

Compact Inverter

# GMD Series

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Three-phase 200 V series: **GMD-00040 to 00150L...**

Three-phase 400 V series: **GMD-00040 to 00150H...**

Single-phase 200 V series: **GMD-00040 to 00220S...**

## **CAUTION**

Thank you for purchasing our **GMD** series of inverters.

- This product is designed to drive a three-phase induction motor and three-phase permanent magnet synchronous motor. Read through this instruction manual and be familiar with the handling procedure for correct use.
- Improper handling might result in incorrect operation, a short life, or even a failure of this product as well as the motor.
- Deliver this manual to the end user of this product. Keep this manual in a safe place until this product is discarded.
- For instructions on how to use an optional device, refer to the instruction and installation manuals for that optional device.

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## Preface

Thank you for purchasing our **GMD** series of inverters.

This product is designed to drive a three-phase induction motor and three-phase permanent magnet synchronous motor (PMSM). Read through this instruction manual and be familiar with proper handling and operation of this product.

Improper handling might result in incorrect operation, a short life, or even a failure of this product as well as the motor.

Have this manual delivered to the end user of this product. Keep this manual in a safe place until this product is discarded.

The materials are subject to change without notice. Be sure to obtain the latest editions for use.

### **Guideline for Suppressing Harmonics in Home Electric and General-purpose Appliances**

Three-phase 200 V class series of inverters with a capacity of 15 kW or less, single-phase 200 V class series with 2.2 kW or less were once subject to the "Japanese Guideline for Suppressing Harmonics in Home Electric and General-purpose Appliances" (established in September 1994 and revised in October 1999), published by the Ministry of International Trade and Industry (currently the Ministry of Economy, Trade and Industry (METI)).

Since the revision of the guideline in January 2004, however, these inverters have no longer been subject to the guideline. The individual inverter manufacturers have voluntarily employed harmonics suppression measures.



As our measure, it is recommended that DC reactors (DCRs) authorized in this manual be connected to the **GMD** series of inverters.

When using DCRs not authorized in this manual, however, consult your **GMCNT** representative for the detailed specifications.

## „ Safety precautions

Read this manual thoroughly before proceeding with installation, connections (wiring), operation, or maintenance and inspection. Ensure you have sound knowledge of the device and familiarize yourself with all safety information and precautions before proceeding to operate the inverter.

Safety precautions are classified into the following two categories in this manual.

 <b>WARNING</b>	Failure to heed the information indicated by this symbol may lead to dangerous conditions, possibly resulting in death or serious bodily injuries.
 <b>CAUTION</b>	Failure to heed the information indicated by this symbol may lead to dangerous conditions, possibly resulting in minor or light bodily injuries and/or substantial property damage.

Failure to heed the information contained under the CAUTION title can also result in serious consequences. These safety precautions are of utmost importance and must be observed at all times.

## Application

### **WARNING**

- **GMD** is designed to drive a three-phase induction motor and three-phase permanent magnet synchronous motor (PMSM). Do not use it for single-phase motors or for other purposes.

**Fire or an accident could occur.**

- **GMD** may not be used for a life-support system or other purposes directly related to the human safety.
- Though **GMD** is manufactured under strict quality control, install safety devices for applications where serious accidents or material losses are foreseen in relation to the failure of it.

**An accident could occur.**

## Installation

### **WARNING**

- Install the inverter on a nonflammable material such as metal.

**Otherwise fire could occur.**

- Do not place flammable matter nearby.

**Doing so could cause fire.**

## CAUTION

- Do not support the inverter by its terminal block cover during transportation.  
**Doing so could cause a drop of the inverter and injuries.**
- Prevent lint, paper fibers, sawdust, dust, metallic chips, or other foreign materials from getting into the inverter or from accumulating on the heat sink.  
**Otherwise, a fire or an accident might result.**
- Do not install or operate an inverter that is damaged or lacking parts.  
**Doing so could cause fire, an accident or injuries.**
- Do not get on a shipping box.
- Do not stack shipping boxes higher than the indicated information printed on those boxes.  
**Doing so could cause injuries.**

## Wiring

### WARNING

- When wiring the inverter to the power source, insert a recommended molded case circuit breaker (MCCB) or residual-current-operated protective device (RCD)/earth leakage circuit breaker (ELCB) (with overcurrent protection) in the path of power lines. Use the devices within the recommended current range.
- Use wires in the specified size.
- When wiring the inverter to the power supply of 500 kVA or more, be sure to connect an optional DC reactor (DCR).  
**Otherwise, fire could occur.**
- Do not use one multicore cable in order to connect several inverters with motors.
- Do not connect a surge killer to the inverter's output (secondary) circuit.  
**Doing so could cause fire.**
- Be sure to connect the grounding wires without fail.  
**Otherwise, electric shock or fire could occur.**
- Qualified electricians should carry out wiring.
- Be sure to perform wiring after turning the power off.
- Ground the inverter in compliance with the national or local electric code.  
**Otherwise, electric shock could occur.**
- Be sure to perform wiring after installing the inverter body.  
**Otherwise, electric shock or injuries could occur.**
- Ensure that the number of input phases and the rated voltage of the product match the number of phases and the voltage of the AC power supply to which the product is to be connected.  
**Otherwise fire or an accident could occur.**
- Do not connect the power source wires to output terminals (U, V, and W).
- Do not insert a braking resistor between terminals P (+) and N (-), P1 and N (-), P (+) and P1, DB and N (-), or P1 and DB.  
**Doing so could cause fire or an accident.**

## **WARNING**

- Generally, control signal wires are not reinforced insulation. If they accidentally touch any of live parts in the main circuit, their insulation coat may break for any reasons. In such a case, an extremely high voltage may be applied to the signal lines. Make a complete remedy to protect the signal line from contacting any hot high voltage lines.

**Doing so could cause an accident or electric shock.**

## **CAUTION**

- Wire the three-phase motor to terminals U, V, and W of the inverter, aligning phases each other.

**Otherwise injuries could occur.**

- The inverter, motor and wiring generate electric noise. Take care of malfunction of the nearby sensors and devices. To prevent the motor from malfunctioning, implement noise control measures.

**Otherwise an accident could occur.**

### Operation

## **WARNING**

- Be sure to install the terminal block cover before turning the power on. Do not remove the cover while power is applied.

**Otherwise electric shock could occur.**

- Do not operate switches with wet hands.

**Doing so could cause electric shock.**

- If the retry function has been selected, the inverter may automatically restart and drive the motor depending on the cause of tripping.

(Design the machinery or equipment so that human safety is ensured after restarting.)

- If the stall prevention function (current limiter), automatic deceleration, and overload prevention control have been selected, the inverter may operate at an acceleration/deceleration time or frequency different from the set ones. Design the machine so that safety is ensured even in such cases.

**Otherwise an accident could occur.**

- The STOP key is only effective when function setting (Function code F02) has been established to enable the STOP key. Prepare an emergency stop switch separately. If you disable the STOP key priority function and enable operation by external commands, you cannot emergency-stop the inverter using the STOP key on the built-in keypad.

- If an alarm reset is made with the operation signal turned on, a sudden start will occur. Ensure that the operation signal is turned off in advance.

**Otherwise an accident could occur.**



## **WARNING**

- If you enable the "restart mode after momentary power failure" (Function code F14 = 4 or 5), then the inverter automatically restarts running the motor when the power is recovered. (Design the machinery or equipment so that human safety is ensured after restarting.)
- If you set the function codes wrongly or without completely understanding this instruction manual and the User's Manual, the motor may rotate with a torque or at a speed not permitted for the machine.

**An accident or injuries could occur.**

- Do not touch the inverter terminals while the power is applied to the inverter even if the inverter stops.

**Doing so could cause electric shock.**

## **CAUTION**

- Do not turn the main circuit power on or off in order to start or stop inverter operation.  
**Doing so could cause failure.**
- Do not touch the heat sink or braking resistor because they become very hot.  
**Doing so could cause burns.**
- Setting the inverter to high speeds is easy. Before changing the frequency (speed) setting, check the specifications of the motor and machinery.
- The brake function of the inverter does not provide mechanical holding means.

**Injuries could occur.**

### **Maintenance and inspection, and parts replacement**

## **WARNING**

- Turn the power off and wait for at least five minutes before starting inspection. Further, check that the LED monitor is unlit, and check the DC link bus voltage between the P (+) and N (-) terminals to be lower than 25 VDC.

**Otherwise, electric shock could occur.**

- Maintenance, inspection, and parts replacement should be made only by qualified persons.
- Take off the watch, rings and other metallic matter before starting work.
- Use insulated tools.

**Otherwise, electric shock or injuries could occur.**

## Disposal

### CAUTION

- Handle the inverter as an industrial waste when disposing of it.  
**Otherwise injuries could occur.**

## Others

### WARNING

- Never attempt to modify the inverter.  
**Doing so could cause electric shock or injuries.**

### GENERAL PRECAUTIONS

Drawings in this manual may be illustrated without covers or safety shields for explanation of detail parts. Restore the covers and shields in the original state and observe the description in the manual before starting operation.



## 1.2 External Views

### (1) External views

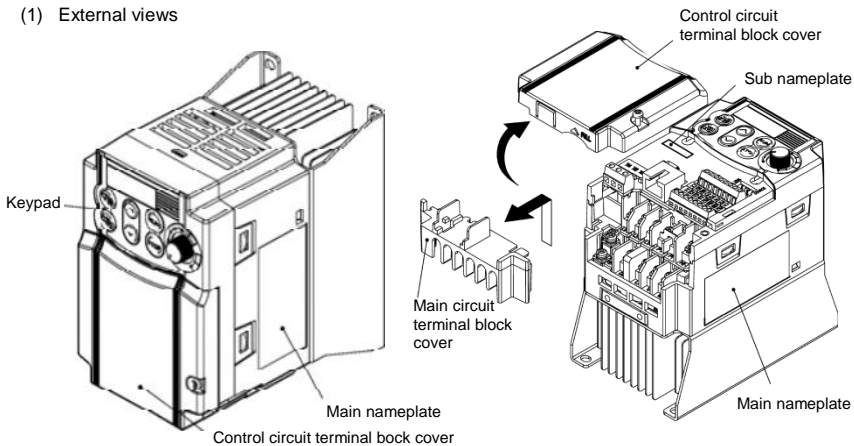
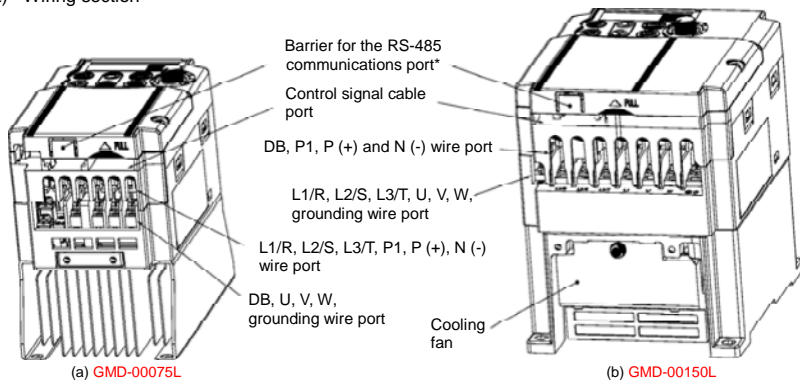


Figure 1.2 External Views of GMD

### (2) Wiring section



(\* When connecting the RS-485 communications cable, remove the control circuit terminal block cover and cut off the barrier provided in it using nippers.)

Figure 1.3 Wiring Section

## Chapter 2 MOUNTING AND WIRING OF THE INVERTER

### 2.1 Operating Environment

Install the inverter in an environment that satisfies the requirements listed in Table 2.1.

Table 2.1 Environmental Requirements

Item	Specifications
Site location	Indoors
Ambient temperature	-10 to +50°C (IP20) <b>(Note 1)</b>
Relative humidity	5 to 95% (No condensation)
Atmosphere	The inverter must not be exposed to dust, direct sunlight, corrosive gases, flammable gas, oil mist, vapor or water drops. <b>(Note 2)</b> The atmosphere can contain only a low level of salt. (0.01 mg/cm <sup>2</sup> or less per year) The inverter must not be subjected to sudden changes in temperature that will cause condensation to form.
Altitude	1,000 m max. <b>(Note 3)</b>
Atmospheric pressure	86 to 106 kPa
Vibration	3 mm (Max. amplitude) 2 to less than 9 Hz 9.8 m/s <sup>2</sup> 9 to less than 20 Hz 2 m/s <sup>2</sup> 20 to less than 55 Hz 1 m/s <sup>2</sup> 55 to less than 200 Hz

Table 2.2 Output Current Derating Factor in Relation to Altitude

Altitude	Output current derating factor
1000 m or lower	1.00
1000 to 1500 m	0.97
1500 to 2000 m	0.95
2000 to 2500 m	0.91
2500 to 3000 m	0.88

**(Note 1)** When inverters are mounted side-by-side without any gap between them, the ambient temperature should be within the range from -10 to +40°C.

**(Note 2)** Do not install the inverter in an environment where it may be exposed to cotton waste or moist dust or dirt which will clog the heat sink in the inverter. If the inverter is to be used in such an environment, install it in the panel of your system or other dustproof containers.

**(Note 3)** If you use the inverter in an altitude above 1000 m, you should apply an output current derating factor as listed in Table 2.2.

### 2.2 Installing the Inverter

#### (1) Mounting base

The temperature of the heat sink may rise up to approx. 90°C during operation of the inverter, so the inverter should be mounted on a base made of material that can withstand temperatures of this level.

 <b>WARNING</b>
Install the inverter on a base made of metal or other non-flammable material. <b>A fire may result with other material.</b>

#### (2) Clearances

Ensure that the minimum clearances indicated in Figure 2.1 are maintained at all times. When installing the inverter in the panel of your system, take extra care with ventilation inside the panel as the temperature around the inverter tends to increase.

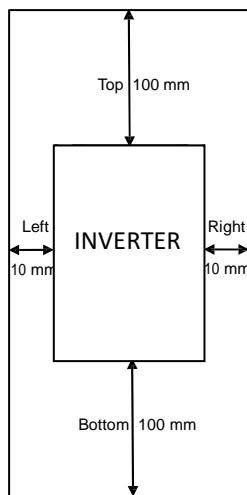


Figure 2.1 Mounting Direction and Required Clearances

### When mounting two or more inverters

When mounting two or more inverters in the same unit or panel, basically lay them out side by side. As long as the ambient temperature is 40°C or lower, inverters can be mounted side by side without any clearance between them. When mounting the inverters necessarily, one above the other, be sure to separate them with a partition plate or the like so that any heat radiating from an inverter will not affect the one(s) above.

### (3) Mounting direction

Secure the inverter to the mounting base with four screws or bolts (M4) so that the **GMD** logo faces outdoors. Tighten those screws or bolts perpendicular to the mounting base.

**Note** Do not mount the inverter upside down or horizontally. Doing so will reduce the heat dissipation efficiency of the inverter and cause the overheat protection function to operate, so the inverter will not run.

## CAUTION

Prevent lint, paper fibers, sawdust, dust, metallic chips, or other foreign materials from getting into the inverter or from accumulating on the heat sink.

**This may result in a fire or accident.**

## 2.3 Wiring

Follow the procedure below. (In the following description, the inverter has already been installed.)

### 2.3.1 Removing and mounting the terminal block covers

- (1) Loosen the screw securing the control circuit terminal block cover.
- (2) Insert your finger in the cutout (near "PULL") in the bottom of the control circuit terminal block cover, then pull the cover towards you.
- (3) Hold both sides of the main circuit terminal block cover between thumb and forefinger and slide it towards you.
- (4) After performing wiring, mount the main circuit terminal block cover and control circuit terminal block cover in the reverse order of removal.

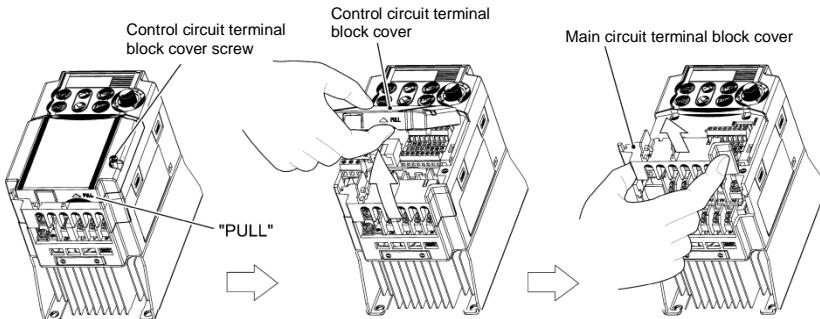



Figure 2.2 Removing the Terminal Block Covers

### 2.3.2 Terminal arrangement and screw specifications

The figures below show the arrangement of the main and control circuit terminals which differs according to inverter type. The two terminals prepared for grounding, which are indicated by the symbol  in Figures A to D, make no distinction between the power supply side (primary circuit) and the motor side (secondary circuit).

#### (1) Arrangement of the main circuit terminals

Table 2.3 Main Circuit Terminals

Power supply voltage	Nominal applied motor (kW)	Inverter type	Terminal screw size	Tightening torque (N·m)	Refer to:
Three-phase 200 V	0.4	GMD-00040L	M3.5	1.2	Figure A
	0.75	GMD-00075L			
	1.5	GMD-00150L	M4	1.8	
	2.2	GMD-00220L			
	3.7	GMD-00370L			
Three-phase 400 V	0.4	GMD-00040H	M4	1.8	Figure B
	0.75	GMD-00075H			
	1.5	GMD-00150H			
	2.2	GMD-00220H			
	3.7	GMD-00370H			
Single-phase 200 V	0.4	GMD-00040S	M3.5	1.2	Figure C
	0.75	GMD-00075S	M4	1.8	Figure D
	1.5	GMD-00150S			
	2.2	GMD-00220S			

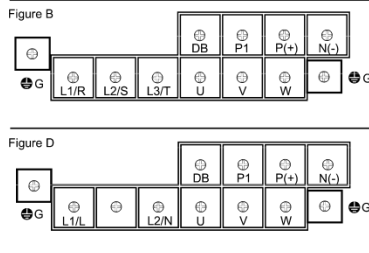
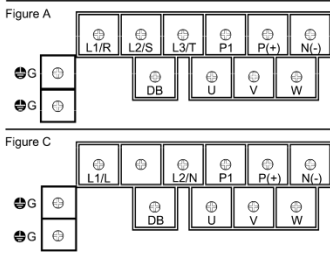


Table 2.3 Main Circuit  
Terminals(continued)

Power supply voltage	Nominal applied motor (kW)	Inverter type	Terminal screw size	Tightening torque (N·m)	Refer to:
Three-phase 200 V	5.5	GMD-00550L	M5	3.0	Figure E
	7.5	GMD-00750L			
	11	GMD-01100L	M6	5.8	Figure F
	15	GMD-01500L			
Three-phase 400 V	5.5	GMD-00550H	M5	3.0	Figure E
	7.5	GMD-00750H			
	11	GMD-01100H	M6	5.8	Figure F
	15	GMD-01500H			

Figure E

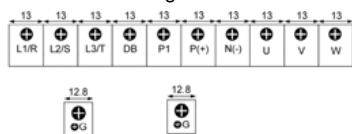
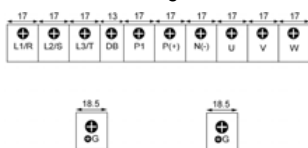


Figure F





## (2) Arrangement of the control circuit terminals (common to all GMD models)

Y1	Y1E	FMA	C1	PLC	X1	X2	X3
----	-----	-----	----	-----	----	----	----

11	12	13	11	CM	FWD	REV	CM
----	----	----	----	----	-----	-----	----

30A	30B	30C
-----	-----	-----

Screw size: M2 Tightening torque: 0.2 N·m

Screw size: M2.5 Tightening torque: 0.4 N·m

Table 2.4 Control Circuit Terminals

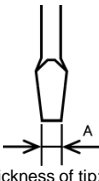


Terminal symbol	Screwdriver (Shape of tip, B x A)  Thickness of tip: B	Allowable wire size	Bared wire length 	Ferrule terminal* Opening dimension in the terminal block 
[30A], [30B], [30C]	Flat screwdriver (0.6 x 3.5 mm)	AWG22 to AWG18 (0.34 to 0.75 mm <sup>2</sup> )	6 to 7 mm	2.8 (W) x 1.7 (H) mm
Other than the above	Flat screwdriver (0.5 x 2.4 mm)	AWG24 to AWG18 (0.25 to 0.75 mm <sup>2</sup> )	5 to 6 mm	1.7 (W) x 1.7 (H) mm

Table 2.5 Recommended Ferrule Terminals

Screw size	Wire size	Type (216- )			
		With insulated collar		Without insulated collar	
		Short type	Long type	Short type	Long type
M2	AWG24 (0.25 mm <sup>2</sup> )	321	301	151	131
M2 or M2.5	AWG22 (0.34 mm <sup>2</sup> )	322	302	152	132
	AWG20 (0.50 mm <sup>2</sup> )	221	201	121	101
	AWG18 (0.75 mm <sup>2</sup> )	222	202	122	102

The length of bared wires to be inserted into ferrule terminals is 5.0 mm or 8.0 mm for the short or long type, respectively.

The following crimping tool is recommended: Variocrimp 4 (Part No. 206-204).

### 2.3.3 Recommended wire sizes

Table 2.6 lists the recommended wire sizes. The recommended wire sizes for the main circuit terminals for an ambient temperature of 50°C are indicated for two types of wire: HIV single wire (for the maximum allowable temperature 75°C) (before a slash (/)) and IV single wire (for 60°C) (after a slash (/)),



Table 2.6 Recommended Wire Sizes

Power supply voltage	Nominal applied motor (kW)	Inverter type	Recommended wire size (mm <sup>2</sup> ) <sup>*1</sup>					Control circuit	
			Main circuit						
			Main circuit power input [L1/R, L2/S, L3/T] [L1/L, L2/N] Grounding [⊕G]		Inverter output [U, V, W]	DCR [P1, P (+)]	Braking resistor [P (+), DB]		
			w/ DCR	w/o DCR <sup>*2</sup>					
Three-phase 200 V	0.4	GMD-00040L	2.0 / 2.0 (2.5)	2.0 / 2.0 (2.5)	2.0 / 2.0 (2.5)	2.0 / 2.0 (2.5)	2.0 / 2.0 (2.5)		
	0.75	GMD-00075L							
	1.5	GMD-00150L							
	2.2	GMD-00220L							
	3.7	GMD-00370L						2.0 / 5.5 (2.5)	2.0 / 3.5 (2.5)
Three-phase 400 V	0.4	GMD-00040H	2.0 / 2.0 (2.5)	2.0 / 2.0 (2.5)	2.0 / 2.0 (2.5)	2.0 / 2.0 (2.5)	2.0 / 2.0 (2.5)		
	0.75	GMD-00075H							
	1.5	GMD-00150H							
	2.2	GMD-00220H							
	3.7	GMD-00370H							
Single-phase 200 V	0.4	GMD-00040S	2.0 / 2.0 (2.5)	2.0 / 2.0 (2.5)	2.0 / 2.0 (2.5)	2.0 / 2.0 (2.5)	2.0 / 2.0 (2.5)		
	0.75	GMD-00075S							
	1.5	GMD-00150S	2.0 / 3.5 (4.0)						
	2.2	GMD-00220S	2.0 / 3.5 (4.0)	3.5 / 5.5 (6.0)	2.0 / 3.5 (4.0)				

DCR: DC reactor

\*1 Use crimp terminals covered with an insulated sheath or insulating tube. Recommended wire sizes are for HIV/IV (PVC in the EU).

\*2 Wire sizes are calculated on the basis of input RMS current under the condition that the power supply capacity and impedance are 500 kVA and 5%, respectively.

\*3 Insert the DC reactor (DCR) in either of the primary power input lines. Refer to Chapter 10 for more details.

Table 2.6 Recommended Wire Sizes(continued)

Power supply voltage	Nominal applied motor (kW)	Inverter type	Recommended wire size (mm <sup>2</sup> ) <sup>*1</sup>					
			Main circuit					Control circuit
			Main circuit power input [L1/R, L2/S, L3/T] [L1/L, L2/N] Grounding [⊕/G]		Inverter output [U, V, W]	DCR [P1, P (+)]	Braking resistor [P (+), DB]	
			w/ DCR	w/o DCR <sup>*2</sup>				
Three-phase 200 V	5.5	GMD-00550L	2.0 / 5.5	3.5 / 8.0	3.5 / 5.5	3.5 / 5.5	2.0 / 2.0	0.5 ~ 1.25
	7.5	GMD-00750L	3.5 / 8.0	5.5 / 14	3.5 / 8.0	5.5 / 14		
	11	GMD-01100L	5.5 / 14	14 / 22	8.0 / 14	8.0 / 22		
	15	GMD-01500L	14 / 22	22 / 38	14 / 22	14 / 38		
Three-phase 400 V	5.5	GMD-00550H	2.0 / 2.0 (2.5)	2.0 / 3.5 (2.5)	2.0 / 2.0 (2.5)	2.0 / 2.0 (2.5)	2.0 / 2.0 (2.5)	0.5 ~ 1.25
	7.5	GMD-00750H		2.0 / 5.5 (4.0)	2.0 / 3.5 (2.5)	2.0 / 3.5 (2.5)		
	11	GMD-01100H	2.0 / 5.5 (4.0)	3.5 / 8.0 (6.0)	2.0 / 5.5 (4.0)	3.5 / 5.5 (4.0)		
	15	GMD-01500H	3.5 / 8.0 (6.0)	5.5 / 14 (10)	3.5 / 8.0 (6.0)	5.5 / 14 (6.0)		

DCR: DC reactor

### 2.3.4 Wiring precautions

Follow the rules below when performing wiring for the inverter.

- (1) Make sure that the source voltage is within the rated voltage range specified on the nameplate.
- (2) Be sure to connect the power wires to the main circuit power input terminals L1/R, L2/S and L3/T (for three-phase voltage input) or L1/L and L2/N (for single-phase voltage input) of the inverter. If the power wires are connected to other terminals, the inverter will be damaged when the power is turned on.
- (3) Always connect the grounding terminal to prevent electric shock, fire or other disasters and to reduce electric noise.
- (4) Use crimp terminals covered with insulated sleeves for the main circuit terminal wiring to ensure a reliable connection.
- (5) Keep the power supply wiring (primary circuit) and motor wiring (secondary circuit) of the main circuit, and control circuit wiring as far away as possible from each other.

## **WARNING**

- When wiring the inverter to the power source, insert a recommended molded case circuit breaker (MCCB) or residual-current-operated protective device (RCD)/earth leakage circuit breaker (ELCB) (with overcurrent protection) in the path of power lines. Use the devices within the related current range.
- Use wires in the specified size.  
**Otherwise, fire could occur.**
- Do not use one multicore cable in order to connect several inverters with motors.
- Do not connect a surge killer to the inverter's output (secondary) circuit.  
**Doing so could cause fire.**
- Be sure to connect the grounding wires without fail.  
**Otherwise, electric shock or fire could occur.**
- Qualified electricians should carry out wiring.
- Be sure to perform wiring after turning the power off.
- Ground the inverter in compliance with the national or local electric code.  
**Otherwise, electric shock could occur.**
- Be sure to perform wiring after installing the inverter body.  
**Otherwise, electric shock or injuries could occur.**
- Ensure that the number of input phases and the rated voltage of the product match the number of phases and the voltage of the AC power supply to which the product is to be connected.  
**Otherwise, fire or an accident could occur.**
- Do not connect the power source wires to output terminals (U, V, and W).
- Do not connect a braking resistor to between terminals P (+) and N (-), P1 and N (-), P (+) and P1, DB and N (-), or P1 and DB.  
**Doing so could cause fire or an accident.**

### 2.3.5 Wiring for main circuit terminals and grounding terminals

Follow the procedure below. Figure 2.3 illustrates the wiring procedure with peripheral equipment.

Wiring procedure

- c** Grounding terminal G\*1
- d** Inverter output terminals (U, V, and W) and grounding terminal G\*1
- e** DC reactor connection terminals (P1 and P(+))\*2
- f** Braking resistor connection terminals (P(+) and DB)\*2
- g** DC link bus terminals (P(+) and N(-))\*2
- h** Main circuit power input terminals (L1/R, L2/S and L3/T) or (L1/L and L2/N)

\*1 Use either one of these two grounding terminals on the main circuit terminal block.

\*2 Perform wiring as necessary.

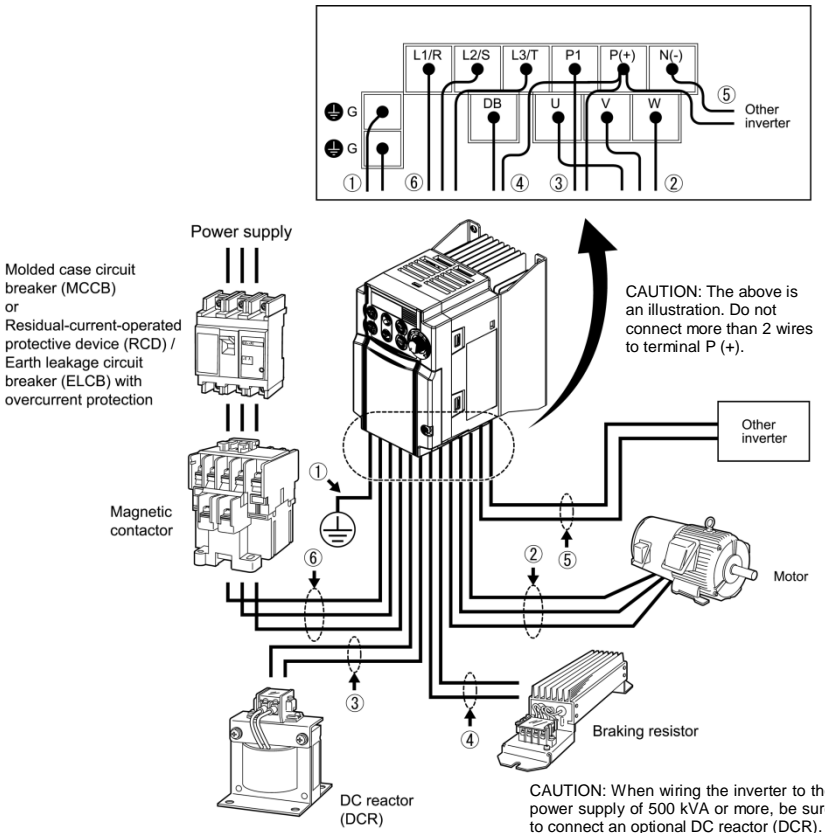


Figure 2.3 Wiring Procedure for Peripheral Equipment

The wiring procedure for the **GMD-00075L** is given below as an example. For other inverter types, perform wiring in accordance with their individual terminal arrangement. (Refer to page 2-3.)

### C Grounding terminal (⚡G)

Be sure to ground either of the two grounding terminals for safety and noise reduction. It is stipulated by the Electric Facility Technical Standard that all metal frames of electrical equipment must be grounded to avoid electric shock, fire and other disasters.

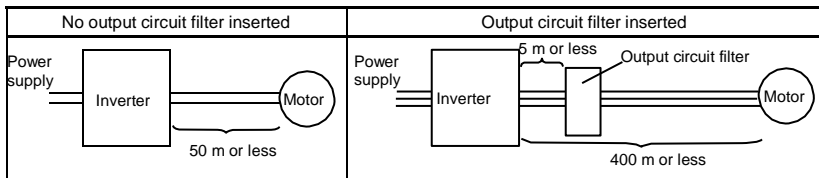
Grounding terminals should be grounded as follows:

- 1) Ground the inverter in compliance with the national or local electric code.
- 2) Connect a thick grounding wire with a large surface area. Keep the wiring length as short as possible.

### d Inverter output terminals, U, V, W and grounding terminal (⚡G)

- 1) Connect the three wires of the three-phase motor to terminals U, V, and W, aligning phases each other.
- 2) Connect the grounding wire of terminals U, V, and W to the grounding terminal (⚡G).

- Note** - The wiring length between the inverter and motor should not exceed 50 m. If it exceeds 50 m, it is recommended that an output circuit filter (option) be inserted.
- Do not use one multicore cable to connect several inverters with motors.



- Note**
- Do not connect a phase-advancing capacitor or surge absorber to the inverter's output lines (secondary circuit).
  - If the wiring length is long, the stray capacitance between the wires will increase, resulting in an outflow of the leakage current. It will activate the overcurrent protection, increase the leakage current, or will not assure the accuracy of the current display. In the worst case, the inverter could be damaged.
  - If more than one motor is to be connected to a single inverter, the wiring length should be the total length of the wires to the motors.

**Note** Driving 400 V series motor

- If a thermal relay is installed in the path between the inverter and the motor to protect the motor from overheating, the thermal relay may malfunction even with a wiring length shorter than 50 m. In this situation, add an output circuit filter (option) or lower the carrier frequency (Function code F26: Motor sound (Carrier frequency)).
- If the motor is driven by a PWM-type inverter, surge voltage that is generated by switching the inverter component may be superimposed on the output voltage and may be applied to the motor terminals. Particularly if the wiring length is long, the surge voltage may deteriorate the insulation resistance of the motor. Consider any of the following measures.
  - Use a motor with insulation that withstands the surge voltage.
  - Connect an output circuit filter (option) to the output terminals (secondary circuits) of the inverter.
  - Minimize the wiring length between the inverter and motor (10 to 20 m or less).

**DC reactor terminals, P1 and P (+)**

- 1) Remove the jumper bar from terminals P1 and P(+).
- 2) Connect a DC reactor (option) to terminals P1 and P(+).

- Note**
- The wiring length should be 10 m or below.
  - If both a DC reactor and a braking resistor are to be connected to the inverter, secure both wires of the DC reactor and braking resistor together to terminal P(+).
  - Do not remove the jumper bar if a DC reactor is not going to be used.

**⚠ WARNING**

When wiring the inverter to the power supply of 500 kVA or more, be sure to connect an optional DC reactor (DCR).

**Otherwise, fire could occur.**

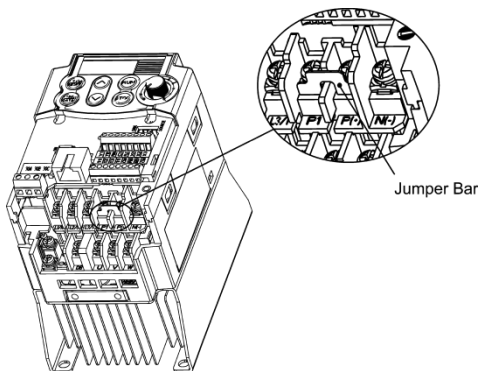


Figure 2.4 Location of Jumper Bar



## **F** Braking resistor terminals, P(+) and DB

- 1) Connect terminals P and DB of a braking resistor (option) to terminals P(+) and DB on the main circuit terminal block.
- 2) Arrange the inverter and braking resistor to keep the wiring length to 5 m or less and twist the two wires or route them together in parallel.



**Note** Do not connect a braking resistor to any inverter of **GMD-00040L.../S...** or below. (Even if connected, the braking resistor will not work.)

### **WARNING**

Never insert a braking resistor between terminals P(+) and N(-), P1 and N(-), P(+) and P1, DB and N(-), or P1 and DB.

**Doing so could cause fire.**

### **When a DC reactor is not to be connected together with the braking resistor**

- 1) Remove the screws from terminals P(+) and P1, together with the jumper bar.
- 2) Connect the wire from terminal P of the braking resistor to terminal P(+) of the inverter and put the jumper bar back into place. Then secure the wire and jumper bar with the screw.
- 3) Tighten the screw of terminal P1 on the jumper bar.
- 4) Connect the wire from terminal DB of the braking resistor to the DB of the inverter.

### **When connecting a DC reactor together with the braking resistor**

- 1) Remove the screw from terminal P(+).
- 2) Overlap the DC reactor wire and braking resistor wire (P) and then secure them to terminal P(+) of the inverter with the screw.
- 3) Connect the wire from terminal DB of the braking resistor to terminal DB of the inverter.
- 4) Do not use the jumper bar.

## **G** DC link bus terminals, P (+) and N (-)

These are provided for the DC link bus powered system. Connect these terminals with terminals P(+) and N (-) of other inverters.



**Note** Consult your **GMCNT** representative if these terminals are to be used.



## h Main circuit power input terminals, L1/R, L2/S, and L3/T (for three-phase voltage input) or L1/L and L2/N (for single-phase voltage input)

- 1) For safety, make sure that the molded case circuit breaker (MCCB) or magnetic contactor (MC) is turned off before wiring the main circuit power input terminals.
- 2) Connect the main circuit power supply wires (L1/R, L2/S and L3/T or L1/L and L2/N) to the input terminals of the inverter via an MCCB or residual-current-operated protective device (RCD)/earth leakage circuit breaker (ELCB)\*, and MC if necessary.

It is not necessary to align phases of the power supply wires and the input terminals of the inverter with each other.

\* With overcurrent protection

**Tip** It is recommended that a magnetic contactor be inserted which can be manually activated. This is to allow you to disconnect the inverter from the power supply in an emergency (e.g., when the protective function is activated) so as to prevent a failure or accident from causing the secondary problems.

### 2.3.6 Wiring for control circuit terminals

#### **WARNING**

In general, sheaths and covers of the control signal cables and wires are not specifically designed to withstand a high electric field (i.e., reinforced insulation is not applied). Therefore, if a control signal cable or wire comes into direct contact with a live conductor of the main circuit, the insulation of the sheath or the cover might break down, which would expose the signal wire to a high voltage of the main circuit. Make sure that the control signal cables and wires will not come into contact with live conductors of the main circuit.

**Failure to observe these precautions could cause electric shock and/or an accident.**

#### **CAUTION**

Noise may be emitted from the inverter, motor and wires.

Implement appropriate measure to prevent the nearby sensors and devices from malfunctioning due to such noise.

**An accident could occur.**

Table 2.8 lists the symbols, names and functions of the control circuit terminals. The wiring to the control circuit terminals differs depending upon the setting of the function codes, which reflects the use of the inverter.

Put back the main circuit terminal block cover and then connect wires to the control circuit terminals. Route these wires correctly to reduce the influence of noise.

Table 2.8 Symbols, Names and Functions of the Control Circuit Terminals

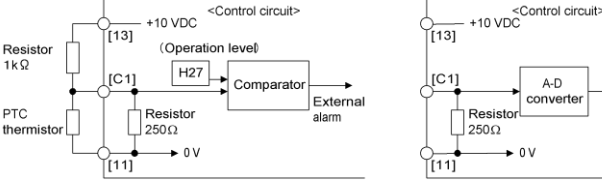
Classification	Symbol	Name	Functions
Analog input	[13]	Power supply for potentiometer	<p>Power supply (+10 VDC) for an external frequency command potentiometer (Potentiometer: 1 to 5 k<math>\Omega</math>)</p> <p>A potentiometer of 1/2 W rating or more should be connected</p> <p>Allowable maximum output current: 10mA.</p>
	[12]	Analog setting voltage input	<p>(1) The frequency is commanded according to the external analog input voltage.</p> <p>0 to +10 (VDC)/0 to 100 (%) (Normal operation)</p> <p>+10 to 0 (VDC)/0 to 100 (%) (Inverse operation)</p> <p>(2) Used for reference signal (PID process command) or PID feedback signal.</p> <p>(3) Used as additional auxiliary setting for various main frequency commands.</p> <p>* Input impedance: 22 k<math>\Omega</math></p> <p>* The allowable maximum input is +15 VDC; however, the voltage higher than +10 VDC is treated as +10 VDC.</p>
	[C1]	Current input	<p>(1) The frequency is commanded according to the external analog input current.</p> <p>+4 to +20 mA DC/0 to 100% (Normal operation)</p> <p>+20 to +4 mA DC/0 to 100% (Inverse operation)</p> <p>+0 to +20 mA DC/0 to 100% (Normal operation)</p> <p>+20 to 0 mA DC/0 to 100% (Inverse operation)</p> <p>(2) Used for reference signal (PID process command) or PID feedback signal.</p> <p>(3) Connects PTC (Positive Temperature Coefficient) thermistor for motor protection.</p> <p>(4) Used as additional auxiliary setting for various main frequency commands.</p> <p>* Input impedance: 250<math>\Omega</math></p> <p>* The allowable maximum input is +30 mA DC; however, the current larger than +20 mA DC is treated as +20 mA DC.</p> 
[11]	Analog common	Common terminal for analog input and output signals	This terminal is electrically isolated from terminals [CM] and [Y1E].

Table 2.8 Symbols, Names and Functions of the Control Circuit Terminals (Continued)


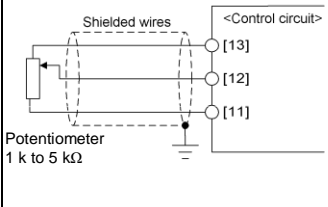
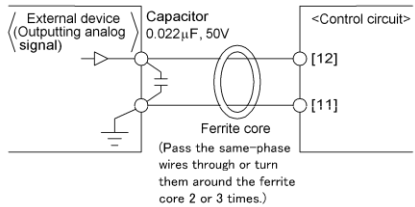
Classification	Symbol	Name	Functions
Analog input			<ul style="list-style-type: none"> <li>- These low level analog signals are especially susceptible to the external noise effects. Route the wiring as short as possible (within 20 m) and use shielded wires. In principle, ground the shielded sheath of wires; if effects of external inductive noises are considerable, connection to terminal [11] may be effective. As shown in Figure 2.5, ground the single end of the shield to enhance the shield effect.</li> <li>- Use a twin-contact relay for low level signals if the relay is used in the control circuit. Do not connect the relay's contact to terminal [11].</li> <li>- When the inverter is connected to an external device outputting analog signals, the external device may malfunction due to electric noise generated by the inverter. If this happens, according to the circumstances, connect a ferrite core (a toroidal core or equivalent) to the device outputting analog signals or connect a capacitor having the good cut-off characteristics for high frequency between control signal wires as shown in Figure 2.6.</li> <li>- Do not apply a voltage of +7.5 VDC or higher to terminal [C1]. Doing so could damage the internal control circuit.</li> </ul>
			
		Figure 2.5 Connection of Shielded Wire	Figure 2.6 Example of Electric Noise Reduction

Table 2.8 Symbols, Names and Functions of the Control Circuit Terminals (Continued)

Classification	Symbol	Name	Functions																						
Digital input	[X1]	Digital input 1	(1) The various signals such as "Coast to a stop," "Enable external alarm trip," and "Select multistep frequency" can be assigned to terminals [X1] to [X3], [FWD] and [REV] by setting function codes E01 to E03, E98, and E99. For details, refer to Chapter 5, Section 5.2 "Details of Function Codes."  (2) Input mode, i.e. Sink/Source, is changeable by using the internal jumper switch.																						
	[X2]	Digital input 2																							
	[X3]	Digital input 3																							
	[FWD]	Run forward command	(3) Switches the logic value (1/0) for ON/OFF of the terminals between [X1] to [X3], [FWD] or [REV], and [CM]. If the logic value for ON between [X1] and [CM] is 1 in the normal logic system, for example, OFF is 1 in the negative logic system and vice versa.																						
	[REV]	Run reverse command	(4) The negative logic signaling cannot be applicable to [FWD] and [REV].  Digital input circuit specifications																						
		<table border="1"> <thead> <tr> <th>Item</th> <th>Min.</th> <th>Max.</th> </tr> </thead> <tbody> <tr> <td rowspan="2">Operation voltage (SINK)</td> <td>ON level</td> <td>0 V</td> <td>2 V</td> </tr> <tr> <td>OFF level</td> <td>22 V</td> <td>27 V</td> </tr> <tr> <td rowspan="2">Operation voltage (SOURCE)</td> <td>ON level</td> <td>22 V</td> <td>27 V</td> </tr> <tr> <td>OFF level</td> <td>0 V</td> <td>2 V</td> </tr> <tr> <td>Operation current at ON (Input Voltage at 0 V)</td> <td>2.5 mA</td> <td>5 mA</td> </tr> <tr> <td>Allowable leakage current at OFF</td> <td>-</td> <td>0.5 mA</td> </tr> </tbody> </table>	Item	Min.	Max.	Operation voltage (SINK)	ON level	0 V	2 V	OFF level	22 V	27 V	Operation voltage (SOURCE)	ON level	22 V	27 V	OFF level	0 V	2 V	Operation current at ON (Input Voltage at 0 V)	2.5 mA	5 mA	Allowable leakage current at OFF	-	0.5 mA
Item	Min.	Max.																							
Operation voltage (SINK)	ON level	0 V	2 V																						
	OFF level	22 V	27 V																						
Operation voltage (SOURCE)	ON level	22 V	27 V																						
	OFF level	0 V	2 V																						
Operation current at ON (Input Voltage at 0 V)	2.5 mA	5 mA																							
Allowable leakage current at OFF	-	0.5 mA																							
[PLC]	PLC signal power	Connects to PLC output signal power supply. Rated voltage: +24 VDC (Allowable range: +22 to +27 VDC), Max. 50 mA																							
[CM]	Digital common	Common terminal for digital input signals This terminal is electrically isolated from terminals [11] and [Y1E].																							

Table 2.8 Symbols, Names and Functions of the Control Circuit Terminals (Continued)

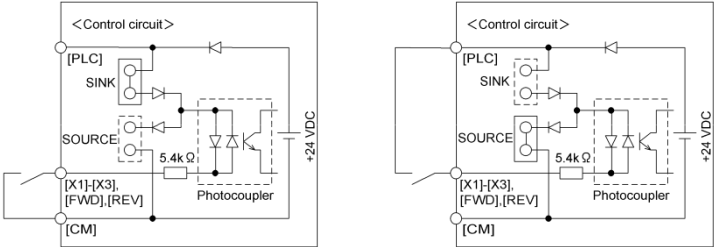
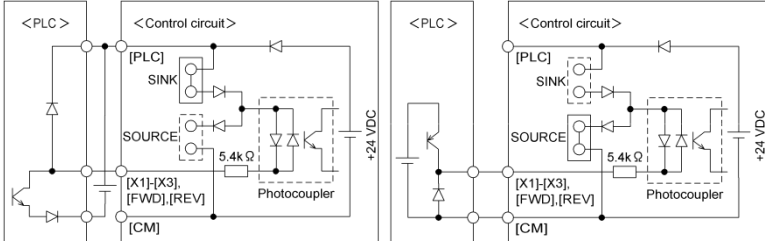
Classification	Symbol	Name	Functions
Digital input	<p><b>Tip</b></p>	<p><b>.. Using a relay contact to turn [X1], [X2], [X3], [FWD] or [REV] ON or OFF</b></p>	<p>Figure 2.7 shows two examples of a circuit that uses a relay contact to turn control signal input [X1], [X2], [X3], [FWD] or [REV] ON or OFF. Circuit (a) has a connecting jumper applied to SINK, whereas circuit (b) has one that is applied to SOURCE.</p> <p><b>Note:</b> To configure this kind of circuit, use a highly reliable relay. (Recommended product: Fuji control relay Model HH54PW)</p> 
		<p><b>.. Using a programmable logic controller (PLC) to turn [X1], [X2], [X3], [FWD] or [REV] ON or OFF</b></p>	<p>Figure 2.8 shows two examples of a circuit that uses a programmable logic controller (PLC) to turn control signal input [X1], [X2], [X3], [FWD] or [REV] ON or OFF. Circuit (a) has a connecting jumper applied to SINK, whereas circuit (b) has one that is applied to SOURCE.</p> <p>In circuit (a) below, short-circuiting or opening the transistor's open collector circuit in the PLC using an external power source turns control signal [X1], [X2], [X3], [FWD] or [REV] ON or OFF. When using this type of circuit, observe the following:</p> <ul style="list-style-type: none"> <li>- Connect the + node of the external power source (which should be isolated from the PLC's power) to terminal [PLC] of the inverter.</li> <li>- Do not connect terminal [CM] of the inverter to the common terminal of the PLC.</li> </ul>
			 <p>(a) With a jumper applied to SINK</p> <p>(b) With a jumper applied to SOURCE</p> <p>Figure 2.8 Circuit Configuration Using a PLC</p> <p>For details about the jumper setting, refer to Section 2.3.7 "Setting up the jumper switches."</p>

Table 2.8 Symbols, Names and Functions of the Control Circuit Terminals (Continued)

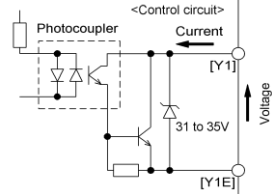

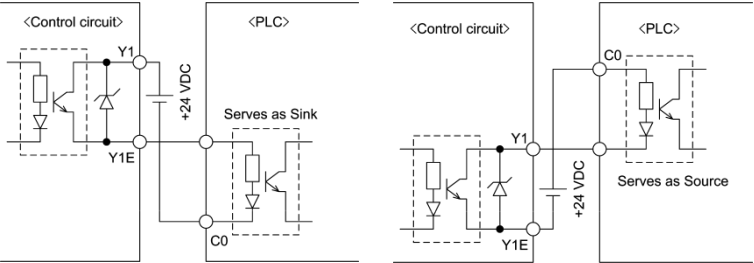
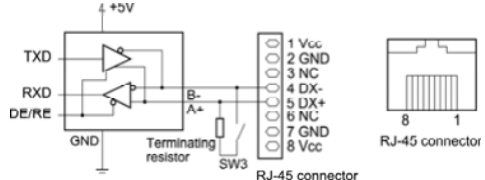
Classification	Symbol	Name	Functions
Analog output	[FMA]	Analog monitor	<p>The monitor signal for analog DC voltage (0 to +10 VDC) is output. The signal functions can be selected from the following with function code F31.</p> <ul style="list-style-type: none"> <li>- Output frequency (before slip compensation)</li> <li>- Output frequency (after slip compensation)</li> <li>- Output current</li> <li>- Input power</li> <li>- DC link bus voltage</li> <li>- PID command (SV)</li> <li>- Output voltage</li> <li>- PID feedback amount</li> <li>- Calibration</li> <li>- PID output (MV)</li> </ul> <p>*Input impedance of external device: Min. 5 k<math>\Omega</math></p>
	[11]	Analog common	<p>Common terminal for analog input and output signals</p> <p>This terminal is electrically isolated from terminals [CM] and [Y1E].</p>
Transistor output	[Y1]	Transistor output	<p>(1) Various signals such as "Inverter running," "Frequency arrival signal" and "Motor overload early warning" can be assigned to terminal [Y1] by setting function code E20. Refer to Chapter 5, Section 5.2 "Details of Function Codes."</p> <p>(2) Switches the logic value (1/0) for ON/OFF of the terminals between [Y1] and [Y1E]. If the logic value for ON between [Y1] and [Y1E] is 1 in the normal logic system, for example, OFF is 1 in the negative logic system and vice versa.</p> <p><u>Digital input circuit specification</u></p>  <p>Figure 2.9 shows examples of connection between the control circuit and a PLC.</p> <p><b>Note</b></p> <ul style="list-style-type: none"> <li>- Check the polarity of the external power inputs.</li> <li>- When connecting a control relay, first connect a surge-absorbing diode across the coil of the relay.</li> </ul>
	[PLC]	Transistor output power	<p>Power source of +24 VDC to be fed to the transistor output circuit load (50 mA at maximum).</p> <p>To enable the source, it is necessary to short-circuit between terminals [Y1E] and [CM].</p> <p>Can also be used as a 24 VDC power source.</p>
	[Y1E]	Transistor output common	<p>Common terminal for transistor output signal</p> <p>This terminal is electrically isolated from terminals [CM] and [11].</p>



Table 2.8 Symbols, Names and Functions of the Control Circuit Terminals (Continued)

Classification	Symbol	Name	Functions
Transistor output		<p><b>.. Connecting programmable controller (PLC) to terminal [Y1]</b></p> <p>Figure 2.9 shows two examples of circuit connection between the transistor output of the inverter's control circuit and a PLC. In example (a), the input circuit of the PLC serves as a sink for the control circuit, whereas in example (b), it serves as a source for the control circuit.</p>	 <p>(a) PLC serving as sink</p> <p>(b) PLC serving as source</p> <p>Figure 2.9 Connecting PLC to Control Circuit</p>
		Relay contact output	<p>[30A], [30B], [30C]</p> <p>Alarm relay output (for any fault)</p>
Communication	<p>RJ-45 connector (RS-485)</p>		<ol style="list-style-type: none"> <li>(1) Used to connect an optional keypad to the inverter.</li> <li>(2) Used to connect the inverter to a computer running FRENIC Loader via the RS-485 communications link. (For the terminating resistor, refer to Section 2.3.7.)</li> </ol>  <p>Figure 2.10 RJ-45 Connector and its Pin Assignment</p> <p>*Pins 1, 2, 7 and 8 are exclusively assigned to power lines for an optional keypad. When connecting any other device to the RJ-45 connector, do not use those pins. For the location of the RJ-45 connector, refer to Figure 2.11 "Locations of Jumper Switches and RJ-45 Connector."</p>



- Route the wiring of the control terminals as far from the wiring of the main circuit as possible. Otherwise electric noise may cause malfunctions.
- Fix the control circuit wires inside the inverter to keep them away from the live parts of the main circuit (such as the terminal block of the main circuit).

### 2.3.7 Setting up the jumper switches



Before changing the jumper switches, turn OFF the power and wait at least five minutes. Make sure that the LED monitor is turned OFF. Further, make sure, using a multimeter or a similar instrument, that the DC link bus voltage between terminals P (+) and N (-) has dropped to the safe level (+25 VDC or below).

**An electric shock may result if this warning is not heeded as there may be some residual electric charge in the DC link bus capacitor even after the power has been turned OFF.**

Switching the jumper switches (shown in Figure 2.11) allows you to customize the specifications of the digital I/O terminals and the RS-485 communication terminating resistor.

To access the jumper switches, remove the terminal block covers.

For details on how to remove the terminal block covers, refer to Section 2.3.1.

Table 2.9 lists function of each jumper switch.

Table 2.9 Function of Jumper Switches

Switch	Function
① SW1	<p><u>SINK/SOURCE switch for digital input terminals</u></p> <ul style="list-style-type: none"> <li>• To use digital input terminals [X1] to [X3], [FWD] and [REV] in the SINK mode, set a jumper in the sink position, to use them in the SOURCE mode, set a jumper in the source position. (See Figure 2.11.)</li> <li>• To switch between SINK and SOURCE modes, use a mini needle-nose pliers or the similar tool to change the mounting position of the jumper.</li> </ul>
② SW3	<p><u>Terminating resistor ON/OFF switch for RS-485 communication</u></p> <ul style="list-style-type: none"> <li>• To connect an optional remote keypad, set a jumper in the OFF position (factory default).</li> <li>• If the inverter is connected to the RS-485 communications network as a terminating device, set a jumper in the ON position.</li> <li>• To switch the terminating resistor ON and OFF, use a mini needle-nose pliers or the similar tool to change the mounting position of the jumper.</li> </ul>

Figure 2.11 shows the locations of jumper switches and the RJ-45 connector.

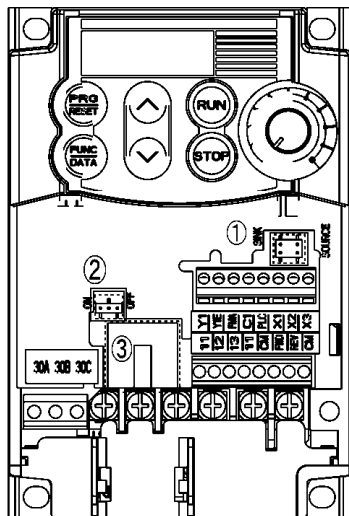






Figure 2.11 Locations of Jumper Switches and RJ-45 Connector

<p>① SW1</p>	<p>SINK</p>  <p>(Factory default for all inverter types)</p>	<p>SOURCE</p> 
<p>② SW3</p>	<p>ON</p> 	<p>OFF</p>  <p>(Factory default for all inverter types)</p>
<p>③ RJ-45 connector</p>		

## Chapter 3 OPERATION USING THE KEYPAD

### 3.1 Names and Functions of Keypad Components

As shown in the figure at right, the keypad consists of a four-digit 7-segment LED monitor, a potentiometer (POT), and six keys.

The keypad allows you to start and stop the motor, monitor running status, configure the function code data, check I/O signal states, and display maintenance information and alarm information.

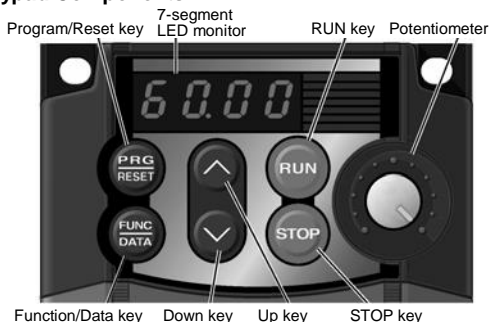


Table 3.1 Names and Functions of Keypad Components

Monitor, Potentiometer and Keys	Functions
	<p>Four-digit, 7-segment LED monitor which displays the following according to the operation modes*.</p> <ul style="list-style-type: none"> <li>„ In Running mode: Running status information (e.g., output frequency, current, and voltage)</li> <li>„ In Programming mode: Menus, function codes and their data</li> <li>„ In Alarm mode: Alarm code which identifies the error factor if the protective function is activated.</li> </ul>
	Potentiometer (POT) which is used to manually set a reference frequency, auxiliary frequencies 1 and 2 or PID process command.
	RUN key. Press this key to run the motor.
	STOP key. Press this key to stop the motor.
	UP/DOWN keys. Press these keys to select the setting items and change the function code data displayed on the LED monitor.
	<p>Program/Reset key which switches the operation modes* of the inverter.</p> <ul style="list-style-type: none"> <li>„ In Running mode: Pressing this key switches the inverter to Programming mode.</li> <li>„ In Programming mode: Pressing this key switches the inverter to Running mode.</li> <li>„ In Alarm mode: Pressing this key after removing the error factor switches the inverter to Running mode.</li> </ul>
	<p>Function/Data key which switches the operation you want to do in each mode as follows:</p> <ul style="list-style-type: none"> <li>„ In Running mode: Pressing this key switches the information to be displayed concerning the status of the inverter (output frequency, output current, output voltage, etc.).</li> <li>„ In Programming mode: Pressing this key displays the function codes and sets their data entered with the  and  keys or the POT.</li> <li>„ In Alarm mode: Pressing this key displays detailed alarm information.</li> </ul>

\* GXX features three operation modes: Running, Programming, and Alarm. Refer to Section 3.2 "Overview of Operation Modes."

## Simultaneous keying

Simultaneous keying means pressing two keys at the same time (expressed by "+"). FRENIC-Mini supports simultaneous keying as listed below.










(For example, the expression "STOP +  keys" stands for pressing the  key while holding down the  key.)

Table 3.2 Simultaneous Keying

Operation mode	Simultaneous keying	Used to:
Running mode	 +  keys	Control entry to/exit from jogging operation.
Programming mode	 +  keys	Change certain function code data. (Refer to function codes F00, H03, H45 and H97 in Chapter 5 "FUNCTION CODES.")
Alarm mode	 +  keys	Switch to Programming mode without clearing alarms.

## About changing of function code data

The function code data can be changed only when the data value displayed on the LED monitor is flashing.

When the data value is lit, no change is allowed. To change the data, stop the inverter or disable the data protection.

## 3.2 Overview of Operation Modes

GMD features the following three operation modes:

- „ Running mode : This mode allows you to enter run/stop commands in regular operation. You can also monitor the running status in real time.
- „ Programming mode : This mode allows you to configure function code data and check a variety of information relating to the inverter status and maintenance.
- „ Alarm mode : If an alarm occurs, the inverter automatically enters the Alarm mode. In this mode, you can view the corresponding alarm code\* and its related information on the LED monitor.

\* Alarm code: Indicates the cause of the alarm condition that has triggered the protective function. For details, refer to Chapter 8, Section 8.5 "Protective Functions."

Figure 3.1 shows the status transition of the inverter between these three operation modes.

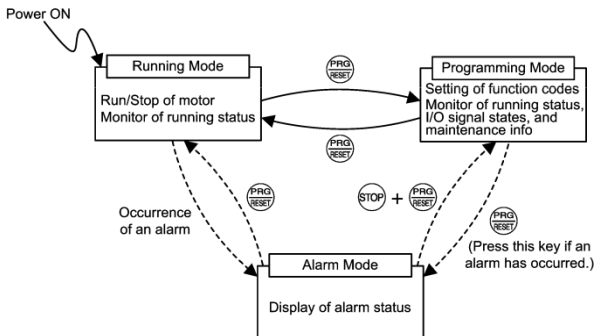


Figure 3.1 Status Transition between Operation Modes



## Chapter 4 RUNNING THE MOTOR

### 4.1 Test Run

#### 4.1.1 Checking prior to powering on

Check the following prior to powering on the inverter.

- (1) Check the wiring to the power input terminals (L1/R, L2/S and L3/T or L1/L and L2/N) and inverter output terminals (U, V and W). Also check that the grounding wires are connected to the grounding terminals correctly. See Figure 4.1.

### ⚠ WARNING ⚠

- Do not connect power supply wires to the inverter output terminals U, V, and W. Otherwise, the inverter may be broken if you turn the power ON.
- Be sure to connect the grounding wires of the inverter and the motor to the ground electrodes. **Otherwise, electric shock may occur.**

- (2) Check the control circuit terminals and main circuit terminals for short circuits or ground faults.
- (3) Check for loose terminals, connectors and screws.
- (4) Check that the motor is separated from mechanical equipment.
- (5) Make sure that all switches of devices connected to the inverter are turned OFF. (Powering on the inverter with any of those switches being ON may cause an unexpected motor operation.)
- (6) Check that safety measures are taken against runaway of the equipment, e.g., a defense to prevent people from access to the equipment.

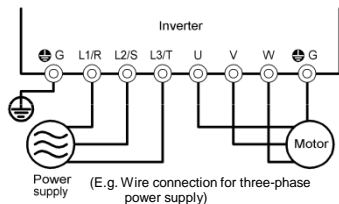


Figure 4.1 Connection of Main Circuit Terminals

#### 4.1.2 Powering ON and checking

### ⚠ WARNING ⚠

- Be sure to mount the terminal block covers before turning the power ON. Do not remove any cover while powering on.
- Do not operate switches with wet hands. **Otherwise electric shock could occur.**

Turn the power ON and check the following points. This is a case when no function code data is changed from the factory defaults.

- (1) Check that the LED monitor displays \*00 (indicating that the frequency command is 0 Hz) that is blinking. (See Figure 4.2.)

If the LED monitor displays any number except \*00, use the potentiometer to set \*00.

- (2) Check that the built-in cooling fan rotates. (Inverters of 1.5 kW below are not equipped with a cooling fan.)



Figure 4.2 Display of the LED Monitor after Power-on

#### 4.1.3 Preparation before a test run--Configuring function code data

Before running the motor, configure function code data specified in Table 4.1 in accordance with the motor ratings and your system design values. The motor ratings are printed on the nameplate of the motor. For your system design values, ask system designers about them.

- For details about how to change function code data, refer to Chapter 3, Section 3.4.1

"Setting

the function codes – "Data Setting." Refer to the function code H03 in Chapter 5 "FUNCTION CODES" for the factory defaults of motor parameters. If any of them is different from the default setting, change the function code data.

- When using a PMSM, refer to Chapter 5, Section 5.3 "Notes in Driving PMSM."

Table 4.1 Settings of Function Code Data before a Test Run

Function code	Name	Function code data	Factory setting
f 04 (a 02)	Base frequency	Motor ratings (printed on the nameplate of the motor)	60.0 (Hz)
f 05 (a 03)	Rated voltage at base frequency		0 (V)
			0 (V)
p 02 (a 16)	Motor parameter (Rated capacity)		Applicable motor rated capacity
p 03 (a 17)	Motor parameter (Rated current)		Rated current of applicable motor
p 99 (a 39)	Motor selection	0: Motor characteristics 0 (Fuji standard 8-series motors)	
f 03 (a 01)	Maximum frequency	System design values * For a test-driving of the motor, increase values so that they are longer than your system design values. If the set time is short, the inverter may not start running the motor.	60.0 (Hz)
f 07	Acceleration time 1*		6.00 (s)
f 08	Deceleration time 1*		6.00 (s)



#### 4.1.4 Test run

### WARNING

If the user configures the function codes wrongly without completely understanding this Instruction Manual and the FRENIC-Mini User's Manual, the motor may rotate with a torque or at a speed not permitted for the machine.





**Accident or injury may result.**

Follow the descriptions given in Section 4.1.1 "Checking prior to powering on" to Section 4.1.3 "Preparation before a test," then begin the test run of the motor.

### CAUTION




If any abnormality is found in the inverter or motor, immediately stop operation and investigate the cause referring to Chapter 6 "TROUBLESHOOTING."

#### ----- Test Run Procedure -----

- (1) Turn the power ON and check that the reference frequency \*00 Hz is blinking on the LED monitor.
- (2) Set a low reference frequency such as 5 Hz, using  /  keys. (Check that the frequency is blinking on the LED monitor.)
- (3) Press the  key to start running the motor in the forward direction. (Check that the reference frequency is displayed on the LED monitor.)
- (4) To stop the motor, press the  key.

#### < Check points during a test run >

- Check that the motor is running in the forward direction.
- Check for smooth rotation without motor humming or excessive vibration.
- Check for smooth acceleration and deceleration.

When no abnormality is found, press the  key again to start driving the motor, then increase the reference frequency using  /  keys. Check the above points again.

If any problem is found, modify the function code data again as described below.

-----

## 4.2 Operation

After confirming that the inverter normally drives the motor in a test run, make mechanical connections (connections to the machine system) and electrical connections (wiring and cabling), and configure the necessary function codes properly before starting a production run.



Depending on the production run conditions, further adjustments may be required, such as adjustments of torque boost (F09, A05), acceleration time (F07, E10), and deceleration time (F08, E11).



## Chapter 5 FUNCTION CODES







### 5.1 Function Code Tables

Function codes enable the **GMD** series of inverters to be set up to match your system requirements.

Each function code consists of a 3-letter alphanumeric string. The first letter is an alphabet that identifies its group and the following two letters are numerals that identify each individual code in the group. The function codes are classified into eight groups: Fundamental Functions (F codes), Extension Terminal Functions (E codes), Control Functions (C codes), Motor 1 Parameters (P codes), High Performance Functions (H codes), Motor 2 Parameters (A codes), Application Functions (J codes) and Link Functions (Y codes). To determine the property of each function code, set data to the function code.

#### .. Changing, validating, and saving function code data when the motor is running

Function codes are indicated by the following based on whether they can be changed or not when the inverter is running:

Notation	Change when running	Validating and saving function code data
Y*	Possible	If the data of the codes marked with Y* is changed, the change will immediately take effect; however, the change is not saved into the inverter's memory. To save the change, press the  key. If you press the  key without pressing the  key to exit the current state, then the changed data will be discarded and the previous data will take effect for the inverter operation.
Y	Possible	The data of the codes marked with Y can be changed with the  and  keys regardless of whether the motor is running or not. Pressing the  key will make the change effective and save it into the inverter's memory.
N	Impossible	—

#### .. Copying data

Connecting an optional remote keypad enables you to copy the function code data stored in the inverter's memory into the keypad's memory (refer to Menu #7 "Data copying" in Programming mode). With this feature, you can easily transfer all function code data saved in a source inverter to other destination inverters.

If the specifications of the source and destination inverters differ, some code data may not be copied to ensure safe operation of your power system. Therefore, you need to set up the uncopied code data individually as necessary. Whether data will be copied or not is detailed with the following symbols in the "Data copy" column of the function code tables given below.

Y: Will be copied unconditionally.

Y1: Will not be copied if the rated capacity differs from the source inverter.

Y2: Will not be copied if the rated input voltage differs from the source inverter.

N: Will not be copied. (Function codes marked with an "N" are not subject to Verify operation, either.)

It is recommended that you set up those function codes which are not subject to the Copy operation individually using Menu #1 "Data setting" as necessary.

Refer to the Remote Keypad Instruction Manual (INR-SI47-0843-E) for details.

### „ Using negative logic for programmable I/O terminals

The negative logic signaling system can be used for digital input terminals and transistor output terminals by setting the function code data specifying the properties for those terminals. Negative logic refers to the inverted ON/OFF (logical value 1 (true)/0 (false)) state of input or output signal. An active-ON signal (the function takes effect if the terminal is short-circuited.) in the normal logic system is functionally equivalent to active-OFF signal (the function takes effect if the terminal is opened.) in the negative logic system. An active-ON signal can be switched to active-OFF signal, and vice versa, with the function code data setting.

To set the negative logic system for an input or output terminal, enter data of 1000s (by adding 1000 to the data for the normal logic) in the corresponding function code.

Example: "Coast to a stop" command **BX** assigned to any of digital input terminals [X1] to [X3] using any of function codes E01 through E03.

Function code data	<b>BX</b>
7	Turning <b>BX</b> ON causes the motor to coast to a stop. (Active ON)
1007	Turning <b>BX</b> OFF causes the motor to coast to a stop. (Active OFF)

### „ Limitation of data displayed on the LED monitor

Only four digits can be displayed on the 4-digit LED monitor. If you enter more than 4 digits of data valid for a function code, any digits after the 4th digit of the set data will not be displayed; however they will be processed correctly.

The following tables list the function codes available for the **GMD** series of inverters.

### **F codes: Fundamental Functions**

Code	Name	Data setting range	Increment	Unit	Change when running	Data copying	Default setting
F00	Data Protection	0: Disable both data protection and digital reference protection 1: Enable data protection and disable digital reference protection 2: Disable data protection and enable digital reference protection 3: Enable both data protection and digital reference protection	–	–	Y	Y	0
F01	Frequency Command 1	0: UP/DOWN keys on keypad 1: Voltage input to terminal [12] (0 to +10 VDC) 2: Current input to terminal [C1] (4 to 20 mA DC) 3: Sum of voltage and current inputs to terminals [12] and [C1] 4: Built-in potentiometer (POT) 7: Terminal command <b>UP/DOWN</b> control	–	–	N	Y	4

Code	Name	Data setting range	Increment	Unit	Change when running	Data copying	Default setting
F02	Operation Method	0: RUN/STOP keys on keypad (Motor rotational direction specified by terminal command <b>FWD/REV</b> ) 1: Terminal command <b>FWD</b> or <b>REV</b> 2: RUN/STOP keys on keypad (forward) 3: RUN/STOP keys on keypad (reverse)	-	-	N	Y	2
F03	Maximum Frequency 1	25.0 to 400.0	0.1	Hz	N	Y	ACU:60.0 E:50.0
F04	Base Frequency 1	25.0 to 400.0	0.1	Hz	N	Y	AU:60.0 CE:50.0
F05	Rated Voltage at Base Frequency 1	0: Output a voltage in proportion to input voltage  80 to 240: Output an AVR-controlled voltage (for 200 V class series) 160 to 500: Output an AVR-controlled voltage (for 400 V class series)	1	V	N	Y2	ACE:0 U:230/ 460
F06	Maximum Output Voltage 1	80 to 240: Output an AVR-controlled voltage (for 200 V class series) 160 to 500: Output an AVR-controlled voltage (for 400 V class series)	1	V	N	Y2	A: 220/ 380 C:200/ 380 E: 230/ 400 U:230/ 460
F07	Acceleration Time 1	0.00 to 3600 Note: Entering 0.00 cancels the acceleration time, requiring external soft-start.	0.01	s	Y	Y	6.00
F08	Deceleration Time 1	0.00 to 3600 Note: Entering 0.00 cancels the deceleration time, requiring external soft-start.	0.01	s	Y	Y	6.00
F09	Torque Boost 1	0.0 to 20.0 (percentage with respect to "F05: Rated Voltage at Base Frequency 1") Note: This setting takes effect when F37 = 0, 1, 3, or 4.	0.1	%	Y	Y	ACE: See Table A. U:0.0
F10	Electronic Thermal Overload Protection for Motor 1 (Motor characteristics)	1: For a general-purpose motor and Fuji standard permanent magnet synchronous motor with shaft-driven cooling fan 2: For an inverter-driven motor with separately powered cooling fan	-	-	Y	Y	1
F11	(Overload detection level)	0.00: Disable, 0.01 to 100.0 1 to 135% of the rated current (allowable continuous drive current) of the motor	0.01	A	Y	Y1 Y2	See Table A.
F12	(Thermal time constant)	0.5 to 75.0	0.1	min	Y	Y	5.0
F14	Restart Mode after Momentary Power Failure (Mode selection)	0: Disable restart (Trip immediately) 1: Disable restart (Trip after a recovery from power failure) 2: Trip after decelerate-to-stop *1 4: Enable restart (Restart at the frequency at which the power failure occurred, for general loads) 5: Enable restart (Restart at the starting frequency)	-	-	Y	Y	AC:1 EU:0
F15	Frequency Limiter (High)	0.0 to 400.0	0.1	Hz	Y	Y	70.0
F16	(Low)	0.0 to 400.0	0.1	Hz	Y	Y	0.0

\*1 Available in the ROM version 0800 or later.

## (F codes continued)

Code	Name	Data setting range	Increment	Unit	Change when running	Data copying	Default setting
F18	Bias (Frequency command 1)	-100.00 to 100.00 *2	0.01	%	Y*	Y	0.00
F20	DC Braking 1 (Braking starting frequency)	0.0 to 60.0	0.1	Hz	Y	Y	0.0
F21	(Braking level)	0 to 100	1	%	Y	Y	0
F22	(Braking time)	0.00 (Disable), 0.01 to 30.00	0.01	s	Y	Y	0.00
F23	Starting Frequency 1	0.1 to 60.0	0.1	Hz	Y	Y	1.0
F24	(Holding time)	0.00 to 10.00	0.01	s	Y	Y	0.00
F25	Stop Frequency	0.1 to 60.0	0.1	Hz	Y	Y	0.2
F26	Motor Sound (Carrier frequency)	0.75 to 16	1	kHz	Y	Y	ACU:2 E:15
F27	(Tone)	0: Level 0 (Inactive) 1: Level 1 2: Level 2 3: Level 3	-	-	Y	Y	0
F30	Analog Output [FMA] (Voltage adjustment)	0 to 300	1	%	Y*	Y	100
F31	(Function)	Select a function to be monitored from the followings. 0: Output frequency 1 (before slip compensation) 1: Output frequency 2 (after slip compensation) 2: Output current 3: Output voltage 6: Input power 7: PID feedback amount (PV) 9: DC link bus voltage 14: Calibration 15: PID command (SV) 16: PID output (MV)	-	-	Y	Y	0
F37	Load Selection/Auto Torque Boost/ Auto Energy Saving Operation 1	0: Variable torque load 1: Constant torque load 2: Auto-torque boost 3: Auto-energy saving operation (Variable torque load during ACC/DEC) 4: Auto-energy saving operation (Constant torque load during ACC/DEC) 5: Auto-energy saving operation (Auto-torque boost during ACC/DEC)	-	-	N	Y	1
F39	Stop Frequency (Holding Time)	0.00 to 10.00	0.01	s	Y	Y	0.00
F42	Control Mode Selection 1	0: V/f control with slip compensation inactive 1: Dynamic torque vector control 2: V/f control with slip compensation active 11: V/f control for PMSM drive *1	-	-	N	Y	0

\*1 Available in the ROM version 0800 or later.

\*2 When you make settings from the keypad, the incremental unit is restricted by the number of digits that the LED monitor can display.

(Example) If the setting range is from -200.00 to 200.00, the incremental unit is:

"1" for -200 to -100, "0.1" for -99.9 to -10.0 and for 100.0 to 200.0, and "0.01" for -9.99 to -0.01 and for 0.00 to 99.99.

## (F codes continued)

Code	Name	Data setting range	Increment	Unit	Change when running	Data copying	Default setting
F43	Current Limiter (Mode selection)	0: Disable (No current limiter works.) 1: Enable at constant speed (Disable during ACC/DEC) 2: Enable during ACC/constant speed operation	—	—	Y	Y	2
F44	(Level)	3.7 kW or below 20 to 180 (The data is interpreted as the rated output current of the inverter for 100%.)	1	%	Y	Y	160
		5.5 kW or below 20 to 200180 (The data is interpreted as the rated output current of the inverter for	1	%	Y	Y	180
F50	Electronic Thermal Overload Protection for Braking Resistor (Discharging capability) (Allowable average loss)	1 to 900, OFF (Cancel)	1	kWs	Y	Y1 Y2	OFF
F51		0.001 to 50.00	0.001	kW	Y	Y1 Y2	0.001

## E codes: Extension Terminal Functions

Code	Name	Data setting range	Increment	Unit	Change when running	Data copying	Default setting
E01	Terminal [X1] Function	Selecting function code data assigns the corresponding function to terminals [X1] to [X3] as listed below.	-	-	N	Y	0
E02	Terminal [X2] Function	0 (1000): Select multistep frequency ( <b>SS1</b> )	-	-	N	Y	7
E03	Terminal [X3] Function	1 (1001): Select multistep frequency ( <b>SS2</b> ) 2 (1002): Select multistep frequency ( <b>SS4</b> ) 3 (1003): Select multistep frequency ( <b>SS8</b> ) 4 (1004): Select ACC/DEC time ( <b>RT1</b> ) 6 (1006): Enable 3-wire operation ( <b>HLD</b> ) 7 (1007): Coast to a stop ( <b>BX</b> ) 8 (1008): Reset alarm ( <b>RST</b> ) 9 (1009): Enable external alarm trip ( <b>THR</b> ) 10 (1010): Ready for jogging ( <b>JOG</b> ) 11 (1011): Select frequency command 2/1 ( <b>Hz2/Hz1</b> ) 12 (1012): Select motor 2/motor 1 ( <b>M2/M1</b> ) 13: Enable DC braking ( <b>DCBRK</b> ) 17 (1017): UP (Increase output frequency) ( <b>UP</b> ) 18 (1018): DOWN (Decrease output frequency) ( <b>DOWN</b> ) 19 (1019): Enable data change with keypad ( <b>WE-KP</b> ) 20 (1020): Cancel PID control ( <b>Hz/PID</b> ) 21 (1021): Switch normal/inverse operation ( <b>IVS</b> ) 24 (1024): Enable communications link via RS-485 ( <b>LE</b> ) 33 (1033): Reset PID integral and differential components ( <b>PID-RST</b> ) 34 (1034): Hold PID integral component ( <b>PID-HLD</b> )  Setting the value in parentheses ( ) shown above assigns a negative logic input (Active-OFF) to a terminal.  Note that, in the case of <b>THR</b> , data "1009" is for normal logic (Active-ON) and "9," for negative logic (Active-OFF).  Signals having no value in parentheses ( ) cannot be used for negative logic.	-	-	N	Y	8
E10	Acceleration Time 2	0.00 to 3600 Note: Entering 0.00 cancels the acceleration time, requiring external soft-start and -stop.	0.01	s	Y	Y	6.00
E11	Deceleration Time 2	0.00 to 3600 Note: Entering 0.00 cancels the deceleration time, requiring external soft-start and -stop.	0.01	s	Y	Y	6.00



## (E codes continued)

Code	Name	Data setting range	Increment	Unit	Change when running	Data copying	Default setting
E20	Terminal [Y1] Function	Selecting function code data assigns the corresponding function to terminals [Y1] and [30A/B/C] as listed below.	—	—	N	Y	0
E27	Terminal [30A/B/C] Function	0 (1000): Inverter running ( <b>RUM</b> ) 1 (1001): Frequency arrival signal ( <b>FAR</b> ) 2 (1002): Frequency detected ( <b>FDT</b> ) 3 (1003): Undervoltage detected (Inverter stopped) ( <b>LU</b> ) 5 (1005): Inverter output limiting ( <b>IOL</b> ) 6 (1006): Auto-restarting after momentary power failure ( <b>IPF</b> ) 7 (1007): Motor overload early warning ( <b>OL</b> ) 26 (1026): Auto-resetting ( <b>TRY</b> ) 30 (1030): Service lifetime alarm ( <b>LIFE</b> ) 35 (1035): Inverter running 2 ( <b>RUN2</b> ) 36 (1036): Overload prevention control ( <b>OLP</b> ) 37 (1037): Current detected ( <b>ID</b> ) 38 (1038): Current detected 2 ( <b>ID2</b> ) 41 (1041): Low current detected ( <b>IDL</b> ) 43 (1043): Under PID control ( <b>PID-CTL</b> ) 44 (1044): Motor stopped due to slow flowrate under PID control ( <b>PID-STP</b> ) 49 (1049): Switched to motor 2 ( <b>SWM2</b> ) 56 (1056): Motor overheat detected by thermistor ( <b>THM</b> ) 57 (1057): Brake signal ( <b>BRKS</b> ) 59 (1059): Terminal [C1] wire break ( <b>C1OFF</b> ) 84 (1084): Maintenance timer ( <b>MNT</b> ) 87 (1087): Frequency arrival detected ( <b>FARFDT</b> ) 99 (1099): Alarm output (for any alarm) ( <b>ALM</b> )  Setting the value in parentheses ( ) shown above assigns a negative logic output to a terminal.	—	—	N	Y	99
E30	Frequency Arrival (Hysteresis width)	0.0 to 10.0	0.1	Hz	Y	Y	2.5
E31	Frequency Detection (Detection level)	0.0 to 400.0	0.1	Hz	Y	Y	ACU:60.0 E:50.0
E32	(Hysteresis width)	0.0 to 400.0	0.1	Hz	Y	Y	1.0
E34	Overload Early Warning/ Current Detection/Low Current Detection (Level)	0.00 (Disable), 0.01 to 100.0 Current value of 1 to 200% of the inverter rated current	0.01	A	Y	Y1 Y2	See Table A.
E35	(Timer)	0.01 to 600.00 *2	0.01	s	Y	Y	10.00

(Note) Alphabets in the Default setting field denote shipping destination: A (Asia), C (China), E (Europe), and U (USA).

\*2 When you make settings from the keypad, the incremental unit is restricted by the number of digits that the LED monitor can display.

(Example) If the setting range is from -200.00 to 200.00, the incremental unit is:

"1" for -200 to -100, "0.1" for -99.9 to -10.0 and for 100.0 to 200.0, and "0.01" for -9.99 to -0.01 and for 0.00 to 99.99.

## (E codes continued)

Code	Name	Data setting range	Increment	Unit	Change when running	Data copying	Default setting
E37	Current Detection 2 (Level)	0.00 (Disable), 0.01 to 100.0 Current value of 1 to 200% of the inverter rated current	0.01	A	Y	Y1 Y2	See Table A.
E38	(Timer)	0.01 to 600.00 *2	0.01	s	Y	Y	10.00
E39	Coefficient for Constant Feeding Rate Time	0.000 to 9.999	0.001	-	Y	Y	0.000
E40	PID Display Coefficient A	-999 to 0.00 to 9990 *3	0.01	-	Y	Y	100
E41	PID Display Coefficient B	-999 to 0.00 to 9990 *3	0.01	-	Y	Y	0.00
E42	LED Display Filter	0.0 to 5.0	0.1	s	Y	Y	0.5
E43	LED Monitor (Display item)	0: Speed monitor (select by E48) 3: Output current 4: Output voltage 9: Input power 10: PID command 12: PID feedback amount 13: Timer 14: PID output 25: Input watt-hour	-	-	Y	Y	0
E45	(Note)						
E46							
E47							
E48	LED Monitor (Speed monitor item)	0: Output frequency (Before slip compensation) 1: Output frequency (After slip compensation) 2: Reference frequency 4: Load shaft speed in r/min 5: Line speed in m/min 6: Constant feeding rate time	-	-	Y	Y	0
E50	Coefficient for Speed Indication	0.01 to 200.00 *2	0.01	-	Y	Y	30.00
E51	Display Coefficient for Input Watt-hour Data	0.000 (Cancel/reset), 0.001 to 9999	0.001	-	Y	Y	0.010
E52	Keypad (Menu display mode)	0: Function code data editing mode (Menu #1) 1: Function code data check mode (Menu #2) 2: Full-menu mode (Menus #0 through #6)	-	-	Y	Y	0

(Note) E45, E46 and E47 appear on the LED monitor, but cannot be used by this inverter.

\*2 When you make settings from the keypad, the incremental unit is restricted by the number of digits that the LED monitor can display.

(Example) If the setting range is from -200.00 to 200.00, the incremental unit is:

"1" for -200 to -100, "0.1" for -99.9 to -10.0 and for 100.0 to 200.0, and "0.01" for -9.99 to -0.01 and for 0.00 to 99.99.

\*3 The significant figure is in three digits, so the incremental unit changes depending upon the magnitude of absolute values.

(Example) The incremental unit is "10" for 1000 to 9990, "1" for -999 to -100 and for 100 to 999, "0.1" for -99.9 to -10.0 and for 10.0 to 99.9, and "0.01" for -9.99 to 9.99.

## (E codes continued)

Code	Name	Data setting range	Increment	Unit	Change when running	Data copying	Default setting
E60	Built-in Potentiometer (Function selection)	0: None 1: Auxiliary frequency command 1 2: Auxiliary frequency command 2 3: PID process command 1	1	–	N	Y	0
E61	Terminal [12] Extended Function	Selecting function code data assigns the corresponding function to terminals [12] and [C1] as listed below.	–	–	N	Y	0
E62	Terminal [C1] Extended Function	0: None 1: Auxiliary frequency command 1 2: Auxiliary frequency command 2 3: PID process command 1 5: PID feedback value	–	–	N	Y	0
E98	Terminal [FWD] Function	Selecting function code data assigns the corresponding function to terminals [FWD] and [REV] as listed below.	–	–	N	Y	98
E99	Terminal [REV] Function	0 (1000): Select multistep frequency ( <b>SS1</b> ) 1 (1001): Select multistep frequency ( <b>SS2</b> ) 2 (1002): Select multistep frequency ( <b>SS4</b> ) 3 (1003): Select multistep frequency ( <b>SS8</b> ) 4 (1004): Select ACC/DEC time ( <b>RT1</b> ) 6 (1006): Enable 3-wire operation ( <b>HLD</b> ) 7 (1007): Coast to a stop ( <b>BX</b> ) 8 (1008): Reset alarm ( <b>RST</b> ) 9 (1009): Enable external alarm trip ( <b>THR</b> ) 10 (1010): Ready for jogging ( <b>JOG</b> ) 11 (1011): Select frequency command 2/1 ( <b>Hz2/Hz1</b> ) 12 (1012): Select motor 2/motor 1 ( <b>M2/M1</b> ) 13: Enable DC braking ( <b>DCBRK</b> ) 17 (1017): UP (Increase output frequency) ( <b>UP</b> ) 18 (1018): DOWN (Decrease output frequency) ( <b>DOWN</b> ) 19 (1019): Enable data change with keypad ( <b>WE-KP</b> ) 20 (1020): Cancel PID control ( <b>Hz/PID</b> ) 21 (1021): Switch normal/inverse operation ( <b>IVS</b> ) 24 (1024): Enable communications link via RS-485 ( <b>LE</b> ) 33 (1033): Reset PID integral and differential components ( <b>PID-RST</b> ) 34 (1034): Hold PID integral component ( <b>PID-HLD</b> ) 98: Run forward ( <b>FWD</b> ) 99: Run reverse ( <b>REV</b> ) Setting the value in parentheses ( ) shown above assigns a negative logic input (Active-OFF) to a terminal. Note that, in the case of <b>THR</b> , data "1009" is for normal logic (Active-ON) and "9," for negative logic (Active-OFF). Signals having no value in parentheses ( ) cannot be used for negative logic.	–	–	N	Y	99

## C codes: Control Functions

Code	Name	Data setting range	Increment	Unit	Change when running	Data copying	Default setting
C01	Jump Frequency 1 2 3	0.0 to 400.0	0.1	Hz	Y	Y	0.0
C02					Y	Y	0.0
C03					Y	Y	0.0
C04	(Hysteresis width)	0.0 to 30.0	0.1	Hz	Y	Y	3.0
C05	Multistep Frequency 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15	0.00 to 400.00 *2	0.01	Hz	Y	Y	0.00
C06					Y	Y	0.00
C07					Y	Y	0.00
C08					Y	Y	0.00
C09					Y	Y	0.00
C10					Y	Y	0.00
C11					Y	Y	0.00
C12					Y	Y	0.00
C13					Y	Y	0.00
C14					Y	Y	0.00
C15					Y	Y	0.00
C16	Y	Y	0.00				
C17	Y	Y	0.00				
C18	Y	Y	0.00				
C19	Y	Y	0.00				
C20	Jogging Frequency	0.00 to 400.00 *2	0.01	Hz	Y	Y	0.00
C21	Timer Operation	0: Disable 1: Enable	-	-	N	Y	0
C30	Frequency Command 2	0: UP/DOWN keys on keypad 1: Voltage input to terminal [12] (0 to +10 VDC) 2: Current input to terminal [C1] (4 to 20 mA DC) 3: Sum of voltage and current inputs to terminals [12] and [C1] 4: Built-in potentiometer (POT) 7: Terminal command <b>UP/DOWN</b> control	-	-	N	Y	2
C32	Analog Input Adjustment for Terminal [12] (Gain)	0.00 to 200.00 *2	0.01	%	Y*	Y	100.0
C33	(Filter time constant)	0.00 to 5.00	0.01	s	Y	Y	0.05
C34	(Gain base point)	0.00 to 100.00 *2	0.01	%	Y*	Y	100.00
C37	Analog Input Adjustment for Terminal [C1] (Gain)	0.00 to 200.00 *2	0.01	%	Y*	Y	100.00
C38	(Filter time constant)	0.00 to 5.00	0.01	s	Y	Y	0.05
C39	(Gain base point)	0.00 to 100.00 *2	0.01	%	Y*	Y	100.00
C40	Terminal [C1] Input Range Selection	0: 4 to 20 mA 1: 0 to 20 mA	-	-	N	Y	0
C50	Bias (Frequency command 1) (Bias base point)	0.00 to 100.00 *2	0.01	%	Y*	Y	0.00
C51	Bias (PID command 1) (Bias value)	-100.00 to 100.00 *2	0.01	%	Y*	Y	0.00
C52	(Bias base point)	0.00 to 100.00 *2	0.01	%	Y*	Y	0.00

\*2 When you make settings from the keypad, the incremental unit is restricted by the number of digits that the LED monitor can display.

(Example) If the setting range is from -200.00 to 200.00, the incremental unit is:

"1" for -200 to -100, "0.1" for -99.9 to -10.0 and for 100.0 to 200.0, and "0.01" for -9.99 to -0.01 and for 0.00 to 99.99.

## (C codes continued)

Code	Name	Data setting range	Increment	Unit	Change when running	Data copying	Default setting
C94	Jump Frequency 4 *1	0.0 to 400.0	0.1	Hz	Y	Y	0.0
C95					5	Y	0.0
C96					6	Y	0.0
C99	Digital Reference Frequency *1	0.00 to 400.00	0.01	Hz	-	Y	0.00

## P codes: Motor 1 Parameters

Code	Name	Data setting range	Increment	Unit	Change when running	Data copying	Default setting
P02	Motor 1 (Rated capacity)	0.01 to 30.00 (kW when P99 = 0, 3, 4, 20 or 21)	0.01 0.01	kW HP	N	Y1 Y2	See Table A.
P03		(Rated current)	0.00 to 100.0	0.01	A	N	Y1 Y2
P04	(Auto-tuning)	0: Disable 1: Tune when the motor stops (%R1, %X) 2: Tune when the motor is rotating under V/f control (%R1, %X, no-load current, slip frequency).	-	-	N	N	0
P06	(No-load current)	0.00 to 50.00	0.01	A	N	Y1 Y2	Rated value of Fuji standard motor
P07	(%R1)	0.00 to 50.00	0.01	%	Y	Y1 Y2	
P08	(%X)	0.00 to 50.00	0.01	%	Y	Y1 Y2	
P09	(Slip compensation gain for driving)	0.0 to 200.0	0.1	%	Y*	Y	100.0
P10	(Slip compensation response time)	0.01 to 10.00	0.01	s	Y	Y1 Y2	1.00
P11	(Slip compensation gain for braking)	0.0 to 200.0	0.1	%	Y*	Y	100.0
P12	(Rated slip frequency)	0.00 to 15.00	0.01	Hz	N	Y1 Y2	Rated value of Fuji standard motor
P60	Permanent magnet synchronous motor *1 (Armature resistance)	0.00 (Disable PMSM), 0.01 to 50.00	0.01	Ω	Y	Y1 Y2	0.00
P61	(d-axis inductance)	0.00 (Disable high-efficiency control), 0.01 to 500.0	0.01	mH	Y	Y1 Y2	0.00
P62	(q-axis inductance)	0.00 (Disable PMSM), 0.01 to 500.0	0.01	mH	Y	Y1 Y2	0.00

\*1 The PMSM drive is available in the ROM version 0500 or later.

## (P codes continued)

Code	Name	Data setting range	Increment	Unit	Change when running	Data copying	Default setting
P63	Permanent magnet synchronous motor *1 (Induced voltage)	0 (Disable PMSM), 80 to 240 (for 200 V class series) 160 to 500 (for 400 V class series)	1	V	N	Y2	0
P74	(Reference current at starting)	10 to 200	1	%	Y	Y1 Y2	80
P89	(Control switching level)	10 to 100	1	%	Y	Y1 Y2	10
P90	(Overcurrent protection level)	0.00 (Disable), 0.01 to 100.0	0.01	A	Y	Y1 Y2	0.00
P91	(d-axis compensation gain under damping control)	0.0 to 25.0, 999 (Table value)	0.1	-	Y	Y1 Y2	999
P92	(q-axis compensation gain under damping control)	0.0 to 25.0, 999 (Table value)	0.1	-	Y	Y1 Y2	999
P93	(Step-out detection current level)	0.0 to 100, 999 (Table value)	1	%	Y	Y1 Y2	999
P99	Motor 1 Selection	0: Motor characteristics 0 (Fuji standard IM, 8-series) 1: Motor characteristics 1 (HP rating IM) 3: Motor characteristics 3 (Fuji standard IM, 6-series) 4: Other motors (IM) 20: Other motors (PMSM) 21: Fuji standard PMSM without sensor	-	-	N	Y1 Y2	0

\*1 The PMSM drive is available in the ROM version 0500 or later.

## H codes: High Performance Functions

Code	Name	Data setting range	Increment	Unit	Change when running	Data copying	Default setting
H03	Data Initialization	0: Disable initialization 1: Initialize all function code data to the factory defaults 2: Initialize motor 1 parameters 3: Initialize motor 2 parameters	-	-	N	N	0
H04	Auto-reset (Times)	0 (Disable), 1 to 10	1	times	Y	Y	0
H05	(Reset interval)	0.5 to 20.0	0.1	s	Y	Y	5.0
H06	Cooling Fan ON/OFF Control	0: Disable (Cooling fan always ON) 1: Enable (ON/OFF control effective)	-	-	Y	Y	0
H07	Acceleration/Deceleration Pattern	0: Linear 1: S-curve (Weak) 2: S-curve (Strong) 3: Curvilinear	-	-	Y	Y	0
H08	Rotational Direction Limitation	0: Disable 1: Enable (Reverse rotation inhibited) 2: Enable (Forward rotation inhibited)	-	-	N	Y	0
H11	Deceleration Mode	0: Normal deceleration 1: Coast-to-stop	-	-	Y	Y	0
H12	Instantaneous Overcurrent Limiting (Mode selection)	0: Disable 1: Enable	-	-	Y	Y	1
H13	Restart Mode after Momentary Power Failure (Restart time)	0.1 to 10.0	0.1	s	Y	Y1 Y2	0.5
H14	(Frequency fall rate)	0.00 (Deceleration time selected) 0.01 to 100.00 999 (Depends upon current limiter)	0.01	Hz/s	Y	Y	999
H15	(Continuous running level) *1	200 to 300 (for 200 V class series) 400 to 600 (for 400 V class series)	1	V	Y	Y2	235 470
H26	Thermistor for Motor (Mode selection)	0: Disable 1: Enable (With PTC, the inverter immediately trips with Oh4 displayed.) 2: Enable (With PTC, the inverter issues output signal <b>THM</b> and continues to run.)	-	-	Y	Y	0
H27	(Level)	0.00 to 5.00	0.01	V	Y	Y	1.6
H30	Communications Link Function (Mode selection)	Frequency command Run command 0: F01/C30 F02 1: RS-485 F02 2: F01/C30 RS-485 3: RS-485 RS-485	-	-	Y	Y	0
H42	Capacitance of DC Link Bus Capacitor	Indication for replacement of DC link bus capacitor (0000 to FFFF in hex.)	1	-	Y	N	-
H43	Cumulative Run Time of Cooling Fan	Indication for replacement of cooling fan (0 to 9999, in units of 10 hours)	1	10h	Y	N	-
H44	Startup Counter of Motor 1	Indication of cumulative startup count (0000 to FFFF in hex.)	-	-	Y	N	-
H45	Mock Alarm	0: Disable 1: Enable (Once a mock alarm occurs, the data automatically returns to 0.)	-	-	Y	N	0
H47	Initial Capacitance of DC Link Bus Capacitor	Indication for replacement of DC link bus capacitor (0000 to FFFF in hex.)	1	-	Y	N	-
H48	Cumulative Run Time of Capacitors on Printed Circuit Boards	Indication for replacement of capacitors on printed circuit boards (0 to 9999, in units of 10 hours)	1	10h	Y	N	-

\*1 Available in the ROM version 0800 or later.

## (H codes continued)

Code	Name	Data setting range	Increment	Unit	Change when running	Data copying	Default setting
H50	Non-linear V/f Pattern 1 (Frequency)	0.0 (Cancel), 0.1 to 400.0	0.1	Hz	N	Y	0.0
H51	(Voltage)	0 to 240: Output an AVR-controlled voltage (for 200 V class series)  0 to 500: Output an AVR-controlled voltage (for 400 V class series)	1	V	N	Y2	ACE:0 U: 230/ 460
H52	Non-linear V/f Pattern 2 (Frequency)	0.0 (Cancel), 0.1 to 400.0	0.1	Hz	N	Y	0.0
H53	(Voltage)	0 to 240: Output an AVR-controlled voltage (for 200 V class series)  0 to 500: Output an AVR-controlled voltage (for 400 V class series)	1	V	N	Y2	0
H54	ACC/DEC Time (Jogging operation)	0.00 to 3600	0.01	s	Y	Y	6.00
H61	<b>UP/DOWN</b> Control (Initial frequency setting)	0: 0.00 1: Last <b>UP/DOWN</b> command value on releasing a run command	-	-	N	Y	1
H63	Low Limiter (Mode selection)	0: Limit by F16 (Frequency limiter: Low) and continue to run  1: If the output frequency lowers below the one limited by F16 (Frequency limiter: Low), decelerate to stop the motor.	-	-	Y	Y	0
H64	(Lower limiting frequency)	0.0 (Depends on F16 (Frequency limiter: Low)) 0.1 to 60.0	0.1	Hz	Y	Y	2.0
H69	Automatic Deceleration (Anti-regenerative control)  (Mode selection)	0: Disable 1: Enable (Lengthen the deceleration time to three times the specified time under voltage limiting control.) (Compatible with the original FRENIC-Mini series FRN.....C1.....) 2: Enable (Torque limit control: Cancel the anti-regenerative control if the actual deceleration time exceeds three times the specified one.) 4: Enable (Torque limit control: Disable force-to-stop processing.)	-	-	Y	Y	0
H70	Overload Prevention Control	0.00: Follow deceleration time specified by F08/E11 0.01 to 100.0, 999 (Cancel)	0.01	Hz/s	Y	Y	999
H71	Deceleration Characteristics	0: Disable 1: Enable	-	-	Y	Y	0
H76	Automatic Deceleration (Frequency increment limit for braking)	0.0 to 400.0	0.1	Hz	Y	Y	5.0
H78	Maintenance Interval *1	0: Disable, 1 to 9999 (in units of 10 hours)	1	-	Y	N	8760
H79	Preset Startup Count for Maintenance *1	0000: Disable, 0001 to FFFF (hex.)	1	-	Y	N	0000
H80	Output Current Fluctuation Damping Gain for Motor 1	0.00 to 0.40	0.01	-	Y	Y	0.20

\*1 Available in the ROM version 0800 or later.



## (H codes continued)

Code	Name	Data setting range	Increment	Unit	Change when running	Data copying	Default setting
H89	Electronic Thermal Overload Protection for Motor (Data retention)	0: Disable 1: Enable	–	–	Y	Y	1
H91	PID Feedback Wire Break Detection (Terminal [C1])	0.0: Disable alarm detection 0.1 to 60.0: After the specified time, cause alarm	0.1	s	Y	Y	0.0
H92	Continuity of Running *1 (P)	0.000 to 10.000 times; 999	0.001	times	Y	Y1 Y2	999
H93	(I)	0.010 to 10.000 s; 999	0.001	s	Y	Y1 Y2	999
H94	Cumulative Run Time of Motor 1	0 to 9999 (in units of 10 hours)	–	–	N	N	–
H95	DC Braking (Braking response mode)	0: Slow 1: Quick	–	–	Y	Y	0
H96	STOP Key Priority/Start Check Function	Data STOP key priority Start check function 0: Disable Disable 1: Enable Disable 2: Disable Enable 3: Enable Enable	–	–	Y	Y	ACE:0 U:3
H97	Clear Alarm Data	0: Disable 1: Clear alarm data	–	–	Y	N	0
H98	Protection/Maintenance Function (Mode selection)	Bit 0: Lower the carrier frequency automatically (0: Disable; 1: Enable) Bit 1: Detect input phase loss (0: Disable; 1: Enable) Bit 2: Detect output phase loss (0: Disable; 1: Enable) Bit 3: Select life judgment threshold of DC link bus capacitor (0: Factory default level; 1: User setup level) Bit 4: Judge the life of DC link bus capacitor (0: Disable; 1: Enable)	–	–	Y	Y	19

\*1 Available in the ROM version 0500 or later.

## A codes: Motor 2 Parameters

Code	Name	Data setting range	Increment	Unit	Change when running	Data copying	Default setting
A01	Maximum Frequency 2	25.0 to 400.0	0.1	Hz	N	Y	ACU:80.0 E:50.0
A02	Base Frequency 2	25.0 to 400.0	0.1	Hz	N	Y	AU:60.0 CE:50.0
A03	Rated Voltage at Base Frequency 2	0: Output a voltage in proportion to input voltage 80 to 240V: Output an AVR-controlled voltage (for 200 V class series) 160 to 500V: Output an AVR-controlled voltage (for 400 V class series)	1	V	N	Y2	ACE:0 U: 230/ 460
A04	Maximum Output Voltage 2	80 to 240V: Output an AVR-controlled voltage (for 200 V class series) 160 to 500V: Output an AVR-controlled voltage (for 400 V class series)	1	V	N	Y2	A: 220/ 380 C:200 380 E: 230/ 400 U:230/ 460
A05	Torque Boost 2	0.0% to 20.0% (percentage with respect to "A03: Rated Voltage at Base Frequency 2")	0.1	%	Y	Y	See Table A.
A06	Electronic Thermal Overload Protection for Motor 2 (Motor characteristics)	1: For a general-purpose motor with shaft-driven cooling fan 2: For an inverter-driven motor with separately powered cooling fan	-	-	Y	Y	1
A07	(Overload detection level)	0.00 (Disable), 0.01 to 100.0 1 to 135% of the rated current (allowable continuous drive current) of the motor	0.01	A	Y	Y1 Y2	See Table A.
A08	(Thermal time constant)	0.5 to 75.0	0.1	min	Y	Y	5.0
A09	DC Braking 2 (Braking starting frequency)	0.0 to 60.0	0.1	Hz	Y	Y	0.0
A10	(Braking level)	0 to 100	1	%	Y	Y	0
A11	(Braking time)	0.00 : Disable 0.01 to 30.00	0.01	s	Y	Y	0.00
A12	Starting Frequency 2	0.1 to 60.0	0.1	Hz	Y	Y	1.0
A13	Load Selection/ Auto Torque Boost/ Auto Energy Saving Operation 2	0: Variable torque load 1: Constant torque load 2: Auto-torque boost 3: Auto-energy saving operation (Variable torque load during ACC/DEC) 4: Auto-energy saving operation (Constant torque load during ACC/DEC) 5: Auto-energy saving operation (Auto-torque boost during ACC/DEC)	-	-	N	Y	1
A14	Control Mode Selection 2	0: V/f control with slip compensation inactive 1: Dynamic torque vector control 2: V/f control with slip compensation active	-	-	N	Y	0
A16	Motor 2 (Rated capacity)	0.01 to 30.00 (kW when A39 = 0, 3, or 4) 0.01 to 30.00 (HP when A39 = 1)	0.01 0.01	kW HP	N	Y1 Y2	See Table A.
A17	(Rated current)	0.00 to 100.0	0.01	A	N	Y1 Y2	Rated value of Fuji standard motor

## (A codes continued)

Code	Name	Data setting range	Increment	Unit	Change when running	Data copying	Default setting
A18	Motor 2 (Auto-tuning)	0: Disable 1: Tune when the motor stops (%R1 and %X) 2: Tune when the motor is rotating under V/f control (%R1, %X, no-load current, slip freq.)	–	–	N	N	0
A20	(No-load current)	0.00 to 50.0	0.01	A	N	Y1 Y2	Rated value of Fuji standard motor
A21	(%R1)	0.00 to 50.00	0.01	%	Y	Y1 Y2	Rated value of Fuji standard motor
A22	(%X)	0.00 to 50.00	0.01	%	Y	Y1 Y2	Rated value of Fuji standard motor
A23	(Slip compensation gain for driving)	0.0 to 200.0	0.1	%	Y*	Y	100.0
A24	(Slip compensation response time)	0.01 to 10.00	0.01	s	Y	Y1 Y2	1.00
A25	(Slip compensation gain for braking)	0.0 to 200.0	0.1	%	Y*	Y	100.0
A26	(Rated slip frequency)	0.00 to 15.00	0.01	Hz	N	Y1 Y2	Rated value of Fuji standard motor
A39	Motor 2 Selection	0: Motor characteristics 0 (Fuji standard IM, 8-series) 1: Motor characteristics 1 (HP rating IM) 3: Motor characteristics 3 (Fuji standard IM, 6-series) 4: Other motors (IM)	–	–	N	Y1 Y2	ACE:0 U:1
A41	Output Current Fluctuation Damping Gain for Motor 2	0.00 to 0.40	0.01	–	Y	Y	0.20
A51	Cumulative Run Time of Motor 2	0 to 9999 (in units of 10 hours)	–	–	N	N	–
A52	Startup Counter for Motor 2	Indication of cumulative startup count (0000 to FFFF in hex.)	–	–	Y	N	–

## J codes: Application Functions

Code	Name	Data setting range	Increment	Unit	Change when running	Data copying	Default setting
J01	PID Control (Mode selection)	0: Disable 1: Enable (Process control, normal operation) 2: Enable (Process control, inverse operation)	-	-	N	Y	0
J02	(Remote command SV)	0: UP/DOWN keys on keypad 1: PID process command 1 (Analog input terminals [12] and [C1]) 3: Terminal command <b>UP/DOWN</b> control 4: Command via communications link	-	-	N	Y	0
J03	P (Gain)	0.000 to 30.000 *2	0.001	times	Y	Y	0.100
J04	I (Integral time)	0.0 to 3600.0 *2	0.1	s	Y	Y	0.0
J05	D (Differential time)	0.00 to 600.00 *2	0.01	s	Y	Y	0.00
J06	(Feedback filter)	0.0 to 900.0	0.1	s	Y	Y	0.5
J15	(Operation level for slow flowrate stop)	0.0 (Disable), 1.0 to 400.0	0.1	Hz	Y	Y	0.0
J16	(Elapsed time from slow flowrate stop)	0 to 3600	1	s	Y	Y	30
J17	(Initiation frequency)	0.0 to 400.0	0.1	Hz	Y	Y	0.0
J23	(Initiation deviation level for slow flowrate stop)	0.0 to 100.0	0.1	%	Y	Y	0.0
J24	(Start latency time for slow flowrate stop)	0 to 3660	1	s	Y	Y	0
J68	Braking Signal (Brake OFF current)	0 to 200	1	%	Y	Y	100
J69	(Brake OFF frequency)	0.0 to 25.0	0.1	Hz	Y	Y	1.0
J70	(Brake OFF timer)	0.0 to 5.0	0.1	s	Y	Y	1.0
J71	(Brake ON frequency)	0.0 to 25.0	0.1	Hz	Y	Y	1.0
J72	(Brake ON timer)	0.0 to 5.0	0.1	s	Y	Y	1.0

\*2 When you make settings from the keypad, the incremental unit is restricted by the number of digits that the LED monitor can display.

(Example) If the setting range is from -200.00 to 200.00, the incremental unit is:

"1" for -200 to -100, "0.1" for -99.9 to -10.0 and for 100.0 to 200.0, and "0.01" for -9.99 to -0.01 and for 0.00 to 99.99.



## Chapter 6 TROUBLESHOOTING

### 6.1 If an Alarm Code Appears on the LED Monitor



„ Quick reference table of alarm codes

Alarm code	Name	Alarm code	Name
<b>Oc1</b>	Instantaneous overcurrent	<b>dbh</b>	Braking resistor overheated
<b>Oc2</b>		<b>O11</b> <b>O12</b>	Motor 1 overload Motor 2 overload
<b>Oc3</b>		<b>O1u</b>	Inverter overload
<b>Ou1</b>	Overvoltage	<b>er1</b>	Memory error
<b>Ou2</b>		<b>er2</b>	Keypad communications error
<b>Ou3</b>		<b>er3</b>	CPU error
<b>Iu</b>	Undervoltage	<b>er6</b>	Operation protection
<b>Iin</b>	Input phase loss	<b>er7</b>	Tuning error
<b>Op1</b>	Output phase loss	<b>er8</b>	RS-485 communications error
<b>Oh1</b>	Heat sink overheat	<b>erf</b>	Data saving error during undervoltage
<b>Oh2</b>	External alarm	<b>err</b>	Mock alarm
<b>Oh4</b>	Motor protection (PTC thermistor)	<b>cof</b>	PID feedback wire break
		<b>erd</b>	Step-out detection (for drive of permanent magnet synchronous motors)


## 6.2 If an Abnormal Pattern Appears on the LED Monitor while No Alarm Code is Displayed

### [ 1 ] - - - - (center bar) appears

**Problem** A center bar (- - - -) has appeared on the LED monitor.

Possible Causes	What to Check and Suggested Measures
(1) When the PID command and its feedback amount are selected as a monitor item, the PID control is disabled.	To view other monitor items: Check if E43 = 10 (PID command) or 12 (PID feedback amount). Set E43 to a value other than "10" or "12."  To view a PID command or its feedback amount: Check if the PID control is disabled (J01 = 0). Set J01 to "1" (Enable process control, normal operation) or "2" (Enable process control, inverse operation).
(2) When timer operation is disabled (C21 = 0), timer is selected as a monitor item (E43 = 13).  When timer operation had been enabled (C21 = 1) and timer had been selected as a monitor item by pressing the  key, you disabled timer operation (C21 = 0).	To view other monitor items: Check if E32 = 13 (Timer). Set E43 to a value other than "13."  To view timer (s): Check if C21 = 0 (Disable). Set C21 to "1."
(3) The remote keypad (option) was poorly connected.	Prior to proceeding, check that pressing the  key does not change the display on the LED monitor.  Check continuity of the extension cable for the keypad used in remote operation. Replace the extension cable.  Check the RJ-45 connector for damage. Ensure the connector of the RJ-45 connector. Replace the remote keypad (option).

### [ 2 ] \_ \_ \_ \_ (under bar) appears

**Problem** Although you pressed the  key or entered a run forward command **FWD** or a run reverse command **REV**, the motor did not start and an under bar (\_ \_ \_ \_) appeared on the LED monitor.

Possible Causes	What to Check and Suggested Measures
(1) The DC link bus voltage was low.	Select 5_01 under Menu #5 "Maintenance Information" in Programming mode on the keypad, then check the DC link bus voltage that should be 200 VDC or below for three-phase 200 V class series and 400 VDC or below for three-phase 400 V class series.  Connect the inverter to a power supply that meets its input specifications.

**[ 3 ] [ ] appears**

Problem      Parentheses ( [ ] ) appeared on the LED monitor during speed monitoring on the keypad.

Possible Causes	What to Check and Suggested Measures
(1) The display data overflows the LED monitor.	Check whether the product of the output frequency and the display coefficient (E50) exceeds 9999. Correct the setting of E50.



## Chapter 7 MAINTENANCE AND INSPECTION

Perform daily and periodic inspection to avoid trouble and keep reliable operation of the inverter for a long time. When performing inspections, follow the instructions given in this chapter.

### **WARNING**

- Before proceeding to the maintenance and inspection, turn OFF the power and wait at least five minutes. Make sure that the LED monitor is turned OFF. Further, make sure, using a multimeter or a similar instrument, that the DC link bus voltage between the terminals P(+) and N(-) has dropped below the safe level (+25 VDC or below).

**Electric shock may occur.**

- Maintenance, inspection, and parts replacement should be made only by authorized persons.
- Take off the watch, rings and other metallic objects before starting work.
- Use insulated tools.
- Never modify the inverter.

**Electric shock or injuries could occur.**

### 7.1 Daily Inspection

Visually inspect the inverter for operation errors from the outside without removing the covers when the inverter is ON or operating.

- Check that the expected performance (satisfying the standard specifications) is obtained.
- Check that the surrounding environment satisfies the requirements given in Chapter 2, Section 2.1 "Operating Environment."
- Check that the LED monitor on the keypad displays normally.
- Check for abnormal noise, odor, or excessive vibration.
- Check for traces of overheat, discoloration and other defects.

### 7.2 Periodic Inspection

Perform periodic inspection according to the items listed in Table 7.1. Before performing periodic inspection, be sure to stop the motor, shut down the power to the inverter, and then remove the terminal block covers.

Table 7.1 List of Periodic Inspections

Check part	Check item	How to inspect	Evaluation criteria
Environment	1) Check the ambient temperature, humidity, vibration and atmosphere (dust, gas, oil mist, or water drops). 2) Check that tools or other foreign materials or dangerous objects are not left around the equipment.	1) Check visually or measure using apparatus. 2) Visual inspection	1) The standard specification must be satisfied. 2) No foreign or dangerous objects are left.
Voltage	Check that the input voltages of the main and control circuit are correct.	Measure the voltages using a multimeter or the like.	The standard specifications must be satisfied.

Table 7.1 List of Periodic Inspections (Continued)

Check part	Check item	How to inspect	Evaluation criteria
Keypad	1) Check that the display is clear. 2) Check that there is no missing part in the displayed characters.	1), 2) Visual inspection	1), 2) The display can be read and there is no fault.
Structure such as frames and covers	Check for: 1) Abnormal noise or excessive vibration 2) Loose bolts (at clamp sections) 3) Deformation or breakage 4) Discoloration caused by overheat 5) Contamination or accumulation of dust or dirt	1) Visual or auditory inspection 2) Retighten. 3), 4), 5) Visual inspection	1), 2), 3), 4), 5) No abnormalities
Main circuit	Common	1) Retighten. 2), 3) Visual inspection	1), 2), 3) No abnormalities
	Conductors and wires	1), 2) Visual inspection	1), 2) No abnormalities
	Terminal blocks	Visual inspection	No abnormalities
	DC link bus capacitor	1), 2) Visual inspection 3) Measure the capacitance if necessary.	1), 2) No abnormalities 3) The discharge time should not be shorter than the one specified by the replacement manual.
	Braking resistor	1) Olfactory and visual inspection 2) Check the wires visually. Or disconnect either wire and measure the conductivity with a multimeter.	1) No abnormalities 2) Within $\pm 10\%$ of the resistance of the braking resistor
	Transformer and reactor	Auditory, visual and olfactory inspection	No abnormalities

Table 7.1 List of Periodic Inspections (Continued)

Check part		Check item	How to inspect	Evaluation criteria
Main circuit	Magnetic contactor and relay	1) Check for chatters during operation.	1) Hearing inspection	1), 2) No abnormalities
		2) Check for rough contacts.	2) Visual inspection	
Control circuit	Printed circuit boards	1) Check for loose screws and connectors.	1) Retighten.	1), 2), 3), 4) No abnormalities
		2) Check for abnormal odor and discoloration. 3) Check for cracks, breakage, deformation and remarkable rust. 4) Check the capacitors for electrolyte leaks and deformation.	2) Olfactory and visual inspection 3), 4) Visual inspection	
Cooling system	Cooling fan	1) Check for abnormal noise and excessive vibration.	1) Auditory and visual inspection, or turn manually (be sure to turn the power OFF).	1) Smooth rotation  2), 3) No abnormalities
		2) Check for loose bolts. 3) Check for discoloration caused by overheat.	2) Retighten. 3) Visual inspection	
	Ventilation path	Check the heat sink, intake and exhaust ports for clogging and foreign materials.	Visual inspection	No abnormalities

Remove dust accumulating on the inverter with a vacuum cleaner. If the inverter is stained, wipe it off with a chemically neutral cloth.

### 7.3 List of Periodical Replacement Parts

The inverter consists of many electronic parts including semiconductor devices. Table 7.2 lists replacement parts that should be periodically replaced for preventive maintenance (Use the lifetime judgment function as a guide). These parts are likely to deteriorate with age due to their constitution and properties, leading to the decreased performance or failure of the inverter.

When the replacement is necessary, consult your Fuji Electric representative.

Table 7.2 Replacement Parts

Part name	Standard replacement intervals (See Note below.)
DC link bus capacitor	10 years
Electrolytic capacitors on the printed circuit boards	10 years
Cooling fan	10 years

(Note) These replacement intervals are based on the inverter's service life estimated under the following conditions.

- Ambient temperature: 40°C

- Load factor: 80% of the rated current given in parentheses ( ) in Chapter 8 "Specifications"

- Running 12 hours/day

In environments with an ambient temperature above 40°C or a large amount of dust or dirt, the replacement intervals may be shorter.

Standard replacement intervals mentioned above are only a guide for replacement, not a guaranteed service life.

## 7.4 Inquiries about Product and Guarantee

### 7.4.1 When making an inquiry

Upon breakage of the product, uncertainties, failure or inquiries, inform your **GMTCNT** representative of the following information.

- 1) Inverter type (Refer to Chapter 1, Section 1.1.)
- 2) SER No. (serial number of equipment) (Refer to Chapter 1, Section 1.1.)
- 3) Function codes and their data that you changed from the factory defaults (Refer to Chapter 3, Section 3.4.2.)
- 4) ROM version (Refer to Chapter 3, Section 3.4.5.)
- 5) Date of purchase
- 6) Inquiries (for example, point and extent of breakage, uncertainties, failure phenomena, and other circumstances)
- 7) Production year & week (Refer to Chapter 1, Section 1.1.)

### 7.4.2 Product warranty

To all our customers who purchase **GNTCNT** products included in this documentation:

Please take the following items into consideration when placing your order.

When requesting an estimate and placing your orders for the products included in these materials, please be aware that any items such as specifications which are not specifically mentioned in the contract, catalog, specifications or other materials will be as mentioned below.

In addition, the products included in these materials are limited in the use they are put to and the place where they can be used, etc., and may require periodic inspection. Please confirm these points with your sales representative or directly with this company.

Furthermore, regarding purchased products and delivered products, we request that you take adequate consideration of the necessity of rapid receiving inspections and of product management and maintenance even before receiving your products.

#### [ 1 ] Free of charge warranty period and warranty range

- (1) Free of charge warranty period
  - 1) The product warranty period is "1 year from the date of purchase" or 24 months from the manufacturing date imprinted on the name place, whichever date is earlier.
  - 2) However, in cases where the use environment, conditions of use, use frequency and times used, etc., have an effect on product life, this warranty period may not apply.
  - 3) Furthermore, the warranty period for parts restored by **GMTCNT**'s Service Department is "6 months from the date that repairs are completed."

(2) Warranty range

- 1) In the event that breakdown occurs during the product's warranty period which is the responsibility of **GNTCNT**, **GNTCNT** will replace or repair the part of the product that has broken down free of charge at the place where the product was purchased or where it was delivered. However, if the following cases are applicable, the terms of this warranty may not apply.
  - c The breakdown was caused by inappropriate conditions, environment, handling or use methods, etc. which are not specified in the catalog, operation manual, specifications or other relevant documents.
  - d The breakdown was caused by the product other than the purchased or delivered **GMTCNT**'s product.
  - e The breakdown was caused by the product other than **GMTCNT**'s product, such as the customer's equipment or software design, etc.
  - f Concerning the **GMTCNT**'s programmable products, the breakdown was caused by a program other than a program supplied by this company, or the results from using such a program.
  - g The breakdown was caused by modifications or repairs affected by a party other than **GMTCNT**.
  - h The breakdown was caused by improper maintenance or replacement using consumables, etc. specified in the operation manual or catalog, etc.
  - i The breakdown was caused by a science or technical problem that was not foreseen when making practical application of the product at the time it was purchased or delivered.
  - j The product was not used in the manner the product was originally intended to be used.
  - k The breakdown was caused by a reason which is not this company's responsibility, such as lightning or other disaster.

(2) Furthermore, the warranty specified herein shall be limited to the purchased or delivered product alone.

(3) The upper limit for the warranty range shall be as specified in item (1) above and any damages (damage to or loss of machinery or equipment, or lost profits from the same, etc.) consequent to or resulting from breakdown of the purchased or delivered product shall be excluded from coverage by this warranty.

(3) Trouble diagnosis

As a rule, the customer is requested to carry out a preliminary trouble diagnosis. However, at the customer's request, this company or its service network can perform the trouble diagnosis on a chargeable basis. In this case, the customer is asked to assume the burden for charges levied in accordance with this company's fee schedule.

**[ 2 ] Exclusion of liability for loss of opportunity, etc.**

Regardless of whether a breakdown occurs during or after the free of charge warranty period, this company shall not be liable for any loss of opportunity, loss of profits, or damages arising from special circumstances, secondary damages, accident compensation to another company, or damages to products other than this company's products, whether foreseen or not by this company, which this company is not be responsible for causing.



### **[ 3 ] Repair period after production stop, spare parts supply period (holding period)**

Concerning models (products) which have gone out of production, this company will perform repairs for a period of 7 years after production stop, counting from the month and year when the production stop occurs. In addition, we will continue to supply the spare parts required for repairs for a period of 7 years, counting from the month and year when the production stop occurs. However, if it is estimated that the life cycle of certain electronic and other parts is short and it will be difficult to procure or produce those parts, there may be cases where it is difficult to provide repairs or supply spare parts even within this 7-year period. For details, please confirm at our company's business office or our service office.

### **[ 4 ] Transfer rights**

In the case of standard products which do not include settings or adjustments in an application program, the products shall be transported to and transferred to the customer and this company shall not be responsible for local adjustments or trial operation.

### **[ 5 ] Service contents**

The cost of purchased and delivered products does not include the cost of dispatching engineers or service costs. Depending on the request, these can be discussed separately.

### **[ 6 ] Applicable scope of service**

Above contents shall be assumed to apply to transactions and use of the country where you purchased the products.

Consult the local supplier or **GNTCNT** for the detail separately.

## Chapter 8 SPECIFICATIONS

### 8.1 Standard Models

#### 8.1.1 Three-phase 200 V class series

Item		Specifications					
Type (GM-____L...)		0.4	0.75	1.5	2.2	3.7	
Applicable motor rating (kW) *1		0.4	0.75	1.5	2.2	3.7	
Output Ratings	Rated capacity (kVA) *2	1.1	1.9	3.0	4.2	6.5	
	Rated voltage (V) *3	Three-phase, 200 to 240 V (with AVR function)					
	Rated current (A) *4	3.0 (2.5)	5.0 (4.2)	8.0 (7.0)	11.0 (10.0)	17.0 (16.5)	
	Overload capability	150% of rated output current for 1 min or 200% of rated output current for 0.5 s (for the rated current given in parentheses)					
	Rated frequency (Hz)	50/60 Hz					
Input Ratings	Phases, voltage, frequency	Three-phase, 200 to 240 V, 50/60 Hz					
	Voltage and frequency variations	Voltage: +10 to -15% (Interphase voltage unbalance: 2% or less) *5, Frequency: +5 to -5%					
	Rated current (A) *6	(w/DCR)	1.6	3.0	5.7	8.3	14.0
		(w/o DCR)	3.1	5.3	9.5	13.2	22.2
Required power supply capacity (kVA) *7	0.6	1.1	2.0	2.9	4.9		
Braking	Torque (%) *8	100		50	30		
	DC braking	Braking starting frequency*9: 0.0 to 60.0 Hz, Braking time: 0.0 to 30.0 s, Braking level: 0 to 100%					
	Braking transistor	--		Built-in			
Applicable safety standards	UL508C, IEC 61800-5-1: 2007 (under application)						
Enclosure	IP20 (IEC 60529:1989), UL open type (UL50)						
Cooling method	Natural cooling			Fan cooling			
Mass (kg)	0.7		0.8	1.7	1.7	2.5	

\*1 Fuji 4-pole standard motors

\*2 Refers to the rated capacity assuming the rated output voltage as 220 V.

\*3 Output voltages cannot exceed the power supply voltage.

\*4 The load shall be reduced so that the continuous operating current is the rated current in parentheses or less if the carrier frequency is set to 3 kHz or above or the ambient temperature exceeds 40°C.

\*5 Interphase voltage unbalance (%) =  $\frac{\text{Max. voltage (V)} - \text{Min. voltage (V)}}{3 \text{ - phase average voltage (V)}} \times 67$  (Refer to IEC 61800-3:2004)

If this value is 2 to 3%, use an optional AC reactor (ACR).

\*6 Refers to the estimated value to apply when the power supply capacity is 500 kVA (inverter capacity x 10 when the inverter capacity exceeds 50 kVA) and the inverter is connected to the %X = 5% power supply.

\*7 Refers to the value to apply when a DC reactor (DCR) is used.

\*8 Refers to the average braking torque to apply when the motor running alone decelerates from 60 Hz with the AVR control being OFF. (It varies with the efficiency of the motor.)

\*9 Available only for induction motor drive.





### 8.1.1 Three-phase 200 V class series

Item		Specifications				
Type (GMD-... L...)		5.5	7.5	11	15	
Applicable motor rating (kW) *1		5.5	7.5	11	15	
Output Ratings	Rated capacity (kVA) *2	9.5	12	17	22	
	Rated voltage (V) *3	Three-phase, 200 to 240 V (with AVR function)				
	Rated current (A) *4	25 (23.5)*10	33.0 (31.0)*10	47.0 (44.0)*10	60.0 (57.0)*10	
	Overload capability	150% of rated output current for 1 min. 150% of rated output current for 1 min or 200% of rated output current for 0.5 s (for the rated current given in parentheses)				
	Rated frequency (Hz)	50/60 Hz				
Input Ratings	Phases, voltage, frequency	Three-phase, 200 to 240 V, 50/60 Hz				
	Voltage and frequency variations	Voltage: +10 to -15% (Interphase voltage unbalance: 2% or less) *5, Frequency: +5 to -5%				
	Rated current (A) *6	(w/ DCR)	21.1	28.8	42.2	57.6
		(w/o DCR)	31.5	42.7	60.7	80.0
Required power supply capacity (kVA) *7	7.4	10	15	20		
Braking	Torque (%) *8	20				
	DC braking	Braking starting frequency*9: 0.0 to 60.0 Hz, Braking time: 0.0 to 30.0 s, Braking level: 0 to 100%				
	Braking transistor	Built-in				
Applicable safety standards		UL508C, IEC 61800-5-1: 2007 (under application)				
Enclosure		IP20 (IEC 60529:1989), UL open type (UL50)				
Cooling method		Fan cooling				
Mass (kg)		3.1	3.1	4.5	4.5	

\*1 Fuji 4-pole standard motors

\*2 Refers to the rated capacity assuming the rated output voltage as 220 V.

\*3 Output voltages cannot exceed the power supply voltage.

\*4 The load shall be reduced so that the continuous operating current is the rated current in parentheses or less if the carrier frequency is set to 3 kHz or above or the ambient temperature exceeds 40°C.

\*5 Interphase voltage unbalance (%) =  $\frac{\text{Max. voltage (V)} - \text{Min. voltage (V)}}{3 - \text{phase average voltage (V)}} \times 67$  (Refer to IEC 61800 - 3 : 2004)

If this value is 2 to 3%, use an optional AC reactor (ACR).

\*6 Refers to the estimated value to apply when the power supply capacity is 500 kVA (inverter capacity x 10 when the inverter capacity exceeds 50 kVA) and the inverter is connected to the %X = 5% power supply.

\*7 Refers to the value to apply when a DC reactor (DCR) is used.

\*8 Refers to the average braking torque to apply when the motor running alone decelerates from 60 Hz with the AVR control being OFF. (It varies with the efficiency of the motor.)

\*9 Available only for induction motor drive.

## 8.1.2 Three-phase 400 V class series

Item		Specifications					
Type (GMD-___-___H...)		0.4	0.75	1.5	2.2	3.7	
Applicable motor rating (kW) *1		0.4	0.75	1.5	2.2	3.7	
Output Ratings	Rated capacity (kVA) *2	1.1	1.9	2.8	4.1	6.8	
	Rated voltage (V) *3	Three-phase, 380 to 480 V (with AVR function)					
	Rated current (A)	1.5	2.5	3.7	5.5	9.0	
	Overload capability	150% of rated output current for 1 min or 200% of rated output current for 0.5 s (for the rated current given in parentheses)					
	Rated frequency (Hz)	50/60 Hz					
Input Ratings	Phases, voltage, frequency	Three-phase, 380 to 480 V, 50/60 Hz					
	Voltage and frequency variations	Voltage: +10 to -15% (Interphase voltage unbalance: 2% or less) *5, Frequency: +5 to -5%					
	Rated current (A) *6	(w/ DCR)	0.85	1.6	3.0	4.4	7.3
		(w/o DCR)	1.7	3.1	5.9	8.2	13.0
	Required power supply capacity (kVA) *7	0.6	1.1	2.0	2.9	4.9	
Braking	Torque (%) *8	100		50	30		
	DC braking	Braking starting frequency*9: 0.0 to 60.0 Hz, Braking time: 0.0 to 30.0 s, Braking level: 0 to 100%					
	Braking transistor	Built-in					
Applicable safety standards	UL508C, IEC 61800-5-1: 2007 (under application)						
Enclosure	IP20 (IEC 60529:1989), UL open type (UL50)						
Cooling method	Natural cooling			Fan cooling			
Mass (kg)	1.2	1.3	1.7	1.7	2.5		

\*1 Fuji 4-pole standard motors

\*2 Refers to the rated capacity assuming the rated output voltage as 440 V.

\*3 Output voltages cannot exceed the power supply voltage.

\*5 Interphase voltage unbalance (%) =  $\frac{\text{Max. voltage (V)} - \text{Min. voltage (V)}}{3\text{-phase average voltage (V)}} \times 67$  (Refer to IEC 61800-3:2004)

If this value is 2 to 3%, use an optional AC reactor (ACR).

\*6 Refers to the estimated value to apply when the power supply capacity is 500 kVA (inverter capacity x 10 when the inverter capacity exceeds 50 kVA) and the inverter is connected to the %X = 5% power supply.

\*7 Refers to the value to apply when a DC reactor (DCR) is used.

\*8 Refers to the average braking torque to apply when the motor running alone decelerates from 60 Hz with the AVR control being OFF. (It varies with the efficiency of the motor.)

\*9 Available only for induction motor drive.

### 8.1.2 Three-phase 400 V class series

Item		Specifications				
Type (GMD-... H...)		5.5	7.5	11	15	
Applicable motor rating (kW) *1		5.5	7.5	11	15	
Output Ratings	Rated capacity (kVA) *2	9.9	13	18	22	
	Rated voltage (V) *3	Three-phase, 380 to 480 V (with AVR function)				
	Rated current (A)	13.0	18.0	24.0	30.0	
	Overload capability	150% of rated output current for 1 min or 200% of rated output current for 0.5 s (for the rated current given in parentheses)				
	Rated frequency (Hz)	50/60 Hz				
Input Ratings	Phases, voltage, frequency	Three-phase, 380 to 480 V, 50/60 Hz				
	Voltage and frequency variations	Voltage: +10 to -15% (Interphase voltage unbalance: 2% or less) *5, Frequency: +5 to -5%				
	Rated current (A) *6	(w/ DCR)	10.6	14.4	21.1	28.8
		(w/o DCR)	17.3	23.2	33.0	43.8
Required power supply capacity (kVA) *7	7.4	10	15	20		
Braking	Torque (%) *8	20				
	DC braking	Braking starting frequency*9: 0.0 to 60.0 Hz, Braking time: 0.0 to 30.0 s, Braking level: 0 to 100%				
	Braking transistor	Built-in				
Applicable safety standards	UL508C, IEC 61800-5-1: 2007 (under application)					
Enclosure	IP20 (IEC 60529:1989), UL open type (UL50)					
Cooling method	Fan cooling					
Mass (kg)	3.1	3.1	4.5	4.5		

\*1 Fuji 4-pole standard motors

\*2 Refers to the rated capacity assuming the rated output voltage as 220 V.

\*3 Output voltages cannot exceed the power supply voltage.

\*5 Interphase voltage unbalance (%) =  $\frac{\text{Max. voltage (V)} - \text{Min. voltage (V)}}{3 - \text{phase average voltage (V)}} \times 67$  (Refer to IEC 61800 - 3 : 2004)

If this value is 2 to 3%, use an optional AC reactor (ACR).

\*6 Refers to the estimated value to apply when the power supply capacity is 500 kVA (inverter capacity x 10 when the inverter capacity exceeds 50 kVA) and the inverter is connected to the %X = 5% power supply.

\*7 Refers to the value to apply when a DC reactor (DCR) is used.

\*8 Refers to the average braking torque to apply when the motor running alone decelerates from 60 Hz with the AVR control being OFF. (It varies with the efficiency of the motor.)

\*9 Available only for induction motor drive.

### 8.1.3 Single-phase 200 V class series

Item		Specifications				
Type (GMD_ _ _ _ H...)		0.4	0.75	1.5	2.2	
Applicable motor rating (kW) *1		0.4	0.75	1.5	2.2	
Output Ratings	Rated capacity (kVA) *2	1.1	1.9	3.0	4.1	
	Rated voltage (V) *3	Three-phase, 200 to 240 V (with AVR function)				
	Rated current (A) *4	3.0 (2.5)	5.0 (4.2)	8.0 (7.0)	11.0 (10.0)	
	Overload capability	150% of rated output current for 1 min or 200% of rated output current for 0.5 s				
	Rated frequency (Hz)	50/60 Hz				
Input Ratings	Phases, voltage, frequency	Single-phase, 200 to 240 V, 50/60 Hz				
	Voltage and frequency variations	Voltage: +10 to -15%, Frequency: +5 to -5%				
	Rated current (A) *6	(w/ DCR)	3.5	6.4	11.6	17.5
		(w/o DCR)	5.4	9.7	16.4	24.0
Required power supply capacity (kVA) *7	0.7	1.3	2.4	3.5		
Braking	Torque (%) *8	100		50	30	
	DC braking	Braking starting frequency*9: 0.0 to 60.0 Hz, Braking time: 0.0 to 30.0 s, Braking level: 0 to 100%				
	Braking transistor	Built-in				
Applicable safety standards	UL508C, IEC 61800-5-1: 2007 (under application)					
Enclosure	IP20 (IEC 60529:1989), UL open type (UL50)					
Cooling method	Natu		Fan cooling			
Mass (kg)	0.7	0.9	1.8	2.5		

\*1 Fuji 4-pole standard motors

\*2 Refers to the rated capacity assuming the rated output voltage as 220 V.

\*3 Output voltages cannot exceed the power supply voltage.

\*4 The load shall be reduced so that the continuous operating current is the rated current in parentheses or less if the carrier frequency is set to 3 kHz or above or the ambient temperature exceeds 40°C.

\*6 Refers to the estimated value to apply when the power supply capacity is 500 kVA (inverter capacity x 10 when the inverter capacity exceeds 50 kVA) and the inverter is connected to the %X = 5% power supply.

\*7 Refers to the value to apply when a DC reactor (DCR) is used.

\*8 Refers to the average braking torque to apply when the motor running alone decelerates from 60 Hz with the AVR control being OFF. (It varies with the efficiency of the motor.)

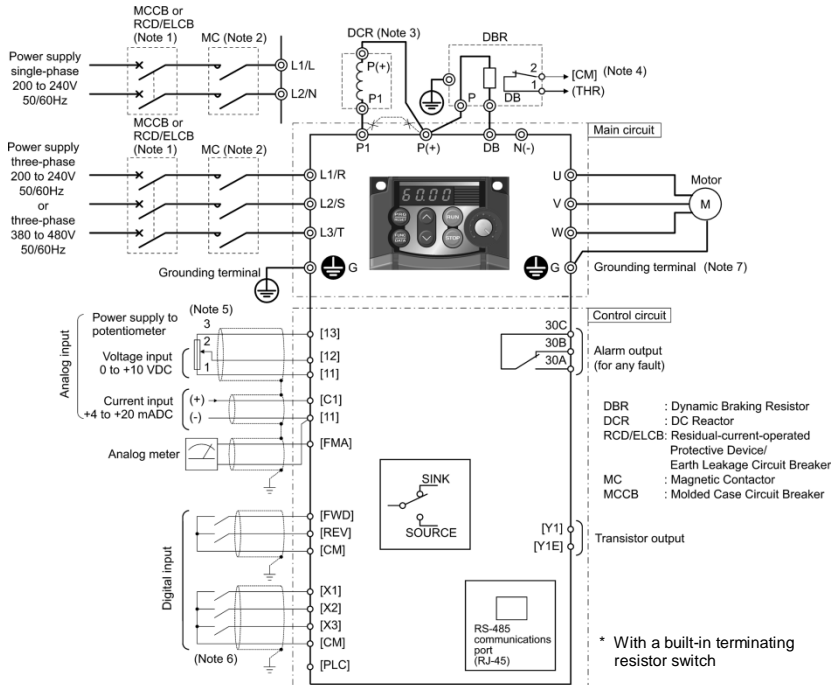
\*9 Available only for induction motor drive.

## 8.2 Terminal Specifications

### 8.2.1 Terminal functions

For details about the main and control circuit terminals, refer to Chapter 2, Section 2.3.5 and Section 2.3.6 (Table 2.8), respectively.

### 8.2.2 Connection diagram in operation by external signal inputs



(Note 1) Install a recommended molded case circuit breaker (MCCB) or a residual-current-operated protective device (RCD)/earth leakage circuit breaker (ELCB) (with overcurrent protection) in the primary circuit of the inverter to protect wiring. Do not use an MCCB or RCD/ELCB whose capacity exceeds the recommended rated current.

(Note 2) A magnetic contactor (MC) should, if necessary, be mounted independent of the MCCB or ELCB to cut off the power fed to the inverter. Refer to page 9-2 for details. MCs or solenoids that will be installed close to the inverter require surge absorbers to be connected in parallel to their coils.

(Note 3) When connecting a DC reactor (option), remove the jumper bar from terminals [P1] and [P+].

(Note 4) The **THR** function can be used by assigning "9" (External alarm) to any of terminals [X1] to [X3], [FWD] or [REV] (function code E01 to E03, E98, or E99). For details, refer to Chapter 9.

(Note 5) Frequency can be set by connecting a frequency setting device (external potentiometer) between terminals [11], [12], and [13] instead of inputting voltage signal (0 to +10 VDC or 0 to +5 VDC) between terminals [12] and [11].

- (Note 6) For the wiring of the control circuit, use shielded or twisted wires. When using shielded wires, connect the shields to earth. To prevent malfunction due to noise, keep the control circuit wiring away from the main circuit wiring as far as possible (recommended: 10 cm or longer), and never set them in the same wire duct. When crossing the control circuit wiring with the main circuit wiring, set them at right angles.
- (Note 7) It is recommended for noise control that 3-phase, 4-wire cable be used for the motor wiring. Connect grounding wires of the motor to the grounding terminal  $\sphericalangle$ G on the inverter.

The basic connection diagram above is for running/stopping the inverter and setting the frequency with external signals. Given below are connection notes.

- (1) Set function code F02 to "1" (External signals).
- (2) Set function code F01 to "1" (Voltage input to terminal [12]) or "2" (Current input to terminal [C1]).
- (3) Short-circuit terminals [FWD] and [CM] to run the motor in the forward direction and opening them to stop it. Short-circuit terminals [REV] and [CM] to run the motor in the reverse direction and opening them to stop it.
- (4) Frequency by voltage input is within the range from 0 to +10 VDC or 0 to the maximum frequency. Frequency by current input is within the range from +4 to +20 mADC or 0 to the maximum frequency.








### 8.3 Protective Functions

"—": Not applicable.

Name	Description	LED monitor displays	Alarm output [30A,B,C]	
Overcurrent protection Short-circuit protection Ground fault protection	<ul style="list-style-type: none"> <li>- Stops the inverter output to protect the inverter from an overcurrent resulting from overload.</li> <li>- Stops the inverter output to protect the inverter from an overcurrent due to a short circuit in the output circuit.</li> <li>- Stops the inverter output to protect the inverter from an overcurrent due to a ground fault in the output circuit. This protection is effective only when the inverter starts. If you turn on the inverter without removing the ground fault, this protection may not work.</li> </ul>	During acceleration	Oc1	Yes
		During deceleration	Oc2	
		During running at constant speed	Oc3	
Overvoltage protection	Stops the inverter output upon detection of overvoltage (400 VDC for 200 V series and 800 VDC for 400 V series) in the DC link bus. This protection is not assured if excess AC line voltage is applied inadvertently.	During acceleration	Ou1	Yes
		During deceleration	Ou2	
		During running at constant speed (Stopped)	Ou3	
Undervoltage protection	Stops the inverter output when the DC link bus voltage drops below the undervoltage level (200 VDC for 200 V series and 400 VDC for 400 V series). However, when F14 = 4 or 5, no alarm is output even if the DC link bus voltage drops.	Iu	Yes (Note)	
Input phase loss protection	Detects input phase loss, stopping the inverter output. This function prevents the inverter from undergoing heavy stress that may be caused by input phase loss or inter-phase voltage unbalance and may damage the inverter. If connected load is light or a DC reactor is connected to the inverter, this function may not detect input phase loss if any. In single-phase series of inverters, this function is disabled by factory default.	Iin	Yes	
Output phase loss protection	Detects breaks in inverter output wiring at the start of running and during running, stopping the inverter output.	Op1	Yes	
Overheat protection	Inverter	- Stops the inverter output upon detecting excess heat sink temperature in case of cooling fan failure or overload.	Oh1	Yes
	Braking resistor	- Protects the braking resistor from overheat in accordance with the setting of the electronic thermal overload relay for braking resistor. * It is necessary to set the function code data according to the braking resistor used (built-in or external).	dbh	Yes
Overload protection	Stops the inverter output according to the inverter heat sink temperature and the switching element temperature calculated from the output current.	Olu	Yes	

(Note) No alarm output depending upon the data setting of the function code.

Name		Description	LED monitor displays	Alarm output displays [30A,B,C]
Motor protection	Electronic thermal overload relay	Stops the inverter output in accordance with the setting of the electronic thermal overload relay to protect the motor. This function protects general-purpose motors and inverter motors over the entire frequency range, as well as protecting the 2nd motor. * The operation level and thermal time constant (0.5 to 75.0 minutes) can be set.	O11 O12	Yes
	PTC thermistor	A PTC thermistor input stops the inverter output for motor protection. A PTC thermistor is connected between terminals [C1] and [11], and a resistor is connected between terminals [13] and [C1].	Oh4	Yes
	Overload early warning	Outputs a preliminary alarm at a preset level before the motor is stopped by the electronic thermal function for the purpose of protecting the motor.	—	—
Stall prevention	Operates if the inverter's output current exceeds the instantaneous overcurrent limit level, avoiding tripping of the inverter (during constant speed operation or during acceleration).	—	—	
External alarm input	Stops the inverter output with an alarm through the digital input signal <b>THR</b> .	Oh2	Yes	
Alarm relay output (for any fault)	The inverter outputs a relay contact signal when the inverter issues an alarm and stops the inverter output. < Alarm Reset > The alarm stop state is reset by pressing the  key or by the digital input signal <b>RST</b> . < Saving the alarm history and detailed data > The information on the previous 4 alarms can be saved and displayed.	—	Yes	
Memory error	The inverter checks memory data after power-on and when the data is written. If a memory error is detected, the inverter stops.	er1	Yes	
Remote keypad (option) communications error	The inverter stops by detecting a communication error between the inverter and the remote keypad (option) during operation from the remote keypad.	er2	Yes	
CPU error	If the inverter detects a CPU error caused by noise or some other factor, the inverter stops.	er3	Yes	
Operation error	STOP key priority	Pressing the  key on the keypad forces the inverter to decelerate and stop the motor even if the inverter is running by any run commands given via the terminals or communications (link operation). After the motor stops, the inverter issues alarm <b>er6</b> .	er6	Yes
	Start check function	Inverters prohibit any run operations and displays <b>er6</b> on the LED monitor if a run command is present at the time of any of the following status changes. - Powering up - An alarm (  key turned ON) is released or an alarm reset ( <b>RST</b> ) is input. - Link command ( <b>LE</b> ) has switched inverter operation and the run command in the source to be switched is active.		

Name	Description	LED monitor displays	Alarm output [30A,B,C]
Tuning error *1	Stops the inverter output when a tuning failure, interruption, or abnormal tuning result is detected during tuning of motor parameters.	er7	Yes
RS-485 communication error	Upon detection of an RS-485 communications error, the inverter stops its output.	er8	Yes
Data save error during undervoltage	If the data could not be saved during activation of the undervoltage protection function, the inverter displays the alarm code.	erf	Yes
Retry function	When the inverter stops due to a trip, this function automatically resets the inverter and restarts it. (The number of retries and the latency between stop and reset can be specified.)	—	—
Surge protection	Protects the inverter against surge voltages which might appear between one of the power lines for the main circuit and the ground.	—	—
Protection against momentary power failure	Upon detection of a momentary power failure lasting 15 ms or more, this function stops the inverter output. If "restart after momentary power failure" is selected, this function invokes a restart process when power has been restored within a predetermined period.	—	—
Overload prevention control	In the event of overheating of the cooling fan or an overload condition (alarm display: Oh1 or OIU ), the output frequency of the inverter is reduced to keep the inverter from tripping.	—	—
Mock alarm	A mock alarm can be generated with keypad operations to check the failure sequence.	err	Yes
PID feedback wire break detection	Upon detection of a PID feedback wire break, this function outputs an alarm.	cof	Yes
Step-out detection *2	Upon detection of a step-out of PMSM, the inverter stops its output.	erd	Yes

\*1 Available only for induction motor drive.

\*2 Available in the ROM version 0500 or later.

## **Compact Inverter**

### **GMD Series**

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## **Instruction Manual**

First Edition, November  
2015

**GMTCNT**

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The purpose of this instruction manual is to provide accurate information in handling, setting up and operating of the **GMD** series of inverters. Please feel free to send your comments regarding any errors or omissions you may have found, or any suggestions you may have for generally improving the manual.

In no event will **GMTCNT** be liable for any direct or indirect damages resulting from the application of the information in this manual.

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