operation Diagram for Multi-step Speed/Position Determination Time (C169)

The inverter recognizes the input data when the time set in C169 elapsed since it detected the status transition of the last input signal.


With zero determination time (C169)
With determination time (C169)
7
3
5
4
1
Position command
CP1
CP2
CP3
Determination time (C169)

6-7-7 Turntable Control

This function is useful when using a system of rotating coordinates such as those of a turn table.

It performs positioning based on the amount of movement per rotation of the rotating coordinates in the direction in which the moving distance is shorter.

- Set the Position Control Mode Selection (P075) to 01 (No limit).
- Set the amount of movement per rotation of the rotating coordinates in the Multi-step Position Command 0 (P060).

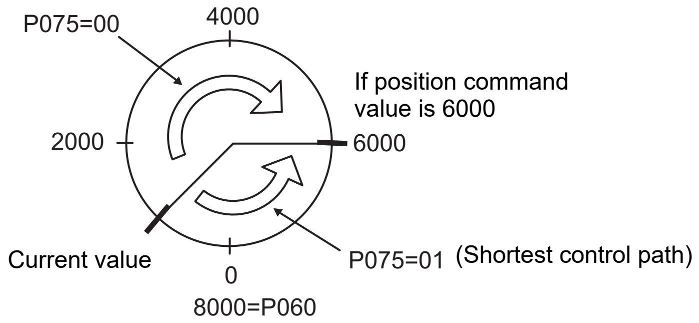
  This value must be set as ×1 multiplication pulses (equivalent the number of phase-A pulses) and a positive value.
- In the Multi-step Position Command 1 to 7 (P061 to P067), set the actual target positions.

  These values must be set as ×1 multiplication pulses (equivalent the number of phase-A pulses).
- Because the Digital Operator of this inverter has a 4-digit display, you can set only the upper 4 digits.

  To set a value over 4 digits, use the computer tool CX-Drive.
- This control is enabled when the Pulse Train Input Type Selection (P004) is set to 00 (Single-phase pulse input) or 01 (Phase A and B 90° phase difference pulse train). Do not use this control with the set value 03 (Single-phase pulse train + direction).
- The origin search, current position preset, and speed/position switching functions do not work when the Position Control Mode Selection (P075) is set to 01 (No limit).

  Do not use the turntable control function in conjunction with the origin search, current position preset, or speed/position switching function.

Parameter No.	Function name	Data	Default data	Unit
P075	Position Control Mode Selection	00: Limit 01: No limit	00	–
P060	Multi-step Position Command 0	Position Limit Setting (Reverse Side) (P073) to Position Limit Setting (Forward Side) (P072) (Displays upper 4 digits including "–") (×1 multiplication)	0	pulse
P061 to P067	Multi-step Position Command 1 to 7	Position Limit Setting (Reverse Side) (P073) to Position Limit Setting (Forward Side) (P072) (Displays upper 4 digits including "–") (×1 multiplication)	0	pulse
P004	Pulse Train Input Type Selection	00: Single-phase pulse input 01: Phase A and B 90°phase difference pulse train	00	–

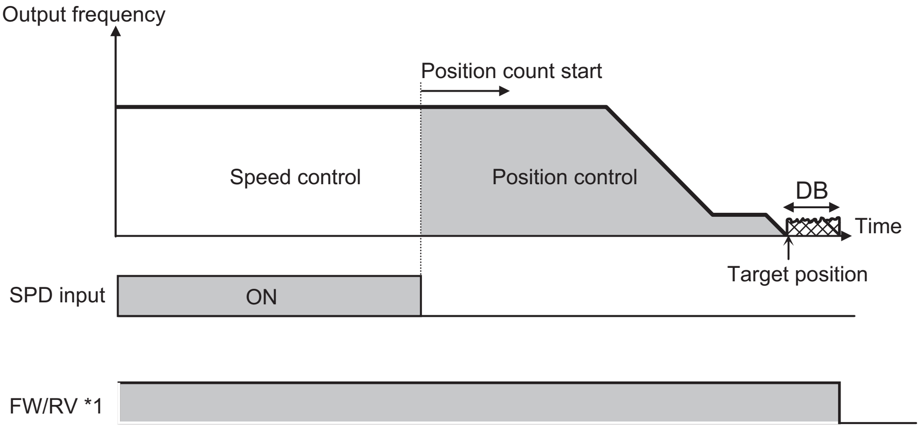


6-7-8 Speed/Position Switching

You can switch between simple position control and speed control (frequency operation).

- Set the Multi-function Input S1 to S7 Selection (C001 to C007) to 73 (SPD (Speed/Position switching)).
- When the SPD (Speed/Position switching) terminal is turned ON, control switches from simple position control to speed control (frequency operation).
- When the SPD (Speed/Position switching) terminal is turned OFF, control switches from speed control (frequency operation) to simple position control.
- In the speed control (frequency operation) mode, the rotation direction depends on the RUN command.
- When the SPD (Speed/Position switching) terminal is ON, the current position is cleared to zero and not counted.
- If the SPD (Speed/Position switching) terminal is turned OFF during operation, the position where it is turned OFF is taken as 0 and speed control switches to simple positioning control.
  At this time, do not set the position command to an extremely small value such that the motor reaches the target position within 4 ms after the switch to simple positioning control.
  The motor cannot correctly decelerate due to variations in response time.
- The speed/position switching function does not operate when Position Control Mode Selection (P075) is set to 01 (No limit). Be sure to set this to 00 (Limit).

Parameter No.	Function name	Data	Default data	Unit
C001 to C007	Multi-function Input S1 to S7 Selection	73: SPD (Speed/Position switching)	–	–
P075	Position Control Mode Selection	00: Limit	00	–



*1 Follow the sign of the position control target (P060 to P067).
Input FW and RV for forward command and reverse command respectively.

6-7-9 Interlock Function with Simple Position Control and Brake Control

The 3G3MX2-V1 Series Inverter has the interlock function with simple position control and brake control.

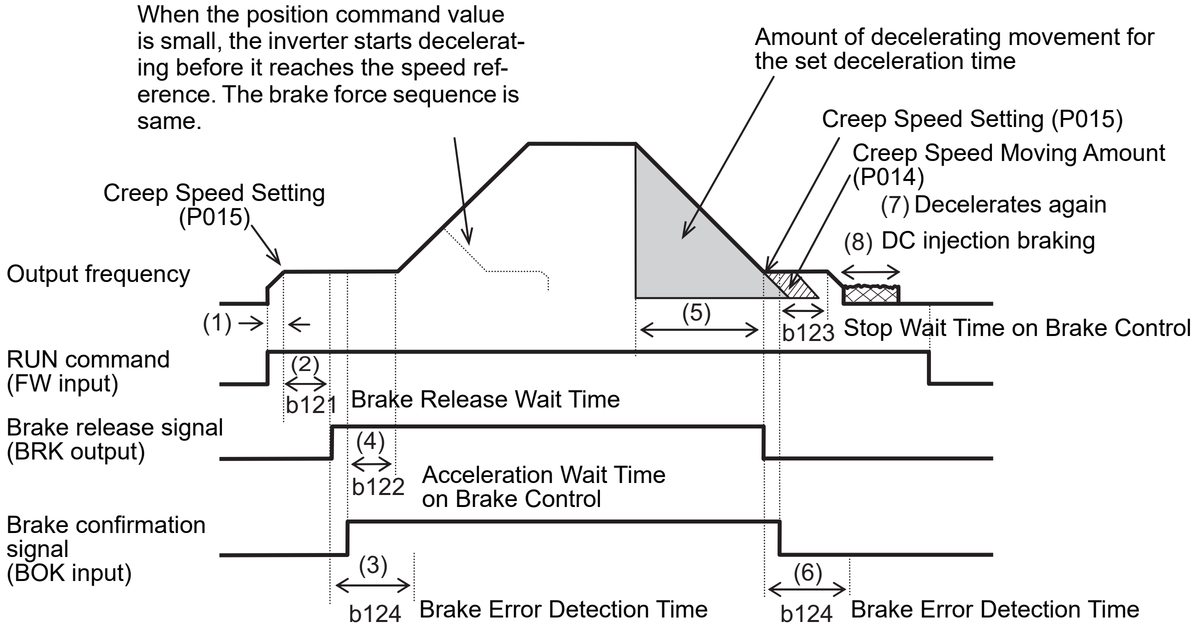
This function is useful in applications where brake control is required, such as an elevator or equipment that must be kept in the stop position.

Operation Sequence of Brake Control Function

Set the Simple Position Control Selection (P012) to 02 (Simple position control enabled), and the Brake Control Function Selection (b120) to 01 (Enabled: DC Injection Braking enabled during stop) to automatically interlock the simple position control with brake control.

The interlock function with simple position control and brake control is enabled only for the 1st Control Method (A044).

The diagram below shows the operation sequence of the interlock function with simple position control and brake control.


When the position command value is small, the inverter starts decelerating before it reaches the speed reference. The brake force sequence is same.
Amount of decelerating movement for the set deceleration time
Creep Speed Setting (P015)
Creep Speed Moving Amount (P014)
(7) Decelerates again
(8) DC injection braking
Creep Speed Setting (P015)
Output frequency
(1)
(5)
b123 Stop Wait Time on Brake Control
RUN command (FW input)
(2)
b121 Brake Release Wait Time
Brake release signal (BRK output)
(4)
b122 Acceleration Wait Time on Brake Control
Brake confirmation signal (BOK input)
(3)
b124 Brake Error Detection Time
(6)
b124 Brake Error Detection Time

Note The above sequence chart shows an example when one of the Multi-function Input S1 to S7 Selection (C001 to C007) is set to 44 (BOK: Brake confirmation).

● During acceleration

(1) The interlock function with simple position control and brake control starts when the RUN command (forward or reverse) turns ON.
The inverter starts its output and accelerates to the frequency set in the Creep Speed Setting (P015).
The inverter judges the direction of movement based on the current position and the target position, regardless of the RUN command.
Or, if the current position is within the range set in the Positioning Completion Range Setting (P017), it stops there without releasing the brake. Whether or not the inverter switches to the DC injection braking mode depends on the Brake Control Function Selection (b120) setting.

(2) After reaching the frequency set in the Creep Speed Setting (P015), the inverter waits until the Brake Release Wait Time (b121) elapses and outputs the brake release signal (C021, C022, C026 = 19: BRK).
However, if the output current did not reach the Brake Release Current (b126) when outputting the brake release signal, the inverter outputs the brake error signal (C021, C022, C026 = 20: BER) without releasing the brake, and detects the E36.□ (Brake error).

(3) After outputting the brake release signal, the inverter waits for the brake confirmation signal (C001 to C007 = 44: BOK) to turn ON during the time set in the Brake Error Detection Time (b124).

If the brake confirmation signal does not turn ON within the time set in b124, the inverter outputs the brake error signal (C021, C022, C026 = 20: BER) and detects the E36.☐ (Brake error).

If any of the Multi-function Input S1 to S7 Selection (C001 to C007) is set to 44 (BOK: Brake confirmation), the Brake Error Detection Time (b124) setting is disabled and the inverter proceeds to step (4) after outputting the brake release signal.

(4) After the brake confirmation signal turns ON (after releasing the brake), the inverter waits until the Acceleration Wait Time on Brake Control (b122) elapses and accelerates again to the set frequency.

If the amount of movement to the target position is small, it decelerates before the set frequency is reached and makes a triangular movement.

● During deceleration

(5) The Inverter starts decelerating the motor when it reaches the position short of the target position by the amount equivalent to the sum of the amount of decelerating movement caused by the deceleration time settings and the Creep Speed Moving Amount (P014).

(6) When the frequency set in the Creep Speed Setting (P015) is reached during deceleration, the inverter turns OFF the brake release signal (C021, C022, C026 = 19: BRK).

After turning OFF the brake release signal, the inverter waits for the brake confirmation signal (C001 to C007 = 44: BOK) to turn OFF during the time set in the Brake Error Detection Time (b124).

If the brake confirmation signal does not turn OFF within the time set in b124, the inverter outputs the brake error signal (C021, C022, C026 = 20: BER) and detects the E36.☐ (Brake error).

If any of the Multi-function Input S1 to S7 Selection (C001 to C007) is set to 44 (BOK: Brake confirmation), the Brake Error Detection Time (b124) is disabled and the inverter proceeds to step (7) after the brake release signal turns OFF.

(7) After the brake confirmation signal turns OFF (after forcing the brake), the inverter waits until the Stop Wait Time on Brake Control (b123) or the time during which the motor moves by the Creep Speed Moving Amount (P014), whichever is longer, elapses and decelerates again to an output frequency of 0 Hz.

(8) After the motor stops, the output status of the inverter depends on the Brake Control Function Selection (b120) setting.

The inverter switches to the DC injection braking mode when b120 is set to 01 (Enabled: DC Injection Braking enabled during stop), and the DC injection braking mode is reset when the RUN command turns OFF.

The inverter shuts off its output when b120 is set to 02 (Enabled: DC Injection Braking disabled during stop).

Precautions for Correct Use

When the frequency set in the Creep Speed Setting (P015) is reached during deceleration, the inverter turns OFF the brake release signal (C021, C022, C026 = 19: BRK) to force the brake, which causes the motor to stop.

This means that the motor stops short of the actual target position, by the amount of the Creep Speed Moving Amount (P014) at most.

Set the Creep Speed Moving Amount (P014) in consideration of the stopping accuracy.

Also, consider the Creep Speed Moving Amount (P014) when setting the Positioning Completion Range Setting (P017).

Settings of Interlock Function with Simple Position Control and Brake Control

This section describes the settings related to the interlock function with simple position control and brake control.

For the simple position control settings, refer to *6-7-3 Simple Position Control Operation and Settings* on page 6-34.

- Set the Simple Position Control Selection (P012) to 02 (Simple position control enabled) and, at the same time, set the Brake Control Function Selection (b120) to 01 (Enabled: DC Injection Braking enabled during stop) or 02 (Enabled: DC Injection Braking disabled during stop).
- The interlock function with simple position control and brake control is enabled only for the 1st control method.
- Allocate one of the Multi-function Output P1/P2 Selection (C021/C022), or Multi-function Relay Output (MA, MB) Function Selection (C026), to the following output signals.

  Brake control output : 19 (BRK: Brake release)
  Brake error output : 20 (BER: Brake error)

- As required, set one of the Multi-function Input S1 to S7 Selection (C001 to C007) to 44 (BOK: Brake confirmation).
- According to your system, set the parameters used for the operation sequence as shown in the table below.
- It is recommended to use sensorless vector control (A044 = 03) that generates a high torque during startup. For details, refer to *6-1 Sensorless Vector Control* on page 6-3.
- Set a frequency higher than the Creep Speed Setting (P015). If the set frequency is equal to or lower than the P015 value, the inverter will detect an overload because the brake cannot be released.

Parameter No.	Function name	Data	Default data	Unit
P012	Simple Position Control Selection	02: Simple position control enabled	00	–
P014	Creep Speed Moving Amount	0.0 to 400.0 Adjust the amount of movement in consideration of the stopping accuracy, with the brake application timing.	125.0	%
P015	Creep Speed Setting [*1]	Starting Frequency to 10.00 (100.0) [*4] Set the frequency for releasing/forcing the brake. This setting is also used for the creep speed under simple position control.	5.00	Hz
P017	Positioning Completion Range Setting	0 to 10000 (×4 multiplication) Set the output range of the positioning completion signal in consideration of the Creep Speed Moving Amount.	50.	pulse
b120	Brake Control Function Selection	01: Enabled (DC injection braking enabled during stop) [*2] 02: Enabled (DC injection braking disabled during stop)	00	–
b121	Brake Release Wait Time	0.00 to 5.00 The time from when the inverter reaches the frequency set in the Creep Speed Setting until it outputs the brake release signal. Set the time until the output current reaches the Brake Release Current value.	0.00	s

Parameter No.	Function name	Data	Default data	Unit
b122	Acceleration Wait Time on Brake Control	0.00 to 5.00 Set the mechanical delay time from when the brake confirmation signal (or brake release signal) turns ON until the brake is activated actually.	0.00	s
b123	Stop Wait Time on Brake Control	0.00 to 5.00 Set the mechanical delay time from when the brake release signal turns OFF until the brake is forced actually. The creep operation time or the stop wait time, whichever is longer, takes priority. Set a sufficient time that causes the brake to be activated and applied without fail.	0.00	s
b124	Brake Error Detection Time	0.00 to 5.00 Set this to equal to or longer than the time until the brake confirmation signal turns ON after the brake release signal is output.	0.00	s
b126	Brake Release Current [*3]	0.00 to 2.00 × Rated current of inverter Set an output current value sufficient enough to support the load and output the brake release signal.	Rated current of inverter	A
C001 to C007	Multi-function Input S1 to S7 Selection	44: BOK (Brake confirmation)	–	–
C021, C022	Multi-function Output P1/P2 Selection	19: BRK (Brake release) 20: BER (Brake error) 23: POK (Positioning ready)	–	–
C026	Multi-function Relay Output (MA, MB) Function Selection		05	–

*1. If the creep speed setting is too low, the inverter may not be able to output a sufficient torque to keep the load in position. Set such a frequency that enables the inverter to stably output a sufficient torque.

*2. DC injection braking is enabled when the interlock function with simple position control and brake control is used. DC injection braking works even when the inverter is stopped to support its load holding capability. This is effective, for example, to prevent fall accidents when the brake is forced.

*3. If the set value is too low, the inverter may not output a sufficient torque when the brake is released.

*4. In the high-frequency mode.

6-8 PM Motor Mode

The 3G3MX2-V1 Series Inverter provides the PM motor mode.

This mode enables the Inverter to control a synchronous motor (PM motor) which is more efficient than an induction motor (IM motor).

This section describes the PM motor mode.

6-8-1 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 3G3MX2-V1 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 rotor is demagnetized, the motor cannot output a sufficient torque and must be replaced.

PM Motor Control

The 3G3MX2-V1 Series Inverter uses sensorless control to realize PM motor control.

This means that the inverter cannot output a large starting torque.

PM motor control is suitable for applications with reduced torque characteristics (which do not require torque at low speeds) such as fans and pumps.

However, it cannot be used 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).

To keep the PM motor in a synchronized state, use the inverter with a starting torque of 50% of the motor rated torque or lower.

Follow the steps below to use PM motor control:

(1) Switch to the PM motor mode. (P. 6-57)

(2) Perform offline auto-tuning for PM motor parameters. (P. 6-57)

(3) Set PM motor parameters. (P. 6-61)

Refer to this section if offline auto-tuning fails.

(4) Adjust the PM motor mode settings. (P. 6-63)

Precautions for Correct Use

- Check the maximum allowable current (limiting current beyond which demagnetization occurs) for your PM motor.

  The inverter could output approximately 300% of the rated output current of the inverter.

  Select a PM motor as follows to prevent demagnetization.

  When comparing each motor specification, note whether it is an effective value or a peak value. The inverter's rated current is an effective value.

  Maximum current of PM motor > Approx. 300% of rated output current of inverter

- In the PM motor mode, some of the inverter functions are unavailable. Unavailable parameters are not displayed on the Digital Operator.

  Refer to *6-8-2 Functional Limitations in PM Motor Mode* on page 6-55.
- The PM motor control mode is applied to one single motor. It is not possible to drive more than one PM motor with a single inverter.
- With an extremely large load, this control may not keep the PM motor in a synchronized state.

  As a guide, the motor-shaft conversion of the moment of load inertia shall be not more than 30 times as great as the moment of inertia of the PM motor.
- At frequency matching restart, the control mode may detect an overvoltage at high rotation speeds of 120 Hz or higher, or at low rotation speeds under a low inductive voltage.

  If an overcurrent is detected, instead of using frequency matching restart, use an external brake or DC injection braking to stop the motor before restarting.

6-8-2 Functional Limitations in PM Motor Mode

In the PM motor mode, induction motor-related functions and some other functions cannot be used.

Parameters for these unavailable functions are not displayed in the PM mode.

In addition, for some parameters, the default data are changed for use with the PM motor.

This section lists the unavailable parameters, unavailable selection functions, and parameter with changed default data, in this order.

Unavailable Parameters

The following parameters are not available and therefore not displayed on the Digital Operator.

Parameter No.	Function name
d008	Real Frequency Monitor
d009	Torque Reference Monitor
d010	Torque Bias Monitor
d012	Output Torque Monitor
d029	Position Command Monitor
d030	Current Position Monitor
A038, A039	Jogging function
A041 to A043	Torque boost function
A044	1st Control Method
A045	1st Output Voltage Gain
A046	1st Automatic Torque Boost Voltage Compensation Gain
A047	1st Automatic Torque Boost Slip Compensation Gain
A081	AVR function
A083	AVR Filter Time Constant
A084	AVR Gain at Deceleration
A085	Operation Mode Selection
A086	Energy-saving Response/Accuracy Adjustment
b027	Overcurrent Suppression Selection
b028 to b030	Frequency pull-in restart function
b036	Reduced Voltage Startup Selection
b040 to b044	Torque limit function
b045	Torque LADSTOP Selection
b046	Reverse Rotation Prevention Selection
b049	Heavy Load/Light Load Selection

Parameter No.	Function name
b100 to b113	Free V/f function
b120 to b127	Brake control function
C054 to C059	Overtorque/Undertorque function
H002 to H034	Induction motor parameter
H050	V/f Control With Speed Feedback Slip Compensation Proportional Gain
H051	V/f Control With Speed Feedback Slip Compensation Integral Gain
P004	Pulse Train Input Type Selection
P011	Number of Encoder Pulses
P012	Simple Position Control Selection
P014	Creep Speed Moving Amount
P015	Creep Speed Setting
P017	Positioning Completion Range Setting
P026	Overspeed Error Detection Level
P027	Speed Deviation Excessive Level
P033 to P041	Torque control function
P060 to P083	Simple position control
F202 to F203 A201 to A296 b213 to b223 C241 H202 to H234	2nd control function

Unavailable Selection Functions

The following parameter selection functions are not available and therefore not displayed on the Digital Operator.

Parameter No.	Function name	Unavailable selection functions
b001	Power Interruption/Undervoltage Restart Selection	04: Frequency pull-in restart
b008	Overvoltage/Overcurrent Restart Selection	04: Frequency pull-in restart
b088	Free-run Stop Selection	02: Frequency pull-in restart
C001	Multi-function Input S1 Selection	06: JG (Jogging) 08: SET (2nd control) 14: CS (Commercial switching) 40: TL (Torque limit enabled) 41: TRQ1 (Torque limit switching 1) 42: TRQ2 (Torque limit switching 2) 44: BOK (Brake confirmation) 46: LAC (LAD cancel) 47: PCLR (Current position clear) 52: ATR (Torque reference input permission) 66: CP1 (Position command selection 1) 67: CP2 (Position command selection 2) 68: CP3 (Position command selection 3) 69: ORL (Origin search limit signal) 70: ORG (Origin search start signal) 73: SPD (Speed/Position switching) 85: EB (Rotation direction detection) 91: PSET (Preset current position)
C002	Multi-function Input S2 Selection	
C003	Multi-function Input S3 Selection	
C004	Multi-function Input S4 Selection	
C005	Multi-function Input S5 Selection	
C006	Multi-function Input S6 Selection	
C007	Multi-function Input S7 Selection	
C021	Multi-function Output P1 Selection	07: OTQ (Overtorque/Undertorque signal) 10: TRQ (Torque limit) 19: BRK (Brake release) 20: BER (Brake error) 22: DSE (Excessive speed deviation) 23: POK (Position ready) 60: SETM (Motor 2 selection)
C022	Multi-function Output P2 Selection	
C026	Multi-function Relay Output (MA, MB) Function Selection	
C027	MP Selection	02: Output torque (Only in the sensorless vector control)
C028	AM Selection	02: Output torque (Only in the sensorless vector control) 11: Output torque (signed) (Only in the sensorless vector control)
C103	Reset Restart Selection	02: Frequency pull-in restart
H001	Auto-tuning Selection	02: Enabled (Motor rotation)
P003	Pulse Train Input RP Selection	01: Frequency setting (including PID)

Parameters with Changed Default Data

Switching from the induction motor heavy load mode (default) to the PM motor mode changes the default data for the following parameter.

Parameter No.	Function name	Default data	
		Initial setting	PM motor mode
b089	Automatic Carrier Reduction	01	00

6-8-3 Switching to PM Motor Mode

To use PM motor control, you need to switch the inverter to the PM motor mode.

Follow the steps below to switch to the PM motor mode:

(1) Set the Inverter Mode Selection (b171) to 03 (PM motor mode).

(2) Set the Initialization Execution (b180) to 01 (Execute initialization), then press the Enter key. Parameter initialization starts.

(3) When parameter initialization is in progress, S 01 and S P are displayed alternately.

(4) When the initialization process is completed, d001 appears, meaning that the inverter was switched to the PM control mode.

Precautions for Correct Use

- If b171 is set to other than 00, regardless of the settings in Initialization Selection (b084) and Initialization Target Setting (b094), when initialization is executed with the Initialization Execution (b180) set to 01 (Execute initialization), all data (set data, fault monitor data, and DriveProgramming data) are initialized.
  However, the following parameters are not initialized: Total RUN Time Monitor (d016), Total Power ON Time Monitor (d017), Heavy Load/Light Load Selection (b049), Initialization Data Selection (b085), Initialization Target Setting (b094), FV/FI Adjustment (C081/C082), Thermistor Adjustment (C085), and Position Data at Power Off (P082).
- To return to the induction motor mode after switching to the PM motor mode, set b171 to 01 (Induction motor mode), then execute initialization with b180 set to 01. The inverter switches to the induction motor mode while displaying “I-C” on the Digital Operator.

Parameter No.	Function name	Data	Default data	Unit
b171	Inverter Mode Selection	00: Selection disabled 01: Induction motor mode 02: Induction motor high-frequency mode 03: PM motor mode	00	–
b180	Initialization Execution	00: Function disabled 01: Execute initialization	00	–

6-8-4 Offline Auto-tuning for PM Motor Parameters

Offline auto-tuning for PM motor parameters consists of the following four steps:

- Presetting of parameters
- Auto-tuning
- Operations after auto-tuning
- Operations in case of error

1 Presetting of parameters

(1) Set the PM Motor Capacity (H103) and the PM Motor Pole Number (H104) according to your PM motor.

(2) Set the rated frequency of the motor in the 1st Base Frequency (A003) and set the maximum frequency in the 1st Maximum Frequency (A004).

The rated/maximum frequency values can be calculated from the rated/maximum rotation speed of the PM motor as follows:

$$\text{Rated frequency (Maximum frequency) [Hz]} = \frac{\text{Rated rotation speed (Maximum rotation speed) [min}^{-1}] \times \text{Number of poles [pole]}}{120}$$

(3) Set the rated voltage of your PM motor in the 1st Motor Rated Voltage Selection (A082) and set the rated current in the PM Motor Rated Current (H105).

The 1s Motor Rated Voltage Selection parameter must be set to the highest value closest to the rated voltage of the motor.

In addition, for the purpose of overload protection, set the rated current of the PM motor in the 1st Electronic Thermal Level (b012).

(4) In the PM Motor Parameter Ke (H109), set the inductive voltage parameter of the PM motor.

Obtain the datasheet of your PM motor from the motor manufacturer and set the inductive voltage parameter (for one phase).

This value must be set in “Vp/(rad/s).” If the datasheet provides this parameter in a different unit, you need to perform unit conversion.

Example

If, for a 4-pole PM motor, the inductive voltage parameter for one phase is 10 [mV/r/min], the set value can be calculated as follows:

$10 \text{ [mV/r/min]} = (10/1000 \text{ [V]}) \times (\sqrt{2}) \times (60 \text{ [s]}) / ((2\pi \times 4 \text{ [pole]} / 2) \text{ [rad]}) = 0.0675 \text{ [Vp/(rad/s)]}$

(5) In the PM Motor Parameter J (H110), set the moment of inertia of your PM motor.

Calculate the motor-shaft conversion of the moment of load inertia, add the moment of inertia of the motor to it, and set the sum.

(6) Set the DC Injection Braking Selection (A051) to 00 (Disabled) (default).

If the DC Injection Braking Selection (A051) is set to 01 (Enabled), change it to 00 (Disabled).

If these parameters are set to Enabled, auto-tuning will not be completed.

(7) Set the motor cable length in the Motor Cable Length (b033).

Set the Motor Cable Length (b033) according to the length of your motor cable.

Parameter No.	Function name	Data	Default data	Unit
H103	PM Motor Capacity	0.1/0.2/0.4/0.55/0.75/1.1/1.5/2.2/3.0/3.7/4.0/5.5/7.5/11.0/15.0/18.5	Maximum applicable motor capacity	kW
H104	PM Motor Pole Number	2/4/6/8 10 to 48: Do not set.	Dependent on capacity	pole
A003	1st Base Frequency	30.0 to 1st Maximum Frequency (A004)	60.0	Hz
A004	1st Maximum Frequency	1st Base Frequency (A003) to 400.0	60.0	Hz
A082	1st Motor Rated Voltage Selection	200-V class: 200/215/220/230/240 400-V class: 380/400/415/440/460/480	200 or 400	V
H105	PM Motor Rated Current	0.20 × Rated current to 1.00 × Rated current	Rated current	A
b012	1st Electronic Thermal Level	0.20 × Rated current to 1.00 × Rated current	Rated current	A

Parameter No.	Function name	Data	Default data	Unit
H109	PM motor Parameter Ke	0001 to 9999 (0.0001 to 0.9999) 1.000 to 6.553	Dependent on capacity	Vp/(rad/s)
H110	PM motor Parameter J	0.001 to 9.999 10.00 to 99.99 100.0 to 999.9 1000. to 9999.	Dependent on capacity	kgm^2
A051	DC Injection Braking Selection	00: Disabled 01: Enabled 02: Enabled (Operates only at set frequency)	00	–
b033	Motor Cable Length	5. to 20.	10.	m

2 Auto-tuning

(1) Set the Auto-tuning Selection (H001) to 01 (Enabled: No motor rotation).

The available setting for PM motor auto-tuning is 01 (Enabled: No motor rotation) only. The setting “02 (Enabled: Motor rotation)” is not displayed.

Parameter No.	Function name	Data	Default data	Unit
H001	Auto-tuning Selection	00: Disabled 01: Enabled (No motor rotation)	00	–

(2) Turn ON the RUN command based on the setting in the 1st RUN Command Selection (A002).

Turing ON the RUN command causes the inverter to start automatic operation, during which auto-tuning is executed in the following sequence.

If auto-tuning is completed successfully, the auto-tuning result will be set to the parameters H111 to H113.

1) Initial pole position estimation (Motor does not rotate.)

↓

2) 1st DC excitation (Motor does not rotate.)

↓

3) 1st AC excitation (Motor does not rotate.)

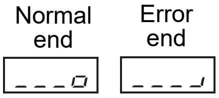
↓

4) 2nd AC excitation (Motor does not rotate.)

↓

5) Auto-tuning result is displayed.

The auto-tuning result will be displayed as follows.



If auto-tuning is aborted due to an error, retry it.

To clear the display, press the STOP/RESET key.

Precautions for Correct Use

- Even if you set H001 to 01 (Auto-tuning without motor rotation), for example, the 4-pole motor may rotate by approximately up to1/8 of a rotation (half the inverse of poles).
- High-tone sound or minor vibration may occur during auto-tuning.
- If a holding brake is provided, release the brake before executing auto-tuning.
- Auto-tuning cannot be performed with a motor whose rated current exceeds the rated output current of the inverter, or with a motor whose rated current is 50% of the rated current of the inverter or lower.
- Adequate auto-tuning may not be performed if a motor cable is long (longer than 20 m).
- Set the Carrier Frequency (b083) to 8.0 kHz or higher. Setting a low carrier frequency results in a poor auto-tuning accuracy, and the inverter cannot perform adequate control.

3 Operations after auto-tuning

- After normal end of auto-tuning, set the PM Motor Parameter Selection (H102) to 01 (Auto-tuning parameter).

  This enables the PM motor parameters (H111 to H113) set by the auto-tuning function.
- At the end of auto-tuning, the inverter automatically resets the Auto-tuning Selection (H001) to 00 (Disabled).

  To retry auto-tuning, set H001 again to enable auto-tuning.

Precautions for Correct Use

Set again the DC Injection Braking Selection (A051) value which you set to 00 (Disabled) in “1. Presetting of parameters” according to the user environment.

Parameter No.	Function name	Data	Default data	Unit
H102	PM Motor Parameter Selection	00: Standard PM motor parameter 01: Auto-tuning parameter	00	–
H111	PM Motor Parameter R (Auto-tuning Data)	0.001 to 65.53	Dependent on capacity	Ω
H112	PM Motor Parameter Ld (Auto-tuning Data)	0.01 to 655.3	Dependent on capacity	mH
H113	PM motor Parameter Lq (Auto-tuning Data)	0.01 to 655.3	Dependent on capacity	mH

4 Operations in case of error

If auto-tuning is aborted due to an error, review the preset parameters according to “1. Presetting of parameters” and check that the rated torque of the motor is at least 50% of the rated output current of the inverter. If the inverter is connected with any load, disconnect it and retry auto-tuning.

If the error persists or auto-tuning is still aborted, enter the motor parameter values directly.

For details, refer to *6-8-5 PM Motor Parameter Settings* on page 6-61.

Precautions for Correct Use

- If a trip occurs during auto-tuning, the auto-tuning process will be forcibly ended. In this case, the inverter displays a trip display in preference to the abort display. Refer to *10-1-2 Alarm Code List* on page 10-4.
- If the auto-tuning process is not ended, press the STOP/RESET key. This causes the process to be forcibly ended. Then, review the preset parameters according to “1. Presetting of parameters” and retry it.
- If the auto-tuning process is aborted, or if you interrupt the process by pressing the STOP/RESET key or by turning OFF the RUN command, the auto-tuning settings may be left in the parameters H111 to H113.

6-8-5 PM Motor Parameter Settings

To use PM motor control, you need to set motor parameters.

Normally, you perform offline auto-tuning to set motor parameters.

However, if the offline auto-tuning process is aborted, for example, when the inverter does not reach 50% of the rated current during auto-tuning, set the motor parameters manually.

- Set the PM Motor Parameter Selection (H102) to 00 (Standard PM motor parameter).
- Set the parameters listed below according to the motor parameters for your PM motor.
- Obtain the motor’s datasheet from the PM motor manufacturer and set each motor parameter.

  For H106 to H109, set the value of the motor with the wiring for one phase in Y-connection (that is, 50% of the phase-to-phase value of the motor).

● PM Motor Capacity and PM Motor Pole Number (H103 and H104)

Set the capacity and number of poles of your PM motor.

● 1st Base Frequency and 1st Maximum Frequency (A003 and A004)

Set the rated frequency and maximum frequency of your PM motor.

The rated/maximum frequency values can be calculated from the rated/maximum rotation speed of the PM motor as follows:

$$\begin{array}{c}\text{Rated frequency}\\ \text{(Maximum frequency) [Hz]}\end{array} = \frac{\text{Rated rotation speed (Maximum rotation speed) [min}^{-1}\text{]} \times \text{Number of poles [pole]}}{120}$$

● 1st Motor Rated Voltage Selection (A082)

Set the highest value closest to the rated voltage of your motor.

● PM Motor Rated Current (H105)

Set the rated current of your PM motor.

In addition, for the purpose of overload protection, set the rated current of the PM motor in the 1st Electronic Thermal Level (b012).

● PM Motor Parameter R (H106)

Set the wiring resistance (in Ω) on the primary side of the motor for one phase in Y-connection.

Alternatively, set 50% of the measured phase-to-phase resistance of the motor.

PM Motor Parameter Ld (H107)

Set the d-axis inductance (in mH) of the motor in Y-connection.

Alternatively, set 50% of the phase-to-phase inductance of the motor measured with an LCR meter.

Be sure to set this parameter so that Ld is equal to or less than Lq. Not doing so may result in an overload.

PM Motor Parameter Lq (H108)

Set the q-axis inductance (in mH) of the motor in Y-connection.

Alternatively, set 50% of the phase-to-phase inductance of the motor measured with an LCR meter.

Be sure to set this parameter so that Ld is equal to or less than Lq.

PM Motor Parameter Ke (H109)

Set the inductive voltage parameter of your PM motor in Vp/(rad/s).

This value must be set in “Vp/(rad/s).” If the datasheet provides this parameter in a different unit, you need to perform unit conversion.

Example

If the inductive voltage parameter for one phase is 10 [mV/r/min], the set value can be calculated as follows:

$10\ [\text{mV/r/min}] = (10/1000\ [\text{V}]) \times (\sqrt{2}) \times (60\ [\text{s}]) / ((2\pi \times 4\ [\text{pole}] / 2)\ [\text{rad}]) = 0.0675\ [\text{Vp/(rad/s)}]$

PM Motor Parameter J (H110)

Calculate the motor-shaft conversion of the moment of load inertia, add the moment of inertia of the motor to it, and set the sum.

Motor Cable Length (b033)

Set the cable length from the inverter to the motor.

To maximize the performance of the inverter, set the cable length to 20 m or shorter.

Parameter No.	Function name	Data	Default data	Unit
A003	1st Base Frequency	30.0 to 1st Maximum Frequency (A004)	60.0	Hz
A004	1st Maximum Frequency	1st Base Frequency (A003) to 400.0	60.0	Hz
b033	Motor Cable Length	5. to 20.	10.	m
A082	1st Motor Rated Voltage Selection	200-V class: 200/215/220/230/240 400-V class: 380/400/415/440/460/480	200 or 400	V
H102	PM Motor Parameter Selection	00: Standard PM motor parameter 02: Auto-tuning parameter	00	–
H103	PM Motor Capacity	0.1/0.2/0.4/0.55/0.75/1.1/1.5/2.2/3.0/3.7/4.0/5.5/7.5/11.0/15.0/18.5	Maximum applicable motor capacity	kW
H104	PM Motor Pole Number	2/4/6/8 10 to 48: Do not set.	Dependent on capacity	pole
H105	PM Motor Rated Current	0.20 × Rated current to 1.00 × Rated current	Rated current	A
b012	1st Electronic Thermal Level	0.20 × Rated current to 1.00 × Rated current	Rated current	A
H106	PM Motor Parameter R	0.001 to 65.53	Dependent on capacity	Ω
H107	PM Motor Parameter Ld	0.01 to 655.3	Dependent on capacity	mH
H108	PM Motor Parameter Lq	0.01 to 655.3	Dependent on capacity	mH

Parameter No.	Function name	Data	Default data	Unit
H109	PM Motor Parameter Ke	0001 to 9999 (0.0001 to 0.9999) 1.000 to 6.553	Dependent on capacity	Vp/ (rad/s)
H110	PM Motor Parameter J	0.001 to 9.999 10.00 to 99.99 100.0 to 999.9 1000. to 9999.	Dependent on capacity	kgm^2

Precautions for Correct Use

- Changing the PM Motor Capacity (H103)/PM Motor Pole Number (H104) automatically changes the values set in A003, A004, and H105 to H110. Be sure to set the PM Motor Capacity (H103)/PM Motor Pole Number (H104) first before setting other motor parameters.

6-8-6 Adjustment of PM Motor Mode Settings

To use PM motor control, perform offline auto-tuning for the PM motor parameters.

If you cannot perform auto-tuning, set the motor parameters appropriately according to *6-8-5 PM Motor Parameter Settings* on page 6-61.

This section describes how to adjust the parameter settings if the inverter cannot provide sufficient performance characteristics after auto-tuning or motor parameter settings.

PM Motor Adjustment Parameters

For the adjustment of PM motor control, this inverter provides parameters for the control during startup, stableness/responsiveness parameters, and initial pole position estimation functions as shown in the table below.

For how to adjust these parameters, refer to the next section, PM Motor Adjustment.

Parameter No.	Function name	Data	Default data	Unit
b083	Carrier Frequency	2.0 to 15.0	10.0	kHz
H106	PM Motor Parameter R	0.001 to 65.53	Dependent on capacity	Ω
H111	PM Motor Parameter R (Auto-tuning Data)			
H107	PM Motor Parameter Ld	0.01 to 655.3	Dependent on capacity	mH
H112	PM Motor Parameter Ld (Auto-tuning Data)			
H108	PM Motor Parameter Lq	0.01 to 655.3	Dependent on capacity	mH
H113	PM Motor Parameter Lq (Auto-tuning Data)			
H116	PM Motor Speed Response	1 to 1000	100	%
H117	PM Motor Starting Current	20.00 to 100.0	70.00	%
H118	PM Motor Starting Time	0.01 to 60.00	1.00	s
H119	PM Motor Stabilization Parameter	0 to 120	100	%
H121	PM Motor Minimum Frequency	0.0 to 25.5	8.0	%
H122	PM Motor No-Load Current	0.00 to 100.0	10.00	%
H123	PM Motor Starting Method Selection	00: Disabled 01: Initial pole position estimation enabled	00	–

Parameter No.	Function name	Data	Default data	Unit
H131	PM Motor Initial Pole Position Estimation 0V Waiting Times	0 to 255	10	time
H132	PM Motor Initial Pole Position Estimation Detection Waiting Times	0 to 255	10	time
H133	PM Motor Initial Pole Position Estimation Detection Times	0 to 255	30	time
H134	PM Initial Pole Position Estimation Voltage Gain	0 to 200	100	%

Precautions for Correct Use

- For a PM motor, even if the DC injection braking function is enabled, the regenerative energy is returned to the inverter. If an overvoltage trip occurs during DC injection braking or during deceleration, consider to use one or more braking resistors.
- If a holding brake is provided, release the brake before running the motor.

  If this timing is not correct, the PM motor will stall.
- To improve the control performance of the PM motor, be sure set the Carrier Frequency (b083) to 8.0 kHz or higher.
- Derating of the output current may be required depending on the installation environment and the Carrier Frequency (b083) setting. For derating of each inverter model, refer to *A-1 Derating* on page A-2.

PM Motor Adjustment

Adjust the PM motor as shown in the table below depending on its operation status and the phenomenon.

Operation status	Phenomenon	Adjustment method	Adjustment item
During startup	Motor rotates in reverse or rotates slightly.	The motor may rotate slightly in magnetic pole alignment during startup. Enable the initial pole position estimation function (refer to P. 6-66) to suppress the rotation speed during startup.	H123
	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 an overload. Check the value in the Electronic Thermal Load Rate Monitor (d104).	H117
		Increase the PM Motor Starting Time value. This increases the time during which the starting current flows to improve the magnetic pole alignment during startup, which results in an increase in the startup torque.	H118
	Motor starting time is too long.	Enable the initial pole position estimation function (refer to P. 6-66) and shorten the motor starting time.	H118, H123

Operation status	Phenomenon	Adjustment method	Adjustment item
PM Motor Minimum Frequency (H121) or lower	Rotation is unstable.	If the motor rotation is unstable during startup, increase the motor starting time. However, setting this parameter to an excessively large value may cause an overload. Check the value in the Electronic Thermal Load Rate Monitor (d104).	H117
	Motor is hunting or vibrating.	Finely adjust the motor parameters for PM motor control. Decrease the PM Motor Parameter R value gradually, down to 70% of the set value.	H106, H111
		Increase the PM Motor Parameter Ld value gradually, up to 130% of the set value.	H107, H112
		Increase the PM Motor Parameter Lq value gradually, up to 130% of the set value. * Be sure to adjust this parameter so that Ld is equal to or less than Lq.	H108, H113
		Decrease the PM Motor Stabilization Parameter value.	H119
Around PM Motor Minimum Frequency (H121)	A shock or overcurrent trip occurs.	Increase the PM Motor Speed Response value.	H116
		Decrease the minimum frequency of the PM motor.	H121
PM Motor Minimum Frequency (H121) or higher	Motor is hunting or vibrating.	Decrease the PM Motor Speed Response value.	H116
		Increase the PM Motor No-Load Current value.	H122
		Increase the Carrier Frequency, if too low.	b083
		Finely adjust the motor parameters for PM motor control. Decrease the PM Motor Parameter R value gradually, down to 70% of the set value.	H106, H111
		Increase the PM Motor Parameter Ld value gradually, up to 130% of the set value.	H107, H112
		Increase the PM Motor Parameter Lq value gradually, up to 130% of the set value. * Be sure to adjust this parameter so that Ld is equal to or less than Lq.	H108, H113
		Decrease the PM Motor Stabilization Parameter value.	H119

Precautions for Correct Use

- Increasing the PM Motor Starting Current (H117) too much causes an overload. Alternatively, doing so causes automatic carrier reduction depending on the set value.
- Decreasing the PM Motor Stabilization Parameter (H119) too much may cause an insufficient torque, shock or overcurrent trip around the value set in PM Motor Minimum Frequency (H121).

PM Motor Initial Pole Position Estimation

The PM motor initial pole position estimation function estimates the magnetic pole position of the PM motor in a stop state and causes the inverter to start its output according to the estimated magnetic pole position.

Set PM motor parameters according to *6-8-4 Offline Auto-tuning for PM Motor Parameters* on page 6-57 or *6-8-5 PM Motor Parameter Settings* on page 6-61 in advance, because the function uses these settings to estimate the magnetic pole position of the PM motor.

- Set the PM Motor Starting Method Selection (H123) to 01 (Initial pole position estimation enabled).
- The PM motor initial pole position estimation function causes the inverter to output a high-frequency detection signal to estimate the magnetic pole position. This means that the estimated position is more accurate as the values set in the PM Motor Initial Pole Position Estimation 0V Waiting Times (H131)/PM Motor Initial Pole Position Estimation Detection Waiting Times (H132) or in the PM Motor Initial Pole Position Estimation Detection Times (H133) is larger.

  However, the motor staring time becomes longer in proportion to the set PM Motor Initial Pole Position Estimation 0V Waiting Times.
- If the accuracy of the estimated position remains low and the motor still rotates during startup even after you increase the PM Motor Initial Pole Position Estimation 0V Waiting Times (H131)/PM Motor Initial Pole Position Estimation Detection Waiting Times (H132), increase the PM Initial Pole Position Estimation Voltage Gain (H134) value to raise the voltage level of the detection signal.

- Depending on the phenomenon during startup, refer to the following table to adjust necessary motor parameters.

Phenomenon	Adjustment method	Adjustment item
Initial pole position estimation time is too long.	Decrease the PM Motor Initial Pole Position Estimation 0V Waiting Times value. Decreasing the value too much may cause the motor to rotate excessively for positioning or stall.	H131
	Decrease the PM Motor Initial Pole Position Estimation Detection Waiting Times value. Decreasing the value too much may cause the motor to rotate excessively for positioning or stall.	H132
	Decrease the PM Motor Initial Pole Position Estimation Detection Times value. Decreasing the value too much may cause the motor to rotate excessively for positioning or stall.	H133
Motor rotates excessively for positioning.	Increase the PM Motor Initial Pole Position Estimation 0V Waiting Times value.	H131
	Increase the PM Motor Initial Pole Position Estimation Detection Waiting Times value.	H132
	Increase the PM Motor Initial Pole Position Estimation Detection Times value.	H133
	Gradually increase the PM Initial Pole Position Estimation Voltage Gain value. Increasing the value too much may cause an overcurrent trip.	H134
An overcurrent trip occurs.	Gradually increase the PM Initial Pole Position Estimation Voltage Gain value. Decreasing the value too much may cause the motor to rotate excessively for positioning or stall.	H134

Precautions for Correct Use

- Although high-tone sound occurs during startup when the PM Motor Starting Method Selection (H123) is set to 01 (Initial pole position estimation enabled), it is not a fault.
- When the PM Motor Starting Method Selection (H123) is set to 01 (Initial pole position estimation enabled), start the inverter with the motor stopped.

  Starting the inverter with the motor rotation may cause the motor to rotate excessively for positioning or stall.

6-9 High-frequency Mode

The 3G3MX2-V1 Series Inverter provides the high-frequency mode to control an induction motor at high frequencies.

Although the maximum frequency is 400 Hz in normal mode, switching to the high-frequency mode allows the inverter to output up to 580 Hz.

Set the Heavy Load/Light Load Selection (b049) to 00 (Heavy load mode (CT)) because the high-frequency mode is supported only in the heavy load rating setting.

6-9-1 Functional Limitations in High-frequency Mode

In the high-frequency mode, PM motor-related functions and some other functions cannot be used.

Parameters for these unavailable functions are not displayed in the high-frequency mode.

This section lists the unavailable parameters and unavailable selection functions.

Unavailable Parameters

The following parameters are not available and therefore not displayed on the Digital Operator.

Parameter No.	Function name
d009	Torque Reference Monitor
d010	Torque Bias Monitor
d012	Output Torque Monitor
A097	Acceleration Pattern Selection
A098	Deceleration Pattern Selection
A131	Acceleration Curve Parameter
A132	Deceleration Curve Parameter
A150	EL-S Shape Acceleration Curve Ratio 1
A151	EL-S Shape Acceleration Curve Ratio 2
A152	EL-S Shape Deceleration Curve Ratio 1
A153	EL-S Shape Deceleration Curve Ratio 2
b040 to b044	Torque limit function
b045	Torque LADSTOP Selection
b046	Reverse Rotation Prevention Selection
b049	Heavy Load/Light Load Selection
b089	Automatic Carrier Reduction

Parameter No.	Function name
C054 to C059	Overtorque/Undertorque function
H001	Auto-tuning Selection
H002/H202	1st/2nd Motor Parameter Selection
H005/H205	1st/2nd Speed Response
H020/H220	1st/2nd Motor Parameter R1
H021/H221	1st/2nd Motor Parameter R2
H022/H222	1st/2nd Motor Parameter L
H023/H223	1st/2nd Motor Parameter Io
H024/H224	1st/2nd Motor Parameter J
H030/H230	1st/2nd Motor Parameter R1 (Auto-tuning Data)
H031/H231	1st/2nd Motor Parameter R2 (Auto-tuning Data)
H032/H232	1st/2nd Motor Parameter L (Auto-tuning Data)
H033/H233	1st/2nd Motor Parameter Io (Auto-tuning Data)
H034/H234	1st/2nd Motor Parameter J (Auto-tuning Data)
H102 to H134	PM motor parameter
P033 to P041	Torque control function

Unavailable Selection Functions

The following parameter selection functions are not available and therefore not displayed on the Digital Operator.

Parameter No.	Function name	Unavailable selection functions
C001	Multi-function Input S1 Selection	40: TL (Torque limit enabled) 41: TRQ1 (Torque limit switching 1) 42: TRQ2 (Torque limit switching 2) 52: ATR (Torque command input permission)
C002	Multi-function Input S2 Selection	
C003	Multi-function Input S3 Selection	
C004	Multi-function Input S4 Selection	
C005	Multi-function Input S5 Selection	
C006	Multi-function Input S6 Selection	
C007	Multi-function Input S7 Selection	
C021	Multi-function Output P1 Selection	07: OTQ (Overtorque/Undertorque signal) 10: TRQ (Torque limit)
C022	Multi-function Output P2 Selection	
C026	Multi-function Relay Output (MA, MB) Function Selection	

Unavailable Selection Functions

In the high-frequency mode, the Output Noise Filter (Model: 3G3AX-NFO□□) cannot be used.

For details, refer to *12-8 Output Noise Filter (Model: 3G3AX-NFO□□)* on page 12-34.

6-9-2 Switching to High-frequency Mode

To use the high-frequency mode, you need to change the Inverter Mode Selection (b171).

Follow the steps below to switch to the high-frequency mode:

(1) Set the Inverter Mode Selection (b171) to 02 (Induction motor high-frequency mode).

(2) Set the Initialization Execution (b180) to 01 (Execute initialization), then press the Enter key. Parameter initialization starts.

(3) When parameter initialization is in progress, S 01 and SH-1 are displayed alternately.

(4) When the initialization process is completed, d001 appears, meaning that the inverter was switched to the high-frequency mode.

Parameter No.	Function name	Data	Default data	Unit
b049	Heavy Load/Light Load Selection	00: Heavy load mode (CT)	00	–
		01: Light load mode (VT)		
b171	Inverter Mode Selection	00: Selection disabled	00	–
		00: Induction motor mode		
		02: Induction motor high-frequency mode		
		03: PM motor mode		
b180	Initialization Execution	00: Function disabled	00	–
		01: Execute initialization		

Precautions for Correct Use

- If b171 is set to other than 00, regardless of the settings in Initialization Selection (b084) and Initialization Target Setting (b094), when initialization is executed with the Initialization Execution (b180) set to 01 (Execute initialization), all data (set data, fault monitor data, and DriveProgramming data) are initialized.

  However, the following parameters are not initialized: Total RUN Time Monitor (d016), Total Power ON Time Monitor (d017), Heavy Load/Light Load Selection (b049), Initialization Data Selection (b085), Initialization Target Setting (b094), FV/FI Adjustment (C081/C082), Thermistor Adjustment (C085), and Position Data at Power Off (P082).
- Selecting the high-frequency mode disables the sensorless vector control.
  Therefore, functions associated with this control such as auto-tuning, motor parameter setting, torque limit functions, overtorque/undertorque function, and torque control are unavailable.

Major Differences between High-frequency Mode and Normal Mode

The following table shows the major differences between high-frequency mode and normal mode.

Parameter No.	Function name	High-frequency mode	Normal mode	
b049	Heavy Load/Light Load Selection	Heavy load rating (CT)	Heavy load rating (CT)	Light load rating (VT)
A004	1st Maximum Frequency	580 [Hz]	400 [Hz]	400 [Hz]
b082	Starting Frequency	0.01 to 100.0 [Hz]	0.01 to 9.99 [Hz]	0.01 to 9.99 [Hz]
b083	Carrier Frequency	2.0 to 10.0 [kHz]	2.0 to 15.0 [kHz]	2.0 to 10.0 [kHz]
A044	1st Control Method	00: Constant torque characteristics (VC) 01: Reduced torque characteristics (VP1.7th power (VC at low speed)) 02: Free V/f setting	00: Constant torque characteristics (VC) 01: Reduced torque characteristics (VP1.7th power (VC at low speed)) 02: Free V/f setting 03: Sensorless vector control	00: Constant torque characteristics (VC) 01: Reduced torque characteristics (VP1.7th power (VC at low speed)) 02: Free V/f setting
A097	Acceleration Pattern Selection	00: Line	00: Line 01: S-shape curve 02: U-shape curve 03: Inverted U-shape curve 04: EL-S-shape curve	00: Line 01: S-shape curve 02: U-shape curve 03: Inverted U-shape curve 04: EL-S-shape curve
A098	Deceleration Pattern Selection			
b089	Automatic Carrier Reduction	00: Disabled	00: Disabled 01: Enabled (dependent on current) 02: Enabled (dependent on cooling fin temperature)	00: Disabled 01: Enabled (dependent on current) 02: Enabled (dependent on cooling fin temperature)

Note In the high-frequency mode, the values are fixed and thus parameters b049, A097, A098 and b089 are not displayed.

Differences in Parameters between Normal Mode with Heavy Load Rating (CT) and High-frequency Mode

The following table shows the differences in the setting ranges and default settings for parameters in normal mode with a heavy load rating (CT) and high-frequency mode.

Parameter No.	Function name	High-frequency mode			Normal mode with a heavy load rating (CT)		
		Data	Default data	Unit	Data	Default data	Unit
F002	1st Acceleration Time 1	0.00 to 3600.	30.00	s	0.00 to 3600.	10.00	s
F202	2nd Acceleration Time 1	0.00 to 3600.	30.00	s	0.00 to 3600.	10.00	s
F003	1st Deceleration Time 1	0.00 to 3600.	30.00	s	0.00 to 3600.	10.00	s
F203	2nd Deceleration Time 1	0.00 to 3600.	30.00	s	0.00 to 3600.	10.00	s
A003	1st Base Frequency	30.0 to 1st Maximum Frequency (A004)	580.0	Hz	30.0 to 1st Maximum Frequency (A004)	60.0	Hz
A203	2nd Base Frequency	30.0 to 2nd Maximum Frequency (A204)	580.0	Hz	30.0 to 2nd Maximum Frequency (A204)	60.0	Hz
A004	1st Maximum Frequency	1st Base Frequency (A003) to 580.0	580.0	Hz	1st Base Frequency (A003) to 400.0	60.0	Hz
A204	2nd Maximum Frequency	2nd Base Frequency (A203) to 580.0	580.0	Hz	2nd Base Frequency (A203) to 400.0	60.0	Hz
A011	FV Start Frequency	0.00 to 580.0	0.00	Hz	0.00 to 400.0	0.00	Hz
A012	FV End Frequency	0.00 to 580.0	0.00	Hz	0.00 to 400.0	0.00	Hz
A038	Jogging Frequency	Starting Frequency to 100.00	6.00	Hz	Starting Frequency to 9.99	6.00	Hz
A044	1st Control Method	00: Constant torque characteristics (VC) 01: Reduced torque characteristics (VP1.7th power (VC at low speed)) 02: Free V/f setting	00	–	00: Constant torque characteristics (VC) 01: Reduced torque characteristics (VP1.7th power (VC at low speed)) 02: Free V/f setting 03: Sensorless vector control	00	–
A244	2nd Control Method	00: Constant torque characteristics (VC) 01: Reduced torque characteristics (VP1.7th power (VC at low speed)) 02: Free V/f setting	00	–	00: Constant torque characteristics (VC) 01: Reduced torque characteristics (VP1.7th power (VC at low speed)) 02: Free V/f setting 03: Sensorless vector control	00	–
A059	DC Injection Braking Carrier Frequency	2.0 to 10.0	5.0	kHz	2.0 to 15.0	5.0	kHz
A063	Jump Frequency 1	0.00 to 580.0	0.00	Hz	0.00 to 400.0	0.00	Hz
A064	Jump Frequency Width 1	0.00 to 100.0	0.50	Hz	0.00 to 10.00	0.50	Hz
A065	Jump Frequency 2	0.00 to 580.0	0.00	Hz	0.00 to 400.0	0.00	Hz
A066	Jump Frequency Width 2	0.00 to 100.0	0.50	Hz	0.00 to 10.00	0.50	Hz

Parameter No.	Function name	High-frequency mode			Normal mode with a heavy load rating (CT)		
		Data	Default data	Unit	Data	Default data	Unit
A067	Jump Frequency 3	0.00 to 580.0	0.00	Hz	0.00 to 400.0	0.00	Hz
A068	Jump Frequency Width 3	0.00 to 100.0	0.50	Hz	0.00 to 10.00	0.50	Hz
A069	Acceleration Stop Frequency	0.00 to 580.0	0.00	Hz	0.00 to 400.0	0.00	Hz
A092	1st Acceleration Time 2	0.01 to 3600.	15.00	s	0.01 to 3600.	10.00	s
A292	2nd Acceleration Time 2	0.01 to 3600.	15.00	s	0.01 to 3600.	10.00	s
A093	1st Deceleration Time 2	0.01 to 3600.	15.00	s	0.01 to 3600.	10.00	s
A293	2nd Deceleration Time 2	0.01 to 3600.	15.00	s	0.01 to 3600.	10.00	s
A095	1st 2-step Acceleration Frequency	0.00 to 580.0	0.00	Hz	0.00 to 400.0	0.00	Hz
A295	2nd 2-step Acceleration Frequency	0.00 to 580.0	0.00	Hz	0.00 to 400.0	0.00	Hz
A096	1st 2-step Deceleration Frequency	0.00 to 580.0	0.00	Hz	0.00 to 400.0	0.00	Hz
A296	2nd 2-step Deceleration Frequency	0.00 to 580.0	0.00	Hz	0.00 to 400.0	0.00	Hz
A101	FI Start Frequency	0.00 to 580.0	0.00	Hz	0.00 to 400.0	0.00	Hz
A102	FI End Frequency	0.00 to 580.0	0.00	Hz	0.00 to 400.0	0.00	Hz
A145	Frequency Addition Amount Setting	0.00 to 580.0	0.00	Hz	0.00 to 400.0	0.00	Hz
A154	Deceleration Stop Frequency	0.00 to 580.0	0.00	Hz	0.00 to 400.0	0.00	Hz
A156	PID Sleep Operation Level	0.00 to 580.0	0.00	Hz	0.00 to 400.0	0.00	Hz
A161	VR Start Frequency	0.00 to 580.0	0.00	Hz	0.00 to 400.0	0.00	Hz
A162	VR End Frequency	0.00 to 580.0	0.00	Hz	0.00 to 400.0	0.00	Hz
b007	Frequency Matching Lower Limit Frequency	0.00 to 580.0	0.00	Hz	0.00 to 400.0	0.00	Hz
b019	Free-electronic Thermal Frequency 3	Free-electronic Thermal Frequency 2 to 580.	0.0	Hz	Free-electronic Thermal Frequency 2 to 400.	0.0	Hz
b054	Deceleration Starting Width on Power Interruption	0.00 to 100.0	0.00	Hz	0.00 to 10.00	0.00	Hz
b082	Starting Frequency	0.01 to 100.0	1.50	Hz	0.01 to 9.99	1.50	Hz
b083	Carrier Frequency	2.0 to 10.0	5.0	kHz	2.0 to 15.0	10.0	kHz
b112	Free V/f Frequency 7	Free V/f Frequency 6 to 580.	0.	Hz	Free V/f Frequency 6 to 400.	0.	Hz

Parameter No.	Function name	High-frequency mode			Normal mode with a heavy load rating (CT)		
		Data	Default data	Unit	Data	Default data	Unit
C027	MP Selection	00: Output frequency 01: Output current 03: Digital output frequency 04: Output voltage 05: Input power 06: Electronic thermal load rate 07: LAD frequency 08: Digital current monitor 10: Cooling fin temperature 12: DriveProgramming (YA(0)) 15: Pulse train input monitor 16: Option (No applicable Option)	07	–	00: Output frequency 01: Output current 02: Output torque (Only in the sensorless vector control) 03: Digital output frequency 04: Output voltage 05: Input power 06: Electronic thermal load rate 07: LAD frequency 08: Digital current monitor 10: Cooling fin temperature 12: DriveProgramming (YA(0)) 15: Pulse train input monitor 16: Option (No applicable Option)	07	–
C028	AM Selection	00: Output frequency 01: Output current 04: Output voltage 05: Input power 06: Electronic thermal load rate 07: LAD frequency 10: Cooling fin temperature 13: DriveProgramming (YA(1)) 16: Option (No applicable Option)	07	–	00: Output frequency 01: Output current 02: Output torque (Only in the sensorless vector control) 04: Output voltage 05: Input power 06: Electronic thermal load rate 07: LAD frequency 10: Cooling fin temperature 11: Output torque (signed) (Only in the sensorless vector control) 13: DriveProgramming (YA(1)) 16: Option (No applicable Option)	07	–
C042	Arrival Frequency During Acceleration 1	0.00 to 580.0	0.00	Hz	0.00 to 400.0	0.00	Hz
C043	Arrival Frequency During Deceleration 1	0.00 to 580.0	0.00	Hz	0.00 to 400.0	0.00	Hz

Parameter No.	Function name	High-frequency mode			Normal mode with a heavy load rating (CT)		
		Data	Default data	Unit	Data	Default data	Unit
C045	Arrival Frequency During Acceleration 2	0.00 to 580.0	0.00	Hz	0.00 to 400.0	0.00	Hz
C046	Arrival Frequency During Deceleration 2	0.00 to 580.0	0.00	Hz	0.00 to 400.0	0.00	Hz
P015	Creep Speed Setting	Starting Frequency to 100.0	5.00	Hz	Starting Frequency to 10.00	5.00	Hz
P070	Origin Search Mode 1 Frequency	0.00 to 100.0	5.00	Hz	0.00 to 10.00	5.00	Hz

Note Data in shaded cells are the same as those for normal mode (heavy load rating).

7

Other Functions

This section describes the details of functions not described in Section 5 or Section 6.

7-1 Monitor Mode 7-4
7-1-1 Output Frequency Monitor [d001] 7-4
7-1-2 Output Current Monitor [d002] 7-4
7-1-3 RUN Direction Monitor [d003] 7-5
7-1-4 PID Feedback Value Monitor [d004] 7-5
7-1-5 Multi-function Input Monitor [d005] 7-5
7-1-6 Multi-function Output Monitor [d006] 7-6
7-1-7 Output Frequency Monitor (After Conversion) [d007] 7-6
7-1-8 Real Frequency Monitor [d008] 7-7
7-1-9 Torque Reference Monitor [d009] 7-7
7-1-10 Torque Bias Monitor [d010] 7-8
7-1-11 Output Torque Monitor [d012] 7-8
7-1-12 Output Voltage Monitor [d013] 7-8
7-1-13 Input Power Monitor [d014] 7-9
7-1-14 Integrated Power Monitor [d015] 7-9
7-1-15 Total RUN Time Monitor [d016] 7-10
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7-1 Monitor Mode

This section describes the output frequency, fault monitor during trip, and other monitor functions of the inverter.

7-1-1 Output Frequency Monitor [d001]

Use this function to display the output frequency of the inverter. The value is 0.00 when the inverter is stopped.

The monitor display LED "Hz" is lit while the value of d001 is displayed.

Parameter No.	Function name	Data	Default data	Unit
d001	Output Frequency Monitor	0.00 to 99.99 (Displayed in increments of 0.01) 100.0 to 400.0 (580.0) [*1] (Displayed in increments of 0.1)	–	Hz
b163	d001/d007 Data Setting Selection	00: Disabled (Frequency cannot be changed in d001/d007) 01: Enabled (Frequency can be changed in d001/d007)	00	–
Related functions		A001, A201, F001, d007		

[*1] In the high-frequency mode.

Additional Information

- When the 1st/2nd Frequency Reference Selection (A001/A201) is set to 02 (Digital Operator: F001), if the d001/d007 Data Setting Selection (b163) is set to 01 (Enabled), you can change the Output Frequency Monitor (d001) by the Increment/Decrement key only during operation.
- The Output Frequency Monitor (d001) value is reflected on the Output Frequency Setting/Monitor (F001) setting and stored to the EEPROM when you press the Enter key.
- Because the inverter updates the F001 value while displaying d001, the input value may not be displayed immediately depending on the acceleration/deceleration time.
- The monitor value cannot be changed while the PID function is activated/stopped.
- In the individual input mode, it is not possible to change the frequency by simultaneously pressing the Increment and Decrement keys.

7-1-2 Output Current Monitor [d002]

Use this function to display the output current value of the inverter. The value is 0.0 when the inverter is stopped.

The monitor display LED "A" is lit while the value of d002 is displayed.

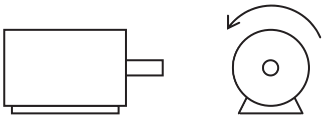
Parameter No.	Function name	Data	Default data	Unit
d002	Output Current Monitor	0.0 to 655.3 Minimal unit depends on inverter capacity.	–	A

7-1-3 RUN Direction Monitor [d003]

Use this function to display the RUN direction of the inverter.
The RUN LED is lit during inverter operation (forward/reverse RUN).

Parameter No.	Function name	Data	Default data	Unit
d003	RUN Direction Monitor	F : Forward o : Stop r : Reverse	–	–

Generally, the forward rotation is defined as the direction in which the motor rotates counterclockwise when viewed from the shaft.


Forward

7-1-4 PID Feedback Value Monitor [d004]

Use this function to monitor the PID feedback value when the PID Selection (A071) is set to 01 (Enabled) or 02 (Reverse output enabled).
The monitor value is displayed in units of percentage as 100% of the 1st/2nd Maximum Frequency (A004/A204) and can be converted by setting the PID Scale (A075) as follows.

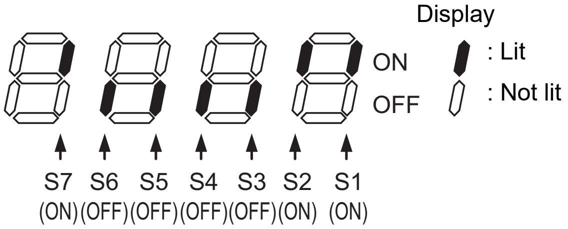
d004 = Feedback value [%] × PID Scale (A075)

Parameter No.	Function name	Data	Default data	Unit
d004	PID Feedback Value Monitor	0.00 to 99.99 (Displayed in increments of 0.01) 100.0 to 999.9 (Displayed in increments of 0.1) 1000. to 9999. (Displayed in increments of 1) 1000 (Displayed in increments of 10)	–	–
A075	PID Scale	0.01 to 99.99 (Set in increments of 0.01)	1.00	time
Related functions		A071, A075		

7-1-5 Multi-function Input Monitor [d005]

Use this function to display the input status of each multi-function input terminal, based on whether the corresponding 7-segment LED is lit or not lit.
The terminal for which the built-in CPU detected the input is indicated as ON. Note that this is independent of the NO/NC contact setting for each multi-function input terminal.

(Example) Multi-function input terminals S7, S2, and S1 : ON
Multi-function input terminals S6, S5, S4, and S3 : OFF



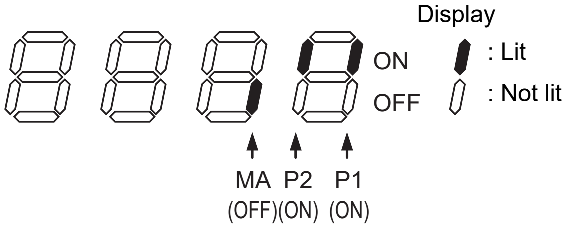
- When the input terminal response time function is enabled, the inverter cannot display the input status immediately. (Refer to *5-9-3 Input Terminal Response Time* on page 5-48.)
- The terminal S5 remains OFF and cannot be monitored when Multi-function Input S5 Selection (C005) is allocated to 19 (TH: PTC thermistor thermal protection).

7-1-6 Multi-function Output Monitor [d006]

Use this function to display the output status of each multi-function output terminal, based on whether the corresponding 7-segment LED is lit or not lit.

Each LED shows the output status detected by the built-in CPU. Note that this is independent of the NO/NC contact setting for each multi-function output terminal.

(Example) Multi-function output terminals P2 and P1 : ON
Relay output terminal MA : OFF



7-1-7 Output Frequency Monitor (After Conversion) [d007]

Use this function to display the output frequency value that is converted based on the Frequency Conversion Coefficient (b086).

This parameter is useful when you want to view the output frequency in a different display unit, for example, to monitor the motor rotation speed.

d007 = Output Frequency Monitor (d001) × Frequency Conversion Coefficient (b086)

(Example) To monitor the rotation speed of a 4-pole motor:

Motor rotation speed N [min–1] = (120 × f [Hz]) / P [pole] = f [Hz] × 30

Therefore, if b086 = 30.0, then, at 60 Hz, the value of this parameter is 60 × 30.0 = 1800.

Parameter No.	Function name	Data	Default data	Unit
d007	Output Frequency Monitor (After Conversion)	0.00 to 99.99 (Displayed in increments of 0.01) 100.0 to 999.9 (Displayed in increments of 0.1) 1000. to 9999. (Displayed in increments of 1) 1000 to 3999 (5799) [*1] (Displayed in increments of 10)	–	–
b086	Frequency Conversion Coefficient	0.01 to 99.99 Set in increments of 0.01 (d007 = d001 × b086)	1.00	–
b163	d001/d007 Data Setting Selection	00: Disabled (Frequency cannot be changed in d001/d007) 01: Enabled (Frequency can be changed in d001/d007)	00	–

*1. In the high-frequency mode.

Additional Information

- When the 1st/2nd Frequency Reference Selection (A001/A201) is set to 02 (Digital Operator: F001), if the d001/d007 Data Setting Selection (b163) is set to 01 (Enabled), you can change the Output Frequency Monitor (After Conversion) (d007) by the Increment/Decrement key only during operation.
- The Output Frequency Monitor (After Conversion) (d007) value is reflected on the Output Frequency Setting/Monitor (F001) setting and stored to the EEPROM when you press the Enter key.
- Because the inverter updates the F001 value while displaying d007, the input value may not be displayed immediately depending on the acceleration/deceleration time.
- The monitor value cannot be changed while the PID function is activated/stopped.
- In the individual input mode, it is not possible to change the frequency by simultaneously pressing the Increment and Decrement keys.

7-1-8 Real Frequency Monitor [d008]

To display the real frequency of the motor, set the Pulse Train Input RP Selection (P003) to 01 (Feedback pulse).

The Real Frequency Monitor (d008) is available only for the 1st control and independent of the 1st Control Method (A044) setting.

Parameter No.	Function name	Data	Default data	Unit
d008	Real Frequency Monitor	(–580.) [*1] –400. to –100. –99.9 to –10.0 –9.99 to 99.99 100.0 to 400.0 (400.1 to 580.0) [*1]	–	Hz
Related functions		P011, H004, H204		

[*1] In the high-frequency mode.

Precautions for Correct Use

Set the Number of Encoder Pulses (P011) and the 1st Motor Pole Number (H004) correctly. For the feedback signal setting and wiring instructions, refer to *6-5 V/f Control with Speed Feedback* on page 6-18 or *6-7 Simple Position Control* on page 6-28.

7-1-9 Torque Reference Monitor [d009]

Use this function to display the torque reference value that is input during operation under sensorless vector control.

To use torque control, set the Multi-function Input S1 to S7 Selection (C001 to C007) to 52 (ATR) and turn ON the terminal ATR.

For details on torque control, refer to *6-4 Torque Control* on page 6-16.

The torque reference monitor function estimates the torque value equivalent to the rated current of the inverter as 100%.

To convert it to the rated motor torque ratio, use the following formula:

Rated motor torque ratio = Monitor value × Rated output current of inverter / Rated motor current

Parameter No.	Function name	Data	Default data	Unit
d009	Torque Reference Monitor	–200. to 200.	–	%
Related functions		A044, A244, C001 to C007, P033, P034		

7-1-10 Torque Bias Monitor [d010]

Use this function to display the current torque bias value under sensorless vector control.

The torque bias monitor function estimates the torque value equivalent to the rated current of the inverter as 100%.

To convert it to the rated motor torque ratio, use the following formula:

Rated motor torque ratio = Monitor value × Rated output current of inverter / Rated motor current

For details on the torque bias monitor function, refer to *6-4-2 Torque Bias Function Settings* on page 6-17.

Parameter No.	Function name	Data	Default data	Unit
d010	Torque Bias Monitor	–200. to 200.	–	%
Related functions		A044, A244, P036, P037, P038		

7-1-11 Output Torque Monitor [d012]

Use this function to display the estimated output torque value of the inverter.

The value is displayed only when sensorless vector control is selected.

The output torque monitor function estimates the torque value equivalent to the rated current of the inverter as 100%.

To convert it to the rated motor torque ratio, use the following formula:

Rated motor torque ratio = Monitor value × Rated output current of inverter / Rated motor current

Parameter No.	Function name	Data	Default data	Unit
d012	Output Torque Monitor	–200. to 200.	–	%
Related functions		A044, A244		

Note During forward RUN, the value is positive for Power Running and negative for Regeneration. During reverse RUN, the value is negative for Power Running and positive for Regeneration.

7-1-12 Output Voltage Monitor [d013]

Use this function to display the output voltage of the inverter.

Parameter No.	Function name	Data	Default data	Unit
d013	Output Voltage Monitor	0.0 to 600.0	–	V

Precautions for Correct Use

Set the 1st/2nd Motor Rated Voltage Selection (A082/A282) correctly. Otherwise, the correct value may not be displayed.

7-1-13 Input Power Monitor [d014]

Use this function to display the input power (instantaneous value) of the inverter.

Parameter No.	Function name	Data	Default data	Unit
d014	Input Power Monitor	0.0 to 100.0	–	kW

7-1-14 Integrated Power Monitor [d015]

Use this function to display the integrated power of the inverter.

The monitor value can be converted and displayed with a different scale factor by setting the Integrated Power Display Scale (b079).

d015 = Actual integrated power / Integrated Power Display Scale (b079)

(Example) If the monitor value is 1000 when b079 is set to 100, the actual integral power is 100,000 [kWh].

To clear the integrated power value, set the Integrated Power Clear (b078) to 01.

It is also possible to clear the integrated power value via terminal input by setting one of the Multi-function Input S1 to S7 Selection (C001 to C007) to 53 (KHC: Integrated power clear).

If the Integrated Power Display Scale (b079) is set to 1000, an integrate power value of up to 999,000,000 [kWh] can be displayed.

This parameter value will be stored to the inverter's EEPROM when the power supply is shut off.

Parameter No.	Function name	Data	Default data	Unit
d015	Integrated Power Monitor	0.0 to 999.9 Displayed in increments of 0.1 kWh × (Value set in b079) 1000. to 9999. Displayed in increments of 1 kWh × (Value set in b079) 1000 to 9999 Displayed in increments of 10 kWh × (Value set in b079) Γ100 to Γ999 Displayed in increments of 1000 kWh × (Value set in b079)	–	–
b078	Integrated Power Clear	00: Clear disabled 01: Clear with the Enter key (Data is reset from 01 to 00 after execution.)	00	–
b079	Integrated Power Display Scale	1. to 1000.	1.	–
C001 to C007	Multi-function Input S1 to S7 Selection	53: KHC (Integrated power clear)	–	–

7-1-15 Total RUN Time Monitor [d016]

Use this function to display the total RUN time of the inverter.

This parameter value will be stored to the inverter’s EEPROM when the power supply is shut off.

Parameter No.	Function name	Data	Default data	Unit
d016	Total RUN Time Monitor	0. to 9999. (Displayed in increments of 1 hour) 1000 to 9999 (Displayed in increments of 10 hours) Γ100 to Γ999 (Displayed in increments of 1000 hours)	–	h

Note Executing initialization does not clear this data.

7-1-16 Total Power ON Time Monitor [d017]

Use this function to display the total power ON time of the inverter.

This parameter value will be stored to the inverter’s EEPROM when the power supply is shut off.

Parameter No.	Function name	Data	Default data	Unit
d017	Total Power ON Time Monitor	0. to 9999. (Displayed in increments of 1 hour) 1000 to 9999 (Displayed in increments of 10 hours) Γ100 to Γ999 (Displayed in increments of 1000 hours)	–	h

Note Executing initialization does not clear this data.

7-1-17 Fin Temperature Monitor [d018]

Use this function to display the temperature of the cooling fin that is built into the inverter.

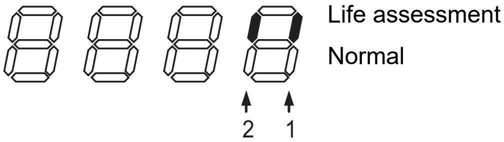
Parameter No.	Function name	Data	Default data	Unit
d018	Fin Temperature Monitor	–20.0 to 150.0	–	°C

7-1-18 Life Assessment Monitor [d022]

Use this function to display the life assessment status based on whether the corresponding 7-segment LED is lit or not lit. This function is intended for the following two items.

For details on the life assessment, refer to *7-8-14 Cooling Fan Life Warning Signal (WAF)* on page 7-85 or *7-8-12 Capacitor Life Warning Signal (WAC)* on page 7-84.

1: Life expectancy of main circuit board capacitor
2: Life expectancy of cooling fan



- The inverter calculates the capacitor life expectancy once in every 10 minutes. If the power supply is turned on/off more frequently than this cycle, the inverter cannot evaluate the capacitor life successfully.
- For 3-phase 200-V class models with a capacity of 0.4 kW or lower and single-phase 200-V class models with a capacity of 0.75 kW or lower, the life assessment monitor function for the cooling fan does not work with the LED lit on the normal status because these models have no cooling fan.

7-1-19 Program Counter (DriveProgramming) [d023]

Use this function to display the line number of the program that is executed while a DriveProgramming function is active.

For details on the DriveProgramming function, refer to “DriveProgramming User’s Manual (I580).”

Parameter No.	Function name	Data	Default data	Unit
d023	Program Counter	0. to 1024.	–	–

7-1-20 User Monitor 0 to 2 (DriveProgramming) [d025 to d027]

These monitor functions correspond to the DriveProgramming function variables UMon(0) to UMon(2).

Use them to display any data in your program.

For details on the DriveProgramming function, refer to “DriveProgramming User’s Manual (I580).”

Parameter No.	Function name	Data	Default data	Unit
d025	User Monitor 0	–2147483647 to 2147483647 Displays DriveProgramming function variables UMon(0) to UMon(2). (Displays upper 4digits including “–”)	–	–
d026	User Monitor 1			
d027	User Monitor 2			

7-1-21 Position Command Monitor [d029]

Use this function to display the position command value in the simple position control mode.

When the Simple Position Control Selection (P012) is set to 02 (Simple position control enabled), it displays the position command monitor value that is currently set.

For details on simple position control, refer to *6-7 Simple Position Control* on page 6-28.

Parameter No.	Function name	Data	Default data	Unit
d029	Position Command Monitor	–268435455 to 268435455 (×1 multiplication) (Displays upper 4digits including “–”) Example If command value is 15600: Displays 1560. If command value is –15600: Displays –156.	–	pulse

7-1-22 Current Position Monitor [d030]

Use this function to monitor the current position under simple position control.

The Current Position Monitor value is cleared to zero when the power supply is turned on.

For details on simple position control, refer to *6-7 Simple Position Control* on page 6-28.

On the 3G3MX2-V1 Series Inverter, setting the Pulse Train Input RP Selection (P003) to 01 (Feedback pulse) enables the current position monitor function even when simple position control is disabled.

This function may be used in conjunction with the position store at power off function, or the function of 47 (PCLR: Current position clear) or 91 (PSET: Preset position) set in the Multi-function Input S1 to S7 Selection (C001 to C007).

For details on these functions, refer to *6-7-4 Origin Search Function, Current Position Preset, Position Data Storage at Power Shutoff* on page 6-40.

Parameter No.	Function name	Data	Default data	Unit
d030	Current Position Monitor	–268435455 to 268435455 (×1 multiplication) (Displays upper 4digits including “–”) Example If current position is 1560000: Displays 1560. If current position is –1560000: Displays –156.	–	pulse

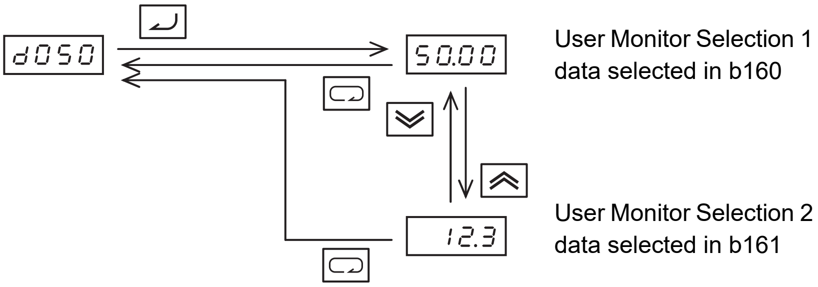
7-1-23 Dual User Monitor [d050]

Use this function to display two set monitor items by switching between them with the Increment/Decrement key.

In b160 and b161, set the parameter numbers whose data you want to monitor.

(Example) To monitor the d001 data, set b160 or b161 to 001.

Parameter No.	Function name	Data	Default data	Unit
d050	Dual User Monitor	Displays two monitor items set in b160 and b161.	–	–
b160	User Monitor Selection 1	001 to 030 (Corresponding to d001 to d030)	001	–
b161	User Monitor Selection 2		002	



Precautions for Correct Use

Even if you select d001 or d007 in b160/b161 and then set the d001/d007 Data Setting Selection (b163) to 01 (Enabled), you cannot switch the data from d050 via key operation.

7-1-24 Inverter Mode Monitor [d060]

Use this function to display the current inverter mode.

The inverter mode setting can be changed by Heavy Load/Light Load Selection (b049) and Inverter Mode Selection (b171). For details on each mode, refer to *5-2-2 Heavy Load/Light Load Selection* on page 5-12 and *6-8 PM Motor Mode* on page 6-53.

Parameter No.	Function name	Data	Default data	Unit
d060	Inverter Mode Monitor	I-C: IM motor heavy load I-V: IM motor light load H-I: IM motor high frequency P: PM motor mode	–	–
Related functions		b049, b171		

7-1-25 Frequency Reference Source Monitor [d062]

Set the frequency reference in the 1st/2nd Frequency Reference Selection (A001/A201).

Alternatively, you can switch the frequency reference via a multi-function input terminal or from a communications option unit.

The Frequency Reference Source Monitor displays the frequency reference source enabled for the inverter.

Parameter No.	Function name	Data	Default data	Unit
d062	Frequency Reference Source Monitor	0: Digital Operator (F001) 1 to 15: Multi-step speed reference 1 to 15 16: Jogging frequency 18: Modbus communication 19: Option 21: Volume (3G3AX-OP01) 22: Pulse train frequency 23: Operation function output 24: DriveProgramming 25: Analog voltage input [FV] 26: Analog current input [FI] 27: Analog Input [FV] + [FI]	–	–

7-1-26 Run Command Source Monitor [d063]

Set the RUN command in the 1st/2nd RUN Command Selection (A002/A202).

Alternatively, you can switch the RUN command via multi-function input or from a communications option unit.

The Run Command Source Monitor displays the RUN command source enabled for the inverter.

Parameter No.	Function name	Data	Default data	Unit
d063	Run Command Source Monitor	1: Control circuit terminal block 2: Digital Operator 3: Modbus communication 4: Option	–	–

7-1-27 Fault Counter [d080]

Use this function to display the number of inverter trips.

This count value will be saved to the inverter’s EEPROM when the power supply is turned OFF.

Parameter No.	Function name	Data	Default data	Unit
d080	Fault Counter	0. to 9999. 1000 to 6553 (Displayed in increments of 10 times)	–	time

7-1-28 Fault Monitor 1 to 6 [d081 to 086]

Use these functions to display the fault history of the last six faults. This count value will be stored to the inverter's EEPROM when the power supply is turned OFF.

The latest fault history is displayed in the Fault Monitor 1 (d081).

● Displayed items

(1) **Trip fault factor (Alarm code): Displays one of E01 to E83.**

Refer to *10-1-2 Alarm Code List* on page 10-4.

(2) **Output frequency at trip [Hz]**

(3) **Output current at trip [A]**

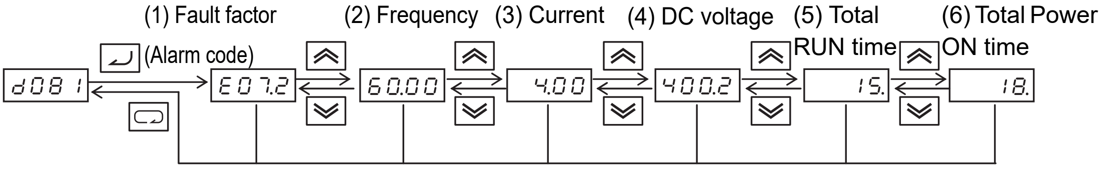
The monitor value may become zero when the inverter is in a stop state (E**.1)

(4) **DC voltage between P and N in main circuit at trip [V]**

The monitor value may become zero if a ground-fault trip occurs when the power supply is turned on.

(5) **Total RUN time of inverter before trip [h]**

(6) **Total power ON time of inverter before trip [h]**



Displays - - - - if there is no trip.

7-1-29 Warning Monitor [d090]

Use this function to display the warning code if any inconsistency is found among the set data.

The program LED "PRG" remains lit during the warning, until the inconsistent data is corrected.

For details on the warning display, refer to *10-1-4 Warning Display* on page 10-12.

7-1-30 DC Voltage Monitor [d102]

Use this function to display the P-N DC voltage of the inverter (DC voltage between the P/+2 and N/– terminals of the inverter.)

During operation, the monitor value changes according to the actual DC voltage of the inverter.

Parameter No.	Function name	Data	Default data	Unit
d102	DC Voltage Monitor	0.0 to 999.9 1000.	–	V

7-1-31 Regenerative Braking Load Rate Monitor [d103]

Use this function to display the regenerative braking load rate. If this monitor value exceeds the value set in the Usage Rate of Regenerative Braking (b090), the inverter will trip with the alarm code E06 (Braking resistor overload protection).

Parameter No.	Function name	Data	Default data	Unit
d103	Regenerative Braking Load Rate Monitor	0.0 to 100.0	–	%
Related functions		b090		

7-1-32 Electronic Thermal Load Rate Monitor [d104]

Use this function to display the electronic thermal load rate. If this monitor value exceeds 100%, the inverter will trip with the alarm code E05 (Overload protection).

The value will be reset to 0 when the power supply is shut off. The value will be reset to 0 also if it was not be incremented for 10 minutes.

Parameter No.	Function name	Data	Default data	Unit
d104	Electronic Thermal Load Rate Monitor	0.0 to 100.0	–	%

7-1-33 Analog Voltage Input FV Monitor [d130]

Use this function to monitor the state of the analog voltage that is input to the analog voltage reference terminal FV for frequency reference input.

It displays the maximum input value for the terminal FV (equivalent to 10.9 V) as 1023 bits.

Parameter No.	Function name	Data	Default data	Unit
d130	Analog Voltage Input FV Monitor	0 to 1023	–	bit

7-1-34 Analog Current Input FI Monitor [d131]

Use this function to monitor the state of the analog current that is input to the analog current reference terminal FI for frequency reference input.

It displays the maximum input value for the terminal FI (equivalent to 23.3 mA) as 1023 bits.

Parameter No.	Function name	Data	Default data	Unit
d131	Analog Current Input FI Monitor	0 to 1023	–	bit

7-1-35 Pulse Train Input RP Monitor [d133]

Use this function to display the pulse train command or feedback value that is input to the pulse train input terminal RP in units of percentage as 100% of the 1st/2nd Maximum Frequency (A004/A204).

This function is enabled independently of the Pulse Train Input RP Selection (P003) setting.

In the Pulse Train Frequency Scale (P055), set the pulse train command value relative to the maximum frequency.

Parameter No.	Function name	Data	Default data	Unit
d133	Pulse Train Input RP Monitor	0.00 to 99.99 100.0	–	%
Related functions		P003, P055		

7-1-36 PID Deviation [d153]

Use this function to display the deviation in PID control when the PID Selection (A071) is set to 01 (Enabled) or 02 (Reverse output enabled). The monitor value is displayed in units of percentage as 100% of the 1st/2nd Maximum Frequency (A004/A204).

Parameter No.	Function name	Data	Default data	Unit
d153	PID Deviation	–100. –99.9 to –10.0 –9.99 to 99.99 100.0	–	%
Related functions		A071, A004, A204		

7-1-37 PID Output Monitor [d155]

Use this function to display the operation output of PID control operation when the PID Selection (A071) is set to 01 (Enabled) or 02 (Reverse output enabled). The monitor value is displayed in units of percentage as 100% of the 1st/2nd Maximum Frequency (A004/A204).

Parameter No.	Function name	Data	Default data	Unit
d155	PID Output Monitor	–100. –99.9 to –10.0 –9.99 to 99.99 100.0	–	%
Related functions		A071, A004, A204		

7-2 Multi-function Input/Output Functions

This section describes the I/O signal settings for this inverter.

7-2-1 Multi-function Input Selection

You can use the function set by allocating the Multi-function Input S1 to S7 Selection (C001 to C007) to the functions listed below.

The multi-function input terminals S1 to S7 can be set to either NO contact or NC contact individually in the Multi-function Input S1 to S7 Selection (C011 to C017).

Do not allocate the same function to more than one multi-function input terminal. If you allocate the same function to more than one multi-function input terminal by mistake, the function will be enabled for the last allocated terminal only, and the previously allocated terminals are reset to 255 (no).

After allocating functions to the terminals S1 to S7, check that the set function is stored.

Parameter No.	Data	Description	Reference item	Reference page
C001 to C007	00	FW: Forward command	RUN Command Selection Forward RUN Command (FW) and Reverse RUN Command (RV)	P. 5-22 P. 5-48
	01	RV: Reverse command		
	02	CF1: Multi-step speed setting binary 1	Multi-step Speed Operation Function	P. 5-49
	03	CF2: Multi-step speed setting binary 2		
	04	CF3: Multi-step speed setting binary 3		
	05	CF4: Multi-step speed setting binary 4		
	06	JG: Jogging	Jogging	P. 5-52
	07	DB: External DC injection braking	DC Injection Braking	P. 7-91
	08	SET: 2nd control	2nd Control Function	P. 7-33
	09	2CH: 2-step acceleration/deceleration	2-step Acceleration/Deceleration Function 2-step Acceleration/Deceleration	P. 5-37 P. 5-53
	11	FRS: Free-run stop	Free-run Stop	P. 5-39
	12	EXT: External trip	External Trip	P. 7-79
	13	USP: Power recovery restart prevention function	Power Recovery Restart Prevention Function	P. 7-67
	14	CS: Commercial switching	Commercial Switching	P. 7-50
	15	SFT: Soft lock	Soft Lock (Control Terminal Block)	P. 7-54
	16	AT: Analog input switching	Frequency Reference Settings Analog input	P. 5-24 P. 7-22
	18	RS: Reset	Reset Reset (RS)	P. 5-43 P. 5-53
	19	TH: PTC thermistor thermal protection	Thermistor Trip Function (Can be set for C005 only)	P. 7-80
	20	STA: 3-wire start	3-wire input function	P. 5-54
	21	STP: 3-wire stop		
	22	F/R: 3-wire forward/reverse		

Parameter No.	Data	Description	Reference item	Reference page
C001 to C007	23	PID: PID disabled	PID Function	P. 7-44
	24	PIDC: PID integral reset		
	27	UP: Remote operation accelerated	Remote Operation Function	P. 7-40
	28	DWN: Remote operation decelerated		
	29	UDC: Remote operation data clear		
	31	OPE: Forced operator function	Forced Operator Function	P. 7-55
	32	SF1: Multi-step speed setting bit 1	Multi-step Speed Operation Function	P. 5-49
	33	SF2: Multi-step speed setting bit 2		
	34	SF3: Multi-step speed setting bit 3		
	35	SF4: Multi-step speed setting bit 4		
	36	SF5: Multi-step speed setting bit 5		
	37	SF6: Multi-step speed setting bit 6		
	38	SF7: Multi-step speed setting bit 7		
	39	OLR: Overload limit switching	Overload Limit/Overload Warning	P. 7-76
	40	TL: Torque limit enabled	Torque Limit Function Settings	P. 6-12
	41	TRQ1: Torque limit switching 1		
	42	TRQ2: Torque limit switching 2		
	44	BOK: Brake confirmation	Brake Control Function Settings	P. 6-25
	46	LAC: LAD cancel	Acceleration/Deceleration Time Settings	P. 5-33
	47	PCLR: Current position clear	Simple Position Control Function	P. 6-28
	50	ADD: Set frequency A145 addition	Frequency Addition Function	P. 7-39
	51	F-TM: Forced terminal block	Forced Terminal Block Function	P. 7-55
	52	ATR: Torque reference input permission	Torque Control	P. 6-16
	53	KHC: Integrated power clear	Integrated Power Monitor	P. 7-9
	56	MI1: General-purpose input 1	DriveProgramming Function	–
	57	MI2: General-purpose input 2		
	58	MI3: General-purpose input 3		
	59	MI4: General-purpose input 4		
	60	MI5: General-purpose input 5		
	61	MI6: General-purpose input 6		
	62	MI7: General-purpose input 7		
	65	AHD: Analog command held	Analog Command Hold Function	P. 7-24
	66	CP1: Position command selection 1	Simple Position Control Mode	P. 6-28
	67	CP2: Position command selection 2		
	68	CP3: Position command selection 3		
	69	ORL: Origin search limit signal		
	70	ORG: Origin search startup signal		
	73	SPD: Speed/Position switching		
	77	GS1: GS1 input	Safety Function (Set via safety function selector switch)	P. 7-97
	78	GS2: GS2 input		
	81	485: Start co-inverter communication	Co-inverter Communication	P. 8-31
	82	PRG: DriveProgramming start	DriveProgramming	–
	83	HLD: Retain output frequency	Acceleration/Deceleration Stop Function	P. 7-37
	84	ROK: Permission of RUN command	Permission of RUN Command	P. 7-38
	85	EB: Rotation direction detection	Simple Position Control Function, V/f Control with Speed Feedback (Can be set for C005 only)	P. 6-28
	86	DISP: Display fixed	Display Fixed	P. 7-57
	91	PSET: Preset position	Current Position Preset	P. 6-40
	255	no: No allocation	–	–

7-2-2 Multi-function Output Selection

Use this function to allocate the functions listed below by setting the Multi-function Output P1/P2 Selection (C021/C022), or Multi-function Relay Output (MA, MB) Function Selection (C026). The multi-function output P1 and P2 terminals are for open-collector output and the multi-function relay output (MA, MB) terminals are for relay output.

These output terminals can be set to either NO contact or NC contact in the Multi-function Output P1/P2 Operation Selection (C031/C032), or the Multi-function Relay Output (MA, MB) Operation Selection (C036) individually.

The default data of Multi-function Relay Output (MA, MB) Function Selection (C026) is 05 (AL: Alarm signal). Therefore, the Multi-function Relay Output (MA, MB) Operation Selection (C036) is set to 01 (NC: NC contact) by default.

This manual describes each function with the Multi-function Output Operation Selection set to 00 (NO: NO contact). Note that the operations of the Multi-function Relay Output (MA, MB) are reversed.

Data	Description		Reference item	Reference page
00	RUN:	Signal during RUN	Signal during RUN	P. 5-56
01	FA1:	Constant speed arrival signal	Constant Speed Arrival Signal	P. 5-57
02	FA2:	Set frequency exceeded signal	Frequency Arrival Signal	P. 7-81
03	OL:	Overload warning	Overload Limit/Overload Warning	P. 7-78
04	OD:	Excessive PID deviation	PID Function	P. 7-44
05	AL:	Alarm signal	Alarm Signal	P. 5-57
06	FA3:	Set-frequency only signal	Frequency Arrival Signal	P. 7-81
07	OTQ:	Overtorque/Undertorque signal	Overtorque/Undertorque	P. 6-15
09	UV:	Signal during undervoltage	Power Interruption/Undervoltage or Overvoltage/Overcurrent Restart	P. 7-63
10	TRQ:	Torque limit	Torque Limit Function	P. 6-12
11	RNT:	RUN time over	RUN Time/Power ON Time Over	P. 7-82
12	ONT:	Power ON time over		
13	THM:	Electronic thermal warning	Electronic Thermal Warning	P. 7-75
19	BRK:	Brake release	Brake Control Function	P. 6-25
20	BER:	Brake error		
21	ZS:	0-Hz detection signal	0-Hz Detection Function	P. 5-58
22	DSE:	Excessive speed deviation	Simple Position Control	P. 6-28
23	POK:	Position ready		
24	FA4:	Set frequency exceeded signal 2	Frequency Arrival Signal	P. 7-81
25	FA5:	Set-frequency only signal 2		
26	OL2:	Overload warning 2	Overload Limit/Overload Warning	P. 7-78
27	FVDc:	Analog FV disconnection detection	Window Comparator	P. 7-88
28	FIDc:	Analog FI disconnection detection		
31	FBV:	PID feedback comparison signal	PID Function	P. 7-44
32	NDc:	Communications disconnection detection	Communication Disconnection Detection Signal	P. 7-85
33	LOG1:	Logic operation output 1	Logic Operation	P. 7-83
34	LOG2:	Logic operation output 2		
35	LOG3:	Logic operation output 3		
39	WAC:	Capacitor life warning signal	Capacitor Life Warning Signal	P. 7-84
40	WAF:	Cooling fan life warning signal	Cooling Fan Life Warning Signal	P. 7-85
41	FR:	Starting contact signal	Starting Contact Signal	P. 7-86
42	OHF:	Cooling fin overheat warning	Cooling Fin Overheat Warning	P. 7-86
43	LOC:	Low current signal	Low Current Signal	P. 7-87

Data	Description		Reference item	Reference page
44	MO1:	General-purpose output 1	DriveProgramming Function	–
45	MO2:	General-purpose output 2		
46	MO3:	General-purpose output 3		
50	IRDY:	Operation ready	Operation Ready	P. 5-59
51	FWR:	Forward run signal	Forward run signal	P. 5-59
52	RVR:	Reverse run signal	Reverse run signal	P. 5-59
53	MJA:	Fatal fault signal	Fatal Fault Signal	P. 7-87
54	WCFV:	Window comparator FV	Window Comparator	P. 7-88
55	WCFI:	Window comparator FI		
58	FREF:	Frequency command source	Frequency Reference Selection Status Signal	P. 7-89
59	REF:	RUN command operator	RUN Command Status Signal	P. 7-89
60	SETM:	Motor 2 selection	2nd Control Selection Signal	P. 7-90
62	EDM:	Safety device monitor	Safety Function (Set via EDM function selector switch)	P. 7-97
63	OPO:	Option	Option Function	P. 7-101
255	no:	No allocation	–	–

7-3 Analog I/O Settings

This section describes the analog I/O signal settings for this inverter.

7-3-1 Analog Input (FV, FI)

This inverter has two types of external analog input terminals.

Frequency reference (Analog voltage input) between terminals FV and SC : 0 to 10 V

This terminal also treats input via the variable resistor (volume) as voltage input to the inverter.

Frequency reference (Analog current input) between terminals FI and SC : 4 to 20 mA

For 0 to 20 mA, set A103 to 0%.

For analog input start/end settings, refer to *7-3-5 Analog Input Start/End Function Settings* on page 7-25.

Note By default, each analog input signal is adjusted to reach the maximum frequency at 9.8 V or 19.8 mA.

The table below shows analog-input related functions. Set each function according to your application.

Parameter No.	Setting item	Function name	Data	Default data	Unit
A001/A201	Frequency reference[*1]	1st/2nd Frequency Reference Selection	01: Control circuit terminal block (Analog input)	02	–
A071	PID feedback selection[*2]	PID Selection	01: Enabled 02: Enabled (Reverse output enabled)	00	–
A076		PID Feedback Selection	00: FI (Current) 01: FV (Voltage)	00	–
A071	PID feedforward selection[*3]	PID Selection	01: Enabled 02: Enabled (Reverse output enabled)	00	–
A079		PID Feedforward Selection	01: FV (Voltage) 02: FI (Current)	00	–
A001/A201	Calculation frequency	1st/2nd Frequency Reference Selection	10: Operation function output	02	–
A141		Calculation Frequency Selection 1	02: Input FV (Voltage) 03: Input FI (Current)	02	–
A142		Calculation Frequency Selection 2		03	–
A143		Calculation Function Operator Selection	00: Addition (A141 + A142) 01: Subtraction (A141 – A142) 02: Multiplication (A141 × A142)	00	–
b040	Torque limit[*4]	Torque Limit Selection	02: Analog voltage input	00	–
P033	Torque control	Torque Reference Input Selection	00: Terminal FV 10 V = 200% 01: Terminal FI 20 mA = 200%	00	–
C001 to C007		Multi-function Input S1 to S7 Selection	52: ATR (Torque reference input permission)	–	–

*1. This switches the frequency reference among the volume, current, and voltage based on the FV/FI Selection (A005) setting and the status of the multi-function input terminal allocated to 16 (AT: Analog input switching). Here, volume represents the volume control (VR) on the optional Digital Operator (Model: 3G3AX-OP01).

*2. Setting the PID Selection (A071) to Enabled causes the analog input selection setting in A076 to be allocated to the PID feedback function. When the 1st Frequency Reference Selection (A001) is set to 01 (Control circuit terminal block), the analog input setting other than that selected in A076 is used as the target frequency reference. In this case, the setting in A005 and the function allocated to the terminal AT (Analog input switching) are disabled.

*3. In A079, you can set a target value, or have a setting that overlaps with the PID Feedback Selection value. With an overlapping setting, the analog input is used for both the feedback and feedforward signals.

*4. This parameter can be set to 02 (Analog voltage input) only. The torque limit is 200% with an input of 10 V.

When the analog input is used as a frequency reference, switching between voltage (FV) and current (FI is performed) is performed as shown in the table below.

However, when none of the multi-function input terminals are set to 16 (AT: Analog input switching), regardless of the A005 setting, the frequency reference value is the sum of the analog voltage input FV and analog current input FI values.

Parameter No.	Function name	Data	Default data	Unit
A005	FV/FI Selection	00: Switches between current and voltage based on terminal AT (Analog input switching) status. Terminal AT (Analog input switching) ON: Current Terminal AT (Analog input switching) OFF: Voltage 02: Enabled only when 3G3AX-OP01 is used. Switches between voltage and VR based on terminal AT (Analog input switching) status. Terminal AT (Analog input switching) ON: VR Terminal AT (Analog input switching) OFF: Voltage 03: Enabled only when 3G3AX-OP01 is used. Switches between current and VR based on terminal AT (Analog input switching) status. Terminal AT (Analog input switching) ON: VR Terminal AT (Analog input switching) OFF: Current	00	–
C001 to C007	Multi-function Input S1 to S7 Selection	16: AT (Analog input switching)	–	–

Note For details on frequency reference settings, refer to *5-5 Frequency Reference Settings* on page 5-24.

7-3-2 Analog Input Filter

This function is effective for removing noise in the analog input circuit.

Use it to set an input filter for voltage or current input when using an external analog signal to input the frequency reference.

However, increasing the set value results in a slow response. The filter time constant is ×2 ms for a set value of 1 to 30.

When set to 31., the parameter applies a filter time constant of 500 ms and a hysteresis of ±0.1 Hz.

Set a larger data value if stable operation cannot be secured because of noise etc.

Parameter No.	Function name	Data	Default data	Unit
A016	Analog Input Filter	1. to 30.: Set value × 2-ms filter 31.: Fixed to 50-ms filter with ±0.1-Hz hysteresis[1]	8.	–

[1] When using the PID function, do not set the Analog Input Filter (A016) to 31 (500-ms filter with ±0.1-Hz hysteresis). Doing so may result in unstable operation.

7-3-3 Analog Command Hold Function (AHD)

Use this function to hold the frequency reference value via analog input.

Set the Multi-function Input S1 to S7 Selection (C001 to C007) to 65 (AHD: Analog command held).

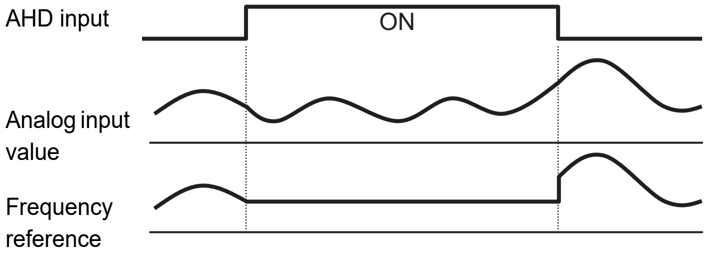
This function causes the inverter to hold the result of analog input to the terminal AHD while it is ON.

While the terminal AHD is ON, you can use the UP/DWN function with the frequency reference held by this function as a reference value. Setting the UP/DWN Storage Selection (C101) to 01 enables the inverter to store the UP/DWN result.

For details on the UP/DWN function, refer to *7-5-9 Remote Operation Function (UP/DWN)* on page 7-40.

If the power supply is turned on, or if the terminal Reset (18: RS) turns from ON to OFF, with the terminal AHD ON, the last held data is available.

Parameter No.	Function name	Data	Default data	Unit
C001 to C007	Multi-function Input S1 to S7 Selection	65: AHD (Analog command held)	–	–
Related functions		C101		



- If you switch from the 1st control to the 2nd control with the terminal AHD ON, the held analog input value will remain as the frequency reference. To switch the control function, turn OFF the terminal AHD and have the inverter hold the signal again.
- Frequent use of this function could shorten the life expectancy of the internal EEPROM device.

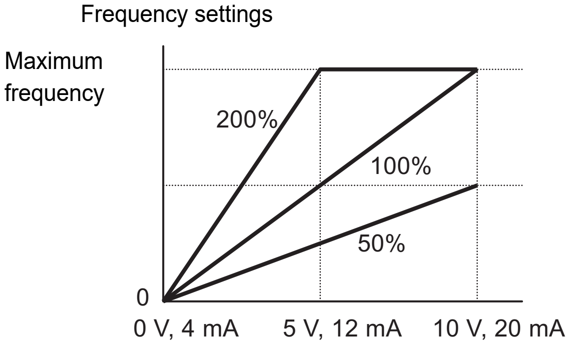
7-3-4 Analog Input Adjustment

You can change the analog input gain. Use this function to fine-tune the analog input signal.

For how to set the scale conversion, for example, from 0-to-10 V to 0-to-5 V, refer to *7-3-5 Analog Input Start/End Function Settings* on page 7-25.

By default, each analog input signal is adjusted to reach the maximum frequency at 9.8 V or 19.8 mA.

Parameter No.	Function name	Data	Default data	Unit
C081	FV Adjustment	0.0 to 200.0 Fine-tune the gain relative to the input voltage.	100.0	%
C082	FI Adjustment	0.0 to 200.0 Fine-tune the gain relative to the input current.	100.0	%



7-3-5 Analog Input Start/End Function Settings

Use these functions to configure the relationship between the analog input signal (FV/FI) or the optional Digital Operator’s volume control (VR) signal and the frequency reference.

- In the FV/FI/VR Start Ratio (A013/A103/A163), set the minimum analog input value.
- In the FV/FI/VR Start Frequency (A011/A101/A161), set the output frequency for the analog input set in the FV/FI/VR Start Ratio.
- In the FV/FI/VR End Ratio (A014/A104/A164), set the maximum analog input value.
- In the FV/FI/VR End Frequency (A012/A102/A162), set the output frequency for the analog input set in the FV/FI/VR End Ratio.
- In the FV/FI/VR Start Selection (A015/A105/A165), set the output frequency from 0 V to the minimum analog input value set in the FV/FI/VR Start Ratio.
- Setting the FV/FI/VR Start Frequency (A011/A101/A161) and the FV/FI/VR End Frequency (A012/A102/A162) to 0.00 Hz disables the Start and End Frequency settings, which causes the analog input function to work in the range of 0 Hz to the maximum frequency.
- With the default settings, this function works as follows.

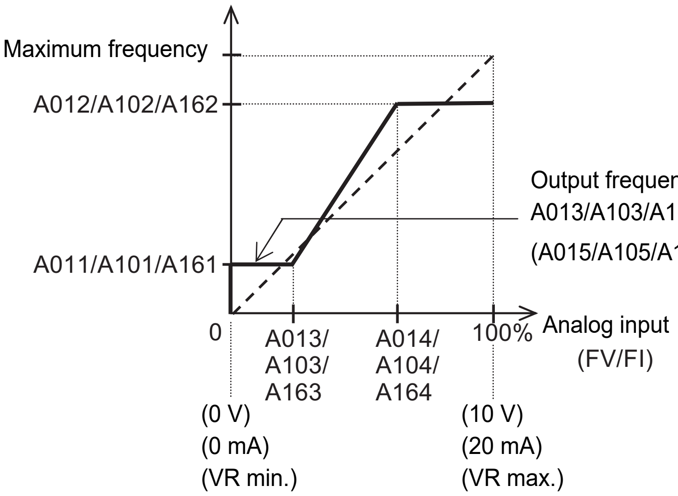
Frequency reference (Analog voltage input) between terminals FV and SC	: 0 to 10 V (0 Hz to Maximum frequency)
Frequency reference (Analog current input) between terminals FI and SC	: 4 to 20 mA (0 Hz to Maximum frequency)
VR (Volume control on optional Digital Operator (Model: 3G3AX-OP01))	: Left end (0 Hz) to Right end (Maximum frequency)

- By default, each analog input signal is adjusted to reach the maximum frequency at 9.8 V or 19.8 mA.
- To input a voltage of 0 to 5 V, set A014 to 50% and use the default settings for A011 to A104.
- To input a voltage of 0 to 20 mA, set A103 to 0% and use the default settings for A101/A102/A104.

Parameter No.	Function name	Data	Default data	Unit
A011/A101/ A161	FV/FI/VR Start Frequency	0.00 to 400.0 (580.0) [*1] Set the frequency at which to start analog input.	0.00	Hz
A012/A102/ A162	FV/FI/VR End Frequency	0.00 to 400.0 (580.0) [*1] Set the frequency at which to end analog input.	0.00	Hz
A013/A103/ A163	FV/FI/VR Start Ratio	0. to V/FI/VR end ratio Set the ratio of the start frequency to the external frequency reference of 0 to 10 V or 0 to 20 mA.	0. (FI: 20.)	%
A014/A104/ A164	FV/FI/VR End Ratio	FV/FI/VR Start Ratio to 100. Set the ratio of the end frequency to the external frequency reference of 0 to 10 V or 0 to 20 mA.	100.	%
A015/A105/ A165	FV/FI/VR Start Selection	00: Start frequency (A011/A101/A161) (Output frequency is A011/A101/A161 value for 0% to A013/A103/A163) 01: 0 Hz (Output frequency is 0 Hz for 0% to A013/A103/A163.)	01	–

[*1] In the high-frequency mode.

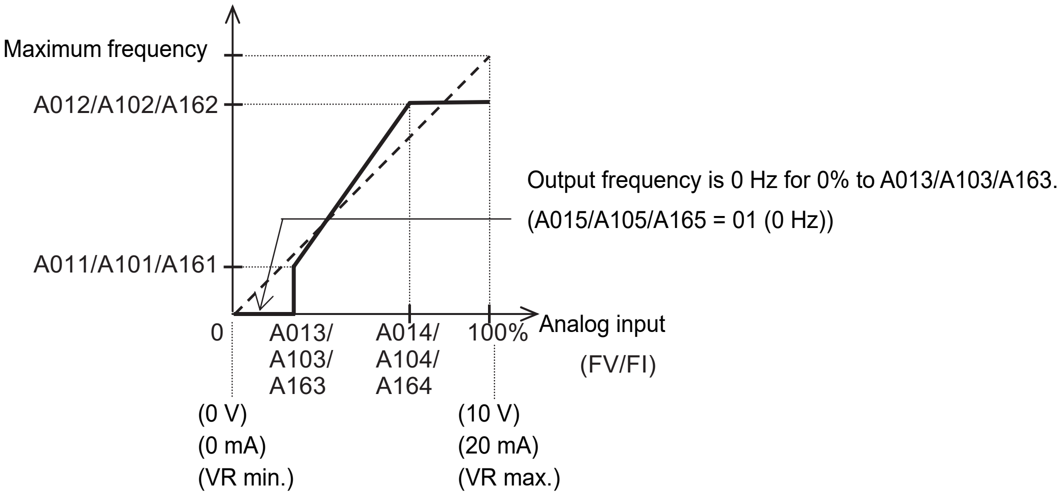
(Example 1) A015/A165 = 00 (Start frequency)



Output frequency is A011/A101/A161 for 0% to A013/A103/A163.

(A015/A105/A165 = 00 (Start frequency))

(Example 2) A015/A165 = 01 (0 Hz)



7-3-6 Terminal MP (Pulse/PWM Output)

The terminal MP provides 10-VDC pulse output or PWM output.

The terminal MP on the control circuit terminal block enables the monitoring of the output frequency and the output current.

MP Selection

Select the signal you want to output from the following table.

For pulse output signals (03, 08, 15), use a digital frequency counter. For other output signals, use an analog meter.

Parameter No.	Function name	Data	Description	PWM/ Pulse	Full-scale value
C027	MP Selection	00	Output frequency[*1 *2]	PWM	0 to Maximum frequency [Hz]
		01	Output current	PWM	0 to 200%
		02	Output torque[*3]	PWM	0 to 200%
		03	Digital output frequency[*4]	Pulse	0 to Maximum frequency [Hz]
		04	Output voltage	PWM	0 to 133% (Example: For 200-V class, 7.5 V at 200 V)
		05	Input power	PWM	0 to 200%
		06	Electronic thermal load rate	PWM	0 to 100%
		07	LAD frequency [*1]	PWM	0 to Maximum frequency [Hz]
		08	Digital current monitor	Pulse	Refer to *MP Gain Setting* on page 7-28.
		10	Cooling fin temperature	PWM	0 to 200°C (Outputs 0°C for 0°C or lower)
		12	DriveProgramming (YA(0))	PWM	Use DriveProgramming to set this function. (0.00 to 100.00%)
		15	Pulse train input monitor	Pulse	Refer to *MP Gain Setting* on page 7-28.
		16	Option (No applicable Option)	–	–

*1. 07 (LAD frequency) represents the frequency commanded by the inverter and is equivalent of the Output Frequency Monitor (d001) value. 00 (Output frequency) represents a frequency value that takes into account the aspects of vector control compensation (such as sensorless vector control) and even stabilization control.

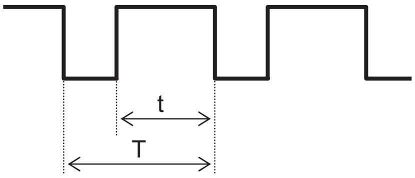
When set to 00 (Output frequency), the parameter may produce an output that appears to be unstable at low speeds, for example, when decelerating due to the overload limit function. In this case, set it to 07 (LAD frequency) to obtain a stable output.

*2. Setting the Pulse Train Input RP Selection (P003) to 01 (Feedback pulse) causes the inverter to output the frequency displayed in the Real Frequency Monitor (d008).

*3. This setting is enabled only when the 1st/2nd Control Method (A044/A244) is set to 03 (Sensorless vector control). When A044/A244 is not set to 03, the inverter does not produce output because it remains at 0 V.

*4. When the Frequency Conversion Coefficient (b086) is set, the digital output frequency outputs a converted value. Refer to *7-1-7 Output Frequency Monitor (After Conversion) [d007]* on page 7-6.

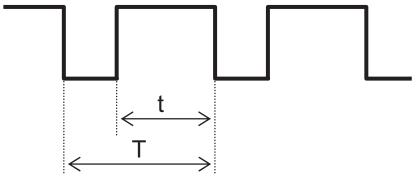
PWM output



Cycle T: Constant (6.4 ms)

Duty ratio t/T: Variable

Pulse output



Cycle T: Variable

Duty ratio t/T: Fixed to 1/2

MP Gain Setting

You can set the output gain in the MP Gain Setting (C105) when the MP Selection (C027) is set to 00 to 02, 04 to 07, 10, or 12 (settings with PWM output).

When C027 is set to 08 (Digital current monitor), set the reference current value for the output pulses in the Digital Current Monitor Reference Value (C030). The output will be made in proportion to this value, so that the current value set in C030 produces an output frequency of 1440 Hz.

When C027 is set to 15 (Pulse train input monitor), you can set the output gain in the Pulse Train Output MP Scale (C047) (to obtain an output of Input value × C047).

Parameter No.	Function name	Data	Default data	Unit
C105	MP Gain Setting	50. to 200. Set the MP monitor gain.	100.	%
C030	Digital Current Monitor Reference Value	0.20 × Rated current to 2.00 × Rated current (In the heavy mode) 0.20 × Rated current to 1.50 × Rated current (In the light mode) (Set the current value at an output of 1440 Hz.)	Rated current	A
C047	Pulse Train Output MP Scale	0.01 to 99.99 Output pulse frequency = Input pulse frequency × (C047)	1.00	–

7-3-7 Terminal AM (Analog Output)

The terminal AM provides an analog output of 0 to 10 VDC.

The digital terminal AM on the control circuit terminal block enables the monitoring of the output frequency and the output current.

The analog output may not stabilize immediately after the power is turned on or off.

AM Selection

Select the signal you want to output from the following table.

Parameter No.	Function name	Data	Description	Full-scale value
C028	AM Selection	00	Output frequency[*1] [*2]	0 to Maximum frequency [Hz]
		01	Output current	0 to 200%
		02	Output torque[*3]	0 to 200%
		04	Output voltage	0 to 133% (Example: For 200-V class, 7.5 V at 200 V)
		05	Input power	0 to 200%
		06	Electronic thermal load rate	0 to 100%
		07	LAD frequency [*1]	0 to Maximum frequency [Hz]
		10	Cooling fin temperature	0 to 200°C (Outputs 0°C for 0°C or lower)
		11	Output torque (signed) [*3]	0 to 200%[*4]
		13	DriveProgramming (YA(1))	Use DriveProgramming to set this function. (0.00 to 100.00%)
		16	Option (No applicable Option)	–

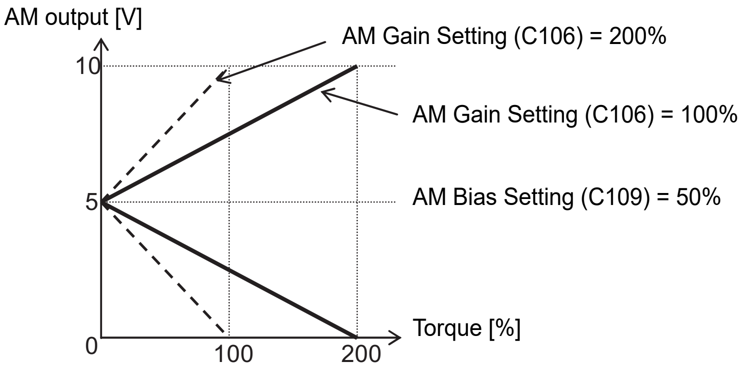
*1. 07 (LAD frequency) represents the frequency commanded by the inverter and is equivalent of the Output Frequency Monitor (d001) value. 00 (Output frequency) represents a frequency value that takes into account the aspects of vector control compensation (such as sensorless vector control) and even stabilization control.

When set to 00 (Output frequency), the parameter may produce an output that appears to be unstable at low speeds, for example, when decelerating due to the overload limit function. In this case, set it to 07 (LAD frequency) to obtain a stable output.

*2. Setting the Pulse Train Input RP Selection (P003) to 01 (Feedback pulse) causes the inverter to output the frequency displayed in the Real Frequency Monitor (d008).

*3. This setting is enabled only when the 1st/2nd Control Method (A044/A244) is set to 03 (Sensorless vector control). When A044/A244 is not set to 03, the inverter does not produce output because it remains at 0 V.

*4. The specifications of the output torque (signed) are as follows.



AM Gain/Bias Setting

Adjust the gain and bias settings of the inverter's AM output based on the meter connected to the terminal AM. The bias setting is once disabled while the reset input is input, and 0 V is output.

Parameter No.	Function name	Data	Default data	Unit
C106	AM Gain Setting	50. to 200. Set the AM monitor gain.	100.	%
C109	AM Bias Setting	0 to 100 Set the AM monitor bias.	0.	%

(Example) To output 0 to 5 V, set C106 to 50% and use the default data for C109.

7-4 Inverter Control Settings

This section describes the carrier frequency function and the 1st/2nd control switching function, which are related to the inverter control.

7-4-1 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 generated by the motor. If the inverter generates a large sound due to resonance with the mechanical system or motor, you can effectively avoid the resonance by setting the carrier frequency out of the resonance frequency range.

However, this results in an increase in electrical noise or leakage current from the inverter.

Parameter No.	Function name	Data	Default data	Unit
b083	Carrier Frequency	Heavy load mode (b049 = 00) 2.0 to 15.0	10.0	kHz
		Light load mode (b049 = 01) 2.0 to 10.0	2.0	
		High-frequency mode (b171 = 02) (2.0 to 10.0) [*1]	(5.0) [*1]	
Related functions		b089		

*1. In the high-frequency mode.

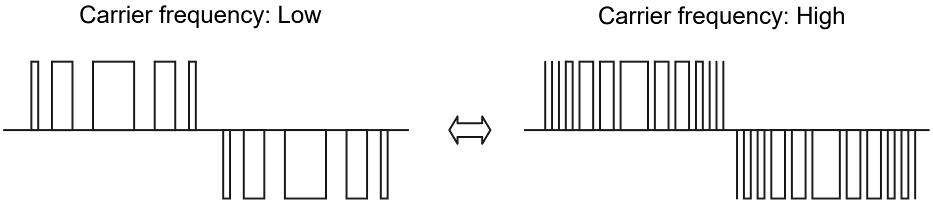
- Derating of the output current may be required depending on the installation environment and the Carrier Frequency (b083) setting. For derating of each inverter model, refer to *A-1 Derating* on page A-2.

  In the Electronic Thermal Level, set the output current value to be derated.

  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 *5-3-2 Electronic Thermal Function* on page 5-16.
- Be aware that adjusting the carrier frequency exceeding the allowable derating level for the output current may cause damage or shortened life expectancy of the inverter.
- The carrier frequency for DC injection braking can be set in A059. For details, refer to *7-9-1 DC Injection Braking (DB)* on page 7-91.
- The table below shows the carrier frequency setting and its influence.

Carrier frequency	Low	High
Noise from motor	Large	Small
Noise, leakage current	Small	Large
Torque	Slightly large	Slightly small



7-4-2 Automatic Carrier Reduction

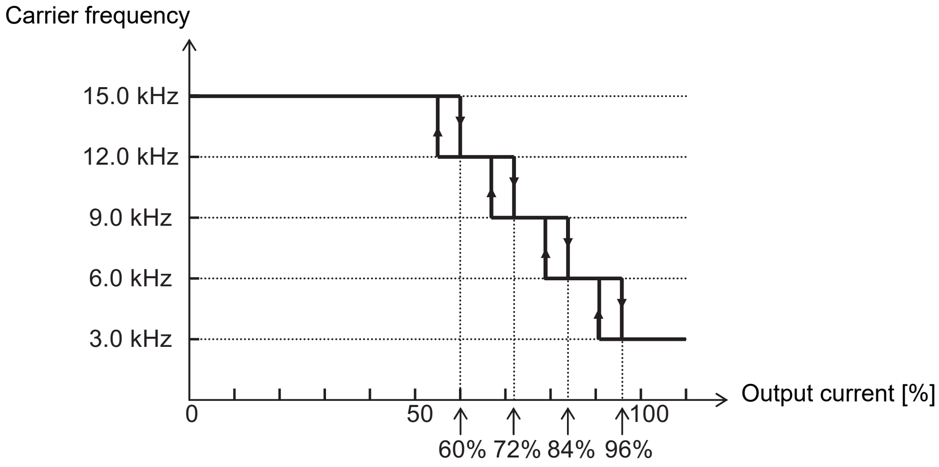
Use this function to reduce the carrier frequency automatically as the output current and the cooling fin temperature increase.

To enable this function, set the Automatic Carrier Reduction (b089) to 01 or 02.

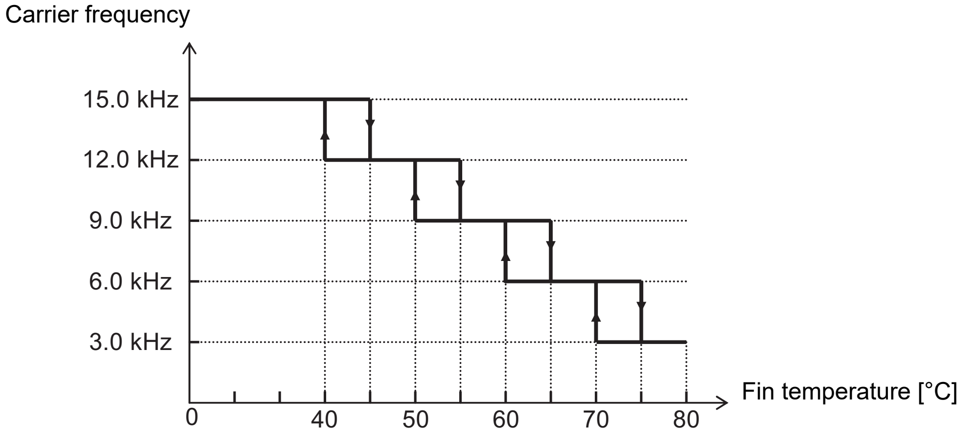
Parameter No.	Function name	Data	Default data	Unit
b089	Automatic Carrier Reduction	00: Disabled 01: Enabled (Dependent on the current) 02: Enabled (Dependent on cooling fin temperature)	01	–
Related functions		b083		

- Depending on the ratio of the output current to the rated current and the cooling fin temperature, this function reduces the carrier frequency to 12, 9, 6, and 3 kHz, as shown below. The normal carrier frequency will be restored when the output current (when dependent on the current) or the fin temperature (when dependent on the cooling fin temperature) exceeds each carrier reduction start level –5% or –5°C, respectively.
- The carrier frequency reduction rate is 2 kHz per second.
- The upper limit of the carrier frequency changeable with this function is equivalent to the value set in the Carrier Frequency (b083); the lower limit of the carrier frequency is 3 kHz.
- When b083 is set to 3 kHz or lower, this function is disabled independently of the b089 setting.

● b089 = 01



● b089 = 02



7-4-3 2nd Control Function (SET)

Use this function to control two induction motors with different motor parameters by switching.

Even with a single motor, you can use the 2nd control to configure the control and settings that best fit your application.

To switch between two motors, set the Multi-function Input S1 to S7 Selection (C001 to C007) to 08 (SET) and turn OFF (1st control) or ON (2nd control) the terminal SET.

Parameter No.	Function name	Data	Default data	Unit
C001 to C007	Multi-function Input S1 to S7 Selection	08: SET (2nd control)	–	–

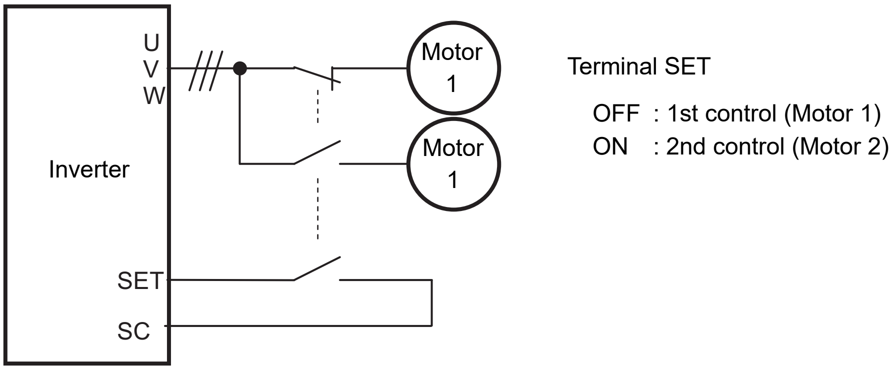
The functions that support motor switching via the terminal SET are as follows.

1st control motor	2nd control motor	Setting item
F001		Output Frequency Setting/Monitor
F002	F202	Acceleration Time 1
F003	F203	Deceleration Time 1
A001	A201	Frequency Reference Selection
A002	A202	RUN Command Selection
A003	A203	Base Frequency
A004	A204	Maximum Frequency
A020	A220	Multi-step Speed Reference 0
A041	A241	Torque Boost Selection
A042	A242	Manual Torque Boost Voltage
A043	A243	Manual Torque Boost Frequency
A044	A244	Control Method
A045	A245	Output Voltage Gain
A046	A246	Automatic Torque Boost Voltage Compensation Gain
A047	A247	Automatic Torque Boost Slip Compensation Gain
A061	A261	Frequency Upper Limit
A062	A262	Frequency Lower Limit
A081	A281	AVR Selection
A082	A282	Motor Rated Voltage Selection
A092	A292	Acceleration Time 2
A093	A293	Deceleration Time 2
A094	A294	2-step Acceleration/Deceleration Selection
A095	A295	2-step Acceleration Frequency
A096	A296	2-step Deceleration Frequency
b012	b212	Electronic Thermal Level
b013	b213	Electronic Thermal Characteristics Selection
b021	b221	Overload Limit Selection
b022	b222	Overload Limit Level
b023	b223	Overload Limit Parameter
C041	C241	Overload Warning Level
H002	H202	Motor Parameter Selection
H003	H203	Motor Capacity
H004	H204	Motor Pole Number
H005	H205	Speed Response
H006	H206	Stabilization Parameter
H020	H220	Motor Parameter R1
H021	H221	Motor Parameter R2

1st control motor	2nd control motor	Setting item
H022	H222	Motor Parameter L
H023	H223	Motor Parameter Io
H024	H224	Motor Parameter J
H030	H230	Motor Parameter R1 (Auto-tuning Data)
H031	H231	Motor Parameter R2 (Auto-tuning Data)
H032	H232	Motor Parameter L (Auto-tuning Data)
H033	H233	Motor Parameter Io (Auto-tuning Data)
H034	H234	Motor Parameter J (Auto-tuning Data)

It is not possible to distinguish between the 1st and 2nd control functions on the display. Check the ON/OFF status of each terminal to determine which control function is enabled.

During operation, attempts to switch between the 1st and 2nd control functions fail. Because switching is enabled only during stop, the inverter will be switched after the operation is stopped.


U
V
W
Inverter
SET
SC
Motor 1
Motor 1
Terminal SET
OFF : 1st control (Motor 1)
ON : 2nd control (Motor 2)

7-5 Other Operation Functions

This section describes the parameters associated with other operation functions.

7-5-1 Starting Frequency

Set the frequency at which the inverter starts its output when the RUN signal turns ON.

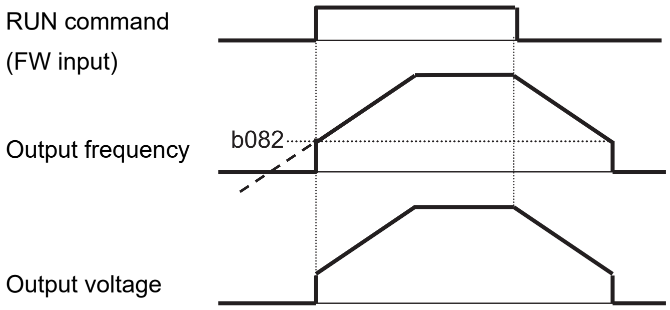
Mainly, use this function to adjust the starting torque.

If you set a high frequency in Starting Frequency (b082), the inverter starts with the full voltage and also the starting current increases. Therefore, the overload limit function may be performed or the inverter may trip easily by the overcurrent protection.

Parameter No.	Function name	Data	Default data	Unit
b082	Starting Frequency	0.01 to 9.99 (100.00) *2	1.50 *1	Hz

*1. The default data was changed from the previous model.

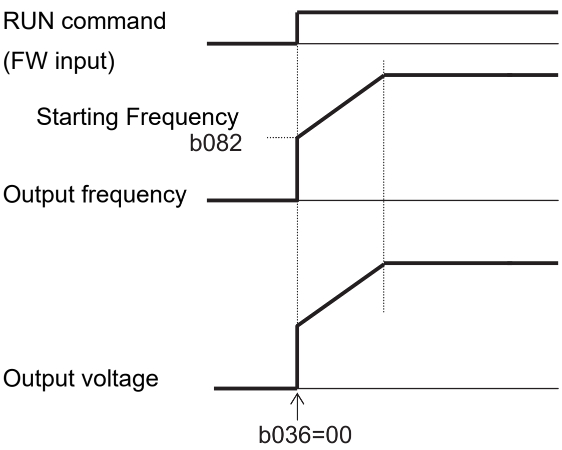
*2. In the high-frequency mode.



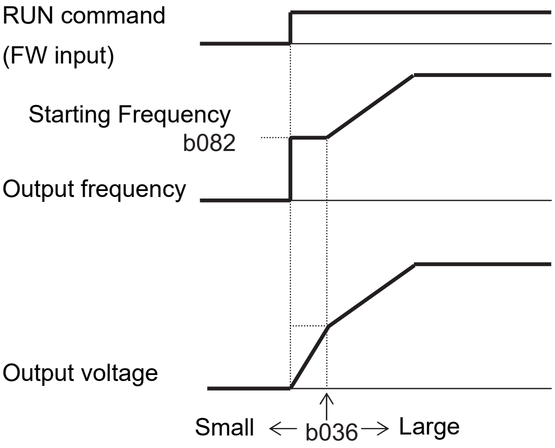
7-5-2 Reduced Voltage Startup Selection

Use this function to increase the voltage slowly during motor startup.
To prevent the surge current or overcurrent trip during startup, increase the value set in the Reduced Voltage Startup Selection (b036). Although setting a small value causes the high starting torque, the inverter operates as with the full voltage starting. Therefore, an overcurrent trip may occur easily.

Parameter No.	Function name	Data	Default data	Unit
b036	Reduced Voltage Startup Selection	0: Reduced voltage startup disabled 1 (Reduced voltage startup time: short) to 255 (Reduced voltage startup time: long)	2	–
Related functions		b082		


RUN command
(FW input)
Starting Frequency
b082
Output frequency
Output voltage
b036=00

Reduced voltage startup disabled


RUN command
(FW input)
Starting Frequency
b082
Output frequency
Output voltage
Small
b036
Large

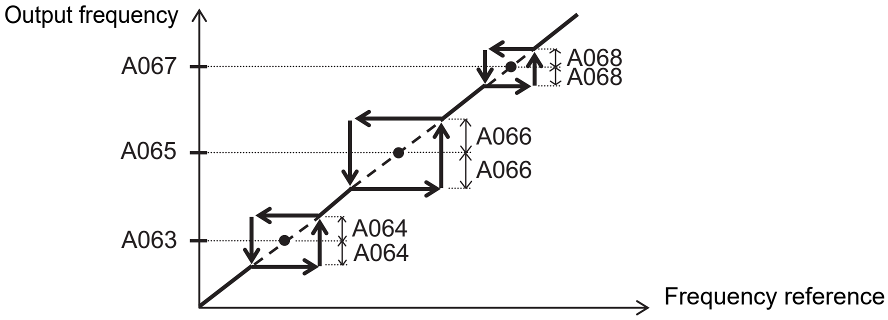
Reduced voltage startup enabled

7-5-3 Frequency Jump Function

Use the frequency jump function to avoid the resonant point of the load machine during operation.
If jump frequency is set, you cannot set the frequency reference within the jump frequency range to avoid steady operation in that range.
The output frequency changes continuously according to the acceleration/deceleration time settings during acceleration/deceleration.
You can set three points for jump frequency.

Parameter No.	Function name	Data	Default data	Unit
A063/A065/ A067	Jump Frequency 1/2/3	0.00 to 400.0 (580.0) *2 Set the center of the jump frequency. *1	0.00	Hz
A064/A066/ A068	Jump Frequency Width 1/2/3	0.00 to 10.00 (100.0) *2 Set 1/2 of the jump frequency width.	0.50	Hz

*1. When set to 0 Hz, this function is disabled.
*2. In the high-frequency mode.


Output frequency
A067
A065
A063
A068
A068
A066
A066
A064
A064
Frequency reference

7-5-4 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.

If the moment of inertia of a load machine is large, you can use it, for example, to have the motor wait until the amount of motor slip during acceleration/deceleration becomes small. You can use it also to prevent an overcurrent/overvoltage trip during acceleration/deceleration.

This function works independently of the Acceleration/Deceleration Pattern Selection (A097/A098) setting. It is activated for all acceleration/deceleration patterns by the frequency reference input via the analog input signal or the optional Digital Operator’s volume control (VR).

There are two acceleration/deceleration stop methods as follows, which can be used in conjunction with each other.

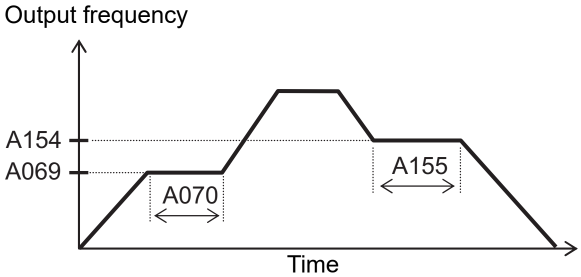
- Stopping automatically when the specified frequency/stop time is reached
- Stopping by inputting the terminal HLD (83: Retain output frequency) set in the Multi-function Input S1 to S7 Selection (C001 to C007)

Using this function prolongs the acceleration/deceleration time configured by the F001/F202 and F003/F203 settings for the duration of the stop time caused by this function.

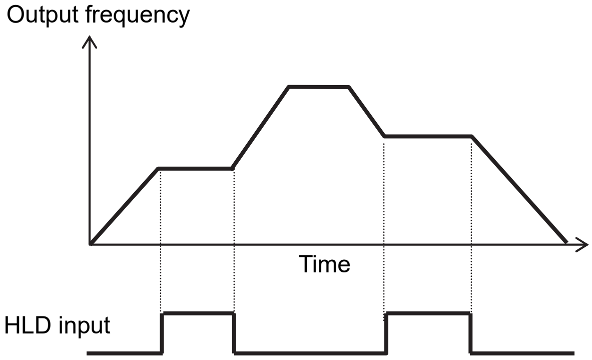
Parameter No.	Function name	Data	Default data	Unit
A069	Acceleration Stop Frequency	0.00 to Starting Frequency: Disabled Frequency above Starting Frequency to 400.0 (580.0) [*1]	0.00	Hz
A070	Acceleration Stop Time	0.0: Disabled 0.1 to 60.0	0.0	s
A154	Deceleration Stop Frequency	0.00 to Starting Frequency: Disabled Frequency above Starting Frequency to 400.0 (580.0) [*1]	0.00	Hz
A155	Deceleration Stop Time	0.0: Disabled 0.1 to 60.0	0.0	s
C001 to C007	Multi-function Input S1 to S7 Selection	83: HLD (Retain output frequency)	–	–

*1. In the high-frequency mode.

● Stopping when the specified frequency/stop time is reached



● Stopping via input to a multi-function input terminal



7-5-5 RUN Direction Limit Selection

Use this function to limit the RUN direction of the motor.

It can be activated either via the control circuit terminal block or the Digital Operator.

When the inverter receives a RUN command input with the RUN direction limit function enabled from the control circuit terminal block, `oooo` is displayed on the Digital Operator.

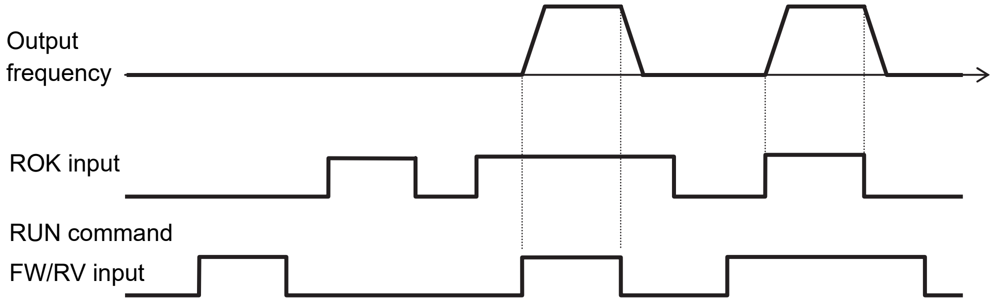
Parameter No.	Function name	Data	Default data	Unit
b035	RUN Direction Limit Selection	00: No direction limit 01: Only Forward is enabled (Motor does not rotate in reverse.) 02: Only Reverse is enabled (Motor does not rotate in forward.)	00	–

7-5-6 Permission of RUN Command

Use this function to have the inverter accept the RUN command only while the permission of RUN command is ON.

To use it, set the Multi-function Input S1 to S7 Selection (C001 to C007) to 84 (ROK).

Parameter No.	Function name	Data	Default data	Unit
C001 to C007	Multi-function Input S1 to S7 Selection	84: ROK (Permission of RUN command)	–	–



7-5-7 Frequency Calculation Function

The frequency calculation function enables the use of calculation results from two frequency reference channels as a frequency reference or PID feedback value.

To use the calculation result as a frequency reference, set the 1st/2nd Frequency Reference Selection (A001/A201) to 10 (Operation function output).

To use the calculation result as a PID feedback value, set the PID Feedback Selection (A076) to 10 (Operation function output).

Parameter No.	Function name	Data	Default data	Unit
A141/A142	Calculation Frequency Selection 1/2	00: Digital Operator (A020/A220) 01: Digital Operator (Volume) (Enabled only when 3G3AX-OP01 is connected) 02: Analog voltage (terminal FV) input 03: Analog current (terminal FI) input 04: Modbus communication 05: Option 07: Pulse train frequency	02 or 03	–
A143	Calculation Function Operator Selection	00: Addition (A141 + A142) 01: Subtraction (A141 – A142) 02: Multiplication (A141 × A142)	00	–
A001/A201	1st/2nd Frequency Reference Selection	10: Operation function output	02	–
A076	PID Feedback Selection	10: Operation function output	00	–

Note 1. When this function is enabled, the remote operation function (UP/DWN) cannot be used. In addition, the frequency settings in the Output Frequency Monitor (d001), Output Frequency Monitor (After Conversion) (d007), and Output Frequency Setting/Monitor (F001) cannot be changed via the Digital Operator keys.

2. A141 and A142 can have the same setting.

7-5-8 Frequency Addition Function

Use this function to add or subtract the value set in the Frequency Addition Amount Setting (A145) to the selected frequency reference value.

To use it, allocate one of the Multi-function Input S1 to S7 Selection (C001 to C007) to 50 (ADD).

The value set in A145 is added or subtracted when the terminal ADD is ON. Turning OFF the terminal ADD resets the Frequency Addition Amount Setting (A145) to the selected frequency reference value.

Parameter No.	Function name	Data	Default data	Unit
A145	Frequency Addition Amount Setting	0.00 to 400.0 (580.0) [*1]	0.00	Hz
A146	Frequency Addition Sign Selection	00: (Frequency reference) + (A145) 01: (Frequency reference) – (A145)	00	–
C001 to C007	Multi-function Input S1 to S7 Selection	50: ADD (Set frequency A145 addition)	–	–

Note 1. If the +/- sign in front of the frequency reference changes (from “–” to “+” or “+” to “–”) as a result of operation, the rotation direction of the motor will be reversed.

2. When the PID function is used, this function is also enabled for the PID target value.

(Note that A145 can be set as a percentage of the maximum frequency in increments of 0.01%.)

[*1] In the high-frequency mode.

7-5-9 Remote Operation Function (UP/DWN)

Use this function to change the inverter output frequency via the multi-function input terminals UP and DWN.

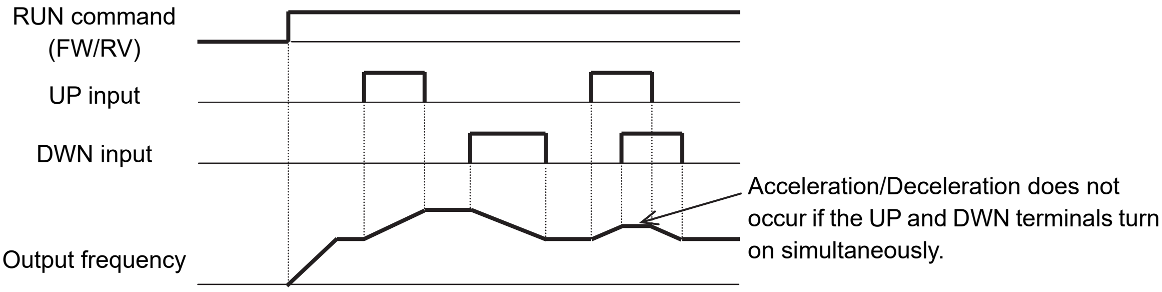
Set the Multi-function Input S1 to S7 Selection (C001 to C007) to 27 (UP) and 28 (DWN).

When the UP/DOWN terminal is ON, the inverter operates according to the acceleration/deceleration time settings (F002/F202, F003/F203, etc.)

In addition, setting C101 to 01 (Store frequency data) enables the inverter to store the frequency reference value after UP/DWN adjustment into its internal EEPROM when the power supply is shut off.

Parameter No.	Function name	Data	Default data	Unit
C101	UP/DWN Storage Selection	00: Not store frequency data 01: Store frequency data[*1]	00	–
C104	UP/DWN Clear Selection	00: 0Hz 01: EEPROM data at power-on	00	–
C001 to C007	Multi-function Input S1 to S7 Selection	27: UP (Remote operation accelerated) 28: DWN (Remote operation decelerated) 29: UDC (Remote operation data clear)	–	–

*1. Do not turn ON/OFF the terminal UP/DWN after turning off the power supply. Otherwise, the inverter may not store data normally.


RUN command (FW/RV)
UP input
DWN input
Output frequency
Acceleration/Deceleration does not occur if the UP and DWN terminals turn on simultaneously.

- The remote operation function is enabled only when the 1st/2nd Frequency Reference Selection (A001/A201) is set to 01 (Control circuit terminal block) or 02 (Digital Operator), or when the multi-step speed operation function is enabled. However, the parameter can be set to 01 (Control circuit terminal block) only when the analog command hold function (AHD) is enabled. For details on the analog command hold function, refer to *7-3-3 Analog Command Hold Function (AHD)* on page 7-24.
- The remote operation function is disabled for the frequency reference via non-held analog input or for jogging operation.
- To clear the frequency reference value adjusted using the UP/DWN function, set the Multi-function Input S1 to S7 Selection (C001 to C007) to 29 (UDC).

  Then, set the command reference value after clearing in the UP/DWN Clear Selection (C104).

7-5-10 Output Voltage Gain

Use this function to decrease the inverter output voltage as a percentage of the voltage set in the 1st/2nd Motor Rated Voltage Selection (A082/A282).

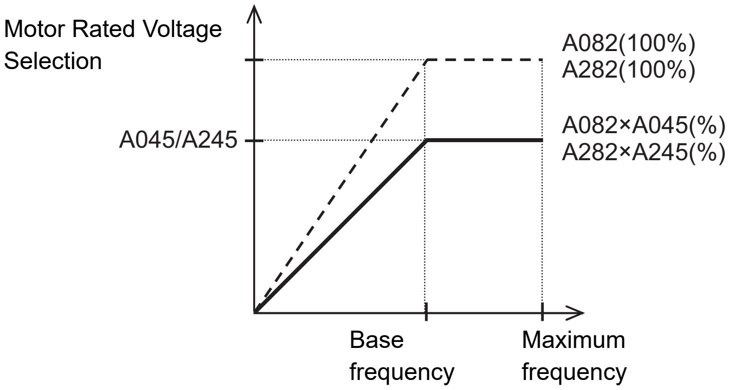
You can avoid motor hunting by decreasing the output voltage gain.

Be sure to change the gain value moderately during operation (as a guide, 10% max.) Otherwise, an overcurrent trip may occur due to sudden output voltage changes.

When the 1st/2nd Control Method (A044/A244) is set to 03 (Sensorless vector control), you can change the set data during operation or stop, but changes will not be reflected on the control behavior. After changing the setting, be sure to turn off and then on the input power supply again. Then, the inverter recalculates the motor parameter values.

This motor parameter calculation is also performed when the reset input turns ON.

Parameter No.	Function name	Data	Default data	Unit
A045/A245	1st/2nd Output Voltage Gain	Set the output voltage reduction factor. 20. to 100.	100.	%
Related functions		A082, A282		



7-5-11 AVR (Automatic Voltage Regulator) Function

Use this function to have the inverter automatically compensate for the output voltage to the motor even if the incoming voltage fluctuates.
It is useful as a preventive measure against low output torque to the motor or overexcitation.
Note, however, that the inverter cannot output voltage exceeding the incoming voltage to the inverter.

AVR (Automatic Voltage Regulator) Function Settings

To enable/disable the AVR (Automatic Voltage Regulator) function, set the 1st/2nd AVR Selection (A081/A281).

- The inverter will output voltage to the motor according to the value set in the 1st/2nd Motor Rated Voltage Selection (A082/A282).
  Note, however, that the inverter cannot output voltage exceeding the incoming voltage to the inverter.
- By default, this parameter is set to 02 (OFF during deceleration) to enable the inverter to output a large deceleration torque during deceleration.
  To avoid possible overcurrent trip during deceleration, set the 1st/2nd AVR Selection (A081/A281) to 00 (Always ON).

Parameter No.	Function name	Data	Default data	Unit
A081/A281	1st/2nd AVR Selection	00: Always ON 01: Always OFF 02: OFF during deceleration[*1]	02	–
A082/A282	1st/2nd Motor Rated Voltage Selection	200 V: 200 to 240 400 V: 380 to 480	200 or 400	V

[*1] This setting decreases the energy to be fed back to the inverter by increasing the motor loss.
It is effective when you need to reduce the deceleration time.
However, to avoid possible overcurrent tripping during deceleration, set the 1st/2nd AVR Selection to 00 (Always ON).

Overexcitation Control during Deceleration

This function 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 optional braking resistors.

- To use this function, set the Overvoltage Suppression Function Selection During Deceleration (b130) to 00 (Disabled).
- Set the 1st/2nd AVR Selection (A081/A281) to 00 (Always ON).
- Setting the AVR Gain at Deceleration (A084) to higher than 100% enables the adjustment of the motor in an overexcited state.
  Set this as a percentage of the 1st/2nd Motor Rated Voltage Selection (A082/A282) value.
- AVR Filter Time Constant (A083) is a parameter to set the filter time constant to adjust the responsiveness of the AVR (Automatic Voltage Regulator).

Parameter No.	Function name	Data	Default data	Unit
b130	Overvoltage Suppression Function Selection During Deceleration	00: Disabled	01[*1]	–
A081/A281	1st/2nd AVR Selection	00: Always ON	02	–
A082/A282	1st/2nd Motor Rated Voltage Selection	200 V: 200 to 240 400 V: 380 to 480	200 or 400	V
A083	AVR Filter Time Constant	0.000 to 10.00	0.300	s
A084	AVR Gain at Deceleration	50. to 200.	100.	%

[*1] The default data was changed from the previous model.

Adjusting overexcitation control during deceleration

(1) **First, set A083 to 0.3 and A084 to 130 to shorten the deceleration time.**

(2) **If you need to set a higher target value for the deceleration time, or to detect an overvoltage with the above settings, first set A083 to 0 and increase the value set in A084 gradually from 130 while checking the deceleration time at each gain level. The adjustment is completed if the inverter achieves the target deceleration time.**

(3) **If an overload or overcurrent occurs**

If an overload or overcurrent occurs as a result of overexcitation control during deceleration, take the following countermeasure.

Overload

As the motor consumes regenerative energy, frequent decelerating movements may cause an overload.
In this case, decrease the value set in A084 gradually and check the inverter state.
If the inverter cannot achieve the target deceleration time or causes an overload, you need to purchase optional braking resistors.

Overcurrent

If the applied voltage during deceleration is too high, the inverter may detect an overload.
If an overcurrent is detected, decrease the value set in A084 gradually and check the inverter state.
If the inverter cannot achieve the target deceleration time or causes an overcurrent, you need to purchase optional braking resistors.

7-5-12 PID Function

Use this function to control the flow rate, air volume, pressure, and other processes. To use this function, set A071 to 01 (Enabled) or 02 (Enabled: Reverse output enabled).

The PID function can be disabled during PID operation via external signal input.

To use this function, set one of the Multi-function Input S1 to S7 Selection (C001 to C007) to 23 (PID: PID disabled). This causes the PID function to be disabled while the terminal PID is ON and the inverter generates an output according to the frequency reference.

You can also use this function to limit the PID output with reference to the target value. Set the upper/lower limit value in the PID Variable Range Limit (A078) as a percentage of the maximum frequency.

Because the PID output is a frequency reference for the inverter, the base frequency, maximum frequency, frequency limit settings are enabled. For details on these functions, refer to *5-3-3 Base Frequency and Maximum Frequency of Motor* on page 5-21, *5-5-3 Frequency Limit* on page 5-31, and PID Variable Range Limit (A078).

Parameter No.	Function name	Data	Default data	Unit
A071	PID Selection	00: Disabled 01: Enabled 02: Enabled (Reverse output enabled)	00	–
A072	PID P Gain	0.00 to 25.00 Set the proportional gain	1.00	–
A073	PID I Gain	0.0 to 3600. Set the integral time	1.0	s
A074	PID D Gain	0.00 to 100.0 Set the derivative time	0.00	s
A075	PID Scale	0.01 to 99.99 For unit conversion for PID Feedback Value Monitor (d004)	1.00	time
A076	PID Feedback Selection	00: Analog current (Terminal FI) *1 4 to 20 mA 01: Analog voltage (Terminal FV) *1 0 to 10 V 02: Modbus communication 03: Pulse train frequency 10: Operation function output *1	00	–
A077	PID Deviation Reverse Output	00: Disabled (Deviation = Target value – Feedback value) 01: Enabled (Deviation = Feedback value – Target value)	00	–
A078	PID Variable Range Limit	0.0 to 100.0 Variable range based on target value	0.0	%
A079	PID Feedforward Selection	00: Disabled 01: Analog voltage (Terminal FV) *2 0 to 10 V 02: Analog current (Terminal FI) *3 4 to 20 mA	00	–
A156	PID Sleep Operation Level	0.00 to 400.0 (580.0) *4 Stops inverter operation if PID output is at the operation level or lower.	0.00	Hz

Parameter No.	Function name	Data	Default data	Unit
A157	PID Sleep Operation Delay Time	0.0 to 25.5 Set the delay time until the sleep operation starts.	0.0	s
C044	PID Deviation Excessive Level	0.0 to 100.0 OD signal output judgment level	3.0	%
C052	Feedback Comparison Signal Off Level	0.0 to 100.0 FBV signal output judgment level	100.0	%
C053	Feedback Comparison Signal On Level	0.0 to 100.0 FBV signal output judgment level	0.0	%
C001 to C007	Multi-function Input S1 to S7 Selection	23: PID (PID disabled) 24: PIDC (PID integral reset)	–	–
C021, C022 C026	Multi-function Output P1/P2 Selection Multi-function Relay Output (MA, MB) Function Selection	04: OD (Excessive PID deviation) 31: FBV (PID feedback comparison signal)	–	–
Related functions		A001, A201, A005, d004		

*1. Setting the PID Selection (A071) to Enabled causes the analog input selection setting in A036 to be allocated to the PID feedback function.

When the 1st Frequency Reference Selection (A001) is set to 01 (Control circuit terminal block), the analog input setting other than that selected in A076 is used as the target frequency reference. In this case, the setting in A005 and the function allocated to the terminal AT (Analog input switching) are disabled.

*2. Refer to *7-5-7 Frequency Calculation Function* on page 7-39.

*3. In A079, you can set a target value, or have a setting that overlaps with the PID Feedback Selection value.

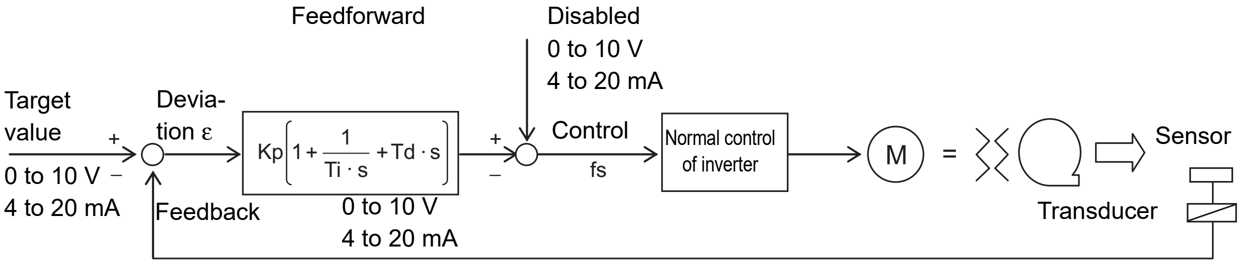
With an overlapping setting, the analog input is used for both the feedback and feedforward signals.

*4. In the high-frequency mode.

Precautions for Correct Use

- When the PID function is enabled, the setting unit for the following parameters is changed to percentage as 100% of the maximum frequency.
  Note also that, these parameters are read or written via Modbus communication, the data unit differs between read and write operations. Set parameter values in units of 0.01 Hz for writing and in units of the following percentages as 100% of the maximum frequency for reading.
  F001: 0.01%
  A011, A012, A020/A220, A021 to A035, A101, A102, A145: 0.1%
- When using the PID function, do not set the Analog Input Filter (A016) to 31 (500-ms filter with ±0.1-Hz hysteresis). Doing so may result in unstable operation.

Basic Structure of PID Control

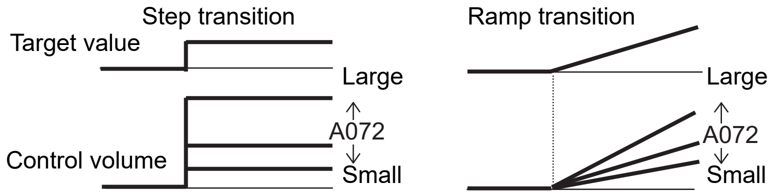


Kp: Proportional gain (A072: PID P gain)
Ti: Integral time (A073: PID I gain)
Td: Derivative time (A074: PID D gain)
s: Operator

PID Operation

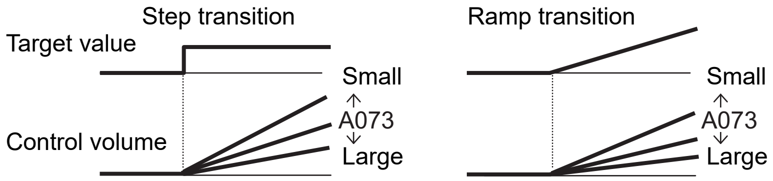
(1) **P Operation**

In this operation, the control volume is proportional to the deviation (difference between the target value and the current value).


Step transition
Target value
Large
A072
Small
Control volume
Ramp transition
Large
A072
Small

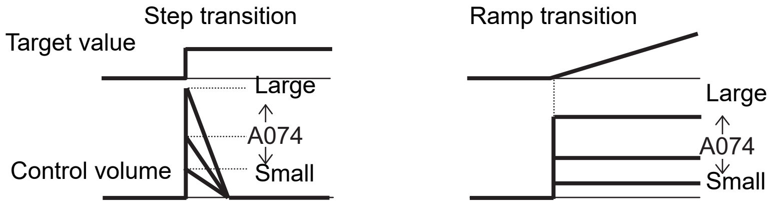
(2) **I Operation**

In this operation, the control volume 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.


Step transition
Target value
Small
A073
Large
Control volume
Ramp transition
Small
A073
Large

(3) **D Operation**

In this operation, the control volume 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.


Step transition
Target value
Large
A074
Small
Control volume
Ramp transition
Large
A074
Small

PID Target Value Setting Unit and PID Scale

When the PID function is enabled, the setting unit for the following parameters is changed to percentage as 100% of the maximum frequency (d004 is always in units of %).
You can set the PID Scale (A075) to perform scale conversion of these parameters:

Value after conversion = Value before conversion × PID Scale (A075)

d004	F001	A011	A012	A020	A220	A021	A022
A023	A024	A025	A026	A027	A028	A029	A030
A031	A032	A033	A034	A035	A101	A102	A145

Precautions for Correct Use

When the following parameters are read or written via Modbus communication, the data unit differs between read and write operations. Set parameter values in units of 0.01 Hz for writing and in units of the following percentages (as 100% of the maximum frequency) for reading.

F001: 0.01%
A011, A012, A020/A220, A021 to A035, A101, A102, A145: 0.1%

Feedback Selection

Select the terminals used to input the feedback signal in PID Feedback Selection (A076).

When the 1st Frequency Reference Selection (A001) is set to 01 (Control circuit terminal block), the analog input setting other than that selected in A076 is used as the target frequency reference. In this case, the setting in A005 and the function allocated to the terminal AT (Analog input switching) are disabled.

When the PID Feedback Selection (A076) is set to 02 (Modbus communication), write the feedback value (100% = 10000) to the holding register address 0006 hex.

Register No.	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution
0006 hex	PID Feedback Selection	–	R/W	0 to 10000	0.01 [%]

Note Although this register supports read and write operations, you can write data only when the PID Feedback Selection (A076) is set to 02 (Modbus communication). You cannot write data with other settings.

When the PID Feedback Selection (A076) is set to 03 (Pulse train input), the inverter recognizes the captured pulse train frequency value [Hz] relative to the pulse train frequency set in the Pulse Train Frequency Scale (P055) as the maximum frequency. As a result, for the feedback value, the inverter captures a value converted into a percentage as 100% of the maximum frequency.

For the pulse train input frequency, refer to *7-5-16 Pulse Train Frequency Input* on page 7-52.

Feedforward Selection

Select the terminals used to input the feedback signal in the PID Feedback Selection (A079).

In A079, you can set a target value, or have a setting that overlaps with the PID Feedback Selection value.

With an overlapping setting, the analog input is used for both the feedback and feedforward signals.

If A079 is set to Disabled, feedforward control will not be performed.

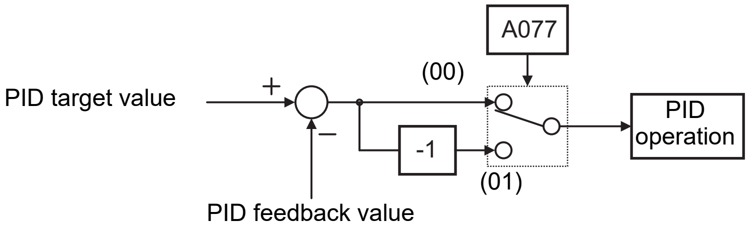
PID Deviation Reverse Output

Depending on the sensor characteristics, etc., the polarity of deviation between the target and feedback values may not match the inverter's command. In this case, you can invert the deviation polarity by setting the PID Deviation Reverse Output (A077) to 01.

(Example) To control a refrigerator compressor

If you are using a temperature sensor designed for use in a temperature range of 0 to 100°C at 0 to 10 V and the target and current temperatures are 5°C and 10°C, respectively, the inverter attempts to reduce the frequency under PID control since the feedback value is larger than the target value.

In this case, set A077 to 01. Then, the inverter attempts to increase the frequency.

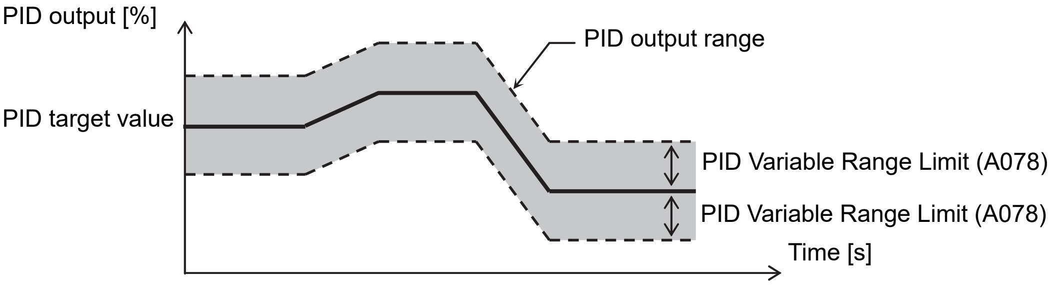


PID Variable Range

This function limits the PID output to within the variable range defined based on the target value.

To use this function, set the PID Variable Range Limit (A078) as a percentage of the maximum frequency. Then, the output frequency will be limited to within a range of Target value ± (A078).

This function is disabled when A078 is set to 0.0 or PID Selection (A071) is set to 02 (Enabled: Reverse output enabled).



PID Reverse Output

Under normal PID control (A071 = 01), the frequency reference to the inverter will be limited to 0 Hz if the result of PID operation is a negative value. However, when the PID Selection (A071) is set to 02 (Reverse output enabled), reverse output is enabled for the inverter if the result of PID operation is a negative value.

When A071 is set to 02, the PID Variable Range Limit (A078) setting is disabled.

PID Gain Adjustment

If the PID function does not provide a stable response, adjust the appropriate gain setting according to the table below.

Phenomenon	Adjustment
Changes in target value are not reflected quickly on feedback value.	Increase PID P Gain (A072).
Changes are reflected quickly on feedback value, but not stable.	Decrease PID P Gain (A072).
Target and feedback values do not match quickly.	Decrease PID I Gain (A073).
Feedback value fluctuates unstably.	Increase PID I Gain (A073).
Increasing PID P Gain does not improve response speed.	Increase PID D Gain (A074).
Increasing PID P Gain results in fluctuating and unstable feedback value.	Decrease PID D Gain (A074).

PID Deviation Excessive (OD)

You can set the PID Deviation Excessive Level (C044) for PID control. This inverter can be configured to output this signal to a multi-function output terminal if the PID deviation ε reaches the level set in C044 or higher. The inverter will not shut off its output (trip), however.

Allocate the Multi-function Output P1/P2 Selection (C021/C022) or the Multi-function Relay Output (MA, MB) Function Selection (C026) to 04 (OD).

Set C044 in units of percentage as 100% of the 1st/2nd Maximum Frequency (A004/A204).

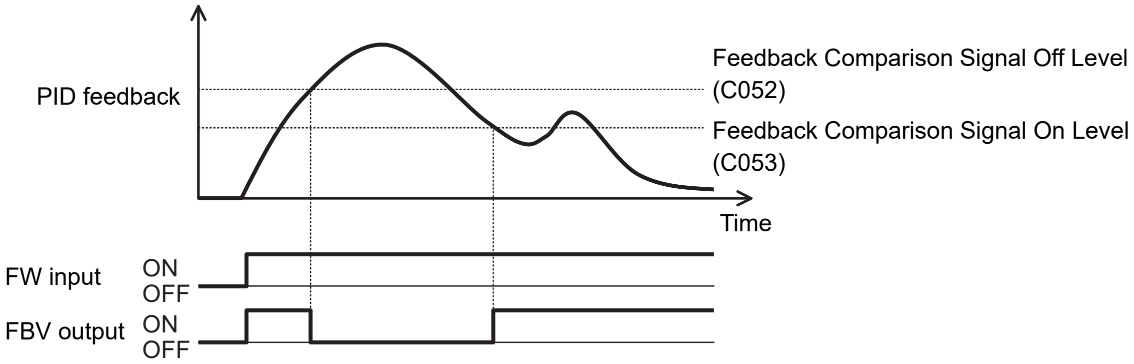
Feedback Comparison Signal

This inverter can be configured to output a control signal from the multi-function output terminal if the PID feedback value falls out of the setting range.

Allocate the Multi-function Output P1/P2 Selection (C021/C022) or the Multi-function Relay Output (MA, MB) Function Selection (C026) to 31 (FBV).

Set the Feedback Comparison Signal Off/On Level (C052/C053) in units of percentage as 100% of the 1st/2nd Maximum Frequency (A004/A204).

When the RUN command is input by the PID function, the FBV output starts with the ON state, independent of the Off/On level of the feedback comparison signal.



PID Feedback Value Monitor (d004)

Use this parameter to monitor the PID feedback value in units of percentage as 100% of the maximum frequency.

The monitor value is displayed as a product of the feedback value and the PID Scale (A075).

d004 = Feedback value × PID Scale (A075)

PID Integral Reset (PIDC)

Use this function to clear the integral value of PID operation.

Allocate the Multi-function Input S1 to S7 Selection (C001 to C007) to 24 (PIDC).

The integral value is cleared every time the PIDC terminal is turned ON.

Never turn ON the PIDC terminal during PID operation. Doing so may cause an overcurrent trip. Be sure to deactivate the PID operation before you turn ON the PIDC terminal.

PID Sleep Function

This inverter can be configured to shut off its output when the PID Sleep Operation Delay Time (A157) elapsed since the PID output reached the PID Sleep Operation Level (A156) or lower. The stop method (deceleration stop/free-run stop) depends on the Stop Selection (b091) setting. The PID sleep function will not be activated if the normal PID output is restored within the PID Sleep Operation Delay Time.

Even if the PID disabled signal is input by the PID function, the inverter will shut off its output when the time set in A157 elapsed since the frequency reference value reached the level set in A156 or lower. The stop method depends on the b091 setting.

7-5-13 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 fan, pump, or other load that reduced torque characteristics.
To perform energy-saving operation using this function, set the Operation Mode Selection (A085) to 01 (Energy-saving operation).

You can adjust the response and accuracy of the function in the Energy-saving Response/Accuracy Adjustment (A086).
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.
The automatic energy-saving operation function may not work sufficiently when the frequency reference source is set to Control circuit terminal block (Analog input). In this case, set the Analog Input Filter (A016) to 31 (500 ms).

Parameter No.	Function name	Data	Default data	Unit
A085	Operation Mode Selection	00: Normal operation 01: Energy-saving operation	00	–

Parameter No.	Function name	Data	Default data	Unit
A086	Energy-saving Response/Accuracy Adjustment	0.0 to 100.0 (Response: Slow to Fast) (Accuracy: High to Low)	50.0	%

7-5-14 Commercial Switching (CS)

Use this function to drive a system subject to a large load inertia moment during acceleration and deceleration with the inverter and during constant speed operation with a commercial power supply, respectively.
Allocate the Multi-function Input S1 to S7 Selection (C001 to C007) to 14 (CS).

Parameter No.	Function name	Data	Default data	Unit
C001 to C007	Multi-function Input S1 to S7 Selection	14: CS (Commercial switching)	–	–
Related functions		b003, b007		

Switching from Inverter Operation to Commercial Power Supply Operation

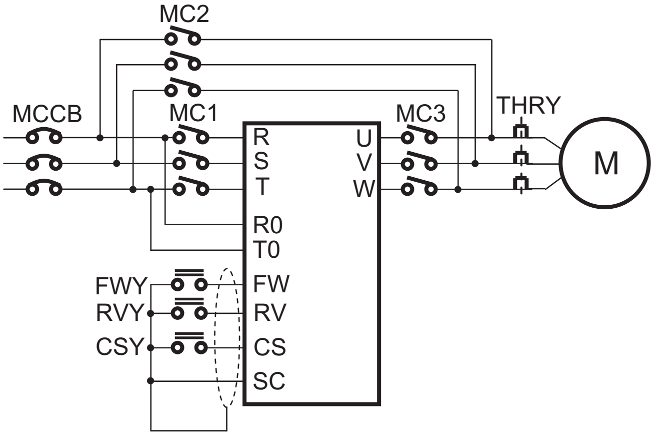
Follow the sequence diagram given below to switch among the terminals MC1 to MC3, FW, and CS.
When the terminal CS turns ON, the inverter shuts off its output and the motor falls in a free-run state.

Switching from Commercial Power Supply Operation to Inverter Operation

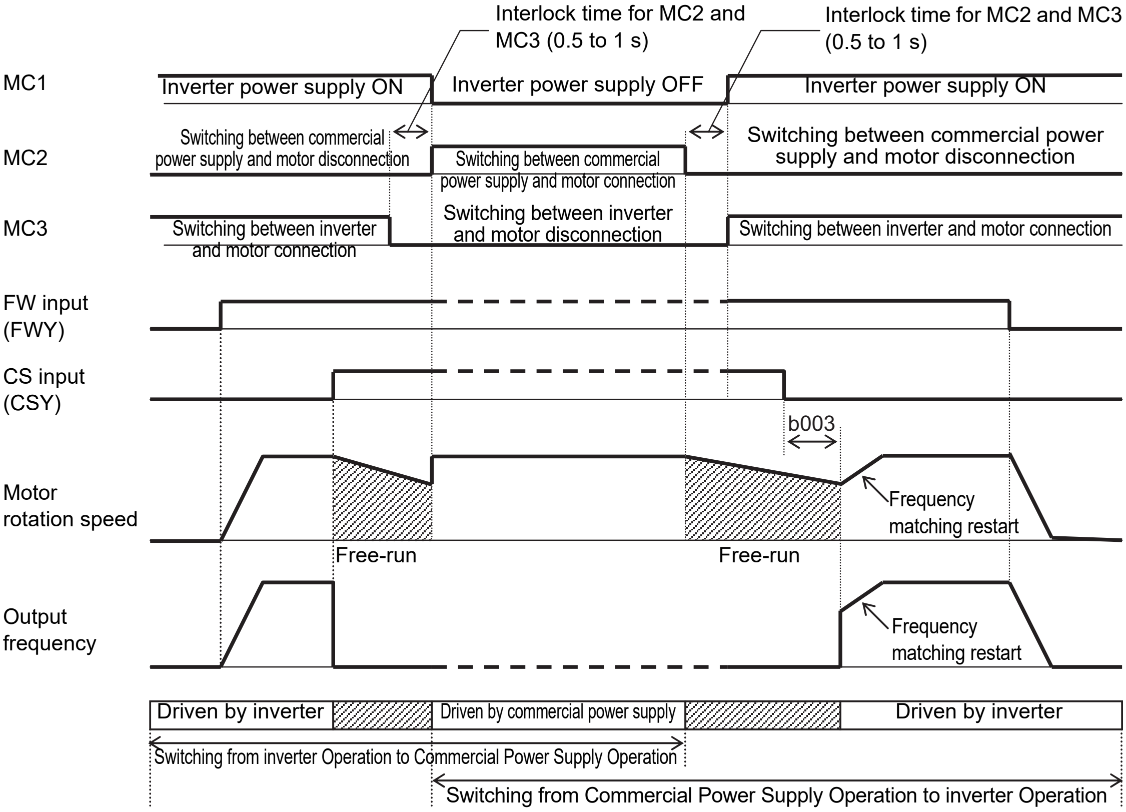
Follow the sequence diagram given below to switch among the terminals MC1 to MC3 and, with the RUN command and CS input ON, turn the terminal CS from ON to OFF. Then, when the Restart Standby Time (b003) elapses, the inverter starts accelerating with its frequency matched with the motor rotation speed during free run (“frequency matching restart”). However, the inverter may restart at 0 Hz in any of the following cases:

- The motor rotation speed is equal to or lower than 1/2 of the base frequency.
- The motor induction voltage decays quickly and the motor rotation speed cannot be detected.
- The motor rotation speed drops to the Frequency Matching Lower Limit Frequency (b007) or lower.

● Connection diagram for commercial switching operation


MC2
MCCB
MC1
MC3
THRY
R
S
T
U
V
W
M
R0
T0
FWY
RVY
CSY
FW
RV
CS
SC

● Timing diagram for commercial switching


Interlock time for MC2 and MC3 (0.5 to 1 s)
Interlock time for MC2 and MC3 (0.5 to 1 s)
MC1
Inverter power supply ON
Inverter power supply OFF
Inverter power supply ON
MC2
Switching between commercial power supply and motor disconnection
Switching between commercial power supply and motor connection
Switching between commercial power supply and motor disconnection
MC3
Switching between inverter and motor connection
Switching between inverter and motor disconnection
Switching between inverter and motor connection
FW input (FWY)
CS input (CSY)
b003
Motor rotation speed
Frequency matching restart
Free-run
Free-run
Output frequency
Frequency matching restart
Driven by inverter
Driven by commercial power supply
Driven by inverter
Switching from inverter Operation to Commercial Power Supply Operation
Switching from Commercial Power Supply Operation to inverter Operation

- Make sure that MC3 and MC2 are mechanically interlocked. Doing so may cause an inverter damage.

Additional Information

- For FWY, RVY, and CSY, use low-voltage relays according to your application.
- If an overcurrent trip occurs during frequency matching, increase the Restart Standby Time (b003).
- The inverter can be set up to restart automatically at power-on. In this case, the terminal CS is not required. For details, refer to *5-8-2 Restart after Resetting* on page 5-45.

7-5-15 Stabilization Parameter

Use this function to stabilize the motor in hunting.

If the motor is hunting, check first whether the 1st/2nd Motor Capacity (H003/H203) and 1st/2nd Motor Pole Number (H004/H204) settings match your motor and, if they do not, match them. If the motor's primary resistance is smaller than that of the standard motor, increase the value set in H006/H206 gradually. Or, to drive a motor with a capacity larger than the rated capacity of the inverter, reduce the set value.

To suppress hunting, you can try the following methods as alternatives to this function.

- To decrease the Carrier Frequency (b083), refer to *7-4-1 Carrier Frequency* on page 7-31.
- To decrease the 1st/2nd Output Voltage Gain (A045/A245), refer to *7-5-10 Output Voltage Gain* on page 7-41.

Parameter No.	Function name	Data	Default data	Unit
H006/H206	1st/2nd Stabilization Parameter	0. to 255. Increase or decrease the value if the motor is hunting.	100.	–
A045/A245	1st/2nd Output Voltage Gain	20. to 100. Decrease the value if the motor is hunting.	100.	%
b083	Carrier Frequency	2.0 to 15.0 or 2.0 to 10.0 (2.0 to 10.0) (Heavy load/Light load) (high-frequency mode) Decrease the value if the motor is hunting.	10.0/2.0	kHz

7-5-16 Pulse Train Frequency Input

Use this function to use the pulse train input (single-phase) to the terminal RP as a frequency reference or PID feedback value in each control mode.

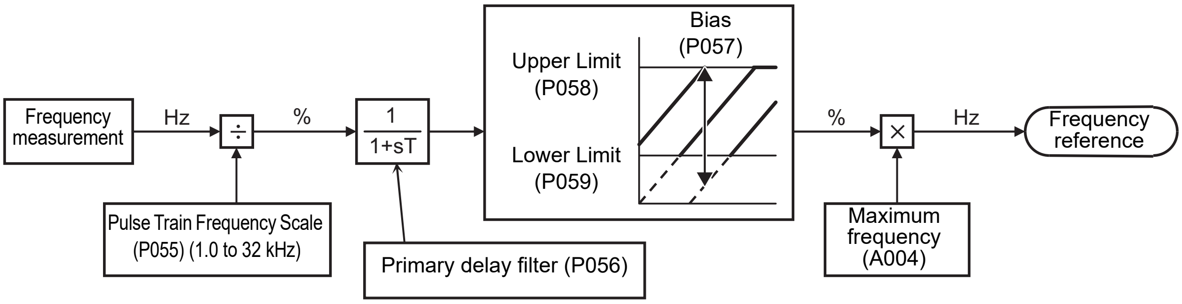
In the Pulse Train Frequency Scale (P055), set the input pulse train frequency at the maximum frequency.

This function cannot be used in conjunction with the analog input start/end function. To apply limits to the pulse train frequency, set the Pulse Train Frequency Bias Amount (P057) and Pulse Train Frequency Upper/Lower Limit (P058/P059). Set these values in units of percentage as 100% of the maximum frequency.

In addition, be sure to set the Pulse Train Frequency Upper Limit (P058) to a value larger than the Pulse Train Frequency Lower Limit (P059). If the P058 value is lower than the P059 value, the inverter will output only the upper limit frequency.

Parameter No.	Function name	Data	Default data	Unit
P003	Pulse Train Input RP Selection	00: Frequency setting or PID feedback value	00	–
P055	Pulse Train Frequency Scale	1.0 to 32.0 Set the input pulse frequency to attain the 1st Maximum Frequency (A004).	25.0	kHz
P056	Pulse Train Frequency Filter Time Parameter	0.01 to 2.00 Set the filter time constant for pulse train input.	0.10	s
P057	Pulse Train Frequency Bias Amount	–100. to 100.	0.	%
P058	Pulse Train Frequency Upper Limit	0. to 100.	100.	%

Parameter No.	Function name	Data	Default data	Unit
P059	Pulse Train Frequency Lower Limit	0.01 to 20.00	1.00	%
A001	1st Frequency Reference Selection	06: Pulse train frequency	02	–
A076	PID Feedback Selection	03: Pulse train frequency	00	–
A141	Calculation Frequency Selection 1	07: Pulse train frequency	02	–
A142	Calculation Frequency Selection 2		03	–


Frequency measurement
Hz
÷
%
1
1+sT
Bias
(P057)
Upper Limit
(P058)
Lower Limit
(P059)
%
×
Hz
Frequency reference
Pulse Train Frequency Scale
(P055) (1.0 to 32 kHz)
Primary delay filter (P056)
Maximum frequency
(A004)

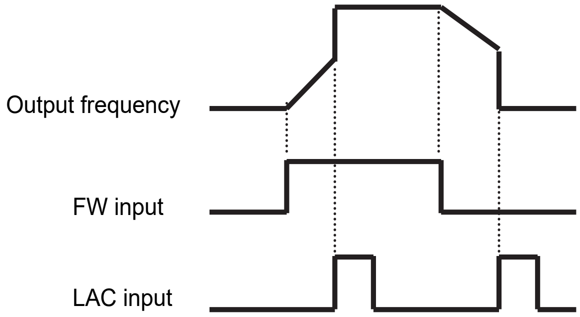
7-5-17 LAD Cancel Function

LAD functions to calculate the transient frequency reference value to enable the motor to reach the reference frequency in the set acceleration/deceleration time. The LAD cancel function disables this frequency acceleration/deceleration function (LAD).

To disable the frequency acceleration/deceleration function (LAD) to output the frequency reference instantaneously, set the Multi-function Input S1 to S7 Selection (C001 to C007) to 46 (LAC: LAD cancel) and turn ON the terminal LAC.

For details on the acceleration/deceleration time, refer to *5-6-1 Acceleration/Deceleration Time Settings* on page 5-33.

Parameter No.	Function name	Data	Default data	Unit
C001 to C007	Multi-function Input S1 to S7 Selection	46: LAC (LAD cancel)	–	–
Related functions		F002, F202, F003, F203		


Output frequency
FW input
LAC input

7-6 Digital Operator and Operation Functions

This section describes the Digital Operator and other operation functions.

7-6-1 Soft Lock Function (SFT)

Use this function to protect various parameter settings against changes. This helps prevent data rewriting due to erroneous operation.

Use the table below to select which type of soft lock you want to apply.

To use this function from a multi-function input terminal, allocate the Multi-function Input S1 to S7 Selection (C001 to C007) to 15 (SFT).

Setting b031 to 10 (Data can be changed during RUN) enables you to change the parameters marked with Enabled under "Changes during operation" in *Section 4 Parameter List* during operation.

Alternatively, you can use the password function to protect parameter data. Refer to *7-6-9 Password Function* on page 7-57.

Parameter No.	Function name	Data	Terminal SFT	Description	Default data	Unit
b031	Soft Lock Selection	00	ON	Rewriting enabled only for b031.	01	–
			OFF	Soft lock function disabled (Normal operation).		
		01	ON	Rewriting enabled only for b031 and frequency settings (F001, A020, A220, A021 to A035, A038).		
			OFF	Soft lock function disabled (Normal operation).		
		02	–	Rewriting enabled only for b031.		
		03	–	Rewriting enabled only for b031 and frequency settings (F001, A020, A220, A021 to A035, A038).		
		10	–	Changes enabled during RUN. (Only functions listed in *Section 4 Parameter List* can be changed.)		
C001 to C007	Multi-function Input S1 to S7 Selection	15: SFT (Soft lock)			–	–

Precautions for Correct Use

When the Soft Lock Selection (b031) is set to prohibit changes of the initialization-related parameters (b084, b094, b180), the initialization cannot be executed. Change the Soft Lock Selection (b031) to enable the initialization.

For details on the parameter initialization, refer to *5-1-2 Parameter Initialization* on page 5-6.

7-6-2 Forced Operator Function (OPE)

When the 1st/2nd Frequency Reference Selection (A001/A201) or 1st/2nd RUN Command Selection (A002/A202) is not set to Digital Operator, use this function to frocibly enable the operation via the Digital Operator based on the ON/OFF status of the multi-function input terminal to which this function is allocated.

To frocibly enable the frequency reference and RUN command via the Digital Operator, set the Multi-function Input S1 to S7 Selection (C001 to C007) to 31 (OPE: Forced operator function) and input the terminal OPE. When the terminal is reset, the inverter operates according to the A001/A002 setting.

If you switch on/off this function during operation, the RUN command will be reset to stop the inverter output. In this case, to ensure safety, once reset the RUN command from the selected reference source and input it again before restarting operation.

The forced operator function has priority if the forced terminal block function (51: F-TM) is input simultaneously. Note also that, for the frequency reference, the multi-step speed reference function has priority over the forced operator function.

Parameter No.	Function name	Data	Default data	Unit
C001 to C007	Multi-function Input S1 to S7 Selection	31: OPE (Forced operator function)	–	–
Related functions		A001, A201, A002, A202		

7-6-3 Forced Terminal Block Function (F-TM)

When the 1st/2nd Frequency Reference Selection (A001/A201) or 1st/2nd RUN Command Selection (A002/A202) is not set to Control circuit terminal block, use this function to frocibly enable the operation via the control circuit terminal block based on the ON/OFF status of the multi-function input terminal to which the function is allocated.

When the Multi-function Input S1 to S7 Selection (C001 to C007) is set to 51 (F-TM: Forced terminal block), the inverter accepts the frequency reference and RUN command via the source set in A001/A002 if the terminal F-TM is reset, and via the control circuit terminal block if the terminal F-TM is input.

If you switch on/off this function during operation, the RUN command will be reset to stop the inverter output. In this case, to ensure safety, once reset the RUN command from the selected reference source and input it again before restarting operation.

The forced operator function has priority if the forced operator function (31: OPE) is input simultaneously.

The frequency reference for the forced terminal block function varies with the FV/FI Selection (A005) setting.

- 00 (Switch between FV (Voltage) and FI (Current)): Switchable between FV and FI via terminal AT (FI when the terminal AT is input)
- 02 (Switch between FV (Voltage) and volume): FV (Non-switchable via terminal AT)
- 03 (Switch between FI (Current) and volume): FI (Non-switchable via terminal AT)

Note that, for the frequency reference, the multi-step speed reference function has priority over the forced terminal block function.

Parameter No.	Function name	Data	Default data	Unit
C001 to C007	Multi-function Input S1 to S7 Selection	51: F-TM (Forced terminal block)	–	–
Related functions		A001, A201, A002, A202, A005		

7-6-4 Operation Selection at External Operator Disconnection

The operation of the inverter depends on the Operation Selection at External Operator Disconnection (b165) setting, when the inverter detects a disconnection (interruption of communications for 5 seconds or longer) with the Digital Operator.

Parameter No.	Function name	Data	Default data	Unit
b165	Operation Selection at External Operator Disconnection	00: Trip (E40.☐) 01: Trip after deceleration stop (E40.☐) 02: Ignore 03: Free-run stop 04: Deceleration stop	02	–

7-6-5 Initial Screen Selection (Initial Screen after Power-on)

Use this parameter to select from the following the screen that appears on the Digital Operator at power-ON. (By factory default, this is set to 001 (d001).)

Parameter No.	Function name	Data	Content of display (Digital Operator)	Default data	Unit
b038	Initial Screen Selection	000	Screen on which the Enter key was last pressed (Parameters except for d*** and F001)[*1]	001	–
		001	d001 (Output Frequency Monitor)		
		002	d002 (Output Current Monitor)		
		003	d003 (RUN Direction Monitor)		
		:	: (Each data corresponds with d***.)		
		060	d060 (Inverter Mode Monitor)		
		201	F001 (Output Frequency Setting/Monitor)		
		202	Do not set.		

*1. If you select 000 and turn off the power supply, the inverter will display this parameter (b038) at the next power-on.

7-6-6 Initial Screen Automatic Return Function

To enable this function, set the Initial Screen Automatic Return Function (b164) to 01 (Enabled).

When enabled, the function will automatically switch the display to the initial screen if the Digital Operator is not operated for 10 minutes.

Parameter No.	Function name	Data	Default data	Unit
b164	Initial Screen Automatic Return Function	00: Disabled (Automatic return disabled) 01: Enabled (Automatic return enabled)	00	–

7-6-7 Inverter Display on Operator Connection

When the inverter is connected with the optional Digital Operator (Model: 3G3AX-OP01), the built-in Digital Operator keys are disabled. Use this function to set the parameter to display on the built-in Digital Operator at this time.

Parameter No.	Function name	Data	Default data	Unit
b150	Inverter Display on Operator Connection	001 to 060 Each data corresponds with the monitor mode parameters d001 to d060.	001	–

7-6-8 Display Fixed (DISP)

Setting the Multi-function Input S1 to S7 Selection (C001 to C007) to 86 (DISP) and turning ON the corresponding terminal causes the Digital Operator to display only the content selected in the Initial Screen Selection (b038), preventing it from displaying other parameters.

Parameter No.	Function name	Data	Default data	Unit
C001 to C007	Multi-function Input S1 to S7 Selection	86: DISP (Display fixed)	–	–
Related functions		b038		

7-6-9 Password Function

Use the password function to set passwords for the Display Selection (b037) and Soft Lock Selection (b031) functions to prevent display and change of the parameter settings.

Parameter No.	Function name	Data	Description	Default data	Unit
b190	Password A Setting	0000	Password function disabled.[*1]	0000	–
		0001 to FFFF	Set the password A for the Display Selection (b037).[*2]		
b191	Password A for Authentication	0000 to FFFF	Set the password A authentication parameter.[*2]	0000	–
b192	Password B Setting	0000	Password function disabled.[*1]	0000	–
		0001 to FFFF	Set the password B for the Soft Lock Selection (b031).[*2]		
b193	Password B for Authentication	0000 to FFFF	Set the password B authentication parameter.[*2]	0000	–
Related functions		b031, b037			

*1. These passwords cannot be set to 0000.

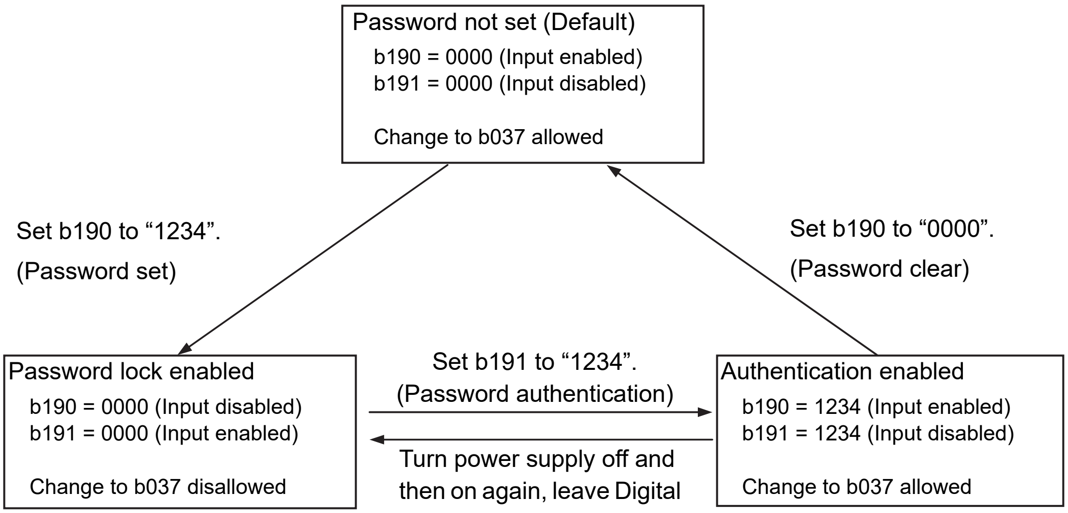
*2. You can use any of the following 16 (hex) characters for parameter setting: 0 to 9, A, b, C, d, E, F.

Precautions for Correct Use

Be sure not to forget the set password. Note that there is no way to reset the password lock once you forget the set password and even OMRON factories and service stations have no means to check your password.

Overview of Password Function

(Example) Password A



Password not set (Default)
b190 = 0000 (Input enabled)
b191 = 0000 (Input disabled)

Change to b037 allowed

Set b190 to “1234”.
(Password set)

Set b190 to “0000”.
(Password clear)

Password lock enabled
b190 = 0000 (Input disabled)
b191 = 0000 (Input enabled)

Change to b037 disallowed

Set b191 to “1234”.
(Password authentication)

Authentication enabled
b190 = 1234 (Input enabled)
b191 = 1234 (Input disabled)

Change to b037 allowed

Password lock enabled. b037 value cannot be changed.

Turn power supply off and then on again, leave Digital Operator unoperated for approximately 10 min, or change password.

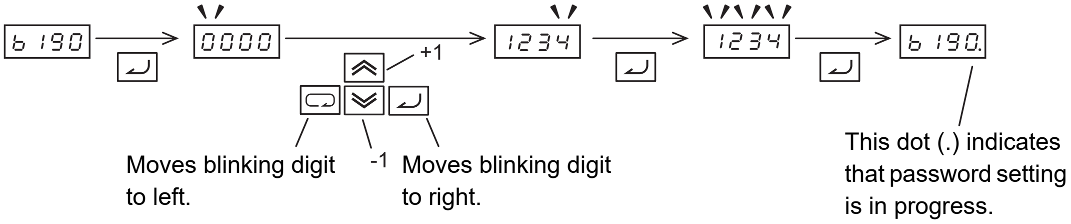
Inverter transits to this state if password is authenticated. Although password settings are not lost, it accepts changes to b037 value. If power supply is turned off and then again, or if Digital Operator is left unoperated for approximately 10 min, inverter automatically returns to password locked state.

Password Setting

● Password setting

(1) **Set the Display Selection (b037) and Soft Lock Selection (b031) depending on the data you want to protect.**

(2) **Set any passwords (except for 0000) in the Password A/B Setting (b190/b192).**



Moves blinking digit to left.

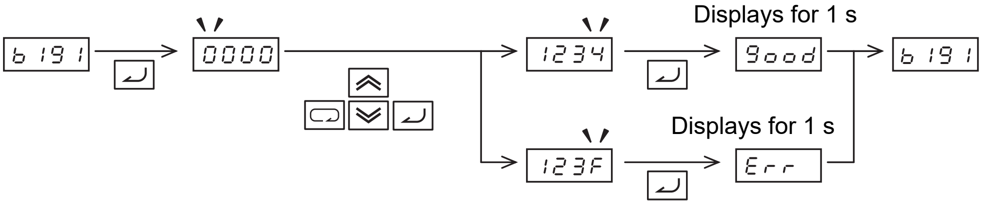
Moves blinking digit to right.

This dot (.) indicates that password setting is in progress.

(3) **The password lock is enabled. You cannot change the b037/b031 value.**

Password authentication (Performed by user who knows password to change b037/b031 data)

(1) **In the Password A/B for Authentication (b191/b193), set any password.**

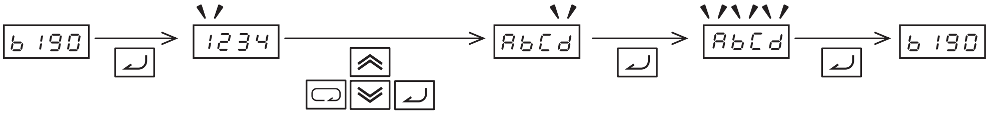


(2) **The inverter displays "Good" if the password is correct, allowing you to change the b037 value. If the set password is incorrect, it displays "Err" and returns to the password lock enabled state, as described in step (3) of Password Setting. If the Digital Operator is left unoperated for approximately 10 min, or if the power supply is turned off and then again, the inverter automatically returns to password lock enabled state, as described in step (3) of Password Setting.**

Password change

(1) **Perform password authentication. You cannot change the password(s) in the password lock enabled state, as described in step (3) of Password Setting. (Make sure that 0000 is displayed.)**

(2) **In the Password A/B for Authentication (b191/b193), set a different password.**



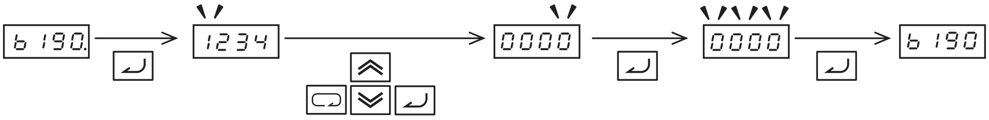
(3) **When the password is changed, the inverter automatically returns to the password lock enabled state, as described in step (3) of Password Setting.**

Password Clear

(1) **Perform password authentication. You cannot clear the password(s) in the password lock enabled state, as described in step (3) of Password Setting. (Make sure that 0000 is displayed.)**

(2) **In the Password A/B Setting (b190/b192), set 0000.**

(3) **The inverter returns to the Password not set state (default) with the password data all cleared.**



7-6-10 User Parameter Setting Function

The parameter group U consists of user parameters. Up to 32 user parameters can be registered as desired. When registration is done, set the Display Selection (b037) to 02 (User setting). After that, you will see only the functions registered with U001 to U032 in addition to d001, F001, and b037.

Parameter No.	Function name	Data	Default data	Unit
U001 to U032	User Selection 1 to 32	no: No registration d001 to P196 Register any function code.	no	–
b037	Display Selection	02: User setting + d001, F001, b037	00[*1]	–

*1. The default data was changed from the previous model.

7-6-11 User Parameter Automatic Setting Function

When the User Parameter Automatic Setting Function (b039) is set to 01 (Enabled), the parameters with changed data are stored automatically in an ascending order from U001 to U032. This function is useful as the change history.

The data (parameter setting) displayed on the screen is stored at the time when you press the Enter key. This is also applicable for storing the monitor functions (d***).

U001 stores the most recent parameter data; U032 stores the oldest.

If the same parameter was changed, the previous change is deleted and the last one is stored. In addition, if the number of the parameters exceeds 32, the data is deleted from the oldest (U032).

Parameter No.	Function name	Data	Default data	Unit
b039	User Parameter Automatic Setting Function	00: Disabled 01: Enabled	00	–
Related functions		U001 to U032		

Note Be aware that changing the 039 value from 00 to 01 initializes (resets to “no”) all parameter data registered to the user parameters U001 to U032.

7-7 Restart Functions

This section describes the restart-related functions and their operations.

7-7-1 Frequency Matching Restart and Frequency Pull-in Restart

The 3G3MX2-V1 Series Inverter supports two restart methods, which can be selected using the following functions.

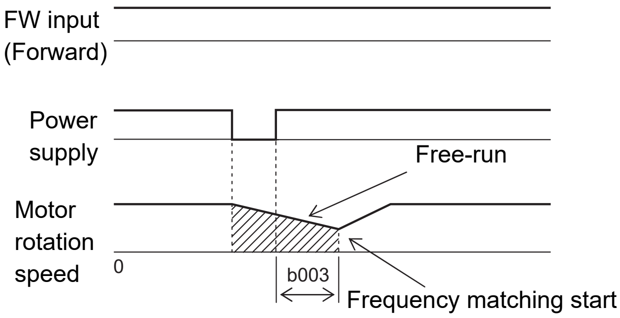
Functions related to frequency matching restart and frequency pull-in restart		Description	Default data	Unit
b001	Power Interruption/Undervoltage Restart Selection (P. 7-63)	Select the restart method after the inverter shuts off its output.	00	–
b008	Overvoltage/Overcurrent Restart Selection (P. 7-63)	Select the restart method after the inverter shuts off its output due to an overvoltage/overcurrent.	00	–
C103	Reset Restart Selection (P. 5-45)	Restart after Resetting the inverter.	00	–
b088	Free-run Stop Selection (P. 5-39)	Select the restart method after the free-run stop input signal is canceled (turned OFF).	00	–

Frequency matching restart and frequency pull-in restart are both intended to enable the inverter to restart without stopping the motor in a free-run state. After output is shut off, the Digital Operator displays 0000 until the inverter restarts.

● Frequency matching restart

Frequency matching restart causes the inverter to restart by recognizing the frequency from the voltage between the motor terminals during free-run stop and adjusting to it. The inverter restarts at 0 Hz if the voltage between the motor terminals is insufficient.

Use this setting if the inverter is in a free-run stop for a few seconds.



Precautions for Correct Use

When a PM motor is controlled in the PM motor mode, frequency matching restart may cause an overvoltage at high rotation speeds of 120 Hz or higher, or at low rotation speeds under a low induction voltage.

If an overcurrent is detected, instead of using frequency matching restart, use an external brake or DC injection braking to stop the motor before restarting.

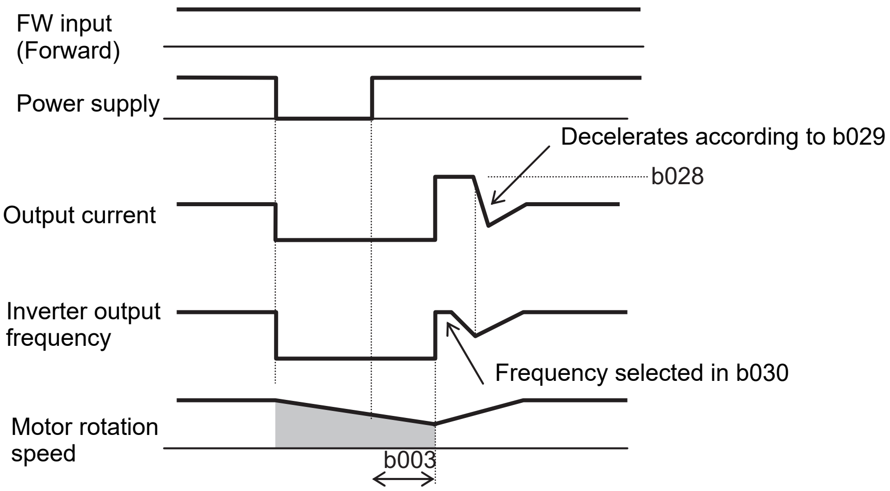
● Frequency pull-in restart

Frequency pull-in restart causes the inverter to restart by outputting the starting frequency set in the Starting Frequency Selection at Frequency Pull-in Restart (b030) to the motor in a free-run stop state and re-accelerating when the Frequency Pull-in Restart Level (b028) is reached.

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.

In the PM motor mode, the inverter does not display “Frequency pull-in restart” for selection functions.


FW input
(Forward)
Power supply
Decelerates according to b029
b028
Output current
Inverter output frequency
Frequency selected in b030
Motor rotation speed
b003

The main parameters associated with frequency matching restart and frequency pull-in restart are as shown in the table below.

For details on free-run stop, refer to *5-7-2 Free-run Stop Selection* on page 5-39.

Parameter No.	Function name	Data	Default data	Unit
b003	Restart Standby Time	0.3 to 100.0 Set the wait time until the inverter restarts.	1.0	s
b007	Frequency Matching Lower Limit Frequency	0.00 to 400.0 (580.0) [*1] The inverter will restart from 0 Hz if the frequency when the motor is in a free-run state drops to the b007 value or lower.	0.00	Hz
b028	Frequency Pull-in Restart Level	0.20 × Rated current to 2.00 × Rated current	Rated current of inverter	A
b029	Frequency Pull-in Restart Parameter	0.1 to 999.9 1000. to 3000. Set the deceleration rate for the output frequency during frequency pull-in restart. Set the deceleration time from the maximum frequency to 0 Hz.	0.5	s
b030	Starting Frequency Selection at Frequency Pull-in Restart	00: Frequency at shutoff 01: Maximum frequency 02: Set frequency (Frequency reference)	00	–

*1. In the high-frequency mode.

7-7-2 Restart during Power Interruption, Undervoltage/Overvoltage, Overcurrent

Select whether to have the inverter trip or restart if restart during power interruption, undervoltage/overvoltage, overcurrent occurs.

Restart during Power Interruption, Undervoltage/Overvoltage, Overcurrent

Power interruption/Undervoltage restart: When the Power Interruption/Undervoltage Restart Selection (b001) is set to one of the restart options, the inverter repeats restart operation for the number of times set in the Power Interruption Restart Count (b005) in the event of a momentary power interruption and then trips.

Overvoltage/Overcurrent restart: When the Overvoltage/Overcurrent Restart Selection (b008) is set to one of the restart options, the inverter repeats restart operation for the number of times set in the Overvoltage/Overcurrent Restart Count (b010) in the event of an undervoltage, and then trips.

Only the Power Interruption Restart Count (b005) can be set to 01 (No limit), which causes the inverter to trip.

In the Power Interruption/Undervoltage Trip Selection During Stop (b004), select whether or not to have the inverter trip if a power interruption/undervoltage occurs during stop.

In the Power Interruption/Undervoltage Restart Selection (b001), select the restart condition according to your system: 0-Hz restart, Frequency matching restart, Trip after frequency matching deceleration stop, or Frequency pull-in restart.

If the inverter is in an undervoltage state continuously for 40 seconds during restart operation, an Undervoltage protection (E09) trip will occur.

Parameter No.	Function name	Data	Description	Default data	Unit
b001	Power Interruption/Undervoltage Restart Selection *1 *2	00	Trip	00	–
		01	0-Hz restart		
		02	Frequency matching restart *3		
		03	Frequency matching restart (Trip after deceleration stop) *3 *4		
		04	Frequency pull-in restart		
b002	Allowable Power Interruption Time	0.3 to 25.0	The inverter restarts if the power interruption duration is shorter than the set time. (Example 1) The inverter trips if the power interruption duration is equal to or longer than the set time. (Example 2)	1.0	s
b003	Restart Standby Time	0.3 to 100.	Set the wait time until the inverter restarts.	1.0	s
b004	Power Interruption/Undervoltage Trip Selection During Stop *1	00	Disabled (Trip disabled during stop)	00	–
		01	Enabled (Trip also enabled during stop)		
		02	Disabled during stop and during deceleration by RUN command OFF.		
b005	Power Interruption Restart Count	00	16 times	00	–
		01	No limit		

Parameter No.	Function name	Data	Description	Default data	Unit
b007	Frequency Matching Lower Limit Frequency	0.00 to 400.0 (580.0) *6	The inverter restarts from 0 Hz if the frequency when the motor is in a free-run state drops to the b007 value or lower. (Examples 3 and 4)	0.00	Hz
b008	Overvoltage/Overcurrent Restart Selection	00	Trip	00	–
		01	0-Hz restart		
		02	Frequency matching restart *3		
		03	Frequency matching restart (Trip after deceleration stop) *3		
		04	Frequency pull-in restart		
b010	Overvoltage/Overcurrent Restart Count	1 to 3	Set how many times you want to have the inverter repeat restart operation if overvoltage/overcurrent occurs. *5	3	time
b011	Overvoltage/Overcurrent Restart Standby Time	0.3 to 100.0	Set the wait time until the inverter restarts.	1.0	s
b028	Frequency Pull-in Restart Level	0.20 × Rated current to 2.00 × Rated current	Set the current level during frequency pull-in restart.	Rated current of inverter	A
b029	Frequency Pull-in Restart Parameter	0.1 to 999.9 1000. to 3000.	Set the deceleration rate for the output frequency during frequency pull-in restart. Set the deceleration time from the maximum frequency to 0 Hz.	0.5	s
b030	Starting Frequency Selection at Frequency Pull-in Restart	00	Frequency at shutoff	00	–
		01	Maximum frequency		
		02	Set frequency (Frequency reference)		
C021, C022, C026	Multi-function Output P1/P2 Selection Multi-function Relay Output (MA, MB) Function Selection	09	UV: During undervoltage signal	–	–

*1. Even when the Power Interruption/Undervoltage Restart Selection (b001) is set to 01 to 03 (a restart option) or the Power Interruption/Undervoltage Trip Selection During Stop (b004) is set to 00 or 02 (a disabled option), the inverter will trip if the actual power interruption time exceeds the Allowable Power Interruption Time (b002). (Example 2)

*2. Even when an restart option is selected, the inverter will trip if it is in an undervoltage state continuously for 40 seconds or more.

*3. The inverter may restart at 0 Hz in any of the following cases:

The motor rotation speed is equal to or lower than 1/2 of the base frequency.

The motor induction voltage decays quickly and the motor rotation speed cannot be detected.

*4. If an overvoltage, overcurrent, or other trip occurs during deceleration, the motor will fall in a free-run state with an Undervoltage (E09) error. In this case, increase the deceleration time.

*5. Even when you selected to restart the inverter during a trip, unless the trip factor is removed, the inverter will trip when the Restart Standby Time (b003) elapses. In this case, increase the restart standby time.

*6. In the high-frequency mode.

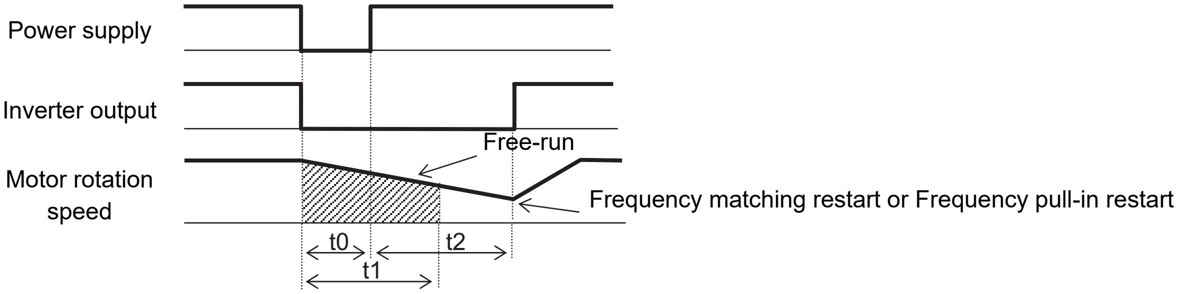
Below are the timing charts for the restart.

t0: Momentary power interruption time

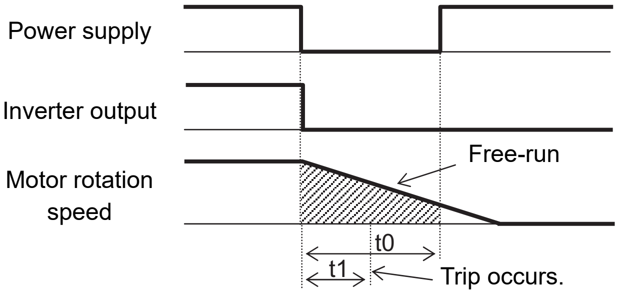
t1: Allowable Power Interruption Time (b002)

t2: Restart Standby Time (b003)

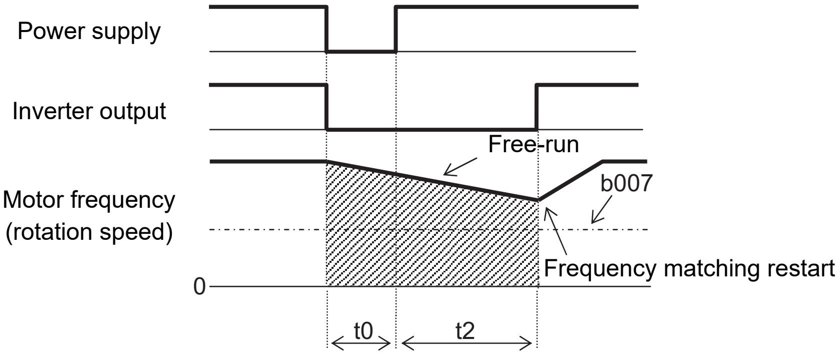
(Example 1) t0 < t1 (b001=02 or 04)



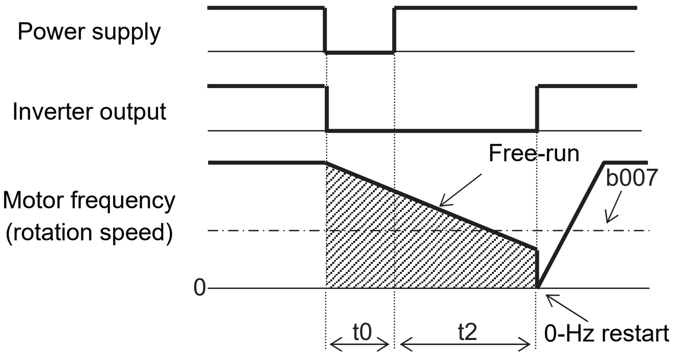
(Example 2) t0 > t1 (b001=02 or 04)



(Example 3) Motor frequency (rotation speed) > b007 (b001=02)



(Example 4) Motor frequency (rotation speed) < b007 (b001=02)



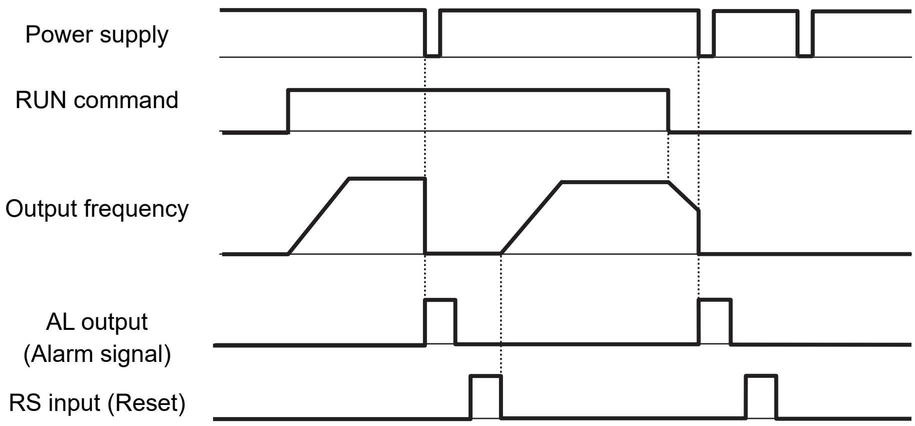
Alarm Signal Output in Case of Power Interruption/Undervoltage during Stop

In the Power Interruption/Undervoltage Trip Selection During Stop (b004), select whether or not to have the inverter output an alarm signal if a power interruption or undervoltage occurs.

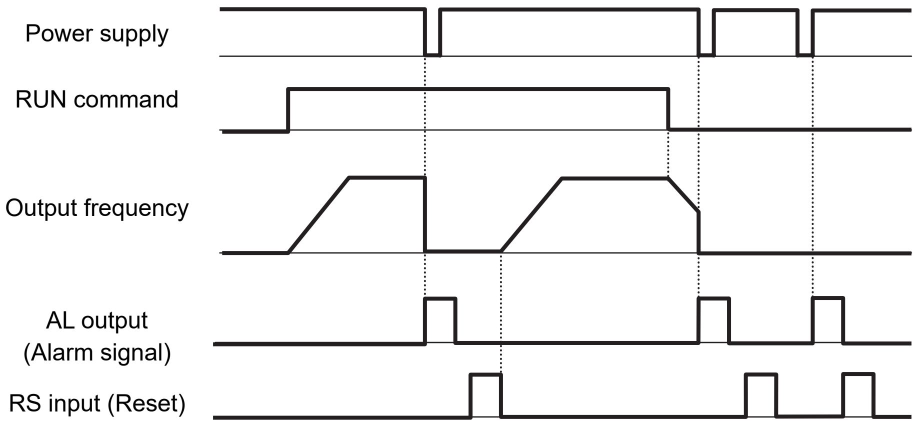
The inverter will output an alarm signal as long as its control power supply remains ON.

● Alarm signal output in case of power interruption/undervoltage during stop

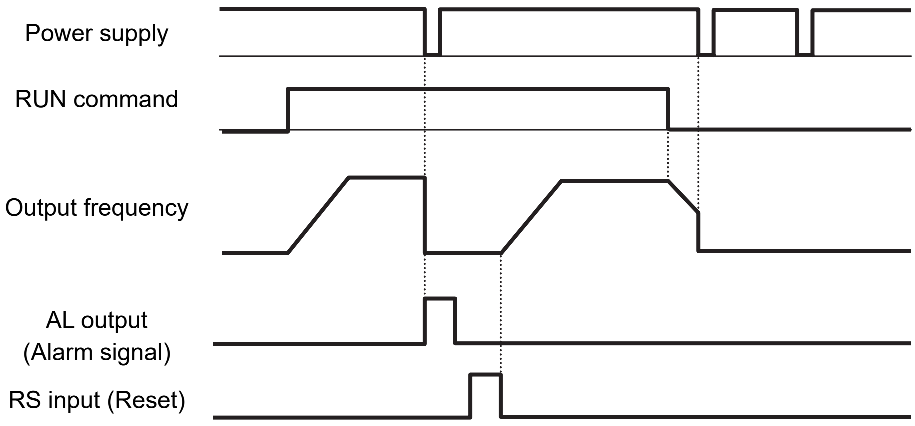
(Example 1) b004 = 00 (Disabled)


Power supply
RUN command
Output frequency
AL output
(Alarm signal)
RS input (Reset)

(Example 2) b004 = 01 (Enabled)


Power supply
RUN command
Output frequency
AL output
(Alarm signal)
RS input (Reset)

(Example 3) b004 = 02 (Disabled during stop and during deceleration by RUN command OFF)


Power supply
RUN command
Output frequency
AL output
(Alarm signal)
RS input (Reset)

7-7-3 Power Recovery Restart Prevention Function (USP)

Use this function to have the inverter trip with the alarm code E13 displayed, if the power supply is turned on with the RUN command ON in the inverter.

To reset a trip, perform the reset operation, or turn OFF the RUN command. (Example 1)

If a trip is reset with the RUN command input ON, the inverter starts running immediately after the trip is reset. (Example 2)

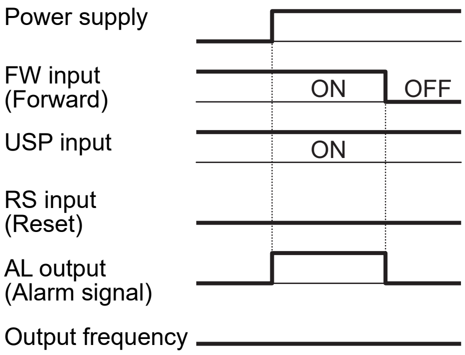
If the RUN command turns ON after the power supply is turned on, the inverter operates normally. (Example 3)

Allocate the Multi-function Input S1 to S7 Selection (C001 to C007) to 13 (USP).

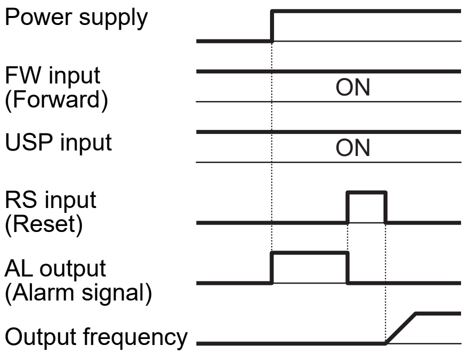
Parameter No.	Function name	Data	Default data	Unit
C001 to C007	Multi-function Input S1 to S7 Selection	13: USP (Power recovery restart prevention function)	–	–

The following shows how the power recovery restart prevention function works.

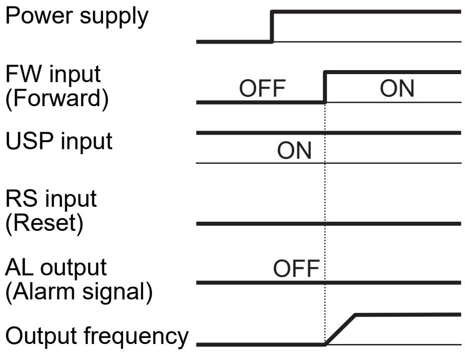
(Example 1) Power-on with RUN command ON
(Reset with RUN command OFF)


Power supply
FW input (Forward)
ON
OFF
USP input
ON
RS input (Reset)
AL output (Alarm signal)
Output frequency

(Example 2) Power-on with RUN command ON
(Reset with reset signal (RS) ON)


Power supply
FW input (Forward)
ON
USP input
ON
RS input (Reset)
AL output (Alarm signal)
Output frequency

(Example 3) RUN command ON after power-on
(Normal operation)


Power supply
FW input (Forward)
OFF
ON
USP input
ON
RS input (Reset)
AL output (Alarm signal)
OFF
Output frequency

7-7-4 Deceleration Stop on Power Interruption Function

Use this function to have the inverter decelerate and stop after the power supply is shut off during operation, while preventing it from exceeding the overvoltage level.

You can select one of the three deceleration stop methods provided in the Deceleration Stop Selection on Power Interruption (b050).

This function will not be canceled until the inverter completes deceleration stop operation. To restart the inverter after power recovery with this function activated, turn ON the STOP command (to turn OFF the RUN command) and then turn ON the RUN command again.

Parameter No.	Function name	Data	Default data	Unit
b050	Deceleration Stop Selection on Power Interruption	00: Disabled 01: Enabled (Deceleration stop) 02: Enabled (Constant voltage, without recovery)*1 03: Enabled (Constant voltage, with recovery)	00	–
b051	Starting Voltage on Power Interruption*2	0.0 to 1000. The function will be activated if the DV voltage drops to the set value or lower.	220.0/ 440.0	V
b052	Deceleration Hold Level on Power Interruption *2*3	0.0 to 1000. The inverter will stop decelerating if the voltage rise caused by regeneration exceeds the set value after starting operation.	360.0/ 720.0	V
b053	Deceleration Time on Power Interruption*4	0.01 to 3600. Set the deceleration time for the deceleration stop on power interruption function.	1.00	s
b054	Deceleration Starting Width on Power Interruption *4	0.00 to 10.00 (100.0) *5 Set when you want to have the inverter start decelerating as the difference from the output frequency.	0.00	Hz
b133	Overvoltage Suppression Proportional Gain During Deceleration	0.00 to 5.00	0.20	–
b134	Overvoltage Suppression Integral Time During Deceleration	0.0 to 150.0	1.0	s
Related functions		b001		

*1. When b050 is set to 02 or 03, PI control works to keep the internal DC voltage constant.
Adjust the Overvoltage Suppression Proportional Gain During Deceleration (b133)/Overvoltage Suppression Integral Time During Deceleration (b134) value:
To improve the responsiveness, increase the proportional gain value and decrease the integral time value. However, doing so increases the possibility of a trip.
Conversely, decreasing the proportional gain value and increasing the integral time value excessively results in an undervoltage.

*2. The values set in b051 and b052 must be the undervoltage level (210 V for 200-V class, 410 V for 400-V class) or higher.
This function will not work if the inverter causes an undervoltage trip.
Note also that the b051 value must be lower than the b052 value.

*3. When the Deceleration Stop Selection on Power Interruption (b050) is set to 01 (Enabled: Deceleration stop), be sure to set the Deceleration Hold Level on Power Interruption (b052) to a value higher than the incoming voltage multiplied by the square root of 2. Set b052 to 380 VDC or higher for 240-VAC incoming voltage and to 750 VDC or higher for 480 VAC-incoming voltage, respectively. If it is set to a value less than the incoming voltage multiplied by the square root of 2, the inverter will remain in a deceleration stop state even after the power is restored and cannot decelerate. (The inverter accepts neither RUN command nor frequency reference input until the deceleration stop operation is completed.) In this case, turn OFF the inverter power supply to complete the operation of the deceleration stop function.
If the value set in the Deceleration Hold Level on Power Interruption (b052) is less than the value set in the Starting Voltage on Power Interruption (b051), the inverter will ignore the b052 setting and operate according to the b051 setting.

*4. If the value set in the Deceleration Starting Width on Power Interruption (b054) is too large, the inverter may decelerate rapidly, which causes an overcurrent. If an overcurrent occurs, decrease the b054 value. Conversely, if the Deceleration Starting Width on Power Interruption (b054) is too small, or if the Deceleration Time on Power Interruption (b053) is too long, the regenerative energy is in short supply and the internal DC power supply voltage of the inverter decreases, which causes an undervoltage. If an undervoltage occurs, increase the b054 value or decrease the b053 value.

*5. In the high-frequency mode.

Deceleration Stop on Power Interruption Function: Deceleration Stop (b050 = 01)

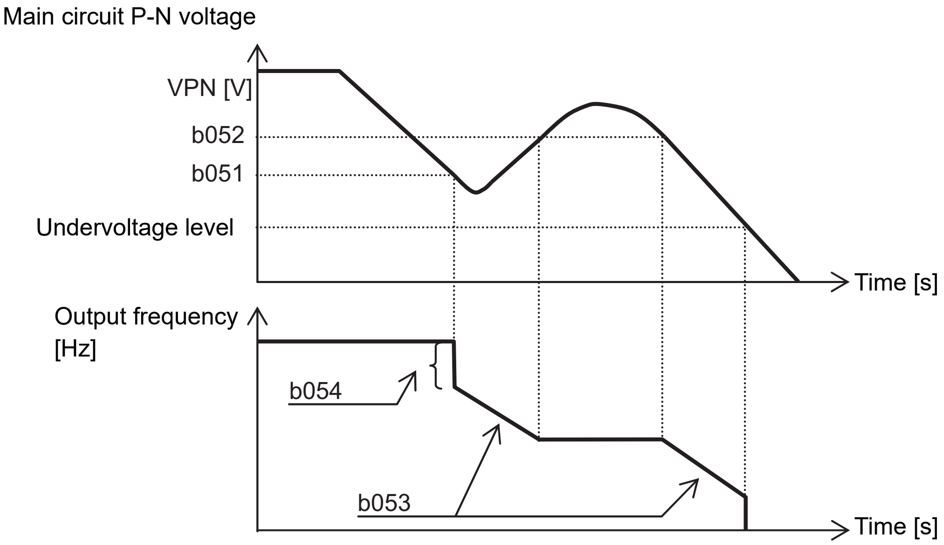
Use this setting to have the inverter decelerate and stop after the power supply is shut off during operation, while preventing it from exceeding the Deceleration Hold Level on Power Interruption (b052).

If the power supply is shut off during operation, the inverter will decelerate by the amount set in the Deceleration Starting Width on Power Interruption (b054) at once when the voltage drops below the Starting Voltage on Power Interruption (b051) value, then decelerate according to the Deceleration Time on Power Interruption (b053) setting.

However, during deceleration, if the inverter falls in an overvoltage state due to regeneration (if it reaches the Deceleration Hold Level on Power Interruption (b052) value or higher), this function will not be activated until the overvoltage state is canceled, so deceleration stop will not occur.

Precautions for Correct Use

- When the Deceleration Stop Selection on Power Interruption (b050) is set to 01 (Enabled: Deceleration stop), be sure to set the Deceleration Hold Level on Power Interruption (b052) to a value higher than the input power supply voltage multiplied by the square root of 2. Set b052 to 380 VDC or higher for 240-VAC incoming voltage and to 750 VDC or higher for 480 VAC-incoming voltage, respectively. If it is set to a value less than the incoming voltage voltage multiplied by the square root of 2, the inverter will remain in a deceleration stop state even after the power is restored and cannot decelerate. (The inverter accepts neither RUN command nor frequency reference input until the deceleration stop operation is completed.) In this case, turn OFF the inverter power supply to complete the operation of the deceleration stop function.
- If the value set in the Deceleration Hold Level on Power Interruption (b052) is less than the value set in the Starting Voltage on Power Interruption (b051), the inverter will ignore the b052 setting and run according to the b051 setting.
- This function will not reset until the deceleration stop operation is completed. To restart the inverter after power recovery during this function operation, in a stop state, input the RUN command again.
- If the value set in the Deceleration Starting Width on Power Interruption (b054) is too large, the inverter may decelerate rapidly, which may cause an overcurrent. If an overcurrent occurs, decrease the b054 value.
- If the Deceleration Starting Width on Power Interruption (b054) is too small, or if the Deceleration Time on Power Interruption (b053) is too long, the regenerative energy is in short supply and the internal DC power supply voltage of the inverter decreases, which causes an undervoltage trip. If an undervoltage trip occurs, increase the b054 value or decrease the b053 value.



Deceleration Stop on Power Interruption Function: DC Voltage Kept Constant (b050 = 02: Without Recovery/b050 = 03: With Recovery)

If a momentary power interruption occur during operation, or if the main circuit DC voltage drops, these settings will cause the inverter to decelerate with the DC voltage in the main circuit kept at the level set in the Deceleration Hold Level on Power Interruption (b052).

This function is activated when all of the following start conditions are met:

- b050 = 02 or 03
- During RUN (Disabled during trip, during undervoltage, and during stop)
- The main circuit DC voltage drops to the Starting Voltage on Power Interruption (b051) level or lower.

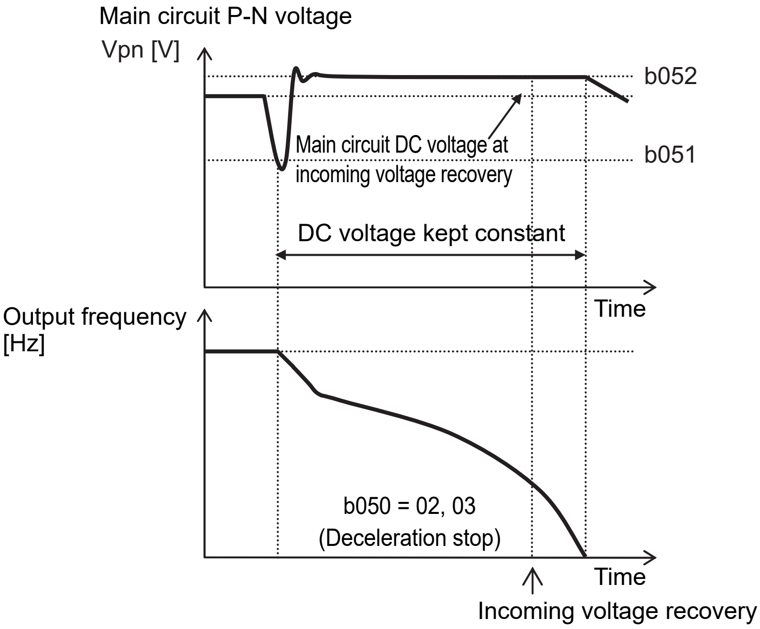
If the power interruption duration is short, the function allows the inverter to decelerate and stop without shutting off its output, so the main circuit DC voltage can be kept constant. However, if the power interruption causes an undervoltage trip, the inverter will shut off its output immediately, so the process of this function will be terminated. The subsequent operation when the power is restored after a momentary power interruption depends on the Power Interruption/Undervoltage Restart Selection (b001) setting.

When b050 is set to 03, if the power interruption state is canceled and the incoming voltage is restored before the occurrence of an under voltage trip, the inverter can recover normal operation. However, this function may cause deceleration stop depending on the b052 setting. Refer to the table and operation examples below.

b050	b052	Operation	
02 (without recovery)	b052 > Main circuit DC voltage at incoming voltage recovery	Deceleration stop (DC voltage constant control)	(Example 1)
	b052 < Main circuit DC voltage at incoming voltage recovery	Deceleration stop (Normal operation)	(Example 2)
03 (with recovery)	b052 > Main circuit DC voltage at incoming voltage recovery	Deceleration stop (DC voltage constant control)	(Example 1)
	b052 < Main circuit DC voltage at incoming voltage recovery	Operation (Normal operation)	(Example 2)

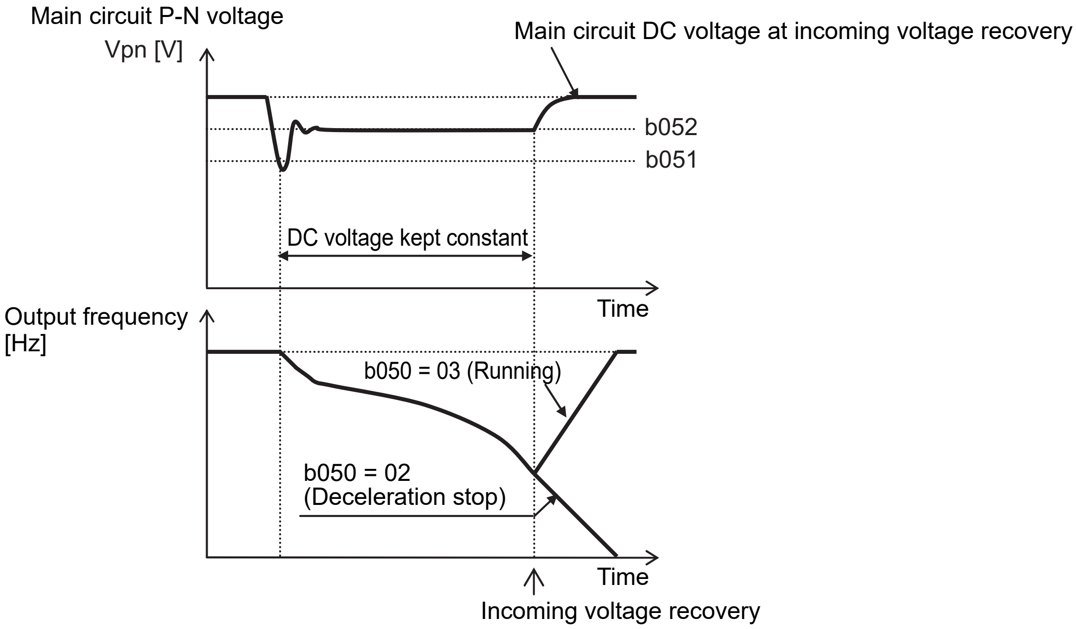
If the inverter makes a deceleration stop as a result of this function, it force-terminates the FW (Forward) signal even if this signal is ON. To restart the inverter, make sure that the incoming voltage is recovered and then turn ON the FW (Forward) signal again.

(Example 1)



Depending on the proportional gain/integral time setting, the function may cause the main circuit DC voltage level to be lower than the b052 value.

(Example 2)



7-8 Functions Related to Protection, Warning, and Various Output Signals

This section describes the protective functions such as warning signals.

7-8-1 Free-electronic Thermal Function

To enable the free-electronic thermal function, set the 1st/2nd Electronic Thermal Characteristics Selection (b013/b213) to 02 (Free setting).

The free-electronic thermal function allows you to set the reduction factor for electronic thermal characteristic according to your application.

As shown in the reduction factor graph below, set the three points that determine the electronic thermal characteristics using the associated parameters.

When b016, b018, and b020 are set to the same rated current value, the reduction factor is x1.0.

However, the basic reduction factor shown below is effective independently of the free-electronic thermal function settings.

The final reduction factor is equivalent to the reduction factor set for the free-electronic thermal function multiplied by the basic reduction factor.

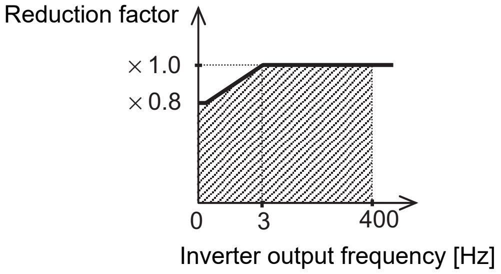
This final reduction factor is then applied to the current value set in the 1st/2nd Electronic Thermal Level (b012/b212) to derive the reference value (100%) of basic characteristics for the electronic thermal function.

For details on electronic thermal characteristics, refer to *5-3-2 Electronic Thermal Function* on page 5-16.

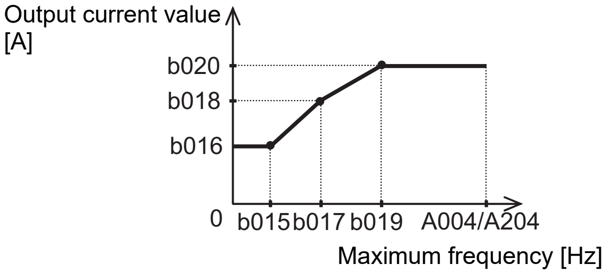
Parameter No.	Function name	Data	Default data	Unit
b015	Free-electronic Thermal Frequency 1	0. to Free-electronic Thermal Frequency 2	0.	Hz
b017	Free-electronic Thermal Frequency 2	Free-electronic Thermal Frequency 1 to Free-electronic Thermal Frequency 3		
b019	Free-electronic Thermal Frequency 3	Free-electronic Thermal Frequency 2 to 400. (580.0) [*1]		
b016/b018/ b020	Free-electronic Thermal Current 1/2/3	0.00 to 1.00 × Rated current Set the current value at each break point.	0.00	A
Related functions		b012, b212, b013, b213		

*1. In the high-frequency mode.

● Basic reduction factor



Free-electronic thermal reduction factor



Example. 3-phase 200-V, 1.5 kW (CT rating 8 A)

- When b012 = 8 [A], b015 = 1.5 [Hz], b016 = 4 [A]

  The basic reduction factor is: × 0.9 at 1.5 Hz. The free-electronic thermal reduction factor is: b016/b012 = × 0.5. The final reduction factor is: 0.9 × 0.5 = x0.45.

  The reference value (100%) of basic characteristics for electronic thermal function is: 8 [A] × 0.45 = 3.6 [A].

  Therefore, 150% of the basic characteristics value is: 5.4 [A] for 60 s.

7-8-2 Motor Electronic Thermal Function

In the 3G3MX2-V1 Series Inverter, the electric thermal function is separated for the motor and for the inverter. The motor electric thermal function is added.

You can use this function to set electronic thermal characteristics according to the motor in use.

To enable the motor electronic thermal function and parameters b911 to b913, set the Motor Electronic Thermal Selection (b910) to 01 to 03.

- You can set electronic thermal characteristics according to the thermal time constant of the motor in use.

  For the thermal time constant of your motor, contact the motor manufacturer.
- In the 1st/2nd Electronic Thermal Level (b012/b212), set the rated current of your motor.
- In the 1st/2nd Electronic Thermal Characteristics Selection (b013/b213), set the characteristics of your motor.
- In the Motor Electronic Thermal Selection (b910), select an appropriate setting for your motor from 01 to 03.

  The recommended setting is 03 (Enabled: b912 time parameter subtraction). The settings 01 (Enabled: Fixed subtraction rate), 02 (Enabled: b911 subtraction rate), and 03 (Enabled: b912 time parameter subtraction) are described later in this section.
- In the Motor Electronic Thermal Subtraction Ratio (b911), set a subtraction rate with an allowance of approximately 40% added to the thermal time constant of your motor when b910 is set to 02.
- In the Motor Electronic Thermal Subtraction Time Constant (b912), set a subtraction time constant with an allowance of approximately 20% added to the thermal time constant of your motor when b910 is set to 03.
- In the Motor Electronic Thermal Integration Gain (b913), set an electronic thermal integration gain when b910 is set to 01 to 03. When b913 is set to 100%, the overload capacity is 150% of the basic characteristics of the electric thermal function for 1 minute.

  For details on the basic characteristics of the electronic thermal function, refer to *5-3-2 Electronic Thermal Function* on page 5-16.

  Decreasing the b913 value prolongs the basic characteristics detection time, while increasing the value shortens the basic characteristics detection time.

  Set an optimal value based on the time during which 150% of the overload capacity of your motor is applied.

  However, be sure to provide a safety margin of 20 to 50%.

  - If 150% of overload capacity of your motor is large:
    Set a small value for 1 minute relative to the time during which 150% of the overload capacity of your motor is applied.
  - If 150% of overload capacity of your motor is small:
    Set a large value for 1 minute relative to the time during which 150% of the overload capacity of your motor is applied.
- Setting the Motor Electronic Thermal Selection (b910) to 00 (Disabled) enables the electronic thermal function to simultaneously detect the inverter and the motor.

  This has the same characteristics as those of the conventional electronic thermal function, which the electronic thermal detection characteristics for the inverter are the basic characteristics. Specifically, the rated output current that serves as the reference value for overload detection changes to the set b012/b212 value. The detection characteristics also change depending on whether the inverter is in the heavy or light load mode.

  For details on the electronic thermal detection function of the inverter, refer to *5-3-2 Electronic Thermal Function* on page 5-16. Note that the subtraction ratio is the same as when b911 is set to 01.

Parameter No.	Function name	Data	Default data	Unit
b012/b212	1st/2nd Electronic Thermal Level	0.20 × Rated current to 1.00 × Rated current	Rated current	A
b013/b213	1st/2nd Electronic Thermal Characteristics Selection	00: Reduced torque characteristics 01: Constant torque characteristics 02: Free setting	01	–
b910	Motor Electronic Thermal Selection[*1][*2]	00: Disabled 01: Enabled (Fixed subtraction rate) 02: Enabled (b911 subtraction rate) 03: Enabled (b912 time parameter subtraction)	03	–
b911	Motor Electronic Thermal Subtraction Ratio	0.10 to 100000.00 (Displays upper 4 digits)	600.00	s
b912	Motor Electronic Thermal Subtraction Time Constant	0.10 to 100000.00 (Displays upper 4 digits)	120.00	s
b913	Motor Electronic Thermal Integration Gain	1.0 to 200.0	100.0	%

*1. When b910 is set to 01 to 03, the electronic thermal function is separated for the motor and for the inverter.

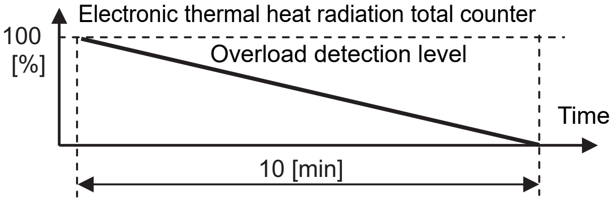
The electronic thermal function for the inverter works based on the constant torque characteristics with reference to the rated output current of the inverter, independent of the b012/b212 setting. For details on the electronic thermal detection function of the inverter, refer to *5-3-2 Electronic Thermal Function* on page 5-16.

*2. When b910 is set to 01 to 03, the overload trip error is divided into the motor overload E05.☐ and the inverter overload E38.☐.

● b910=01: Enabled (Fixed subtraction rate)

The electronic thermal function is separated for the motor and for the inverter. For the motor, the heat radiation is calculated with a fixed subtraction ratio.

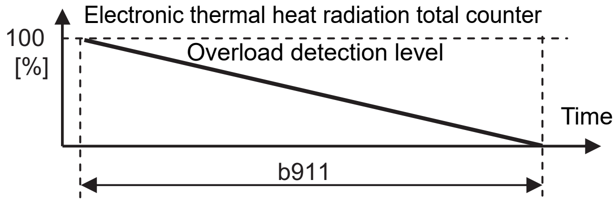
This subtraction ratio is fixed and applied to electronic thermal values from 100% to 0% for 10 minutes.



- **b910=02: Enabled (b911 subtraction rate)**

The electronic thermal function is separated for the motor and for the inverter. The heat radiation is calculated with the subtraction ratio set in b911.

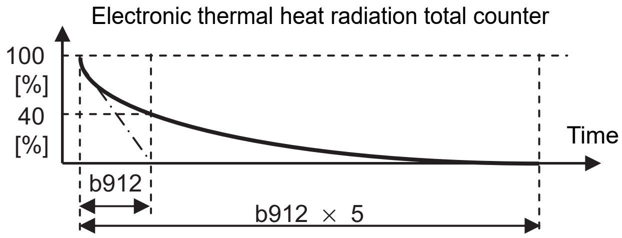
Set the b911 value according to the thermal time constant of the motor.



- **b910=03: Enabled (b912 time parameter subtraction)**

The electronic thermal function is separated for the motor and for the inverter. The heat radiation is calculated with the time parameter set in b912.

Set the b912 value according to the thermal time constant of the motor.



7-8-3 Electronic Thermal Warning

Use this function to output a warning signal before the motor electronic thermal function executes an overload protection. In C061, set the warning level.

Set the Multi-function Output P1/P2 Selection (C021/C022) or Multi-function Relay Output (MA, MB) Function Selection (C026) to 13 (THM).

Parameter No.	Function name	Data	Default data	Unit
C061	Electronic Thermal Warning Level	0. Electric thermal warning disabled	90.	%
		1. to 100.[*1] Set the output level of the thermal warning signal.		
C021, C022, C026	Multi-function Output P1/P2 Selection Multi-function Relay Output (MA, MB) Function Selection	13: THM (Electronic thermal warning)	–	–

*1. Set this in units of percentage as 100% of the overload trip level (E05).

7-8-4 Overload Limit/Overload Warning

Overload Limit

The inverter monitors the motor current during acceleration or constant speed operation and, if the set overload limit level is reached, decreases the output frequency automatically according to the overload limit parameter.

This function is useful to prevent the occurrence of an overcurrent trip due to an excessive torque during acceleration or rapid load fluctuations during constant speed operation.

By using two sets of parameters b021/b022/b023 and b024/b025/b026, you can configure two overload limit function settings.

To switch between the parameter sets b021/b022/b023 and b024/b025/b026, set the Multi-function Input S1 to S7 Selection (C001 to C007) to 39 (OLR) and turn ON/OFF the terminal to which the OLR function is allocated.

In the Overload Limit Level (b022/b025/b222), set the current value at which you want to activate this function.

In the Overload Limit Parameter (b023/b026/b223), set the deceleration time from the maximum frequency to 0 Hz.

When this function is enabled when the inverter is accelerating, the acceleration time will be longer than the set time.

When sensorless vector control is selected as the control method and, at the same time, b021/b024 is set to 03 (Enabled during acceleration/constant speed (Accelerated during regeneration)), the frequency will increase if such a large current that exceeds the set Overload Limit Level flows during regenerative operation.

Because this function causes automatic deceleration even during acceleration, if the value set in the Overload Limit Parameter (b023/b026/b223) is too small, an overvoltage trip may occur due to the regenerative energy from the motor.

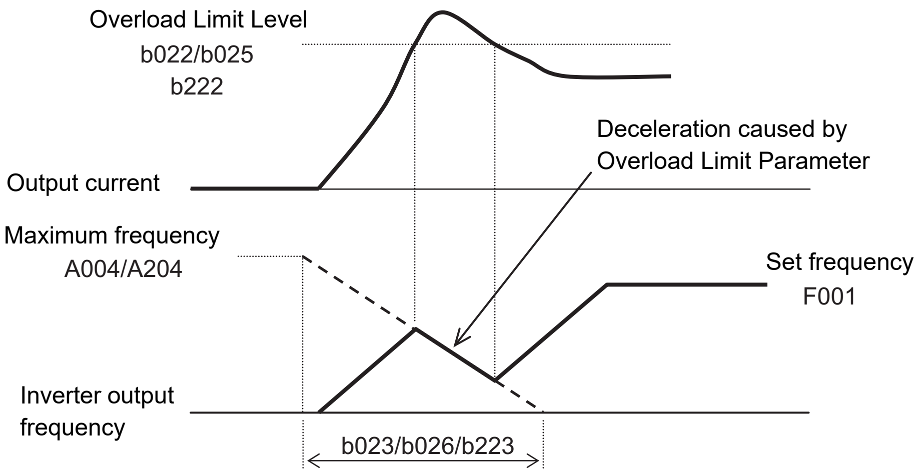
If this function is activated during acceleration to prevent the target frequency from being attained, make the following adjustments.

- Increase the acceleration time. (Refer to *5-6 Acceleration/Deceleration Time Settings* on page 5-33.)
- Increase the Overload Limit Level (b022/b025/b222).

Parameter No.	Function name	Data	Default data	Unit
b021/b024 b221	1st Overload Limit Selection/ 1st Overload Limit Selection 2 2nd Overload Limit Selection	00: Disabled 01: Enabled during acceleration/constant speed 02: Enabled during constant speed 03: Enabled during acceleration /constant speed (Accelerated during regeneration)	01	–
b022/b025 b222	1st Overload Limit Level/ 1st Overload Limit Level 2 2nd Overload Limit Level	Set the current value at which you want to activate this function. Heavy load mode (b049 = 00): 0.20 × Rated current to 2.00 × Rated current Light load mode (b049 = 01): 0.20 × Rated current to 1.50 × Rated current	Heavy load mode: Rated current × 1.50 Light load mode: Rated current × 1.20	A

Parameter No.	Function name	Data	Default data	Unit
b023/b026 b223	1st Overload Limit Parameter/1st Overload Limit Parameter 2 2nd Overload Limit Parameter	0.1 to 3000. Set the deceleration rate for the output frequency when the overload limit function is enabled. Set the deceleration time from the maximum frequency to 0 Hz.	1.0	s
C001 to C007	Multi-function Input S1 to S7 Selection	39: OLR (Overload limit switching)	–	–

● Example case where overload limit function is activated during acceleration (b021/b024/b221 = 01 or 03)


Overload Limit Level
b022/b025
b222
Deceleration caused by
Overload Limit Parameter
Output current
Maximum frequency
A004/A204
Set frequency
F001
Inverter output
frequency
b023/b026/b223

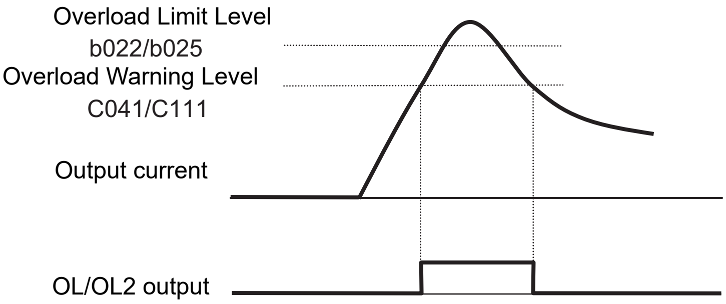
Overload Warning

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.

Allocate the Multi-function Output P1/P2 selection (C021/C022) or the Multi-function Relay Output (MA, MB) Function Selection (C026) to 03 (OL: Overload warning) or 26 (OL2: Overload warning 2). (Two types of overload warning signals can be output.)

Parameter No.	Function name	Data	Default data	Unit
C040	Overload Warning Signal Output Selection	00: Enabled during acceleration/deceleration and constant speed 01: Enabled during constant speed	01	–
C041/C241	1st/2nd Overload Warning Level	0.00: Overload warning disabled 0.01 × Rated current to 2.00 × Rated current (In the heavy mode) 0.01 × Rated current to 1.50 × Rated current (In the light mode) The inverter will output the OL signal when the set overload warning level is reached.	Rated current × 1.15	A
C111	1st Overload Warning Level 2	0.00: Overload warning disabled 0.01 × Rated current to 2.00 × Rated current (In the heavy mode) 0.01 × Rated current to 1.50 × Rated current (In the light mode) The inverter will output the OL2 signal when the set overload warning level is reached.	Rated current × 1.15	A
C021, C022 C026	Multi-function Output P1/P2 Selection Multi-function Relay Output (MA, MB) Function Selection	03: OL (Overload warning) 26: OL2 (Overload warning 2)	–	–



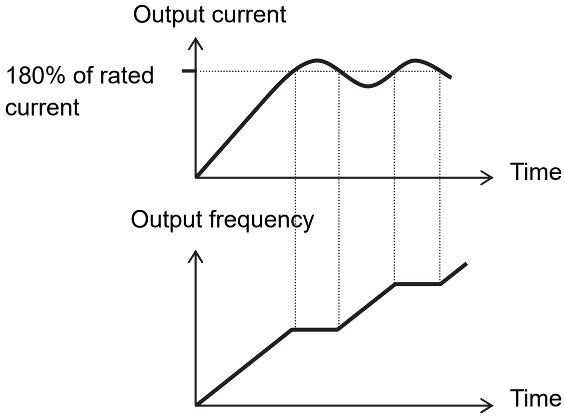
7-8-5 Overcurrent Suppression Function

This function suppresses the overcurrent caused by a steep current increase due to an impact load etc. It causes the inverter to stop accelerating when the output current reaches approximately 180% of the rated current.

Parameter No.	Function name	Data	Default data	Unit
b027	Overcurrent Suppression Selection	00: Disabled 01: Enabled 02: Enabled (Reduced voltage startup)	01[*1]	–

*1. The default data was changed from the previous model.

- If setting the Overcurrent Suppression Selection (b027) to 01 (Enabled) still causes an overcurrent, set it to 02 (Reduced voltage startup). This setting reduces the output voltage and moreover suppresses the overcurrent at the startup after a temporal stop.
- Although the overcurrent suppression function is enabled, an overcurrent trip may occur due to short circuit or equivalent.

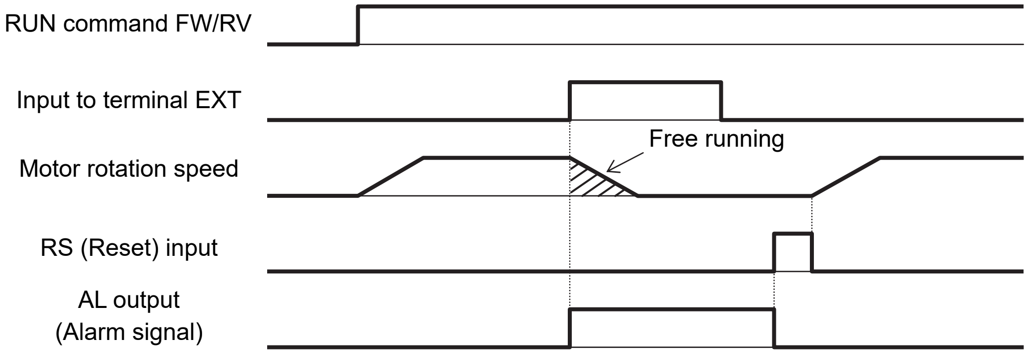


7-8-6 External Trip (EXT)

Use this signal to have the inverter trip via an error signal generated by a peripheral system. To do so, set the Multi-function Input S1 to S7 Selection (C001 to C007) to 12 (EXT).
When the EXT terminal turns ON, the inverter trips with the alarm code E12 displayed and shuts off its output.
Once the inverter trips with the alarm code E12 displayed, the trip status will not be reset even if the error signal is reset from external equipment (the terminal EXT is turned OFF).
In this case, perform the reset operation or cycle the power supply to reset the trip.

Parameter No.	Function name	Data	Default data	Unit
C001 to C007	Multi-function Input S1 to S7 Selection	12: EXT (External trip)	–	–

- Do not turn ON the terminal EXT when the power supply is off. Otherwise, the inverter may not store the fault monitor data correctly.



7-8-7 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.

Connect a PTC thermistor to the inverter. If the resistance of the PTC thermistor becomes approximately 3 kΩ or more, the inverter will trip (E35).

To have the inverter trip at lower than 3 kΩ, increase the Thermistor Adjustment (C085) value. Conversely, to have the inverter trip at higher than 3 kΩ, decrease the C085 value.

Connect the external thermistor between the control terminals S5 and SC and set the Multi-function Input S5 Selection (C005) to 19 (TH: PTC thermistor thermal protection).

Then, set the adjustment parameter according to the specifications of the thermistor.

When using this function, keep the wiring distance between the motor and the inverter at 20 m or shorter.

Since the current flowing through the thermistor is weak, take measures, such as isolating the thermistor cable, to prevent noise due to the motor current.

Parameter No.	Function name	Data	Default data	Unit
C085	Thermistor Adjustment	0.0 to 200.0 Fine-tune the gain relative to the input voltage.	100.0	%
C005	Multi-function Input S5 Selection	19: TH (PTC thermistor thermal protection)	02 (CF1)	–

Note If no thermistor is connected when C005 is set to 19, a trip will occur.

7-8-8 Signal during RUN (RUN)

The RUN signal will be output from a multi-function output terminal or the multi-function relay output terminal during inverter operation.

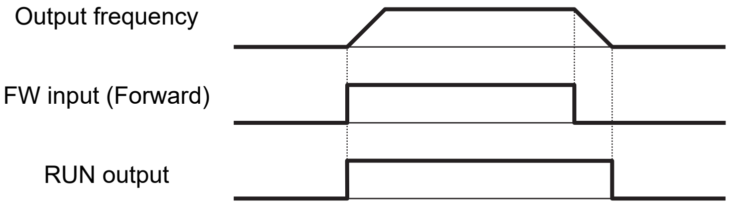
This signal turns ON only with the inverter output. The RUN signal is not output even if the RUN command is input when the frequency is set to 0 Hz. (Note that the RUN LED is lit when the RUN command is input.)

Allocate the Multi-function Output P1/P2 Selection (C021/C022) or the Multi-function Relay Output (MA, MB) Function Selection (C026) to 00 (RUN: Signal during RUN).

This signal is also output when DC injection braking is active.

The timing diagram is as follows. The RUN signal remains ON until the motor stops even if the RUN command (FW) turns OFF.

Parameter No.	Function name	Data	Default data	Unit
C021, C022	Multi-function Output P1/P2 Selection	00: RUN (Signal during RUN)	–	–
C026	Multi-function Relay Output (MA, MB) Function Selection			



7-8-9 Frequency Arrival Signal (FA2 to FA5)

The inverter outputs the frequency arrival signal when the output frequency reaches the set level.

Allocate the Multi-function Output P1/P2 Selection (C021/C022) or Multi-function Relay Output (MA, MB) Function Selection (C026) to 02 (FA2: Set frequency exceeded signal), 06 (FA3: Set frequency only signal), 24 (FA4: Set frequency exceeded signal 2) or 25 (FA5: Set frequency only signal 2).

The hysteresis of the signals FA2 (02) and FA4 (24) is calculated as follows.

ON : (Set frequency) − (1% of maximum frequency) [Hz]
OFF : (Set frequency) − (2% of maximum frequency) [Hz]

The hysteresis of the signals FA3 (06) and FA4 (25) during acceleration is calculated as follows.

ON : (Set frequency) − (1% of maximum frequency) [Hz]
OFF : (Set frequency) + (2% of maximum frequency) [Hz]

The hysteresis of these signals during deceleration is calculated as follows.

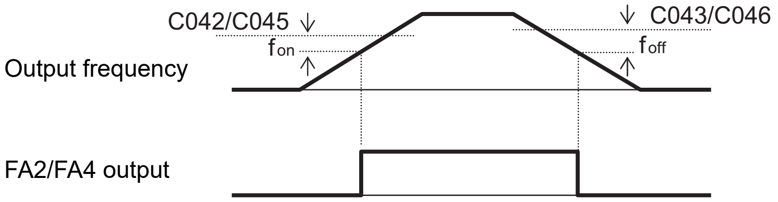
ON : (Set frequency) + (1% of maximum frequency) [Hz]
OFF : (Set frequency) − (2% of maximum frequency) [Hz]

Parameter No.	Function name	Data	Default data	Unit
C042/C045	Arrival Frequency During Acceleration 1/Arrival Frequency During Acceleration 2	0.00 Not output arrival signal during acceleration	0.00	Hz
		0.01 to 400.0 (580.0)[*1] Output arrival signal during acceleration		
C043/C046	Arrival Frequency During Deceleration 1/Arrival Frequency During Deceleration 2	0.00 Not output arrival signal during deceleration	0.00	Hz
		0.01 to 400.0 (580.0)[*1] Output arrival signal during deceleration		
C021, C022 C026	Multi-function Output P1/P2 Selection Multi-function Relay Output (MA, MB) Function Selection	02: FA2 (Set frequency exceeded signal) 06: FA3 (Set-frequency only signal) 24: FA4 (Set frequency exceeded signal 2) 25: FA5 (Set-frequency only signal 2)	−	−

*1. In the high-frequency mode.

Set Frequency Exceeded Signal (C021, C022, C026 = 02: FA2, 24: FA4)

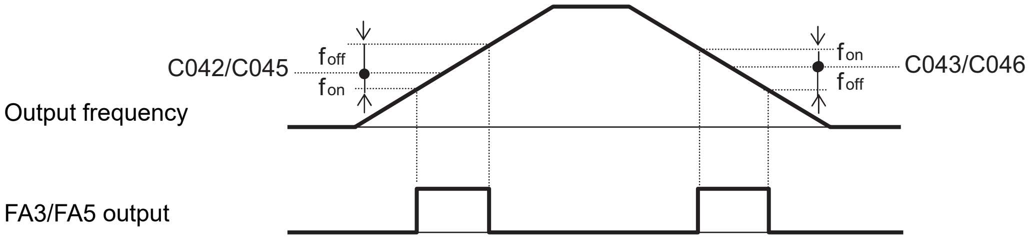
The inverter outputs the frequency arrival signal when the inverter reaches the frequency set in the Arrival Frequency During Acceleration 1/2 (C042/C045) or Arrival Frequency During Deceleration 1/2 (C043/C046) or higher.



fon: 1% of maximum frequency
foff: 2% of maximum frequency

Set-frequency Only Signal (C021, C022, C026 = 06: FA3, 25: FA5)

The inverter outputs the frequency arrival signal only when the inverter reaches the frequency set in the Arrival Frequency During Acceleration 1/2 (C042/C045) or Arrival Frequency During Deceleration 1/2 (C043/C046).



fon: 1% of maximum frequency
foff: 2% of maximum frequency

7-8-10 RUN Time/Power ON Time Over (RNT/ONT)

If the total RUN time or power ON time of the inverter exceeds the RUN Time/Power ON Time Detection Level (b034), the inverter will output the RUN time over (RNT) or Power ON time over (ONT) signal.

Parameter No.	Function name	Data	Default data	Unit
b034	RUN Time/Power ON Time Detection Level	0. Function is disabled	0.	10 hex
		1. to 9999. Set in increments of 10 hours (10 to 99,990 h)		
		1000 to 6553 (10000 to 65530) Set in increments of 100 (10) hours (100,000 to 655,300 h)		
C021, C022 C026	Multi-function Output P1/P2 Selection, Multi-function Relay Output (MA, MB) Function Selection	11: RNT (RUN time over) 12: ONT (Power ON time over)	–	–
Related functions		d016, d017		

RUN Time Over (C021, C022, C026 = 11: RNT)

Allocate the Multi-function Output P1/P2 Selection (C021/C022) or Multi-function Relay Output (MA, MB) Function Selection (C026) to 11 (RNT: RUN time over).

Set the RUN Time/Power ON Time Detection Level (b034).

Power ON Time Over (C021, C022, C026 = 12: ONT)

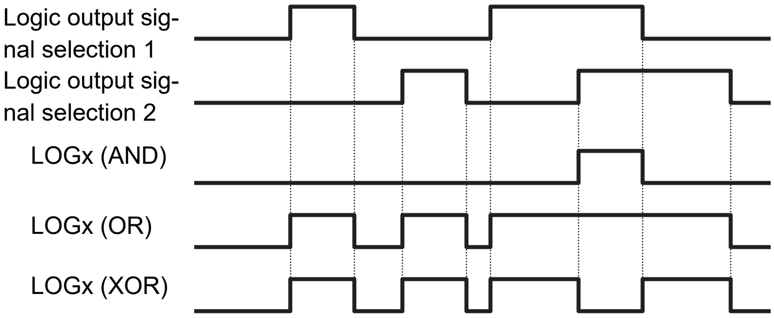
Allocate the Multi-function Output P1/P2 Selection (C021/C022) or Multi-function Relay Output (MA, MB) Function Selection (C026) to 12 (ONT: Power ON time over).

Set the RUN Time/Power ON Time Detection Level (b034).

7-8-11 Logic Operation Output Signal (LOG1 to LOG3)

Use these signals to have the inverter internally perform logical operations with output signals. Set the Multi-function Output P1/P2 Selection (C021/C022), or Multi-function Relay Output (MA, MB) Function Selection (C026), to 33 (LOG1: Logic operation output 1), 34 (LOG2: Logic operation output 2), or 35 (LOG3: Logic operation output 3). The logic output signal selection parameters cannot be set to 255 (no: No allocation), 63 (OPO: Option), or 33 to 35 (LOG1 to LOG3: Logic operation output 1 to 3).

Three operators, AND, OR, and XOR, are available.


Logic output signal selection 1
Logic output signal selection 2
LOGx (AND)
LOGx (OR)
LOGx (XOR)

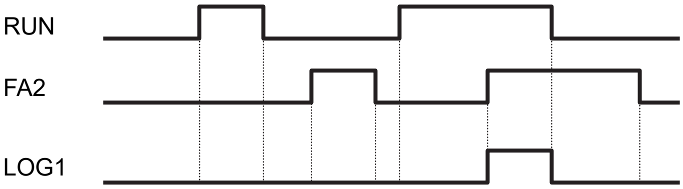
Each logic operation output signal requires different parameter settings.

Set the necessary parameters according to the table below.

Selected signal	Logic output signal selection 1	Logic output signal selection 2	Operator selection
33: Logic operation output 1 (LOG1)	C142	C143	C144
34: Logic operation output 2 (LOG2)	C145	C146	C147
35: Logic operation output 3 (LOG3)	C148	C149	C150

(Example) To output the result of the AND operation between RUN (00: Signal during RUN) and FA2 (01: Set frequency exceeded signal) to the multi-function output terminal P2 as a logic operation output 1 (LOG1) terminal

Multi-function Output P2 Selection (C022) : 33 (LOG1)
Logic Output Signal 1 Selection 1 (C142) : 00 (RUN)
Logic Output Signal 1 Selection 2 (C143) : 02 (FA2)
Logic Output Signal 1 Operator Selection (C144) : 00 (AND)



Parameter No.	Function name	Data	Default data	Unit
C142 C145 C148	Logic Output Signal 1 to 3 Selection 1	00 to 63: Same as options for C021 (Except 33 (LOG1) to 35 (LOG3), 63 (OPO), and 255 (no))	00	–
C143 C146 C149	Logic Output Signal 1 to 3 Selection 2		00	–
C144 C147 C150	Logic Output Signal 1 to 3 Operator Selection	00: AND 01: OR 02: XOR	00	–

Parameter No.	Function name	Data	Default data	Unit
C021, C022, C026	Multi-function Output P1/P2 Selection, Multi-function Relay Output (MA, MB) Function Selection	33: LOG1: Logic operation output 1 34: LOG2: Logic operation output 2 35: LOG3: Logic operation output 3	–	–

7-8-12 Capacitor Life Warning Signal (WAC)

Use this signal to determines the life expectancy of the capacitor on the option board based on the inverter's internal temperature and conduction time.

The status of this signal can be monitored in the Life Assessment Monitor (d022).

Set this function according to *A-2 Smoothing Capacitor Life Curve* on page A-8.

Parameter No.	Function name	Data	Default data	Unit
C021, C022	Multi-function Output P1/P2 Selection	39: WAC (Capacitor life warning signal)	–	–
C026	Multi-function Relay Output (MA, MB) Function Selection			

7-8-13 Cooling Fan Operation

Select whether to enable the inverter's built-in cooling fan constantly or only during inverter operation.

Parameter No.	Function name	Data	Default data	Unit
b092	Cooling Fan Operation	00: Always enabled 01: Enabled only during operation (Note that the cooling fan is also enabled for 5 min after power-on and 5 min after inverter operation stop.) 02: Dependent on cooling fin temperature (Enabled at approximately 45°C or higher)	01	–
b093	Total Fan Operation Time Clear	00: Clear disabled (Value increasing continuously) 01: Clear with the Enter key (Data is reset from 01 to 00 after execution.)	00	–

Note 1. If a momentary power interruption or power shutoff occurs when the cooling fan is operating, the cooling fan will stop temporarily and, after power recovery, restart automatically.

2. Clear the total operation time only when you replace the cooling fan. Otherwise, the Life Assessment Monitor (d022) will not display correct monitor data.

7-8-14 Cooling Fan Life Warning Signal (WAF)

In the Ambient Temperature (b075), set the ambient temperature in the operating environment of the inverter.

This warning is made on the assumption that the life expectancy of the cooling fan is approximately 10 years under an ambient temperature of 40°C or lower.

If this signal is output, it is recommended to check the cooling fan for clogging etc.

The status of this signal can be monitored in the Life Assessment Monitor (d022).

Parameter No.	Function name	Data	Default data	Unit
b075	Ambient Temperature	−10 to 50 Set the ambient temperature in the operating environment.	40	°C
C021, C022	Multi-function Output P1/P2 Selection	40: WAF (Cooling fan life warning signal)	–	–
C026	Multi-function Relay Output (MA, MB) Function Selection			
Related functions		b092, d022		

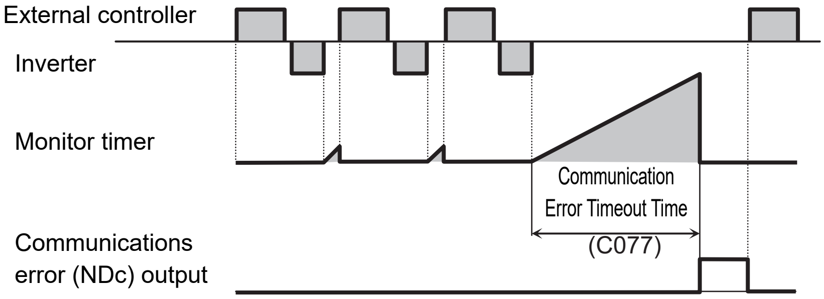
7-8-15 Communication Disconnection Detection Signal (NDc)

This signal is enabled only when Modbus communication is selected for RS485 communications.

If a reception timeout error occurs, this signal will be output until the next data is received.

Set the time until the reception timeout in the Communication Error Timeout Time (C077).

For details, refer to *Section 8 Communications Functions*.


External controller
Inverter
Monitor timer
Communication Error Timeout Time (C077)
Communications error (NDc) output

Parameter No.	Function name	Data	Default data	Unit
C077	Communication Error Timeout Time	0.00: Timeout disabled 0.01 to 99.99 Set the reception timeout time.	0.00	s
C021, C022	Multi-function Output P1/P2 Selection	32: NDc (Communications disconnection detection)	–	–
C026	Multi-function Relay Output (MA, MB) Function Selection			

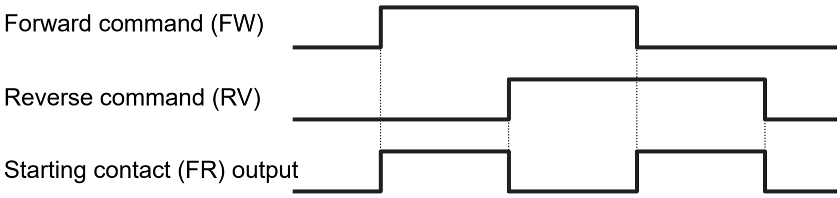
7-8-16 Starting Contact Signal (FR)

The starting contact signal will be output while the inverter is ready to accept the RUN command.

The output is enabled independently of the 1st/2nd RUN Command Selection (A002/A202) setting.

The inverter will stop if the FW and RV signals are input simultaneously.

Parameter No.	Function name	Data	Default data	Unit
C021, C022	Multi-function Output P1/P2 Selection	41: FR (Starting contact signal)	–	–
C026	Multi-function Relay Output (MA, MB) Function Selection			



7-8-17 Cooling Fin Overheat Warning (OHF)

This function monitors the temperature of the cooling fin located inside the inverter and outputs a signal if the temperature is at or higher than the Cooling Fin Overheat Warning Level (C064).

Parameter No.	Function name	Data	Default data	Unit
C064	Cooling Fin Overheat Warning Level	0. to 110. Set the temperature at which to the overheat warning signal is output.	100.	°C
C021, C022	Multi-function Output P1/P2 Selection	42: OHF (Cooling fin overheat warning)	–	–
C026	Multi-function Relay Output (MA, MB) Function Selection			

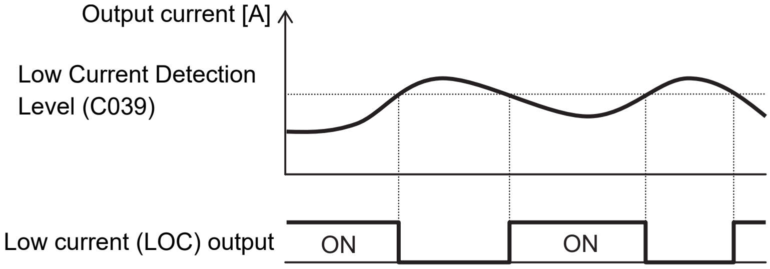
7-8-18 Low Current Signal (LOC)

This signal will be output when the output current falls to or below the Low Current Detection Level (C039).

In the Low Current Signal Output Selection (C038), 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
C038	Low Current Signal Output Selection	00: Enabled during acceleration/deceleration and constant speed 01: Enabled during constant speed[*1]	01	–
C039	Low Current Detection Level	0.00 to 2.00 × Rated current (In the heavy mode) 0.00 to 1.50 × Rated current (In the light mode) Set the output level of the low current signal.	Rated current	A
C021, C022	Multi-function Output P1/P2 Selection	43: LOC (Low current signal)	–	–
C026	Multi-function Relay Output (MA, MB) Function Selection			

[*1] When the 1st/2nd Frequency Reference Selection (A001/A201) is set to 01 (Control circuit terminal block (Analog input)), the signal may not be judged as a constant speed depending on the sampling condition. In this case, set C038 to 00 (Enabled during acceleration/deceleration and constant speed) or increase the value set in the Analog Input Filter (A016).



7-8-19 Fatal Fault Signal (MJA)

If any of the following trips occurs, the inverter will output a separate signal besides the alarm signal (05: AL).

This signal indicates that the trip is associated with a hardware failure.

Alarm code	Description
E08.☐	EEPROM error
E10.☐	Current detector error
E11.☐	CPU error
E14.☐	Ground protection
E22.☐	CPU communications error
E25.☐	Main circuit error

Parameter No.	Function name	Data	Default data	Unit
C021, C022	Multi-function Output P1/P2 Selection	53: MJA (Fatal fault signal)	–	–
C026	Multi-function Relay Output (MA, MB) Function Selection			

7-8-20 Window Comparator (WCFV/WCFI) (Disconnection Detection FVDc/FIDc)

The window comparator signal will be output when the analog input FV/FI value is between the upper and lower limit settings. It is useful for monitoring the analog input at a level to detect disconnection or other faults.

The hysteresis width can be set for the upper and lower limit level settings for the window comparator function.

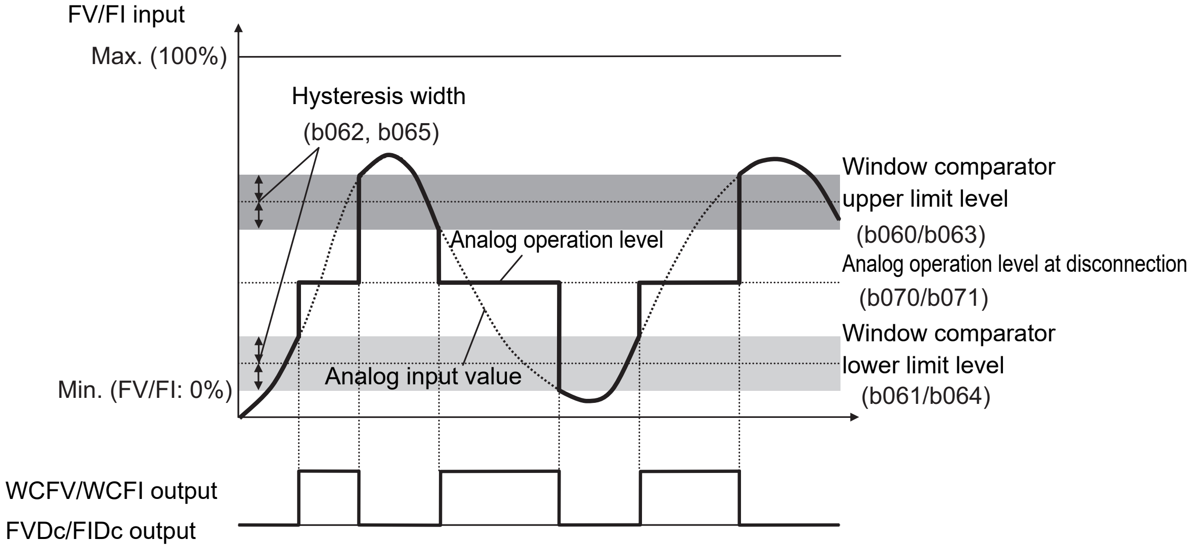
In addition to the hysteresis width, the upper and lower limit levels can be set individually for each of the analog input signals FV and FI.

The analog operation level during WCFV/WCFI output can be set to a fixed value. To do so, set the Analog Operation Level at FV/FI/FE Disconnection (b070/b071). When set to no, the analog input value will be used “as is.”

The signals FVDc and FIDc will be output in the same way as WCFV and WCFI, respectively.

Parameter No.	Function name	Data range	Default data	Unit
b060	Window Comparator FV Upper Limit Level	Lower limit level + Hysteresis width × 2 (0. min.) to 100. Set an upper limit level.	100.	%
b063	Window Comparator FI Upper Limit Level			
b061	Window Comparator FV Lower Limit Level	0. to Lower limit level − Hysteresis width × 2 (100. max.) Set a lower limit level.	0.	%
b064	Window Comparator FI Lower Limit Level			
b062	Window Comparator FV Hysteresis Width	0. to (Upper limit level − Lower limit level) ÷ 2 (10. max.) Set a hysteresis width for the upper and lower limit levels.	0.	%
b065	Window Comparator FI Hysteresis Width			
b070	Analog Operation Level at FV Disconnection	0. to 100. 255: no (Disabled) Set the analog operation level during WCFV/WCFI (FVDc/FIDc) output.	no	–
b071	Analog Operation Level at FI Disconnection			
C021 C022 C026	Multi-function Output P1/P2 Selection Multi-function Relay Output (MA, MB) Function Selection	27: FVDc (Analog FV disconnection detection) 28: FIDc (Analog FI disconnection detection) 54: WCFV (Window Comparator FV) 55: WCFI (Window Comparator FI)	–	–

Note Set the upper and lower limit level settings for the window comparator function as a percentage [%] of the input voltage (10 V) or current (20 mA).



Additional Information

To use this function for disconnection detection, set the disconnection detection level in the Window Comparator FV/FI Upper Limit Level (b060/b063).

(In this case, the inverter uses the bandwidth over the upper limit value in normal operation and, if the input falls below the upper limit value, the inverter detects a disconnection error.)

7-8-21 Frequency Reference Selection Status Signal (FREF)

This signal will be output when the RUN command is input via the Digital Operator (A001=02), or when the forced operator function (31: OPE) is allocated to one of the multi-function output terminals and that terminal is ON.

It is OFF when the RUN command is not input via the Digital Operator.

Parameter No.	Function name	Data	Default data	Unit
C021, C022	Multi-function Output P1/P2 Selection	58: FREF (Frequency command source)	–	–
C026	Multi-function Relay Output (MA, MB) Function Selection			

7-8-22 RUN Command Status Signal (REF)

This signal will be output when the RUN command is input via the Digital Operator (A001=02), or when the forced operator function (31: OPE) is allocated to one of the multi-function output terminals and that terminal is ON.

It is OFF when the RUN command is not input via the Digital Operator.

Parameter No.	Function name	Data	Default data	Unit
C021, C022	Multi-function Output P1/P2 Selection	59: REF (RUN command source)	–	–
C026	Multi-function Relay Output (MA, MB) Function Selection			

7-8-23 2nd Control Selection Signal (SETM)

This signal will be output when the SETM (Motor 2 selection) function is allocated to one of the multi-function output terminals and the terminal SET is ON.

Parameter No.	Function name	Data	Default data	Unit
C021, C022	Multi-function Output P1/P2 Selection	60: SETM (Motor 2 selection)	–	–
C026	Multi-function Relay Output (MA, MB) Function Selection			

7-9 DC Injection Braking Function

This section describes the DC injection braking function.

7-9-1 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 the Multi-function Input S1 to S7 Selection (C001 to C007) to 07 (DB: External DC injection braking) and turning ON/OFF the terminal to which the external DC injection braking function is allocated.
- Setting the DC Injection Braking Selection (A051) to 01 (Enabled) and then setting appropriate function parameters.
- Setting the DC Injection Braking Selection (A051) to 02 (Enabled) 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.

Parameter No.	Function name	Data	Default data	Unit
A051	DC Injection Braking Selection	00: Disabled 01: Enabled 02: Enabled (Operates only via set frequency)	00	–
A052	DC Injection Braking Frequency	0.00 to 60.00 Set the frequency at which you want to start DC injection braking to stop the motor rotation, when the DC injection braking function is enabled.	0.50	Hz
A053	DC Injection Braking Delay Time	0.0 to 5.0 Set the delay time until the motor starts applying DC injection braking after the set DC Injection Braking Frequency is reached, or after the terminal DB turns ON.	0.0	s
A054	DC Injection Braking Power	Heavy load mode (b049 = 00): 0. to 100. Light load mode (b049 = 01): 0. to 70.	50.	%
A057	Startup DC Injection Braking Power	0. (Weakest: Zero current) to 100. (Strongest: Rated current)	0.	%
A055	DC Injection Braking Time	0.0 to 60.0 Set the time during which DC injection braking is applied after deceleration stop. Setting this time is effective when the terminal DB performs edge operation.	0.5	s
A056	DC Injection Braking Edge/Level Selection	00: Edge operation (Examples 1 –a to 6–a) 01: Level operation (Examples 1–b to 6–b)	01	–

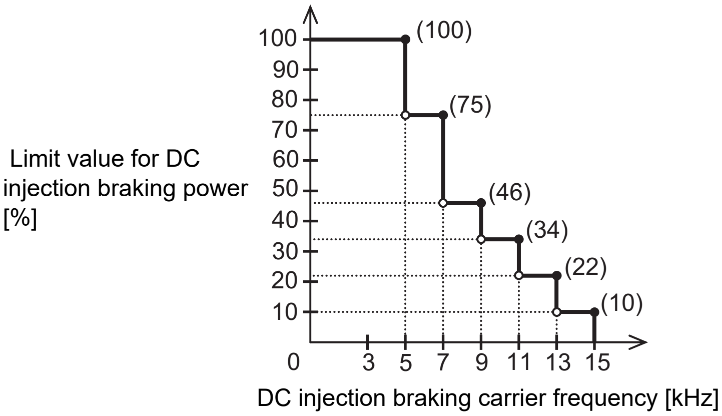
Parameter No.	Function name	Data	Default data	Unit
A058	Startup DC Injection Braking Time	0.0 to 60.0 Set the time during which DC injection braking is applied when the RUN command is ON, when the DC injection braking function is enabled.	0.0	s
A059	DC Injection Braking Carrier Frequency	Heavy load mode (b049 = 00): 2.0 to 15.0 Light load mode (b049 = 01): 2.0 to 10.0	5.0/2.0	kHz
C001 to C007	Multi-function Input S1 to S7 Selection	07: DB (External DC injection braking)	–	–

DC Injection Braking Carrier Frequency

The carrier frequency for DC injection braking can be set in the DC Injection Braking Carrier Frequency (A059). Note, however, that setting a 5 kHz or higher frequency automatically applies a limit value to the DC Injection Braking Power (A054).

The graph below shows the relationship between the carrier frequency and the limit value for the DC injection braking power.

The value enclosed in parentheses ( ) on the graph represents the limit value at that carrier frequency.



Controlling DC Injection Braking via ON/OFF Status of External DC Injection Braking Terminal

Use this method to control DC injection braking according to the ON/OFF status of the external DC injection braking signal allocated to the multi-function input terminal.

Allocate the Multi-function Input S1 to S7 Selection (C001 to C007) to 07 (DB: External DC injection braking).

When the terminal DB turns ON, DC injection braking is applied independently of the RUN command operation.

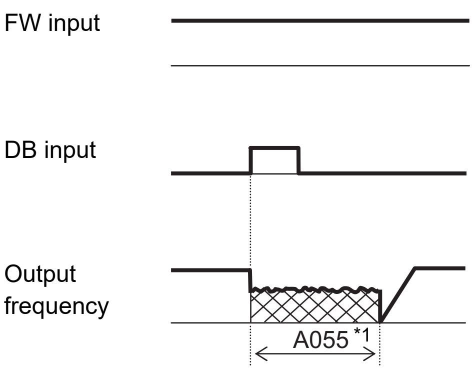
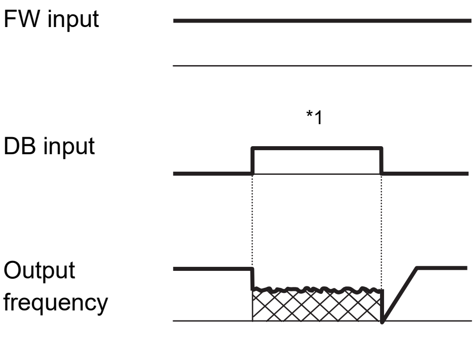
- DC injection braking works according to the ON/OFF status of the terminal DB, regardless of whether the DC Injection Braking Selection (A051) is set to 00 (Disabled) or 01 (Enabled). Note that the DC injection braking via the terminal DB has priority over the DC injection braking via the parameter setting 01 (Enabled).

  However, when A051 is set to 02, DC injection braking via the terminal DB is disabled.
- In the DC Injection Braking Power (A054), set the braking power required for your application.

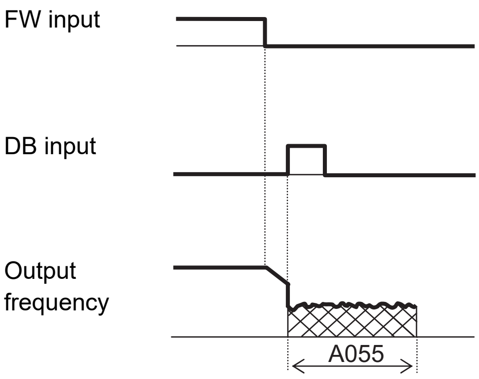
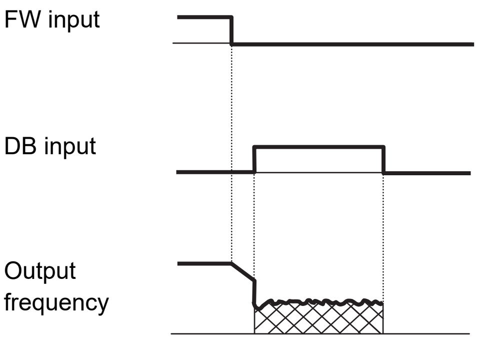
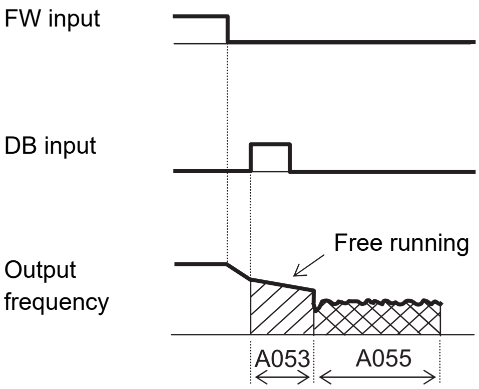
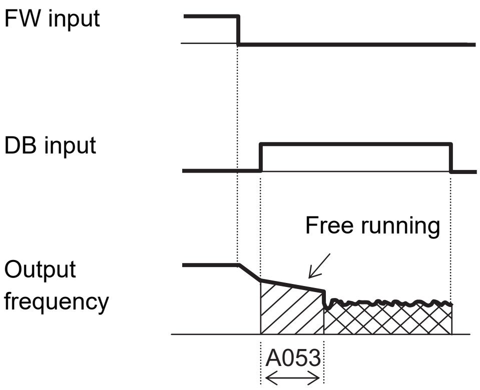
  Be aware that a limit value is automatically applied to the DC Injection Braking Power (A054) setting.

- When the DC Injection Braking Delay Time (A053) is set, the inverter shuts off its output and remains in a free-run sate during the set time. After the expiration of the set time, the inverter starts DC injection braking.
- In the DC Injection Braking Edge/Level Selection (A056), you can set the operation of DC injection braking after the terminal DB turns ON.

  Select optimal operation according to your system, with reference to the example below.
- When A056 is set to 00 (Edge operation), you need to also set the time during which DC injection braking is applied in the DC Injection Braking Time (A055).

(a) Edge operation (A056 = 00)	(b) Level operation (A056 = 01)
(Example 1-a)  FW input DB input Output frequency A055 *1	(Example 1-b)  FW input *1 DB input Output frequency

*1. Set the DC Injection Braking Time (A055) or the DC injection time by DB input in consideration of the heat generation of the motor.

(a) Edge operation (A056 = 00)	(b) Level operation (A056 = 01)
(Example 2-a)  FW input DB input Output frequency A055	(Example 2-b)  FW input DB input Output frequency
(Example 3-a)  FW input DB input Free running Output frequency A053 A055	(Example 3-b)  FW input DB input Free running Output frequency A053

Note During free running and during DB operation, the output frequency is 0.

Controlling DC Injection Braking via Parameter Settings (A051 = 01)

Use this method to control DC injection braking according to the ON/OFF status of the RUN command.

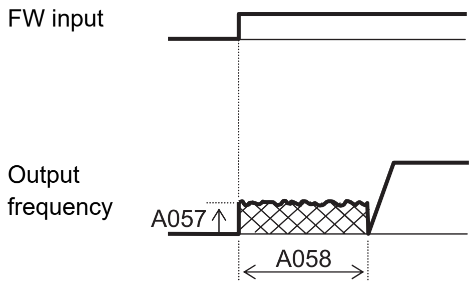
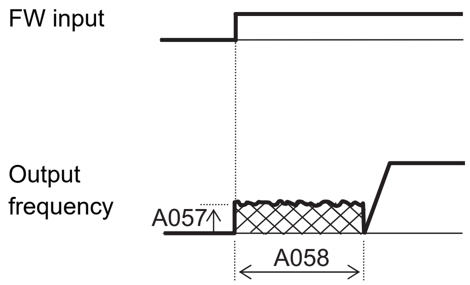
Set the DC Injection Braking Selection (A051) to 01 (Enabled).

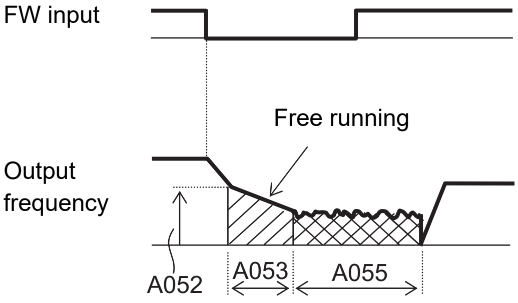
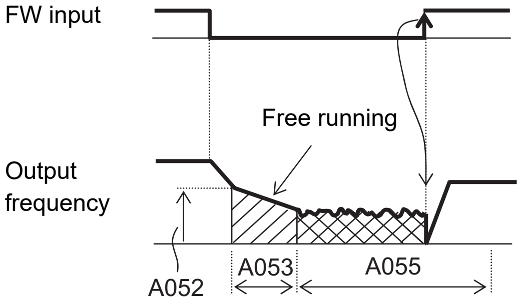
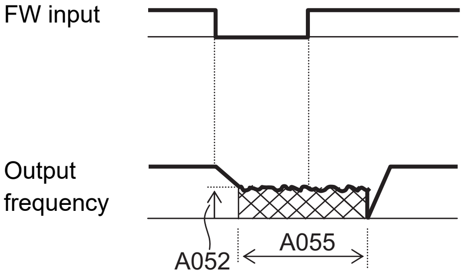
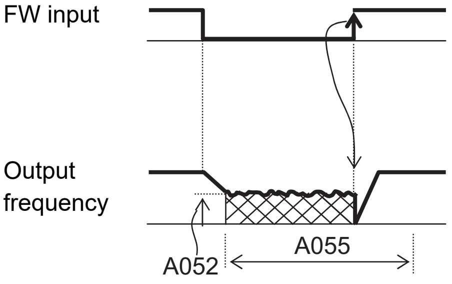
- To enable the DC injection braking function during startup, set the time during which DC injection braking is applied in the Startup DC Injection Braking Power (A057) and the time during which DC injection braking is applied in the Startup DC Injection Braking Time (A058).
- To enable the DC injection braking function during stop, set the braking power in the DC Injection Braking Power (A054), the frequency at which to start DC injection braking in the DC Injection Braking Frequency (A052), and the time during which DC injection braking is applied in the DC Injection Braking Time (A055).
- When the DC Injection Braking Delay Time (A053) is set, the inverter shuts off its output after the frequency reaches the stop frequency value set in A052 and remains in a free-run state during the time set in A053. After the expiration of the time set in A053, the inverter starts DC injection braking. (Examples 5-a and 5-b)

  When A053 is set to 0.0, DC injection braking works after the inverter reaches the frequency set in A052. (Examples 6-a and 6-b)
- In the DC Injection Braking Edge/Level Selection (A056), you can set the priority between the DC injection braking time and the RUN command input. Select optimal operation according to your system, with reference to the example below.

  However, DC injection braking during startup works independently of the DC Injection Braking Edge/Level Selection setting. (Examples 4-a and 4-b)

Edge operation	: The inverter gives priority to the DC Injection Braking Time (A055) and performs DC injection braking according to the time set in A055. Once the RUN command (FW) turns OFF, the inverter applies DC injection braking for the time set in A055 when the output frequency reaches the value set in A052. Even if the RUN command is turned ON while DC injection braking is active, the inverter continues to apply DC injection braking during the time set in A055. (Examples 5-a and 6-a)
Level operation	: Giving priority to the RUN command, the inverter ignores the DC Injection Braking Time (A055) setting and shifts to normal operation. If the RUN command turns ON while DC injection braking is active, the inverter returns to normal operation, ignoring the time set in A055. (Examples 5-b and 6-b)

(a) Edge operation (A056 = 00)	(b) Level operation (A056 = 01)
Example 4-a. During startup 	Example 4-b. During startup 

(a) Edge operation (A056 = 00)	(b) Level operation (A056 = 01)
Example 5-a. During stop (with A053 setting)  FW input Free running Output frequency A052 A053 A055	Example 5-b. During stop (with A053 setting)  FW input Free running Output frequency A052 A053 A055
Example 6-a. During stop (A053 = 0.0)  FW input Output frequency A052 A055	Example 6-b. During stop (A053 = 0.0)  FW input Output frequency A052 A055

Note During free running and during DB operation, the output frequency is 0.

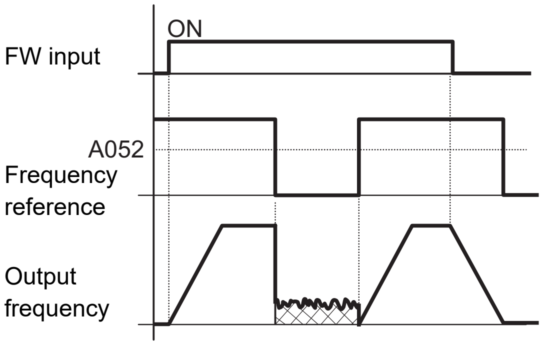
Controlling DC Injection Braking Only via Set Frequency (A051 = 02)

Use this method to control DC injection braking only by changing the set frequency.

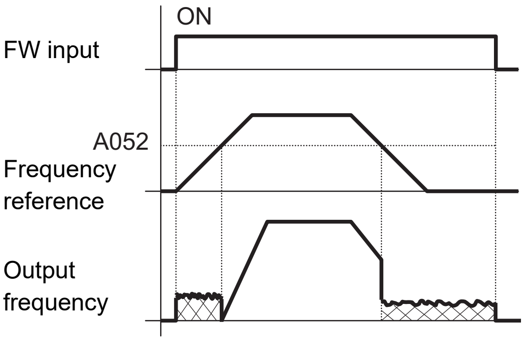
Set the DC Injection Braking Selection (A051) to 02 (Operates only via set frequency).

- When A051 is set to 02, the external DC injection braking terminal function is disabled.
- If both the set frequency and the output frequency are equal to or lower than the A052 value with the RUN command ON, the inverter starts DC injection braking. (Example 1-a)
- When the set frequency becomes +2 Hz higher than the A052 value, the inverter releases DC injection braking and returns to normal output. (Example 1-a)
- The inverter releases DC injection braking if the RUN command turns OFF with DC injection enabled. (Example 1-b)
- If the set frequency starts from 0 via analog input etc., the inverter resets both the set frequency and the output frequency and starts operation with DC injection braking. (Example 1-b)
- If the RUN command turns ON via analog input etc. with the set frequency larger than the A052 value, the inverter starts operation with the normal frequency. (Example 1-a)

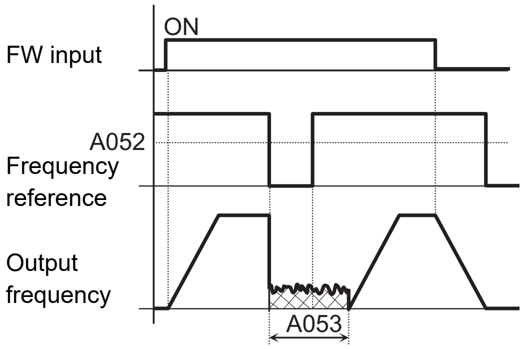
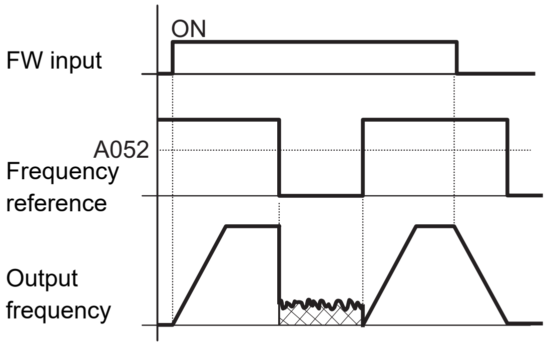
Example 1-a


ON
FW input
A052
Frequency reference
Output frequency

Example 1-b


ON
FW input
A052
Frequency reference
Output frequency

The timing in which the inverter releases DC injection braking depends on the value set in the DC Injection Braking Edge/Level Selection (A056).

(a) Edge operation (A056 = 00)	(b) Level operation (A056 = 01)
 ON FW input A052 Frequency reference Output frequency A053	 ON FW input A052 Frequency reference Output frequency

7-10 Safety Function

7-10-1 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 PLd under ISO 13849-1.

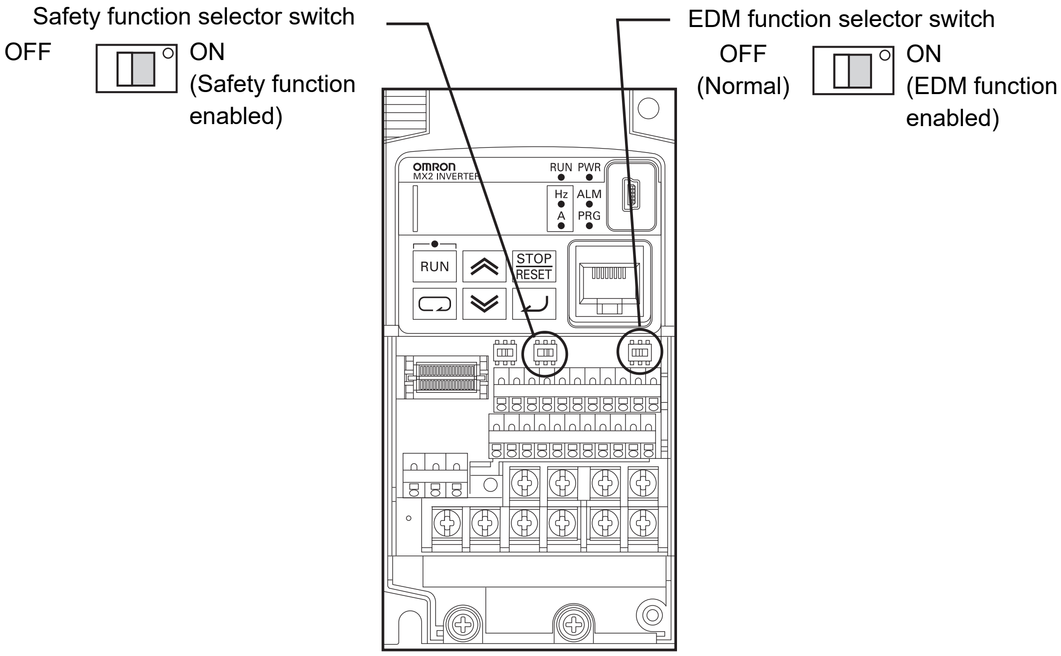
The safety input function allows the inverter output when current flows in both the terminals GS1 and GS2. When the safety input function is activated, in compliance with the above standards, the output transistor operation of the inverter is stopped safely (by shutting off its output). As a result, the motor stops with free run.

- It takes 10 ms or shorter from when the safety input is input till when the inverter shuts off the output.
- The emergency shutoff (E37) is displayed and the inverter trips. If this trip occurs simultaneously with the external trip (E12), the emergency shutoff (E37) has priority, except at power-on.
- This inverter meets PLc under ISO 13849-1 when the EDM function is not wired for use.

7-10-2 Safety Function Settings

With the inverter power supply turned off, turn ON the safety function selector switch. This automatically allocates the Multi-function Input S3/S4 Selection (C003/C004) to 77 (GS1: GS1 input) and 78 (GS2: GS2 input).

To enable the EDM output (safety monitor output), turn ON the EDM function selector switch. This automatically allocates the Multi-function Output P1 Selection (C021) to 62 (EDM).



- When the safety function selector switch or EDM function selector switch is turned from ON to OFF, the input/output terminals allocated to GS1/GS2 or EDM are reset to 255 (no: No allocation) and the input/output operation selection settings keep NC contact

7-10-3 Wiring Safety Function for Use

Perform wiring with reference to *7-10-4 Wiring Example* on page 7-99 to meet the applicable safety standards. Be sure to use both GS1 and GS2 inputs and configure a system that turns OFF both of the GS1 and GS2 input signals when the safety function is activated.

If the inverter detects that either the GS1 or GS2 input is OFF, the safety function is activated and the inverter shuts off the output.

Additional Information

The safety device monitor (62: EDM) turns ON when the inverter detects that both of the GS1 and GS2 input signals turn OFF and shuts off the output. If the EDM output signal does not turn ON even when the inverter shuts off the output by the safety function, check the GS1 and GS2 input circuits and the EDM detection circuit.

Parameter No.	Function name	Data	Default data	Unit
C003	Multi-function Input S3/S4 Selection	77: GS1 (GS1 input)[*1]	18	–
C004		78: GS2 (GS2 input)[*1]	12	
C013	Multi-function Input S3/S4 Operation Selection	01: NC (NC contact)[*1]	00	–
C014				
C021	Multi-function Output P1 Selection	62: EDM (Safety device monitor)[*2]	00	–
C031	Multi-function Output P1 Operation Selection	00: NO (NO contact) [*2]	00	–
b145	GS Input Operation Selection	00: No trip (shut off by hardware) 01: Trip[*3][*4]	00	–

*1. When the safety function selector switch is ON, these functions are forcibly set and cannot be changed.

*2. When the EDM function selector switch is ON, these functions are forcibly set and cannot be changed.

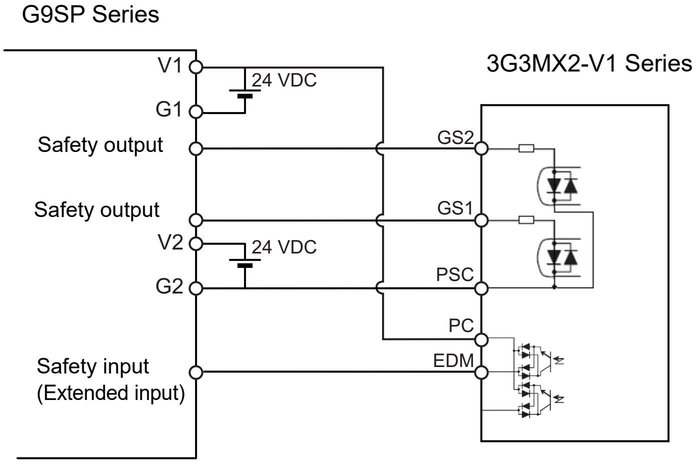
*3. The inverter will trip with E37. If this trip occurs simultaneously with the external trip (E12), the emergency shut-off (E37) has priority, except at power-on.

*4. The safety function cannot ensure safety if either one of the GS1 and GS2 input terminals turns ON during the inverter trip with E37.

7-10-4 Wiring Example

Wiring Example

Wiring example when EDM is enabled (for compliance with ISO13849-1 PLd)



When connecting to multiple inverters or safety devices, be sure to use the equipment within its guaranteed operating range, according to the above figure.

System Configuration Example

An example of the safety-compliant peripheral equipment recommendable for system configuration is shown below.

Model	Applicable standard for system configuration	Certification authority
G9SP	EN ISO13849-1 PLd Cat. 3	TÜV Rheinland

Periodic Inspection

When the safety input function is activated, the inverter shuts off its output if the current does not flow in either the terminal GS1 or GS2. Therefore, you must check the inverter periodically to ensure that there is no defect in the GS1 and GS2 wirings. Be sure to perform periodical inspection at least once a year.

For the wiring information on the terminals GS1, GS2, and EDM, refer to the table below.

Terminal	Status			
GS1	Current OFF	Current ON	Current OFF	Current ON
GS2	Current OFF	Current OFF	Current ON	Current ON
EDM	ON	OFF	OFF	OFF
Inverter output	Output shut off	Output shut off	Output shut off	Output enabled

Precautions

- 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 30 m or shorter.
- When using two or more inverters with GS1 and GS2 used as common terminals, always insert diodes as shown in *Precaution for using more than one inverter* on page 2-38. Otherwise, GS1 and GS2 may turn ON, and the inverter may output even in the safety mode.
- 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 GS1 and GS2 input signals of the inverter are is ON.**

  (5) **Turn ON the RUN command to restart the inverter.**
- It takes 10 ms or shorter from when the safety input is input till when the inverter shuts off the output.

7-11 Option/Applied Functions (Group P)

This section describes the functions associated with option unit connected to the option unit connector, as well as the applied functions of the inverter.

7-11-1 Operation Selection on Option Error

Select whether to have the inverter trip or continue operation with the error from the option unit ignored, if an error caused by the option unit connected to the connector for option unit.

Parameter No.	Function name	Data	Default data	Unit
P001	Operation Selection on Option Error	00: Trip 01: Continue operation	00	–

7-11-2 Communications Option Function

- Use this function when using a CompoNet/DeviceNet Communications Unit to communicate with the host equipment.
- For details of parameters, refer to the following manuals.
  - MX2/RX Series DeviceNet Communications Unit User's Manual (I581)
  - MX2/RX Series CompoNet Communications Unit User's Manual (I582)
- Set the network slave address in the DeviceNet MAC ID (P192) or CompoNet Node Address (P190).
- In the Assembly Instance Number (P046), set the remote I/O function of the communications unit.
- If you select the flexible format for the remote I/O function, use the following parameters to configure the interface for the remote I/O function.
  - Option I/F Flexible Format Output Register 1 to 10 (P160 to P169)
  - Option I/F Flexible Format Input Register 1 to 10 (P170 to P179)
- To command the inverter frequency reference as a rotation speed, set the number of motor poles in the Number of Poles for Rotation Speed Setting (P049).
- In the Communications Error Detection Timer Setting (P044), set the function for monitoring the data communications between the inverter and the communications unit.
- In the Operation Selection at Host Communications Error (P045), set how the inverter should operate if an error etc. occurs in the host network.
- In the Operation Selection at Idle Mode Detection (P048), set how the inverter should operate when the network is in the Idle (communications standby) mode.
- You can use a multi-function output terminal built into the inverter as a general-purpose output terminal for the communications host.
  To use it as the general-purpose output terminal for the communications host, set the Multi-function Output P1/P2 Selection (C021/C022) or Multi-function Relay Output (MA, MB) Function Selection (C026) to 63 (OPO: Option).

Parameter No.	Function name	Data	Default data	Unit
P044	Communications Error Detection Timer Setting	0.00 to 99.99	1.00	s
P045	Operation Selection at Host Communications Error	00: Trip 01: Trip after deceleration stop 02: Ignore 03: Free-run stop 04: Deceleration stop	00	–
P046	Assembly Instance Number	0 to 20	1	–

Parameter No.	Function name	Data	Default data	Unit
P048	Operation Selection at Idle Mode Detection	00: Trip 01: Trip after deceleration stop 02: Ignore 03: Free-run stop 04: Deceleration stop	00	–
P049	Number of Poles for Rotation Speed Setting	0/2/4/8 10 to 48: Do not set.	0	–
P160 to P169	Option I/F Flexible Format Output Register 1 to 10	0000 to FFFF	0000	–
P170 to P179	Option I/F Flexible Format Input Register 1 to 10	0000 to FFFF	0000	–
P190	CompoNet Node Address	0 to 63	0	–
P192	DeviceNet MAC ID	0 to 63	63	–
C021, C022	Multi-function Output P1, P2 Selection	63: OPO (Option)	–	–
C026	Multi-function Relay Output (MA, MB) Function Selection		05	–

7-11-3 DriveProgramming Function Parameters

- Set these parameters to use the DriveProgramming parameters.
- In the DriveProgramming Function Selection (A017), enable/disable the DriveProgramming function with the start/stop method.
- Use the DriveProgramming User Parameters to change the values of the user variables (U00 to U31) used in the DriveProgramming program.
- For details, refer to “DriveProgramming User’s Manual (I580)”.

Parameter No.	Function name	Data	Default data	Unit
A017	DriveProgramming Function Selection	00: Disabled 01: Enabled (Start/stop via multi-function input PRG terminal) 02: Enabled (Start/stop via power on/off)	00	–
P100 to P131	DriveProgramming User Parameter U00 to U31	0. to 9999. 1000 to 6553 (10000 to 65530)	0.	–

8

Communications Functions

This section describes the general-purpose serial communications functions (Modbus communication).

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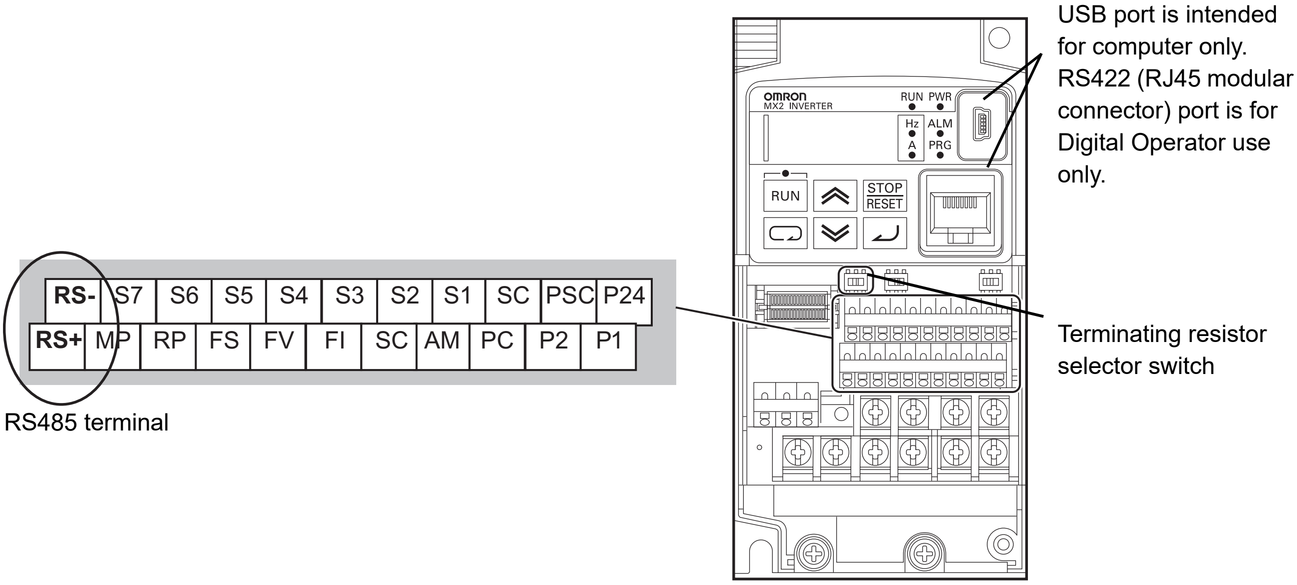
8-1 Communications Specifications

The 3G3MX2-V1 Series Inverter has the RS485-compliant Modbus communication function as standard, which enables communications with external network controllers. The basic specifications of this communications function are provided in the table below. Note that the built-in Modbus communication function is disabled when a communications option unit is mounted on the inverter.

Item	Description	Remarks
Protocol	Modbus communication (Slave)	
Transmission speed	2,400, 4,800, 9,600, 19.2 k, 38.4 k, 57.6 k, 76.8 k, 115.2 kbps	Selectable via parameter
Synchronous system	Start-stop synchronous system	
Transmission code	Binary	
Transmission mode	LSB first (Transmission starts with Least Significant Bit)	
Compatible interface	RS485	
Data bit length	8 bits	
Parity	No/Even/Odd	Selectable via parameter
Stop bit length	1 or 2 bits	Selectable via parameter
Startup method	One-side start by host command	–
Wait time	Silent Interval 0 to 1,000 [ms]	Selectable via parameter
Connection form	1: N (N = 247 max.) (32 units max. connectable without repeaters)	Selectable via parameter
Error check	Overrun/Framing/CRC-16/Horizontal parity	
Communications cable length	500 m	

8-2 RS485 Terminal Arrangement and Connection

The communications terminals are arranged as follows.

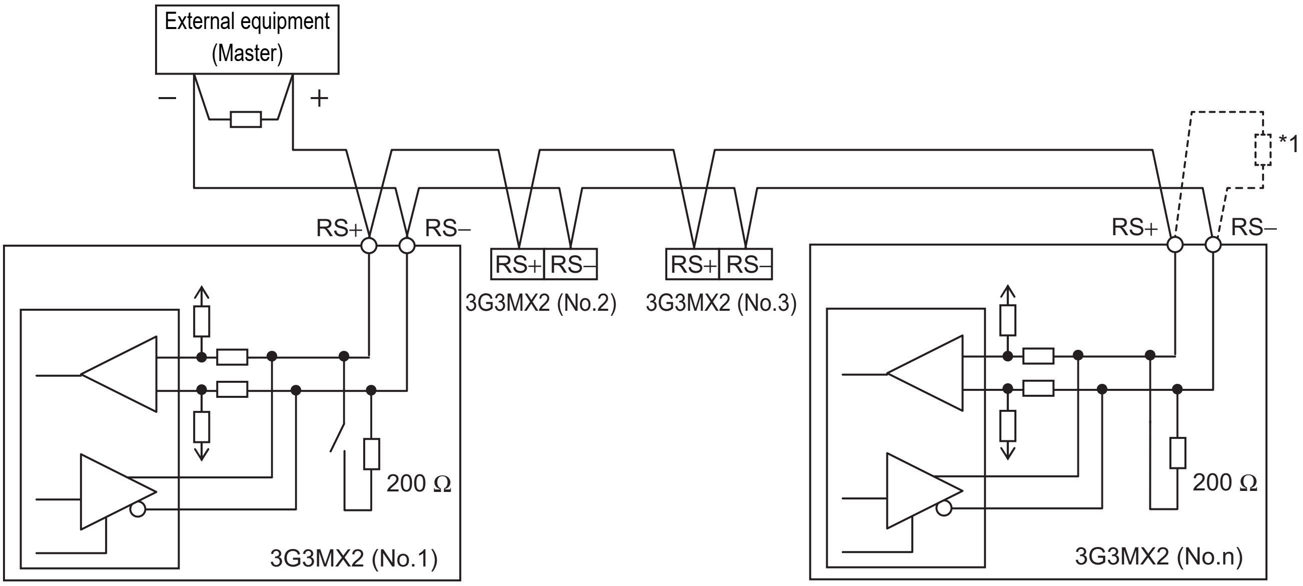


RS- S7 S6 S5 S4 S3 S2 S1 SC PSC P24
RS+ MP RP FS FV FI SC AM PC P2 P1
omron
MX2 INVERTER
RUN PWR
Hz ALM
A PRG
RUN
STOP
RESET

RS485 terminal

USB port is intended for computer only. RS422 (RJ45 modular connector) port is for Digital Operator use only.

Terminating resistor selector switch



External equipment
(Master)
−
+
*1
RS+
RS−
RS+
RS−
RS+
RS−
3G3MX2 (No.2)
RS+
RS−
3G3MX2 (No.3)
200 Ω
3G3MX2 (No.1)
200 Ω
3G3MX2 (No.n)

*1. If the communications are unstable, install a terminating resistor appropriate to the impedance of the cable to each cable end. The resistance of the terminating resistor built into this inverter is 200 Ω.

8-3 Modbus Communication Parameters

Set the following parameters according to the communications specifications.

Note that changes to the C071, C074, and C075 data are applied when the power supply is cycled.

- To control the frequency reference or RUN command via Modbus communication, set the 1st/2nd Frequency Reference Selection (A001/A201) or 1st/2nd RUN Command Selection (A002/A202) to 03 (Modbus communication).
- According to the communications specifications of the host, set the Communication Speed Selection (Baud Rate Selection) (C071), Communication Parity Selection (C074), Communication Stop Bit Selection (C075), Communication Error Timeout Time (C077), and Communication Wait Time (C078).
- In the Communication Station No. Selection (C072), set the slave address of the inverter.
- If the communications with the host are interrupted for a period longer than the Communication Error Timeout Time (C077) setting, the inverter will detect an communications error. In the Operation Selection on Communication Error (C076), set how the inverter should operate if it detects a communications error.

  When this parameter is set to 00 or 01, you must reset the trip in order to resume the inverter control.

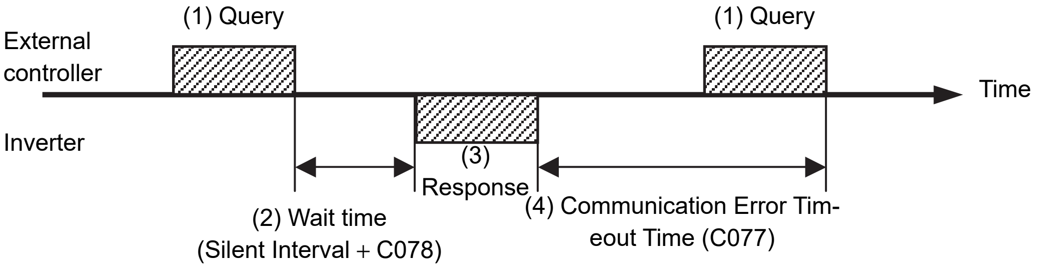
00 (Trip)	: Detects a Modbus communication error (E41.☐) and shuts of the output.
01 (Trip after deceleration stop)	: Makes a deceleration stop and detects a Modbus communication error (E41.☐).
02 (Ignore)	: Ignores the communications error and continues to run according to the current reference/command.
03 (Free-run stop)	: Shuts off the output, but does not trip.
04 (Deceleration stop)	: Makes a deceleration stop, but does not trip.

Parameter No.	Function name	Data	Default data	Unit
A001/A201	1st/2nd Frequency Reference Selection	03: Modbus communication	02	–
A002/A202	1st/2nd RUN Command Selection	03: Modbus communication	02	–
C071	Communication Speed Selection (Baud Rate Selection)	03: 2400 bps 04: 4800 bps 05: 9600 bps 06: 19.2 kbps 07: 38.4 kbps 08: 57.6 kbps 09: 76.8 kbps 10: 115.2 kbps	05	–
C072	Communication Station No. Selection	1. to 247.	1.	–
C074	Communication Parity Selection	00: No parity 01: Even parity 02: Odd parity	00	–
C075	Communication Stop Bit Selection	1: 1 bit 2: 2 bits	1	–
C076	Operation Selection on Communication Error	00: Trip 01: Trip after deceleration stop 02: Ignore 03: Free-run stop 04: Deceleration stop	02	–

Parameter No.	Function name	Data	Default data	Unit
C077	Communication Error Timeout Time	0.00: Timeout disabled 0.01 to 99.99	0.00	s
C078	Communication Wait Time	0. to 1000.	0.	ms

8-4 Modbus Communication Protocol

The inverter communicates with external controllers as follows.


(1) Query
(1) Query
External controller
Time
Inverter
(3) Response
(2) Wait time (Silent Interval + C078)
(4) Communication Error Timeout Time (C077)

(1) Frame (Query) that is sent from the external control device to the inverter

(2) After receiving a query frame, the inverter waits the total time of the silent Interval and the Communication Wait Time (C078), before returning a response.

Silent interval

The wait time that is specified on Modbus communication; its data length is 3.5 characters (3.5 bytes).

It depends on the Modbus communication speed setting.

(Example) 1 character:10 bits (1 start bit + 8 data bits + 1 stop bit)
Time required per character: 1/9,600 (bps) × 10 (bit) × 1,000 = 1.04 ms
Time required for 3.5 characters: 1.04 ms × 3.5 = 3.64 ms
However, according to the Modbus specifications, this time is fixed to 1.75 ms for communications speeds exceeding 19.2 kbps.

(3) Frame (Response) that is sent from the inverter back to the external controller.

(4) After sending a response, the inverter monitors the time until it completes receiving the query frame from the external control device. The inverter judges it as a communications error if it receives no response within the Communication Error Timeout Time (C077).

Then, the inverter operates according the Operation Selection on Communication Error (C076), while waiting for the reception of the first data again.

The monitoring of the Communication Error Timeout Time starts from the first sending/receiving operation is established after the power supply is cycled or after the inverter is reset.

The inverter does not recognize as a communications error timeout if the sending/receiving operation is not established at all.

8-4-1 Message Configuration

The command message sent from the master to a slave (or slaves) is called “query” and the response message returned from the slave(s) is called “response.” The transmission format of a query/response is as follows.

Query	Response
Slave address	Confirmation slave address
Function code	Confirmation function code
Query data	Response data
Error check (CRC-16)	Error check (CRC-16)

Slave Address

A slave address is a serial number from 1 to 247 set in advance for each inverter (slave). (Only the inverter that matches the slave address specified in the query will capture that query.)

Simultaneous broadcast to up to five groups

Set the slave address to 0 to perform broadcasting (simultaneous broadcast).

In a broadcast, all slaves receive data, but they return no response to it.

Moreover, during a broadcast, this inverter cannot perform data read or loop-back operation.

Although the Modbus specifications define the slave addresses between 1 to 247, using the slave addresses 250 to 254 on the master side enables you to perform simultaneous broadcasting by group. (In this case, the slaves return no response.)

Please note that this function is enabled for write commands (function code: 05 hex, 06 hex, 0F hex, and 10 hex) only.

Slave address	Recipient
250 (FA hex)	Simultaneous broadcast to slave addresses 01 to 09
251 (FB hex)	Simultaneous broadcast to slave addresses 10 to 19
252 (FC hex)	Simultaneous broadcast to slave addresses 20 to 29
253 (FD hex)	Simultaneous broadcast to slave addresses 30 to 39
254 (FE hex)	Simultaneous broadcast to slave addresses 40 to 247

Function Code

A function code specifies the function to be performed by the target inverter(s).

The supported function codes are as shown in the table below.

Function code

Function code	Function	Maximum number of data bytes per message	Maximum number of data per message
01 hex	Read Coil Status	4	32 coils (in bits)
03 hex	Read from Holding Register	32	16 registers (in bytes)
05 hex	Write to Coil	2	1 coil (in bits)
06 hex	Write to Holding Register	2	1 register (in bytes)
08 hex	Loop-back Test	–	–
0F hex	Write to Multiple Coils	4	32 coils (in bits)
10 hex	Write to Multiple Holding Registers	32	16 registers (in bytes)
17 hex	Read/Write from/to Multiple Holding Registers	32 each for read/write operation	16 registers each for read/write operation (in bytes)

Data

A message sends data related the function code.

The data transmission format differs depending on the function code.

Among the data used in Modbus communication, the 3G3MX2 Series supports the following data types.

Data name	Description
Coil	Binary data (1 bit) that supports read/write operation
Holding register	16-bit data that supports read/write operation

Error Check

In Modbus communication, CRC (Cyclic Redundancy Check) is used for error checking.

The CRC code is 16-bit data generated for any data block with a data length in 8-bit unit.

For CRC code generation, the following generator polynomial is used: CRC-16 ($X^{16} + X^{15} + X^2 + + 1$).

8-4-2 Required Communications Time

The time that the inverter takes to send a response after receiving a query is the sum of the silent interval (3.5 characters) and the Communication Wait Time (C078).

After receiving a response from an inverter, be sure to include an interval equivalent to the silent interval (3.5 characters) or more before sending the next query to the inverter.

(Example) 1 character:10 bits (1 start bit + 8 data bits + 1 stop bit)
Time required per character: 1/9,600 (bps) × 10 (bit) × 1,000 = 1.04 ms
Time required for 3.5 characters: 1.04 ms × 3.5 = 3.64 ms
However, according to the Modbus specifications, this time is fixed to 1.75 ms for communications speeds exceeding 19.2 kbps.

8-4-3 Normal Response

If the function code included in a query is for the Loop-back Test (08 hex), Write to Coil (05 hex, 0F hex), or Write to Holding Register(s) (06 hex,10 hex) function, the inverter returns a response with the same content as that of the query.

If the function code included in a query is for the Read Coil Status (01 hex) or Read from Holding Register (03 hex) function, the inverter returns a response that includes data with the same slave address and function code.

Refer to the later section, *8-5 Explanation of Each Function Code* on page 8-11.

8-4-4 Abnormal Response

● Response

Slave address
Function code
Exception code
Error check (CRC-16)

If an error (except for a communications error) is found in the query content, the inverter will return an exception response without performing any operation.

For the cause of an error, check the function code for the response. The function code for an exception response is the sum of the function code for the query and 80 hex (where the MSB is 1). For the cause of an error, check the exception code.

Exception code

Code	Description
01 hex	An unsupported function is specified.
02 hex	The specified address does not exist.
03 hex	The specified data is in an unacceptable format.
21 hex	Writing to a holding register is specified, but the data is out of the range allowed for the inverter.
22 hex	The inverter does not allow this function because: • Function attempts to change a register that cannot be changed during RUN. • Function attempts to issue the Enter command during RUN (UV [*1]). • Function attempts to write data to a register during trip (UV [*1]). • Function attempts to write data to a register on which the soft lock function is enabled. • Function attempts to change an I/O terminal that cannot be changed. • Function attempts to change the contact type of the terminal to which the RS (Reset) is allocated. • Function attempts to write data to a register when the auto-tuning function is enabled. • Function attempts to write data to a password-locked register when the password function is enabled. etc.
23 hex	Function attempts to write data to a read-only register (coil).

[*1] UV: Undervoltage

8-4-5 No Response

The inverter will ignore the query and return no response if:

- It receives a broadcast (query with the address set to 0).
- It detects a communications error in receiving a query.
- The slave address specified in a query differs from the inverter's slave address setting.
- The length of the time interval set for the inverter to receive the next data of the message after receiving a message is less than 3.5 characters.
- The data length of a query is inappropriate.
- The length of the reception interval in a frame exceeds 1.5 characters.
- The error check code specified in a query does not match (CRC error).
- It receives a simultaneous broadcast by group (query with the address set to 250 to 254).

- Provide a timer on the master side for monitoring the response and set it to resend the same query if no response is received within the set time.

8-5 Explanation of Each Function Code

8-5-1 Read Coil Status [01 hex]

Reads the coil status (ON/OFF).

Example. Reading Data from Multi-function Input Terminals S1 to S7 of Inverter with Slave Address 1

The status of each multi-function input terminal is as follows.

Item	Data						
Coil No.	0007 hex	0008 hex	0009 hex	000A hex	000B hex	000C hex	000D hex
Multi-function input terminal	S1	S2	S3	S4	S5	S6	S7
Coil status	ON	OFF	ON	OFF	OFF	OFF	ON

- **Query**

No.	Field name	Example [hex]
1	Slave address [*1]	01
2	Function code	01
3	Coil start address (MSB) [*2]	00
4	Coil start address (LSB) [*2]	06
5	Number of coils (MSB)	00
6	Number of coils (LSB)	07
7	CRC-16 (LSB)	9D
8	CRC-16 (LSB)	C9

(Coil address) = (Coil number) – 1

- **Response**

No.	Field name	Example [hex]
1	Slave address [*1]	01
2	Function code	01
3	Number of data bytes	01
4	Coil data [*3]	45
7	CRC-16 (MSB)	90
8	CRC-16 (LSB)	7B

Input terminal S7

Input terminal S1

←45 hex = 0100 0101

[*1] Broadcasting cannot be performed.

[*2] Note that the coil start address is 0006, which is 1 less than the coil number 0007: Coil start address = Coil number - 1.

[*3] Data as much as the number of data bytes will be transferred. The MSB (the first received data) has the smallest coil address.

The data received in a response shows the status for coils 0007 to 000D hex. Therefore, the received data “45 hex = 0100 0101b” can be read, with the status for coil 0007 hex as the LSB, as described in “Response” on the previous page.

The received data is always transferred in 1-byte (8 bits) format. Bits that lack data are transferred as 0.

If the Read Coil Status function is not executed normally, refer to *8-5-9 Exception Response* on page 8-20.

(Example) When the status of 16 coils starting from coil number 0001 hex is read, the order of data is as shown below. Data 1 is the initial byte data to be sent.

	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
Data 1	0008 hex	0007 hex	0006 hex	0005 hex	0004 hex	0003 hex	0002 hex	0001 hex
Data 2	0010 hex	000F hex	000E hex	000D hex	000C hex	000B hex	000A hex	0009 hex

8-5-2 Read from Holding Register [03 hex]

Reads the contents of consecutive holding registers. From the specified holding register, the specified number of holding registers can be read.

Example. Reading Latest Trip Data (0012 to 0017 Hex) from Inverter with Slave Address 1

● Query

No.	Field name	Example [hex]	
1	Slave address [*1]	01	
2	Function code	03	
3	Register start address (MSB) [*2]	00	(Register address) = (Register number) – 1
4	Register start address (LSB) [*2]	11	
5	Number of holding registers (MSB)	00	6 registers
6	Number of holding registers (LSB)	06	
7	CRC-16 (MSB)	95	
8	CRC-16 (LSB)	CD	

- **Response**

No.	Field name	Example [hex]
1	Slave address *1	01
2	Function code	03
3	Number of data bytes *3	0C
4	Register data 1 (MSB)	00
5	Register data 1 (LSB)	03
6	Register data 2 (MSB)	00
7	Register data 2 (LSB)	04
8	Register data 3 (MSB)	00
9	Register data 3 (LSB)	00
10	Register data 4 (MSB)	04
11	Register data 4 (LSB)	D2
12	Register data 5 (MSB)	01
13	Register data 5 (LSB)	2C
14	Register data 6 (MSB)	0B
15	Register data 6 (LSB)	18
16	CRC-16 (MSB)	D0
17	CRC-16 (LSB)	6D

0003 hex → 03 dec → E03 (Factor: Overcurrent)

0004 hex → 4 dec (Inverter status: During acceleration)

0000 04D2 hex → 1234 dec → 12.34 [Hz] (Frequency)

012C hex → 300 dec → 3.00 [A] (Current)

0B18 hex → 2840 dec → 284.0 [V] (DC voltage)

dec: Decimal

hex: Hexadecimal

*1. Broadcasting cannot be performed.

*2. Note that the holding register start address is 0011 hex, which is 1 less than the register number 0012 hex: Register address = Register number - 1.

*3. Data as much as the number of data bytes will be transferred. In this example, the inverter sends back data from six holding registers, which is 12 (0C hex) bytes.

8-5-3 Write to Coil [05 hex]

Writes the ON/OFF status to a single coil. The coil status changes as shown in the table below.

Data	Coil status	
	OFF to ON	ON to OFF
Written data (MSB)	FF hex	00 hex
Written data (LSB)	00 hex	00 hex

Example. Issuing RUN Command to Inverter with Slave Address 1

You need to set the 1st RUN Command Selection (A002) to03 (Modbus communication).
The coil number for the RUN command is 0001.

- **Query**

No.	Field name	Example [hex]
1	Slave address *1	01
2	Function code	05
3	Coil address (MSB) *2	00
4	Coil address (LSB) *2	00
5	Written data (MSB)	FF
6	Written data (LSB)	00
7	CRC-16 (MSB)	8C
8	CRC-16 (LSB)	3 A

(Coil address) = (Coil number) – 1

OFF to ON: FF00 hex

Response

No.	Field name	Example [hex]
1	Slave address [*1]	01
2	Function code	05
3	Coil address (MSB) [*2]	00
4	Coil address (LSB) [*2]	00
5	Written data (MSB)	FF
6	Written data (LSB)	00
7	CRC-16 (MSB)	8C
8	CRC-16 (LSB)	3 A

*1. For a broadcast, no response will be sent back.

*2. Note that the coil address is 0000, which is 1 less than the coil number 0001: Coil address = Coil number - 1.

If the Write to Coil function is not executed normally, refer to *8-5-9 Exception Response* on page 8-20.

8-5-4 Write to Holding Register [06 hex]

Writes data to the specified holding register.

Example. Writing 50.00 Hz to Inverter with Slave Address 1 as Output Frequency Setting Value (F001 = A020)

Because the holding registers for the Output Frequency Setting/Monitor (F001) have a data resolution of 0.01 Hz, to set 50.00 Hz, set the written data to 5000 (1388 hex).

Query

No.	Field name	Example [hex]	
1	Slave address [*1]	01	
2	Function code	06	
3	Register address (MSB) [*2]	00	(Register address) = (Register number) – 1
4	Register address (LSB) [*2]	01	
5	Written data (MSB)	13	1388 hex → 5000 dec → 50.00 Hz
6	Written data (LSB)	88	
7	CRC-16 (MSB)	D5	
8	CRC-16 (LSB)	5C	

Precautions for Correct Use

Some parameter data, such as the Output Frequency Setting/Monitor (F001), 1st/2nd Multi-step Speed Reference 0 (A020/A220), Multi-step Speed Reference 1 to 15 (A021 to A035), 1st/2nd Acceleration Time 1 (F002/A202), and 1st/2nd Deceleration Time 1 (F003/A203), occupy two registers. In Modbus communication, handle these parameters as follows:

- For reading/writing data from/to an MSB register, use the Read/Write from/to Multiple Holding Registers function to read/write data from/to two registers at the same time.
  Attempting to read/write data from/to only the MSB register results in an error and you will receive an exception response.
- For an LSB register, however, attempts to read/write from/to only a single register will be processed successfully. The MSB register data remains intact in this case.

- **Response**

No.	Field name	Example [hex]
1	Slave address [*1]	01
2	Function code	06
3	Register address (MSB) [*2]	00
4	Register address (LSB) [*2]	01
5	Written data (MSB)	13
6	Written data (LSB)	88
7	CRC-16 (MSB)	D5
8	CRC-16 (LSB)	5C

*1. For a broadcast, no response will be sent back.

*2. Note that the holding register start address for F001(LOW) is 0001 hex, which is 1 less than the register number 0002 hex: Register address = Register number - 1.

Note that, except for F001, changing the parameter value on the data display does not update the displayed data realtime. To view the updated value, once return to the parameter display and then display the data again.

If the Write to Holding Register function is not executed normally, refer to *8-5-9 Exception Response* on page 8-20.

8-5-5 Loop-back Test [08 hex]

Checks the communications between the master and the slave. Any value can be used for test data.

Example. Perform a Loop-back Test on Inverter with Slave Address 1

- **Query**

No.	Field name	Example [hex]
1	Slave address[*1]	01
2	Function code	08
3	Test sub code (MSB)	00
4	Test sub code (LSB)	00
5	Data (MSB)	Any
6	Data (LSB)	Any
7	CRC-16 (MSB)	CRC
8	CRC-16 (LSB)	CRC

- **Response**

No.	Field name	Example [hex]
1	Slave address *1	01
2	Function code	08
3	Test sub code (MSB)	00
4	Test sub code (LSB)	00
5	Data (MSB)	Any
6	Data (LSB)	Any
7	CRC-16 (MSB)	CRC
8	CRC-16 (LSB)	CRC

*1. Broadcasting cannot be performed.

The test sub code supports the Echo Query Data command (00 hex, 00 hex) only. Other commands are not supported.

8-5-6 Write to Multiple Coils [0F hex]

Rewrites the ON/OFF status to consecutive multiple coils.

Example. Changing Status of Multi-function Input Terminals S1 to S7 of Inverter with Slave Address 1

Change the ON/OFF status of the multi-function input terminal S1 to S7 as shown in the following table.

Item	Data						
Coil No.	0007 hex	0008 hex	0009 hex	000A hex	000B hex	000C hex	000D hex
Multi-function input terminal	S1	S2	S3	S4	S5	S6	S7
Terminal status	ON	ON	ON	OFF	ON	OFF	OFF

- **Query**

No.	Field name	Example [hex]
1	Slave address *1	01
2	Function code	0F
3	Coil start address (MSB) *2	00
4	Coil start address (LSB) *2	06
5	Number of coils (MSB)	00
6	Number of coils (LSB)	07
7	Number of bytes	02
8	Change data (MSB) *3	17
9	Change data (LSB) *3	00
10	CRC-16 (MSB)	06
	CRC-16 (LSB)	98

(Coil address) = (Coil number) – 1

17 hex = 0001 0111

Input terminal S1 input

Input terminal S7

● Response

No.	Field name	Example [hex]
1	Slave address [*1]	01
2	Function code	0F
3	Coil start address (MSB) [*2]	00
4	Coil start address (LSB) [*2]	06
5	Number of coils (MSB)	00
6	Number of coils (LSB)	07
7	CRC-16 (MSB)	F4
8	CRC-16 (LSB)	08

[*1] During a broadcast, no response will be sent back.

[*2] Note that the coil start address is 0006, which is 1 less than the coil number 0007: Coil start address = Coil number - 1.

[*3] Since written data occupies both MSB and LSB as a set, make the data to have an even number of bytes by adding one byte of padding data, even if you actually need to change an odd number of bytes.

A multi-function input terminal is recognized as ON when either the terminal block input or the communications setting turns ON.

Also note that the Multi-function Input Monitor (d005) monitors the terminal block input only.

If the Write to Multiple Coils function is not executed normally, refer to *8-5-9 Exception Response* on page 8-20.

(Example) When the status of coils from coil number 0001 to 000D hex is written, the order of data is as shown below. Data 1 is the initial byte data to send.

	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
Data 1	0008 hex	0007 hex	0006 hex	0005 hex	0004 hex	0003 hex	0002 hex	0001 hex
Data 2	–	–	–	000D hex	000C hex	000B hex	000A hex	0009 hex

8-5-7 Write to Multiple Holding Registers [10 hex]

Writes data to consecutive multiple holding registers.

Example. Writing 10 Seconds to Inverter with Slave Address 1 as 1st Acceleration Time 1 (F002) Value

Because the holding registers 1103 to 1104 hex for the 1st Acceleration Time 1 (F002) has a data resolution of 0.01 s, to set 10 seconds, set the written data to 1000 (0000 03E8 hex).

- **Query**

No.	Field name	Example [hex]	
1	Slave address [*1]	01	
2	Function code	10	
3	Register start address (MSB) [*2]	11	(Register address) = (Register number) – 1
4	Register start address (LSB) [*2]	02	
5	Number of registers (MSB)	00	
6	Number of registers (LSB)	02	
7	Number of bytes [*3]	04	
8	Written data 1 (MSB)	00	0000 03E8 hex → 1000 dec → 10.00 s
9	Written data 1 (LSB)	00	
10	Written data 2 (MSB)	03	
11	Written data 2 (LSB)	E8	
12	CRC-16 (MSB)	B2	
13	CRC-16 (LSB)	98	

- **Response**

No.	Field name	Example [hex]
1	Slave address [*1]	01
2	Function code	10
3	Register start address (MSB) [*2]	11
4	Register start address (LSB) [*2]	02
5	Number of registers (MSB)	00
6	Number of registers (LSB)	02
7	CRC-16 (MSB)	E5
8	CRC-16 (LSB)	34

[*1] During a broadcast, no response will be sent back.

[*2] Note that the holding register start address is 1102 hex, which is 1 less than the register number 1103 hex: Register starting address = Register number - 1.

[*3] This is not the number of holding registers, but the number of bytes to be changed actually.

If the Write to Multiple Registers function is not executed normally, refer to *8-5-9 Exception Response* on page 8-20.

8-5-8 Read/Write from/to Multiple Holding Registers [17h]

Reads data from and writes data to consecutive multiple holding registers in a continuous manner.

Example. Writing 50.00 Hz to Output Frequency Setting/Monitor (F001) and Reading from Output Frequency Monitor (d001) Value from Inverter with Slave Address 1

Because the holding registers 0001 to 0002 hex for the Output Frequency Setting/Monitor (F001) have a data resolution of 0.01 s, to set 50.00 Hz, set the written data to 5000 (0000 1388 hex).
Similarly, the holding registers for the Output Frequency Monitor (d001) are 1001 to 1002 hex.

- **Query**

No.	Field name	Example [hex]	
1	Slave address [*1]	01	
2	Function code	17	
3	Read register start address (MSB) [*2]	10	(Register address) = (Register number) – 1
4	Read register start address (LSB) [*2]	00	
5	Number of read registers (MSB)	00	
6	Number of read registers (LSB)	02	
7	Write register start address (MSB) [*2]	00	(Register address) = (Register number) – 1
8	Write register start address (LSB) [*2]	00	
9	Number of write registers (MSB)	00	
10	Number of write registers (LSB)	02	
11	Number of written data bytes n	04	
12	Written data 1 (MSB)	00	0000 1388 hex → 5000 dec → 50.00 Hz
13	Written data 1 (LSB)	00	
14	Written data 2 (MSB)	13	
15	Written data 2 (LSB)	88	
16	CRC-16 (MSB)	F4	
17	CRC-16 (LSB)	86	

- **Response**

No.	Field name	Example [hex]	
1	Slave address [*1]	01	
2	Function code	17	
3	Number of read data bytes n	04	
4	Read data 1 (MSB)	00	0000 1388 hex → 5000 dec → 50.00 Hz
5	Read data 1 (LSB)	00	
6	Read data 2 (MSB)	13	
7	Read data 2 (LSB)	88	
8	CRC-16 (MSB)	F4	
9	CRC-16 (LSB)	71	

[*1] Broadcasting cannot be performed.

[*2] Note that the holding register start address is 1 less than the register number: Register address = Register number - 1.

If the Read/Write from/to Multiple Holding Registers function is not executed normally, refer to *8-5-9 Exception Response* on page 8-20.

8-5-9 Exception Response

In a query, the master requests a response, except for broadcast or simultaneous broadcast by group. Although the inverter normally returns a response to the query, it returns an exception response if the query has an error.

An exception response has the field configuration shown in the table below.

Field configuration
Slave address
Function code
Exception code
Error check

The details of the field configuration are as shown below. An exception response has a function code, which is the sum of the function code value of the query and 80 hex. An exception code shows the factor of the exception response.

Function code	
Query	Exception Response
01 hex	81 hex
03 hex	83 hex
05 hex	85 hex
06 hex	86 hex
0F hex	8F hex
10 hex	90 hex
17 hex	97 hex

* The MSB is 1.

Exception code	Description
01 hex	An unsupported function is specified.
02 hex	The specified address does not exist.
03 hex	The specified data is in an unacceptable format.
21 hex	The Write to Holding Register function is specified, but the data is out of the setting range.
22 hex	The inverter does not allow this function because: • Function attempts to change a register that cannot be changed during RUN. • Function attempts to issue the Enter command during RUN (UV [*1]). • Function attempts to write data to a register during trip (UV[*1]). • Function attempts to write data to a register on which the soft lock function is enabled. • Function attempts to change an I/O terminal that cannot be changed. • Function attempts to change the contact type of the terminal to which the RS (Reset) is allocated. • Function attempts to write data to a register when the auto-tuning function is enabled. • Function attempts to write data to a password-locked register when the password function is enabled.
23 hex	Function attempts to write data to a read-only register (coil).

[*1] UV: Undervoltage

8-6 Saving a Change to Holding Register (Enter Command)

The Write to Holding Register (06 hex) or Write to Consecutive Holding Registers (10 hex or 17 hex) function is used to enable new register data. However, the new data is not stored in the EEPROM of the inverter and is restored to the previous value when the inverter power supply is shut off.

To store a change to holding registers in the inverter's EEPROM memory, issue the Enter command according to the following procedure. In addition, after changing a control parameter, you need to recalculate the motor parameters. In this case, also use the Enter command to execute recalculation.

8-6-1 How to Issue Enter Command

Use the Write to Holding Register (06 hex) command to write data to the holding register for the Enter command (0900 hex). Below are the values to be written to the holding register (0900 hex).

Set value	Description
0000	Motor parameter initialization *1
0001	Set value storage
0002 to FFFF	Motor parameter initialization *1 and set value storage

*1. When the motor parameter initialization is executed, the parameters listed below are initialized to the default data.

● The list of parameters that are initialized by the motor parameter initialization

Parameter No.	Function name
A003/A203	Base Frequency
A004/A204	Maximum Frequency
A044/A244	Control Method
A082/A282	Motor Rated Voltage Selection
b112	Free V/f Frequency 7
H002/H202	Motor parameter selection
H003/H203	Motor Capacity
H004/H204	Motor Pole Number
H005/H205	Speed Response
H020/H220 to H024/H224	Various motor parameters

Parameter No.	Function name
H030/H230 to H034/H234	Various motor parameters (Auto-tuning Data)
H102	PM Motor Parameter Selection
H103	PM Motor Capacity
H104	PM Motor Pole Number
H105	PM Motor Rated Current
H106 to H110	Various PM motor parameters
H111 to H113	Various PM motor parameters (Auto-tuning Data)
H116	PM Motor Speed Response

Precautions for Correct Use

- After receiving the Enter command, the inverter returns a response to the host and writes the value to the EEPROM memory. You can monitor the during data write signal (Coil No. 0049 hex) to check whether the data is written.
- Since the inverter's EEPROM memory has a limit for the number of rewrites (approximately 100,000 times), the inverter life may be shortened if the Enter command is frequently used.

Example. Issuing Enter Command (Storing Set Value) for Inverter with Slave Address 8

- **Query**

No.	Field name	Example [hex]
1	Slave address[*1]	08
2	Function code	06
3	Register address (MSB) [*2]	08
4	Register address (LSB) [*2]	FF
5	Written data (MSB)	00
6	Written data (LSB)	01
7	CRC-16 (MSB)	7A
8	CRC-16 (LSB)	C3

(Register address) = (Register number) – 1

- **Response**

No.	Field name	Example [hex]
1	Slave address	08
2	Function code	06
3	Register address (MSB) [*2]	08
4	Register address (LSB) [*2]	FF
5	Written data (MSB)	00
6	Written data (LSB)	01
7	CRC-16 (MSB)	7A
8	CRC-16 (LSB)	C3

[*1] For a broadcast, no response will be sent back.

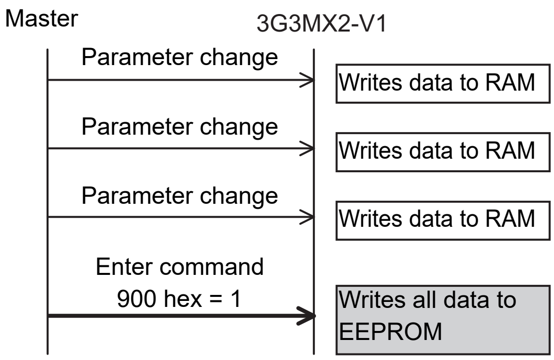
[*2] Note that the register address is 08FF hex, which is 1 less than the register number 0900 hex.

8-6-2 EEPROM Write Mode

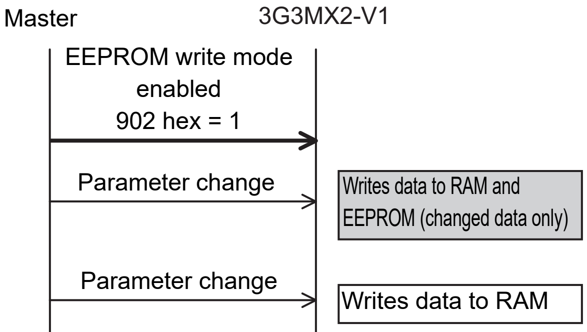
- To set the EEPROM write mode, use the Write to Holding Register (06 hex) command etc. to write 1 to the holding register for the EEPROM write mode (0902 hex).
- In the EEPROM write mode, the data changed by the Write to Holding Register (06 hex) command is written to both the RAM (volatile memory for operation) and the EEPROM (non-volatile memory for storage). Then, the EEPROM write mode is canceled.
- The EEPROM write mode is canceled also if a command other than the Write to Holding Register (06 hex) command is received in the EEPROM write mode.

● Difference between enter command and EEPROM write mode

Enter command


Master
3G3MX2-V1
Parameter change
Writes data to RAM
Parameter change
Writes data to RAM
Parameter change
Writes data to RAM
Enter command
900 hex = 1
Writes all data to EEPROM

EEPROM write mode


Master
3G3MX2-V1
EEPROM write mode enabled
902 hex = 1
Parameter change
Writes data to RAM and EEPROM (changed data only)
Parameter change
Writes data to RAM

EEPROM write mode is enabled only for a single parameter change operation.

8-7 Modbus Mapping Function

The 3G3MX2-V1 Series Inverter newly has the Modbus mapping function.

This Modbus mapping function can change up to 10 register addresses.

For example, when designing replacement, you can match the inverter-side register addresses without changing the communications program.

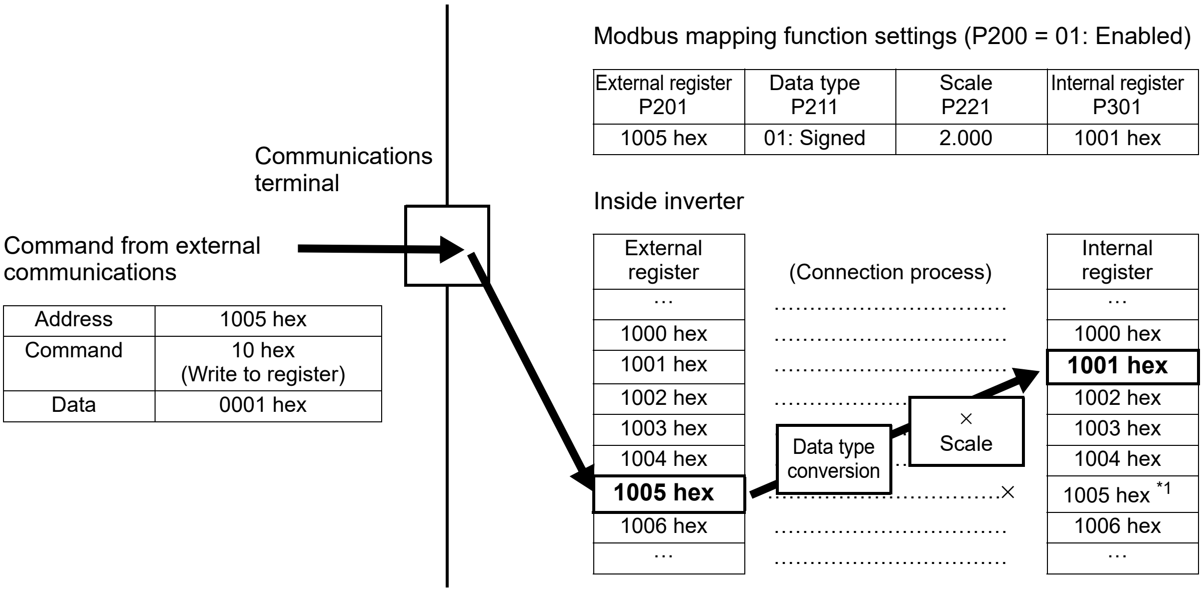
It is also possible to set the data type, scale, and endian (byte order) of communication data according to your application.

8-7-1 Operation of Modbus Mapping Function

The Modbus mapping function can set up to 10 register addresses.

This function processes the command, which is sent to the external register address specified from the external communications, for data in the address set in Modbus Mapping Internal Register.

Even if the data are different between the external and internal registers, it is possible to adjust data by the settings of Modbus Mapping External Register Type and Modbus Mapping Scaling.



Modbus mapping function settings (P200 = 01: Enabled)

External register P201	Data type P211	Scale P221	Internal register P301
1005 hex	01: Signed	2.000	1001 hex

Command from external communications

Address	1005 hex
Command	10 hex (Write to register)
Data	0001 hex

Communications terminal
Inside inverter
External register
(Connection process)
Internal register
…
1000 hex
1001 hex
1002 hex
1003 hex
1004 hex
1005 hex
1006 hex
…
Data type conversion
×
Scale
×
…
1000 hex
1001 hex
1002 hex
1003 hex
1004 hex
1005 hex *1
1006 hex
…

*1. The internal register (Modbus register inside the inverter) that overlaps with the external register setting is disabled.

To use that internal register, set an external register not to overlap or set a different Modbus mapping function to access from a different address.

8-7-2 Modbus Mapping Function Settings

To use the Modbus mapping function, set the Modbus Mapping Function Selection (P200) to 01 (Modbus mapping enabled) and set each Modbus mapping parameter.

- Each number of 1 to 10 in Modbus Mapping External Register, Modbus Mapping External Register Type, Modbus Mapping Scaling, and Modbus Mapping Internal Register corresponds to one set of Modbus mapping function settings, respectively.
- In the Modbus Mapping External Register 1 to 10 (P201 to P210), set the register address to receive commands from external communications. When this is set to 0000, the command will not be processed.
- In the Modbus Mapping External Register Type 1 to 10 (P211 to P220), set the data type used for the external register on the external communications side.
- In the Modbus Mapping Scaling 1 to 10 (P221 to P230), set the scale factor for receiving data from external communications and capturing it into the inverter. Conversely, each of these settings provides a subtraction factor when internal data is output to external communications.
- In the Modbus Mapping Internal Register 1 to 10 (P301 to P310), set the Modbus register address inside the inverter to process commands from external communications.

  For the Modbus register addresses of the inverter, refer to *8-9 Modbus Communication Data Lists* on page 8-37.
- The Modbus mapping function is intended for 16-bit single-word data only and does not support double-word data and coils. Therefore, the main information with double-word data is compressed into single-word data to be used in the Modbus mapping function.

  Refer to the register list provided in *8-7-3 Compressed Single-word Registers* on page 8-26.
- After setting or changing the Modbus mapping function, be sure to cycle the inverter power supply.

  Until the power supply is cycled, the inverter does not apply the changes to the Modbus mapping function settings.
- If the Modbus communication function is executed with any erroneous Modbus function setting, the inverter will return an exception response to the command. In this case, check the exception code for the exception response.

  For details on exception codes, refer to *8-7-4 Troubleshooting for Modbus Mapping Function* on page 8-28.

Parameter No.	Function name	Data	Default data	Unit
P200	Modbus Mapping Function Selection	00: Standard Modbus address 01: Modbus mapping enabled	00	–
P201 to P210	Modbus Mapping External Register 1 to 10	0000 to FFFF hex	0000	–
P211 to P220	Modbus Mapping External Register Type 1 to 10	00: Unsigned 01: Signed	00	–
P221 to P230	Modbus Mapping Scaling 1 to 10	0.001 to 65.535	1.000	–
P301 to P310	Modbus Mapping Internal Register 1 to 10	0000 to FFFF hex	0000	–

Precautions for Correct Use

- The Modbus mapping function settings are reflected on not only Modbus communication, but also USB communications and communications option units.

  Set and use the USB communications and communications option units as follows.

When using CX-Drive:	When the CX-Drive is used to read/write parameters, be sure to set in advance the Modbus Mapping Function Selection (P200) to 00 (Standard Modbus address). If the Modbus Mapping Function Selection (P200) is set to 01 (Modbus mapping enabled), the operation is performed for the set address. Therefore the data is not read/written from/to the intended parameter.
When using communications option units:	Be sure to set the Modbus Mapping Function Selection (P200) to 00 (Standard Modbus address). Otherwise, the internal process cannot be performed normally between the inverter and communications option unit.

- If the same address is set in the Modbus Mapping External Register 1 to 10 (P201 to P210), the inverter will return an exception response with the exception code “32 hex” attached to the communications command.
- If an address that does not exist in the internal Modbus register or double-word data address is set in the Modbus Mapping Internal Register 1 to 10 (P301 to P310), the inverter will return an exception response with the exception code “31 hex” or “32 hex” attached to the communications command.
- Be sure to set the Modbus Mapping External Register Type 1 to 10 (P211 to P220) and Modbus Mapping Scaling 1 to 10 (P221 to P230) correctly. After setting these parameters, check that data values are set as intended.

  Note that the inverter does not perform checks other than the upper and lower limit checks and operates according to settings even if they are incorrect.

8-7-3 Compressed Single-word Registers

The Modbus mapping function is intended for 16-bit single-word data only and does not support double-word data and coils. Therefore, the main information with double-word data is compressed into single-word data to be used in the Modbus mapping function. Also, the main coils with single-word data are provided.

For compressed single-word registers, refer to the list below.

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution
1E21 hex	1E20 hex	Output Frequency Monitor	d001	R	0 to 40000 (58000) *1	0.01 [Hz]
1E22 hex	1E21 hex	PID Feedback Value Monitor	d004	R	0 to 65535	0.01
1E23 hex	1E22 hex	Output Frequency Monitor (After conversion)	d007	R	0 to 65535	0.01
1E24 hex	1E23 hex	Real Frequency Monitor	d008	R	–32768 to 32767	0.01 [Hz]
1E25 hex	1E24 hex	Fault Monitor 1 Frequency	d081	R	0 to 40000 (58000) *1	0.01 [Hz]
1F31 hex	1F30 hex	Output Frequency Setting/ Monitor	F001	R/W	0/Starting frequency to Maximum frequency	0.01 [Hz]
1F32 hex	1F31 hex	1st Acceleration Time 1	F002	R/W	0 to 65535	0.01 [s]

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution
1F33 hex	1F32 hex	1st Deceleration Time 1	F003	R/W	0 to 65535	0.01 [s]
1F34 hex	1F33 hex	1st Multi-step Speed Reference 0	A020	R/W	0/Starting Frequency to 1st Maximum Frequency	0.01 [Hz]
1F35 hex	1F34 hex	Multi-step Speed Reference 1	A021	R/W	0/Starting frequency to Maximum frequency	0.01 [Hz]
1F36 hex	1F35 hex	Multi-step Speed Reference 2	A022	R/W	0/Starting frequency to Maximum frequency	0.01 [Hz]
1F37 hex	1F36 hex	Multi-step Speed Reference 3	A023	R/W	0/Starting frequency to Maximum frequency	0.01 [Hz]
1F38 hex	1F37 hex	1st Frequency Upper Limit	A061	R/W	0/Frequency Lower Limit to Maximum Frequency	0.01 [Hz]
1F39 hex	1F38 hex	1st Frequency Lower Limit	A062	R/W	0 to Frequency Upper Limit	0.01 [Hz]
1F3A hex	1F39 hex	Acceleration Stop Frequency	A069	R/W	0.00 to Starting Frequency: Disabled Frequency above Starting Frequency to 40000 (58000) *1	0.01 [Hz]
1F3B hex	1F3A hex	Frequency Addition Amount Setting	A145	R/W	0 to 40000 (58000) *1	0.01 [Hz]
1F3C hex	1F3B hex	Deceleration Stop Frequency	A154	R/W	0.00 to Starting Frequency: Disabled Frequency above Starting Frequency to 40000 (58000) *1	0.01 [Hz]
1F3D hex	1F3C hex	PID Sleep Operation Level	A156	R/W	0 to 40000 (58000) *1	0.01 [Hz]
1F3E hex	1F3D hex	Frequency Matching Lower Limit Frequency	b007	R/W	0 to 40000 (58000) *1	0.01 [Hz]

*1. In the high-frequency mode.

● Inverter control input register No. 1F01 hex

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Name	–	–	In7	In6	In5	In4	In3	In2	In1	–	–	RS	EXT	Dir	Opr	–

Opr	RUN command (0: Stop/ 1: RUN)	In3	Multi-function input S3
Dir	Rotation direction command (0: Forward/1: Reverse)	In4	Multi-function input S4
EXT	External trip	In5	Multi-function input S5
RS	Reset	In6	Multi-function input S6
In1	Multi-function Input S1	In7	Multi-function Input S7
In2	Multi-function Input S2		

Inverter status monitor register No. 1E01 hex

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Name	ONT	RNT	TRQ	UV	–	OTQ	FA3	AL	OD	OL	FA2	FA1	RUN	–	IRDY	Dir

Dir	Rotation direction (0: Forward/1: Reverse)	AL	Alarm
IRDY	Inverter ready	FA3	Set-frequency only
RUN	During RUN	OTQ	Overtorque/Undertorque
FA1	Constant speed reached	UV	Undervoltage
FA2	Set frequency exceeded	TRQ	Torque limit
OL	Overload warning	RNT	RUN time over
OD	Excessive PID deviation	ONT	Power ON time over

8-7-4 Troubleshooting for Modbus Mapping Function

If there is any setting error for the Modbus mapping function, the inverter will display an exception response during Modbus communication.

In this case, check the exception code for the exception response.

Below are exception codes associated with exception response and the Modbus mapping function setting errors.

For details on other exception codes, refer to *8-5-9 Exception Response* on page 8-20.

Exception response for erroneous setting

The function code for an exception response is the sum of the executed function code and 80 hex. Check the error condition with the exception code.

Response

Slave address
Function code
Exception code
Error check (CRC-16)

Exception code	Error condition	Countermeasure
31 hex	• The external address is set to other than 0000 and the internal address is not changed from 0000. • The internal address has a double-word register address. • The set internal address does not exist. • The external address overlaps.	• Set the internal address other than 0000. • Use a compressed single-word register. • Set the internal address correctly. • Set the external address so that it does not overlap.
32 hex	• When the external address overlaps with double-word data in the Modbus register inside the inverter, the inverter received a command to a non-overlapping address, which has double-word data.	• The Modbus registers inside the inverter that overlap with the external address specified by the Modbus mapping function are disabled. For double-word data, both registers are disabled. Review the external communications, or set the Modbus mapping function for that address.

8-7-5 Endian Function

In communications, endian refers to the byte order in single-word communications data to be sent/received.

Generally, big endian (where the MSB-side byte is stored first) and little endian (where the LSB-side byte is stored first) are used.

Special endian is a kind of big endian where the word order of double-word data is reversed. For 3G3MX2-V1 Series Inverter, Modbus communication is configured in big endian.

The endian function can set endian only for data sent/received in communications (without changing the address).

In the Modbus Mapping Endian Selection (P400), set the endian you want to use.

The Modbus Mapping Endian Selection (P400) setting is enabled independent of the Modbus Mapping Function Selection (P200) setting.

Parameter No.	Function name	Data	Default data	Unit
P400	Modbus Mapping Endian Selection	00: Big endian 01: Little endian 02: Special endian	00	–

● Byte order of single-word data

- Relationship between single-word data bits and bytes

Bit	8 to 15	7 to 0
Byte	MSB byte	LSB byte

- Order of data during Modbus communication

Send/Receive byte order	Big endian	Little endian	Special endian
1	MSB byte	LSB byte	MSB byte
2	LSB byte	MSB byte	LSB byte

● Byte order of double-word data

- Relationship between double-word data bits and bytes

Bit	24 to 31	16 to 23	8 to 15	7 to 0
Byte	MSB byte	Data 1	Data 2	LSB byte

- Order of data during Modbus communication

Send/Receive byte order	Big endian	Little endian	Special endian
1	MSB byte	LSB byte	Data 2
2	Data 1	Data 2	LSB byte
3	Data 2	Data 1	MSB byte
4	LSB byte	MSB byte	Data 1

Executable function codes

This function is enabled only for the function codes listed below.

Other function codes will be processed in big endian.

Function code	
03 hex	Read from multiple holding registers
06 hex	Write to a holding register
10 hex	Write to multiple holding registers
17 hex	Read/Write from/to multiple holding registers

Precautions for Correct Use

- The Modbus mapping endian function settings are reflected on not only Modbus communication, but also USB communications and communications option units.

  Set and use the USB communications and communications option units as follows.

When using CX-Drive:	When the CX-Drive is used to read/write parameters, be sure to set in advance the Modbus Mapping Endian Selection (P400) to 00 (Big endian). If the Modbus Mapping Endian Selection (P400) is not set to 00 (Big endian), parameter data cannot be processed normally.
When using communications option units:	Be sure to set the Modbus Mapping Endian Selection (P400) to 00 (Big endian). Otherwise, the internal process cannot be performed normally between the inverter and communications option unit.

- The Modbus mapping endian function does not work with the fault monitor functions (Register No.: 0012 to 004E hex).

  To use the fault monitor functions, be sure to set P400 to 00 (Big endian).

8-8 Co-inverter Communication

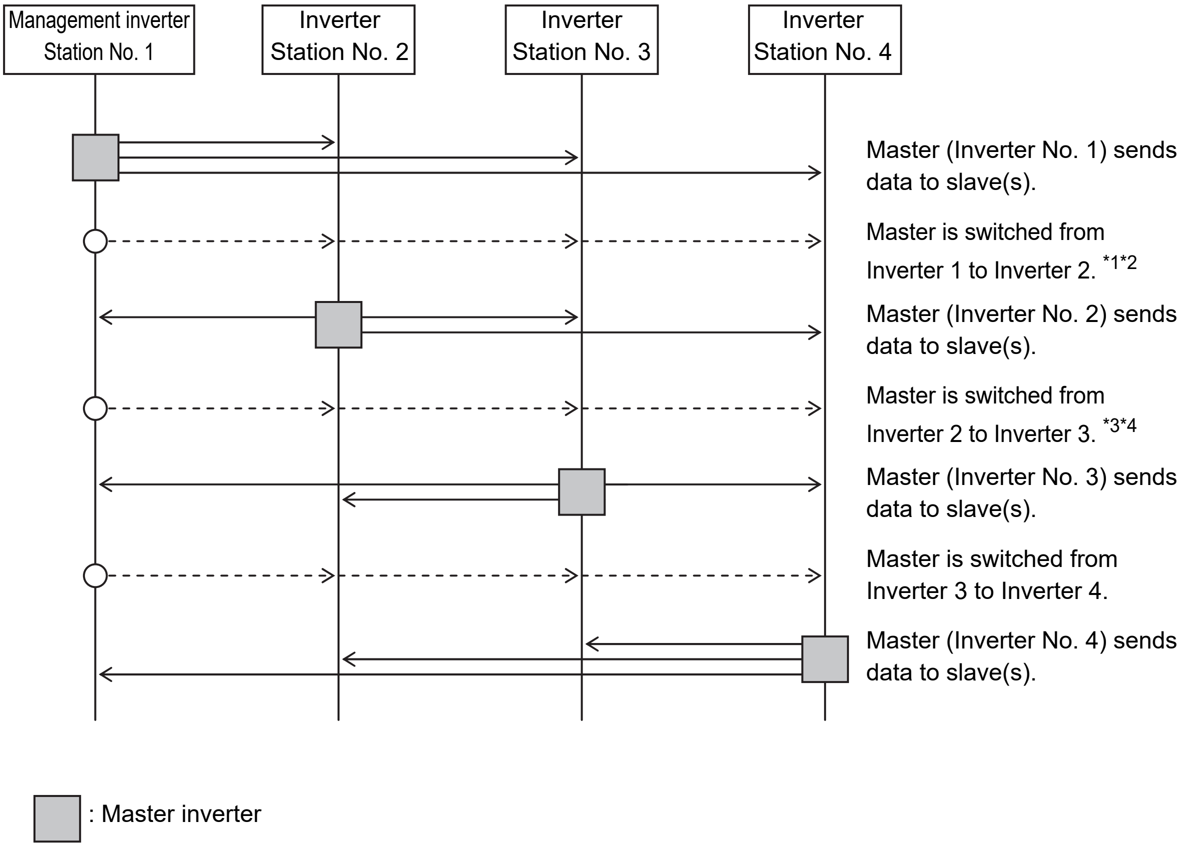
In addition to the standard Modbus communication (slave), the 3G3MX2-V1 Series Inverter provides the co-inverter communication function, which enables more than one 3G3MX2-V1 Series Inverter to communicate mutually without master equipment such as a computer or PLC.

In co-inverter communication, the inverters are assigned as “management inverter,” “master inverter,” and “slave inverter”. The master inverter is specified by the management inverter according to the user settings. The others are slave inverters. The management inverter is always fixed, but the master inverter is switched sequentially. Therefore, the management inverter may serve as the master or a slave inverter. Other conditions are as follows.

- One management inverter is required within a network.
- Up to 8 inverters can serve as the master inverter.
- Up to 247 inverters can be connected within the entire network (32 inverters without repeaters in compliance with the RS485 specifications).

In co-inverter communication, be sure to assign the station No. 1, which serves as the management inverter.

The master inverter can write data to the holding registers on any slave inverter. At this time, up to five different station numbers and holding registers can be specified at once. On completion of each data transmission session between the master and a slave (or slaves), the master inverter is switched to the next in a sequential manner. In this way, data transmission is repeated according to the settings for each master inverter.


Management inverter Station No. 1
Inverter Station No. 2
Inverter Station No. 3
Inverter Station No. 4
Master (Inverter No. 1) sends data to slave(s).
Master is switched from Inverter 1 to Inverter 2. *1*2
Master (Inverter No. 2) sends data to slave(s).
Master is switched from Inverter 2 to Inverter 3. *3*4
Master (Inverter No. 3) sends data to slave(s).
Master is switched from Inverter 3 to Inverter 4.
Master (Inverter No. 4) sends data to slave(s).
: Master inverter

---

*1. Switching of the master is performed automatically by the management inverter.

*2. The management inverter sends the master switching command from Inverter No. 01 to 02 after data is sent from Inverter 01 (master) to a slave (or slaves), with a wait time of “silent interval + Communication Wait Time (C078).

*3. After receiving data from the master inverter, the management inverter sends the next master switching command with a wait time of “silent interval + Communication Wait Time (C078). If the management inverter cannot receive the data sent from the master inverter within the Communication Error Timeout Time (C077), a communication timeout occurs and the management inverter follows the operation set in the Operation Selection on Communication Error (C076).

*4. Be sure to enable the Communication Error Timeout Time setting (C077 = 0.01 to 99.99) on the management inverter. When this setting is disabled (C077 = 0), the co-inverter communication will stop if the management inverter cannot receive data from the master. In this case, cycle the power supply for the management inverter, or reset the management inverter (by turning ON/OFF the terminal RS).

8-8-1 Co-inverter Communication Parameters

The parameters required to establish co-inverter communication are shown in the table below.

Parameter No.	Function name	Data	Default data	Unit	Setting target[*1]
C072[*2]	Communication Station No. Selection	1. to 247.[*3]	1.	–	ALL[*4]
C076[*5]	Operation Selection on Communication Error	00: Trip 01: Trip after deceleration stop 02: Ignore 03: Free-run stop 04: Deceleration stop	02	–	ALL
C077	Communication Error Timeout Time	0.00: Timeout disabled 0.01 to 99.99	0.00	s	ALL
C078	Communication Wait Time	0. to 1000.	0.	ms	ALL
C096 [*2]	Communication Selection	00: Modbus communication 01: Co-inverter communication 02: Co-inverter communication (management inverter)	00	–	– B A
C098 [*2]	Co-inverter Communication Starting Station Number	1. to 8. Setting required only for management inverter[*6]	1.	–	A
C099 [*2]	Co-inverter Communication Ending Station Number	1. to 8. Setting required only for management inverter [*6]	1.	–	A
C100 [*2]	Co-inverter Communication Start Selection	00: Start via 485 terminal[*7] 01: Constant communication[*8]	00	–	A A
P140	Number of Sent Data of All Stations in Co-inverter Communication	1 to 5	5	–	M
P141	Recipient Station Number of All Stations in Co-inverter Communication 1	1 to 247[*9]	1	–	M
P142	Recipient Register of All Stations in Co-inverter Communication 1	0000 to FFFF	0000	–	M

Parameter No.	Function name	Data	Default data	Unit	Setting target[*1]
P143	Sender Register of All Stations in Co-inverter Communication 1	0000 to FFFF	0000	–	M
P144	Recipient Station Number of All Stations in Co-inverter Communication 2	1 to 247	2	–	M
P145	Recipient Register of All Stations in Co-inverter Communication 2	0000 to FFFF	0000	–	M
P146	Sender Register of All Stations in Co-inverter Communication 2	0000 to FFFF	0000	–	M
P147	Recipient Station Number of All Stations in Co-inverter Communication 3	1 to 247	3	–	M
P148	Recipient Register of All Stations in Co-inverter Communication 3	0000 to FFFF	0000	–	M
P149	Sender Register of All Stations in Co-inverter Communication 3	0000 to FFFF	0000	–	M
P150	Recipient Station Number of All Stations in Co-inverter Communication 4	1 to 247	4	–	M
P151	Recipient Register of All Stations in Co-inverter Communication 4	0000 to FFFF	0000	–	M
P152	Sender Register of All Stations in Co-inverter Communication 4	0000 to FFFF	0000	–	M
P153	Recipient Station Number of All Stations in Co-inverter Communication 5	1 to 247	5	–	M
P154	Recipient Register of All Stations in Co-inverter Communication 5	0000 to FFFF	0000	–	M
P155	Sender Register of All Stations in Co-inverter Communication 5	0000 to FFFF	0000	–	M
C001 to C007	Multi-function Input S1 to S7 Selection	81: 485 (Start co-inverter communication) [*7]	–	–	A

[*1] Below are the details of the setting target.

ALL: Setting required for all connected inverters

A: Setting required only for management inverter (Station No. 1)

B: Setting required for inverters other than management inverter (Station No. 1)

M: Setting required only for inverters set in C098 to C099 (= Inverters assigned with master role)

*2. After changing any of the C072 and C096 to C100 data on the management inverter, be sure to cycle the power supply to apply the changes. For inverters other than the management inverter, these changes will be applied immediately.

*3. To switch the master inverter among more than one inverter, be sure to set sequential station numbers. If the set station numbers include any skipped number, communications cannot be established.

*4. For the management inverter, set the station number to 1 (C072 = 1).

*5. When the Operation Selection on Communication Error (C076) is set to 02 (Ignore) on the management inverter, the co-inverter communication session will stop if a communications timeout error occurs on the management inverter. In this case, cycle the power supply of the management inverter.

*6. Set these parameters so that C098 is equal to or less than C099.

*7. When the Co-inverter Communication Start Selection (C100) is set to 00 (Start via 485 terminal), set one of the Multi-function Input S1 to S7 Selection (C001 to C007) to 81 (Start co-inverter communication).

*8. When the Co-inverter Communication Start Selection (C100) is set to 01 (Constant communication), the management inverter starts sending data as soon as the power supply is turned on. At this time, if the next master inverter is delayed in the startup and cannot receive the master switching command, the master inverter cannot send the data, which results in a communications timeout error on the management inverter.

When you set C100 to 01, check that the startup of the other inverters is completed and power on the management inverter finally.

*9. Although, in master-to-slave communications, you set recipient slave's station number, actually, data is sent to all stations via broadcast communications (Station No. 00). Slaves that are not specified as the recipient on the master side discard the received data.

8-8-2 Co-inverter Communication Settings

- On each inverter, set the station number in the Communication Station No. Selection (C072) so that they do not overlap among the inverters. Do not forget to set the station No. 1, which serves as the management inverter.
- On the management inverter, set the Communication Selection (C096) to 02 (Co-inverter communication (management inverter)). For other inverters, set the Communication Selection (C096) to 01 (Co-inverter communication).
- Set a station number 1 to 8 on inverters that serve as the master inverter. To switch the master inverter among more than one inverter, the station numbering must be sequential. On the management inverter, set the smallest master station number in the Co-inverter Communication Starting Station Number (C098) and the largest master station number in the Co-inverter Communication Ending Station Number (C099).
- In the Co-inverter Communication Start Selection (C100), set how to start inverter communications. When C100 is set to 00 (Start via 485 terminal), set one of the Multi-function Input S1 to S7 Selection (C001 to C007) to 81 (Start co-inverter communication).
- In P140 to 155, set the following parameters, which are required when the master inverter writes data: the number of sent data, recipient station number, recipient register address, and sender register address.

Co-inverter Communication Operation

(1) The master inverter sends data to one or more slave inverters according to the settings for that master inverter.

(This data is also sent to the management inverter that does not serve as the master inverter.)

(2) The management inverter sends the master switching command and the master inverter is switched accordingly.

(3) The next master inverter sends data to one or more slave inverters in the same manner as explained in step (1).

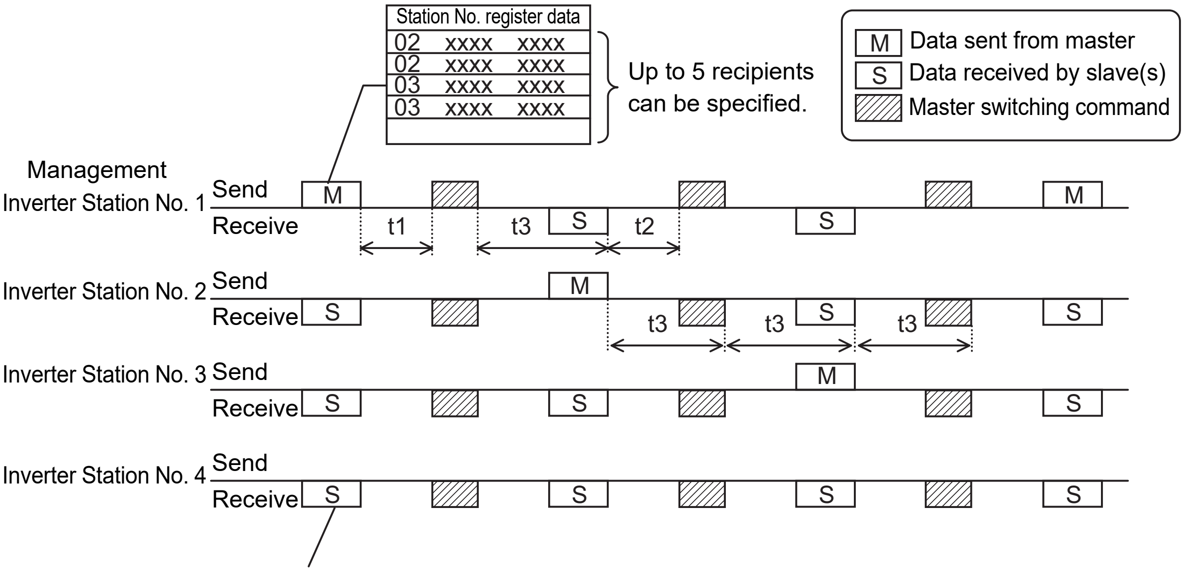
(This data is also sent to the management inverter that does not serve as the master inverter.)

(4) Steps (2) and (3) are followed repeatedly.

Note Because this inverter is designed to establish co-inverter communication as broadcast communications (Station No. 00), communications data is sent to all stations. Therefore, slaves that are not specified as the recipient on the master side receive the data once, but discard internally the data not addressed to them.

Example of Co-inverter Communication Sequence

The sequence diagram below shows co-inverter communication among four inverters with station numbers from 1 to 4, where Stations No. 1 to 3 are set as the master inverter.


Station No. register data
02 xxxx xxxx
02 xxxx xxxx
03 xxxx xxxx
03 xxxx xxxx
Up to 5 recipients can be specified.
M Data sent from master
S Data received by slave(s)
▨ Master switching command
Management Inverter Station No. 1
Inverter Station No. 2
Inverter Station No. 3
Inverter Station No. 4
Send
Receive
M
S
t1
t2
t3

All slaves receive data from the master but discard it if not destined to them.

t1: Silent Interval + Communication Wait Time (C078)
t2: Silent Interval + Communication Wait Time (C078)
t3: Communication Error Timeout Time (C077)

- Be sure to set the Communication Error Timeout Time (C077) to other than 0.00 (1 second or longer is recommended) on the management inverter. When this parameter is set to 0.00, the inverter's communications function will stop if no data is received from the master. If it stops working, cycle the power supply of the management inverter.
- The communications error timeout timer starts when the inverter starts waiting for data reception and times out when it cannot complete data reception within the set time. If a timeout occurs, the inverter performs the operation set in the Operation Selection on Communication Error (C076). (t3 in above diagram)
- When the management inverter is the master, the master switching command will be sent with a wait time of "silent interval + Communication Wait Time (C078) after the master sends data. (t1 in above diagram)
- When an inverter other than the management inverter is the master, the master switching command will be sent with a wait time of "silent interval + Communication Wait Time (C078) after receipt of data sent from the master inverter. (t2 in above diagram)
- When the Co-inverter Communication Start Selection (C100) is set to 01 (Constant communication), the management inverter starts sending data as soon as the power supply is turned on. Therefore, if the power-on timing of any other inverter is delayed, the communications cannot be established normally, which results in a communications timeout error on the management inverter. When you set this to 01 (Constant communication), check that the startup of the other inverters is completed and power on the management inverter finally.
- Do not set 08FF hex (EEPROM Write) or 0901 hex (EEPROM Write Mode Selection) in the recipient registers. Doing so causes the co-inverter communication session to stop in the EEPROM write process.
- After changing any of the C096 to C100 data, be sure to cycle the power supply to apply the changes.

8-9 Modbus Communication Data Lists

R/W in the list shows whether data can be read from, or written to, the coil or holding register.

(R: Read only, R/W: Read and write enabled)

Precautions for Correct Use

- The “Coil No.” in the table header shows the coil number used inside the inverter.
  Use this coil number when setting the communications option unit (EtherCAT/CompoNet/DeviceNet) for the inverter.
- The “Modbus coil spec. No.” in the table header shows the coil number used to actually specify the coil in the Modbus communication process.
  This coil number is 1 less than the inverter “Coil No.” according to the Modbus communication specifications.

8-9-1 Coil Number List

Coil No.	Modbus coil spec. No.	Item	R/W	Description
0000 hex	–	Not used	–	Not accessible
0001 hex	0000 hex	RUN command	R/W	1: Run 0: Stop (Enabled when A002/A202 = 03)
0002 hex	0001 hex	Rotation direction command	R/W	1: Reverse 0: Forward (Enabled when A002/A202 = 03)
0003 hex	0002 hex	External Trip (EXT)	R/W	1: Trip
0004 hex	0003 hex	Trip reset (RS)	R/W	1: Reset
0005 hex	–	Reserved	–	–
0006 hex				
0007 hex	0006 hex	Multi-function Input 1 [*1]	R/W	1: ON 0: OFF
0008 hex	0007 hex	Multi-function Input 2 [*1]	R/W	1: ON 0: OFF
0009 hex	0008 hex	Multi-function Input 3 [*1]	R/W	1: ON 0: OFF
000A hex	0009 hex	Multi-function Input 4 [*1]	R/W	1: ON 0: OFF
000B hex	000A hex	Multi-function Input 5 [*1]	R/W	1: ON 0: OFF
000C hex	000B hex	Multi-function Input 6 [*1]	R/W	1: ON 0: OFF
000D hex	000C hex	Multi-function Input 7 [*1]	R/W	1: ON 0: OFF
000E hex	–	Reserved	–	–
000F hex	000E hex	Operation status	R	1: Run 0: Stop (Interlocked with d003)

[*1] These input terminals can be turned ON/OFF via Modbus communication. This inverter recognizes that an input terminal is ON when it is turned ON either via communications or by the input signal to the control circuit terminal block.

Coil No.	Modbus coil spec. No.	Item	R/W	Description
0010 hex	000F hex	RUN direction	R	1: Reverse 0: Forward (Interlocked with d003)
0011 hex	0010 hex	Inverter ready	R	1: Ready 0: Not ready
0012 hex	–	Reserved	–	–
0013 hex	0012 hex	RUN (During RUN)	R	1: ON 0: OFF
0014 hex	0013 hex	FA1 (Constant speed arrival signal)	R	1: ON 0: OFF
0015 hex	0014 hex	FA2 (Set frequency exceeded signal)	R	1: ON 0: OFF
0016 hex	0015 hex	OL (Overload warning)	R	1: ON 0: OFF
0017 hex	0016 hex	OD (Excessive PID deviation)	R	1: ON 0: OFF
0018 hex	0017 hex	AL (Alarm signal)	R	1: ON 0: OFF
0019 hex	0018 hex	FA3 (Set-frequency only signal)	R	1: ON 0: OFF
001A hex	0019 hex	OTQ (Overtorque/Under-torque)	R	1: ON 0: OFF
001B hex	–	Reserved	–	–
001C hex	001B hex	UV (Undervoltage)	R	1: ON 0: OFF
001D hex	001C hex	TRQ (Torque limit)	R	1: ON 0: OFF
001E hex	001D hex	RNT (RUN time over)	R	1: ON 0: OFF
001F hex	001E hex	ONT (Power ON time over)	R	1: ON 0: OFF
0020 hex	001F hex	THM (Electronic thermal warning)	R	1: ON 0: OFF
0021 to 0025 hex	–	Reserved	–	–
0026 hex	0025 hex	BRK (Brake release)	R	1: ON 0: OFF
0027 hex	0026 hex	BER (Brake error)	R	1: ON 0: OFF
0028 hex	0027 hex	ZS (0-Hz detection signal)	R	1: ON 0: OFF
0029 hex	0028 hex	DSE (Excessive speed deviation)	R	1: ON 0: OFF
002A hex	0029 hex	POK (Positioning ready)	R	1: ON 0: OFF
002B hex	002A hex	FA4 (Set frequency exceeded signal 2)	R	1: ON 0: OFF
002C hex	002B hex	FA5 (Set-frequency only signal 2)	R	1: ON 0: OFF
002D hex	002C hex	OL2 (Overload warning 2)	R	1: ON 0: OFF

Coil No.	Modbus coil spec. No.	Item	R/W	Description
002E hex	002D hex	FVDc (Analog FV disconnection detection)	R	1: ON 0: OFF
002F hex	002E hex	FIDc (Analog FI disconnection detection)	R	1: ON 0: OFF
0030 hex 0031 hex	–	Reserved	–	–
0032 hex	0031 hex	FBV (PID feedback comparison)	R	1: ON 0: OFF
0033 hex	0032 hex	NDc (Communications disconnection detection)	R	1: ON 0: OFF
0034 hex	0033 hex	LOG1 (Logic operation output 1)	R	1: ON 0: OFF
0035 hex	0034 hex	LOG2 (Logic operation output 2)	R	1: ON 0: OFF
0036 hex	0035 hex	LOG3 (Logic operation output 3)	R	1: ON 0: OFF
0037 to 0039 hex	–	Reserved	–	–
003A hex	0039 hex	WAC (Capacitor life warning)	R	1: ON 0: OFF
003B hex	003A hex	WAF (Cooling fan life warning)	R	1: ON 0: OFF
003C hex	003B hex	FR (Starting contact signal)	R	1: ON 0: OFF
003D hex	003C hex	OHF (Cooling fin overheat warning)	R	1: ON 0: OFF
003E hex	003D hex	LOC (Low current signal)	R	1: ON 0: OFF
003F to 0044 hex	–	Reserved	–	–
0045 hex	0044 hex	IRDY (Operation ready)	R	1: ON 0: OFF
0046 hex	0045 hex	FWR (Forward run signal)	R	1: ON 0: OFF
0047 hex	0046 hex	RVR (Reverse run signal)	R	1: ON 0: OFF
0048 hex	0047 hex	MJA (Fatal fault signal)	R	1: ON 0: OFF
0049 hex	0048 hex	During data write	R	1: Writing 0: Normal
004A hex	0049 hex	CRC error[*1]	R	1: Error 0: No error
004B hex	004A hex	Overrun error [*1]	R	1: Error 0: No error
004C hex	004B hex	Framing error [*1]	R	1: Error 0: No error
004D hex	004C hex	Parity error [*1]	R	1: Error 0: No error
004E hex	004D hex	Checksum error [*1]	R	1: Error 0: No error

*1. The data of communication error is held until a fault reset is input. (Fault reset can be executed during operation.)

Coil No.	Modbus coil spec. No.	Item	R/W	Description
004F hex	–	Reserved	–	–
0050 hex	004F hex	WCFV (Window comparator FV)	R	1: ON 0: OFF
0051 hex	0050 hex	WCFI (Window comparator FI)	R	1: ON 0: OFF
0052 hex	–	Reserved	–	–
0053 hex				
0054 hex	0053 hex	FREF (Frequency command source)	R	1: Digital Operator 0: Other than Digital Operator
0055 hex	0054 hex	REF (RUN command source)	R	1: Digital Operator 0: Other than Digital Operator
0056 hex	0055 hex	SETM (Motor 2 selection)	R	1: 2nd control selected 0: 1st control selected
0057 hex	–	Reserved	–	–
0058 hex				
0059 to 005A hex	–	Not used	–	Not accessible

8-9-2 Monitor Function/Enter Command Register List

Precautions for Correct Use

- The “Register No.” in the table header shows the register number used inside the inverter.

  Use this register number when setting the communications option unit (EtherCAT/CompoNet/DeviceNet) for the inverter.
- The “Modbus register spec. No.” in the table header shows the register number used to actually specify the register in the Modbus communication process.

  This register number is 1 less than the inverter “Register No.” according to the Modbus communication specifications.

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution
0000 hex	–	Reserved	–	–	–	–
0001 hex	0000 hex	Output Frequency Setting/Monitor	F001 (HIGH)	R/W	0 to Maximum frequency (Enabled when A001 = 03)	0.01 [Hz][1]
0002 hex	0001 hex		F001 (LOW)	R/W		
0003 hex	0002 hex	Inverter Status A	–	R	0: Initial status 2: Stop 3: Run 4: Free-run stop 5: Jogging 6: DC injection braking 8: Trip 9: During UV	–
0004 hex	0003 hex	Inverter Status B	–	R	0: During stop 1: During RUN 2: During trip	–
0005 hex	0004 hex	Inverter Status C	–	R	0: – 1: Stop 2: Deceleration 3: Constant speed 4: Acceleration 5: Forward 6: Reverse 7: Forward to reverse 8: Reverse to forward 9: Forward run start 10: Reverse run start	–

[1] When the PID function is enabled, the data unit differs between read and write operations. Set parameter values in units of 0.01 Hz for writing and in units of 0.01% (as 100% of the maximum frequency) for reading.

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution
0006 hex	0005 hex	PID Feedback [*1]	–	R/W	0 to 10000	0.01 [%]
0007 to 0010 hex	–	Reserved	–	–	–	–
0011 hex	0010 hex	Fault Counter	d080	R	0 to 65535	1 [time]
0012 hex	0011 hex	Fault Monitor 1 Fault Factor	d081	R	Refer to *Inverter trip fault factor list* on page 8-46.	–
0013 hex	0012 hex	Fault Monitor 1 Inverter Status			Refer to *Inverter trip fault factor list* on page 8-46.	–
0014 hex	0013 hex	Fault Monitor 1 Frequency (HIGH)			0 to 40000 (58000) [*2]	0.01 [Hz]
0015 hex	0014 hex	Fault Monitor 1 Frequency (LOW)				
0016 hex	0015 hex	Fault Monitor 1 Output Current			Output current value at the time of trip	0.01 [A]
0017 hex	0016 hex	Fault Monitor 1 DC Voltage			DC input voltage at the time of trip	0.1 [V]
0018 hex	0017 hex	Fault Monitor 1 Total RUN Time (HIGH)			Total RUN time before the trip	1 [h]
0019 hex	0018 hex	Fault Monitor 1 Total RUN Time (LOW)				
001A hex	0019 hex	Fault Monitor 1 Total Power ON Time (HIGH)			Total power ON time before the trip	1 [h]
001B hex	001A hex	Fault Monitor 1 Total Power ON Time (LOW)				
001C hex	001B hex	Fault Monitor 2 Fault Factor	d082	R	Refer to *Inverter trip fault factor list* on page 8-46.	–
001D hex	001C hex	Fault Monitor 2 Inverter Status			Refer to *Inverter trip fault factor list* on page 8-46.	–
001E hex	001D hex	Fault Monitor 2 Frequency (HIGH)			0 to 40000 (58000) [*2]	0.01 [Hz]
001F hex	001E hex	Fault Monitor 2 Frequency (LOW)				
0020 hex	001F hex	Fault Monitor 2 Output Current			Output current value at the time of trip	0.01 [A]
0021 hex	0020 hex	Fault Monitor 2 DC Voltage			DC input voltage at the time of trip	0.1 [V]
0022 hex	0021 hex	Fault Monitor 2 Total RUN Time (HIGH)			Total RUN time before the trip	1 [h]
0023 hex	0022 hex	Fault Monitor 2 Total RUN Time (LOW)				
0024 hex	0023 hex	Fault Monitor 2 Total Power ON Time (HIGH)			Total power ON time before the trip	1 [h]
0025 hex	0024 hex	Fault Monitor 2 Total Power ON Time (LOW)				

*1. Data can be written to the PID feed back register when the PID Feedback Selection (A076) is set to 02 (Modbus communication).

*2. In the high-frequency mode.

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution
0026 hex	0025 hex	Fault Monitor 3 Fault Factor	d083	R	Refer to *Inverter trip fault factor list* on page 8-46.	–
0027 hex	0026 hex	Fault Monitor 3 Inverter Status			Refer to *Inverter trip fault factor list* on page 8-46.	–
0028 hex	0027 hex	Fault Monitor 3 Frequency (HIGH)			0 to 40000 (58000) [*1]	0.01 [Hz]
0029 hex	0028 hex	Fault Monitor 3 Frequency (LOW)				
002A hex	0029 hex	Fault Monitor 3 Output Current			Output current value at the time of trip	0.01 [A]
002B hex	002A hex	Fault Monitor 3 DC Voltage			DC input voltage at the time of trip	0.1 [V]
002C hex	002B hex	Fault Monitor 3 Total RUN Time (HIGH)			Total RUN time before the trip	1 [h]
002D hex	002C hex	Fault Monitor 3 Total RUN Time (LOW)				
002E hex	002D hex	Fault Monitor 3 Total Power ON Time (HIGH)			Total power ON time before the trip	1 [h]
002F hex	002E hex	Fault Monitor 3 Total Power ON Time (LOW)				
0030 hex	002F hex	Fault Monitor 4 Fault Factor	d084	R	Refer to *Inverter trip fault factor list* on page 8-46.	–
0031 hex	0030 hex	Fault Monitor 4 Inverter Status			Refer to *Inverter trip fault factor list* on page 8-46.	–
0032 hex	0031 hex	Fault Monitor 4 Frequency (HIGH)			0 to 40000 (58000) [*1]	0.01 [Hz]
0033 hex	0032 hex	Fault Monitor 4 Frequency (LOW)				
0034 hex	0033 hex	Fault Monitor 4 Output Current			Output current value at the time of trip	0.01 [A]
0035 hex	0034 hex	Fault Monitor 4 DC Voltage			DC input voltage at the time of trip	0.1 [V]
0036 hex	0035 hex	Fault Monitor 4 Total RUN Time (HIGH)			Total RUN time before the trip	1 [h]
0037 hex	0036 hex	Fault Monitor 4 Total RUN Time (LOW)				
0038 hex	0037 hex	Fault Monitor 4 Total Power ON Time (HIGH)			Total power ON time before the trip	1 [h]
0039 hex	0038 hex	Fault Monitor 4 Total Power ON Time (LOW)				

[*1] In the high-frequency mode.

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution
003A hex	0039 hex	Fault Monitor 5 Fault Factor	d085	R	Refer to *Inverter trip fault factor list* on page 8-46.	–
003B hex	003A hex	Fault Monitor 5 Inverter Status			Refer to *Inverter trip fault factor list* on page 8-46.	–
003C hex	003B hex	Fault Monitor 5 Frequency (HIGH)			0 to 40000 (58000) *1	0.01 [Hz]
003D hex	003C hex	Fault Monitor 5 Frequency (LOW)				
003E hex	003D hex	Fault Monitor 5 Output Current			Output current value at the time of trip	0.01 [A]
003F hex	003E hex	Fault Monitor 5 DC Voltage			DC input voltage at the time of trip	0.1 [V]
0040 hex	003F hex	Fault Monitor 5 Total RUN Time (HIGH)			Total RUN time before the trip	1 [h]
0041 hex	0040 hex	Fault Monitor 5 Total RUN Time (LOW)				
0042 hex	0041 hex	Fault Monitor 5 Total Power ON Time (HIGH)			Total power ON time before the trip	1 [h]
0043 hex	0042 hex	Fault Monitor 5 Total Power ON Time (LOW)				
0044 hex	0043 hex	Fault Monitor 6 Fault Factor	d086	R	Refer to *Inverter trip fault factor list* on page 8-46.	–
0045 hex	0044 hex	Fault Monitor 6 Inverter Status			Refer to *Inverter trip fault factor list* on page 8-46.	–
0046 hex	0045 hex	Fault Monitor 6 Frequency (HIGH)			0 to 40000 (58000) *1	0.01 [Hz]
0047 hex	0046 hex	Fault Monitor 6 Frequency (LOW)				
0048 hex	0047 hex	Fault Monitor 6 Output Current			Output current value at the time of trip	0.01 [A]
0049 hex	0048 hex	Fault Monitor 6 DC Voltage			DC input voltage at the time of trip	0.1 [V]
004A hex	0049 hex	Fault Monitor 6 Total RUN Time (HIGH)			Total RUN time before the trip	1 [h]
004B hex	004A hex	Fault Monitor 6 Total RUN Time (LOW)				
004C hex	004B hex	Fault Monitor 6 Total Power ON Time (HIGH)			Total power ON time before the trip	1 [h]
004D hex	004C hex	Fault Monitor 6 Total Power ON Time (LOW)				
004E hex	004D hex	Warning Monitor	d090	R	Warning code	–
004F to 08FF hex	–	Not used	–	–	Not accessible	–

*1. In the high-frequency mode.

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution
0900 hex	08FF hex	EEPROM Write	–	W	0: Motor parameter initialization 1: Set value storage in EEPROM Others: Motor parameter initialization and set value storage in EEPROM	–
0901 hex	–	Not used	–	–	Not accessible	–
0902 hex	0901 hex	EEPROM Write Mode Selection	–	W	0: Write disabled 1: Write enabled	–
0903 to 1000 hex	–	Not used	–	–	Not accessible	–

Inverter trip fault factor list

Trip factor in MSB (Fault factor)			Trip factor in LSB (Inverter Status)		
Name	**Code**	**Transmission data**	**Name**	**Code**	**Transmission data**
No trip factor	0	0 hex	During reset	0	0 hex
Overcurrent protection during constant speed	1	01 hex	During stop	1	01 hex
Overcurrent protection during deceleration	2	02 hex	During deceleration	2	02 hex
Overcurrent protection during acceleration	3	03 hex	During constant speed	3	03 hex
Overcurrent protection during stop	4	04 hex	During acceleration	4	04 hex
Overload protection	5	05 hex	Operates at frequency = 0	5	05 hex
Braking resistor overload protection	6	06 hex	During startup	6	06 hex
Overvoltage protection	7	07 hex	During DB (DC injection braking)	7	07 hex
EEPROM error	8	08 hex	During overload limit	8	08 hex
Undervoltage protection	9	09 hex			
Current detector error	10	0A hex			
CPU error	11	0B hex			
External trip	12	0C hex			
USP error	13	0D hex			
Ground protection	14	0E hex			
Incoming overvoltage protection	15	0F hex			
Temperature detection error	19	13 hex			
Temperature error	21	15 hex			
Main circuit error	25	19 hex			
Servo Drive error	30	1E hex			
Thermistor error	35	23 hex			
Brake error	36	24 hex			
Emergency shutoff	37	25 hex			
Overload protection in low speed range	38	26 hex			
Digital Operator connection failure	40	28 hex			
Modbus communication	41	29 hex			
Internal data error	43 to 45 50 to 69	2B to 2D hex 32 to 45 hex			
Encoder disconnection	80	50 hex			
Overspeed	81	51 hex			
Position control range trip	83	53 hex			

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution	Page
1001 hex	1000 hex	Output Frequency Monitor	d001 (HIGH)	R	0 to 40000 (58000) [*1]	0.01 [Hz]	P. 7-4
1002 hex	1001 hex		d001 (LOW)				
1003 hex	1002 hex	Output Current Monitor	d002	R	0 to 65530	0.01 [A]	P. 7-4
1004 hex	1003 hex	RUN Direction Monitor	d003	R	0: Stop 1: Forward 2: Reverse	–	P. 7-5
1005 hex	1004 hex	PID Feedback Value Monitor	d004 (HIGH)	R	0 to 100000	0.1	P. 7-5
1006 hex	1005 hex		d004 (LOW)				
1007 hex	1006 hex	Multi-function Input Monitor	d005	R	2^0: Terminal S1 to 2^6: Terminal S7/EB	Bit	P. 7-5
1008 hex	1007 hex	Multi-function Output Monitor	d006	R	2^0: Terminal P1 to 2^1: Terminal P2 2^6: Relay output terminal MA	Bit	P. 7-6
1009 hex	1008 hex	Output Frequency Monitor (After Conversion)	d007 (HIGH)	R	0 to 3999600 (5799420)[*1]	0.01	P. 7-6
100A hex	1009 hex		d007 (LOW)				
100B hex	100A hex	Real Frequency Monitor	d008 (HIGH)	R	–58000 to 58000	0.01 [Hz]	P. 7-7
100C hex	100B hex		d008 (LOW)	R			
100D hex	100C hex	Torque Reference Monitor	d009	R	–200 to 200	1 [%]	P. 7-7
100E hex	100D hex	Torque Bias Monitor	d010	R	–200 to 200	1 [%]	P. 7-8
100F hex	100E hex	Reserved	–	–	–	–	–
1010 hex	100F hex	Output Torque Monitor	d012	R	–200 to 200	1 [%]	P. 7-8
1011 hex	1010 hex	Output Voltage Monitor	d013	R	0 to 6000	0.1 [V]	P. 7-8
1012 hex	1011 hex	Input Power Monitor	d014	R	0 to 1000	0.1 [kW]	P. 7-9
1013 hex	1012 hex	Integrated Power Monitor	d015 (HIGH)	R	0 to 9999000	–	P. 7-9
1014 hex	1013 hex		d015 (LOW)				
1015 hex	1014 hex	Total RUN Time Monitor	d016 (HIGH)	R	0 to 999000	1 [h]	P. 7-10
1016 hex	1015 hex		d016 (LOW)				
1017 hex	1016 hex	Total Power ON Time Monitor	d017 (HIGH)	R	0 to 999000	1 [h]	P. 7-10
1018 hex	1017 hex		d017 (LOW)				
1019 hex	1018 hex	Fin Temperature Monitor	d018	R	–200 to 1500	0.1 [°C]	P. 7-10
101A to 101C hex	–	Reserved	–	–	–	–	–
101D hex	101C hex	Life Assessment Monitor	d022	R	2^0: Capacitor on main circuit board 2^1: Cooling fan	Bit	P. 7-11

[*1] In the high-frequency mode.

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution	Page
101E hex	101D hex	Program Counter (DriveProgramming)	d023	R	0 to 1024	1	P. 7-11
101F to 1025 hex	–	Reserved	–	–	–	–	–
1026 hex	1025 hex	DC Voltage Monitor	d102	R	0 to 10000	0.1 [V]	P. 7-15
1027 hex	1026 hex	Regenerative Braking Load Rate Monitor	d103	R	0 to 1000	0.1 [%]	P. 7-16
1028 hex	1027 hex	Electronic Thermal Load Rate Monitor	d104	R	0 to 1000	0.1 [%]	P. 7-16
1029 to 102D hex	–	Reserved	–	–	–	–	–
102E hex	102D hex	User Monitor 0 (DriveProgramming)	d025 (HIGH)	R	Displays DriveProgramming execution result –2147483647 to 2147483647	1	P. 7-11
102F hex	102E hex		d025 (LOW)				
1030 hex	1029 hex	User Monitor 1 (DriveProgramming)	d026 (HIGH)	R	Displays DriveProgramming execution result –2147483647 to 2147483647	1	
1031 hex	1030 hex		d026 (LOW)				
1032 hex	1031 hex	User Monitor 2 (DriveProgramming)	d027 (HIGH)	R	Displays DriveProgramming execution result –2147483647 to 2147483647	1	
1033 hex	1032 hex		d027 (LOW)				
1034 hex	–	Reserved	–	–	–	–	–
1035 hex							
1036 hex	1035 hex	Position Command Monitor	d029 (HIGH)	R	–268435455 to 268435455	1	P. 7-12
1037 hex	1036 hex		d029 (LOW)	R			
1038 hex	1037 hex	Current Position Monitor	d030 (HIGH)	R	–268435455 to 268435455	1	P. 7-12
1039 hex	1038 hex		d030 (LOW)	R			
103A to 1056 hex	–	Reserved	–	–	–	–	–
1057 hex	1056 hex	Inverter Mode Monitor	d060	R	0: I-C (IM motor heavy load) 1: I-V (IM motor light load) 2: H-I (IM motor high frequency) 3: P (PM motor mode)	–	P. 7-13
1058 hex	–	Not used	–	–	Not accessible	–	–

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution	Page
1059 hex	1058 hex	Frequency Reference Source Monitor	d062	R	00 : Digital Operator (F001) 01 to 15: Multi-step speed reference 1 to 15 16 : Jogging frequency 18 : Modbus communication 19 : Option 21 : Volume (3G3AX-OP01) 22 : Pulse train frequency 23 : Operation function output 24 : DriveProgramming 25 : Analog voltage input (FV) 26 : Analog current input (FI) 27 : Analog Input (FV + FI)	–	P. 7-14
105A hex	1059 hex	RUN Command Source Monitor	d063	R	1: Control circuit terminal block 2: Digital Operator 3: Modbus communication 4: Option	–	P. 7-14
105B to 108D hex	–	Not used	–	–	Not accessible	–	–
108E hex	108D hex	Analog Voltage Input FV Monitor	d130	R	0 to 1023 (1023= Equivalent to A/D converter output of 10.9 V)	1 [Bit]	P. 7-16
108F hex	108E hex	Analog Current Input FI Monitor	d131	R	0 to 1023 (1023= Equivalent to A/D converter output of 23.3 mA)	1 [Bit]	P. 7-16
1091 hex	1090 hex	Pulse Train Input RP Monitor	d133	R	0 to 10000	0.01 [%]	P. 7-17
1092 to 10AD hex	–	Not used	–	–	Not accessible	–	–
10AE hex	10AD hex	PID Deviation	d153 (HIGH)	R	–10000 to 10000	0.01 [%]	P. 7-17
10AF hex	10AE hex		d153 (LOW)				
10B0 hex	–	Not used	–	–	Not accessible	–	–
10B1 hex							
10B2 hex	10B1 hex	PID Output Monitor	d155 (HIGH)	R	–10000 to 10000	0.01 [%]	P. 7-17
10B3 hex	10B2 hex		d155 (LOW)				
10B4 to 1102 hex	–	Not used	–	–	Not accessible	–	–

8-9-3 Group F Register List

Precautions for Correct Use

- The “Register No.” in the table header shows the register number used inside the inverter.

  Use this register number when setting the communications option unit (EtherCAT/CompoNet/DeviceNet) for the inverter.
- The “Modbus register spec. No.” in the table header shows the register number used to actually specify the register in the Modbus communication process.

  This register number is 1 less than the inverter “Register No.” according to the Modbus communication specifications.

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution	Page
1103 hex	1102 hex	1st Acceleration Time 1	F002 (HIGH)	R/W	0 to 360000	0.01 [s]	P. 5-33
1104 hex	1103 hex		F002 (LOW)				
1105 hex	1104 hex	1st Deceleration Time 1	F003 (HIGH)	R/W	0 to 360000	0.01 [s]	
1106 hex	1105 hex		F003 (LOW)				
1107 hex	1106 hex	RUN Direction Selection	F004	R/W	00: Forward 01: Reverse	–	P. 5-22
1108 to 1200 hex	–	Not used	–	–	Not accessible	–	–

8-9-4 Group A/b/C/H/P Register List

Precautions for Correct Use

- The “Register No.” in the table header shows the register number used inside the inverter.

  Use this register number when setting the communications option unit (EtherCAT/CompoNet/DeviceNet) for the inverter.
- The “Modbus register spec. No.” in the table header shows the register number used to actually specify the register in the Modbus communication process.

  This register number is 1 less than the inverter “Register No.” according to the Modbus communication specifications.

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution	Page
1201 hex	1200 hex	1st Frequency Reference Selection	A001	R/W	00: Volume[*1] 01: Control circuit terminal block (Analog input) 02: Digital Operator 03: Modbus communication 04: Option 06: Pulse train frequency 07: DriveProgramming 10: Operation function output	−	P. 5-24
1202 hex	1201 hex	1st RUN Command Selection[*2]	A002	R/W	01: Control circuit terminal block (DriveProgramming) 02: Digital Operator 03: Modbus communication 04: Option	−	P. 5-22

[*1] This setting is enabled when the Digital Operator with the volume control (Model: 3G3AX-OP01) is connected.

[*2] If you change the 1st RUN Command Selection setting, be sure to wait at least 40 ms before actually inputting the RUN command.

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution	Page
1203 hex	1202 hex	1st Base Frequency	A003	R/W	300 to 1st Maximum Frequency	0.1 [Hz]	P. 5-21
1204 hex	1203 hex	1st Maximum Frequency	A004	R/W	1st Base Frequency to 4000 (5800) *1	0.1 [Hz]	P. 5-21
1205 hex	1204 hex	FV/FI Selection	A005	R/W	00: Switch between FV and FI 02: Switch between FV and volume 03: Switch between FI and volume	–	P. 7-22
1206 to 120A hex	–	Reserved	–	–	–	–	–
120B hex	120A hex	FV Start Frequency	A011 (HIGH)	R/W	0 to 40000 (58000) *1	0.01 [Hz]*2	P. 7-25
120C hex	120B hex		A011 (LOW)				
120D hex	120C hex	FV End Frequency	A012 (HIGH)	R/W	0 to 40000 (58000) *1	0.01 [Hz] *2	
120E hex	120D hex		A012 (LOW)				
120F hex	120E hex	FV Start Ratio	A013	R/W	0 to 100	1 [%]	
1210 hex	120F hex	FV End Ratio	A014	R/W	0 to 100	1 [%]	
1211 hex	1210 hex	FV Start Selection	A015	R/W	00: FV Start Frequency (A011) 01: 0 Hz	–	
1212 hex	1211 hex	Analog Input Filter	A016	R/W	1 to 30/31 (500-ms filter with ±0.1-Hz hysteresis)	1	P. 7-24
1213 hex	1212 hex	DriveProgramming Function Selection	A017	R/W	00: Disabled 01: Enabled (Start/stop via multi-function input PRG terminal) 02: Enabled (Start/stop at power on/off)	–	–
1214 hex	–	Reserved	–	–	–	–	–
1215 hex	1214 hex	Multi-step Speed Selection	A019	R/W	00: Binary (16-step selection with 4 terminals) 01: Bit (8-step selection with 7 terminals)	–	P. 5-29
1216 hex	1215 hex	1st Multi-step Speed Reference 0	A020 (HIGH)	R/W	0 Starting Frequency to 1st Maximum Frequency	0.01 [Hz] *2	
1217 hex	1216 hex		A020 (LOW)	R/W			
1218 hex	1217 hex	Multi-step Speed Reference 1	A021 (HIGH)	R/W	0 Starting frequency to Maximum frequency	0.01 [Hz] *2	
1219 hex	1218 hex		A021 (LOW)	R/W			
121A hex	1219 hex	Multi-step Speed Reference 2	A022 (HIGH)	R/W	0 Starting frequency to Maximum frequency	0.01 [Hz] *2	
121B hex	121A hex		A022 (LOW)	R/W			

*1. In the high-frequency mode.

*2. When the PID function is enabled, the data unit differs between read and write operations.

Set parameter values in units of 0.01 Hz for writing and in units of 0.1% (as 100% of the maximum frequency) for reading.

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution	Page
121C hex	121B hex	Multi-step Speed Reference 3	A023 (HIGH)	R/W	0 Starting frequency to Maximum frequency	0.01 [Hz]*1	P. 5-29
121D hex	121C hex		A023 (LOW)	R/W			
121E hex	121D hex	Multi-step Speed Reference 4	A024 (HIGH)	R/W	0 Starting frequency to Maximum frequency	0.01 [Hz] *1	
121F hex	121E hex		A024 (LOW)	R/W			
1220 hex	121F hex	Multi-step Speed Reference 5	A025 (HIGH)	R/W	0 Starting frequency to Maximum frequency	0.01 [Hz] *1	
1221 hex	1220 hex		A025 (LOW)	R/W			
1222 hex	1221 hex	Multi-step Speed Reference 6	A026 (HIGH)	R/W	0 Starting frequency to Maximum frequency	0.01 [Hz] *1	
1223 hex	1222 hex		A026 (LOW)	R/W			
1224 hex	1223 hex	Multi-step Speed Reference 7	A027 (HIGH)	R/W	0 Starting frequency to Maximum frequency	0.01 [Hz] *1	
1225 hex	1224 hex		A027 (LOW)	R/W			
1226 hex	1225 hex	Multi-step Speed Reference 8	A028 (HIGH)	R/W	0 Starting frequency to Maximum frequency	0.01 [Hz] *1	
1227 hex	1226 hex		A028 (LOW)	R/W			
1228 hex	1227 hex	Multi-step Speed Reference 9	A029 (HIGH)	R/W	0 Starting frequency to Maximum frequency	0.01 [Hz] *1	
1229 hex	1228 hex		A029 (LOW)	R/W			
122A hex	1229 hex	Multi-step Speed Reference 10	A030 (HIGH)	R/W	0 Starting frequency to Maximum frequency	0.01 [Hz] *1	
122B hex	122A hex		A030 (LOW)	R/W			
122C hex	122B hex	Multi-step Speed Reference 11	A031 (HIGH)	R/W	0 Starting frequency to Maximum frequency	0.01 [Hz] *1	
122D hex	122C hex		A031 (LOW)	R/W			
122E hex	122D hex	Multi-step Speed Reference 12	A032 (HIGH)	R/W	0 Starting frequency to Maximum frequency	0.01 [Hz] *1	
122F hex	122E hex		A032 (LOW)	R/W			
1230 hex	122F hex	Multi-step Speed Reference 13	A033 (HIGH)	R/W	0 Starting frequency to Maximum frequency	0.01 [Hz] *1	
1231 hex	1230 hex		A033 (LOW)	R/W			
1232 hex	1231 hex	Multi-step Speed Reference 14	A034 (HIGH)	R/W	0 Starting frequency to Maximum frequency	0.01 [Hz] *1	
1233 hex	1232 hex		A034 (LOW)	R/W			
1234 hex	1233 hex	Multi-step Speed Reference 15	A035 (HIGH)	R/W	0 Starting frequency to Maximum frequency	0.01 [Hz] *1	
1235 hex	1234 hex		A035 (LOW)	R/W			

*1. When the PID function is enabled, the data unit differs between read and write operations.

Set parameter values in units of 0.01 Hz for writing and in units of 0.1% (as 100% of the maximum frequency) for reading.

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution	Page
1236 hex	–	Reserved	–	–	–	–	–
1237 hex							
1238 hex	1237 hex	Jogging Frequency	A038	R/W	Starting Frequency to 999 (10000) [*1]	0.01 [Hz]	P. 5-52
1239 hex	1238 hex	Jogging Stop Selection	A039	R/W	00: Free-running on jogging stop/Disabled during operation 01: Deceleration stop on jogging stop/Disabled during operation 02: DC injection braking on jogging stop/Disabled during operation 03: Free-running on jogging stop/Enabled during operation 04: Deceleration stop on jogging stop/Enabled during operation 05: DC injection braking on jogging stop/Enabled during operation	–	
123A hex	–	Reserved	–	–	–	–	–
123B hex	123A hex	1st Torque Boost Selection	A041	R/W	00: Manual torque boost 01: Automatic torque boost	–	P. 5-60
123C hex	123B hex	1st Manual Torque Boost Voltage	A042	R/W	0 to 200	0.1 [%]	
123D hex	123C hex	1st Manual Torque Boost Frequency	A043	R/W	0 to 500	0.1 [%]	
123E hex	123D hex	1st Control Method	A044	R/W	00: Constant torque characteristics 01: Reduced torque characteristics 02: Free V/f setting 03: Sensorless vector control[*2]	–	P. 5-9
123F hex	123E hex	1st Output Voltage Gain	A045	R/W	20 to 100	1 [%]	P. 7-41

[*1] In the high-frequency mode.

[*2] Sensorless vector control can be set in the heavy load mode only.

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution	Page
1240 hex	123F hex	1st Automatic Torque Boost Voltage Compensation Gain	A046	R/W	0 to 255	1 [%]	P. 5-60
1241 hex	1240 hex	1st Automatic Torque Boost Slip Compensation Gain	A047	R/W	0 to 255	1 [%]	
1242 to 1244 hex	–	Reserved	–	–	–	–	–
1245 hex	1244 hex	DC Injection Braking Selection	A051	R/W	00: Disabled 01: Enabled 02: Enabled (Operates only at set frequency)	–	P. 7-91
1246 hex	1245 hex	DC Injection Braking Frequency	A052	R/W	0 to 6000	0.01 [Hz]	
1247 hex	1246 hex	DC Injection Braking Delay Time	A053	R/W	0 to 50	0.1 [s]	
1248 hex	1247 hex	DC Injection Braking Power	A054	R/W	0 to 100 (70)	1 [%]	
1249 hex	1248 hex	DC Injection Braking Time	A055	R/W	0 to 600	0.1 [s]	
124A hex	1249 hex	DC Injection Braking Edge/Level Selection	A056	R/W	00: Edge operation 01: Level operation	–	

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution	Page
124B hex	124A hex	Startup DC Injection Braking Power	A057	R/W	0 to 100 (70)	1 [%]	P. 7-91
124C hex	124B hex	Startup DC Injection Braking Time	A058	R/W	0 to 600	0.1 [s]	
124D hex	124C hex	DC Injection Braking Carrier Frequency	A059	R/W	20 to 150 (100)	0.1 [kHz]	
124E hex	–	Reserved	–	–	–	–	–
124F hex	124E hex	1st Frequency Upper Limit	A061 (HIGH)	R/W	0 1st Frequency Lower Limit to 1st Maximum Frequency	0.01 [Hz]	P. 5-31
1250 hex	124F hex		A061 (LOW)	R/W			
1251 hex	1250 hex	1st Frequency Lower Limit	A062 (HIGH)	R/W	0 Starting Frequency to 1st Maximum Frequency	0.01 [Hz]	
1252 hex	1251 hex		A062 (LOW)	R/W			
1253 hex	1252 hex	Jump Frequency 1	A063 (HIGH)	R/W	0 to 40000 (58000) *1	0.01 [Hz]	P. 7-36
1254 hex	1253 hex		A063 (LOW)	R/W			
1255 hex	1254 hex	Jump Frequency Width 1	A064	R/W	0 to 1000 (10000) *1	0.01 [Hz]	
1256 hex	1255 hex	Jump Frequency 2	A065 (HIGH)	R/W	0 to 40000 (58000) *1	0.01 [Hz]	
1257 hex	1256 hex		A065 (LOW)	R/W			
1258 hex	1257 hex	Jump Frequency Width 2	A066	R/W	0 to 1000 (10000) *1	0.01 [Hz]	
1259 hex	1258 hex	Jump Frequency 3	A067 (HIGH)	R/W	0 to 40000 (58000) *1	0.01 [Hz]	
125A hex	1259 hex		A067 (LOW)	R/W			
125B hex	125A hex	Jump Frequency Width 3	A068	R/W	0 to 1000 (10000) *1	0.01 [Hz]	
125C hex	125B hex	Acceleration Stop Frequency	A069 (HIGH)	R/W	0 to Starting Frequency: Disabled Frequency above Starting Frequency to 40000 (58000) *1	0.01 [Hz]	P. 7-37
125D hex	125C hex		A069 (LOW)	R/W			
125E hex	125D hex	Acceleration Stop Time	A070	R/W	0: Disabled 1 to 600	0.1 [s]	

*1. In the high-frequency mode.

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution	Page
125F hex	125E hex	PID Selection	A071	R/W	00: Disabled 01: Enabled 02: Enabled (Reverse output enabled)	–	P. 7-44
1260 hex	125F hex	PID P Gain	A072	R/W	0 to 2500	0.01	
1261 hex	1260 hex	PID I Gain	A073	R/W	0 to 36000	0.1 [s]	
1262 hex	1261 hex	PID D Gain	A074	R/W	0 to 10000	0.01 [s]	
1263 hex	1262 hex	PID Scale	A075	R/W	1 to 9999	0.01	
1264 hex	1263 hex	PID Feedback Selection	A076	R/W	00: Current (FI) 01: Voltage (FV) 02: Modbus communication 03: Pulse train frequency 10: Operation function output	–	
1265 hex	1264 hex	PID Deviation Reverse Output	A077	R/W	00: Disabled (Deviation = Target value – Feedback value) 01: Enabled (Deviation = Feedback value – Target value)	–	
1266 hex	1265 hex	PID Variable Range Limit	A078	R/W	0 to 1000	0.1 [%]	
1267 hex	1266 hex	PID Feedforward Selection	A079	R/W	00: Disabled 01: Voltage (FV) 02: Current (FI)	–	
1268 hex	–	Reserved	–	–	–	–	–
1269 hex	1268 hex	1st AVR Selection	A081	R/W	00: Always ON 01: Always OFF 02: OFF during deceleration	–	P. 7-42
126A hex	1269 hex	1st Motor Rated Voltage Selection	A082	R/W	200-V class: 00 (200) 01 (215) 02 (220) 03 (230) 04 (240) 400-V class: 05 (380) 06 (400) 07 (415) 08 (440) 09 (460) 10 (480)		
126B hex	126A hex	AVR Filter Time Constant	A083	R/W	0 to 1000	0.01 [s]	P. 7-42
126C hex	126B hex	AVR Gain at Deceleration	A084	R/W	50 to 200	1 [%]	
126D hex	126C hex	Operation Mode Selection	A085	R/W	00: Normal operation 01: Energy-saving operation	–	P. 7-50
126E hex	126D hex	Energy-saving Response/Accuracy Adjustment	A086	R/W	0 to 1000	0.1 [%]	
126F to 1273 hex	–	Reserved	–	–	–	–	–

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution	Page
1274 hex	1273 hex	1st Acceleration Time 2	A092 (HIGH)	R/W	0 to 360000	0.01 [s]	P. 5-37
1275 hex	1274 hex		A092 (LOW)	R/W			
1276 hex	1275 hex	1st Deceleration Time 2	A093 (HIGH)	R/W	0 to 360000	0.01 [s]	
1277 hex	1276 hex		A093 (LOW)	R/W			
1278 hex	1277 hex	1st 2-step Acceleration/ Deceleration Selection	A094	R/W	00: Switch via 2CH terminal (multi-function input: 09) 01: Switch by setting (A095/A295/A096/ A296) 02: Switch only during forward/reverse switching	–	
1279 hex	1278 hex	1st 2-step Acceleration Frequency	A095 (HIGH)	R/W	0 to 40000 (58000) [*1]	0.01 [Hz]	
127A hex	1279 hex		A095 (LOW)	R/W			
127B hex	127A hex	1st 2-step Deceleration Frequency	A096 (HIGH)	R/W	0 to 40000 (58000) [*1]	0.01 [Hz]	
127C hex	127B hex		A096 (LOW)	R/W			
127D hex	127C hex	Acceleration Pattern Selection	A097	R/W	00: Line 01: S-shape curve 02: U-shape curve 03: Inverted U-shape curve 04: EL-S-shape curve	–	P. 5-34
127E hex	127D hex	Deceleration Pattern Selection	A098	R/W	00: Line 01: S-shape curve 02: U-shape curve 03: Inverted U-shape curve 04: EL-S-shape curve	–	
127F hex	–	Reserved	–	–	–	–	–
1280 hex							
1281 hex	1280 hex	FI Start Frequency	A101 (HIGH)	R/W	0 to 40000 (58000) [*1]	0.01 [Hz][*2]	P. 7-25
1282 hex	1281 hex		A101 (LOW)	R/W			
1283 hex	1282 hex	FI End Frequency	A102 (HIGH)	R/W	0 to 40000 (58000) [*1]	0.01 [Hz] [*2]	
1284 hex	1283 hex		A102 (LOW)	R/W			
1285 hex	1284 hex	FI Start Ratio	A103	R/W	0 to 100	1 [%]	
1286 hex	1285 hex	FI End Ratio	A104	R/W	0 to 100	1 [%]	
1287 hex	1286 hex	FI Start Selection	A105	R/W	00: FI Start Frequency (A101) 01: 0 Hz	–	

*1. In the high-frequency mode.

*2. When the PID function is enabled, the data unit differs between read and write operations.
Set parameter values in units of 0.01 Hz for writing and in units of 0.1% (as 100% of the maximum frequency) for reading.

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution	Page
1288 to 12A4 hex	–	Reserved	–	–	–	–	–
12A5 hex	12A4 hex	Acceleration Curve Parameter	A131	R/W	01 (Small curve) to 10 (Large curve)	–	P. 5-34
12A6 hex	12A5 hex	Deceleration Curve Parameter	A132	R/W	01 (Small curve) to 10 (Large curve)	–	
12A7 to 12AE hex	–	Reserved	–	–	–	–	–
12AF hex	12AE hex	Calculation Frequency Selection 1	A141	R/W	00: Digital Operator (A020/A220) 01: Volume[*1] 02: Voltage (FV) input 03: Current (FI) input 04: Modbus communication 05: Option 07: Pulse train frequency	–	P. 7-39
12B0 hex	12AF hex	Calculation Frequency Selection 2	A142	R/W	00: Digital Operator (A020/A220) 01: Volume [*1] 02: Voltage (FV) input 03: Current (FI) input 04: Modbus communication 05: Option 07: Pulse train frequency	–	
12B1 hex	12B0 hex	Calculation Function Operator Selection	A143	R/W	00: Addition (A141 + A142) 01: Subtraction (A141 – A142) 02: Multiplication (A141 × A142)	–	
12B2 hex	–	Reserved	–	–	–	–	–
12B3 hex	12B2 hex	Frequency Addition Amount Setting	A145 (HIGH)	R/W	0 to 40000 (58000) [*2]	0.01 [Hz][*3]	P. 7-39
12B4 hex	12B3 hex		A145 (LOW)	R/W			
12B5 hex	12B4 hex	Frequency Addition Sign Selection	A146	R/W	00: Frequency reference + A145 01: Frequency reference – A145	–	
12B6 to 12B8 hex	–	Reserved	–	–	–	–	–
12B9 hex	12B8 hex	EL-S Shape Acceleration Curve Ratio 1	A150	R/W	0 to 50	1 [%]	P. 5-34
12BA hex	12B9 hex	EL-S Shape Acceleration Curve Ratio 2	A151	R/W	0 to 50	1 [%]	
12BB hex	12BA hex	EL-S Shape Deceleration Curve Ratio 1	A152	R/W	0 to 50	1 [%]	
12BC hex	12BB hex	EL-S Shape Deceleration Curve Ratio 2	A153	R/W	0 to 50	1 [%]	

*1. This setting is enabled when the Digital Operator with the volume control (Model: 3G3AX-OP01) is connected.

*2. In the high-frequency mode.

*3. When the PID function is enabled, the data unit differs between read and write operations.
Set parameter values in units of 0.01 Hz for writing and in units of 0.1% (as 100% of the maximum frequency) for reading.

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution	Page
12BD hex	12BC hex	Deceleration Stop Frequency	A154 (HIGH)	R/W	0 to Starting Frequency: Disabled Frequency above Starting Frequency to 40000 (58000)*1	0.01 [Hz]	P. 7-37
12BE hex	12BD hex		A154 (LOW)				
12BF hex	12BE hex	Deceleration Stop Time	A155	R/W	0: Disabled 1 to 600	0.1 [s]	
12C0 hex	12BF hex	PID Sleep Operation Level	A156 (HIGH)	R/W	0 to 40000 (58000) *1	0.01 [Hz]	P. 7-44
12C1 hex	12C0 hex		A156 (LOW)				
12C2 hex	12C1 hex	PID Sleep Operation Delay Time	A157	R/W	0 to 255	0.1 [s]	
12C3 to 12C5 hex	–	Reserved	–	–	–	–	–
12C6 hex	12C5 hex	VR Start Frequency	A161 (HIGH)	R/W	0 to 40000 (58000) *1	0.01 [Hz]	P. 7-25
12C7 hex	12C6 hex		A161 (LOW)	R/W			
12C8 hex	12C7 hex	VR End Frequency	A162 (HIGH)	R/W	0 to 40000 (58000) *1	0.01 [Hz]	
12C9 hex	12C8 hex		A162 (LOW)	R/W			
12CA hex	12C9 hex	VR Start Ratio	A163	R/W	0 to VR End Ratio	1 [%]	
12CB hex	12CA hex	VR End Ratio	A164	R/W	VR Start Ratio to 100	1 [%]	
12CC hex	12CB hex	VR Start Selection	A165	R/W	00: VR Start Frequency (A161) 01: 0 Hz	–	
12CD to 1300 hex	–	Not used	–	–	Not accessible	–	–
1301 hex	1300 hex	Power Interruption/ Undervoltage Restart Selection	b001	R/W	00: Trip 01: 0-Hz restart 02: Frequency matching restart 03: Trip after frequency matching deceleration stop 04: Frequency pull-in restart	–	P. 7-61
1302 hex	1301 hex	Allowable Power Interruption Time	b002	R/W	3 to 250	0.1 [s]	
1303 hex	1302 hex	Restart Standby Time	b003	R/W	3 to 1000	0.1 [s]	P. 7-61
1304 hex	1303 hex	Power Interruption/ Undervoltage Trip Selection During Stop	b004	R/W	00: Disabled 01: Enabled 02: Disabled during stop and deceleration stop by turning off the RUN command	–	P. 7-63
1305 hex	1304 hex	Power Interruption Restart Count	b005	R/W	00: 16 times 01: No limit	–	
1306 hex	–	Reserved	–	–	–	–	–

*1. In the high-frequency mode.

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution	Page
1307 hex	1306 hex	Frequency Matching Lower Limit Frequency	b007 (HIGH)	R/W	0 to 40000 (58000) *1	0.01 [Hz]	P. 7-61
1308 hex	1307 hex		b007 (LOW)	R/W			
1309 hex	1308 hex	Overvoltage/ Overcurrent Restart Selection	b008	R/W	00: Trip 01: 0-Hz restart 02: Frequency matching restart 03: Trip after frequency matching deceleration stop 04: Frequency pull-in restart	–	P. 7-61
130A hex	–	Reserved	–	–	–	–	–
130B hex	130A hex	Overvoltage/ Overcurrent Restart Count	b010	R/W	1 to 3	1 [time]	P. 7-63
130C hex	130B hex	Overvoltage/ Overcurrent Restart Standby Time	b011	R/W	3 to 1000	0.1 [s]	
130D hex	130C hex	1st Electronic Thermal Level	b012	R/W	200 to 1000	0.1 [%]	P. 7-73
130E hex	130D hex	1st Electronic Thermal Characteristics Selection	b013	R/W	00: Reduced torque characteristics 01: Constant torque characteristics 02: Free setting	–	
130F hex	–	Reserved	–	–	–	–	–
1310 hex	130F hex	Free-electronic Thermal Frequency 1	b015	R/W	0 to Free-electronic Thermal Frequency 2	1 [Hz]	P. 7-72
1311 hex	1310 hex	Free-electronic Thermal Current 1	b016	R/W	0 to 1000	0.1 [%]	
1312 hex	1311 hex	Free-electronic Thermal Frequency 2	b017	R/W	Free-electronic Thermal Frequency 1 to Free-electronic Thermal Frequency 3	1 [Hz]	
1313 hex	1312 hex	Free-electronic Thermal Current 2	b018	R/W	0 to 1000	0.1 [%]	P. 7-72
1314 hex	1313 hex	Free-electronic Thermal Frequency 3	b019	R/W	Free-electronic Thermal Frequency 2 to 400 (580)*1	1 [Hz]	
1315 hex	1314 hex	Free-electronic Thermal Current 3	b020	R/W	0 to 1000	0.1 [%]	

*1. In the high-frequency mode.

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution	Page
1316 hex	1315 hex	1st Overload Limit Selection	b021	R/W	00: Disabled 01: Enabled during acceleration and constant speed 02: Enabled during constant speed 03: Enabled during acceleration and constant speed (Accelerated during regeneration)	–	P. 7-76
1317 hex	1316 hex	1st Overload Limit Level	b022	R/W	200 to 2000 (1500)	0.1 [%]	
1318 hex	1317 hex	1st Overload Limit Parameter	b023	R/W	1 to 30000	0.1 [s]	
1319 hex	1318 hex	1st Overload Limit Selection 2	b024	R/W	00: Disabled 01: Enabled during acceleration and constant speed 02: Enabled during constant speed 03: Enabled during acceleration and constant speed (Accelerated during regeneration)	–	
131A hex	1319 hex	1st Overload Limit Level 2	b025	R/W	200 to 2000 (1500)	0.1 [%]	
131B hex	131A hex	1st Overload Limit Parameter 2	b026	R/W	1 to 30000	0.1 [s]	
131C hex	131B hex	Overcurrent Suppression Selection	b027	R/W	00: Disabled 01: Enabled 02: Enabled (at reduced voltage startup)	–	P. 7-79
131D hex	131C hex	Frequency Pull-in Restart Level	b028	R/W	200 to 2000 (1500)	0.1 [%]	P. 5-45 P. 7-61
131E hex	131D hex	Frequency Pull-in Restart Parameter	b029	R/W	1 to 30000	0.1 [s]	
131F hex	131E hex	Starting Frequency Selection at Frequency Pull-in Restart	b030	R/W	00: Frequency at interruption 01: Maximum frequency 02: Set frequency (Frequency reference)	–	

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution	Page
1320 hex	131F hex	Soft Lock Selection	b031	R/W	00: Data other than b031 cannot be changed when terminal SFT is ON. 01: Data other than b031 and the set frequency cannot be changed when terminal SFT is ON. 02: Data other than b031 cannot be changed. 03: Data other than b031 and set frequency cannot be changed. 10: Data can be changed during RUN.	–	P. 7-54
1321 hex	–	Reserved	–	–	–	–	–
1322 hex	1321 hex	Motor Cable Length	b033	R/W	5 to 20	1 [m]	–
1323 hex	1322 hex	RUN Time/Power ON Time Detection Level	b034 (HIGH)	R/W	0 to 65535	10 [h]	P. 7-82
1324 hex	1323 hex		b034 (LOW)	R/W			
1325 hex	1324 hex	RUN Direction Limit Selection	b035	R/W	00: No direction limit 01: Only Forward is enabled (Reverse is limited) 02: Only Reverse is enabled (Forward is limited)	–	P. 7-38
1326 hex	1325 hex	Reduced Voltage Startup Selection	b036	R/W	0 (Reduced voltage startup time: Short) to 255 (Reduced voltage startup time: Long)	–	P. 7-36
1327 hex	1326 hex	Display Selection	b037	R/W	00: Complete display 01: Individual display of functions 02: User setting +d001, F001, b037 03: Data comparison display 04: Basic display 05: Monitor display only + b037	–	P. 5-3

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution	Page
1328 hex	1327 hex	Initial Screen Selection	b038	R/W	00: Screen on which the Enter key was last pressed 001 to 060: (d001 to d060) 201: F001 202: Do not set.	–	P. 7-56
1329 hex	1328 hex	User Parameter Automatic Setting Function	b039	R/W	00: Disabled 01: Enabled	–	P. 7-60
132A hex	1329 hex	Torque Limit Selection	b040	R/W	00: Four-quadrant separate setting 01: Terminal switching 02: Analog voltage input 03: Option (No applicable Option)	–	P. 6-12
132B hex	132A hex	Torque Limit 1 (Four-quadrant Mode Forward Power Running)	b041	R/W	0 to 200 255: no	1 [%]	
132C hex	132B hex	Torque Limit 2 (Four-quadrant Mode Reverse Regeneration)	b042	R/W	0 to 200 255: no	1 [%]	
132D hex	132C hex	Torque Limit 3 (Four-quadrant Mode Reverse Power Running)	b043	R/W	0 to 200 255: no	1 [%]	
132E hex	132D hex	Torque Limit 4 (Four-quadrant Mode Forward Regeneration)	b044	R/W	0 to 200 255: no	1 [%]	
132F hex	132E hex	Torque LADSTOP Selection	b045	R/W	00: Disabled 01: Enabled	–	P. 6-14
1330 hex	132F hex	Reverse Rotation Prevention Selection	b046	R/W	00: Disabled 01: Enabled	–	P. 6-11
1331 hex 1332 hex	–	Reserved	–	–	–	–	–
1333 hex	1332 hex	Heavy Load/Light Load Selection	b049	R/W	00: Heavy load mode (CT) 01: Light load mode (VT)	–	P. 5-12

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution	Page
1334 hex	1333 hex	Deceleration Stop Selection on Power Interruption	b050	R/W	00: Disabled 01: Enabled (Deceleration stop) 02: Enabled (Constant voltage, without recovery) 03: Enabled (Constant voltage, with recovery)	–	P. 7-68
1335 hex	1334 hex	Starting Voltage on Power Interruption	b051	R/W	0 to 10000	0.1 [V]	
1336 hex	1335 hex	Deceleration Hold Level on Power Interruption	b052	R/W	0 to 10000	0.1 [V]	
1337 hex	1336 hex	Deceleration Time on Power Interruption	b053 (HIGH)	R/W	1 to 360000	0.01 [s]	
1338 hex	1337 hex		b053 (LOW)	R/W			
1339 hex	1338 hex	Deceleration Starting Width on Power Interruption	b054	R/W	0 to 1000 (10000) *1	0.01 [Hz]	
133A to 133E hex	–	Reserved	–	–	–	–	–
133F hex	133E hex	Window Comparator FV Upper Limit Level	b060	R/W	0. to 100. (Lower limit: b061 + b062 × 2)	1 [%]	P. 7-88
1340 hex	133F hex	Window Comparator FV Lower Limit Level	b061	R/W	0. to 100. (Upper limit: b060 – b062 × 2)	1 [%]	
1341 hex	1340 hex	Window Comparator FV Hysteresis Width	b062	R/W	0. to 10. (Upper limit: (b060 – b061) / 2)	1 [%]	
1342 hex	1341 hex	Window Comparator FI Upper Limit Level	b063	R/W	0. to 100. (Lower limit: b064 + b065 × 2)	1 [%]	
1343 hex	1342 hex	Window Comparator FI Lower Limit Level	b064	R/W	0. to 100. (Upper limit: b063 – b065 × 2)	1 [%]	
1344 hex	1343 hex	Window Comparator FI Hysteresis Width	b065	R/W	0. to 10. (Upper limit: (b063 – b064) / 2)	1 [%]	

*1. In the high-frequency mode.

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution	Page
1345 to 1348 hex	–	Reserved	–	–	–	–	–
1349 hex	1348 hex	Analog Operation Level at FV Disconnection	b070	R/W	0 to 100 255: no (Disabled)	1 [%]	P. 7-88
134A hex	1349 hex	Analog Operation Level at FI Disconnection	b071	R/W	0 to 100 255: no (Disabled)	1 [%]	
134B to 134D hex	–	Reserved	–	–	–	–	–
134E hex	134D hex	Ambient Temperature	b075	R/W	–10 to 50	1 [°C]	P. 7-85
134F to 1350 hex	–	Reserved	–	–	–	–	–
1351 hex	1350 hex	Integrated Power Clear	b078	R/W	00: Clear disabled 01: Executes Clear (Resets to 00 after execution.)	–	P. 7-9
1352 hex	1351 hex	Integrated Power Display Scale	b079	R/W	1 to 1000	1	
1353 hex 1354 hex	–	Reserved	–	–	–	–	–
1355 hex	1354 hex	Starting Frequency	b082	R/W	1 to 999 (10000) [*1]	0.01 [Hz]	P. 7-35
1356 hex	1355 hex	Carrier Frequency	b083	R/W	20 to 150 (100)	0.1 [kHz]	P. 7-31
1357 hex	1356 hex	Initialization Selection	b084	R/W	00: Initialization disabled 01: Clearing fault monitor 02: Initialize data 03: Clear fault monitor + Initialize data 04: Clear fault monitor + Initialize data + Clear DriveProgramming	–	P. 5-6
1358 hex	1357 hex	Initialization Data Selection	b085	R/W	Do not change the default 00.	–	
1359 hex	1358 hex	Frequency Conversion Coefficient	b086	R/W	1 to 9999	0.01	P. 7-6
135A hex	1359 hex	STOP Key Selection	b087	R/W	00: Enabled 01: Disabled 02: Only RESET enabled	–	P. 5-42
135B hex	135A hex	Free-run Stop Selection	b088	R/W	00: 0-Hz restart 01: Frequency matching restart 02: Frequency pull-in restart	–	P. 5-39

[*1] In the high-frequency mode.

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution	Page
135C hex	135B hex	Automatic Carrier Reduction	b089	R/W	00: Disabled 01: Enabled (dependent on current) 02: Enabled (dependent on cooling fin temperature)	–	P. 7-32
135D hex	135C hex	Usage Rate of Regenerative Braking	b090	R/W	0: Regenerative braking not active 1 to 1000 (limited by setting in b097.)	0.1 [%]	P. 5-65
135E hex	135D hex	Stop Selection	b091	R/W	00: Deceleration stop 01: Free-run stop	–	P. 5-39
135F hex	135E hex	Cooling Fan Operation	b092	R/W	00: Always enabled 01: Enabled only during operation (including 5 minutes after power on/stop) 02: Dependent on cooling fin temperature	–	P. 7-84
1360 hex	135F hex	Total Fan Operation Time Clear	b093	R/W	00: Clear disabled 01: Executes Clear (Resets to 00 after execution.)	–	
1361 hex	1360 hex	Initialization Target Setting	b094	R/W	00: All data 01: Data other than terminals/communications 02: U*** registration function only 03: Other than U*** registration function and b37	–	P. 5-6
1362 hex	1361 hex	Regenerative Braking Selection	b095	R/W	00: Disabled (Function not active) 01: Enabled (Disabled during stop) 02: Enabled (Enabled during stop)	–	P. 5-65

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution	Page
1363 hex	1362 hex	Regenerative Braking ON Level	b096	R/W	200-V class: 330 to 380 400-V class: 660 to 760	1 [V]	P. 5-65
1364 hex	1363 hex	Braking Resistor Value	b097	R/W	Minimum connection resistance to 6000	0.1 [Ω]	
1365 to 1366 hex	–	Reserved	–	–	–	–	–
1367 hex	1366 hex	Free V/f Frequency 1	b100	R/W	0. to Free V/f Frequency 2	1 [Hz]	P. 5-9
1368 hex	1367 hex	Free V/f Voltage 1	b101	R/W	0 to 8000	0.1 [V]	
1369 hex	1368 hex	Free V/f Frequency 2	b102	R/W	Free V/f Frequency 1 to Free V/f Frequency 3	1 [Hz]	
136A hex	1369 hex	Free V/f Voltage 2	b103	R/W	0 to 8000	0.1 [V]	
136B hex	136A hex	Free V/f Frequency 3	b104	R/W	Free V/f Frequency 2 to Free V/f Frequency 4	1 [Hz]	
136C hex	136B hex	Free V/f Voltage 3	b105	R/W	0 to 8000	0.1 [V]	
136D hex	136C hex	Free V/f Frequency 4	b106	R/W	Free V/f Frequency 3 to Free V/f Frequency 5	1 [Hz]	
136E hex	136D hex	Free V/f Voltage 4	b107	R/W	0 to 8000	0.1 [V]	
136F hex	136E hex	Free V/f Frequency 5	b108	R/W	Free V/f Frequency 4 to Free V/f Frequency 6	1 [Hz]	
1370 hex	136F hex	Free V/f Voltage 5	b109	R/W	0 to 8000	0.1 [V]	
1371 hex	1370 hex	Free V/f Frequency 6	b110	R/W	Free V/f Frequency 5 to Free V/f Frequency 7	1 [Hz]	
1372 hex	1371 hex	Free V/f Voltage 6	b111	R/W	0 to 8000	0.1 [V]	
1373 hex	1372 hex	Free V/f Frequency 7	b112	R/W	Free V/f Frequency 6 to 400 (580) *1	1 [Hz]	
1374 hex	1373 hex	Free V/f Voltage 7	b113	R/W	0 to 8000	0.1 [V]	
1375 to 137A hex	–	Reserved	–	–	–	–	–
137B hex	137A hex	Brake Control Function Selection	b120	R/W	00: Disabled 01: Enabled (DC Injection braking enabled during stop) 02: Enabled (DC Injection braking disabled during stop)	–	P. 6-25
137C hex	137B hex	Brake Release Wait Time	b121	R/W	0 to 500	0.01 [s]	
137D hex	137C hex	Acceleration Wait Time on Brake Control	b122	R/W	0 to 500	0.01 [s]	
137E hex	137D hex	Stop Wait Time on Brake Control	b123	R/W	0 to 500	0.01 [s]	
137F hex	137E hex	Brake Error Detection Time	b124	R/W	0 to 500	0.01 [s]	
1380 hex	137F hex	Brake Release Frequency	b125	R/W	0 to 40000	0.01 [Hz]	
1381 hex	1380 hex	Brake Release Current	b126	R/W	0 to 2000	0.1 [%]	
1382 hex	1381 hex	Brake Force Frequency	b127	R/W	0 to 40000	0.01 [Hz]	
1383 hex 1384 hex	–	Reserved	–	–	–	–	–

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution	Page
1385 hex	1384 hex	Overvoltage Suppression Function Selection During Deceleration	b130	R/W	00: Disabled 01: DC voltage kept constant 02: Acceleration enabled	–	P. 5-63
1386 hex	1385 hex	Overvoltage Suppression Level During Deceleration	b131	R/W	200-V class: 330 to 395 400-V class: 660 to 790	1 [V]	
1387 hex	1386 hex	Overvoltage Suppression Parameter During Deceleration	b132	R/W	10 to 3000	0.01 [s]	P. 5-63
1388 hex	1387 hex	Overvoltage Suppression Proportional Gain During Deceleration	b133	R/W	0 to 500	0.01	
1389 hex	1388 hex	Overvoltage Suppression Integral Time During Deceleration	b134	R/W	0 to 1500	0.1 [s]	
138A to 1393 hex	–	Reserved	–	–	–	–	–
1394 hex	1393 hex	GS Input Operation Selection	b145	R/W	00: Not trip 01: Trip	–	P. 7-98
1395 to 13A5 hex	–	Reserved	–	–	–	–	–
13A6 hex	13A5 hex	d001/d007 Data Setting Selection	b163	R/W	00: Disabled 01: Enabled	–	P. 7-4 P. 7-6
13A7 hex	13A6 hex	Initial Screen Automatic Return Function	b164	R/W	00: Disabled 01: Enabled	–	P. 7-56
13A8 hex	13A7 hex	Operation Selection at External Operator Disconnection	b165	R/W	00: Trip 01: Trip after deceleration stop 02: Ignore 03: Free-run stop 04: Deceleration stop	–	P. 7-56

*1. In the high-frequency mode.

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution	Page
13A9 hex	–	(Reserved)	b166	–	Do not change the default 00.	–	–
13AA to 13AD hex	–	Reserved	–	–	–	–	–
13AE hex	13AD hex	Inverter Mode Selection	b171	R/W	00: Selection disabled 01: Induction motor mode 02: Induction motor high-frequency mode 03: PM motor mode	–	P. 6-57
13AF to 13B6 hex	–	Reserved	–	–	–	–	–
13B7 hex	13B6 hex	Initialization Execution	b180	R/W	00: Function disabled 01: Execute initialization	–	P. 5-6
13B8 to 13C5 hex	–	Not used	–	–	Not accessible	–	–
13C6 hex	13C5 hex	Motor Electronic Thermal Selection	b910	R/W	00: Disabled 01: Enabled (fixed subtraction ratio) 02: Enabled (b911 subtraction ratio) 03: Enabled (b912 time parameter subtraction)	–	P. 7-73
13C7 hex	13C6 hex	Motor Electronic Thermal Subtraction Ratio	b911 (HIGH)	R/W	10 to 10000000	0.01 [s]	P. 7-73
13C8 hex	13C7 hex		b911 (LOW)				
13C9 hex	13C8 hex	Motor Electronic Thermal Subtraction Time Constant	b912 (HIGH)	R/W	10 to 10000000	0.01 [s]	P. 7-73
13CA hex	13C9 hex		b912 (LOW)				
13CB hex	13CA hex	Motor Electronic Thermal Integration Gain	b913	R/W	10 to 2000	0.1 [%]	P. 7-73
13CD to 1400 hex	–	Not used	–	–	Not accessible	–	–

- For Modbus communication, the parameters b150, b160, and b161 have no corresponding registers.

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution	Page
1401 hex	1400 hex	Multi-function Input S1 Selection	C001	R/W	00: FW (Forward) 01: RV (Reverse) 02: CF1 (Multi-step speed setting binary 1) 03: CF2 (Multi-step speed setting binary 2) 04: CF3 (Multi-step speed setting binary 3) 05: CF4 (Multi-step speed setting binary 4) 06: JG (Jogging) 07: DB (External DC injection braking) 08: SET (2nd control) 09: 2CH (2-step acceleration/deceleration) 11: FRS (Free-run stop) 12: EXT (External trip) 13: USP (Power recovery restart prevention function) 14: CS (Commercial switch) 15: SFT (Soft lock) 16: AT (Analog input switching) 18: RS (reset) 19: TH (PTC thermistor thermal protection) <C005 only> 20: STA (3-wire start) 21: STP (3-wire stop) 22: F/R (3-wire forward/reverse) 23: PID (PID disabled) 24: PIDC (PID integral reset) 27: UP (Remote operation accelerated) 28: DWN (Remote operation decelerated) 29: UDC (Remote operation data clear) 31: OPE (Forced operator function) 32: SF1 (Multi-step speed setting bit 1) 33: SF2 (Multi-step speed setting bit 2) 34: SF3 (Multi-step speed setting bit 3) 35: SF4 (Multi-step speed setting bit 4) 36: SF5 (Multi-step speed setting bit 5) 37: SF6 (Multi-step speed setting bit 6) 38: SF7 (Multi-step speed setting bit 7) 39: OLR (Overload limit switching) 40: TL (Torque limit enabled) 41: TRQ1 (Torque limit switching 1) 42: TRQ2 (Torque limit switching 2) 44: BOK (Brake confirmation) 46: LAC (LAD cancel) 47: PCLR (Current position clear) 50: ADD (Set frequency A145 addition) 51: F-TM (Forced terminal block) 52: ATR (Torque reference input permission) 53: KHC (Integrated power clear) 56: MI1 (General-purpose input 1) 57: MI2 (General-purpose input 2) 58: MI3 (General-purpose input 3) 59: MI4 (General-purpose input 4) 60: MI5 (General-purpose input 5) 61: MI6 (General-purpose input 6) 62: MI7 (General-purpose input 7) 65: AHD (Analog command held) 66: CP1 (Position command selection 1) 67: CP2 (Position command selection 2) 68: CP3 (Position command selection 3) 69: ORL (Origin search limit signal) 70: ORG (Origin search startup signal) 73: SPD (Speed/Position switching) 77: GS1 (GS1 input) <C003 only> 78: GS2 (GS2 input) <C004 only> 81: 485 (Start co-inverter communication) 82: PRG (DriveProgramming start) 83: HLD (Retain output frequency) 84: ROK (Permission of RUN command) 85: EB (Rotation direction detection) 86: DISP (Display fixed) 91: PSET (Preset position) 255: no (No allocation)	–	P. 7-18
1402 hex	1401 hex	Multi-function Input S2 Selection	C002	R/W		–	
1403 hex	1402 hex	Multi-function Input S3 Selection	C003	R/W		–	
1404 hex	1403 hex	Multi-function Input S4 Selection	C004	R/W		–	
1405 hex	1404 hex	Multi-function Input S5 Selection	C005	R/W		–	
1406 hex	1405 hex	Multi-function Input S6 Selection	C006	R/W		–	
1407 hex	1406 hex	Multi-function Input S7 Selection	C007	R/W		–	

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution	Page
1408 to 140A hex	–	Reserved	–	–	–	–	–
140B hex	140A hex	Multi-function Input S1 Operation Selection	C011	R/W	00: NO (NO contact) 01: NC (NC contact)	–	P. 5-48
140C hex	140B hex	Multi-function Input S2 Operation Selection	C012	R/W		–	
140D hex	140C hex	Multi-function Input S3 Operation Selection	C013	R/W		–	
140E hex	140D hex	Multi-function Input S4 Operation Selection	C014	R/W		–	
140F hex	140E hex	Multi-function Input S5 Operation Selection	C015	R/W		–	
1410 hex	140F hex	Multi-function Input S6 Operation Selection	C016	R/W		–	
1411 hex	1410 hex	Multi-function Input S7 Operation Selection	C017	R/W		–	
1412 to 1414 hex	–	Reserved	–	–	–	–	–

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution	Page
1415 hex	1414 hex	Multi-function Output P1 Selection	C021	R/W	00: RUN (During RUN) 01: FA1 (Constant speed arrival signal) 02: FA2 (Set frequency exceeded signal) 03: OL (Overload warning) 04: OD (Excessive PID deviation) 05: AL (Alarm signal) 06: FA3 (Set-frequency only signal) 07: OTQ (Overtorque/Undertorque signal) 09: UV (Signal during undervoltage) 10: TRQ (Torque limit) 11: RNT (RUN time over) 12: ONT (Power ON time over) 13: THM (Electronic thermal warning) 19: BRK (Brake release) 20: BER (Brake error) 21: ZS (0-Hz detection signal) 22: DSE (Excessive speed deviation) 23: POK (Position ready) 24: FA4 (Set frequency exceeded signal 2) 25: FA5 (Set-frequency only signal 2) 26: OL2 (Overload warning 2) 27: FVDc (Analog FV disconnection detection) 28: FIDc (Analog FI disconnection detection) 31: FBV (PID feedback comparison) 32: NDc (Communications disconnection detection) 33: LOG1 (Logic operation output 1) 34: LOG2 (Logic operation output 2) 35: LOG3 (Logic operation output 3) 39: WAC (Capacitor life warning) 40: WAF (Cooling fan life warning) 41: FR (Starting contact signal) 42: OHF (Cooling fin overheat warning) 43: LOC (Low current signal) 44: MO1 (General-purpose output 1) 45: MO2 (General-purpose output 2) 46: MO3 (General-purpose output 3) 50: IRDY (Operation ready) 51: FWR (Forward run) 52: RVR (Reverse run) 53: MJA (Fatal fault signal) 54: WCFV (Window comparator FV) 55: WCFI (Window comparator FI) 58: FREF (Frequency reference source) 59: REF (RUN command source) 60: SETM (Motor 2 selection) 62: EDM (Safety device monitor signal) 63: OPO (Option) 255: no (No allocation)	–	P. 5-55
1416 hex	1415 hex	Multi-function Output P2 Selection	C022	R/W		–	
1417 to 1419 hex	–	Reserved	–	–	–	–	–

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution	Page
141A hex	1419 hex	Multi-function Relay Output (MA, MB) Function Selection	C026	R/W	00: RUN (During RUN) 01: FA1 (Constant speed arrival signal) 02: FA2 (Set frequency exceeded signal) 03: OL (Overload warning) 04: OD (Excessive PID deviation) 05: AL (Alarm signal) 06: FA3 (Set-frequency only signal) 07: OTQ (Overtorque/Undertorque signal) 09: UV (Signal during undervoltage) 10: TRQ (Torque limit) 11: RNT (RUN time over) 12: ONT (Power ON time over) 13: THM (Electronic thermal warning) 19: BRK (Brake release) 20: BER (Brake error) 21: ZS (0-Hz detection signal) 22: DSE (Excessive speed deviation) 23: POK (Position ready) 24: FA4 (Set frequency exceeded signal 2) 25: FA5 (Set-frequency only signal 2) 26: OL2 (Overload warning 2) 27: FVDc (Analog FV disconnection detection) 28: FIDc (Analog FI disconnection detection) 31: FBV (PID feedback comparison) 32: NDc (Communications disconnection detection) 33: LOG1 (Logic operation output 1) 34: LOG2 (Logic operation output 2) 35: LOG3 (Logic operation output 3) 39: WAC (Capacitor life warning) 40: WAF (Cooling fan life warning) 41: FR (Starting contact signal) 42: OHF (Cooling fin overheat warning) 43: LOC (Low current signal) 44: MO1 (General-purpose input 1) 45: MO2 (General-purpose input 2) 46: MO3 (General-purpose input 3) 50: IRDY (Operation ready) 51: FWR (Forward run) 52: RVR (Reverse run) 53: MJA (Fatal fault signal) 54: WCFV (Window comparator FV) 55: WCFI (Window comparator FI) 58: FREF (Frequency reference source) 59: REF (RUN command source) 60: SETM (Motor 2 selection) 62: EDM (Safety device monitor) 63: OPO (Option) 255: no (No allocation)	–	P. 5-55

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution	Page
141B hex	141A hex	MP Selection	C027	R/W	00: Output frequency 01: Output current 02: Output torque*1 03: Digital output frequency 04: Output voltage 05: Input power 06: Electronic thermal load rate 07: LAD frequency 08: Digital current monitor 10: Cooling fin temperature 12: DriveProgramming (YA(0)) 15: Pulse train input monitor 16: Option (No applicable Option)	–	P. 7-27
141C hex	141B hex	AM Selection	C028	R/W	00: Output frequency 01: Output current 02: Output torque *1 04: Output voltage 05: Input power 06: Electronic thermal load rate 07: LAD frequency 10: Cooling fin temperature 11: Output torque (signed) *1 13: DriveProgramming (YA(1)) 16: Option (No applicable Option)	–	P. 7-29
141D hex	–	Reserved	–	–	–	–	–
141E hex	141D hex	Digital Current Monitor Reference Value	C030	R/W	200 to 2000 (1500)	0.1 [%]	P. 7-27
141F hex	141E hex	Multi-function Output P1 Operation Selection	C031	R/W	00: NO (NO contact) 01: NC (NC contact)	–	P. 5-55
1420 hex	141F hex	Multi-function Output P2 Operation Selection	C032	R/W	00: NO (NO contact) 01: NC (NC contact)	–	
1421 to 1423 hex	–	Reserved	–	–	–	–	–

[1] This setting is enabled only when the 1st/2nd Control Method (A044/A244) is set to 03 (Sensorless vector control).

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution	Page
1424 hex	1423 hex	Multi-function Relay Output (MA, MB) Operation Selection	C036	R/W	00: NO (NO contact) 01: NC (NC contact)	–	P. 5-55
1425 hex	–	Reserved	–	–	–	–	–
1426 hex	1425 hex	Low Current Signal Output Selection	C038	R/W	00: During acceleration/deceleration and constant speed 01: Only during constant speed	–	P. 7-87
1427 hex	1426 hex	Low Current Detection Level	C039	R/W	0 to 2000 (1500)	0.1 [%]	
1428 hex	1427 hex	Overload Warning Signal Output Selection	C040	R/W	00: Enabled during acceleration/deceleration and constant speed 01: Enabled during constant speed	–	P. 7-76
1429 hex	1428 hex	1st Overload Warning Level	C041	R/W	0 to 2000 (1500)	0.1 [%]	
142A hex	1429 hex	Arrival Frequency During Acceleration 1	C042 (HIGH)	R/W	0 to 40000 (58000) *1	0.01 [Hz]	P. 7-81
142B hex	142A hex		C042 (LOW)	R/W			
142C hex	142B hex	Arrival Frequency During Deceleration 1	C043 (HIGH)	R/W	0 to 40000 (58000) *1	0.01 [Hz]	
142D hex	142C hex		C043 (LOW)	R/W			
142E hex	142D hex	PID Deviation Excessive Level	C044	R/W	0 to 1000	0.1 [%]	P. 7-44
142F hex	142E hex	Arrival Frequency During Acceleration 2	C045 (HIGH)	R/W	0 to 40000 (58000) *1	0.01 [Hz]	P. 7-81
1430 hex	142F hex		C045 (LOW)	R/W			
1431 hex	1430 hex	Arrival Frequency During Deceleration 2	C046 (HIGH)	R/W	0 to 40000 (58000) *1	0.01 [Hz]	
1432 hex	1431 hex		C046 (LOW)	R/W			
1433 hex	1432 hex	Pulse Train Output MP Scale	C047	R/W	1 to 9999	0.01	P. 7-27
1434 to 1437 hex	–	Reserved	–	–	–	–	–
1438 hex	1437 hex	Feedback Comparison Signal Off Level	C052	R/W	0 to 1000	0.1 [%]	P. 7-44
1439 hex	1438 hex	Feedback Comparison Signal On Level	C053	R/W	0 to 1000	0.1 [%]	

*1. In the high-frequency mode.

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution	Page
143A hex	1439 hex	Overtorque/ Undertorque Selection	C054	R/W	00: Overtorque 01: Undertorque	–	P. 6-15
143B hex	143A hex	Overtorque/ Undertorque Level (Forward Power Running)	C055	R/W	0 to 200	1 [%]	
143C hex	143B hex	Overtorque/ Undertorque Level (Reverse Regeneration)	C056	R/W	0 to 200	1 [%]	
143D hex	143C hex	Overtorque/ Undertorque Level (Reverse Power Running)	C057	R/W	0 to 200	1 [%]	
143E hex	143D hex	Overtorque/ Undertorque Level (Forward Regeneration)	C058	R/W	0 to 200	1 [%]	
143F hex	143E hex	Overtorque/ Undertorque Signal Operation	C059	R/W	00: Enabled during acceleration/deceleration and constant speed 01: Enabled during constant speed	–	
1440 hex	–	Reserved	–	–	–	–	–
1441 hex	1440 hex	Electronic Thermal Warning Level	C061	R/W	0 to 100	1 [%]	P. 7-75
1442 hex	–	Reserved	–	–	–	–	–
1443 hex	1442 hex	0 Hz Detection Level	C063	R/W	0 to 10000	0.01 [Hz]	P. 5-58
1444 hex	1443 hex	Cooling Fin Overheat Warning Level	C064	R/W	0 to 110	1 [°C]	P. 7-86
1445 to 144A hex	–	Reserved	–	–	–	–	–
144B hex	144A hex	Communication Speed Selection (Baud Rate Selection)	C071	R/W	03 (2400 bps) 04 (4800 bps) 05 (9600 bps) 06 (19.2 kbps) 07 (38.4 kbps) 08 (57.6 kbps) 09 (76.8 kbps) 10 (115.2 kbps)	–	P. 8-5
144C hex	144B hex	Communication Station No. Selection	C072	R/W	1 to 247	–	
144D hex	–	Reserved	–	–	–	–	–

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution	Page
144E hex	144D hex	Communication Parity Selection	C074	R/W	00: No 01: Even 02: Odd	–	P. 8-5
144F hex	144E hex	Communication Stop Bit Selection	C075	R/W	1: 1 bit 2: 2 bits	–	
1450 hex	144F hex	Operation Selection on Communication Error	C076	R/W	00: Trip 01: Trip after deceleration stop 02: Ignore 03: Free-run stop 04: Deceleration stop	–	
1451 hex	1450 hex	Communication Error Timeout Time	C077	R/W	0: Timeout disabled 1 to 9999	0.01 [s]	
1452 hex	1451 hex	Communication Wait Time	C078	R/W	0 to 1000	1 [ms]	
1453 to 1454 hex	–	Reserved	–	–	–	–	–
1455 hex	1454 hex	FV Adjustment	C081	R/W	0 to 2000	0.1 [%]	P. 7-25
1456 hex	1455 hex	FI Adjustment	C082	R/W	0 to 2000	0.1 [%]	
1457 to 1458 hex	–	Reserved	–	–	–	–	–
1459 hex	1458 hex	Thermistor Adjustment	C085	R/W	0 to 2000	0.1 [%]	P. 7-80
145A to 145E hex	–	Reserved	–	–	–	–	–
145F hex	145E hex	Reserved	C091	R	Do not change the default 0.	–	–
1460 to 1463 hex	–	Reserved	–	–	–	–	–
1464 hex	1463 hex	Communication Selection	C096	R/W	00: Modbus communication 01: Co-inverter communication 02: Co-inverter communication (management inverter)	–	P. 8-31
1465 hex	–	Reserved	–	–	–	–	–
1466 hex	1465 hex	Co-inverter Communication Starting Station Number	C098	R/W	1 to 8	–	P. 8-31
1467 hex	1466 hex	Co-inverter Communication Ending Station Number	C099	R/W	1 to 8	–	
1468 hex	1467 hex	Co-inverter Communication Start Selection	C100	R/W	00: Start via 485 terminal 01: Constant communication	–	
1469 hex	1468 hex	UP/DWN Storage Selection	C101	R/W	00: Not store frequency data 01: Store frequency data	–	P. 7-40

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution	Page
146A hex	1469 hex	Reset Selection	C102	R/W	00: Trip reset at power-on 01: Trip reset at power-off 02: Enabled only during trip (Reset at power-on) 03: Trip reset only	–	P. 5-43
146B hex	146A hex	Reset Restart Selection	C103	R/W	00: 0 Hz restart 01: Frequency matching restart 02: Frequency pull-in restart	–	
146C hex	146B hex	UP/DWN Clear Selection	C104	R/W	00: 0 Hz 01: EEPROM data at power-on	–	P. 7-40
146D hex	146C hex	MP Gain Setting	C105	R/W	50 to 200	1 [%]	P. 7-28
146E hex	146D hex	AM Gain Setting	C106	R/W	50 to 200	1 [%]	P. 7-30
146F to 1470 hex	–	Reserved	–	–	–	–	–
1471 hex	1470 hex	AM Bias Setting	C109	R/W	0 to 100	1 [%]	P. 7-30
1472 hex	–	Reserved	–	–	–	–	–
1473 hex	1472 hex	1st Overload Warning Level 2	C111	R/W	0 to 2000 (1500)	0.1 [%]	P. 7-76
1474 to 1485 hex	–	Reserved	–	–	–	–	–
1486 hex	1485 hex	Multi-function Output P1 ON Delay Time	C130	R/W	0 to 1000	0.1 [s]	P. 5-56
1487 hex	1486 hex	Multi-function Output P1 OFF Delay Time	C131	R/W	0 to 1000	0.1 [s]	
1488 hex	1487 hex	Multi-function Output P2 ON Delay Time	C132	R/W	0 to 1000	0.1 [s]	
1489 hex	1488 hex	Multi-function Output P2 OFF Delay Time	C133	R/W	0 to 1000	0.1 [s]	
148A to 148F hex	–	Reserved	–	–	–	–	–
1490 hex	148F hex	Multi-function Relay Output ON Delay Time	C140	R/W	0 to 1000	0.1 [s]	P. 5-56
1491 hex	1490 hex	Multi-function Relay Output OFF Delay Time	C141	R/W	0 to 1000	0.1 [s]	

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution	Page
1492 hex	1491 hex	Logic Output Signal 1 Selection 1	C142	R/W	Same as C021 (Except 33 (LOG1) to 35 (LOG3), 63 (OPO), and 255 (no))	–	P. 7-83
1493 hex	1492 hex	Logic Output Signal 1 Selection 2	C143	R/W	Same as C021 (Except 33 (LOG1) to 35 (LOG3), 63 (OPO), and 255 (no))	–	
1494 hex	1493 hex	Logic Output Signal 1 Operator Selection	C144	R/W	00: AND 01: OR 02: XOR	–	
1495 hex	1494 hex	Logic Output Signal 2 Selection 1	C145	R/W	Same as C021 (Except 33 (LOG1) to 35 (LOG3), 63 (OPO), and 255 (no))	–	
1496 hex	1495 hex	Logic Output Signal 2 Selection 2	C146	R/W	Same as C021 (Except 33 (LOG1) to 35 (LOG3), 63 (OPO), and 255 (no))	–	
1497 hex	1496 hex	Logic Output Signal 2 Operator Selection	C147	R/W	00: AND 01: OR 02: XOR	–	
1498 hex	1497 hex	Logic Output Signal 3 Selection 1	C148	R/W	Same as C021 (Except 33 (LOG1) to 35 (LOG3), 63 (OPO), and 255 (no))	–	
1499 hex	1498 hex	Logic Output Signal 3 Selection 2	C149	R/W	Same as C021 (Except 33 (LOG1) to 35 (LOG3), 63 (OPO), and 255 (no))	–	
149A hex	1499 hex	Logic Output Signal 3 Operator Selection	C150	R/W	00: AND 01: OR 02: XOR	–	
149B to 14A3 hex	–	Reserved	–	–	–	–	–
14A4 hex	14A3 hex	Multi-function Input S1 Response Time	C160	R/W	0 to 200	2 [ms]	P. 5-48
14A5 hex	14A4 hex	Multi-function Input S2 Response Time	C161	R/W	0 to 200	2 [ms]	
14A6 hex	14A5 hex	Multi-function Input S3 Response Time	C162	R/W	0 to 200	2 [ms]	
14A7 hex	14A6 hex	Multi-function Input S4 Response Time	C163	R/W	0 to 200	2 [ms]	
14A8 hex	14A7 hex	Multi-function Input S5 Response Time	C164	R/W	0 to 200	2 [ms]	
14A9 hex	14A8 hex	Multi-function Input S6 Response Time	C165	R/W	0 to 200	2 [ms]	
14AA hex	14A9 hex	Multi-function Input S7 Response Time	C166	R/W	0 to 200	2 [ms]	
14AB to 14AC hex	–	Reserved	–	–	–	–	–
14AD hex	14AC hex	Multi-step Speed/Position Determination Time	C169	R/W	0 to 200	10 [ms]	P. 6-45
14AE to 1500 hex	–	Not used	–	–	Not accessible	–	–

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution	Page
1501 hex	1500 hex	Auto-tuning Selection	H001	R/W	00: Disabled 01: Enabled (No motor rotation) 02: Enabled (Motor rotation)	–	P. 6-4
1502 hex	1501 hex	1st Motor Parameter selection	H002	R/W	00: Standard motor parameter 02: Auto-tuning data parameter	–	P. 6-4
1503 hex	1502 hex	1st Motor Capacity	H003	R/W	00: 0.1 01: 0.2 02: 0.4 03: 0.55 04: 0.75 05: 1.1 06: 1.5 07: 2.2 08: 3.0 09: 3.7 10: 4.0 11: 5.5 12: 7.5 13: 11.0 14: 15.0 15: 18.5	–	P. 6-3
1504 hex	1503 hex	1st Motor Pole Number	H004	R/W	00: 2P 01: 4P 02: 6P 03: 8P 04 to 23: Do not set 10 to 48P.	–	
1505 hex	–	Reserved	–	–	–	–	–
1506 hex	1505 hex	1st Speed Response	H005	R/W	0 to 1000	1 [%]	P. 6-9
1507 hex	1506 hex	1st Stabilization Parameter	H006	R/W	0 to 255	1	P. 7-52
1508 to 1515 hex	–	Reserved	–	–	–	–	–
1516 hex	1515 hex	1st Motor Parameter R1	H020	R/W	1 to 65535	0.001 [Ω]	P. 6-9
1517 hex	–	Reserved	–	–	–	–	–
1518 hex	1517 hex	1st Motor Parameter R2	H021	R/W	1 to 65535	0.001 [Ω]	P. 6-9
1519 hex	–	Reserved	–	–	–	–	–
151A hex	1519 hex	1st Motor Parameter L	H022	R/W	1 to 65535	0.01 [mH]	P. 6-9
151B hex	–	Reserved	–	–	–	–	–
151C hex	151B hex	1st Motor Parameter Io	H023	R/W	1 to 65535	0.01 [A]	P. 6-9
151D hex	151C hex	1st Motor Parameter J	H024 (HIGH)	R/W	1 to 9999000	0.001 [kgm^2]	
151E hex	151D hex		H024 (LOW)	R/W			

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution	Page
151F to 1524 hex	–	Reserved	–	–	–	–	–
1525 hex	1524 hex	1st Motor Parameter R1 (Auto-tuning Data)	H030	R/W	1 to 65535	0.001 [Ω]	P. 6-4
1526 hex	–	Reserved	–	–	–	–	–
1527 hex	1526 hex	1st Motor Parameter R2 (Auto-tuning Data)	H031	R/W	1 to 65535	0.001 [Ω]	P. 6-4
1528 hex	–	Reserved	–	–	–	–	–
1529 hex	1528 hex	1st Motor Parameter L (Auto-tuning Data)	H032	R/W	1 to 65535	0.01 [mH]	P. 6-4
152A hex	–	Reserved	–	–	–	–	–
152B hex	152A hex	1st Motor Parameter Io (Auto-tuning Data)	H033	R/W	1 to 65535	0.01 [A]	P. 6-4
152C hex	152B hex	1st Motor Parameter J (Auto-tuning Data)	H034 (HIGH)	R/W	1 to 9999000	0.001 [kgm^2]	
152D hex	152C hex		H034 (LOW)	R/W			
152E to 153C hex	–	Reserved	–	–	–	–	–
153D hex	153C hex	V/f Control With Speed Feedback Slip Compensation Proportional Gain	H050	R/W	0 to 1000	0.01 [%]	P. 6-24
153E hex	153D hex	V/f Control With Speed Feedback Slip Compensation Integral Gain	H051	R/W	0 to 1000	1 [s]	
153F to 1570 hex	–	Not used	–	–	Not accessible	–	–
1571 hex	1570 hex	PM Motor Parameter Selection	H102	R/W	00: Standard PM motor parameter 01: Auto-tuning data parameter	–	P. 6-61
1572 hex	1571 hex	PM Motor Capacity	H103	R/W	00: 0.1 01: 0.2 02: 0.4 03: 0.55 04: 0.75 05: 1.1 06: 1.5 07: 2.2 08: 3.0 09: 3.7 10: 4.0 11: 5.5 12: 7.5 13: 11.0 14: 15.0 15: 18.5	–	

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution	Page
1573 hex	1572 hex	PM Motor Pole Number	H104	R/W	00: 2P 01: 4P 02: 6P 03: 8P 04 to 23: Do not set 10 to 48P.	–	P. 6-61
1574 hex	1573 hex	PM Motor Rated Current	H105	R/W	0 to 1000	0.1 [%]	
1575 hex	1574 hex	PM Motor Parameter R	H106	R/W	1 to 65535	0.001 [Ω]	
1576 hex	1575 hex	PM Motor Parameter Ld	H107	R/W	1 to 65535	0.01 [mH]	
1577 hex	1576 hex	PM motor Parameter Lq	H108	R/W	1 to 65535	0.01 [mH]	
1578 hex	1577 hex	PM motor Parameter Ke	H109	R/W	1 to 65535	0.0001 [Vp/(rad/s)]	
1579 hex	1578 hex	PM motor Parameter J	H110 (HIGH)	R/W	1 to 9999000	0.001 [kgm^2]	
157A hex	1579 hex		H110 (LOW)				
157B hex	157A hex	PM Motor Parameter R (Auto-tuning Data)	H111	R/W	1 to 65535	0.001 [Ω]	P. 6-57
157C hex	157B hex	PM Motor Parameter Ld (Auto-tuning Data)	H112	R/W	1 to 65535	0.01 [mH]	
157D hex	157C hex	PM Motor Parameter Lq (Auto-tuning Data)	H113	R/W	1 to 65535	0.01 [mH]	
157E to 1580 hex	–	Not used	–	–	Not accessible	–	–
1581 hex	1580 hex	PM Motor Speed Response	H116	R/W	1 to 1000	1 [%]	P. 6-63
1582 hex	1581 hex	PM Motor Starting Current	H117	R/W	2000 to 10000	0.01 [%]	
1583 hex	1582 hex	PM Motor Starting Time	H118	R/W	1 to 6000	0.01 [s]	
1584 hex	1583 hex	PM Motor Stabilization Parameter	H119	R/W	0 to 120	1 [%]	
1585 hex	–	Not used	–	–	Not accessible	–	–
1586 hex	1585 hex	PM Motor Minimum Frequency	H121	R/W	0 to 255	0.1 [%]	P. 6-63
1587 hex	1586 hex	PM Motor No-Load Current	H122	R/W	0 to 10000	0.01 [%]	
1588 hex	1587 hex	PM Motor Starting Method Selection	H123	R/W	00: Disabled 01: Initial pole position estimation enabled	–	
1589 hex	–	Not used	–	–	Not accessible	–	–

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution	Page
158A hex	1589 hex	PM Motor Initial Pole Position Estimation 0V Waiting Times	H131	R/W	0 to 255	1 [time]	P. 6-63
158B hex	158A hex	PM Motor Initial Pole Position Estimation Detection Waiting Times	H132	R/W	0 to 255	1 [time]	
158C hex	158B hex	PM Motor Initial Pole Position Estimation Detection Times	H133	R/W	0 to 255	1 [time]	
158D hex	158C hex	PM Initial Pole Position Estimation Voltage Gain	H134	R/W	0 to 200	1 [%]	P. 6-63
158E to 1600 hex	–	Not used	–	–	Not accessible	–	–
1601 hex	1600 hex	Operation Selection on Option Error	P001	R/W	00: Trip 01: Continues operation	00	P. 7-101
1602 hex	–	Reserved	–	–	–	–	–
1603 hex	1602 hex	Pulse Train Input RP Selection	P003	R/W	00: Frequency setting (including PID) 01: Feedback pulse (enabled only when 1st control is selected) 02: MI8 (General-purpose input 8 for DriveProgramming)	–	P. 7-52
1604 hex	1603 hex	Pulse Train Input Type Selection	P004	R/W	00: Single-phase pulse input 01: Phase A and B 90°phase difference pulse train 02: Do not set. 03: Single-phase pulse train + direction	–	P. 6-28
1605 to 160A hex	–	Reserved	–	–	–	–	–
160B hex	160A hex	Number of Encoder Pulses	P011	R/W	32 to 1024	1 [pulse]	P. 6-28
160C hex	160B hex	Simple Position Control Selection	P012	R/W	00: Simple position control disabled 02: Simple position control enabled	–	
160D hex	–	Reserved	–	–	–	–	–
160E hex	160D hex	Creep Speed Moving Amount	P014	R/W	0 to 4000	0.1 [%]	P. 6-34
160F hex	160E hex	Creep Speed Setting	P015	R/W	Starting Frequency to 1000 (10000) [*1]	0.01 [Hz]	

[*1] In the high-frequency mode.

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution	Page
1610 hex	–	Reserved	–	–	–	–	–
1611 hex	1610 hex	Positioning Completion Range Setting	P017	R/W	0 to 10000	1 [pulse]	P. 6-34
1612 to 1619 hex	–	Reserved	–	–	–	–	–
161A hex	1619 hex	Overspeed Error Detection Level	P026	R/W	0 to 1500	0.1 [%]	P. 6-23
161B hex	161A hex	Speed Deviation Excessive Level	P027	R/W	0 to 12000	0.01 [Hz]	
161C to 161E hex	–	Reserved	–	–	–	–	–
161F hex	161E hex	Acceleration/ Deceleration Time Input Type	P031	R/W	00: Digital Operator 03: DriveProgramming	–	P. 5-33
1620 hex	–	Reserved	–	–	–	–	–
1621 hex	1620 hex	Torque Reference Input Selection	P033	R/W	00: Terminal FV 01: Terminal FI 03: Digital Operator 06: Option (No applicable Option)	–	P. 6-16
1622 hex	1621 hex	Torque Reference Setting	P034	R/W	0 to 200	1 [%]	
1623 hex	–	Reserved	–	–	–	–	–
1624 hex	1623 hex	Torque Bias Selection	P036	R/W	00: Disabled 01: Digital Operator 05: Option (No applicable Option)	–	P. 6-17
1625 hex	1624 hex	Torque Bias Value	P037	R/W	–200 to 200	1 [%]	
1626 hex	1625 hex	Torque Bias Polarity Selection	P038	R/W	00: As per sign 01: Dependent on RUN direction	–	
1627 hex	1626 hex	Speed Limit Value in Torque Control (Forward)	P039 (HIGH)	R/W	0 to 12000	0.01 [Hz]	P. 6-16
1628 hex	1627 hex		P039 (LOW)	R/W			
1629 hex	1628 hex	Speed Limit Value in Torque Control (Reverse)	P040 (HIGH)	R/W	0 to 12000	0.01 [Hz]	
162A hex	1629 hex		P040 (LOW)	R/W			
162B hex	162A hex	Speed/Torque Switching Time	P041	R/W	0 to 1000	1 [ms]	
162C hex	–	Reserved	–	–	–	–	–
162D hex							
162E hex	162D hex	Communications Error Detection Timer Setting	P044	R/W	0 to 9999	0.01 [s]	P. 7-101
162F hex	162E hex	Operation Selection at Host Communications Error	P045	R/W	00: Trip 01: Trip after deceleration stop 02: Ignore 03: Free-run stop 04: Deceleration stop	–	P. 7-101
1630 hex	162F hex	Assembly Instance Number	P046	R/W	0 to 20	–	P. 7-101

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution	Page
1631 hex	–	Reserved	–	–	–	–	–
1632 hex	1631 hex	Operation Selection at Idle Mode Detection	P048	R/W	00: Trip 01: Trip after deceleration stop 02: Ignore 03: Free-run stop 04: Deceleration stop	–	P. 7-101
1633 hex	1632 hex	Number of Poles for Rotation Speed Setting	P049	R/W	00: 2P 01: 4P 02: 6P 03: 8P 04 to 23: Do not set 10 to 48P.	–	P. 7-101
1634 to 1638 hex	–	Reserved	–	–	–	–	–
1639 hex	1638 hex	Pulse Train Frequency Scale	P055	R/W	10 to 320 * Input frequency at maximum frequency	0.1 [kHz]	P. 7-52
163A hex	1639 hex	Pulse Train Frequency Filter Time Parameter	P056	R/W	1 to 200	0.01 [s]	
163B hex	163A hex	Pulse Train Frequency Bias Amount	P057	R/W	–100 to 100	1 [%]	
163C hex	163B hex	Pulse Train Frequency UpperLimit	P058	R/W	0 to 100	1 [%]	
163D hex	163C hex	Pulse Train Frequency Lower Limit	P059	R/W	1 to 2000	0.01 [%]	
163E hex	163D hex	Multi-step Position Command 0	P060 (HIGH)	R/W	Position range setting (reverse side) to position range setting (forward side)	1 [pulse]	P. 6-45
163F hex	163E hex		P060 (LOW)	R/W			
1640 hex	163F hex	Multi-step Position Command 1	P061 (HIGH)	R/W	Position range setting (reverse side) to position range setting (forward side)	1 [pulse]	
1641 hex	1640 hex		P061 (LOW)	R/W			
1642 hex	1641 hex	Multi-step Position Command 2	P062 (HIGH)	R/W	Position range setting (reverse side) to position range setting (forward side)	1 [pulse]	
1643 hex	1642 hex		P062 (LOW)	R/W			
1644 hex	1643 hex	Multi-step Position Command 3	P063 (HIGH)	R/W	Position range setting (reverse side) to position range setting (forward side)	1 [pulse]	
1645 hex	1644 hex		P063 (LOW)	R/W			

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution	Page
1646 hex	1645 hex	Multi-step Position Command 4	P064 (HIGH)	R/W	Position range setting (reverse side) to position range setting (forward side)	1 [pulse]	P. 6-45
1647 hex	1646 hex		P064 (LOW)	R/W			
1648 hex	1647 hex	Multi-step Position Command 5	P065 (HIGH)	R/W	Position range setting (reverse side) to position range setting (forward side)	1 [pulse]	
1649 hex	1648 hex		P065 (LOW)	R/W			
164A hex	1649 hex	Multi-step Position Command 6	P066 (HIGH)	R/W	Position range setting (reverse side) to position range setting (forward side)	1 [pulse]	
164B hex	164A hex		P066 (LOW)	R/W			
164C hex	164B hex	Multi-step Position Command 7	P067 (HIGH)	R/W	Position range setting (reverse side) to position range setting (forward side)	1 [pulse]	
164D hex	164C hex		P067 (LOW)	R/W			
164E hex	164D hex	Origin Search Mode	P068	R/W	00: Origin Search Mode 1 01: Origin Search Mode 2	–	P. 6-40
164F hex	164E hex	Origin Search Direction Selection	P069	R/W	00: Forward 01: Reverse	–	
1650 hex	164F hex	Origin Search Mode 1 Frequency	P070	R/W	0 to 1000 (10000)*1	0.01 [Hz]	
1651 hex	1650 hex	Origin Search Mode 2 Frequency	P071	R/W	0 to 1st Maximum Frequency	0.01 [Hz]	
1652 hex	1651 hex	Position Limit Setting (Forward Side)	P072 (HIGH)	R/W	0 to 268435455	1 [pulse]	P. 6-34
1653 hex	1652 hex		P072 (LOW)	R/W			
1654 hex	1653 hex	Position Limit Setting (Reverse Side)	P073 (HIGH)	R/W	–268435455 to 0	1 [pulse]	
1655 hex	1654 hex		P073 (LOW)	R/W			
1656 hex	–	Reserved	–	–	–	–	–
1657 hex	1656 hex	Position Control Mode Selection	P075	R/W	00: Limit 01: No limit	–	P. 6-34
1658 hex	–	Reserved	–	–	–	–	–
1659 hex	1658 hex	Encoder Disconnection Detection Time	P077	R/W	0: Disconnection detection disabled 1 to 100	0.1 [s]	P. 6-34
165A hex	–	Reserved	–	–	–	–	–
165B hex							
165C hex	165B hex	Restarting Positioning Range Setting	P080	R/W	0 to 10000	1 [pulse]	P. 6-45

*1. In the high-frequency mode.

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution	Page
165D hex	165C hex	Position Store Selection at Power Off	P081	R/W	00: Not store 01: Store	–	P. 6-44
165E hex	165D hex	Position Data at Power Off	P082 (HIGH)	R/W	Position range setting (reverse side) to position range setting (forward side)	1 [pulse]	
165F hex	165E hex		P082 (LOW)				
1660 hex	165F hex	Preset Position Data	P083 (HIGH)	R/W	Position range setting (reverse side) to position range setting (forward side)	1 [pulse]	P. 6-43
1661 hex	1660 hex		P083 (LOW)				
1662 to 1665 hex	–	Reserved	–	–	–	–	–
1666 hex	1665 hex	DriveProgramming User Parameter U00	P100	R/W	0 to 65535	1	P. 7-102
1667 hex	1666 hex	DriveProgramming User Parameter U01	P101	R/W	0 to 65535	1	
1668 hex	1667 hex	DriveProgramming User Parameter U02	P102	R/W	0 to 65535	1	
1669 hex	1668 hex	DriveProgramming User Parameter U03	P103	R/W	0 to 65535	1	
166A hex	1669 hex	DriveProgramming User Parameter U04	P104	R/W	0 to 65535	1	
166B hex	166A hex	DriveProgramming User Parameter U05	P105	R/W	0 to 65535	1	
166C hex	166B hex	DriveProgramming User Parameter U06	P106	R/W	0 to 65535	1	
166D hex	166C hex	DriveProgramming User Parameter U07	P107	R/W	0 to 65535	1	
166E hex	166D hex	DriveProgramming User Parameter U08	P108	R/W	0 to 65535	1	
166F hex	166E hex	DriveProgramming User Parameter U09	P109	R/W	0 to 65535	1	
1670 hex	166F hex	DriveProgramming User Parameter U10	P110	R/W	0 to 65535	1	
1671 hex	1670 hex	DriveProgramming User Parameter U11	P111	R/W	0 to 65535	1	
1672 hex	1671 hex	DriveProgramming User Parameter U12	P112	R/W	0 to 65535	1	
1673 hex	1672 hex	DriveProgramming User Parameter U13	P113	R/W	0 to 65535	1	
1674 hex	1673 hex	DriveProgramming User Parameter U14	P114	R/W	0 to 65535	1	
1675 hex	1674 hex	DriveProgramming User Parameter U15	P115	R/W	0 to 65535	1	
1676 hex	1675 hex	DriveProgramming User Parameter U16	P116	R/W	0 to 65535	1	
1677 hex	1676 hex	DriveProgramming User Parameter U17	P117	R/W	0 to 65535	1	
1678 hex	1677 hex	DriveProgramming User Parameter U18	P118	R/W	0 to 65535	1	
1679 hex	1678 hex	DriveProgramming User Parameter U19	P119	R/W	0 to 65535	1	

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution	Page
167A hex	1679 hex	DriveProgramming User Parameter U20	P120	R/W	0 to 65535	1	P. 7-102
167B hex	167A hex	DriveProgramming User Parameter U21	P121	R/W	0 to 65535	1	
167C hex	167B hex	DriveProgramming User Parameter U22	P122	R/W	0 to 65535	1	
167D hex	167C hex	DriveProgramming User Parameter U23	P123	R/W	0 to 65535	1	
167E hex	167D hex	DriveProgramming User Parameter U24	P124	R/W	0 to 65535	1	
167F hex	167E hex	DriveProgramming User Parameter U25	P125	R/W	0 to 65535	1	
1680 hex	167F hex	DriveProgramming User Parameter U26	P126	R/W	0 to 65535	1	
1681 hex	1680 hex	DriveProgramming User Parameter U27	P127	R/W	0 to 65535	1	
1682 hex	1681 hex	DriveProgramming User Parameter U28	P128	R/W	0 to 65535	1	
1683 hex	1682 hex	DriveProgramming User Parameter U29	P129	R/W	0 to 65535	1	
1684 hex	1683 hex	DriveProgramming User Parameter U30	P130	R/W	0 to 65535	1	
1685 hex	1684 hex	DriveProgramming User Parameter U31	P131	R/W	0 to 65535	1	
1686 to 168D hex	–	Reserved	–	–	–	–	–
168E hex	168D hex	Number of Sent Data of All Stations in Co-inverter Communication	P140	R/W	1 to 5	–	P. 8-31
168F hex	168E hex	Recipient Station Number of All Stations in Co-inverter Communication 1	P141	R/W	1 to 247	–	
1690 hex	168F hex	Recipient Register of All Stations in Co-inverter Communication 1	P142	R/W	0000 to FFFF hex	–	
1691 hex	1690 hex	Sender Register of All Stations in Co-inverter Communication 1	P143	R/W	0000 to FFFF hex	–	
1692 hex	1691 hex	Recipient Station Number of All Stations in Co-inverter Communication 2	P144	R/W	1 to 247	–	
1693 hex	1692 hex	Recipient Register of All Stations in Co-inverter Communication 2	P145	R/W	0000 to FFFF hex	–	

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution	Page
1694 hex	1693 hex	Sender Register of All Stations in Co-inverter Communication 2	P146	R/W	0000 to FFFF hex	–	P. 8-31
1695 hex	1694 hex	Recipient Station Number of All Stations in Co-inverter Communication 3	P147	R/W	1 to 247	–	
1696 hex	1695 hex	Recipient Register of All Stations in Co-inverter Communication 3	P148	R/W	0000 to FFFF hex	–	
1697 hex	1696 hex	Sender Register of All Stations in Co-inverter Communication 3	P149	R/W	0000 to FFFF hex	–	
1698 hex	1697 hex	Recipient Station Number of All Stations in Co-inverter Communication 4	P150	R/W	1 to 247	–	
1699 hex	1698 hex	Recipient Register of All Stations in Co-inverter Communication 4	P151	R/W	0000 to FFFF hex	–	
169A hex	1699 hex	Sender Register of All Stations in Co-inverter Communication 4	P152	R/W	0000 to FFFF hex	–	
169B hex	169A hex	Recipient Station Number of All Stations in Co-inverter Communication 5	P153	R/W	1 to 247	–	
169C hex	169B hex	Recipient Register of All Stations in Co-inverter Communication 5	P154	R/W	0000 to FFFF hex	–	
169D hex	169C hex	Sender Register of All Stations in Co-inverter Communication 5	P155	R/W	0000 to FFFF hex	–	
169E to 16A1 hex	–	Reserved	–	–	–	–	–
16A2 hex	16A1 hex	Option I/F Flexible Format Output Register 1	P160	R/W	0000 to FFFF hex	1	P. 7-101
16A3 hex	16A2 hex	Option I/F Flexible Format Output Register 2	P161	R/W	0000 to FFFF hex	1	
16A4 hex	16A3 hex	Option I/F Flexible Format Output Register 3	P162	R/W	0000 to FFFF hex	1	

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution	Page
16A5 hex	16A4 hex	Option I/F Flexible Format Output Register 4	P163	R/W	0000 to FFFF hex	1	P. 7-101
16A6 hex	16A5 hex	Option I/F Flexible Format Output Register 5	P164	R/W	0000 to FFFF hex	1	
16A7 hex	16A6 hex	Option I/F Flexible Format Output Register 6	P165	R/W	0000 to FFFF hex	1	
16A8 hex	16A7 hex	Option I/F Flexible Format Output Register 7	P166	R/W	0000 to FFFF hex	1	
16A9 hex	16A8 hex	Option I/F Flexible Format Output Register 8	P167	R/W	0000 to FFFF hex	1	
16AA hex	16A9 hex	Option I/F Flexible Format Output Register 9	P168	R/W	0000 to FFFF hex	1	
16AB hex	16AA hex	Option I/F Flexible Format Output Register 10	P169	R/W	0000 to FFFF hex	1	
16AC hex	16AB hex	Option I/F Flexible Format Input Register 1	P170	R/W	0000 to FFFF hex	1	
16AD hex	16AC hex	Option I/F Flexible Format Input Register 2	P171	R/W	0000 to FFFF hex	1	
16AE hex	16AD hex	Option I/F Flexible Format Input Register 3	P172	R/W	0000 to FFFF hex	1	
16AF hex	16AE hex	Option I/F Flexible Format Input Register 4	P173	R/W	0000 to FFFF hex	1	
16B0 hex	16AF hex	Option I/F Flexible Format Input Register 5	P174	R/W	0000 to FFFF hex	1	
16B1 hex	16B0 hex	Option I/F Flexible Format Input Register 6	P175	R/W	0000 to FFFF hex	1	
16B2 hex	16B1 hex	Option I/F Flexible Format Input Register 7	P176	R/W	0000 to FFFF hex	1	
16B3 hex	16B2 hex	Option I/F Flexible Format Input Register 8	P177	R/W	0000 to FFFF hex	1	
16B4 hex	16B3 hex	Option I/F Flexible Format Input Register 9	P178	R/W	0000 to FFFF hex	1	
16B5 hex	16B4 hex	Option I/F Flexible Format Input Register 10	P179	R/W	0000 to FFFF hex	1	
16B6 hex	16B5 hex	(Reserved)	P180	–	Do not change the default 0.	–	–

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution	Page
16B7 hex	16B6 hex	(Reserved)	P181	–	Do not change the default 0.	–	–
16B8 hex	16B7 hex	(Reserved)	P182	–	Do not change the default 0.	–	–
16B9 hex	16B8 hex	(Reserved)	P183	–	Do not change the default 0.	–	–
16BA hex	–	Reserved	–	–	–	–	–
16BB hex	16BA hex	(Reserved)	P185	–	Do not change the default 0.	–	–
16BC hex	16BB hex	(Reserved)	P186	–	Do not change the default 6.	–	–
16BD to 16BF hex	–	Not used	–	–	Not accessible	–	–
16C0 hex	16BF hex	CompoNet Node Address	P190	R/W	0 to 63	1	P. 7-101
16C1 hex	–	Not used	–	–	Not accessible	–	–
16C2 hex	16C1 hex	DeviceNet MAC ID	P192	R/W	0 to 63	1	P. 7-101
16C3 hex	–	Not used	–	–	Not accessible	–	–
16C4 hex							
16C5 hex	16C4 hex	(Reserved)	P195	–	Do not change the default 0.	–	–
16C6 hex	16C5 hex	(Reserved)	P196	–	Do not change the default 21.	–	–
16C7 hex	–	Not used	–	–	Not accessible	–	–
16C8 hex	16C7 hex	Modbus Mapping Function Selection	P200	R/W	00: Standard Modbus address 01: Modbus mapping enabled	–	P. 8-24
16C9 hex	16C8 hex	Modbus Mapping External Register 1	P201	R/W	0000 to FFFF hex	1	
16CA hex	16C9 hex	Modbus Mapping External Register 2	P202	R/W	0000 to FFFF hex	1	
16CB hex	16CA hex	Modbus Mapping External Register 3	P203	R/W	0000 to FFFF hex	1	
16CC hex	16CB hex	Modbus Mapping External Register 4	P204	R/W	0000 to FFFF hex	1	
16CD hex	16CC hex	Modbus Mapping External Register 5	P205	R/W	0000 to FFFF hex	1	
16CE hex	16CD hex	Modbus Mapping External Register 6	P206	R/W	0000 to FFFF hex	1	
16CF hex	16CE hex	Modbus Mapping External Register 7	P207	R/W	0000 to FFFF hex	1	
16D0 hex	16CF hex	Modbus Mapping External Register 8	P208	R/W	0000 to FFFF hex	1	
16D1 hex	16D0 hex	Modbus Mapping External Register 9	P209	R/W	0000 to FFFF hex	1	
16D2 hex	16D1 hex	Modbus Mapping External Register 10	P210	R/W	0000 to FFFF hex	1	

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution	Page
16D3 hex	16D2 hex	Modbus Mapping External Register Type 1	P211	R/W	00: Unsigned 01: Signed	–	P. 8-24
16D4 hex	16D3 hex	Modbus Mapping External Register Type 2	P212	R/W	00: Unsigned 01: Signed	–	
16D5 hex	16D4 hex	Modbus Mapping External Register Type 3	P213	R/W	00: Unsigned 01: Signed	–	
16D6 hex	16D5 hex	Modbus Mapping External Register Type 4	P214	R/W	00: Unsigned 01: Signed	–	
16D7 hex	16D6 hex	Modbus Mapping External Register Type 5	P215	R/W	00: Unsigned 01: Signed	–	
16D8 hex	16D7 hex	Modbus Mapping External Register Type 6	P216	R/W	00: Unsigned 01: Signed	–	
16D9 hex	16D8 hex	Modbus Mapping External Register Type 7	P217	R/W	00: Unsigned 01: Signed	–	
16DA hex	16D9 hex	Modbus Mapping External Register Type 8	P218	R/W	00: Unsigned 01: Signed	–	
16DB hex	16DA hex	Modbus Mapping External Register Type 9	P219	R/W	00: Unsigned 01: Signed	–	
16DC hex	16DB hex	Modbus Mapping External Register Type 10	P220	R/W	00: Unsigned 01: Signed	–	
16DD hex	16DC hex	Modbus Mapping Scaling 1	P221	R/W	1 to 65535	0.001	
16DE hex	16DD hex	Modbus Mapping Scaling 2	P222	R/W	1 to 65535	0.001	
16DF hex	16DE hex	Modbus Mapping Scaling 3	P223	R/W	1 to 65535	0.001	
16E0 hex	16DF hex	Modbus Mapping Scaling 4	P224	R/W	1 to 65535	0.001	
16E1 hex	16E0 hex	Modbus Mapping Scaling 5	P225	R/W	1 to 65535	0.001	
16E2 hex	16E1 hex	Modbus Mapping Scaling 6	P226	R/W	1 to 65535	0.001	
16E3 hex	16E2 hex	Modbus Mapping Scaling 7	P227	R/W	1 to 65535	0.001	
16E4 hex	16E3 hex	Modbus Mapping Scaling 8	P228	R/W	1 to 65535	0.001	
16E5 hex	16E4 hex	Modbus Mapping Scaling 9	P229	R/W	1 to 65535	0.001	
16E6 hex	16E5 hex	Modbus Mapping Scaling 10	P230	R/W	1 to 65535	0.001	

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution	Page
16E7 hex	16E6 hex	Modbus Mapping Internal Register 1	P301	R/W	0000 to FFFF hex	1	P. 8-24
16E8 hex	16E7 hex	Modbus Mapping Internal Register 2	P302	R/W	0000 to FFFF hex	1	
16E9 hex	16E8 hex	Modbus Mapping Internal Register 3	P303	R/W	0000 to FFFF hex	1	
16EA hex	16E9 hex	Modbus Mapping Internal Register 4	P304	R/W	0000 to FFFF hex	1	
16EB hex	16EA hex	Modbus Mapping Internal Register 5	P305	R/W	0000 to FFFF hex	1	
16EC hex	16EB hex	Modbus Mapping Internal Register 6	P306	R/W	0000 to FFFF hex	1	
16ED hex	16EC hex	Modbus Mapping Internal Register 7	P307	R/W	0000 to FFFF hex	1	
16EE hex	16ED hex	Modbus Mapping Internal Register 8	P308	R/W	0000 to FFFF hex	1	
16EF hex	16EE hex	Modbus Mapping Internal Register 9	P309	R/W	0000 to FFFF hex	1	
16F0 hex	16EF hex	Modbus Mapping Internal Register 10	P310	R/W	0000 to FFFF hex	1	
16F1 hex	16F0 hex	Modbus Mapping Endian Selection	P400	R/W	00: Big endian 01: Little endian 02: Special endian	–	P. 8-29
16F2 to 1E00 hex	–	Not used	–	–	Not accessible	–	–

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution	Page
1E01 hex	1E00 hex	Coil data 1[*1]	–	R	2^0: Coil No. 0010 hex to 2^{15}: Coil No. 001F hex	–	–
1E02 hex	1E01 hex	Coil data 2 [*1]	–	R	2^0: Coil No. 0020 hex to 2^{15}: Coil No. 002F hex	–	–
1E03 hex	1E02 hex	Coil data 3 [*1]	–	R	2^0: Coil No. 0030 hex to 2^{15}: Coil No. 003F hex	–	–
1E04 hex	1E03 hex	Coil data 4 [*1]	–	R	2^0: Coil No. 0040 hex to 2^{15}: Coil No. 004F hex	–	–
1E05 hex	1E04 hex	Coil data 5 [*1]	–	R	2^0: Coil No. 0050 hex to 2^8: Coil No. 0058 hex	–	–
1E06 to 1E18 hex	–	Reserved	–	–	–	–	–
1E19 to 1F00 hex	–	Not used	–	–	Not accessible	–	–
1F01 hex	1F00 hex	Coil data 0 [*1]	–	R/W	2^1: Coil No. 0001 hex to 2^{15}: Coil No. 000F hex	–	–
1F02 to 1F1D hex	–	Reserved	–	–	–[*2]	–	–
1F1E to 2102 hex	–	Not used	–	–	Not accessible	–	–

[*1] Each of these holding registers (coil data 0 to 5) comprises 16 registers. Because the co-inverter communication function does not support coils (only holding registers are supported), use these holding registers to access coils, if necessary.

[*2] Do not write data to the holding registers 1F02 to 1F1D hex.

8-9-5 2nd Control Register Number List

Precautions for Correct Use

- The “Register No.” in the table header shows the register number used inside the inverter.

  Use this register number when setting the communications option unit (EtherCAT/CompoNet/DeviceNet) for the inverter.
- The “Modbus register spec. No.” in the table header shows the register number used to actually specify the register in the Modbus communication process.

  This register number is 1 less than the inverter “Register No.” according to the Modbus communication specifications.

● Group F

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution	Page
2103 hex	2102 hex	2nd Acceleration Time 1	F202 (HIGH)	R/W	0 to 360000	0.01 [s]	P. 5-33
2104 hex	2103 hex		F202 (LOW)	R/W			
2105 hex	2104 hex	2nd Deceleration Time 1	F203 (HIGH)	R/W	0 to 360000	0.01 [s]	
2106 hex	2105 hex		F203 (LOW)	R/W			
2107 to 2200 hex	–	Not used	–	–	Not accessible	–	–

● Group A/b/C/H/P

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution	Page
2201 hex	2200 hex	2nd Frequency Reference Selection	A201	R/W	00: Volume 01: Control circuit terminal block (Analog input) 02: Digital Operator 03: Modbus communication 04: Option 06: Pulse train frequency 07: DriveProgramming 10: Operation function output	–	P. 5-24
2202 hex	2201 hex	2nd RUN Command Selection*1	A202	R/W	01: Control circuit terminal block (DriveProgramming) 02: Digital Operator 03: Modbus communication 04: Option	–	P. 5-22

*1. If you change the 2nd RUN Command Selection setting, be sure to wait at least 40 ms before actually inputting the RUN command.

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution	Page
2203 hex	2202 hex	2nd Base Frequency	A203	R/W	300 to 2nd Maximum Frequency	0.1 [Hz]	P. 5-21
2204 hex	2203 hex	2nd Maximum Frequency	A204	R/W	2nd Base Frequency to 4000 (5800) *1	0.1 [Hz]	P. 5-21
2205 to 2215 hex	–	Reserved	–	–	–		–
2216 hex	2215 hex	2nd Multi-step Speed Reference 0	A220 (HIGH)	R/W	0 Starting Frequency to 2nd Maximum Frequency	0.01 [Hz]*2	P. 5-49
2217 hex	2216 hex		A220 (LOW)	R/W			
2218 to 223A hex	–	Reserved	–	–	–	–	–
223B hex	223A hex	2nd Torque Boost Selection	A241	R/W	00: Manual torque boost 01: Automatic torque boost	–	P. 5-60
223C hex	223B hex	2nd Manual Torque Boost Voltage	A242	R/W	0 to 200	0.1 [%]	
223D hex	223C hex	2nd Manual Torque Boost Frequency	A243	R/W	0 to 500	0.1 [%]	
223E hex	223D hex	2nd Control Method	A244	R/W	00: Constant torque characteristics 01: Reduced torque characteristics 02: Free V/f setting 03: Sensorless vector control*3	–	P. 5-9 P. 6-3
223F hex	223E hex	2nd Output Voltage Gain	A245	R/W	20 to 100	1 [%]	P. 7-41
2240 hex	223F hex	2nd Automatic Torque Boost Voltage Compensation Gain	A246	R/W	0 to 255	1 [%]	P. 5-60
2241 hex	2240 hex	2nd Automatic Torque Boost Slip Compensation Gain	A247	R/W	0 to 255	1 [%]	
2242 to 224E hex	–	Reserved	–	–	–	–	–
224F hex	224E hex	2nd Frequency Upper Limit	A261 (HIGH)	R/W	0 2nd Frequency Lower Limit to 2nd Maximum Frequency	0.01 [Hz]	P. 5-31
2250 hex	224F hex		A261 (LOW)	R/W			
2251 hex	2250 hex	2nd Frequency Lower Limit	A262 (HIGH)	R/W	0 Starting Frequency to 2nd Frequency Upper Limit	0.01 [Hz]	
2252 hex	2251 hex		A262 (LOW)	R/W			

*1. In the high-frequency mode.

*2. When the PID function is enabled, the data unit differs between read and write operations.

Set parameter values in units of 0.01 Hz for writing and in units of 0.1% (as a percentage of the maximum frequency) for reading.

*3. Sensorless vector control can be set in the heavy load mode only.

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution	Page
2253 to 2268 hex	–	Reserved	–	–	–	–	–
2269 hex	2268 hex	2nd AVR Selection	A281	R/W	00: Always ON 01: Always OFF 02: OFF during deceleration	–	P. 7-42
226A hex	2269 hex	2nd Motor Rated Voltage Selection	A282	R/W	200-V class: 00 (200) 01 (215) 02 (220) 03 (230) 04 (240) 400-V class: 05 (380) 06 (400) 07 (415) 08 (440) 09 (460) 10 (480)	–	P. 5-21 P. 7-42
226B to 226E hex	–	Reserved	–	–	–	–	–
226F hex	226E hex	2nd Acceleration Time 2	A292 (HIGH)	R/W	1 to 360000	0.01 [s]	P. 5-37
2270 hex	226F hex		A292 (LOW)	R/W			
2271 hex	2270 hex	2nd Deceleration Time 2	A293 (HIGH)	R/W	1 to 360000	0.01 [s]	
2272 hex	2271 hex		A293 (LOW)	R/W			
2273 hex	2272 hex	2nd 2-step Acceleration/ Deceleration Selection	A294	R/W	00: Switch via 2CH terminal 01: Switch by 2-step Acceleration/Deceleration Frequency 02: Switch only during forward/reverse switching	–	
2274 hex	2273 hex	2nd 2-step Acceleration Frequency	A295 (HIGH)	R/W	0 to 40000 (58000) *1	0.01 [Hz]	
2275 hex	2274 hex		A295 (LOW)	R/W			
2276 hex	2275 hex	2nd 2-step Deceleration Frequency	A296 (HIGH)	R/W	0 to 40000 (58000) *1	0.01 [Hz]	
2277 hex	2276 hex		A296 (LOW)	R/W			
2278 to 230B hex	–	Not used	–	–	Not accessible	–	–

*1. In the high-frequency mode.

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution	Page
230C hex	230B hex	2nd Electronic Thermal Level	b212	R/W	200 to 1000 (1500)	0.1 [%]	P. 5-16
230D hex	230C hex	2nd Electronic Thermal Characteristics Selection	b213	R/W	00: Reduced torque characteristics 01: Constant torque characteristics 02: Free setting	–	
230E to 2315 hex	–	Reserved	–	–	–	–	–
2316 hex	2315 hex	2nd Overload Limit Selection	b221	R/W	00: Disabled 01: Enabled during acceleration and constant speed 02: Enabled during constant speed 03: Enabled during acceleration and constant speed (Accelerated during regeneration)	–	P. 7-76
2317 hex	2316 hex	2nd Overload Limit Level	b222	R/W	100 to 2000 (1500)	0.1 [%]	
2318 hex	2317 hex	2nd Overload Limit Parameter	b223	R/W	1 to 30000	0.1 [s]	
2319 to 2428 hex	–	Not used	–	–	Not accessible	–	–
2429 hex	2428 hex	2nd Overload Warning Level	C241	R/W	0 to 2000 (1500)	0.1 [%]	P. 7-76
242A to 2501 hex	–	Not used	–	–	Not accessible	–	–
2502 hex	2501 hex	2nd Motor Parameter Selection	H202	R/W	00: Standard motor parameter 02: Auto-tuning parameter	–	P. 6-4
2503 hex	2502 hex	2nd Motor Capacity	H203	R/W	00: 0.1 01: 0.2 02: 0.4 03: 0.55 04: 0.75 05: 1.1 06: 1.5 07: 2.2 08: 3.0 09: 3.7 10: 4.0 11: 5.5 12: 7.5 13: 11.0 14: 15.0 15: 18.5	–	

Register No.	Modbus register spec. No	Function name	Parameter No.	R/W	Monitor or setting data	Data resolution	Page
2504 hex	2503 hex	2nd Motor Pole Number Selection	H204	R/W	00: 2P 01: 4P 02: 6P 03: 8P 04 to 23: Do not set 10 to 48P.	–	P. 6-4
2505 hex	2504 hex	2nd Speed Response	H205 (HIGH)	R/W	1 to 1000	1 [%]	
2506 hex	2505 hex		H205 (LOW)	R/W			
2507 hex	2506 hex	2nd Stabilization Parameter	H206	R/W	0 to 255	1	P. 7-52
2508 to 2515 hex	–	Reserved	–	–	–	–	–
2516 hex	2515 hex	2nd Motor Parameter R1	H220	R/W	1 to 65535	0.001 [Ω]	P. 6-9
2517 hex	–	Reserved	–	–	–	–	–
2518 hex	2517 hex	2nd Motor Parameter R2	H221	R/W	1 to 65535	0.001 [Ω]	P. 6-9
2519 hex	–	Reserved	–	–	–	–	–
251A hex	2519 hex	2nd Motor Parameter L	H222	R/W	1 to 65535	0.01 [mH]	P. 6-9
251B hex	–	Reserved	–	–	–	–	–
251C hex	251B hex	2nd Motor Parameter Io	H223	R/W	1 to 65535	0.01 [A]	P. 6-9
251D hex	251C hex	2nd Motor Parameter J	H224 (HIGH)	R/W	1 to 9999000	0.001 [kgm^2]	P. 6-9
251E hex	251D hex		H224 (LOW)	R/W			
251F to 2524 hex	–	Reserved	–	–	–	–	–
2525 hex	2524 hex	2nd Motor Parameter R1 (Auto-tuning Data)	H230	R/W	1 to 65535	0.001 [Ω]	P. 6-4
2526 hex	–	Reserved	–	–	–	–	–
2527 hex	2526 hex	2nd Motor Parameter R2 (Auto-tuning Data)	H231	R/W	1 to 65535	0.001 [Ω]	P. 6-4
2528 hex	–	Reserved	–	–	–	–	–
2529 hex	2528 hex	2nd Motor Parameter L (Auto-tuning Data)	H232	R/W	1 to 65535	0.01 [mH]	P. 6-4
252A hex	–	Reserved	–	–	–	–	–
252B hex	252A hex	2nd Motor Parameter Io (Auto-tuning Data)	H233	R/W	1 to 65535	0.01 [A]	P. 6-4
252C hex	252B hex	2nd Motor Parameter J (Auto-tuning Data)	H234 (HIGH)	R/W	1 to 9999000	0.001 [kgm^2]	P. 6-4
252D hex	252C hex		H234 (LOW)	R/W			
252E to 3102 hex	–	Not used	–	–	Not accessible	–	–

9

Overview of DriveProgramming

This section provides the features of the DriveProgramming.

9-1 Overview of DriveProgramming 9-2

9-1 Overview of DriveProgramming

The 3G3MX2-V1 Series Inverter has the built-in simple sequence function (DriveProgramming), which enables a stand-alone inverter to perform simple sequence control.

You can create programs easily by using the CX-Drive. The user programs you created can be downloaded onto the inverter for programmed inverter operation.

Features of DriveProgramming

- The DriveProgramming supports both flowchart and text language method programming.
- Five tasks can be processed in parallel.
- User programs can be executed externally by the ON/OFF signal input via a multi-function input terminal.
- The user programs can be used to read and write functions allocated to the multi-function input and output terminals.
- The Digital Operator enables you to change the settings of the output frequency, acceleration/deceleration time, and other parameters that require on-site adjustment by specifying the user parameters (P100 to P131), without connecting any computer.
- Because user programs are stored in the internal EEPROM of the inverter, you can start a program immediately after the inverter power supply is turned on.

Precautions for Safe Use

If the DriveProgramming stops during multi-function output, the output status is held. Take safety precautions such as stopping peripheral devices.

Precautions for Correct Use

The 3G3MX2-V1 Series Inverter does not support the optional LCD Digital Operator (Model: 3G3AX-OP05). Therefore, the clock command built into the LCD Digital Operator cannot be used.

DriveProgramming Function

The details of the main DriveProgramming function are as follows.

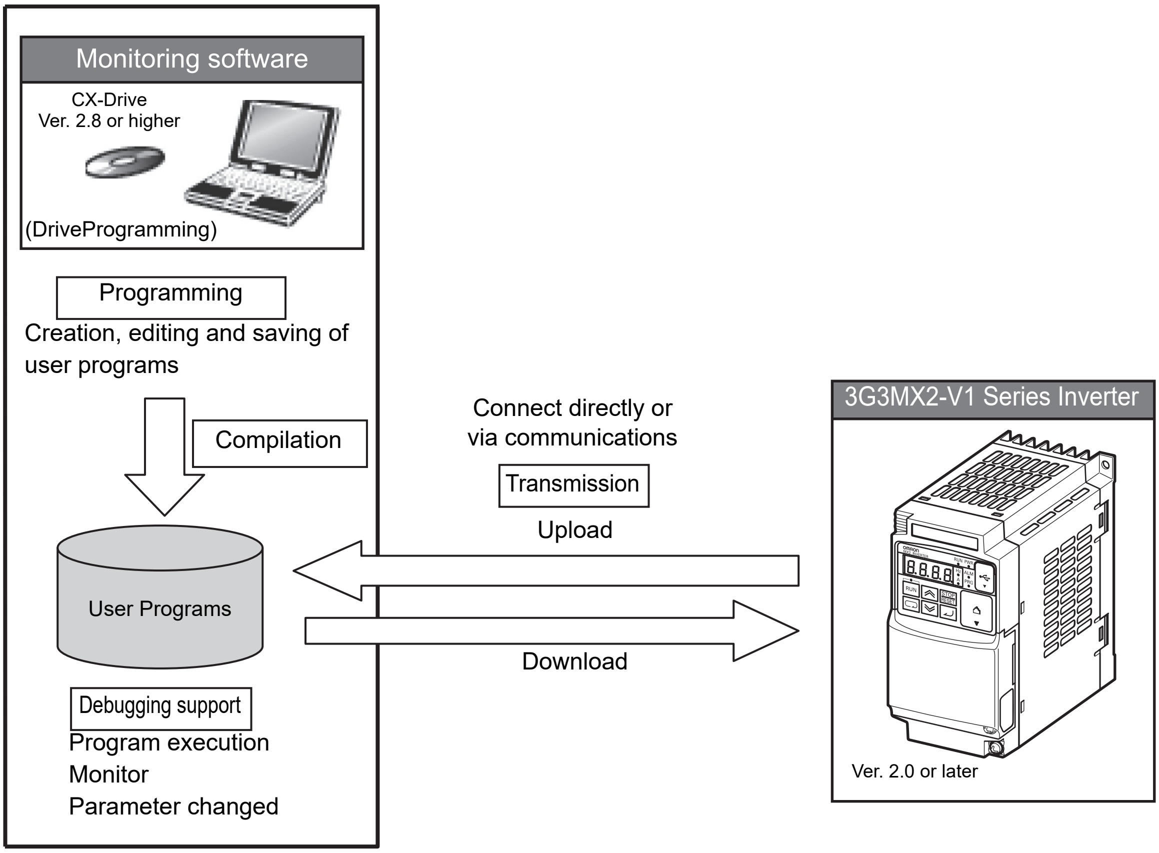
Item		Specifications
Program specifications	Programming language	Flowchart and text language method
	Input device	Windows computer (The supported operating systems are Windows XP SP3, Windows Vista, and Windows 7.)
	Program capacity	1024 steps max.: 6 KB (1024 steps max. for a total of 5 tasks)
	Programming support function	Functions supported in Inverter/Servo support tool CX-Drive • Program editing and display • Program compilation (Program configuration check) • Program downloading, uploading, and all clear
	Execution format	• Execution by interpreter • Execution cycle: 2 ms/step (5 commands executable through 5-task parallel processing) • Subroutine call supported (Nesting in 8 levels max.)

The main functions of the DriveProgramming Editor available in CX-Drive are as shown below.

Function	Description
Programming	Supports the creation, editing, saving, reading, and printing of user programs.
Compilation	Compiles a user programs. [*1]
Transfer	Downloads a user program to the inverter, or uploads a user program from the inverter.
Debugging support	Starts and stops the execution of a program. This allows the user to check the inverter status monitor etc.

[*1] Compilation is the process to generate an intermediate code after a program check.

For details, refer to “DriveProgramming User’s Manual (I580).”


Monitoring software
CX-Drive
Ver. 2.8 or higher
(DriveProgramming)
Programming
Creation, editing and saving of user programs
Compilation
User Programs
Debugging support
Program execution
Monitor
Parameter changed
Connect directly or via communications
Transmission
Upload
Download
3G3MX2-V1 Series Inverter
Ver. 2.0 or later

10

Troubleshooting

This section describes how to analyze the cause and take countermeasures if the inverter fails, and provides troubleshooting for possible troubles.

10-1 Alarm Display and Remedies 10-2
10-1-1 Alarm Display 10-2
10-1-2 Alarm Code List 10-4
10-1-3 Option Unit Protective Function List 10-10
10-1-4 Warning Display 10-12
10-1-5 Other Indications on Digital Operator 10-13
10-2 Troubleshooting 10-14

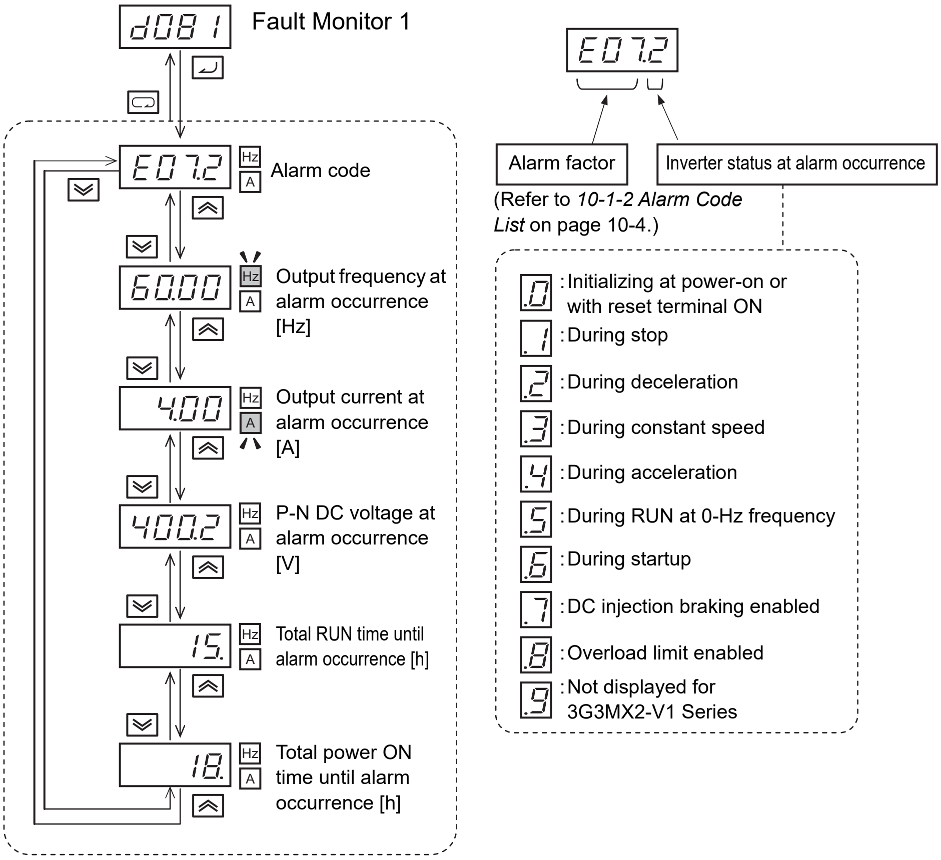
10-1 Alarm Display and Remedies

10-1-1 Alarm Display

If an error occurs, the inverter shuts off its output (“trip”), turns ON the ALARM LED, and displays an alarm code. With the alarm code displayed, you can press the Increment key to view the detailed information such as the output frequency, current, and DC voltage when the alarm signal was output.
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.
Note that, during an inverter trip, you cannot change parameter settings and data cannot be written to the EEPROM via communications. To change parameter settings, cycle the power supply, or reset the trip in advance.
This section describes how to deal with troubles that may occur after you start using the inverter.

Fault Monitor Display

Use the Fault Monitor 1 to 6 (d081 to d086) to check the current alarm, as well as the past alarms. The Fault Monitor 1 (d081) displays information on the latest alarm.


d081
Fault Monitor 1
E07.2
Hz
A
Alarm code
60.00
Output frequency at alarm occurrence [Hz]
4.00
Output current at alarm occurrence [A]
400.2
P-N DC voltage at alarm occurrence [V]
15.
Total RUN time until alarm occurrence [h]
18.
Total power ON time until alarm occurrence [h]
E07.2
Alarm factor
Inverter status at alarm occurrence
(Refer to 10-1-2 Alarm Code List on page 10-4.)
.0 : Initializing at power-on or with reset terminal ON
.1 : During stop
.2 : During deceleration
.3 : During constant speed
.4 : During acceleration
.5 : During RUN at 0-Hz frequency
.6 : During startup
.7 : DC injection braking enabled
.8 : Overload limit enabled
.9 : Not displayed for 3G3MX2-V1 Series

Precautions for Correct Use

The status information displayed on the inverter in the event of an alarm may not match the apparent operation of the motor.
For example, under PID control or in applications where the frequency is input via the analog signal, the inverter may accelerate and decelerate slightly in a repetitive manner due to fluctuation of the analog signal etc. even though the motor may appear to rotate at a constant speed.

How to Reset a Trip State

The inverter in a trip state can be reset in either of the following two methods.

- Press the STOP/RESET key on the Digital Operator.
  This key can be used to reset a trip error when the STOP Key Selection (b087) is set to 00 (Enabled) or 02 (Only resetting enabled).
- Input the reset signal via the control circuit terminal block.
  Set one of the Multi-function Input S1 to S7 Selection (C001 to C007) to 18 (RS: Reset).

The above reset methods may not be effective depending on the trip factor.

In such cases, cycle the power supply.

10-1-2 Alarm Code List

Name	Description		Alarm code	Check and remedy	Reference page
Overcurrent protection	If the brake is applied to the motor, or if motor is rapidly accelerated or decelerated, a large current will flow through the inverter, which results in a fault. Therefore, the protection circuit is activated at approximately 200% of the inverter rated output current, and the inverter trips.	During constant speed	E01.☐	Is there any rapid load fluctuation? • Eliminate load fluctuation. Is there any output short-circuit? • Check the output wiring. Is there any ground fault? • Check the output wiring and the motor.	P. 5-33 P. 5-60 P. 6-61 P. 7-76 P. 7-79
		During Deceleration	E02.☐	Is there any rapid deceleration? • Increase the deceleration time.	
		During Acceleration	E03.☐	Is there any rapid acceleration? • Increase the acceleration time. Is the motor locked? • Check the motor and wiring. Is the torque boost too high? • Decrease the torque boost setting. • If a PM motor is in use, is the motor set and adjusted properly?	
		Others	E04.☐	Is the DC injection braking power too high? • Decrease the braking power.	P. 7-91
Overload protection[*1]	This function monitors the inverter output current and, if the built-in electronic thermal function detects a motor overload, causes the inverter to trip. If the Motor Electronic Thermal Selection (b910) is set to separate the overload protection for the motor and for the inverter, this function serves as the motor overload protection.		E05.☐	Is the load too heavy? • Reduce the load rate. Is the thermal level setting (b012/b212) correct? • Adjust the thermal level to an appropriate level.	P. 5-16 P. 5-60 P. 6-61 P. 7-73 P. 7-76
Braking resistor overload protection	The inverter trips if the usage rate of the regenerative braking circuit exceeds the value set in b090.		E06.☐	Is there any rapid deceleration? • Increase the deceleration time. Is the operation cycle time too short? • Increase the operation cycle time.	P. 5-33 P. 5-65

[*1] The inverter will not accept the reset command until approximately 10 seconds after the occurrence of a trip (specifically, after activation of the protective function).

Name	Description	Alarm code	Check and remedy	Reference page
Overvoltage protection	Extremely high DC voltage between P/+2 and N/– may result in a fault. Therefore, the inverter trips if the DC voltage between P/+2 and N/– exceeds approximately 400 VDC (for 200-V class) or 800 VDC (for 400-V class) due to regenerative energy from the motor or an increase in the incoming voltage.	E07.☐	Is there any rapid deceleration? • Increase the deceleration time. Is there any ground fault? • Check the output wiring and the motor. Is the motor rotated from the load side? • Decrease the amount of regeneration. Is the incoming voltage too high? • Lower the incoming voltage, suppress the power supply fluctuation, install the AC reactor in the input power circuit.	P. 2-31 P. 5-33 P. 5-63 P. 5-65 P. 7-42
EEPROM error[*1]	The inverter trips if an error occurs in the built-in EEPROM due to external noise or abnormal temperature rise. (This may result in a CPU error.)	E08.☐	Is there any large noise source around? • Take measures against noise. Is the cooling efficiency reduced? • Check the cooling fin for clogging and clean it.	–
Undervoltage	The inverter shuts off its output if the incoming voltage drops below the specified level, because the control circuit fails to work properly at such a low incoming voltage. Then, the inverter trips if the DC voltage between P/+2 and N/– exceeds drops to approximately 173 VDC (for 200-V class) or 345 VDC (for 400-V class) or lower.	E09.☐	Is the power supply voltage decreased? • Check the power supply. Is the power supply capacity sufficient? • Check the power supply. Is the thyristor in the inrush current protection circuit broken? • Check that the DC voltage between P/+2 and N/– decreases only at large output current values.	P. 7-68
Current detector error	The inverter trips if an error occurs in the current detector.	E10.☐	The inverter has a defect. • Repair it.	–
CPU error[*1]	The inverter trips if a malfunction or error occurs in the built-in CPU.	E11.☐	Is there any large noise source around? • Take measures against noise. The inverter has a defect. • Repair it.	–
External trip	The inverter trips if the multi-function input terminal allocated to the External trip (12: EXT) function turns ON.	E12.☐	The external equipment has a defect. • Check the external equipment.	P. 7-79

[*1] If this error occurs, the inverter will not accept the reset operation via the terminal RS or the STOP/RESET key. Turn off the power supply once.

If this error is still displayed at the next power-on, it is possible that the memory is corrupt or the parameters are not stored correctly. Perform parameter initialization to reset the parameter settings.

Name	Description	Alarm code	Check and remedy	Reference page
USP error	The inverter trips if the power supply is turned on with the RUN signal ON. (This alarm is displayed only when the USP function is selected.)	E13.☐	Is the power supply turned on with the RUN signal ON? • Check the RUN command.	P. 7-67
Grounding protection[*1]	The inverter trips if a ground fault is detected between the inverter output unit and the motor when the power supply is turned on. (This function does not work when a residual voltage remains in the motor.)	E14.☐	Is there any ground fault? • Check the output wiring and the motor. Is there any fault in the inverter itself? • Disconnect the output wiring and check it. Is there any fault in the main circuit? • Check the main circuit. (Refer to *Section 11 Maintenance and Inspection*.)	–
Incoming overvoltage protection	The inverter trips if the incoming voltage remains in an overload state for 100 seconds. An overvoltage state will be detected when DC voltage between P/+2 and N/– is at approximately 390 VDC (for 200-V class) or 780 VDC (for 400-V class).	E15.☐	Is the incoming voltage too high? • Lower the incoming voltage. • Suppress the power supply fluctuation. • Install the AC reactor in the input power circuit.	–
Abnormal temperature	The inverter trips if the temperature in the main circuit exceeds the specified value due to such as high ambient temperature.	E21.☐	Is the inverter installed vertically? • Check the installation. Is the ambient temperature high? • Decrease the ambient temperature.	–
CPU communication error	The inverter trips if a malfunction or error occurs in the built-in CPU during communications.	E22.☐	Is there any large noise source around? • Take measures against noise. The inverter is faulty. • Repair it.	–
Main circuit error	The inverter trips if an error occurs in the main circuit board.	E25.☐	Is there any large noise source around? • Take measures against noise. The inverter is faulty. • Repair it.	–

[*1] If this error occurs, the inverter will not accept the reset operation via the terminal RS or the STOP/RESET key. Turn off the power supply once.

If this error is still displayed at the next power-on, it is possible that the memory is corrupt or the parameters are not stored correctly. Perform parameter initialization to reset the parameter settings.

Name	Description	Alarm code	Check and remedy	Reference page
Driver error[*1]	This error is detected by the driver IC incorporated in the inverter. The inverter trips to protect the main element if a momentary overcurrent (approximately 350% or higher of the rated current), abnormal temperature in the main element, or drop of the main element drive power supply occurs. (If this trip occurs, the inverter cannot be restarted.)	E30.☐	Is there any output short-circuit? • Check the output wiring. Is there any ground fault? • Check the output wiring and the motor. Is the main element damaged? • Check the IGBT. For the check method, refer to *11-1-7 Inverter/Converter Unit Test* on page 11-7. Is the cooling fin clogged? • Clean the fin.	P. 11-8
Thermistor error	The inverter trips if it detects an abnormal temperature from the resistance value of an external thermistor when the thermistor input function is enabled.	E35.☐	Is the motor temperature too high? • Check the temperature. Is the thermistor damaged? • Check the thermistor. Is there any noise in the thermistor signal? • Separate the wiring.	P. 7-80
Brake error	The inverter trips if it cannot recognize the ON/OFF status of the brake within the Brake Error Detection Time (b124) after outputting the brake release signal, when the brake control function is enabled (b120 = 01).	E36.☐	Is the brake ON/OFF function working? • Check the brake. Is the time set in b124 too short? • Increase the b124 value. Is the brake confirmation signal input? • Check the wiring.	P. 6-25 P. 6-49
Emergency shutoff[*2]	The inverter trips if the safety input terminal GS1/GS2 are input.	E37.☐	Are the GS1/GS2 signals input to the terminal correctly? • Check the wiring and sequence. Is the parameter set correctly? • Check the GS Input Operation Selection (b145) setting.	P. 7-98

[*1] If this error occurs, the inverter will not accept the reset operation via the terminal RS or the STOP/RESET key. Turn off the power supply once.

If this error is still displayed at the next power-on, it is possible that the memory is corrupt or the parameters are not stored correctly. Perform parameter initialization to reset the parameter settings.

[*2] In this case, the trip cannot be reset using the STOP/RESET key. Cycle the power supply or perform the reset operation via the terminal RS (Reset) to reset the trip.

Name	Description	Alarm code	Check and remedy	Reference page
Overload protection in a low speed range (Inverter overload protection)	The inverter trips if its built-in electronic thermal function detects an overload in an extremely low speed range of 0.2 Hz or lower. (However, the error history may indicate a high frequency.) If the Motor Electronic Thermal Selection (b910) is set to separate the overload protection for the motor and for the inverter, this function serves as the inverter overload protection.	E38.☐	Is the load too heavy? • Reduce the load rate.	P. 5-16 P. 5-60 P. 6-61 P. 7-35 P. 7-76
Digital Operator connection failure	The inverter trips if an error or disconnection occurs when it communicates with the external Digital Operator (optional).	E40.☐	Is there any communications error? • Check/replace the cable. This error detection function is disabled when b165 is set to 02 (Ignore).	P. 7-56
Modbus communication error	The inverter trips if a timeout occurs when the Operation Selection on Communication Error (C076) is set to 00 (Trip).	E41.☐	Is the communication speed correct? • Check the set value. Is the wiring distance appropriate? • Check the communications wires. Is there any disconnected wire? • Check the wiring.	P. 8-5
DriveProgramming error	• Program error (E43.☐ to E45.☐) • User trip (E50.☐ to E59.☐)	E43.☐ to E59.☐	For details, refer to the DriveProgramming User's Manual.	–
Option error	This error is received from the option unit.	E60.☐ to E68.☐	For details, refer to the manual for the option unit.	P. 10-10
Option timeout	The inverter trips if a timeout occurs in communications between the inverter and the option unit.	E69.☐	No option unit is connected. • Check that the housing of the option unit is mounted properly with the inverter. Check also that the fixation screws are not loosened. The option unit is faulty. • The option unit may be faulty if it is mounted properly.	P. 10-10

Name	Description	Alarm code	Check and remedy	Reference page
Encoder disconnection	The inverter trips, when the output frequency is at the Creep Speed Setting (P015) or higher, if the motor rotation speed detected by the encoder remains lower than the Starting Frequency (b082) for the duration set in the Encoder Disconnection Detection Time (P077 ≠ 0) or longer.	E80.☐	The encoder wiring is disconnected or connected improperly. • Check the encoder wiring. The actual motor rotation speed remains lower than the Starting Frequency (b082) for the duration set in the Encoder Disconnection Detection Time (P077) or longer. • Adjust the parameter values. Set a slightly longer time in P077 and a slightly higher value in P015. This alarm also occurs if the motor rotation speed drops to lower than the Starting Frequency under simple position control. • Adjust the parameter values. Set a slightly longer time in P077 and a slightly higher value in P015.	P. 6-18 P. 6-28
Overspeed	The inverter trips if the motor rotation speed exceeds the value set in Maximum Frequency × Overspeed Error Detection Level (P026 ≠ 0).	E81.☐	This alarm is displayed based on the speed detected by the encoder. The encoder wiring is disconnected or connected improperly. • Check the encoder wiring. The Number of Encoder Pulses does not match. • Check the number of encoder pulses. (P011) The actual motor speed is higher than the error detection level. • Adjust the Overspeed Error Detection Level (P026) setting.	P. 6-18 P. 6-28
Position control range trip	The inverter trips if the current position is out of the range set in the Position Limit Setting (P072, P073) during simple position control.	E83.☐	Check the current position. • Check the parameter settings (P072, P073). • Check the origin.	P. 6-34

10-1-3 Option Unit Protective Function List

When an option unit is mounted on the 3G3MX2 Series, the alarm code “E6*.☐” is displayed if the protective function is performed on the option unit.

Protective Function Display when EtherCAT Communications Unit (Model: 3G3AX-MX2-ECT) is Mounted

Description	Alarm code on Digital Operator
When an unrecoverable error is detected in the option unit, the inverter generates a trip.	E60.☐
The inverter trips if a timeout occurs in communications between the inverter and the option unit.	E69.☐

Additional Information

Refer to the “MX2/RX Series EtherCAT Communication Unit User’s Manual (I574)”.

Protective Function Display when CompoNet Communications Unit (Model: 3G3AX-MX2-CRT-E) is Mounted

Description	Alarm code on Digital Operator
This alarm appears if a fatal fault occurs on the communications unit when the power supply is ON or during operation.	E60.☐
This alarm appears if an overlapping node address is found.	E61.☐
This alarm appears if the inverter trips due to an external fault (EXT) detected via the fieldbus connection.	E62.☐
This alarm appears if a communications idle error or communications timeout error is detected in the RUN mode.	E63.☐
This alarm appears if a setting error is detected in any of the parameters P160 to P169 and P170 to P179.	E64.☐
This alarm appears if the inverter settings are not compatible with the communications unit.	E65.☐
This alarm appears if an option connection error or a fatal fault is detected when the communications unit operates.	E69.☐

Additional Information

Refer to the “MX2/RX Series CompoNet Communications Unit User’s Manual (I582)”.

Protective Function Display when DeviceNet Communications Unit (Model: 3G3AX-MX2-DRT-E) is Mounted

Description	Alarm code on Digital Operator
This alarm appears if a fatal fault occurs on the communications unit when the power supply is ON or during operation.	E60.☐
This alarm appears if an overlapping node address is found.	E61.☐
This alarm appears if the inverter trips due to an external fault (EXT) detected via the fieldbus connection.	E62.☐
This alarm appears if a communications idle error, communications timeout error, or network power supply error is detected in the RUN mode.	E63.☐
This alarm appears if a setting error is detected in any of the parameters P160 to P169 and P170 to P179.	E64.☐
This alarm appears if the inverter settings are not compatible with the communications unit.	E65.☐
This alarm appears if an option connection error or a fatal fault is detected when the communications unit operates.	E69.☐

Additional Information

Refer to the “MX2/RX Series DeviceNet Communications Unit User’s Manual (I581)”.

10-1-4 Warning Display

If the set parameter contradicts other set value, the inverter will display a warning with the program LED blinking.

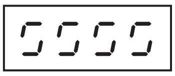
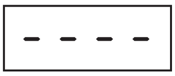
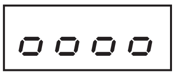
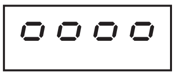
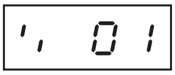
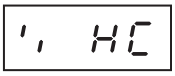
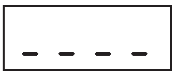
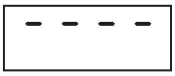
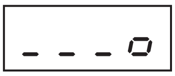
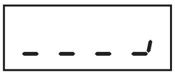
The table below lists the warning displays and their display conditions. If the warning display appears, change the parameter setting according to this table. (Inputting the RUN command does not rewrite the correct parameter value automatically.)

The latest warning display is stored in the parameter d090.

Warning display	Warning display conditions		
W001	1st Frequency Upper Limit (A061)	>	1st Maximum Frequency (A004)
W002	1st Frequency Lower Limit (A062)	>	1st Maximum Frequency (A004)
W005	Output Frequency Setting/Monitor (F001), 1st Multi-step Speed Reference 0 (A020)	>	1st Maximum Frequency (A004)
W015	Output Frequency Setting/Monitor (F001), 1st Multi-step Speed Reference 0 (A020)	>	1st Frequency Upper Limit (A061)
W025	1st Frequency Lower Limit (A062)	>	Output Frequency Setting/Monitor (F001), 1st Multi-step Speed Reference 0 (A020)
W031	Starting Frequency (b082)	>	1st Frequency Upper Limit (A061)
W032	Starting Frequency (b082)	>	1st Frequency Lower Limit (A062)
W035	Starting Frequency (b082)	>	Output Frequency Setting/Monitor (F001), 1st Multi-step Speed Reference 0 (A020)
W037	Starting Frequency (b082)	>	Jogging Frequency (A038)
W085	Output Frequency Setting/Monitor (F001), 1st Multi-step Speed Reference 0 (A020)	=	Jump Frequency[*1] (A063/A065/A067 ± A064/A066/A068)
W086	Multi-step Speed Reference 1 to 15 (A021 to A035)	=	
W091	Free V/f Frequency 7 (b112)	>	1st Frequency Upper Limit (A061)
W092	Free V/f Frequency 7 (b112)	>	1st Frequency Lower Limit (A062)
W095	Free V/f Frequency 7 (b112)	>	Output Frequency Setting/Monitor (F001), 1st Multi-step Speed Reference 0 (A020)
W201	2nd Frequency Upper Limit (A261)	>	2nd Maximum Frequency (A204)
W202	2nd Frequency Lower Limit (A262)	>	2nd Maximum Frequency (A204)
W205	Output Frequency Setting/Monitor (F001), 2nd Multi-step Speed Reference 0 (A220)	>	2nd Maximum Frequency (A204)
W215	Output Frequency Setting/Monitor (F001), 2nd Multi-step Speed Reference 0 (A220)	>	2nd Frequency Upper Limit (A261)
W225	2nd Frequency Lower Limit (A262)	>	Output Frequency Setting/Monitor (F001), 2nd Multi-step Speed Reference 0 (A220)
W231	Starting Frequency (b082)	>	2nd Frequency Upper Limit (A261)
W232	Starting Frequency (b082)	>	2nd Frequency Lower Limit (A262)
W235	Starting Frequency (b082)	>	Output Frequency Setting/Monitor (F001), 2nd Multi-step Speed Reference 0 (A220)
W285	Output Frequency Setting/Monitor (F001), 2nd Multi-step Speed Reference 0 (A220)	=	Jump Frequency [*1] (A063/A065/A067 ± A064/A066/A068)
W291	Free V/f Frequency 7 (b112)	>	2nd Frequency Upper Limit (A261)
W292	Free V/f Frequency 7 (b112)	>	2nd Frequency Lower Limit (A262)
W295	Free V/f Frequency 7 (b112)	>	Output Frequency Setting/Monitor (F001), 2nd Multi-step Speed Reference 0 (A220)

[*1] A warning will occur if the frequency set in F001, A020, A220, or A021 to A035 is within the frequency range set in the frequency jump function.

10-1-5 Other Indications on Digital Operator

Name	Description	Alarm code on Digital Operator
During reset	This indication appears when the input terminal allocated to the reset (RS) is ON, or when a trip state is reset via the STOP/RESET key.	Rotating 
Undervoltage standby	This indication appears when the inverter is in an undervoltage standby state, or when the power supply is shut off.	
Restart during momentary power interruption/Restart on trip	This indication appears while restart operation is in progress.	
Limited RUN command	This indication appears when the RUN command is input from the control terminal, with the RUN direction limited by the RUN Direction Limit Selection (b035) setting.	
Setting initialization	This indication appears while the parameter settings are initialized.	
Fault Monitor initialization	This indication appears while the fault monitor data is initialized.	
No data	This indication appears when there is no applicable data. (This indicates that the fault monitor has no trip data.)	
Communications error	This indication appears if an error occurs between a remote Digital Operator and the inverter.	Blinking 
Auto-tuning OK	This indication appears when auto-tuning is completed normally.	
Auto-tuning NG	This indication appears when auto-tuning fails.	

10-2 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 *10-1 Alarm Display and Remedies* on page 10-2.

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.	P. 2-10 P. 2-25
	Input wiring is disconnected.	Check the input wiring.	
The RUN command is input, but the motor does not rotate.	The 1st RUN Command Selection (A002) setting is incorrect.	Set the 1st RUN Command Selection (A002) correctly.	P. 5-22
	The 1st Frequency Reference Selection (A001) setting is incorrect.	Set the 1st Frequency Reference Selection (A001) correctly, then set the frequency according to the selected frequency reference input method.	P. 5-24
	The frequency is set to 0 Hz.	When the 1st Frequency Reference Selection (A001) is set to 01 (Control circuit terminal block), input the analog voltage or current signal corresponding to the frequency to the terminal FV or FI. For details on switching between the analog voltage and current signals, refer to *5-5-1 Frequency Reference Selection* on page 5-24.	
		When the 1st Frequency Reference Selection (A001) is set to 02 (Digital Operator), input the frequency in the Output Frequency Setting/Monitor (F001).	
		Set the frequency according to the 1st Frequency Reference Selection (A001) setting. (The input frequency will be displayed in the Output Frequency Setting/Monitor (F001).)	
		For the multi-step speed operation, set the frequency to the Multi-step Speed Reference 0 to 15 (A020 to A035, A220).	P. 5-49
	No multi-function input terminal is allocated for the RUN command.	To input the RUN command via a multi-function input terminal, set the Multi-function Input S1 to S7 Selection (C001 to C007) to 00 (FW) or 01 (RV). To input the RUN command via the 3-wire input function, set them to 20 (STA), 21 (STP), and 22 (F/R).	P. 5-48 P. 5-54
	The Multi-function Input S1 to S7 Selection (C001 to C007) are set to 02 (CF1) to 05 (CF4) and those terminals are ON to enable the Multi-step speed setting.	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 Speed Reference 1 to 15 (A021 to A035) are 0 (default).	P. 5-49
	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.	P. 5-48

Symptom	Possible cause	Remedy	Reference page
The RUN command is input, but the motor does not rotate.	The RUN Direction Limit Selection (b035) is set to limit the forward or reverse rotation.	Set the RUN Direction Limit Selection (b035) correctly.	P. 7-38
	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 Multi-function Input Monitor (d005).)	P. 2-10 P. 2-12 P. 2-33
	The analog voltage/current or variable resistor input wiring for the frequency reference is incorrect.	Wire correctly. • For the analog voltage or variable resistor input wiring, measure the voltage between the terminals FC and SC with a tester etc. to check that the voltage is correct. • For the analog current input wiring, with the wires disconnected, measure the current flowing between the power supply and FI terminals with a tester etc. to check that the current is correct.	P. 2-10 P. 7-22
	Although the inverter is operated via the Digital Operator, the Multi-function Input S1 to S7 Selection (C001 to C007) is set to 51 (F-TM: Forced terminal block) and that terminal is ON.	Turn OFF the terminal to which the function is allocated.	P. 7-55
	Although the inverter is operated via the control circuit terminal block, the Multi-function Input S1 to S7 Selection (C001 to C007) is set to 31 (OPE: Forced operator function) and that terminal is ON.	Turn OFF the terminal to which the function is allocated.	P. 7-55
	The inverter trip occurred. (The ALARM LED is lit with “Exxx” on the display.)	Press the STOP/RESET key to reset the trip and, after determining the cause and taking countermeasures based on the alarm code, restart the inverter.	P. 5-43 P. 10-2
	When the safety function selector switch is ON, either the multi-function input terminal S3/GS1 or S4/GS2 is OFF.	To use the safety function, turn ON both of the safety input terminals GS1 and GS2. To disable this function, set the safety function selector switch to OFF.	P. 7-97
	The Multi-function Input S1 to S7 Selection (C001 to C007) is set to 18 (RS: Reset), 14 (CS: Commercial switching), or 11 (FRS: Free-run stop) and that terminal is ON.	Turn OFF the terminal to which the function is allocated.	P. 5-39 P. 5-53 P. 7-50
	The Multi-function Input S1 to S7 Selection (C001 to C007) is set to 84 (ROK: Permission of RUN command) and that terminal is ON.	Turn ON the terminal to which the function is allocated.	P. 7-38
	The wiring from the inverter to the motor, or the internal wiring of the motor, is disconnected.	Check the input wiring.	P. 2-10 P. 2-28
	The load is too heavy.	Reduce the load.	–
	The motor brake is applied.	Release the brake.	–

Symptom	Possible cause	Remedy	Reference page
The motor rotation speed does not increase.	There is a contact failure for the analog voltage/current or variable resistor input wiring.	Check the input wiring. • For the analog voltage or variable resistor input wiring, measure the voltage between the terminals FC and SC with a tester etc. to check that the voltage is correct. • For the analog current input wiring, with the wires disconnected, measure the current flowing between the power supply and FI terminals with a tester etc. to check that the current is correct.	P. 2-10 P. 7-22
	The overload limit or overcurrent suppression function is active.	Disable the function, or increase the level at which the function is activated.	P. 7-76 P. 7-79
	The 1st Maximum Frequency (A004) or the 1st/2nd Frequency Upper Limit (A061/A261) is set too low.	Change the set value.	P. 5-21 P. 5-31
	The set acceleration time is too long.	Decrease the value set in the 1st/2nd Acceleration Time 1/2 (F002/F202/A092/A292).	P. 5-33
	The Multi-function Input S1 to S7 Selection (C001 to C007) is set to 06 (JG: Jogging) and that terminal is ON.	Turn OFF the terminal to which the function is allocated.	P. 5-52
	The Multi-function Input S1 to S7 Selection (C001 to C007) are set to 02 (CF1) to 05 (CF4) and those terminals are ON to enable the Multi-step speed setting.	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 Speed Reference 1 to 15 (A021 to A035).)	P. 5-50
	The load is too heavy.	Reduce the load.	–
	The motor brake is applied.	Release the brake.	–
The Output Frequency Setting/Monitor (F001) cannot be set via the Digital Operator.	The 1st Frequency Reference Selection (A001) is set to other than Digital Operator.	Set the 1st Frequency Reference Selection (A001) to 02 (Digital Operator).	P. 5-24
	The Multi-function Input S1 to S7 Selection (C001 to C007) is set to 51 (F-TM: Forced terminal block) and that terminal is ON.	Turn OFF the terminal to which the function is allocated.	P. 7-55
The specified parameter does not appear.	The Display Selection (b037) is set to 01 (Individual display of functions), 04 (Basic display), etc.	Set the Display Selection (b037) to 00 (Complete display).	P. 5-3
	The Multi-function Input S1 to S7 Selection (C001 to C007) is set to 86 (DISP: Display fixed) and that terminal is ON.	Turn OFF the terminal to which the function is allocated.	P. 7-57
The Digital Operator keys do not function.	The Multi-function Input S1 to S7 Selection (C001 to C007) is set to 86 (DISP: Display fixed) and that terminal is ON.	Turn OFF the terminal to which the function is allocated.	P. 7-57

Symptom	Possible cause	Remedy	Reference page
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. Setting b031 to 10 (Data can be changed during RUN) enables parameter settings to be changed even when the inverter operates.	–
	The soft lock function is enabled.	Disable the Soft Lock Selection (b031).	P. 7-54
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.	P. 2-11
	The 3-wire input function is enabled, but the forward/reverse logic is incorrect.	Check the logic of the F/R (3-wire forward/reverse) signal allocated to a multi-function input terminal (C001 to C007 = 22).	P. 5-54
The motor rotates in reverse when the RUN key is pressed.	The RUN Direction Selection (F004) setting is incorrect.	Set the RUN Direction Selection (F004) correctly.	P. 5-22
The inverter trips with an Overcurrent protection (E03) during operation.	The acceleration time is set too short.	Increase the value set in the 1st/2nd Acceleration Time 1/2 (F002/F202/A092/A292).	P. 5-33 P. 5-37
		Use the acceleration/deceleration stop function to change the operation pattern to stop accelerating temporarily.	P. 7-37
	The load is too heavy.	Reduce the load.	–
		Use the torque boost function to adjust the torque.	P. 5-60
		Set the 1st/2nd Control Method (A044/A244) to 03 (Sensorless vector control) and perform tuning.	P. 5-9 P. 6-3
	The 1st Overload Limit Selection (b021)/1st Overload Limit Selection 2 (b024) is set to 00 (Disabled).	Enable the 1st Overload Limit Selection (b021)/1st Overload Limit Selection 2 (b024).	P. 7-76
	If an overcurrent trip occurs during operation although the overload limit function is enabled:		
	The 1st Overload Limit Level (b022)/1st Overload Limit Level 2 (b025) value is too high.	Decrease the 1st Overload Limit Level (b022)/1st Overload Limit Level 2 (b025) value.	P. 7-76
	The 2nd Overload Limit Parameter/1st Overload Limit Parameter 2 (b023/b026) value is too small.	Increase the 2nd Overload Limit Parameter/1st Overload Limit Parameter 2 (b023/b026) value.	P. 7-76
The STOP/RESET key does not function.	The STOP/RESET key is disabled.	Set the STOP Key Selection (b087) correctly.	P. 5-42
	The Overvoltage Suppression Function Selection During Deceleration (b130) is enabled.	Set the Overvoltage Suppression Function Selection During Deceleration (b130) to 00 (Disabled), or adjust the level and other settings of the function.	P. 5-63
	The Deceleration Stop Selection on Power Interruption (b050) is enabled.	Set the Deceleration Stop Selection on Power Interruption (b050) to 00 (Disabled), or adjust the level and other settings of the function.	P. 7-63

Symptom	Possible cause	Remedy	Reference page
The motor or machine causes a loud noise.	The carrier frequency is too low.	Increase the Carrier Frequency (b083) value. 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 *A-1 Derating* on page A-2.	P. 7-31 P. A-2
	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 frequency jump function settings (A063 to A068) to avoid the resonance frequency.	P. 7-36
	The motor is overexcited.	Set the 1st/2nd Base Frequency (A003/A203) and the 1st/2nd Motor Rated Voltage Selection (A082/A282) according to the motor ratings. If this does not improve the condition, decrease the 1st Output Voltage Gain (A045/A245) slightly. Or set the 1st/2nd Control Method (A044/A244) to 02 (Free V/f setting) and perform tuning.	P. 5-9 P. 5-21 P. 7-41
The inverter trips with an Overload protection (E05).	The electronic thermal level is inappropriate.	Set the 1st Electronic Thermal Level (b012)/1st Electronic Thermal Characteristics Selection (b013) to a correct value.	P. 5-16 P. 7-73
The inverter trips with an Overvoltage protection (E07) during deceleration.	The set deceleration time is too short.	Increase the value set in the 1st/2nd Deceleration Time 1/2 (F003/F203/A093/A293).	P. 5-33 P. 5-37
	The Overvoltage Suppression Function Selection During Deceleration (b130) is set to 00 (Disabled).	Set the Overvoltage Suppression Function Selection During Deceleration (b130) to 01 or 02 to enable the overvoltage suppression during deceleration function. (However, when this function is enabled, the actual deceleration time may be longer than the set value. For details, refer to *5-12-1 Overvoltage Suppression Function during Deceleration* on page 5-63.)	P. 5-63
	If an overvoltage trip (E07) occurs during deceleration although Overvoltage Suppression Function Selection During Deceleration (b130) is set to Enable:		
	The Overvoltage Suppression Proportional Gain During Deceleration (b133)/Overvoltage Suppression Integral Time During Deceleration (b134) value is inappropriate.	Change the set values. For details, refer to *5-12-1 Overvoltage Suppression Function during Deceleration* on page 5-63.	P. 5-63
	The Overvoltage Suppression Level During Deceleration (b131) value is too high.	Decrease the Overvoltage Suppression Level During Deceleration (b131) value. Note, however, that setting an excessively small value may disable deceleration. Consider that the minimum value is: Incoming voltage × √2 × 110%.	P. 5-63
The inverter trips with a Thermistor error (E35).	The Multi-function Input S5 Selection is set to 19 (TH: PTC thermistor thermal protection) and 24-VDC voltage is input to the terminal TH.	Deallocate the external thermistor function from the terminal TH.	P. 7-80

Symptom	Possible cause	Remedy	Reference page
The output frequency is unstable.	The parameter settings are inappropriate.	Change the output frequency value slightly away from the power supply frequency.	P. 5-24
		Change the 1st/2nd Stabilization Parameter (H006/H206) value.	P. 7-52
	The load changes significantly.	Increase the motor/inverter capacity.	–
	The power supply voltage fluctuates.	Take measure to reduce the fluctuation.	–
The output torque is insufficient.	The parameter settings are inappropriate. (During acceleration/constant speed)	Increase the 1st/2nd Manual Torque Boost Voltage (A042/A242), 1st/2nd Manual Torque Boost Frequency (A043/A243) value.	P. 5-60
		Set the 1st/2nd Torque Boost Selection (A041/A241) to 01 (Automatic torque boost).	P. 5-60
		Decrease the Carrier Frequency (b083).	P. 7-31
		Set the 1st/2nd Control Method (A044/A244) to 03 (Sensorless vector control).	P. 6-3
	The parameter settings are inappropriate. (During deceleration)	Increase the value set in the 1st/2nd Deceleration Time 1/2 (F003/F203/A093/A293).	P. 5-33
		Set the 1st/2nd AVR Selection (A081/A281) to 01 or 02 (OFF).	P. 7-42
		Use braking resistors or regenerative braking units.	–
Removing the Digital Operator causes the inverter to trip, or fall in a free-run or deceleration stop state.	The Operation Selection at External Operator Disconnection (b165) setting is inappropriate.	Set the Operation Selection at External Operator Disconnection (b165) to 02 (Ignore).	P. 7-56
The operation/setting via Modbus communication is not possible.	Changes are not reflected to the communications parameters.	After changing the Communication Speed Selection (Baud Rate Selection) (C071), Communication Parity Selection (C074), or Communication Stop Bit Selection (C075), cycle the power supply, or reset the inverter (by turning ON to OFF the terminal RS).	P. 8-5
	The 1st/2nd RUN Command Selection (A002/A202) setting is incorrect.	Set the 1st/2nd RUN Command Selection (A002/A202) to 03 (Modbus communication).	P. 5-22
	The 1st /2nd Frequency Reference Selection (A001/A201) setting is incorrect.	Set the 1st /2nd Frequency Reference Selection (A001/A201) to 03 (Modbus communication).	P. 5-24
	The communications speed setting is incorrect.	Set a correct communications speed in the Communication Speed Selection (Baud Rate Selection) (C071).	P. 8-5
	The unit number setting is incorrect or overlaps.	Set a correct station number in the Communication Station No. Selection (C072).	P. 8-5
	The communications parity setting is incorrect.	Set a correct parity type in the Communication Parity Selection (C074).	P. 8-5
	The communications stop bit setting is incorrect.	Set a correct stop bit type in the Communication Stop Bit Selection (C075).	P. 8-5
	The wiring is incorrect.	Connect the wiring correctly to the terminal RS+/RS– on the control circuit terminal block.	P. 8-4

Symptom	Possible cause	Remedy	Reference page
The operation/setting via Modbus communication is not possible.	Some address setting is incorrect.	• Check that the coil or register address setting is correct, which is 1 less than the coil or register No. • If the Modbus mapping function is in use, check if the function settings are correct and, if necessary, make corrections.	P. 8-11 P. 8-24
Operating the inverter activates the earth leakage breaker.	The leakage current from the inverter is too large.	Decrease the Carrier Frequency (b083) value.	P. 7-31
		Increase the sensitivity current of the earth leakage breaker. Or replace the earth leakage breaker with one with a higher sensitivity current.	P. 2-22
The DC injection braking function does not work.	The DC injection braking power is not set.	Set the DC Injection Braking Power (A054).	P. 7-91
	The DC injection braking time is not set.	Set the DC Injection Braking Time (A055).	P. 7-91
The inverter trips with an Undervoltage (E09).	The voltage dropped because the power supply capacity is insufficient.	Increase the power supply capacity.	–
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 (E60 to E68) occurred.	The inverter received an error detected in the option unit.	For details, 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. The option connector is not fit securely: If the problem persists even after clearing the contact area, replace the inverter.	–
An Option error (E69) 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 and the option unit cover are fit securely on the inverter and fixed securely with the fixation screws.	–
	The Modbus mapping endian function setting is inappropriate.	Set the Modbus Mapping Endian Selection (P400) to 00 (Big endian).	P. 8-29
The operation/setting via the option unit (communications unit) is not possible.	The 1st/2nd RUN Command Selection (A002/A202) setting is incorrect.	Set the 1st/2nd RUN Command Selection (A002/A202) to 04 (Option).	P. 5-22
	The 1st/2nd Frequency Reference Selection (A001/A201) setting is incorrect.	Set the 1st/2nd Frequency Reference Selection (A001/A201) to 04 (Option).	P. 5-24
	Some address setting is incorrect.	Check that index/sub-index (for EtherCAT) and Class/Instance/Attribute (for CompoNet/DeviceNet) settings are correct.	–
	The Modbus mapping function is enabled.	Set the Modbus Mapping Function Selection (P200) to 00 (Standard Modbus address).	P. 8-24

Symptom	Possible cause	Remedy	Reference page
The CX-Drive cannot be connected with the inverter.	The CX-Drive version is not supported.	To connect the CX-Drive to the 3G3MX2-V1 Series, use Ver. 2.8 or higher.	P. 3-13
	The inverter software number does not match.	Set the software number of the connected inverter in the CX-Drive.	P. 3-17
	The Modbus mapping endian function setting is inappropriate.	Set the Modbus Mapping Endian Selection (P400) to 00 (Big endian).	P. 8-29
The inverter does not accept parameter settings from the CX-Drive.	The inverter is in operation.	Stop the inverter and, after the motor falls in a deceleration-stop state, set the parameters again. Setting b031 to 10 (Data can be changed during RUN) enables parameter settings to be changed even when the inverter is in operation.	–
	The Modbus mapping function is enabled.	Set the Modbus Mapping Function Selection (P200) to 00 (Standard Modbus address).	P. 8-24
The brake control function causes an Overload protection alarm (E05).	The inverter is in operation with the brake force.	Turn OFF the RUN command to the inverter when the brake is applied. Even under DC injection braking, an Overload protection alarm may occur.	P. 6-25 P. 6-49
The brake control function causes a Brake error (E36).	The output current does not reach the set brake release current value.	Increase the Brake Release Wait Time (b121) value or decrease the Brake Release Current (b126).	P. 6-25 P. 6-49
	The brake confirmation signal is not input.	• Correct the wiring for the brake confirmation signal (44: BOK). Deallocate the brake confirmation function from the multi-function input setting. • Review the operation sequence so that the brake confirmation signal (44: BOK) is input after the brake is released. • Replace the brake if it is faulty.	P. 6-25 P. 6-49
The brake control function causes the load to fall.	The set brake release current is insufficient.	• Increase the Brake Release Current (b126) value. • Set the 1st/2nd Control Method (A044/A244) to 03 (Sensorless vector control).	P. 6-25 P. 6-49
	The frequency setting for releasing/forcing the brake is too low.	Increase the Brake Release Frequency (b125), Brake Force Frequency (b127), or Creep Speed Setting (P015) value.	P. 6-25 P. 6-49
The PM motor rotates during startup.	The magnetic pole position of the motor during startup is incorrect.	Set the PM Motor Starting Method Selection (H123) to 01 (Initial pole position estimation enabled).	P. 6-63
The PM motor causes an Overcurrent protection alarm (E03) during startup.	The PM motor stalls.	Increase the PM Motor Starting Current (H117) value. Or perform adjustments according to *6-8-6 Adjustment of PM Motor Mode Settings* on page 6-63.	P. 6-63
	The load too heavy.	Reduce the load. Or increase the acceleration/deceleration time.	P. 5-33

11

Maintenance and Inspection

This section describes the maintenance and periodical inspection items.

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11-1 Maintenance and Inspection

⚠ WARNING	
⚠	Do not change wiring and slide switches, put on or take off Operator and optional devices, replace cooling fans while the input power is being supplied. Doing so may result in a serious injury due to an electric shock.
⚠	Do not remove the terminal cover during the power supply and 10 minutes after the power shut off. Doing so may result in a serious injury due to an electric shock.
⚠	Do not touch the inverter cooling fins, braking resistors, and the motor, which become too hot during the power supply and for some time after the power shut off. Doing so may result in a burn.

⚠ CAUTION	
🛇	Do not dismantle, repair or modify the product. Doing so may result in an injury.

Precautions for Safe Use

Maintenance and Inspection

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

Operation Stop Command

- Provide a separate emergency stop switch because the STOP Key on the Operator is valid only when function settings are performed.
- 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.

Maintenance and Parts Replacement

- Inverters contain components and will operate properly only when each component operates normally. Some of the electrical components require maintenance depending on application conditions. Periodic inspection and replacement are necessary to ensure proper long-term operation of inverters. (Quoted from The Recommendation for Periodic Maintenance of a General-purpose Inverter published by JEMA.)

Product Disposal

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

11-1-1 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 are no abnormal vibration and sound.
- There are no abnormal overheat and discoloration.
- There is no abnormal odor.

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.

11-1-2 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 Digital Operator display.

11-1-3 Periodic Inspection

Check the parts that must be checked with the operation stopped, as well as those that require periodic inspection:

- There are no faults in the cooling system.
  → Clean the air filter etc.
- Check for loose screws and retightening.
  → 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.

11-1-4 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 dust.	✓			Refer to *2-1 Installation* on page 2-4.	Ambient temperature: −10 to 50°C, no freezing Operating humidity: 90% max., no condensation	Thermometer Hygrometer Recorder
	Entire system	Check for abnormal vibration and sound.	✓			Perform visual and acoustic inspection.	No faults	
	Power supply voltage	Check main circuit voltage.	✓			Measure line voltage between inverter main circuit terminals R/L1, S/L2, and T/L3.	Within allowable AC voltage fluctuation range	Tester, digital multimeter
Main circuit	General	Perform megger check (between main circuit terminals and ground terminal).		✓		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 R/L1, S/L2, T/L3, U/T1, V/T2, W/T3, P/+2, +1, N/−, and RB.	5 MΩ min.	500-VDC class megger
		Check for loose bolts and screws.		✓		Retighten loose bolts and screws.	No faults	
		Check each part for traces of overheating.		✓		Perform visual inspection.	No faults	
	Conductor/wire	Check for distorted conductor.		✓		Perform visual inspection.	No faults	
		Check for broken cable sheaths.		✓				
	Terminal Blocks	Check for damage.		✓		Perform visual inspection.	No faults	

Inspection category	Inspection item	Inspection point	Inspection frequency			Inspection method	Criteria	Meter
				Periodic				
			Daily	1 year	2 years			
Main circuit	Inverter unit Converter unit (including resistors)	Check resistance between terminals.			✓	Disconnect wires from the inverter main circuit terminal block and measure the resistance between the terminals R/L1, S/L2, T/L3 and the terminals P/+2, N/–, and between the terminals U/T1, V/T2, W/T3 and the terminals P/+2, N/– with a tester in the ×1 Ω range.	Refer to *11-1-7 Inverter/Converter Unit Test* on page 11-7. Inverter unit replacement interval: 10^6 start-stop cycles [*3]	Analog tester
	Smoothing capacitor [*1]	Check that there is no liquid leakage.	✓			Perform visual inspection.	No faults	Capacity meter
		Check that the safety valve does not come out and that there is no bulge.	✓					
	Relay	Check for chattering sound during operation.		✓		Perform acoustic inspection.	No faults	
		Check for rough contact surface.		✓		Perform visual inspection.	No faults	
Control circuit, protection circuit	Operation check	Check output voltage balance between phases during stand-alone inverter operation.		✓		Measure the line voltage between the inverter main circuit terminals U/T1, V/T2, and W/T3.	Phase-to-phase voltage balance 200-V class: 4 V max. 400-V class: 8 V max.	Digital multimeter Rectifier Voltmeter
		Check that there is no error in protection and display circuits through sequence protection function test.		✓		Short-circuit or open the inverter protection circuit output under simulated conditions.	Error is found in the sequence.	
Cooling system	Cooling fan	Check for abnormal vibration and sound.	✓			Rotate the fan manually with the power off.	Smooth rotation, no faults [*2]	
		Check for loose connections.		✓		Perform visual inspection.		
	Cooling fin	Check for clogging.		✓		Perform visual inspection.	No clogging	

Inspection category	Inspection item	Inspection point	Inspection frequency			Inspection method	Criteria	Meter
			Daily	Periodic				
				1 year	2 years			
Display	Indicator	Check that the LED indicators are lit properly.	✓			Perform visual inspection.	The LED indicators are lit.	
		Perform cleaning.		✓		Clean it with a waste cloth.		
	Meter	Check indicated value.	✓			Check the indicated values on panel meters.	Specified value, control value	Voltmeter, ammeter, etc.
Motor	General	Check for abnormal vibration and sound.	✓			Perform acoustic, sensory, and visual inspection.	No faults	
		Check for abnormal odor.	✓			No abnormal odor due to overheating, damage, etc.	No faults	
	Isolation resistance	Perform megger check (between motor terminals and ground terminal).			✓	Disconnect wires from the inverter main circuit terminals U/T1, V/T2, W/T3 and short-circuit the 3-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 the inverter replacement guideline, refer to *A-2 Smoothing Capacitor Life Curve* on page A-8.

*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.

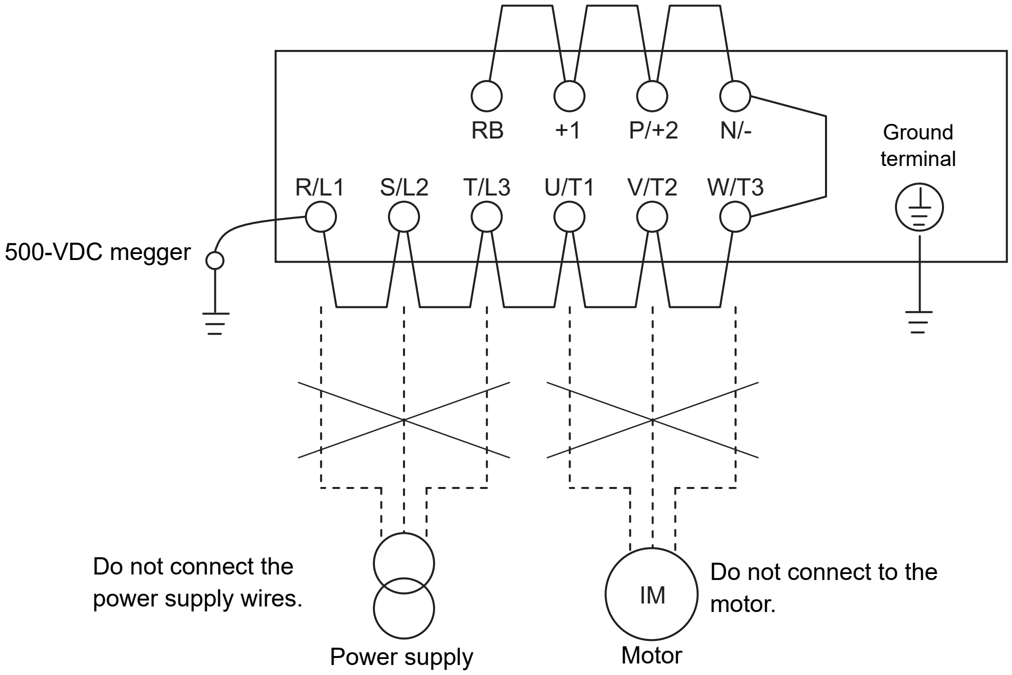
11-1-5 Megger Test

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 R/L1, S/L2, T/L3, U/T1, V/T2, W/T3, RB, +1, P/+2, 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.



11-1-6 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.

11-1-7 Inverter/Converter Unit Test

Use the following procedure to check conditions of the inverter and converter units by using a tester.

Preparation

1 **Disconnect the externally connected power supply wires (R/L1, S/L2, T/L3), the motor connection wires (U/T1, V/T2, W/T3), and the regenerative braking resistance (P/+2, RB).**

2 **Prepare a tester. Use the 1 Ω resistance measurement range.**

Test Method

Measure the resistance at the inverter main circuit terminals block R/L1, S/L2, T/L3, U/T1, V/T2, W/T3, RB, P/+2, and N/– by alternating the polarity of the tester to judge the conduction state.

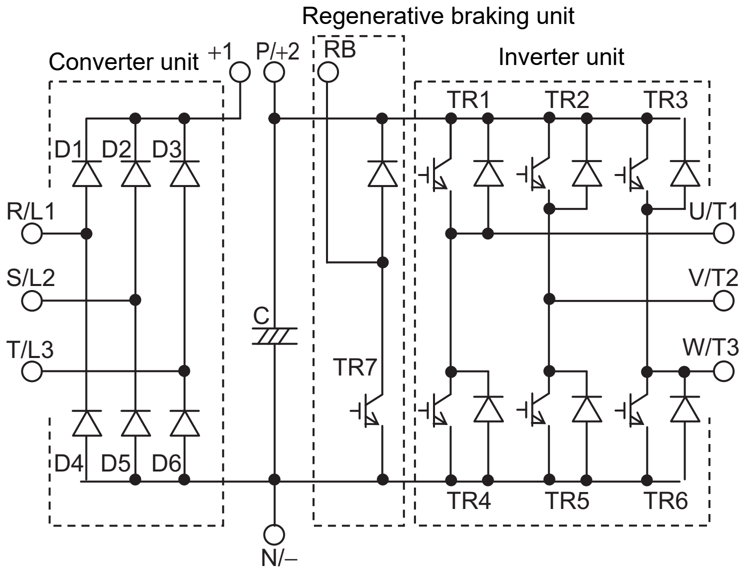
- Before starting the test, measure the voltage between P/+2 and N/– in the DC voltage range to check that the smoothing capacitor is sufficiently discharged.
- The tester will show nearly infinite resistance in a no-conduction state. (With conduction, the tester will show a resistance from a few Ω to several tens of Ω.)

  However, it may not show infinite resistance if a momentary conduction is detected due to the influence of the smoothing capacitor.

  The inverter or converter unit is in good condition if the measured value for each item in the following table is nearly equal, although it does not match exactly because of the element type, tester type, and so on.

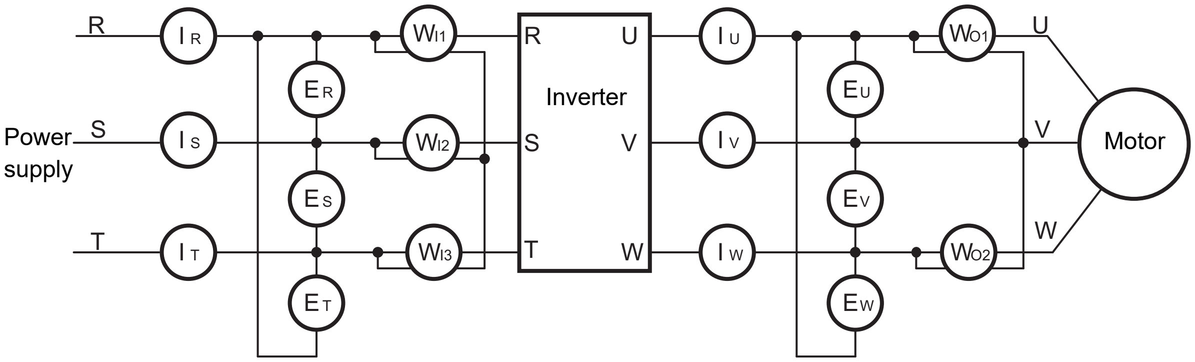
		Tester polarity		**Measurement result**
		+ (Red)	**− (Black)**	
Converter unit	D1	R/L1	+1	No conduction
		+1	R/L1	Conduction
	D2	S/L2	+1	No conduction
		+1	S/L2	Conduction
	D3	T/L3	+1	No conduction
		+1	T/L3	Conduction
	D4	R/L1	N/–	Conduction
		N/–	R/L1	No conduction
	D5	S/L2	N/–	Conduction
		N/–	S/L2	No conduction
	D6	T/L3	N/–	Conduction
		N/–	T/L3	No conduction

		Tester polarity		**Measurement result**
		+ (Red)	**− (Black)**	
Inverter unit	TR1	U/T1	P/+2	No conduction
		P/+2	U/T1	Conduction
	TR2	V/T2	P/+2	No conduction
		P/+2	V/T2	Conduction
	TR3	W/T3	P/+2	No conduction
		P/+2	W/T3	Conduction
	TR4	U/T1	N/–	Conduction
		N/–	U/T1	No conduction
	TR5	V/T2	N/–	Conduction
		N/–	V/T2	No conduction
	TR6	W/T3	N/–	Conduction
		N/–	W/T3	No conduction
Regenerative braking unit	TR7	RB	P/+2	No conduction
		P/+2	RB	Conduction
		RB	N/–	No conduction
		N/–	RB	No conduction



11-1-8 I/O Voltage/Current/Electric Power Measurement Method

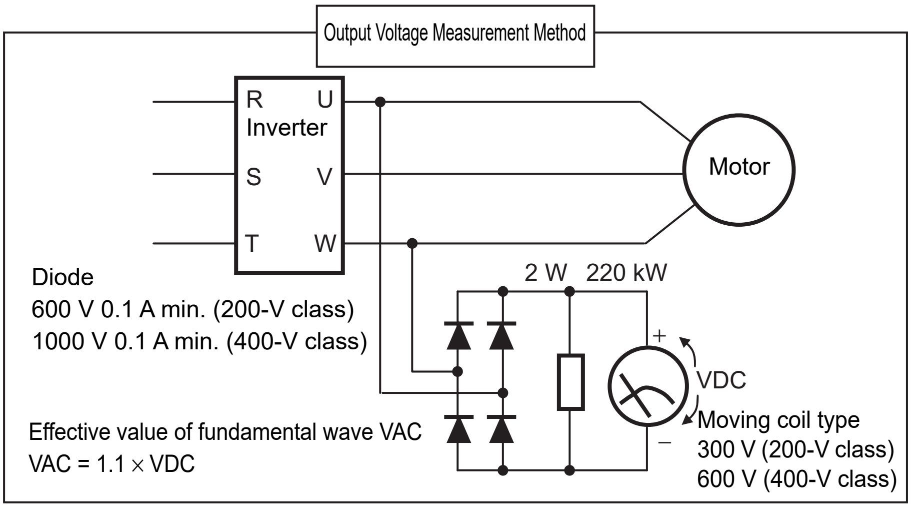
Measuring instruments commonly used for input/output voltage, current, or electric power measurement are shown below.



Measurement item	Measurement point	Measuring instrument	Remarks	Measurement value reference
Power supply voltage E_{IN}	Between R/L1 and S/L2 (E_R) Between S/L2 and T/L3 (E_R) Between T/L3 and R/L1 (E_R)	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
Power supply current I_{IN}	Current in R/L1, S/L2 T/L3: (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 R/L1 and S/L2 (W_{I1}) Between S/L2 and T/L3 (W_{I2}) Between T/L3 and R/L1 (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/T1 and V/T2 (E_U) Between V/T2 and W/T3 (E_V) Between W/T3 and U/T1 (E_W)	Refer to the figure on the next page. (Or rectifier type voltmeter)	Effective value of fundamental wave	–
Output current I_{OUT}	Current (I_U), (I_V), (I_W) of U/T1, V/T2, W/T3	Moving iron ammeter	All effective values	–
Output power W_{OUT}	Between U/T1 and V/T2 (W_{O1}) Between V/T2 and W/T3 (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.

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.


Output Voltage Measurement Method
R
U
Inverter
S
V
T
W
Motor
Diode
600 V 0.1 A min. (200-V class)
1000 V 0.1 A min. (400-V class)
2 W 220 kW
+
VDC
−
Moving coil type
300 V (200-V class)
600 V (400-V class)
Effective value of fundamental wave VAC
VAC = 1.1 × VDC

12

Options

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12-1 Overview of Optional Equipment

This section provides an overview of the optional equipment available with the 3G3MX2-V1 Series Inverter. For details, refer to the manual for each optional product.

12-1-1 Part Names and Descriptions

Regenerative Braking Unit (Model: 3G3AX-RBU□□)/Braking Resistor (Model: 3G3AX-RBA/RBB/RBC□□□□)

These products absorb the regenerative energy generated when a load decelerates or an elevating axis descends to prevent overvoltage trip of the inverter.

For details, refer to *External Braking Resistor Connection Terminal (P/+2, RB)/ Regenerative Braking Unit Connection Terminal (P/+2, N/–)* on page 2-31.

DC Reactor (Model: 3G3AX-DL□□□□)/AC Reactor (Model: 3G3AX-AL□□□□)

Use these reactors to suppress harmonics generated from the inverter.

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.

The DC/AC reactor also has an effect of improving the power factor.

For details, refer to *2-3-4 Wiring for Main Circuit Terminals* on page 2-15 and *Harmonic Current Measures and DC/AC Reactor Wiring (+1, P/2)* on page 2-25.

Input Noise Filter (Model: 3G3AX-NFI□□)

Use this filter to reduce the conductive noise generated in the inverter and transmitted to power supply lines.

For details, refer to *Installing input noise filter* on page 2-24.

Output Noise Filter (Model: 3G3AX-NFO□□)

Use this filter to reduce the conductive noise generated in the inverter and transmitted to the motor side wires.

For details, refer to *Installing output noise filter* on page 2-29.

Radio Noise Filter (Model: 3G3AX-ZCL□)

Use this filter to reduce the radiated noise generated in the inverter and emitted from the power-supply line side and motor side wires.

For details, refer to *Measures against radio noise* on page 2-30.

EMC Noise Filter (Model: 3G3AX-EFI□□) (Scheduled to be supported)

Use this filter to reduce the conductive noise generated in the inverter and transmitted to power supply lines for compliance with European EC Directives.

OMRON currently plans to support the EMC noise filters for the 3G3MX2-V1 Series.

Digital Operator (Model: 3G3AX-OP01)/ Digital Operator Cable (Model: 3G3AX-OPCN□)

In addition to the Digital Operator as standard equipment, the following Digital Operator products are also available.

- **Digital Operator (Model: 3G3AX-OP01)**

  This LED Digital Operator has a volume control to adjust frequency reference.

EtherCAT Communications Unit (Model: 3G3AX-MX2-ECT)

This option unit can control the inverter via EtherCAT communications.

For details, refer to “MX2/RX Series EtherCAT Communication Unit User's Manual (I574).”

CompoNet Communications Unit (Model: 3G3AX-MX2-CRT-E)

This option unit can control the inverter via CompoNet communications.

For details, refer to “MX2/RX Series CompoNet Communications Unit User’s Manual (I582).”

DeviceNet Communications Unit (Model: 3G3AX-MX2-DRT-E)

This option unit can control the inverter via DeviceNet communications.

For details, refer to “MX2/RX Series DeviceNet Communications Unit User’s Manual (I581).”

12-2 Regenerative Braking Unit (Model: 3G3AX-RBU□□)

12-2-1 Specifications

Built-in Resistor Type (Model: 3G3AX-RBU21/RBU22/RBU41)

Voltage class		3-phase 200-V class		3-phase 400-V class
Model		3G3AX-RBU21	3G3AX-RBU22	3G3AX-RBU41[*1]
Connection resistance		17 Ω min.	17 Ω min.	34 Ω min.
Operating voltage (ON/OFF)		ON: 362.5 ± 5 V OFF: 355 ± 5 V (–5% or –10% setting available[*2])		ON: 725 ± 5 V OFF: 710 ± 5 V (–5% or –10% setting available[*2])
Operation indication		LED ON (Lit)		
Maximum number of units for parallel interlocking operation[*2]		5 units		
Model		3G3AX-RBU21	3G3AX-RBU22	3G3AX-RBU41[*1]
Cable length between regenerative braking unit and inverter		5 m max.		
Built-in resistor	Internal resistance	120 W 180 Ω	120 W 20 Ω	120 W 180 Ω × 2 in series
	Allowable continuous ON time	10 s max.	0.5 s max.	10 s max.
	Allowable operation cycle	Cycle 1/10 (ON for 10 s/OFF for 90 s)	Cycle 1/80 (ON for 0.5 s/OFF for 40 s)	Cycle 1/10 (ON for 10 s/OFF for 90 s)
	Power consumption	Instantaneous: 0.73 kW Short-time rating: 120 W	Instantaneous: 6.6 kW Short-time rating: 120 W	Instantaneous: 1.46 kW Short-time rating: 240 W
Protective function	Built-in resistor overheat protection	Built-in relay specifications Built-in resistor temperature: Relay trips at approximately 200°C or higher and resets at approximately 170°C or lower. Built-in thermal fuse (No resetting)[*3] Contact rating: 250 VAC 200 mA (R load) 12 VDC 500 mA (R load) 42 VDC 200 mA (R load) Minimum load: 1 mA		
Operating environment	Operating ambient temperature	–10 to 50°C		
	Storage ambient temperature	–20 to 65°C		
	Operating ambient humidity	20% to 90% (with no condensation)		
	Vibration resistance	$5.9\ m/s^2$ (0.6 G) 10 to 55 Hz		
	Location	At a maximum altitude of 1,000 m (without corrosive gases or dust)		
Weight [kg]		1.7		2.0
Paint color		Munselle 5Y7/1 (except for cooling fan with aluminum base color)		

*1. To use the braking resistor (Model: 3G3AX-RAB/RBB/RBC) for the 400-V class regenerative braking unit, be sure to remove the built-in resistor and connect two resistors of the same model in series. Using a 400-V class regenerative braking unit with only a single braking resistor connected may cause damage to the braking resistor.

*2. Use DIP switches (SW1 to SW4) on the regenerative braking unit to set the number of connected units.

*3. The built-in resistor has a thermal fuse. If the alarm terminals are not connected, the fuse may blow out in order to prevent the overheating. If the fuse blows out, the regenerative braking unit must be repaired.

External Resistor Type (Model: 3G3AX-RBU23/RBU24/RBU42/RBU43)

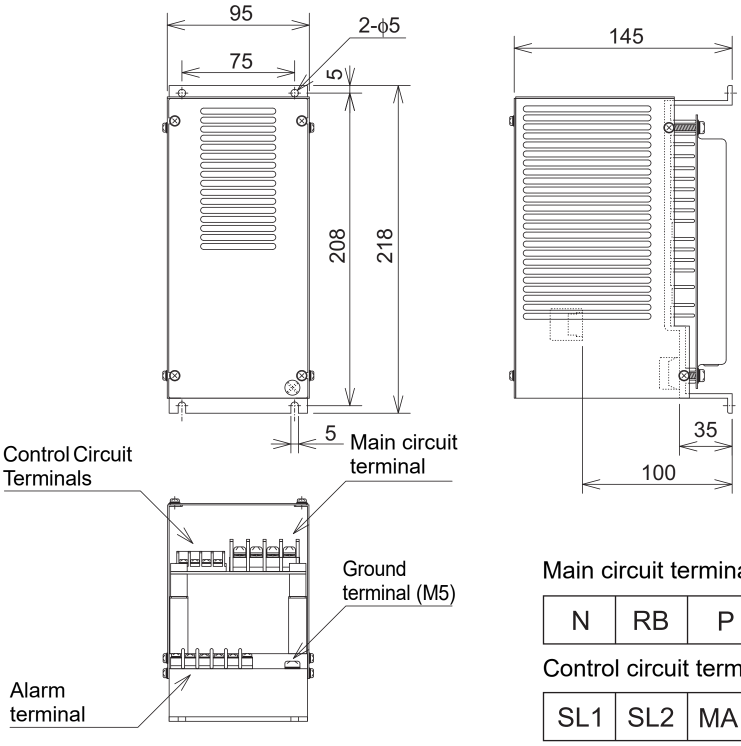
Voltage class		3-phase 200-V class		3-phase 400-V class	
Model		3G3AX-RBU23	3G3AX-RBU24	3G3AX-RBU42 *1	3G3AX-RBU43 *1
Connection resistance	Continuous operation	6 Ω min.	4 Ω min.	24 Ω min.	12 Ω min.
	Short-time operation/Allowable operation cycle/Allowable continuous ON time	4 Ω min. Cycle 1/5 (ON for 2 min/OFF for 8 min) 2 min	2 Ω min. Cycle 1/5 (ON for 2 min/OFF for 8 min) 2 min	10 Ω min. Cycle 1/10 (ON for 10 s/OFF for 90 s) 10 s	6 Ω min. Cycle 1/5 (ON for 2 min/OFF for 8 min) 2 min
Operating voltage (ON/OFF)		ON: 362.5 ± 5 V, OFF: 355 ± 5V (–5% or –10% setting available *2)		ON: 725 ± 5 V, OFF: 710 ± 5 V (–5% or –10% setting available *2)	
Operation indication		LED ON (Lit)			
Maximum number of units for parallel interlocking operation *2		2 units			
Model		3G3AX-RBU23	3G3AX-RBU24	3G3AX-RBU42 *1	3G3AX-RBU43 *1
Cable length between regenerative braking unit and inverter		4 m max.	Braking resistance: 4 Ω or lower for 4 m min. Lower than 4 Ω for 3 m min.	4 m max.	4 m max.
Protective function	Internal power module overheat protection	Built-in relay specifications Cooling fin temperature: Relay trips at approximately 100°C or higher. Contact rating: 240 VAC 3 A (R load) 36 VDC 2 A (R load) Minimum load: 5 VDC 50 mA (R load)			
Operating environment	Operating ambient temperature	–10 to 50°C			
	Storage ambient temperature	–20 to 65°C			
	Operating ambient humidity	20% to 90% (with no condensation)			
	Vibration resistance	4.9 m/s^2 (0.5 G), 10 to 55 Hz			
	Location	At a maximum altitude of 1,000 m (without corrosive gases or dust)			
Weight [kg]		6	8	2	6
Paint color		Munselle 5Y7/1 (except for cooling fan with aluminum base color)			

*1. To use the braking resistor (Model: 3G3AX-RAB/RBB/RBC) for the 400-V class regenerative braking unit, be sure to remove the built-in resistor and connect two resistors of the same model in series. Using a 400-V class regenerative braking unit with only a single braking resistor connected may cause damage to the braking resistor.

*2. Use DIP switches (SW1 to SW4) on the regenerative braking unit to set the number of connected units.

12-2-2 External Dimensions

3G3AX-RBU21/RBU22/RBU41


95
2-φ5
75
5
208
218
5
Main circuit terminal
Control Circuit Terminals
Ground terminal (M5)
Alarm terminal
145
35
100

Main circuit terminal: Terminal width 9, M4 screw

N	RB	P	P

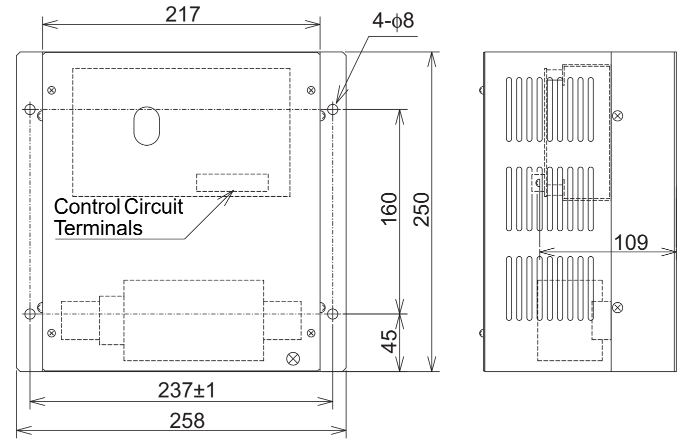
Control circuit terminal: Terminal width 6, M3 screw

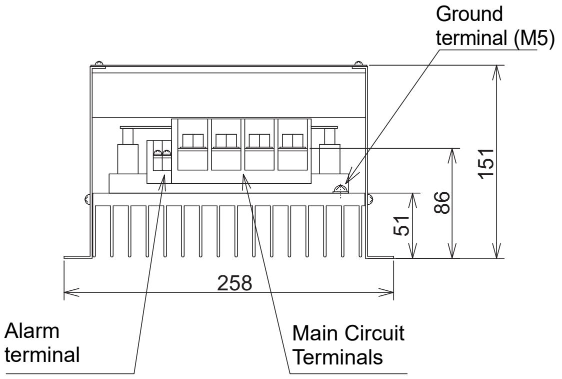
SL1	SL2	MA1	MA2

Alarm terminal: Terminal width 7, M3 screw

AL1	AL2	R1	R2

3G3AX-RBU23


217
4-ϕ8
Control Circuit Terminals
160
250
45
109
237±1
258


Ground terminal (M5)
151
86
51
258
Alarm terminal
Main Circuit Terminals

Main circuit terminal: Terminal width 23, M8 screw

N	RB	P	P

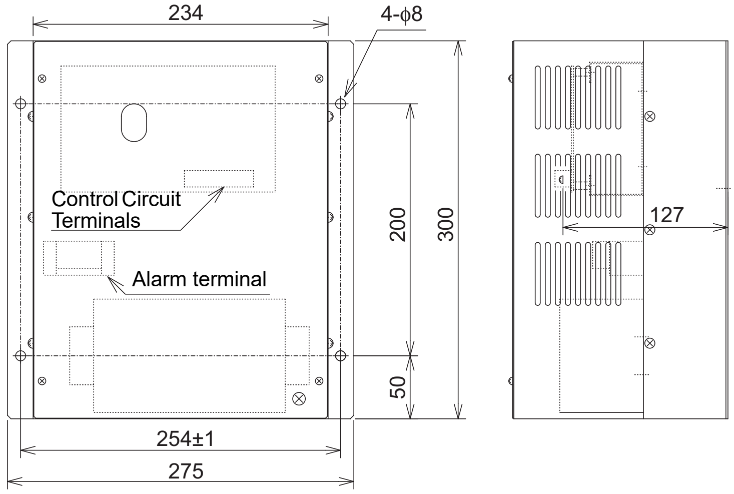
Control circuit terminal: Terminal width 6.4, M3 screw

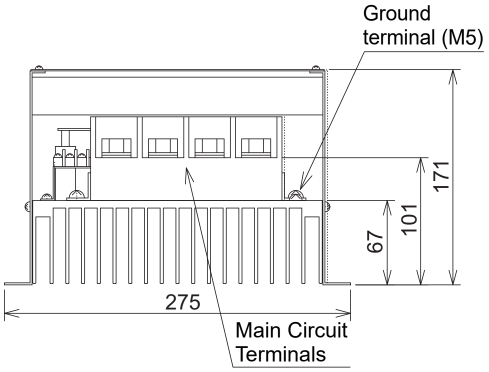
SL1	SL2	MA1	MA2

Alarm terminal: Terminal width 5.9, M3 screw

AL2	AL1

3G3AX-RBU24


234
4-ϕ8
Control Circuit Terminals
Alarm terminal
200
300
50
254±1
275
127


Ground terminal (M5)
171
101
67
275
Main Circuit Terminals

Main circuit terminal: Terminal width 33, M10 screw

N	RB	P	P

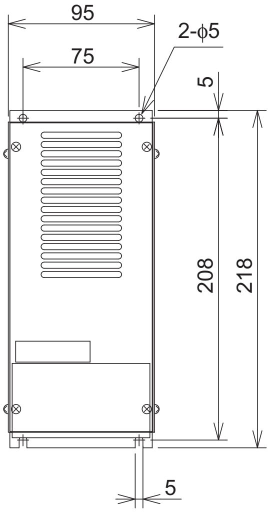
Control circuit terminal: Terminal width 6.4, M3 screw

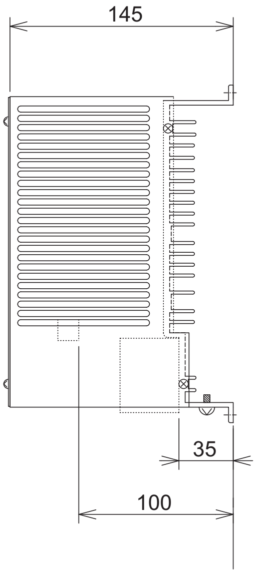
SL1	SL2	MA1	MA2

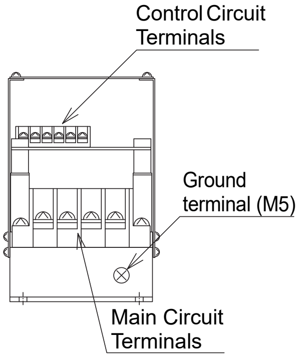
Alarm terminal: Terminal width 7.5, M3 screw

AL2	AL1

3G3AX-RBU42


95
75
2-φ5
5
208
218
5




Control Circuit Terminals
Ground terminal (M5)
Main Circuit Terminals

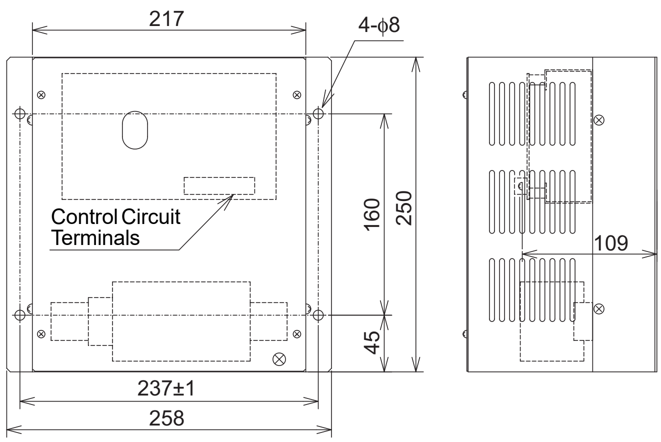
Main circuit terminal: Terminal width 13, M5 screw

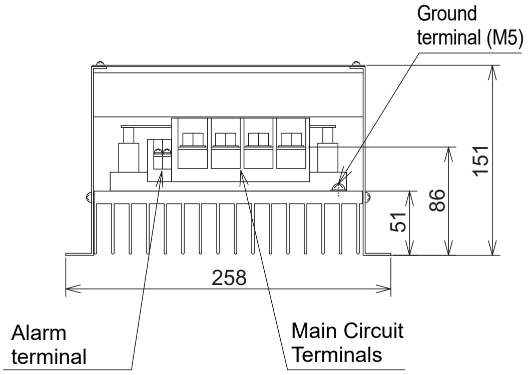
N	RB	P	P

Control circuit terminal: Terminal width 6, M3 screw

SL1	SL2	MA1	MA2	AL1	AL2

3G3AX-RBU43


217
4-ϕ8
Control Circuit Terminals
160
250
45
109
237±1
258


Ground terminal (M5)
151
86
51
258
Alarm terminal
Main Circuit Terminals

Main circuit terminal: Terminal width 23, M8 screw

N	RB	P	P

Control circuit terminal: Terminal width 6.4, M3 screw

SL1	SL2	MA1	MA2

Alarm terminal: Terminal width 5.9, M3 screw

AL2	AL1

12-2-3 Connection Examples

For how to connect regenerative braking unit(s), refer to *External Braking Resistor Connection Terminal (P/+2, RB)/ Regenerative Braking Unit Connection Terminal (P/+2, N/–)* on page 2-31 in this manual.

12-3 Braking Resistor (Model: 3G3AX-RBA/RBB/RBC□□□□)

12-3-1 Specifications

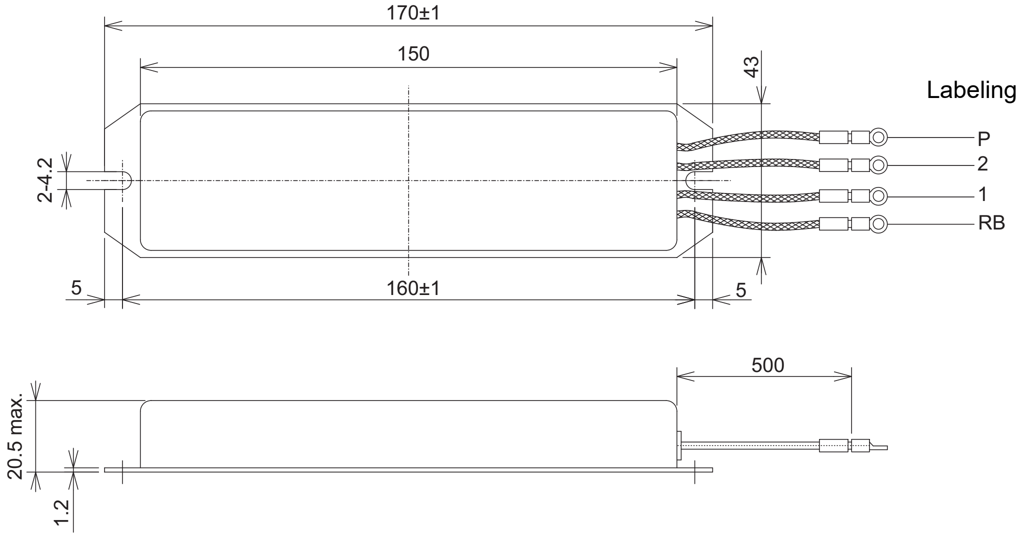
Model		Compact type (Model: 3G3AX-RBA□□□□)				Standard type (Model: 3G3AX-RBB□□□□)				Medium capacity type (Model: 3G3AX-RBC□□□□)		
		1201	1202	1203	1204	2001	2002	3001	4001	4001	6001	12001
Resistance	Capacity [W]	120				200		300	400	400	600	1200
	Resistance [Ω]	180	100	50	35	180	100	50	35	50	35	17
Allowable braking frequency [%]		5	2.5	1.5	1.0	10	7.5	7.5	7.5	10		
Allowable continuous braking time [s]		20	12	5	3	30			20	10		
Weight [kg]		0.27				0.97		1.68	2.85	2.5	3.6	6.5
Error detection function		Built-in thermal (Contact capacity: 240 VAC 2 A max., Minimum current: 5 mA) Normally ON (NC contact) Built-in thermal fuse (No resetting)								Built-in thermal relay: Normally ON (NC contact) Contact capacity: 240 VAC 3 A (resistance load)/0.2 A (L load), 36 VDC 2 A (resistance load)		
General specifications	Operating ambient temperature	–10 to 50°C										
	Storage ambient temperature	–20 to 65°C										
	Operating ambient humidity	20% to 90% (with no condensation)										
	Vibration resistance	5.9 m/s^2 (0.6 G), 10 to 55 Hz										
	Location	At a maximum altitude of 1,000 m (without corrosive gases or dust)										
	Cooling method	Self-cooling										

Precautions for Safe Use

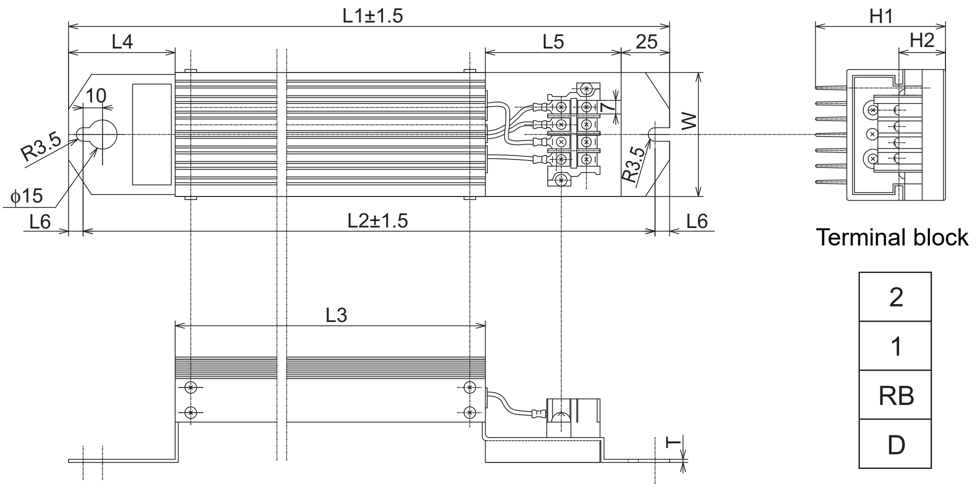
When using the Braking Resistor (Model: 3G3AX-RBA/RBB/RBC) with a 400-V class inverter or Regenerative Braking Unit (Model: 3G3AX-RBU41/RBU42/RBU43), be sure to connect two braking resistors of the same model in series. Using the Regenerative Braking Unit with only one braking resistor connected may cause damage to the braking resistor.

12-3-2 External Dimensions

3G3AX-RBA□□□□

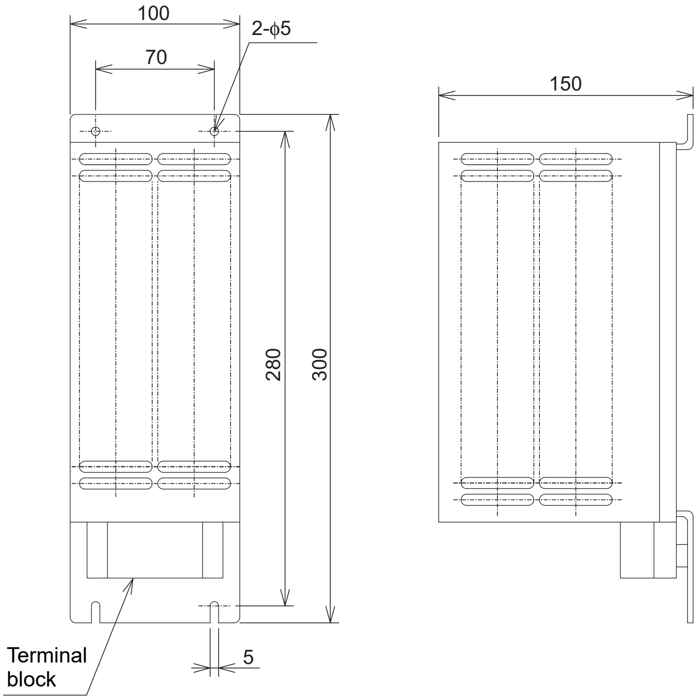

170±1
150
43
Labeling
P
2
1
RB
2-4.2
5
160±1
5
500
20.5 max.
1.2

3G3AX-RBB□□□□


L1±1.5
L4
L5
25
10
7
W
R3.5
R3.5
ϕ15
L6
L2±1.5
L6
L3
T
H1
H2
Terminal block
2
1
RB
D

Model	Rated capacity [W]	Resistance [Ω]	Dimensions [mm]										Weight [kg]	Terminal screw
			L1	L2	L3	L4	L5	L6	H1	H2	W	T		
3G3AX-RBB 2001	200	180	310	295	160	55	70	7.5	67	12	64	1.6	0.97	M3.5
3G3AX-RBB 2002	200	100	310	295	160	55	70	7.5	67	12	64	1.6	0.97	
3G3AX-RBB 3001	300	50	470	455	320	55	70	7.5	67	12	64	1.6	1.68	
3G3AX-RBB 4001	400	35	435	422	300	50	60	6.5	94	15	76	2	2.85	

3G3AX-RBC4001


100
2-ϕ5
70
150
280
300
Terminal block
5

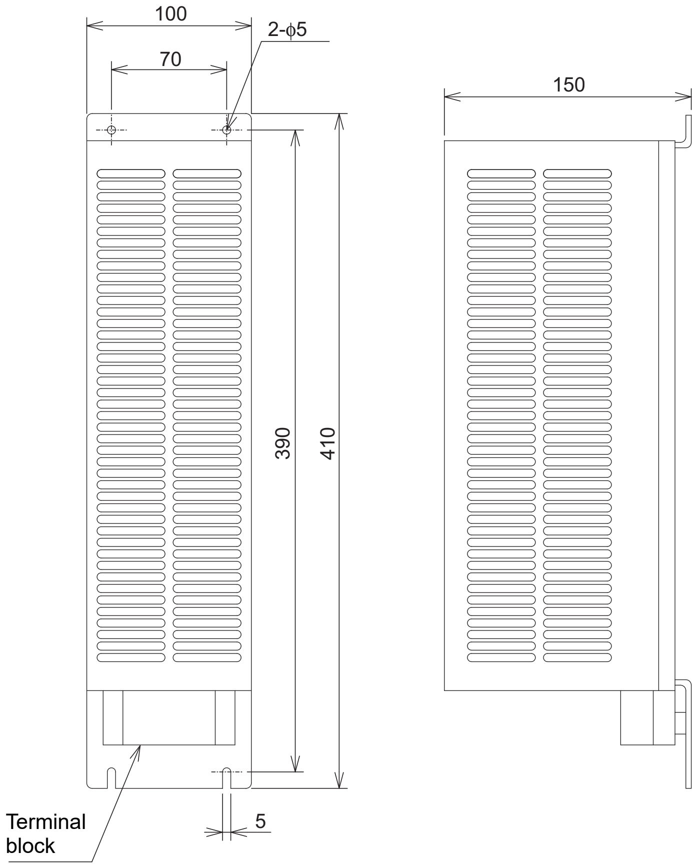
Terminal block

P	RB	AL1	AL2

Terminal width W = 9 mm

Screw M4

3G3AX-RBC6001


100
2-ϕ5
70
150
390
410
Terminal block
5

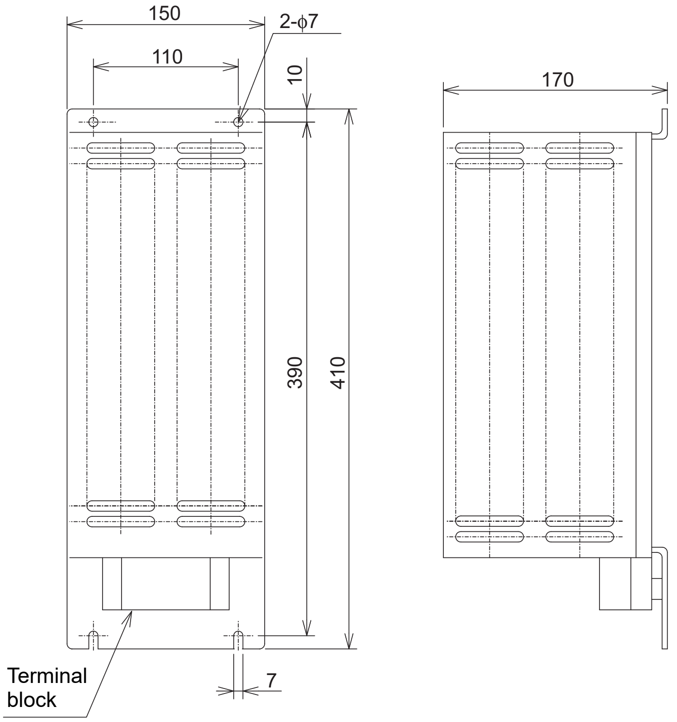
Terminal block

P	RB	AL1	AL2

Terminal width W = 9 mm

Screw M4

3G3AX-RBC12001



Terminal block

P	RB	AL1	AL2

Terminal width W = 9 mm

Screw M4

12-3-3 Connection Examples

For how to connect regenerative braking unit(s), refer to *External Braking Resistor Connection Terminal (P/+2, RB)/ Regenerative Braking Unit Connection Terminal (P/+2, N/–)* on page 2-31 in this manual.

12-4 Regenerative Braking Unit and Braking Resistor Combination Selection Table

A table that lists the available combinations of the inverter with the regenerative braking unit and braking resistor is provided on the next page.

Below is the meaning of each header item of this combination table. Choose the combination appropriate to your inverter.

If the usage rate exceeds 10% ED, or if you need a torque larger than the approximate braking torque, you need to follow the instruction provided in *A-5 Overview of Inverter Selection* on page A-12.

Item	Description
Inverter	Select the model of your inverter. However, the table below assumes that your inverter is used in the heavy load mode and connected to a single motor with the same capacity. Therefore, in the light load mode, a motor with the same capacity means a motor that is one size larger in capacity than the inverter and the approximate braking torque decreases in proportion to the motor capacity.
Operating condition	Shows the torque during deceleration (Approximate braking torque) and the processing time for regeneration such as deceleration time calculated as a percentage of the cycle time for 1 cycle of operation including the stop time (% ED).
Braking unit/Braking resistor	Shows the required model and number of units.
Connection form	Shows the configuration of the regenerative braking unit(s) and braking resistor(s) that are illustrated in the connection form table after this selection table.
Restriction	Shows the processing time for regeneration, such as the maximum deceleration time, allowable for the combination shown in the combination selection table (Allowable continuous ON time) and the minimum resistance that can be connected to the inverter’s built-in regenerative braking circuit or external regenerative braking unit(s) (Min. connection resistance).

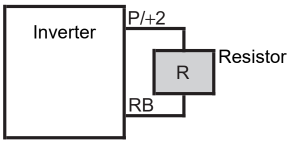
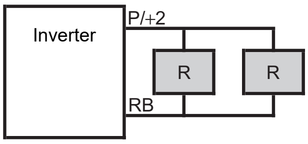
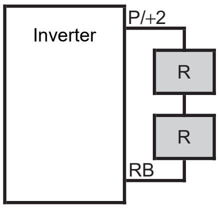
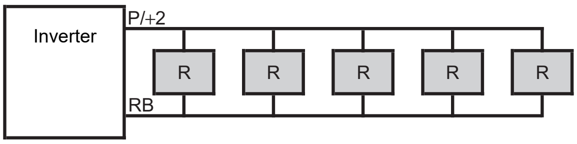
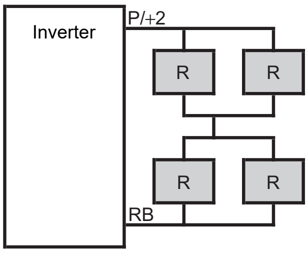
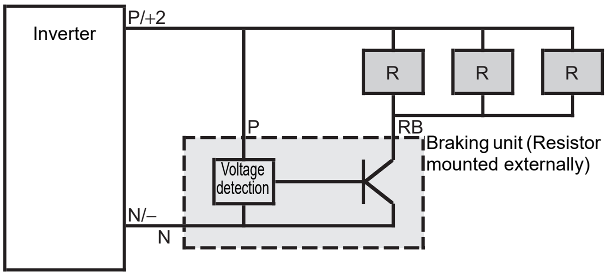
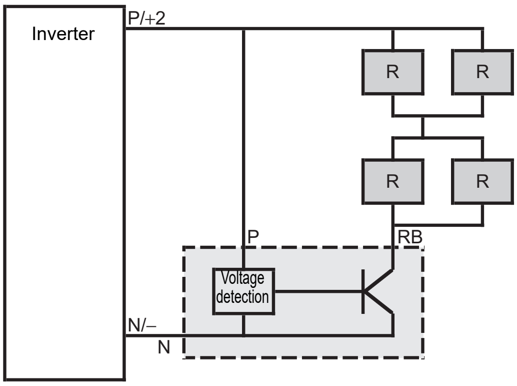
Inverter			Operating condition		Braking unit		Braking resistor		Connection form	Restriction	
Voltage class	Max. applicable motor capacity [kW]	Model	%ED [%]	Approximate braking torque [%*1]	Model	No. of units	Model	No. of units		Allowable continuous ON time [s]	Min. connection resistance [Ω]
200-V class	0.1	3G3MX2-A2001-V1	3.0%	220%	Built into unit	–	3G3AX-RBA1201	1	1	20	100
		3G3MX2-AB001-V1	10.0%	220%		–	3G3AX-RBB2001	1	1	30	100
	0.2	3G3MX2-A2002-V1	3.0%	220%	Built into unit	–	3G3AX-RBA1201	1	1	20	100
		3G3MX2-AB002-V1	10.0%	220%		–	3G3AX-RBB2001	1	1	30	100
	0.4	3G3MX2-A2004-V1	3.0%	220%	Built into unit	–	3G3AX-RBA1201	1	1	20	100
		3G3MX2-AB004-V1	10.0%	220%		–	3G3AX-RBB2001	1	1	30	100
	0.75	3G3MX2-A2007-V1	3.0%	120%	Built into unit	–	3G3AX-RBA1201	1	1	20	50
		3G3MX2-AB007-V1	10.0%	120%		–	3G3AX-RBB2001	1	1	30	50
	1.5	3G3MX2-A2015-V1	2.5%	110%	Built into unit	–	3G3AX-RBA1202	1	1	12	50
		3G3MX2-AB015-V1	10.0%	215%		–	3G3AX-RBC4001	1	1	10	50
	2.2	3G3MX2-A2022-V1	3.0%	150%	Built into unit	–	3G3AX-RBB3001	1	1	30	35
		3G3MX2-AB022-V1	10.0%	150%		–	3G3AX-RBC4001	1	1	10	35
	3.7	3G3MX2-A2037-V1	3.0%	125%	Built into unit	–	3G3AX-RBB4001	1	1	20	35
			10.0%	125%		–	3G3AX-RBC6001	1	1	10	35
	5.5	3G3MX2-A2055-V1	3.0%	120%	Built into unit	–	3G3AX-RBB3001	2	2	30	20
			10.0%	120%		–	3G3AX-RBC4001	2	2	10	20
	7.5	3G3MX2-A2075-V1	3.0%	125%	Built into unit	–	3G3AX-RBB4001	2	2	20	17
			10.0%	125%		–	3G3AX-RBC6001	2	2	10	17
	11	3G3MX2-A2110-V1	3.0%	90%	Built into unit	–	3G3AX-RBC12001	1	1	10	17
			10.0%	90%		–	3G3AX-RBC12001	1	1	10	17
			10.0%	125%	3G3AX-RBU23	1	3G3AX-RBC6001	3	6	10	4
	15	3G3MX2-A2150-V1	3.0%	110%	Built into unit	–	3G3AX-RBB3001	5	4	30	10
			10.0%	110%		–	3G3AX-RBC4001	5	4	10	10

Inverter			Operating condition		Braking unit		Braking resistor		Connection form	Restriction	
Voltage class	Max. applicable motor capacity [kW]	Model	%ED [%]	Approximate braking torque [%*1]	Model	No. of units	Model	No. of units		Allowable continuous ON time [s]	Min. connection resistance [Ω]
400-V class	0.4	3G3MX2-A4004-V1	3.0%	220%	Built into unit	–	3G3AX-RBA1201	2	3	20	180
			10.0%	220%		–	3G3AX-RBB2001	2	3	30	180
	0.75	3G3MX2-A4007-V1	3.0%	220%	Built into unit	–	3G3AX-RBA1201	2	3	20	180
			10.0%	220%		–	3G3AX-RBB2001	2	3	30	180
	1.5	3G3MX2-A4015-V1	3.0%	120%	Built into unit	–	3G3AX-RBA1201	2	3	20	180
			10.0%	120%		–	3G3AX-RBB2001	2	3	30	180
	2.2	3G3MX2-A4022-V1	2.5%	150%	Built into unit	–	3G3AX-RBA1202	2	3	12	100
			10.0%	220%		–	3G3AX-RBC4001	2	3	10	100
	3.0	3G3MX2-A4030-V1	2.5%	110%	Built into unit	–	3G3AX-RBA1202	2	3	12	100
			10.0%	215%		–	3G3AX-RBC4001	2	3	10	100
	4.0	3G3MX2-A4040-V1	3.0%	165%	Built into unit	–	3G3AX-RBB3001	2	3	30	100
			10.0%	165%		–	3G3AX-RBC4001	2	3	10	100
	5.5	3G3MX2-A4055-V1	3.0%	120%	Built into unit	–	3G3AX-RBB3001	2	3	30	70
			10.0%	120%		–	3G3AX-RBC4001	2	3	10	70
	7.5	3G3MX2-A4075-V1	3.0%	125%	Built into unit	–	3G3AX-RBB4001	2	3	20	70
			10.0%	125%		–	3G3AX-RBC6001	2	3	10	70
	11	3G3MX2-A4110-V1	3.0%	85%	Built into unit	–	3G3AX-RBB4001	2	3	20	70
			10.0%	85%		–	3G3AX-RBC6001	2	3	10	70
			10.0%	120%	3G3AX-RBU41*2	1	3G3AX-RBC4001	4	7	10	34
	15	3G3MX2-A4150-V1	3.0%	125%	Built into unit	–	3G3AX-RBB4001	4	5	20	35
			10.0%	125%		–	3G3AX-RBC6001	4	5	10	35

*1. This is shown in units of percentage as 100% of the rated torque of the motor.

*2. Remove the built-in resistor.

- **Connection Form Table**

No.	Connection form	
1	1 resistor unit	 Inverter P/+2 R Resistor RB
2	2 resistor units connected in parallel	 Inverter P/+2 R R RB
3	2 resistor units connected in series	 Inverter P/+2 R R RB
4	5 resistor units connected in parallel	 Inverter P/+2 R R R R R RB
5	2 groups of 2 parallel resistor units are series-connected	 Inverter P/+2 R R R R RB
6	1 braking unit and 3 resistor units connected in parallel	 Inverter P/+2 R R R P RB Braking unit (Resistor mounted externally) Voltage detection N/– N
7	1 braking unit and 2 groups of 2 parallel resistor units are series-connected	 Inverter P/+2 R R R R P RB Voltage detection N/– N

12-5 DC Reactor (Model: 3G3AX-DL□□□□)

12-5-1 Specifications

Inverter						DC reactor specifications				
Voltage class	Max. applicable motor capacity [kW]	Model	Heavy/ Light load mode	Max. applicable motor capacity [kW]	Rated input current [A]	Model	Inductance [mH]	Heat generation [W]	Operating ambient temperature/ humidity	Location
3-phase 200-V class	0.1	3G3MX2-A2001-V1	Heavy load[*1]	0.1	1.0	3G3AX-DL2002	21.4	8	−10 to 50°C 20% to 90%	At an altitude of 1,000 m max.; indoors (without corrosive gases or dust)
			Light load	0.2	1.2					
	0.2	3G3MX2-A2002-V1	Heavy load[*1]	0.2	1.6					
			Light load	0.4	1.9	3G3AX-DL2004	10.7			
	0.4	3G3MX2-A2004-V1	Heavy load[*1]	0.4	3.3					
			Light load	0.75	3.9	3G3AX-DL2007	6.75	10		
	0.75	3G3MX2-A2007-V1	Heavy load[*1]	0.75	6.0					
			Light load	1.1	7.2	3G3AX-DL2015	3.51			
	1.5	3G3MX2-A2015-V1	Heavy load[*1]	1.5	9.0					
			Light load	2.2	10.8	3G3AX-DL2022	2.51	13		
	2.2	3G3MX2-A2022-V1	Heavy load[*1]	2.2	12.7					
			Light load	3.0	13.9	3G3AX-DL2037	1.60	20		
	3.7	3G3MX2-A2037-V1	Heavy load[*1]	3.7	20.5					
			Light load	5.5	23.0	3G3AX-DL2055	1.11	26		
	5.5	3G3MX2-A2055-V1	Heavy load[*1]	5.5	30.8	3G3AX-DL2075	0.84	36		
			Light load	7.5	37.0					
	7.5	3G3MX2-A2075-V1	Heavy load[*1]	7.5	39.6					
			Light load	11	48.0	3G3AX-DL2110	0.59	52		
	11	3G3MX2-A2110-V1	Heavy load[*1]	11	57.1					
			Light load	15	68.0	3G3AX-DL2150	0.44	60		
	15	3G3MX2-A2150-V1	Heavy load[*1]	15	62.6					
			Light load	18.5	72.0	3G3AX-DL2220	0.30	63		
Single-phase 200-V Class	0.1	3G3MX2-AB001-V1	Heavy load[*1]	0.1	1.3	3G3AX-DL2002	21.4	8	−10 to 50°C 20% to 90%	At an altitude of 1,000 m max.; indoors (without corrosive gases or dust)
			Light load	0.2	2.0					
	0.2	3G3MX2-AB002-V1	Heavy load[*1]	0.2	3.0					
			Light load	0.4	3.6	3G3AX-DL2004	10.7			
	0.4	3G3MX2-AB004-V1	Heavy load[*1]	0.4	6.3					
			Light load	0.55	7.3	3G3AX-DL2007	6.75	10		
	0.75	3G3MX2-AB007-V1	Heavy load[*1]	0.75	11.5					
			Light load	1.1	13.8	3G3AX-DL2015	3.51			
	1.5	3G3MX2-AB015-V1	Heavy load[*1]	1.5	16.8					
			Light load	2.2	20.2	3G3AX-DL2022	2.51	13		
	2.2	3G3MX2-AB022-V1	Heavy load[*1]	2.2	22.0					
			Light load	3.0	24.0	3G3AX-DL2037	1.60	20		

Inverter						DC reactor specifications				
Voltage class	Max. applicable motor capacity [kW]	Model	Heavy/ Light load mode	Max. applicable motor capacity [kW]	Rated input current [A]	Model	Inductance [mH]	Heat generation [W]	Operating ambient temperature/ humidity	Location
3-phase 400-V class	0.4	3G3MX2-A4004-V1	Heavy load [1]	0.4	1.8	3G3AX-DL4004	43.0	10	−10 to 50°C 20% to 90%	At an altitude of 1,000 m max.; indoors (without corrosive gases or dust)
			Light load	0.75	2.1	3G3AX-DL4007	27.0			
	0.75	3G3MX2-A4007-V1	Heavy load [1]	0.75	3.6					
			Light load	1.5	4.3	3G3AX-DL4015	14.0			
	1.5	3G3MX2-A4015-V1	Heavy load [1]	1.5	5.2					
			Light load	2.2	5.9	3G3AX-DL4022	10.1	13		
	2.2	3G3MX2-A4022-V1	Heavy load [1]	2.2	6.5					
			Light load	3.0	8.1	3G3AX-DL4037	6.4	20		
	3.0	3G3MX2-A4030-V1	Heavy load [1]	3.0	7.7					
			Light load	4.0	9.4					
	4.0	3G3MX2-A4040-V1	Heavy load [1]	4.0	11.0					
			Light load	5.5	13.3	3G3AX-DL4055	4.41	26		
	5.5	3G3MX2-A4055-V1	Heavy load [1]	5.5	16.9					
			Light load	7.5	20.0	3G3AX-DL4075	3.35	36		
	7.5	3G3MX2-A4075-V1	Heavy load [1]	7.5	18.8					
			Light load	11	24.0	3G3AX-DL4110	2.33	52		
	11	3G3MX2-A4110-V1	Heavy load [1]	11	29.4					
			Light load	15	38.0	3G3AX-DL4150	1.75	60		
	15	3G3MX2-A4150-V1	Heavy load [1]	15	35.9					
			Light load	18.5	44.0	3G3AX-DL4220	1.2	67		

[1] The DC reactor model for the heavy-load mode is selected with reference to the rated current value of a general-purpose motor, which is 85% of the rated output current of the inverter. If you intend to constantly drive a motor whose rated current value exceeds 85% of the rated output current of the inverter, use the DC reactor model selected for the light-load mode.

12-5-2 External Dimensions

Inverter input power supply	Model	Fig. No.	Applicable Motor capacity [kW]	Dimensions [mm]									Weight [kg]	Standard applicable wire
				W	D	H	A	B	X	Y	C	K		
3-phase/ 1-phase 200 VAC	3G3AX-DL2002	Fig. 1	0.1, 0.2	66	90	98	–	85	56	72	5.2 × 8	M4	0.8	1.25 mm^2 min.
	3G3AX-DL2004		0.4	66	90	98	–	95	56	72	5.2 × 8	M4	1.0	1.25 mm^2 min.
	3G3AX-DL2007		0.55, 0.75	66	90	98	–	105	56	72	5.2 × 8	M4	1.3	2 mm^2 min.
	3G3AX-DL2015		1.1, 1.5	66	90	98	–	115	56	72	5.2 × 8	M4	1.6	2 mm^2 min.
	3G3AX-DL2022		2.2	86	100	116	–	105	71	80	6 × 9	M4	2.1	2 mm^2 min.
	3G3AX-DL2037		3.0, 3.7	86	100	118	–	120	71	80	6 × 9	M4	2.6	3.5 mm^2 min.
	3G3AX-DL2055	Fig. 2	5.5	111	100	210	–	110	95	80	7 × 11	M5	3.6	8 mm^2 min.
	3G3AX-DL2075		7.5	111	100	212	–	120	95	80	7 × 11	M6	3.9	14 mm^2 min.
	3G3AX-DL2110		11	146	120	252	–	110	124	96	7 × 11	M6	6.5	22 mm^2 min.
	3G3AX-DL2150		15	146	120	256	–	120	124	96	7 × 11	M8	7.0	38 mm^2 min.
	3G3AX-DL2220	Fig. 3	18.5	120	175	356	140	145	98	151	7 × 11	M8	9.0	60 mm^2 min.
3-phase 400 VAC	3G3AX-DL4004	Fig. 1	0.4	66	90	98	–	85	56	72	5.2 × 8	M4	0.8	1.25 mm^2 min.
	3G3AX-DL4007		0.75	66	90	98	–	95	56	72	5.2 × 8	M4	1.1	1.25 mm^2 min.
	3G3AX-DL4015		1.5	66	90	98	–	115	56	72	5.2 × 8	M4	1.6	2 mm^2 min.
	3G3AX-DL4022		2.2	86	100	116	–	105	71	80	6 × 9	M4	2.1	2 mm^2 min.
	3G3AX-DL4037		3.0	86	100	116	–	120	71	80	6 × 9	M4	2.6	2 mm^2 min.
	3G3AX-DL4055		5.5	111	100	138	–	110	95	80	7 × 11	M4	3.6	3.5 mm^2 min.
	3G3AX-DL4075		7.5	111	100	138	–	115	95	80	7 × 11	M4	3.9	3.5 mm^2 min.
	3G3AX-DL4110	Fig. 2	11	146	120	250	–	105	124	96	7 × 11	M5	5.2	5.5 mm^2 min.
	3G3AX-DL4150		15	146	120	252	–	120	124	96	7 × 11	M6	7.0	14 mm^2 min.
	3G3AX-DL4220	Fig. 3	18.5	120	175	352	140	145	98	151	7 × 11	M6	9.5	22 mm^2 min.

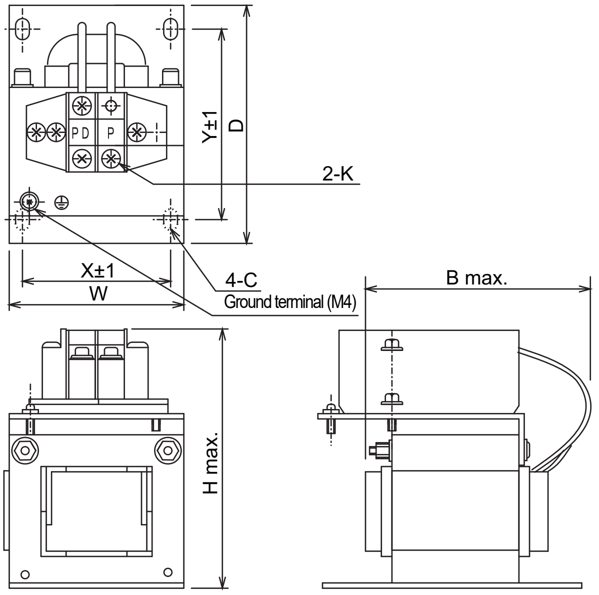

PD
P
Y±1
D
2-K
X±1
W
4-C
Ground terminal (M4)
B max.
H max.

Fig. 1

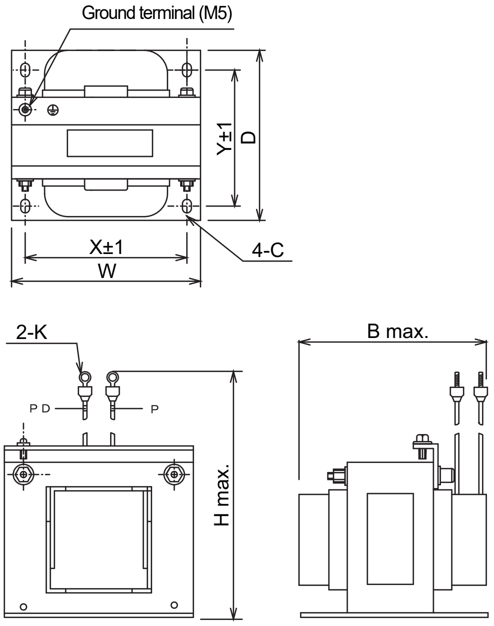

Ground terminal (M5)
Y±1
D
X±1
W
4-C
2-K
PD
P
B max.
H max.

Fig. 2

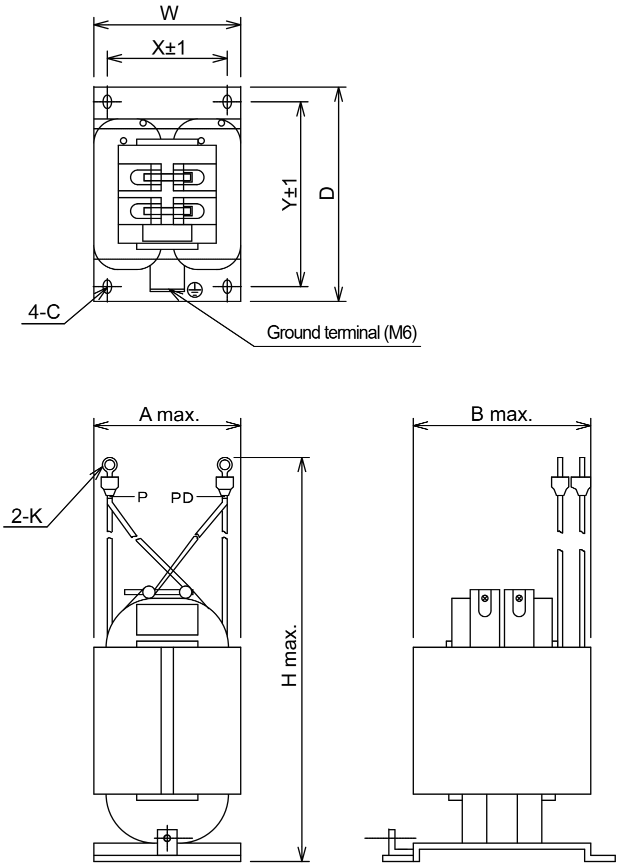
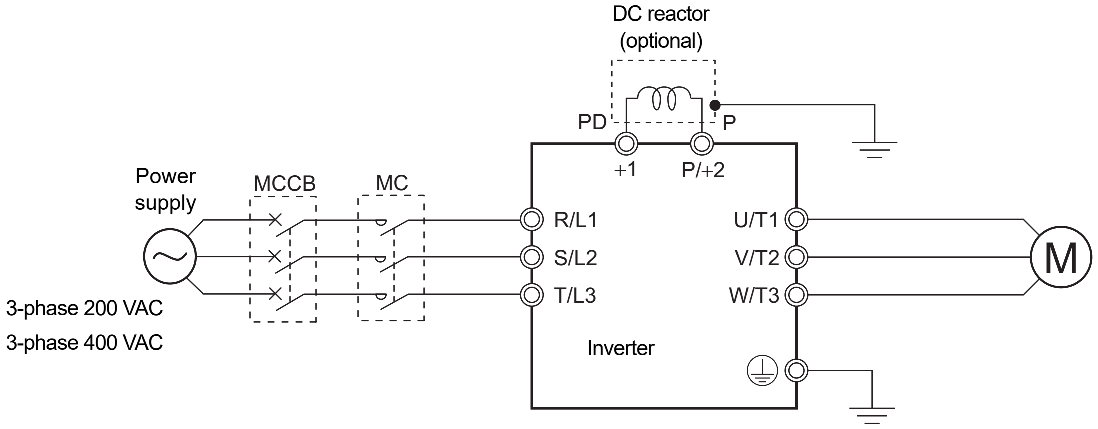

W
X±1
Y±1
D
4-C
Ground terminal (M6)
A max.
B max.
2-K
P
PD
H max.

Fig. 3

12-5-3 Connection Examples


DC reactor
(optional)
PD
P
+1
P/+2
Power supply
MCCB
MC
R/L1
S/L2
T/L3
U/T1
V/T2
W/T3
M
3-phase 200 VAC
3-phase 400 VAC
Inverter

DC Reactor Connection Terminals (+1, P/+2)

- These terminals are used to connect the optional DC reactor for power factor improvement.

  By factory setting, a short-circuit bar is connected between the terminals +1 and P/+2. Before connecting the DC reactor, remove this short-circuit bar.
- The length of the DC reactor connection cable must be 5 m or shorter.
- The DC reactor has no polarity.

Precautions for Correct Use

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.

12-6 AC Reactor (Model: 3G3AX-AL□□□□)

12-6-1 Specifications

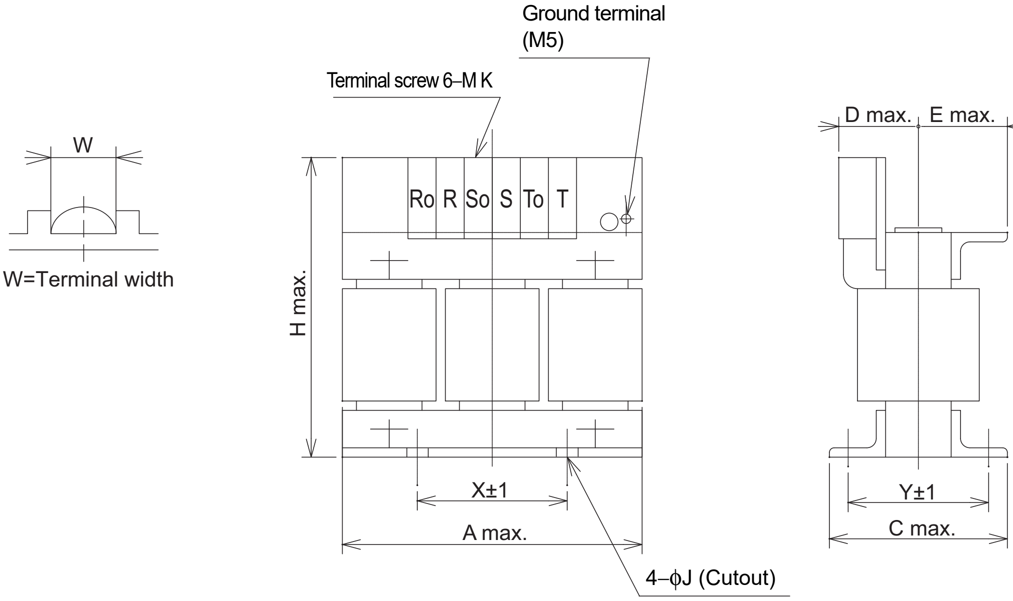
Inverter						AC reactor specifications				
Voltage class	**Max. applicable motor capacity [kW]**	**Model**	**Heavy/ Light load mode**	**Max. applicable motor capacity [kW]**	**Rated input current [A]**	**Model**	**Inductance [mH]**	**Heat generation [W]**	**Operating ambient temperature/ humidity**	**Location**
3-phase 200-V class	0.1	3G3MX2-A2001-V1	Heavy load	0.1	1.0	3G3AX-AL2025	2.8	12	−10 to 50°C 20% to 90%	At an altitude of 1,000 m max.; indoors (without corrosive gases or dust)
			Light load	0.2	1.2					
	0.2	3G3MX2-A2002-V1	Heavy load	0.2	1.6					
			Light load	0.4	1.9					
	0.4	3G3MX2-A2004-V1	Heavy load	0.4	3.3					
			Light load	0.75	3.9					
	0.75	3G3MX2-A2007-V1	Heavy load	0.75	6.0					
			Light load	1.1	7.2					
	1.5	3G3MX2-A2015-V1	Heavy load	1.5	9.0					
			Light load	2.2	10.8	3G3AX-AL2055	0.88	25		
	2.2	3G3MX2-A2022-V1	Heavy load	2.2	12.7					
			Light load	3.0	13.9					
	3.7	3G3MX2-A2037-V1	Heavy load	3.7	20.5	3G3AX-AL2110	0.35	50		
			Light load	5.5	23.0					
	5.5	3G3MX2-A2055-V1	Heavy load	5.5	30.8					
			Light load	7.5	37.0					
	7.5	3G3MX2-A2075-V1	Heavy load	7.5	39.6	3G3AX-AL2220	0.18	50		
			Light load	11	48.0					
	11	3G3MX2-A2110-V1	Heavy load	11	57.1					
			Light load	15	68.0					
	15	3G3MX2-A2150-V1	Heavy load	15	62.6					
			Light load	18.5	72.0	3G3AX-AL2330	0.09	85		
Single-phase 200-V Class	0.1	3G3MX2-AB001-V1	Heavy load	0.1	1.3	3G3AX-AL2025	2.8	12	−10 to 50°C 20% to 90%	At an altitude of 1,000 m max.; indoors (without corrosive gases or dust)
			Light load	0.2	2.0					
	0.2	3G3MX2-AB002-V1	Heavy load	0.2	3.0					
			Light load	0.4	3.6					
	0.4	3G3MX2-AB004-V1	Heavy load	0.4	6.3					
			Light load	0.55	7.3					
	0.75	3G3MX2-AB007-V1	Heavy load	0.75	11.5	3G3AX-AL2055	0.88	25		
			Light load	1.1	13.8					
	1.5	3G3MX2-AB015-V1	Heavy load	1.5	16.8					
			Light load	2.2	20.2	3G3AX-AL2110	0.35	50		
	2.2	3G3MX2-AB022-V1	Heavy load	2.2	22.0					
			Light load	3.0	24.0					

Inverter						AC reactor specifications				
Voltage class	**Max. applicable motor capacity [kW]**	**Model**	**Heavy/ Light load mode**	**Max. applicable motor capacity [kW]**	**Rated input current [A]**	**Model**	**Inductance [mH]**	**Heat generation [W]**	**Operating ambient temperature/ humidity**	**Location**
3-phase 400-V class	0.4	3G3MX2-A4004-V1	Heavy load	0.4	1.8	3G3AX-AL4025	7.7	12	–10 to 50°C 20% to 90%	At an altitude of 1,000 m max.; indoors (without corrosive gases or dust)
			Light load	0.75	2.1					
	0.75	3G3MX2-A4007-V1	Heavy load	0.75	3.6					
			Light load	1.5	4.3					
	1.5	3G3MX2-A4015-V1	Heavy load	1.5	5.2					
			Light load	2.2	5.9					
	2.2	3G3MX2-A4022-V1	Heavy load	2.2	6.5	3G3AX-AL4055	3.5	25		
			Light load	3.0	8.1					
	3.0	3G3MX2-A4030-V1	Heavy load	3.0	7.7					
			Light load	4.0	9.4					
	4.0	3G3MX2-A4040-V1	Heavy load	4.0	11.0	3G3AX-AL4110	1.3	50		
			Light load	5.5	13.3					
	5.5	3G3MX2-A4055-V1	Heavy load	5.5	16.9					
			Light load	7.5	20.0					
	7.5	3G3MX2-A4075-V1	Heavy load	7.5	18.8					
			Light load	11	24.0	3G3AX-AL4220	0.74	60		
	11	3G3MX2-A4110-V1	Heavy load	11	29.4					
			Light load	15	38.0	3G3AX-AL4330	0.36	90		
	15	3G3MX2-A4150-V1	Heavy load	15	35.9					
			Light load	18.5	44.0					

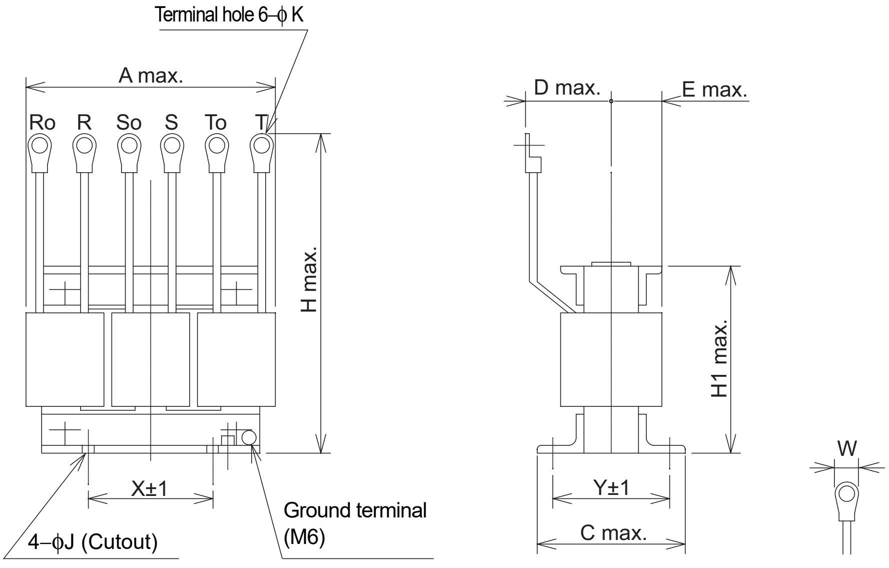
12-6-2 External Dimensions

Inverter input power supply	Model	Applicable motor capacity [kW]	Dimensions [mm]											Weight [kg]
			A	C	D	E	H	H1	X	Y	J	K	W	
3-phase 200 VAC (Single-phase 200 VAC)	3G3AX-AL2025	0.1 to 1.5	120	82	60	40	150	94	50	67	6	4	9.5	2.8
	3G3AX-AL2055	2.2 to 3.7	120	98	60	40	150	94	50	75	6	4	9.5	4.0
	3G3AX-AL2110	5.5, 7.5	150	103	70	55	170	108	60	80	6	5.3	12.0	5.0
	3G3AX-AL2220	11, 15	180	113	75	55	190	140	90	90	6	8.4	16.5	10.0
	3G3AX-AL2330	18.5	180	113	85	60	230	140	125	90	6	8.4	22.0	11.0
3-phase 400 VAC	3G3AX-AL4025	0.4 to 1.5	130	82	60	40	150	94	50	67	6	4	9.5	2.7
	3G3AX-AL4055	2.2, 3.7	130	98	60	40	150	94	50	75	6	5	12.5	4.0
	3G3AX-AL4110	5.5, 7.5	150	116	75	55	170	106	60	98	6	5	12.5	6.0
	3G3AX-AL4220	11, 15	180	103	75	55	190	140	100	80	6	5.3	12.0	10.0
	3G3AX-AL4330	18.5	180	123	85	60	230	140	100	100	6	6.4	16.5	11.5

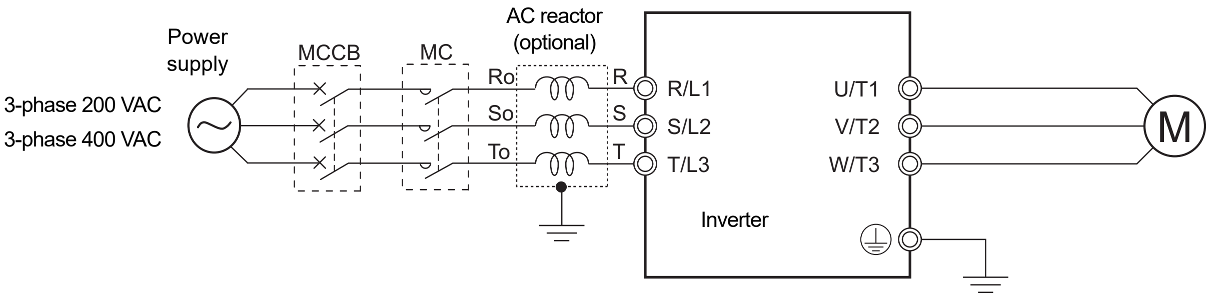
3G3AX-AL2025/AL2055/AL4025/AL4055/AL4110


Ground terminal (M5)
Terminal screw 6–M K
W
W=Terminal width
Ro R So S To T
H max.
X±1
A max.
4–ϕJ (Cutout)
D max.
E max.
H1 max.
Y±1
C max.

3G3AX-AL2110/AL2220/AL2330/AL4220/AL4330


Terminal hole 6–ϕ K
A max.
Ro R So S To T
H max.
X±1
4–ϕJ (Cutout)
Ground terminal (M6)
D max.
E max.
H1 max.
Y±1
C max.
W

12-6-3 Connection Examples


Power supply
3-phase 200 VAC
3-phase 400 VAC
MCCB
MC
AC reactor (optional)
Ro
So
To
R
S
T
R/L1
S/L2
T/L3
U/T1
V/T2
W/T3
M
Inverter

12-7 Input Noise Filter (Model: 3G3AX-NFI□□)

12-7-1 Specifications

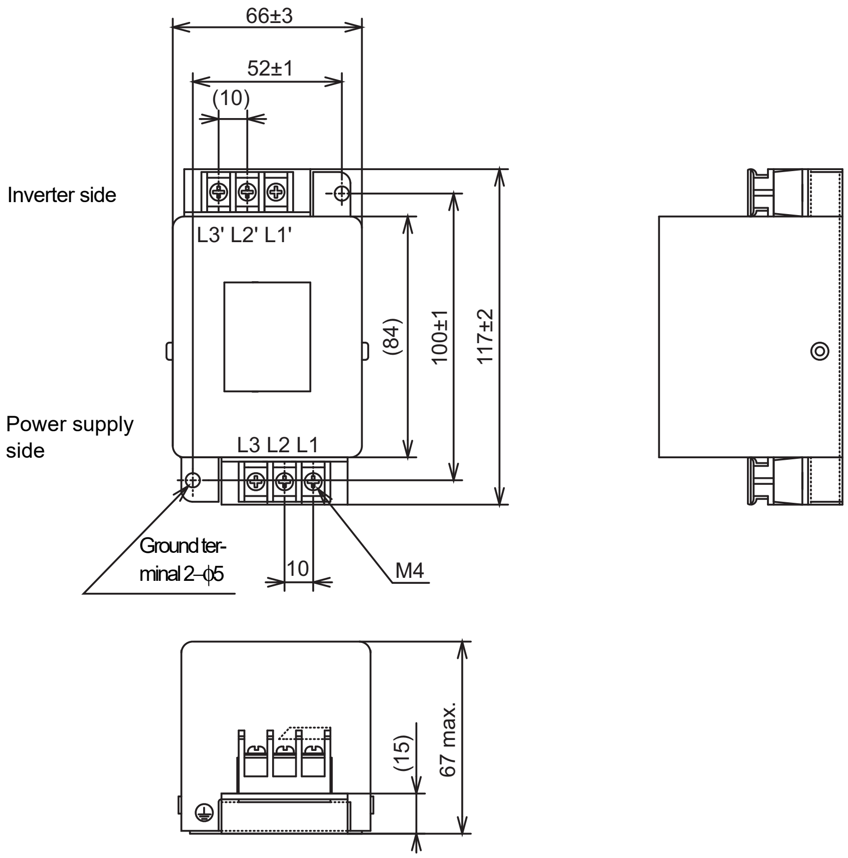
Inverter						Input noise filter specifications				
Voltage class	**Max. applicable motor capacity [kW]**	**Model**	**Heavy/ Light load mode**	**Max. applicable motor capacity [kW]**	**Rated input current [A]**	**Model**	**Max. input voltage**	**Rated input current (at 50°C)**	**Heat generation [W]**	**Leakage current (at 60 Hz)**
3-phase 200-V Class	0.1	3G3MX2-A2001-V1	Heavy load	0.1	1.0	3G3AX-NFI21	250 VAC +10%	6 A	3	1.5 mA max. (250 VAC)
			Light load	0.2	1.2					
	0.2	3G3MX2-A2002-V1	Heavy load	0.2	1.6					
			Light load	0.4	1.9					
	0.4	3G3MX2-A2004-V1	Heavy load	0.4	3.3					
			Light load	0.75	3.9					
	0.75	3G3MX2-A2007-V1	Heavy load	0.75	6.0	3G3AX-NFI22		10 A	4	
			Light load	1.1	7.2					
	1.5	3G3MX2-A2015-V1	Heavy load	1.5	9.0					
			Light load	2.2	10.8	3G3AX-NFI23		20 A	6	
	2.2	3G3MX2-A2022-V1	Heavy load	2.2	12.7					
			Light load	3.0	13.9					
	3.7	3G3MX2-A2037-V1	Heavy load	3.7	20.5	3G3AX-NFI24		30 A	9	
			Light load	5.5	23.0					
	5.5	3G3MX2-A2055-V1	Heavy load	5.5	30.8	3G3AX-NFI25		40 A	11	
			Light load	7.5	37.0					
	7.5	3G3MX2-A2075-V1	Heavy load	7.5	39.6					
			Light load	11	48.0	3G3AX-NFI26		60 A	17	
	11	3G3MX2-A2110-V1	Heavy load	11	57.1					
			Light load	15	68.0	3G3AX-NFI27		80 A	21	
	15	3G3MX2-A2150-V1	Heavy load	15	62.6					
			Light load	18.5	72.0					
Single-phase 200-V Class	0.1	3G3MX2-AB001-V1	Heavy load	0.1	1.3	3G3AX-NFI21	250 VAC +10%	6 A	3	1.5 mA max. (250 VAC)
			Light load	0.2	2.0					
	0.2	3G3MX2-AB002-V1	Heavy load	0.2	3.0					
			Light load	0.4	3.6					
	0.4	3G3MX2-AB004-V1	Heavy load	0.4	6.3	3G3AX-NFI22		10 A	4	
			Light load	0.55	7.3					
	0.75	3G3MX2-AB007-V1	Heavy load	0.75	11.5	3G3AX-NFI23		20 A	6	
			Light load	1.1	13.8					
	1.5	3G3MX2-AB015-V1	Heavy load	1.5	16.8					
			Light load	2.2	20.2	3G3AX-NFI24		30 A	9	
	2.2	3G3MX2-AB022-V1	Heavy load	2.2	22.0					
			Light load	3.0	24.0					

Inverter						Input noise filter specifications				
Voltage class	**Max. applicable motor capacity [kW]**	**Model**	**Heavy/ Light load mode**	**Max. applicable motor capacity [kW]**	**Rated input current [A]**	**Model**	**Max. input voltage**	**Rated input current (at 50°C)**	**Heat generation [W]**	**Leakage current (at 60 Hz)**
3-phase 400-V class	0.4	3G3MX2-A4004-V1	Heavy load	0.4	1.8	3G3AX-NFI41	480 VAC +10%	7A	2	7.5 mA max. (480 VAC)
			Light load	0.75	2.1					
	0.75	3G3MX2-A4007-V1	Heavy load	0.75	3.6					
			Light load	1.5	4.3					
	1.5	3G3MX2-A4015-V1	Heavy load	1.5	5.2					
			Light load	2.2	5.9					
	2.2	3G3MX2-A4022-V1	Heavy load	2.2	6.5					
			Light load	3.0	8.1	3G3AX-NFI42		10 A	4	
	3.0	3G3MX2-A4030-V1	Heavy load	3.0	7.7					
			Light load	4.0	9.4					
	4.0	3G3MX2-A4040-V1	Heavy load	4.0	11.0	3G3AX-NFI43		20 A	6	
			Light load	5.5	13.3					
	5.5	3G3MX2-A4055-V1	Heavy load	5.5	16.9					
			Light load	7.5	20.0					
	7.5	3G3MX2-A4075-V1	Heavy load	7.5	18.8					
			Light load	11	24.0	3G3AX-NFI44		30 A	9	
	11	3G3MX2-A4110-V1	Heavy load	11	29.4					
			Light load	15	38.0	3G3AX-NFI45		40 A	11	
	15	3G3MX2-A4150-V1	Heavy load	15	35.9					
			Light load	18.5	44.0	3G3AX-NFI46		50 A	12	

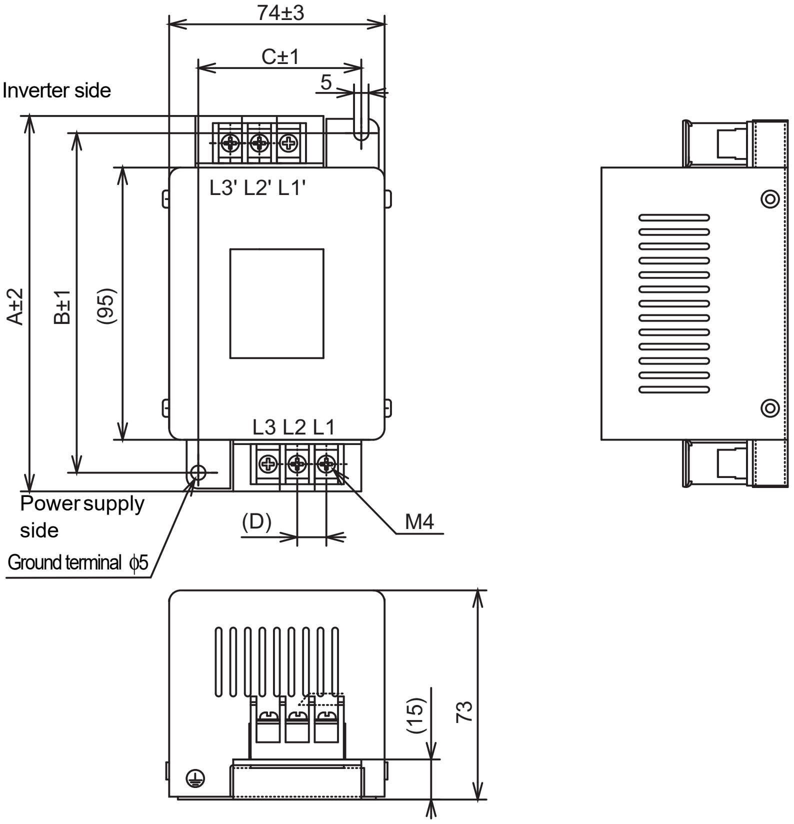
12-7-2 External Dimensions

Model	Case, enclosure rating	Terminal size	Wire diameter	Weight [kg]
3G3AX-NFI21	Plastic, IP00	M4	1.25 mm^2	0.5
3G3AX-NFI22	Plastic, IP00	M4	2 mm^2	0.6
3G3AX-NFI23	Plastic, IP00	M4	2 mm^2, 3.5 mm^2	0.7
3G3AX-NFI24	Plastic, IP00	M4	5.5 mm^2	0.8
3G3AX-NFI25	Plastic, IP00	M5	8 mm^2	1.4
3G3AX-NFI26	Plastic, IP00	M5	14 mm^2	1.8
3G3AX-NFI27	Metal, IP00	M6	22 mm^2	3.6
3G3AX-NFI41	Plastic, IP00	M4	1.25 mm^2, 2 mm^2	0.7
3G3AX-NFI42	Plastic, IP00	M4	2 mm^2	0.7
3G3AX-NFI43	Plastic, IP00	M4	2 mm^2, 3.5 mm^2	0.7
3G3AX-NFI44	Plastic, IP00	M4	5.5 mm^2	0.8
3G3AX-NFI45	Plastic, IP00	M5	8 mm^2	1.4
3G3AX-NFI46	Plastic, IP00	M5	14 mm^2	1.6

3G3AX-NFI21/NFI22

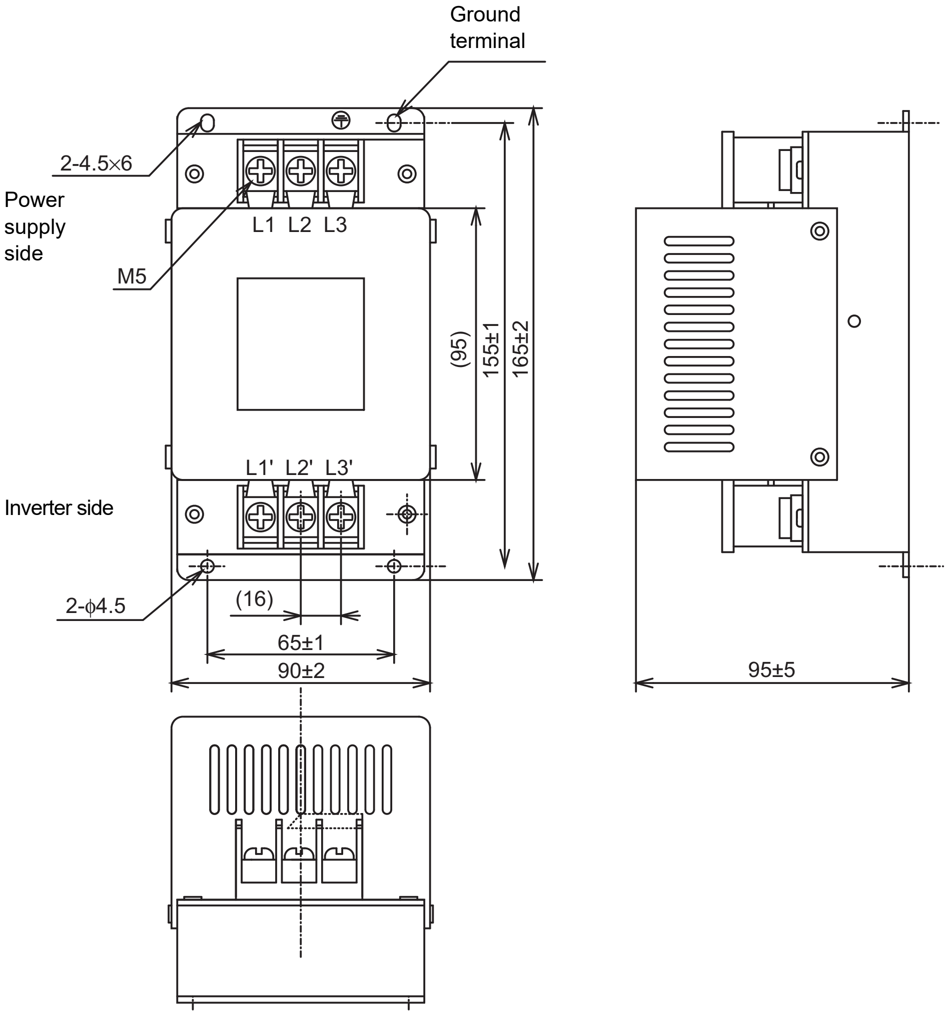

66±3
52±1
(10)
Inverter side
L3' L2' L1'
(84)
100±1
117±2
Power supply side
L3 L2 L1
Ground terminal 2–ϕ5
10
M4
(15)
67 max.

3G3AX-NFI23/NFI24/NFI41/NFI42/NFI43/NFI44

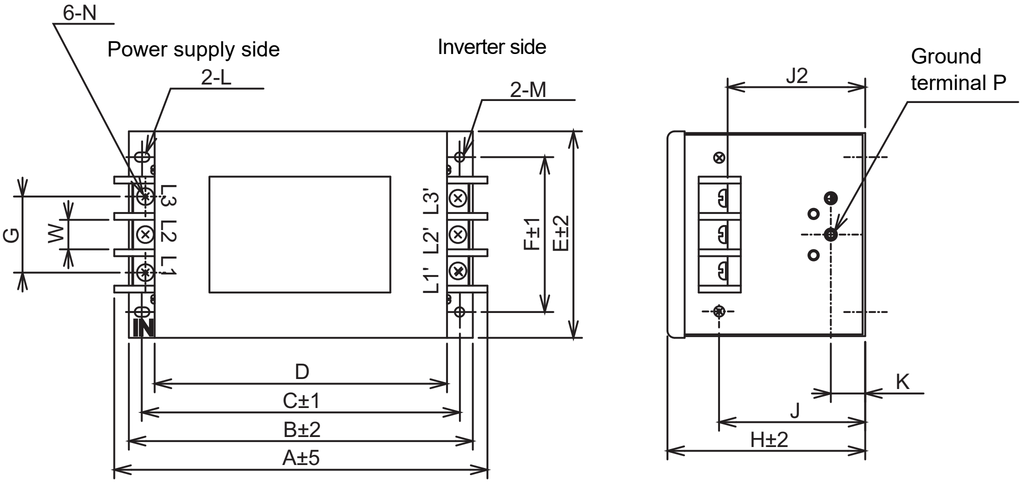

74±3
C±1
5
Inverter side
L3' L2' L1'
A±2
B±1
(95)
L3 L2 L1
Power supply side
Ground terminal ϕ5
(D)
M4
(15)
73

Model	Dimensions [mm]			
	A	B	C	D
3G3AX-NFI23	128	118	56	10
3G3AX-NFI24	144	130	56	11
3G3AX-NFI41	144	130	56	11
3G3AX-NFI42	144	130	56	11
3G3AX-NFI43	144	130	56	11
3G3AX-NFI44	144	130	56	11

3G3AX-NFI25/NFI26/NFI45/NFI46

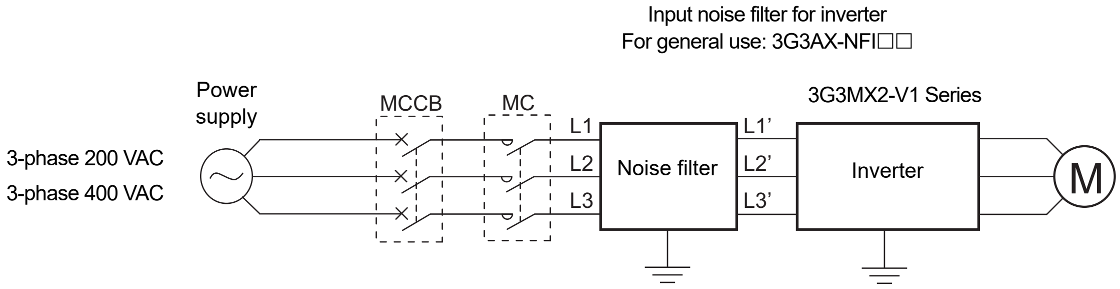

Ground terminal
2-4.5×6
Power supply side
M5
L1 L2 L3
(95)
155±1
165±2
L1' L2' L3'
Inverter side
2-ϕ4.5
(16)
65±1
90±2
95±5

3G3AX-NFI27


6-N
Power supply side
2-L
Inverter side
2-M
J2
Ground
terminal P
G
W
L3 L2 L1
L1' L2' L3'
F±1
E±2
D
C±1
B±2
A±5
K
J
H±2

Model	Dimensions [mm]															
	A	B	C	D	E	F	G	H	J	J2	K	L	M	N	P	W
3G3AX-NFI27	217	200	185	170	120	90	44	115	85	82	20	R2.75 Length 7	ϕ5.5	M6	M4	17

12-7-3 Connection Examples


Input noise filter for inverter
For general use: 3G3AX-NFI□□
Power
supply
3-phase 200 VAC
3-phase 400 VAC
MCCB
MC
L1
L2
L3
Noise filter
L1'
L2'
L3'
3G3MX2-V1 Series
Inverter
M

12-8 Output Noise Filter (Model: 3G3AX-NFO□□)

12-8-1 Specifications

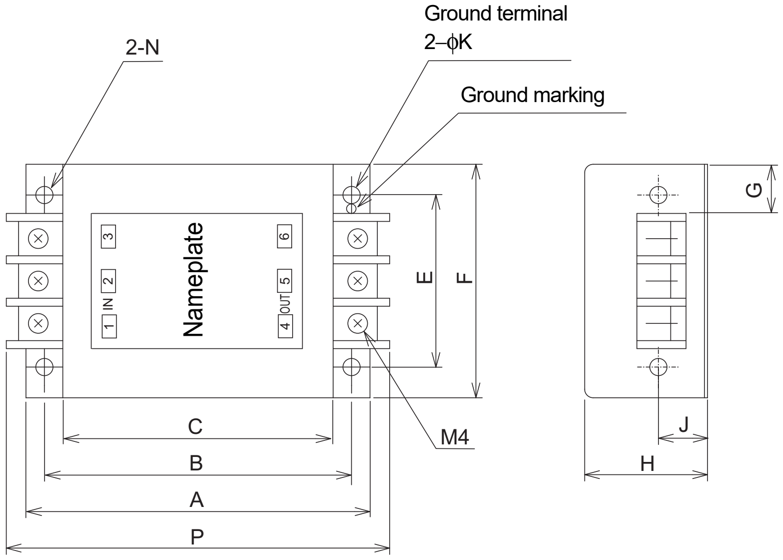
Inverter						Output noise filter specifications			
Voltage class	Max. applicable motor capacity [kW]	Model	Heavy/ Light load mode	Max. applicable motor capacity [kW]	Rated output current [A]	Model	Rated voltage	Rated input current [A]	Weight [kg]
3-phase 200-V class	0.1	3G3MX2-A2001-V1	Heavy load	0.1	1.0	3G3AX-NFO01	500 VAC	6	0.7
			Light load	0.2	1.2				
	0.2	3G3MX2-A2002-V1	Heavy load	0.2	1.6				
			Light load	0.4	1.9				
	0.4	3G3MX2-A2004-V1	Heavy load	0.4	3.0				
			Light load	0.75	3.5				
	0.75	3G3MX2-A2007-V1	Heavy load	0.75	5.0				
			Light load	1.1	6.0	3G3AX-NFO02		12	0.9
	1.5	3G3MX2-A2015-V1	Heavy load	1.5	8.0				
			Light load	2.2	9.6				
	2.2	3G3MX2-A2022-V1	Heavy load	2.2	11.0				
			Light load	3.0	12.0	3G3AX-NFO03		25	2.1
	3.7	3G3MX2-A2037-V1	Heavy load	3.7	17.5				
			Light load	5.5	19.6				
	5.5	3G3MX2-A2055-V1	Heavy load	5.5	25.0				
			Light load	7.5	30.0	3G3AX-NFO04		50	3.7
	7.5	3G3MX2-A2075-V1	Heavy load	7.5	33.0				
			Light load	11	40.0				
	11	3G3MX2-A2110-V1	Heavy load	11	47.0				
			Light load	15	56.0	3G3AX-NFO05		75	5.7
	15	3G3MX2-A2150-V1	Heavy load	15	60.0				
			Light load	18.5	69.0				
Single-phase 200-V class	0.1	3G3MX2-AB001-V1	Heavy load	0.1	1.0	3G3AX-NFO01	500 VAC	6	0.7
			Light load	0.2	1.2				
	0.2	3G3MX2-AB002-V1	Heavy load	0.2	1.6				
			Light load	0.4	1.9				
	0.4	3G3MX2-AB004-V1	Heavy load	0.4	3.0				
			Light load	0.55	3.5				
	0.75	3G3MX2-AB007-V1	Heavy load	0.75	5.0				
			Light load	1.1	6.0	3G3AX-NFO02		12	0.9
	1.5	3G3MX2-AB015-V1	Heavy load	1.5	8.0				
			Light load	2.2	9.6				
	2.2	3G3MX2-AB022-V1	Heavy load	2.2	11.0				
			Light load	3.0	12.0	3G3AX-NFO03		25	2.1

Note The maximum frequency for the Output Noise Filter is 400 Hz.

Inverter						Output noise filter specifications			
Voltage class	**Max. applicable motor capacity [kW]**	**Model**	**Heavy/ Light load mode**	**Max. applicable motor capacity [kW]**	**Rated output current [A]**	**Model**	**Rated voltage**	**Rated input current [A]**	**Weight [kg]**
3-phase 400-V class	0.4	3G3MX2-A4004-V1	Heavy load	0.4	1.8	3G3AX-NFO01	500 VAC	6	0.7
			Light load	0.75	2.1				
	0.75	3G3MX2-A4007-V1	Heavy load	0.75	3.4				
			Light load	1.5	4.1				
	1.5	3G3MX2-A4015-V1	Heavy load	1.5	4.8				
			Light load	2.2	5.4				
	2.2	3G3MX2-A4022-V1	Heavy load	2.2	5.5				
			Light load	3.0	6.9	3G3AX-NFO02		12	0.9
	3.0	3G3MX2-A4030-V1	Heavy load	3.0	7.2				
			Light load	4.0	8.8				
	4.0	3G3MX2-A4040-V1	Heavy load	4.0	9.2				
			Light load	5.5	11.1	3G3AX-NFO03		25	2.1
	5.5	3G3MX2-A4055-V1	Heavy load	5.5	14.8				
			Light load	7.5	17.5				
	7.5	3G3MX2-A4075-V1	Heavy load	7.5	18.0				
			Light load	11	23.0				
	11	3G3MX2-A4110-V1	Heavy load	11	24.0				
			Light load	15	31.0	3G3AX-NFO04		50	3.7
	15	3G3MX2-A4150-V1	Heavy load	15	31.0				
			Light load	18.5	38.0				

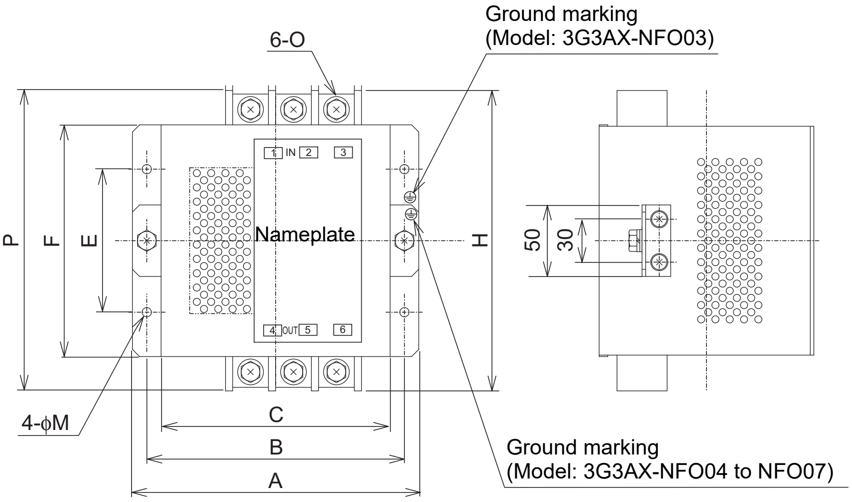
12-8-2 External Dimensions

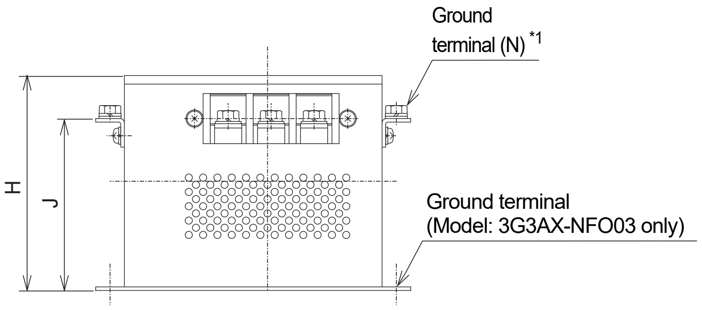
3G3AX-NFO01/NFO02



Model	Dimensions [mm]									
	A	**B**	**C**	**E**	**F**	**G**	**H**	**J**	**K**	**P**	**N**
3G3AX-NFO01	140	125	110	70	95	22	50	20	4.5	156	2-R2.25 Length 6
3G3AX-NFO02	160	145	130	80	110	30	70	25	5.5	176	2-R2.75 Length 7

3G3AX-NFO03/NFO04/NFO05

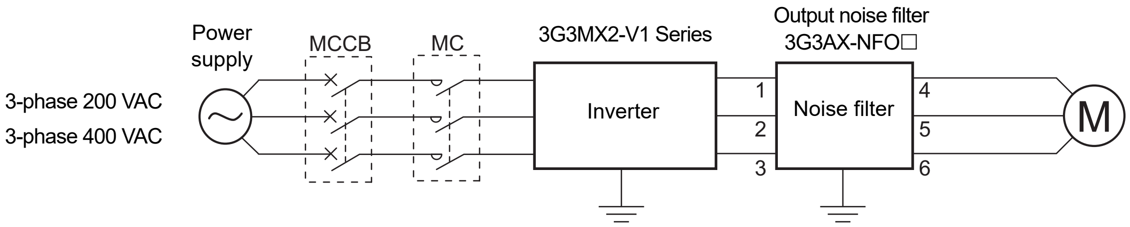

6-O
Ground marking
(Model: 3G3AX-NFO03)
IN
1
2
3
Nameplate
4
OUT
5
6
P
F
E
H
50
30
4-ϕM
C
B
A
Ground marking
(Model: 3G3AX-NFO04 to NFO07)


Ground
terminal (N) *1
H
J
Ground terminal
(Model: 3G3AX-NFO03 only)

*1. For 3G3AX-NFO03, this ground terminal is not provided.
The mounting hole is used also for grounding.

Model	Dimensions [mm]										
	A	B	C	E	F	H	J	M	N	O	P
3G3AX-NFO03	160	145	130	80	112	120	–	ϕ6.5	–	M4	154
3G3AX-NFO04	200	180	160	100	162	150	120	ϕ6.5	M5	M5	210
3G3AX-NFO05	220	200	180	100	182	170	140	ϕ6.5	M6	M6	230

12-8-3 Connection Examples


Power supply
MCCB
MC
3G3MX2-V1 Series
Output noise filter
3G3AX-NFO□
3-phase 200 VAC
3-phase 400 VAC
Inverter
1
2
3
Noise filter
4
5
6
M

12-9 Radio Noise Filter (Model: 3G3AX-ZCL☐)

12-9-1 Specifications

Select the radio noise filter according to the maximum applicable motor capacity for the heavy/light load mode of the inverter.

- The recommended number of turns is 4. If it is not possible to wind the wire 4 turns due to the limitation of the wire size, decrease the number to 3, 2, and so on. When the wire can be wound only a single turn, use 4 or more filters side by side, with each wire wound in the same direction.
- The number of turns should be limited to approximately 8, although the filtering effect is larger with a larger number of turns. Exceeding this limit may cause negative effects.

3G3AX-ZCL1

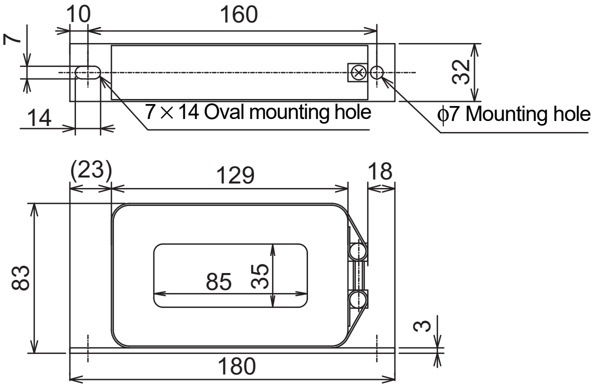
Applicable motor capacity [kW]	200-V class				400-V class			
	Input side		Output side		Input side		Output side	
	Quantity	No. of turns	Quantity	No. of turns	Quantity	No. of turns	Quantity	No. of turns
0.2	1	4	1	4	No applicable model		No applicable model	
0.4	1	4	1	4	1	4	1	4
0.75	1	4	1	4	1	4	1	4
1.5	1	4	1	4	1	4	1	4
2.2	1	4	1	4	1	4	1	4
3.0	1	4	1	4	1	4	1	4
3.7	1	4	1	4	No applicable model		No applicable model	
4.0	No applicable model		No applicable model		1	4	1	4
5.5	1	4	1	4	1	4	1	4
7.5	1	4	1	4	1	4	1	4
11	1	3	1	3	1	4	1	4
15	1	2	1	2	1	4	1	4

3G3AX-ZCL2

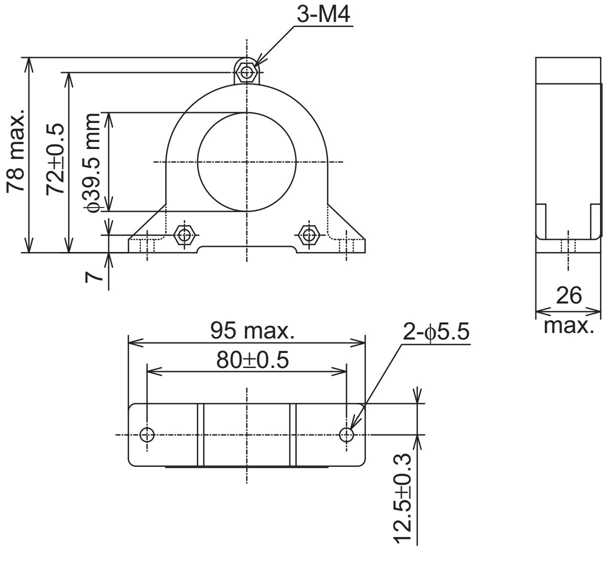
Applicable motor capacity [kW]	200-V class				400-V class			
	Input side		Output side		Input side		Output side	
	Quantity	No. of turns	Quantity	No. of turns	Quantity	No. of turns	Quantity	No. of turns
0.1	1	4	1	4	No applicable model		No applicable model	
0.2	1	4	1	4				
0.4	1	4	1	4	1	4	1	4
0.75	1	4	1	4	1	4	1	4
1.5	1	4	1	4	1	4	1	4
2.2	1	4	1	4	1	4	1	4
3.0	1	4	1	4	1	4	1	4
3.7	1	4	1	4	No applicable model		No applicable model	
4.0	No applicable model		No applicable model		1	4	1	4
5.5	1	3	1	3	1	4	1	4
7.5	1	2	1	2	1	4	1	4

12-9-2 External Dimensions

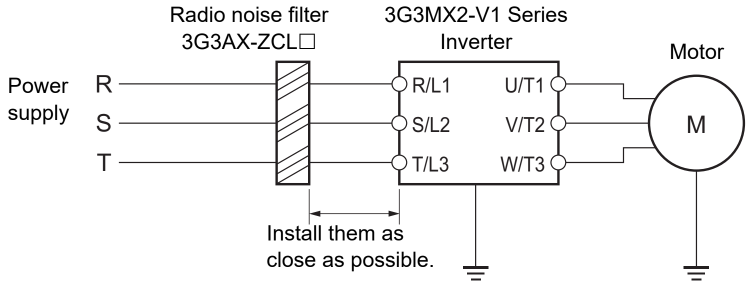
3G3AX-ZCL1


10
160
7
32
14
7 × 14 Oval mounting hole
ϕ7 Mounting hole
(23)
129
18
83
85
35
3
180

3G3AX-ZCL2


3-M4
78 max.
72±0.5
ϕ39.5 mm
7
26
max.
95 max.
80±0.5
2-ϕ5.5
12.5±0.3

12-9-3 Connection Examples


Radio noise filter
3G3AX-ZCL□
3G3MX2-V1 Series
Inverter
Motor
Power
supply
R
S
T
R/L1
S/L2
T/L3
U/T1
V/T2
W/T3
M
Install them as
close as possible.

Precautions for Correct Use

- Wind the phase-R/S/T wire in the same direction.
- This noise filter can be used in the same manner on both the input and output side of the inverter.

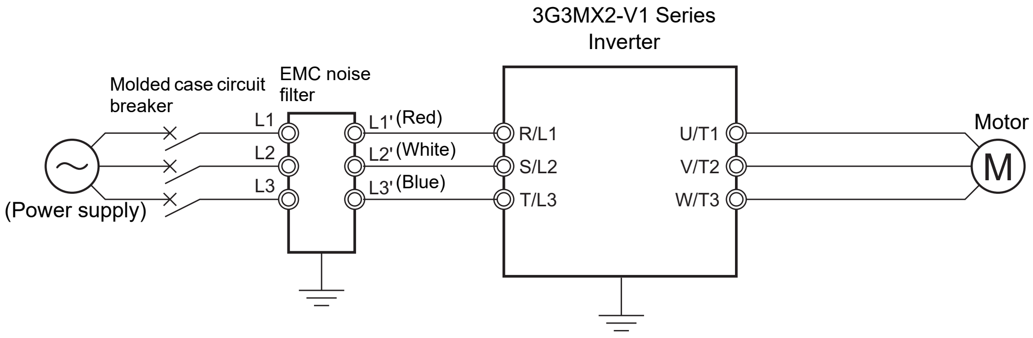
12-10 EMC Noise Filter

12-10-1 Specifications

Inverter						EMC noise filter specifications				
Voltage class	Max. applicable motor capacity [kW]	Model	Heavy/ Light load mode	Max. applicable motor capacity [kW]	Rated input current [A]	Model	Max. input voltage	Rated input current [A]	Heat generation [W]	Leakage current
3-phase 200-V Class	0.1	3G3MX2-A2001-V1	Heavy load	0.1	1.0	(Scheduled to be supported)				
			Light load	0.2	1.2					
	0.2	3G3MX2-A2002-V1	Heavy load	0.2	1.6					
			Light load	0.4	1.9					
	0.4	3G3MX2-A2004-V1	Heavy load	0.4	3.3					
			Light load	0.75	3.9					
	0.75	3G3MX2-A2007-V1	Heavy load	0.75	6.0					
			Light load	1.1	7.2					
	1.5	3G3MX2-A2015-V1	Heavy load	1.5	9.0					
			Light load	2.2	10.8					
	2.2	3G3MX2-A2022-V1	Heavy load	2.2	12.7					
			Light load	3.0	13.9					
	3.7	3G3MX2-A2037-V1	Heavy load	3.7	20.5					
			Light load	5.5	23.0					
	5.5	3G3MX2-A2055-V1	Heavy load	5.5	30.8					
			Light load	7.5	37.0					
	7.5	3G3MX2-A2075-V1	Heavy load	7.5	39.6					
			Light load	11	48.0					
	11	3G3MX2-A2110-V1	Heavy load	11	57.1					
			Light load	15	68.0					
	15	3G3MX2-A2150-V1	Heavy load	15	62.6					
			Light load	18.5	72.0					
Single-phase 200-V Class	0.1	3G3MX2-AB001-V1	Heavy load	0.1	1.3					
			Light load	0.2	2.0					
	0.2	3G3MX2-AB002-V1	Heavy load	0.2	3.0					
			Light load	0.4	3.6					
	0.4	3G3MX2-AB004-V1	Heavy load	0.4	6.3					
			Light load	0.55	7.3					
	0.75	3G3MX2-AB007-V1	Heavy load	0.75	11.5					
			Light load	1.1	13.8					
	1.5	3G3MX2-AB015-V1	Heavy load	1.5	16.8					
			Light load	2.2	20.2					
	2.2	3G3MX2-AB022-V1	Heavy load	2.2	22.0					
			Light load	3.0	24.0					

Inverter						EMC noise filter specifications				
Voltage class	Max. applicable motor capacity [kW]	Model	Heavy/ Light load mode	Max. applicable motor capacity [kW]	Rated input current [A]	Model	Max. input voltage	Rated input current [A]	Heat generation [W]	Leakage current
3-phase 400-V class	0.4	3G3MX2-A4004-V1	Heavy load	0.4	1.8	(Scheduled to be supported)				
			Light load	0.75	2.1					
	0.75	3G3MX2-A4007-V1	Heavy load	0.75	3.6					
			Light load	1.5	4.3					
	1.5	3G3MX2-A4015-V1	Heavy load	1.5	5.2					
			Light load	2.2	5.9					
	2.2	3G3MX2-A4022-V1	Heavy load	2.2	6.5					
			Light load	3.0	8.1					
	3.0	3G3MX2-A4030-V1	Heavy load	3.0	7.7					
			Light load	4.0	9.4					
	4.0	3G3MX2-A4040-V1	Heavy load	4.0	11.0					
			Light load	5.5	13.3					
	5.5	3G3MX2-A4055-V1	Heavy load	5.5	16.9					
			Light load	7.5	20.0					
	7.5	3G3MX2-A4075-V1	Heavy load	7.5	18.8					
			Light load	11	24.0					
	11	3G3MX2-A4110-V1	Heavy load	11	29.4					
			Light load	15	38.0					
	15	3G3MX2-A4150-V1	Heavy load	15	35.9					
			Light load	18.5	44.0					

12-10-2 Connection Examples


3G3MX2-V1 Series
Inverter
Molded case circuit
breaker
EMC noise
filter
L1
L2
L3
L1' (Red)
L2' (White)
L3' (Blue)
R/L1
S/L2
T/L3
U/T1
V/T2
W/T3
Motor
M
(Power supply)

12-11 Digital Operator (Model: 3G3AX-OP01)

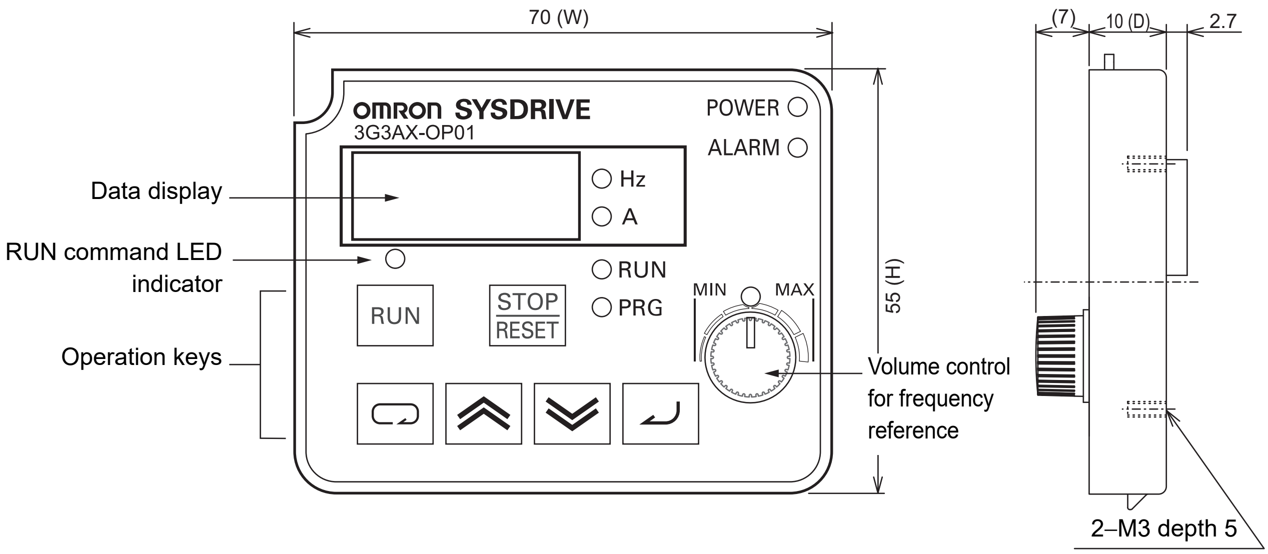
12-11-1 Specifications

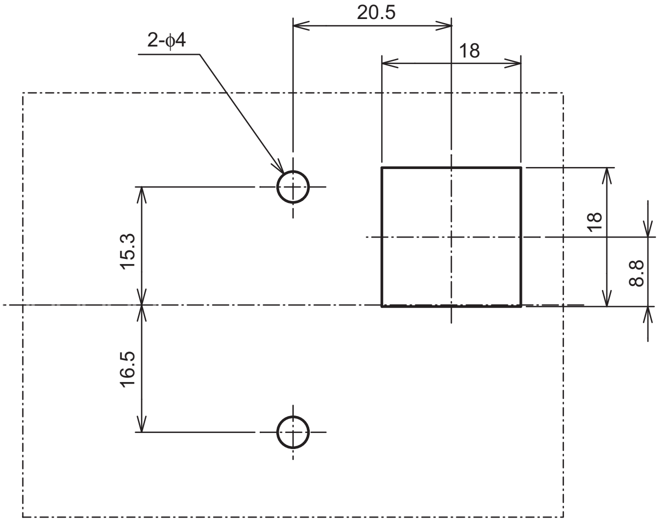
3G3AX-OP01

Item	Specifications
Display	LED digital display
External Dimensions	55 (H) × 70 (W) × 10 (D) mm
Weight	100 g max.
Operating ambient temperature	–10 to 50°C
Operating ambient humidity	20% to 90% (with no condensation)
Storage ambient temperature	–20 to 65°C
Location	At a maximum altitude of 1,000 m (without corrosive gases or dust)
Others	Built-in volume control for frequency setting

12-11-2 External Dimensions

3G3AX-OP01


70 (W)
55 (H)
(7)
10 (D)
2.7
OMRON SYSDRIVE
3G3AX-OP01
POWER
ALARM
Hz
A
RUN
PRG
MIN
MAX
RUN
STOP
RESET
Data display
RUN command LED indicator
Operation keys
Volume control for frequency reference
2–M3 depth 5


20.5
2-ϕ4
18
18
8.8
15.3
16.5

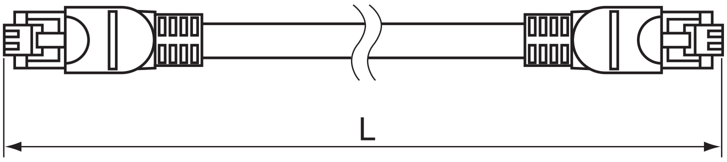
Panel cut dimensions

12-12 Digital Operator Cable (Model: 3G3AX-OPCN□)

12-12-1 Specifications

Item	Specifications
Connector	RJ45 connector
Cable	EIA568-compliant cable (UTP category 5)

12-12-2 External Dimensions



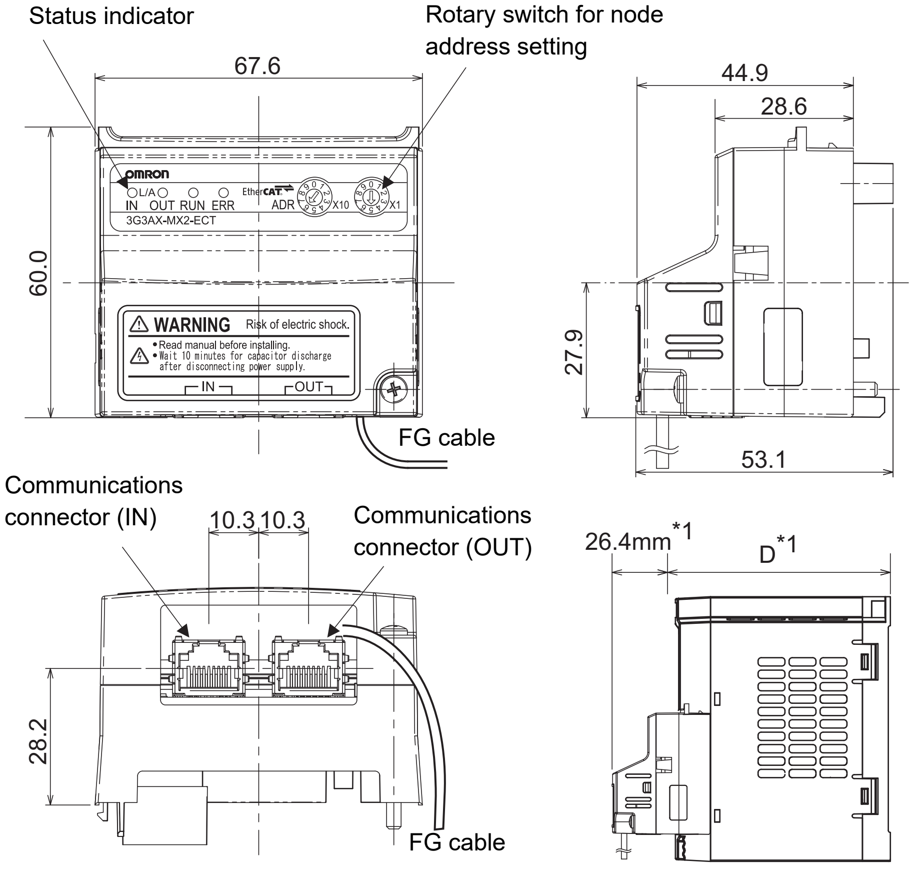
Model	Cable length [m]
3G3AX-OPCN1	1
3G3AX-OPCN3	3

12-13 EtherCAT Communications Unit (Model: 3G3AX-MX2-ECT)

12-13-1 Specifications

Item		Specifications
General specifications	Power supply	Supplied from inverter
	Enclosure rating	IP20
	Operating ambient temperature	−10 to 50°C
	Storage ambient temperature	−20 to 65°C
	Operating ambient humidity	20% to 90% (with no condensation)
	Vibration resistance	5.9 m/s^2 (0.6 G), 10 to 55 Hz
	Location	At a maximum altitude of 1,000 m, indoors (without corrosive gases or dust)
	Weight	100 g max. (Shipping weight: Approx. 130g)
	EC Directives	EMC Directive: EN61800-3 Low Voltage Directive: EN61800-5-1
	UL/cUL Standard	UL 508C
EtherCAT Communication specifications	Communications standard	IEC 61158 Type12, IEC 61800-7 CiA 402 drive profile
	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 PDO mapping
	Mailbox (CoE)	Emergency messages, SDO requests, SDO responses, and SDO information
	Distributed clock	Free-run mode (asynchronous)
	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

12-13-2 External Dimensions


Status indicator
Rotary switch for node address setting
67.6
60.0
44.9
28.6
27.9
53.1
OMRON
L/A
IN OUT RUN ERR
EtherCAT
ADR
X10
X1
3G3AX-MX2-ECT
WARNING Risk of electric shock.
• Read manual before installing.
• Wait 10 minutes for capacitor discharge after disconnecting power supply.
IN
OUT
FG cable
Communications connector (IN)
10.3
10.3
Communications connector (OUT)
28.2
FG cable
26.4mm*1
D*1

*1. With the EtherCAT Communication Unit mounted, dimension D of the inverter increases by 26.4 mm. (Dimension D of the inverter varies depending on the capacity. Refer to *1-3-2 External Dimensions* on page 1-17).

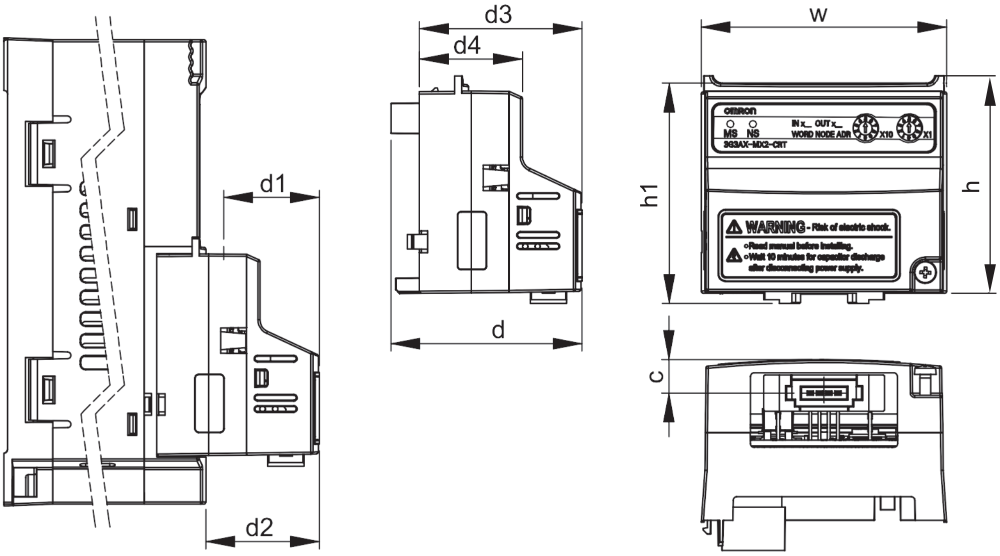
12-14 CompoNet Communications Unit (Model: 3G3AX-MX2-CRT-E)

12-14-1 Specifications

Item		Specifications
Mounting	Unit type	MX2 Series CompoNet Communications Unit
	Model	3G3AX-MX2-CRT-E
	Weight	100 g max. (Shipping weight: Approx. 170 g)
Environment	Operating ambient temperature	–10 to 50°C (with no freezing or condensation)
	Operating ambient humidity	20% to 90%
	Storage ambient temperature	–20 to 65°C (with no freezing or condensation)
	Vibration resistance	5.9 m/s^2 (0.6 G), 10 to 55 Hz
	Dielectric strength	500 VAC (between isolated circuits)
	Location	At a maximum altitude of 1,000 m, indoors (without corrosive gases or dust)
	Compliance with EMC and electrical safety standards	EN61800-3: 2004 (2004/108/EC) Second environment, Category C3
		EN61800-5-1: 2007(2006/95/EC) SELV
	UL/cUL standard	UL508
	Internal power supply	Supplied from inverter
	Enclosure rating	IP20
CompoNet interface	Communications protocol	CompoNet
	Certification	CompoNet conformance test
	CompoNet profile	AC drive (0×02)
	Supported connections	Remote I/O: Master-Slave connection Poll Explicit message Conforming to the CompoNet specifications
	Communications power supply	– (External power supply not required)
	Unit device address range	Node address MAC ID 0 to 63, set via inverter parameter P190 or rotary switch
	Supported baud rates	4 Mbps, 3 M bps, 1.5 Mbps, or 93.75 kbps Automatic baud rate detection by Master Unit
CompoNet configuration	Default connection path	Supported, set via inverter parameter P046
	Supported assemblies	Basic Speed I/O (Output assembly 20, Input assembly 70) Extended Speed I/O (21, 71) Extended Speed and Torque Control (123, 173) Special I/O (100, 150) Extended Control I/O (101, 151) Extended Control I/O and Multi-function Input Monitor (101, 153) Flexible format (139, 159) Extended Speed and Acceleration Control (110, 111) [1]
	EDS file	Dependent on inverter model

[1] Use the specified output and input assembly pair.

12-14-2 External Dimensions


d1
d2
d3
d4
d
w
h1
h
c
omron
MS NS
3G3AX-MX2-CRT
WARNING - Risk of electric shock.

Dimensions [mm]								
h	h1	w	c	d	d1[*1]	d2	d3	d4
60.0	60.7	67.6	9.4	52.6	26.4	31.3	44.8	28.4

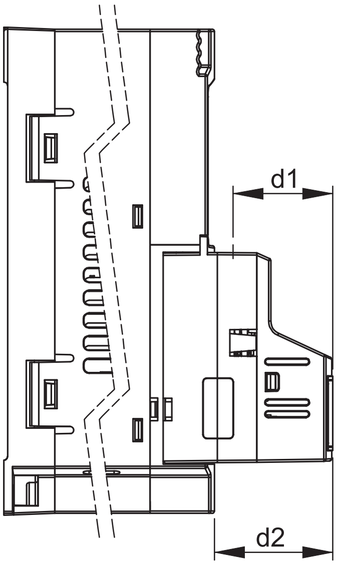
[*1] With the CompoNet Communication Unit mounted, dimension D of the inverter increases by 26.4 mm. (Dimension D of the inverter varies depending on the capacity. Refer to *1-3-2 External Dimensions* on page 1-17).

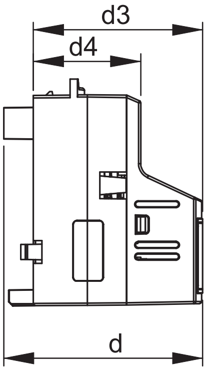
12-15 DeviceNet Communications Unit (Model: 3G3AX-MX2-DRT-E)

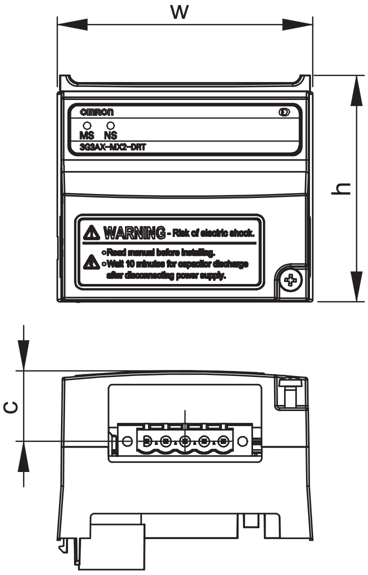
12-15-1 Specifications

Item		Specifications
Mounting	Unit type	MX2 Series DeviceNet Communications Unit
	Model	3G3AX-MX2-DRT-E
	Weight	100 g max. (Shipping weight: Approx. 170 g)
Environment	Operating ambient temperature	−10 to 50°C (with no freezing or condensation)
	Operating ambient humidity	20% to 90%
	Storage ambient temperature	−20 to 65°C (with no freezing or condensation)
	Vibration resistance	5.9 m/s^2 (0.6 G), 10 to 55 Hz
	Dielectric strength	500 VAC (between isolated circuits)
	Location	At a maximum altitude of 1,000 m, indoors (without corrosive gases or dust)
	Compliance with EMC and electrical safety standards	EN61800-3: 2004 (2004/108/EC) Second environment, Category C3
		EN61800-5-1: 2007(2006/95/EC) SELV
	UL/cUL standard	UL508
	Enclosure rating	IP20
DeviceNet interface	Communications protocol	DeviceNet
	Certification	DeviceNet conformance test
	DeviceNet profile	AC drive (0×02)
	Supported connections	Remote I/O: Master-Slave connection Poll Explicit message Conforming to the DeviceNet specifications
	Communications power supply	11 to 25 VDC (50 mA max., typ. 20 mA)
	Unit device address range	Node address MAC ID 0 to 63, set via inverter parameter P192 or rotary switch
	Supported baud rates	125, 250, or 500 kbps Automatic baud rate detection by Master Unit
DeviceNet configuration	Default connection path	Supported, set via inverter parameter P046
	Supported assemblies	Basic Speed I/O (Output assembly 20, Input assembly 70) Extended Speed I/O (21, 71) Extended Speed and Torque Control (123, 173) Special I/O (100, 150) Extended Control I/O (101, 151) Extended Control I/O and Multi-function Input Monitor (101, 153) Flexible format (139, 159) Extended Speed and Acceleration Control (110, 111) In case the DeviceNet Master Unit is configured using user allocation, only the input/output pairs can be configured.
	EDS file	Dependent on inverter model

12-15-2 External Dimensions






w
h
c
omron
MS NS
3G3AX-MX2-DRT
WARNING - Risk of electric shock.
Read manual before installing.
Wait 10 minutes for capacitor discharge after disconnecting power supply.

Dimensions [mm]							
h	w	c	d	d1[*1]	d2	d3	d4
60.0	67.6	18.7	52.6	26.4	31.3	44.8	28.4

*1. With the DeviceNet Communication Unit mounted, dimension D of the inverter increases by 26.4 mm. (Dimension D of the inverter varies depending on the capacity. Refer to *1-3-2 External Dimensions* on page 1-17).

A

Appendices

This section provides information on derating, capacitor life curve, compliance with the UL/cUL Standards, and inverter selection.

A-1 Derating **A-2**
A-2 Smoothing Capacitor Life Curve **A-8**
A-3 Life Alarm Output **A-9**
A-4 UL/cUL Standards Cautions **A-10**
A-5 Overview of Inverter Selection **A-12**

A-1 Derating

If you intend to use the inverter models with “Yes” in the column “Derating” of the following table at an ambient temperature of 40°C or higher, or to use more than one inverter installed next to each other (side-by-side installation), you need to derate the output current as shown in the graphs below. (The ambient temperature specification for side-by-side installation is –10 to 40°C.)

In the 1st/2nd Electronic Thermal Level (b012/b212), set the output current value to be derated. For details on the electronic thermal level, refer to *5-3-2 Electronic Thermal Function* on page 5-16.

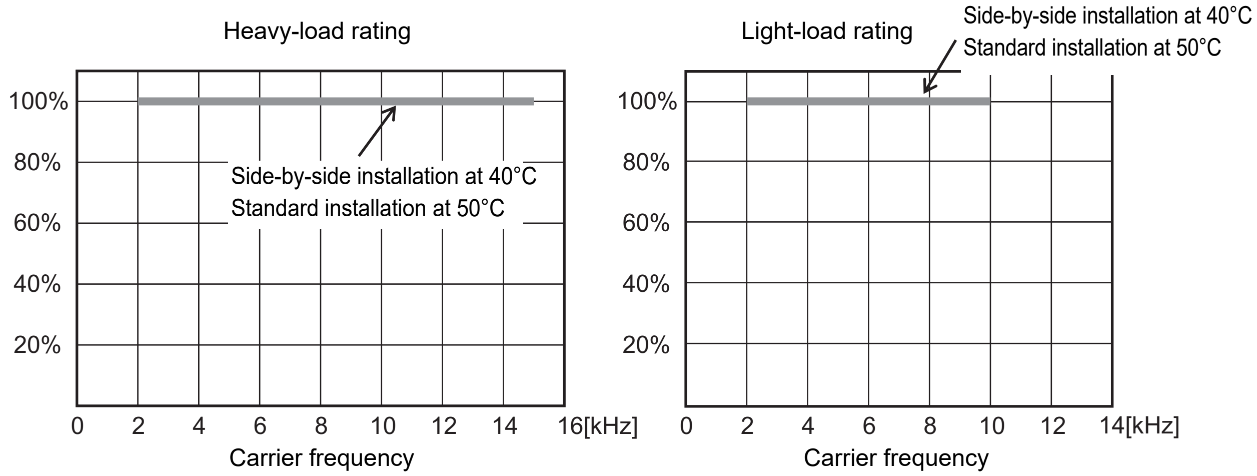
Necessity of Derating

Rated voltage	Model	Derating
3-phase 200 VAC	3G3MX2-A2001	No
	3G3MX2-A2002	Yes
	3G3MX2-A2004	Yes
	3G3MX2-A2007	No
	3G3MX2-A2015	No
	3G3MX2-A2022	No
	3G3MX2-A2037	Yes
	3G3MX2-A2055	No
	3G3MX2-A2075	Yes
	3G3MX2-A2110	Yes
	3G3MX2-A2150	Yes
Single-phase 200 VAC	3G3MX2-AB001	No
	3G3MX2-AB002	No
	3G3MX2-AB004	Yes
	3G3MX2-AB007	No
	3G3MX2-AB015	No
	3G3MX2-AB022	No
3-phase 400 VAC	3G3MX2-A4004	No
	3G3MX2-A4007	Yes
	3G3MX2-A4015	No
	3G3MX2-A4022	No
	3G3MX2-A4030	No
	3G3MX2-A4040	Yes
	3G3MX2-A4055	No
	3G3MX2-A4075	Yes
	3G3MX2-A4110	Yes
	3G3MX2-A4150	Yes

Note Yes: Derating is necessary, No: Derating is Not necessary

For the inverter models with “No” in the column “Derating” of the above table, setting is not necessary to derate the output current. Use the inverter within the range of the rated specifications.

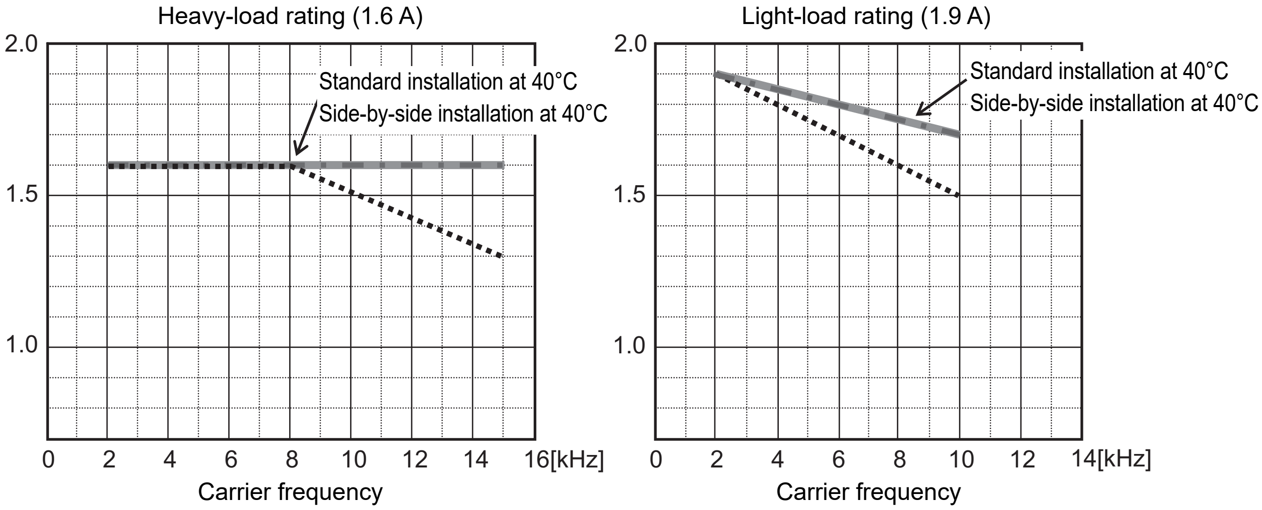
Models for Which Derating is Not Necessary



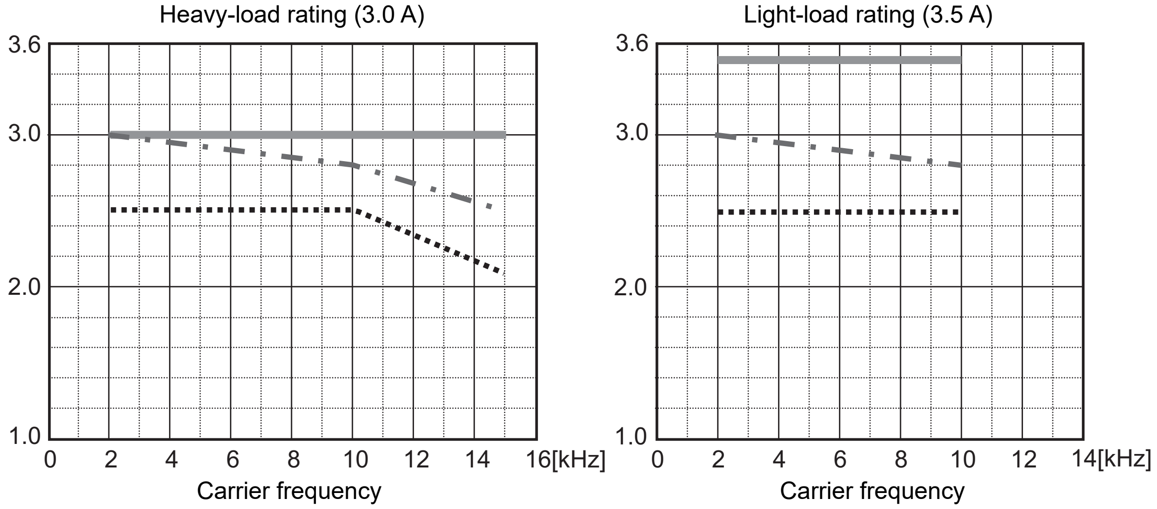
Models for Which Derating is Necessary

━━━━ Standard installation (Stand-alone installation) at 40°C
▬ · ▬ · ▬ · ▬ Side-by-side installation at 40°C
‧‧‧‧‧‧‧‧‧‧‧‧ Standard installation (Stand-alone installation) at 50°C

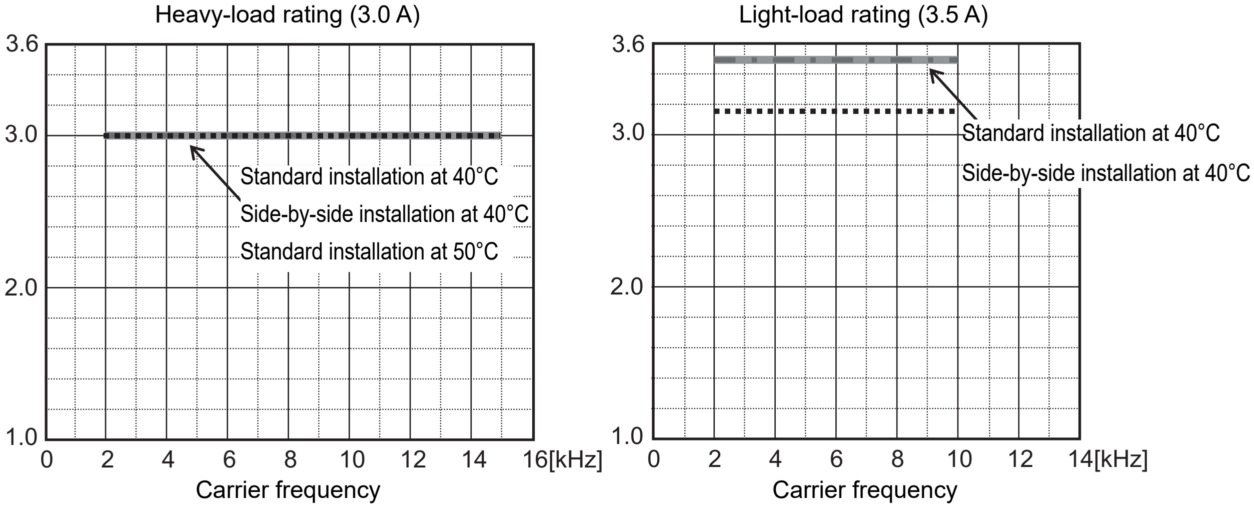
● 3G3MX2-A2002



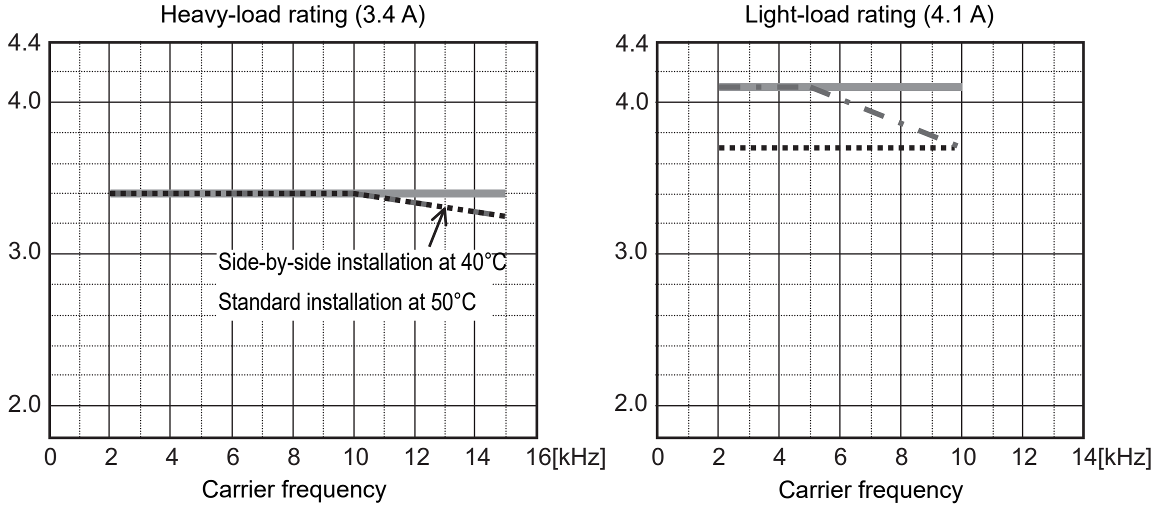
● 3G3MX2-AB004



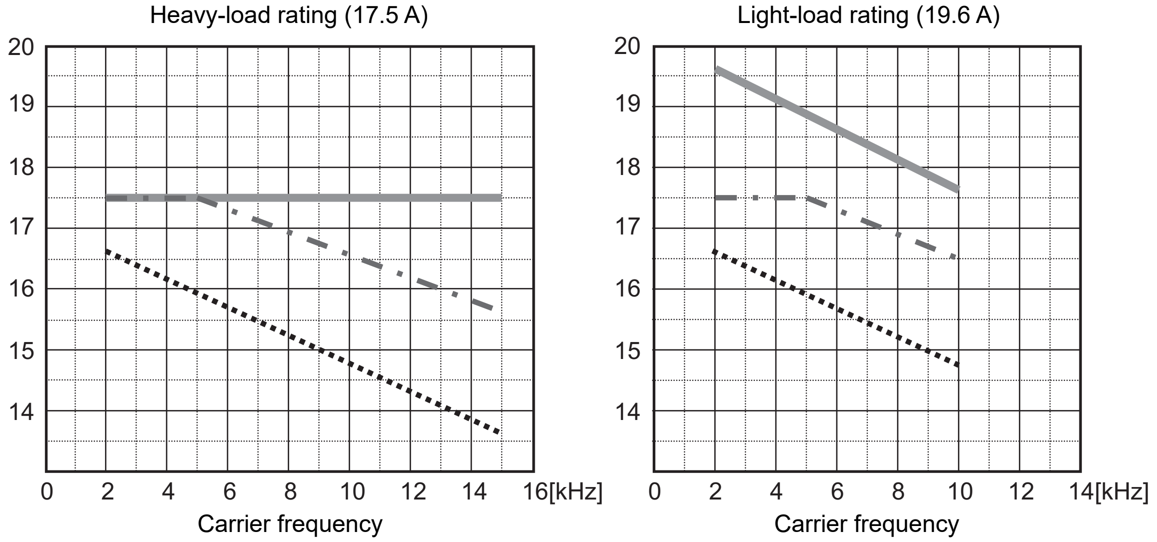
● 3G3MX2-A2004



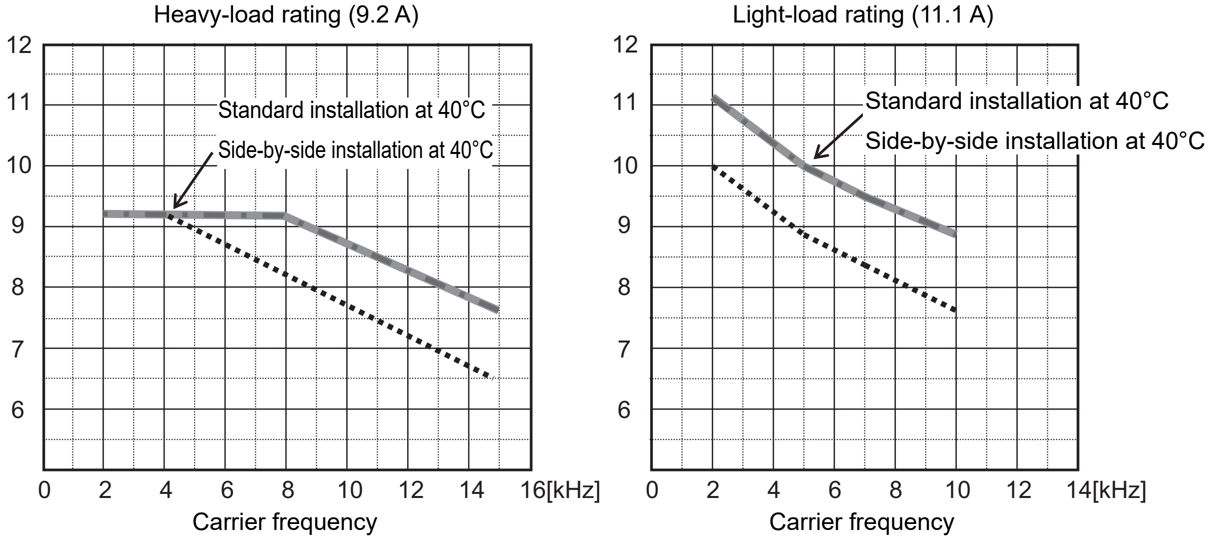
● 3G3MX2-A4007



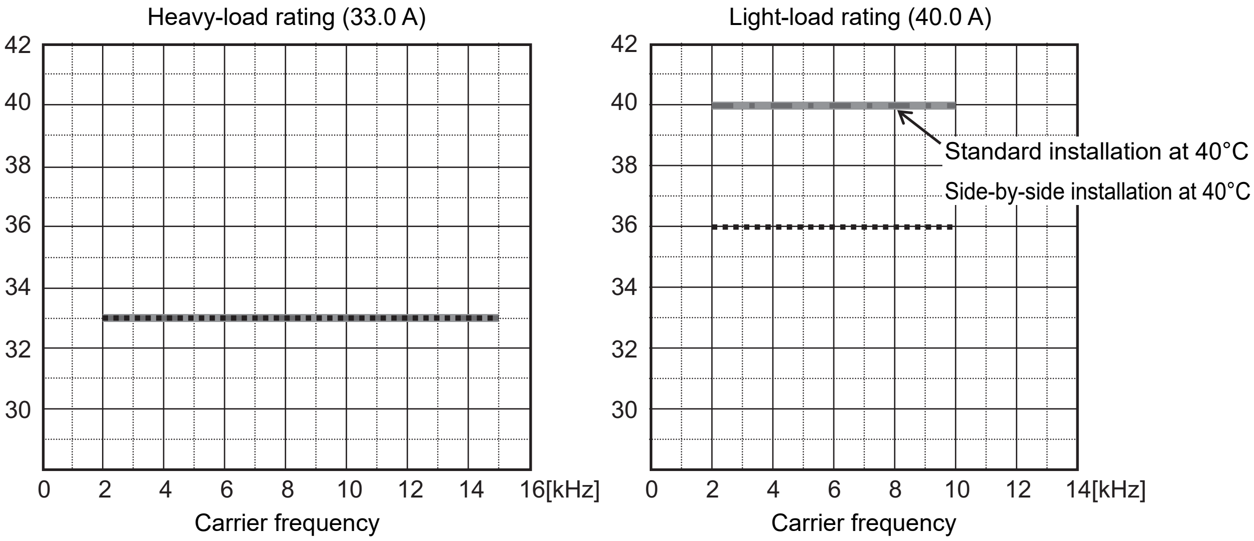
● 3G3MX2-A2037



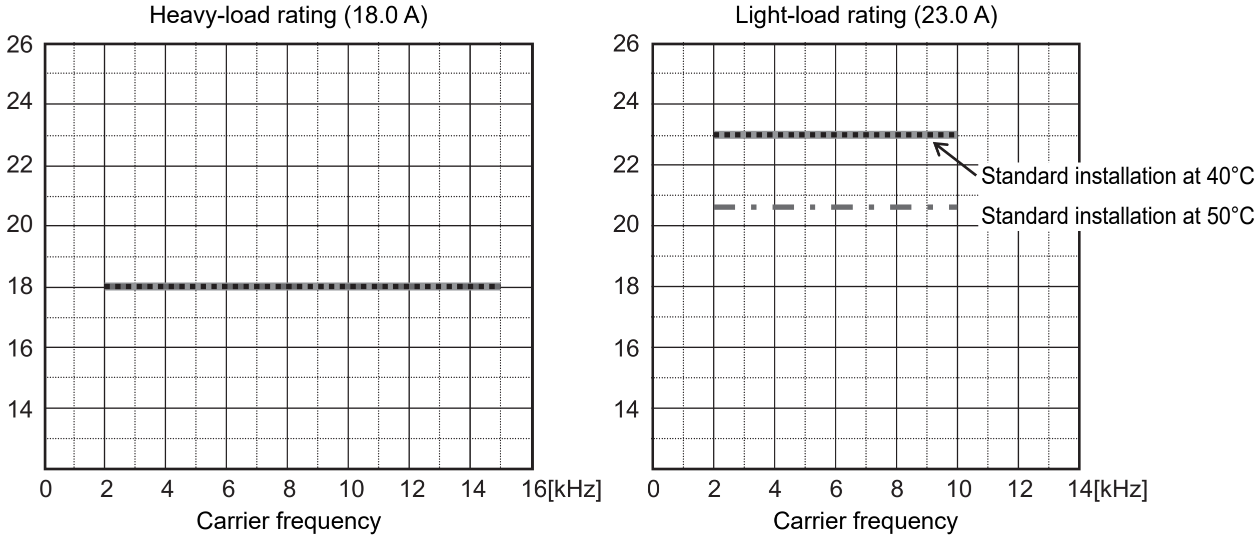
● 3G3MX2-A4040



● 3G3MX2-A2075

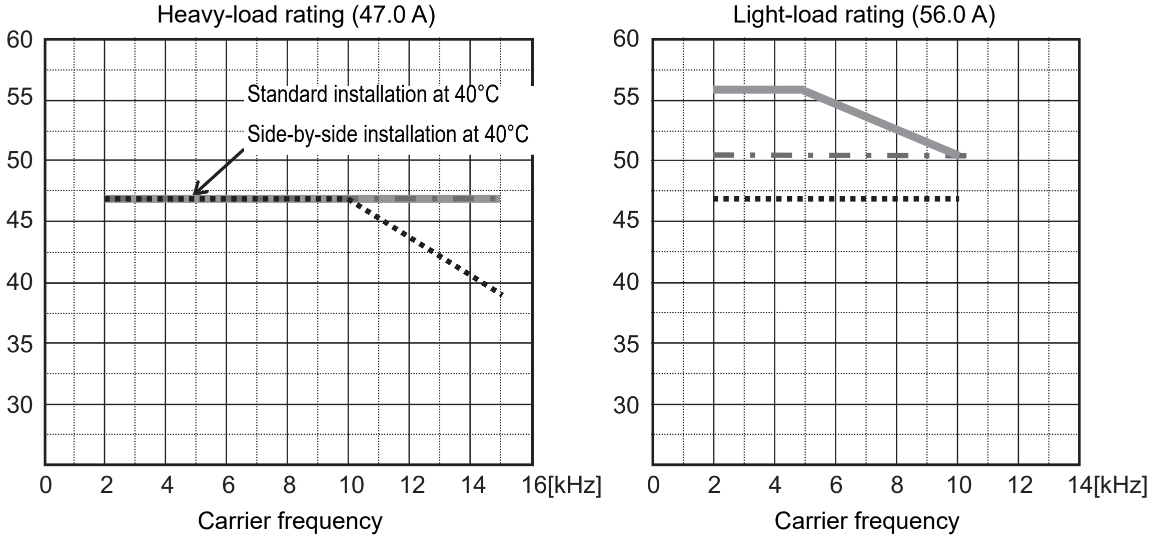


● 3G3MX2-A4075


Heavy-load rating (18.0 A)

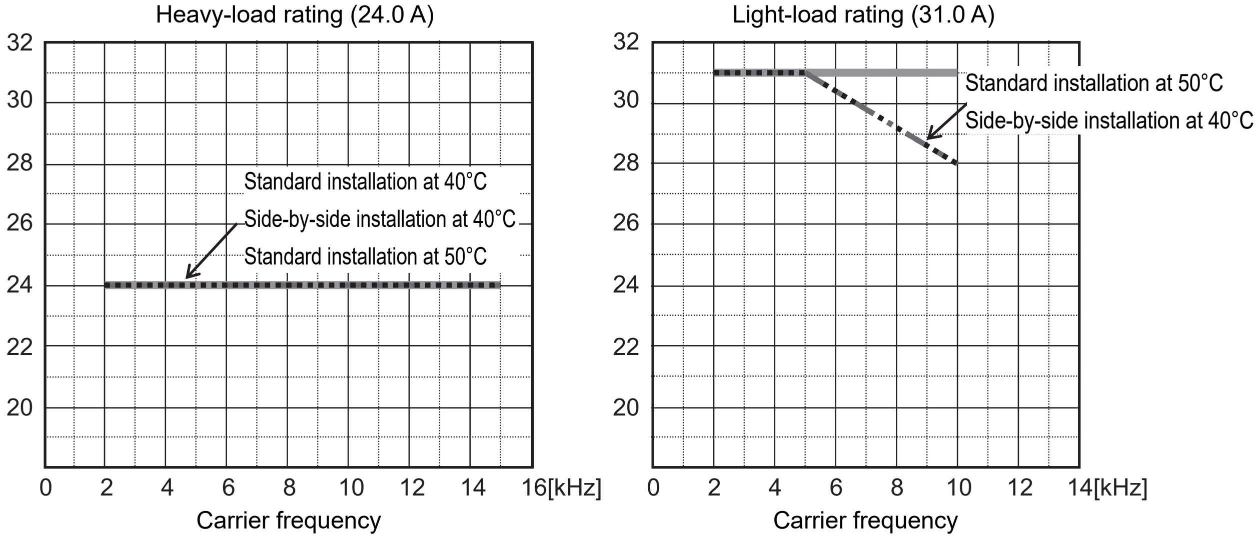
Light-load rating (23.0 A)

● 3G3MX2-A2110


Heavy-load rating (47.0 A)

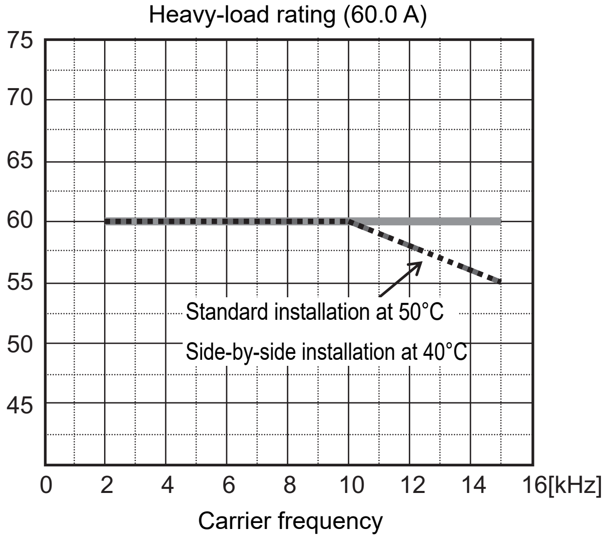
Light-load rating (56.0 A)

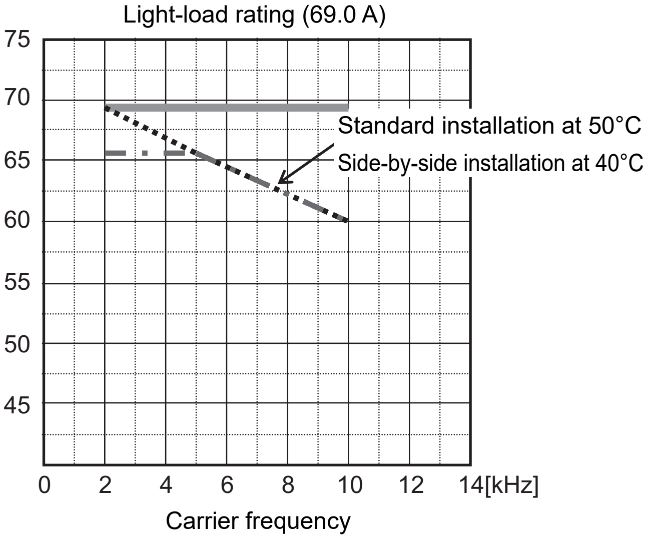
● 3G3MX2-A4110


Heavy-load rating (24.0 A)

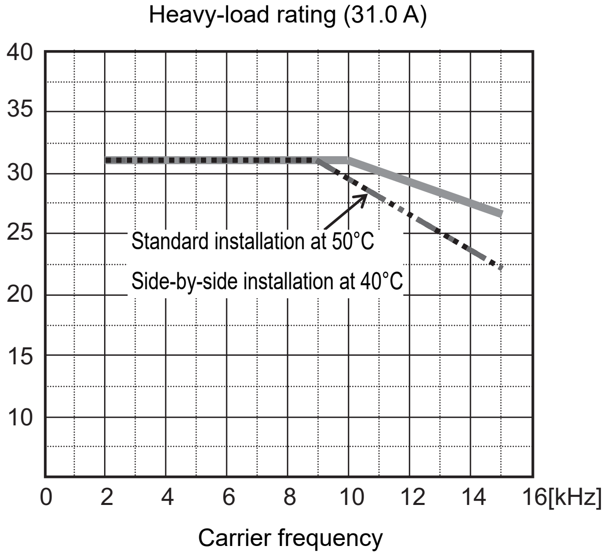
Light-load rating (31.0 A)

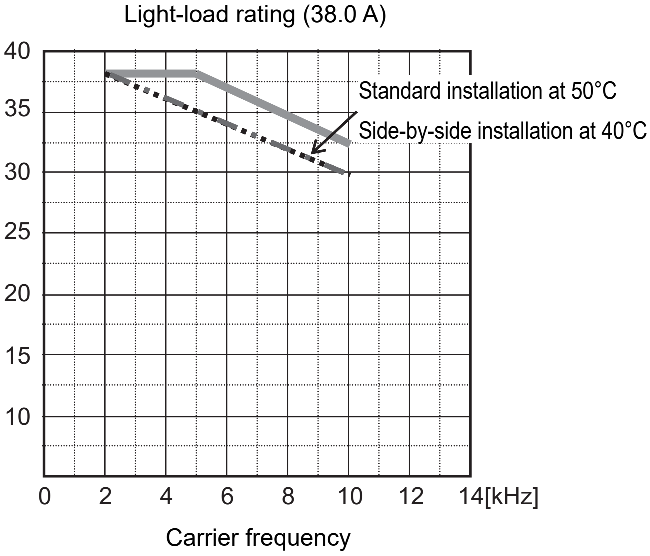
- **3G3MX2-A2150**



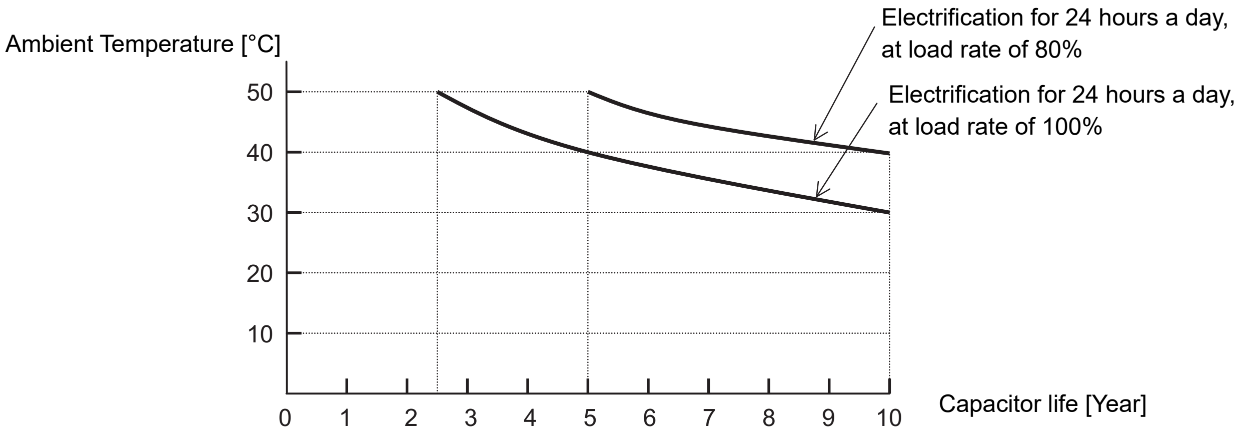


- **3G3MX2-A4150**





A-2 Smoothing Capacitor Life Curve



Note 1. "Ambient temperature" refers to the temperature measured at a distance of approximately 5 cm from the bottom center of the inverter (atmospheric temperature).

It refers to an interior temperature if the inverter is stored in a cabinet.

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-3 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 such as on-board smoothing capacitors and cooling fans (except for the main circuit smoothing 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 *7-1-18 Life Assessment Monitor [d022]* on page 7-11, *7-2-2 Multi-function Output Selection* on page 7-20, and *5-10-2 Multi-function Output Operation Selection* on page 5-55.

A-4 UL/cUL Standards Cautions

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

- Use 60/75°C Cu wire only.
  (For models:3G3MX2-A2001-V1, -A2002-V1, -A2004-V1, -A2007-V1, -AB015-V1, -AB022-V1, -A4004-V1, -A4007-V1, -A4015-V1, -A4022-V1, and -A4030-V1)
- Use 75°C Cu wire only.
  (For models:3G3MX2-AB001-V1, -AB002-V1, -AB004-V1, -AB007-V1, -A2015-V1, -A2022-V1, -A2037-V1, -A2055-V1, -A2075-V1, -A2110-V1, -A2150-V1, -A4040-V1, -A4055-V1, -A4075-V1, -A4110-V1 and -A4150-V1)
- Suitable for use on a circuit capable of delivering not more than 100,000 rms Symmetrical Amperes, 240 or 480 Volts Maximum.
- When Protected by CC, G, J, or T Class Fuses, or when Protected By A Circuit Breaker Having An Interrupting Rating Not Less Than 100,000 rms Symmetrical Amperes, 240 or 480 Volts Maximum.
- Install device in pollution degree 2 environment.
- Maximum surrounding air temperature rating of 50°C
- Solid State motor overload protection reacts with max. 150% of FLA.
- 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.

Terminal Symbols and Screw Size

Model No.	Screw size	Required torque [N•m]	Wire range
3G3MX2-AB001-V1, 3G3MX2-AB002-V1, 3G3MX2-AB004-V1	M3.5	1.0	AWG16 (1.3 mm^2)
3G3MX2-AB007-V1	M4	1.4	AWG12 (3.3 mm^2)
3G3MX2-AB015-V1, 3G3MX2-AB022-V1	M4	1.4	AWG10 (5.3 mm^2)
3G3MX2-A2001-V1, 3G3MX2-A2002-V1, 3G3MX2-A2004-V1, 3G3MX2-A2007-V1	M3.5	1.0	AWG16 (1.3 mm^2)
3G3MX2-A2015-V1	M4	1.4	AWG14 (2.1 mm^2)
3G3MX2-A2022-V1	M4	1.4	AWG12 (3.3 mm^2)
3G3MX2-A2037-V1	M4	1.4	AWG10 (5.3 mm^2)
3G3MX2-A2055-V1, 3G3MX2-A2075-V1	M5	3.0	AWG6 (13 mm^2)
3G3MX2-A2110-V1	M6	3.9 to 5.1	AWG4 (21 mm^2)
3G3MX2-A2150-V1	M8	5.9 to 8.8	AWG2 (34 mm^2)
3G3MX2-A4004-V1, 3G3MX2-A4007-V1, 3G3MX2-A4015-V1	M4	1.4	AWG16 (1.3 mm^2)
3G3MX2-A4022-V1, 3G3MX2-A4030-V1	M4	1.4	AWG14 (2.1 mm^2)
3G3MX2-A4040-V1	M4	1.4	AWG12 (3.3 mm^2)
3G3MX2-A4055-V1, 3G3MX2-A4075-V1	M5	3.0	AWG10 (5.3 mm^2)
3G3MX2-A4110-V1, 3G3MX2-A4150-V1	M6	3.9 to 5.1	AWG6 (13 mm^2)

Fuse Size

The inverter shall be connected with a UL Listed Cartridge Nonrenewable fuse, rated 600Vac with the current ratings as shown in the table below.

Model No.	Type	Rating
3G3MX2-AB001-V1, 3G3MX2-AB002-V1, 3G3MX2-AB004-V1	Class J	10 A, AIC 200 kA
3G3MX2-AB007-V1		20 A, AIC 200 kA
3G3MX2-AB015-V1		30 A, AIC 200 kA
3G3MX2-AB022-V1		30 A, AIC 200 kA
3G3MX2-A2001-V1, 3G3MX2-A2002-V1, 3G3MX2-A2004-V1	Class J	10 A, AIC 200 kA
3G3MX2-A2007-V1, 3G3MX2-A2015-V1		15 A, AIC 200 kA
3G3MX2-A2022-V1		20 A, AIC 200 kA
3G3MX2-A2037-V1		30 A, AIC 200 kA
3G3MX2-A2055-V1, 3G3MX2-A2075-V1		60 A, AIC 200 kA
3G3MX2-A2110-V1, 3G3MX2-A2150-V1		80 A, AIC 200 kA
3G3MX2-A4004-V1, 3G3MX2-A4007-V1, 3G3MX2-A4015-V1, 3G3MX2-A4022-V1	Class J	10 A, AIC 200 kA
3G3MX2-A4030-V1, 3G3MX2-A4040-V1		15 A, AIC 200 kA
3G3MX2-A4055-V1, 3G3MX2-A4075-V1		30 A, AIC 200 kA
3G3MX2-A4110-V1, 3G3MX2-A4150-V1		50 A, AIC 200 kA

A-5 Overview of Inverter Selection

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.

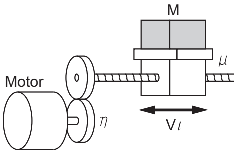
■ Simplified Selection Method (Required Output Calculation)

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.

* 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 P0 [kW]

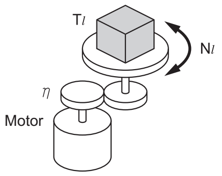


$$P_0\ [\text{kW}] = \frac{\mu \cdot Mg \cdot V_l}{60 \cdot \eta} \times 10^{-3}$$

μ : Friction coefficient
M : Mass of linear motion part [kg]
g : Acceleration of gravity (g≈9.8 [m/s^2])
V_l : Speed of linear motion part [m/min]
η : Efficiency of transfer part ($\eta \leq 1$)

* The same calculating formula is applicable to belt conveyors.

- For rotation motion: Steady power P0 [kW]



$$P_0\ [\text{kW}] = \frac{2\pi \cdot T_l \cdot N_l}{60 \cdot \eta} \times 10^{-3}$$

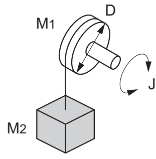
T_l : Load torque (Load shaft) [N·m]
N_l : Rotation speed of load shaft [r/min]
η : Efficiency of transfer part ($\eta \leq 1$)

■ 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.

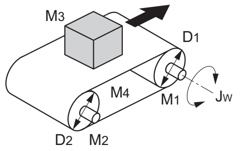
• Example in hoist application



$$J_W\ [\text{kg}\cdot\text{m}^2] = J_1 + J_2 = \left(\frac{M_1 \cdot D^2}{8} + \frac{M_2 \cdot D^2}{4} \right) \times 10^{-6}$$

J_W : Shaft conversion inertia [kg·m^2]
J_1 : Inertia of cylinder (Shaft conversion) [kg·m^2]
J_2 : Inertia of workpiece (Shaft conversion) [k·m^2]
M_1 : Mass of cylinder [kg]
M_2 : Mass of workpiece [kg]
D : Diameter of cylinder [mm]

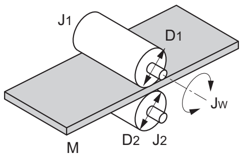
• Example in conveyor application



$$J_W\ [\text{kg}\cdot\text{m}^2] = J_1+J_2+J_3+J_4 = \left(\frac{M_1 \cdot D_1^2}{8} + \frac{M_2 \cdot D_2^2}{8} \cdot \frac{D_1^2}{D_2^2} + \frac{M_3 \cdot D_1^2}{4} + \frac{M_4 \cdot D_1^2}{4} \right) \times 10^{-6}$$

J_W : Shaft conversion inertia (Cylinder-1-shaft conversion) [kg·m^2]
J_1 : Inertia of cylinder 1 (Cylinder-1-shaft conversion) [kg·m^2]
J_2 : Inertia of cylinder 2 (Cylinder-1-shaft conversion) [kg·m^2]
J_3 : Inertia of workpiece (Cylinder-1-shaft conversion) [kg·m^2]
J_4 : Inertia of belt (Cylinder-1-shaft conversion) [kg·m^2]
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]

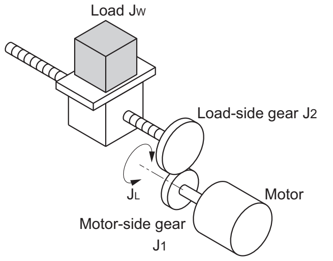
• Example in roller application



$$J_W\ [\text{kg}\cdot\text{m}^2] = J_1 + \left(\frac{D_1^2}{D_2^2} \right) J_2 + \frac{M \cdot D_1^2}{4} \times 10^{-6}$$

J_W : Shaft conversion inertia (Roller-1-shaft conversion) [kg·m^2]
J_1 : Inertia of roller 1 (Roller-1-shaft conversion) [kg·m^2]
J_2 : Inertia of roller 2 (Roller-2-shaft conversion) [kg·m^2]
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



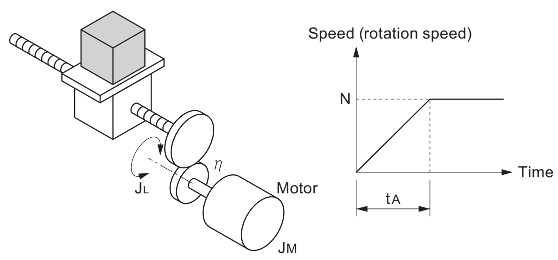
$$J_L: [\text{kg}\cdot\text{m}^2] = J_1 + G^2(J_2 + J_W)$$

J_L : Motor-shaft conversion inertia [kg·m^2]
J_W : Load inertia (Load-side gear-shaft conversion) [kg·m^2]
J_1 : Inertia of motor-side gear [kg·m^2]
J_2 : Inertia of load-side gear [kg·m^2]
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.

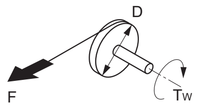
• Calculation of acceleration torque (TA)



$$T_A\ [\mathrm{N{\cdot}m}] = \frac{2\pi \cdot N}{60 \cdot t_A}\left(J_M + \frac{J_L}{\eta}\right)$$

T_A : Acceleration torque [N·m]
J_L : Motor-shaft conversion load inertia [kg·m^2]
J_M : Motor-rotor inertia [kg·m^2]
η : Efficiency of transfer part ($\eta \leq 1$)
t_A : Acceleration time [s]
N : Motor rotation speed [r/min]

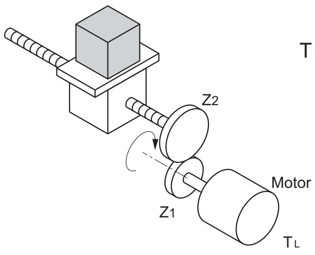
• Calculation of motor-shaft conversion load torque (TL)



$$T_W\ [\mathrm{N{\cdot}m}] = F \cdot \frac{D}{2} \times 10^{-3}$$

T_W : Load torque (Load-shaft conversion) [N·m]
F : External force [N]
D : Diameter of cylinder [mm]

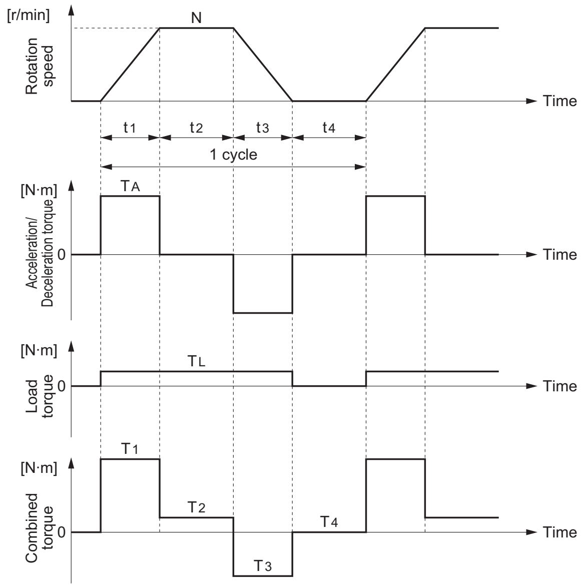
(Generally, the friction force can be calculated as below:
$F = \mu Mg$ [N], where
μ : Coefficient of friction
M : Mass of motion part [kg]
g : Acceleration of gravity ($g \approx 9.8$ [m/s^2])



$$T_L\ [\mathrm{N{\cdot}m}] = T_W \cdot \frac{G}{\eta}$$

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

Motor capacity [kW] $= \dfrac{2\pi \cdot T_{RMS} \cdot N}{60} \times 10^{-3}$ N: Maximum rotation speed [r/min]

• Motor capacity required for maximum torque output

Motor capacity [kW] $= \dfrac{2\pi \cdot T_{MAX} \cdot N}{60 \times 1.5} \times 10^{-3}$ N: Maximum rotation speed [r/min]

* The above calculation formulae assume that the maximum motor toque is 150% of the rated torque.

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 the both of the following conditions. If not, select an inverter with one size larger in capacity and check again.

Rated motor current ≤ Rated output current of inverter
Max. continuous torque output time for application ≤ 1 min

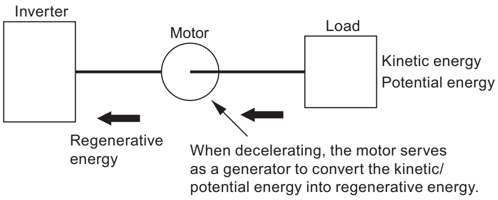
Note 1. In the light load mode, the overload capacity of the inverter is 150% of the rated torque for 5 seconds. Use the 5-seconds rating when determining the maximum continuous torque.
2. If you want to use 0-Hz sensorless vector control, need a holding torque at a rotation speed of 0 (r/min), or frequently 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.

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.


Inverter
Motor
Load
Kinetic energy
Potential energy
Regenerative energy
When decelerating, the motor serves as a generator to convert the kinetic/ potential energy into 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

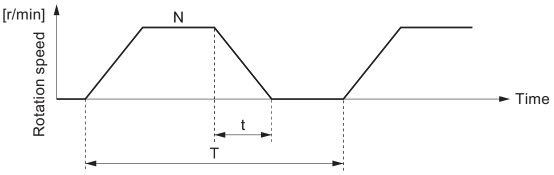
  Increase the deceleration time to prevent the occurrence of an overvoltage in the main circuit.
  This decreases the amount of regenerative energy per unit time.

  - 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.



- Usage rate [%ED] = 100 x t/T
  t: Deceleration time (regenerative time) [s]
  T: 1cycle operation time [s]

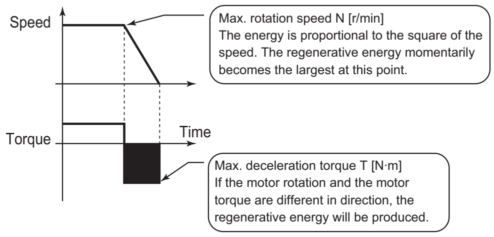
- For models with built-in regenerative braking circuit
  All models of the 3G3MX2-V1 Series Inverter have built-in regenerative braking circuit.
  Select a braking resistor based on the usage rate calculated from the operation pattern.
  Connect a braking resistor suitable for your inverter according to the braking resistor list provided in the inverter manual/catalog.

- For models without built-in regenerative braking circuit
  If a braking torque or regenerative energy is extremely large, even the 3G3MX2-V1 Series Inverter may require the Regenerative Braking Unit.
  Select an appropriate regenerative braking unit and braking resistor.
  Connect a regenerative braking unit and braking resistor suitable for your inverter according to the regenerative braking unit/braking resistor list provided in the inverter manual and catalog.

Detailed Braking Resistor Selection

When the usage rate of the braking resistor selected on the previous page 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



Max. rotation speed N [r/min]
The energy is proportional to the square of the speed. The regenerative energy momentarily becomes the largest at this point.

Max. deceleration torque T [N·m]
If the motor rotation and the motor torque are different in direction, the regenerative energy will be produced.

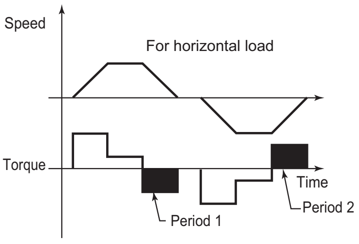
Resistance of braking resistor: $R \le \dfrac{60 \times V^2}{2\pi \cdot (T - 0.2 \times Tm) \cdot N}$

V : 200-V class inverter 362.5 [V]
400-V class inverter 725 [V]
T : Maximum braking torque [N·m]
Tm : 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.

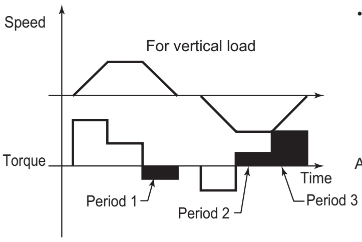
- Calculation of average regenerative energy

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 1 [J] i
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.

Average regenerative energy [W] = $\dfrac{(P1 + P2 + \cdots + Pi)[J]}{1 \text{ cycle time [s]}}$

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.
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 described on the left section.

- Required braking resistance ≥ Resistance of braking resistor ≥ Min. connection resistance of inverter or regenerative braking unit
- Average regenerative energy ≤ Resistance capacity of braking resistor

Note)
1. Connecting a braking resistor whose resistance is less than the minimum connection resistance value of the inverter or regenerative braking unit results in damage to the internal braking transistor. If the required braking resistance is less than the minimum connection resistance, change the inverter or regenerative braking unit to one having a larger capacity and ensure that the required braking resistance is not less than the minimum connection resistance.
2. Two or more regenerative braking units can be connected in parallel. Refer to the following formula to know the braking resistance value in such a case: Braking resistance [Ω] = (Required braking resistance calculated as above) x (No. of units)
3. Make allowance for the resistance capacity of the braking resistor. Select a braking resistor whose capacity is at least 20% larger than the calculated value. Otherwise, it may be overheated.

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