



## Instruction Manual

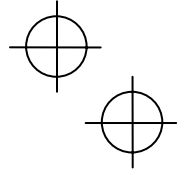
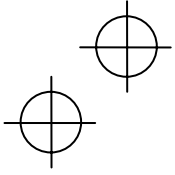
High Performance, Multifunction Inverter

# ***FRENIC-MEGA***

### CAUTION

Thank you for purchasing our FRENIC-MEGA series of inverters.

- This product is designed to drive a three-phase induction 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 how to use an optional device, refer to the instruction and installation manuals for that optional device.

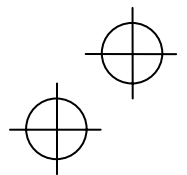
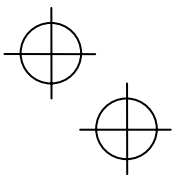


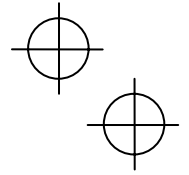
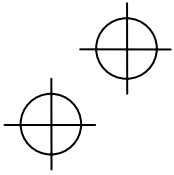
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## Preface

Thank you for purchasing our FRENIC-MEGA series of inverters.

This product is designed to drive a three-phase induction motor. 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.

This instruction manual has been prepared for the inverter versions to be destined for Asia (FRN \_ \_ \_ G1■-2A/4A) and EU (FRN \_ \_ \_ G1■-4E). The major differences from other inverter versions are factory defaults.

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

Listed below are the other materials related to the use of the FRENIC-MEGA. Read them in conjunction with this manual as necessary.



- FRENIC-MEGA User's Manual
- RS-485 Communication User's Manual

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

### ■ 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.

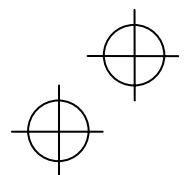
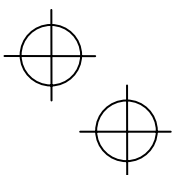
Safety precautions are classified into the following two categories in this manual.

 <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

 <b>WARNING</b>
<ul style="list-style-type: none"><li>• The FRENIC-MEGA is designed to drive a three-phase induction motor. Do not use it for single-phase motors or for other purposes. <b>Fire or an accident could occur.</b></li><li>• The FRENIC-MEGA may not be used for a life-support system or other purposes directly related to the human safety.</li><li>• Though the FRENIC-MEGA is manufactured under strict quality control, install safety devices for applications where serious accidents or property damages are foreseen in relation to the failure of it. <b>An accident could occur.</b></li></ul>





## Installation

### **WARNING**

- Install the inverter on a base made of metal or other non-flammable material.  
**Otherwise, a fire could occur.**
- Do not place flammable object nearby.  
**Doing so could cause fire.**
- Inverters with a capacity of 30 kW or above, whose protective structure is IP00, involve a possibility that a human body may touch the live conductors of the main circuit terminal block. Inverters to which an optional DC reactor is connected also involve the same. Install such inverters in an inaccessible place.  
**Otherwise, electric shock or injuries could occur.**

### **CAUTION**

- Do not support the inverter by its front 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.
- When changing the positions of the top and bottom mounting bases, use only the specified screws.  
**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.**


## Wiring

### **WARNING**

- If no zero-phase current (earth leakage current) detective device such as a ground-fault relay is installed in the upstream power supply line in order to avoid the entire power supply system's shutdown undesirable to factory operation, install a residual-current-operated protective device (RCD)/earth leakage circuit breaker (ELCB) individually to inverters to break the individual inverter power supply lines only.  
**Otherwise, a fire could occur.**
- 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 each pair of power lines to inverters. Use the recommended devices within the recommended current capacity.
- Use wires in the specified size.
- Tighten terminals with specified torque.  
**Otherwise, a fire could occur.**
- When there is more than one combination of an inverter and motor, do not use a multicore cable for the purpose of handling their wirings together.
- Do not connect a surge killer to the inverter's output (secondary) circuit.  
**Doing so could cause a fire.**
- Be sure to connect an optional DC reactor (DCR) when the capacity of the power supply transformer exceeds 500 kVA and is 10 times or more the inverter rated capacity.  
**Otherwise, a fire could occur.**



## **WARNING**

- Ground the inverter in compliance with the national or local electric code.
- Be sure to ground the inverter's grounding terminals G.  
**Otherwise, an electric shock or a fire could occur.**
- Qualified electricians should carry out wiring.
- Be sure to perform wiring after turning the power OFF.  
**Otherwise, an electric shock could occur.**
- Be sure to perform wiring after installing the inverter unit.  
**Otherwise, an 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, a fire or an accident could occur.**
- Do not connect the power supply wires to output terminals (U, V, and W).
- When connecting a DC braking resistor (DBR), never connect it to terminals other than terminals P(+) and DB.  
**Doing so could cause fire or an accident.**
- In general, sheaths of the control signal wires are not specifically designed to withstand a high voltage (i.e., reinforced insulation is not applied). Therefore, if a control signal wire comes into direct contact with a live conductor of the main circuit, the insulation of the sheath might break down, which would expose the signal wire to a high voltage of the main circuit. Make sure that the control signal wires will not come into contact with live conductors of the main circuit.  
**Doing so could cause an accident or an electric shock.**
- Before changing the switches or touching the control circuit terminal symbol plate, turn OFF the power and wait at least five minutes for inverters with a capacity of 22 kW or below, or at least ten minutes for inverters with a capacity of 30 kW or above. Make sure that the LED monitor and charging lamp are 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 to the safe level (+25 VDC or below).  
**Otherwise, an electric shock could occur.**

## **CAUTION**

- The inverter, motor and wiring generate electric noise. Be careful about malfunction of the nearby sensors and devices. To prevent them from malfunctioning, implement noise control measures.  
**Otherwise an accident could occur.**


### Operation



## **WARNING**

- Be sure to mount the front cover before turning the power ON. Do not remove the cover when the inverter power is ON.  
**Otherwise, an electric shock could occur.**
- Do not operate switches with wet hands.  
**Doing so could cause electric shock.**
- If the auto-reset 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 at the time of restarting.  
**Otherwise, an accident could occur.**



## **WARNING**

- If the stall prevention function (current limiter), automatic deceleration (anti-regenerative control), or overload prevention control has been selected, the inverter may operate with acceleration/deceleration or frequency different from the commanded ones. Design the machine so that safety is ensured even in such cases.
- The  key on the keypad is effective only when the keypad operation is enabled with function code F02 (= 0, 2 or 3). When the keypad operation is disabled, prepare an emergency stop switch separately for safe operations.

Switching the run command source from keypad (local) to external equipment (remote) by turning ON the "Enable communications link" command **LE** disables the  key. To enable the  key for an emergency stop, select the STOP key priority with function code H96 (= 1 or 3).
- If any of the protective functions have been activated, first remove the cause. Then, after checking that the all run commands are set to OFF, release the alarm. If the alarm is released while any run commands are set to ON, the inverter may supply the power to the motor, running the motor.

**Otherwise, an accident could occur.**
- If you enable the "Restart mode after momentary power failure" (Function code F14 = 3 to 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 the user configures the function codes wrongly without completely understanding this Instruction Manual and the FRENIC-MEGA 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.**
- Even if the inverter has interrupted power to the motor, if the voltage is applied to the main circuit input terminals L1/R, L2/S and L3/T, voltage may be output to inverter output terminals U, V, and W.
- Even if the run command is set to OFF, voltage is output to inverter output terminals U, V, and W if the servo-lock command is ON.

**An electric shock may occur.**
- The inverter can easily accept high-speed operation. When changing the speed setting, carefully check the specifications of motors or equipment beforehand.

**Otherwise, injuries could occur.**

## **CAUTION**

- Do not touch the heat sink and braking resistor because they become very hot.

**Doing so could cause burns.**
- The DC brake function of the inverter does not provide any holding mechanism.

**Injuries could occur.**
- When the inverter is controlled with the digital input signals, switching run or frequency command sources with the related terminal commands (e.g., **SS1**, **SS2**, **SS4**, **SS8**, **Hz2/Hz1**, **Hz/PID**, **IVS**, and **LE**) may cause a sudden motor start or an abrupt change in speed.

**An accident or injuries could occur.**



## Maintenance and inspection, and parts replacement

### **WARNING**

- Before proceeding to the maintenance/inspection jobs, turn OFF the power and wait at least five minutes for inverters with a capacity of 22 kW or below, or at least ten minutes for inverters with a capacity of 30 kW or above. Make sure that the LED monitor and charging lamp are 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 to the safe level (+25 VDC or below).  
**Otherwise, an electric shock could occur.**
- Maintenance, inspection, and parts replacement should be made only by qualified persons.
- Take off the watch, rings and other metallic objects before starting work.
- Use insulated tools.  
**Otherwise, an electric shock or injuries could occur.**
- Never modify the inverter.  
**Doing so could cause an electric shock or injuries.**

## Disposal

### **CAUTION**


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


### **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.

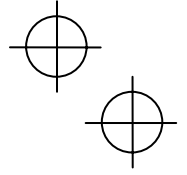
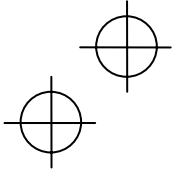
## Icons

The following icons are used throughout this manual.

 **Note** This icon indicates information which, if not heeded, can result in the inverter not operating to full efficiency, as well as information concerning incorrect operations and settings which can result in accidents.

 **Tip** This icon indicates information that can prove handy when performing certain settings or operations.


 This icon indicates a reference to more detailed information.

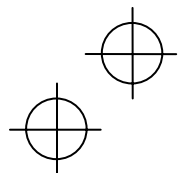
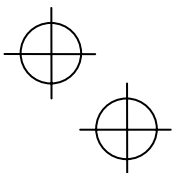


### Conformity to the Low Voltage Directive in the EU

If installed according to the guidelines given below, inverters marked with CE are considered as compliant with the Low Voltage Directive 73/23/EEC.

## CAUTION

1. The ground terminal  G should always be connected to the ground. Do not use only a residual-current-operated protective device (RCD)/earth leakage circuit breaker (ELCB)\* as the sole method of electric shock protection. Be sure to use ground wires whose size is greater than power supply lines.  
\*With overcurrent protection.
2. When used with the inverter, a molded case circuit breaker (MCCB), residual-current-operated protective device (RCD)/earth leakage circuit breaker (ELCB) or magnetic contactor (MC) should conform to the EN or IEC standards.
3. When you use a residual-current-operated protective device (RCD)/earth leakage circuit breaker (ELCB) for protection from electric shock in direct or indirect contact power lines or nodes, be sure to install **type B of RCD/ELCB** on the input (primary) of the inverter if the power supply is three-phase 200/400 V.
4. The inverter should be used in an environment that does not exceed Pollution Degree 2 requirements. If the environment conforms to Pollution Degree 3 or 4, install the inverter in an enclosure of IP54 or higher.
5. Install the inverter, AC or DC reactor, input or output filter in an enclosure with minimum degree of protection of IP2X (Top surface of enclosure shall be minimum IP4X when it can be easily accessed), to prevent human body from touching directly to live parts of these equipment.
6. Do not connect any copper wire directly to grounding terminals. Use crimp terminals with tin or equivalent plating to connect them.
7. When you use an inverter at an altitude of more than 2000 m, you should apply basic insulation for the control circuits of the inverter. The inverter cannot be used at altitudes of more than 3000 m.





Conformity to the Low Voltage Directive in the EU (Continued)



8. Use wires listed in EN60204 Appendix C.

Power supply voltage	Nominal applied motor	Inverter type	HD/LD mode	MCCB or RCD/ELCB *1 Rated current		Recommended wire size (mm <sup>2</sup> )									
						Main circuit						Control circuit	Aux. control power supply [R0, T0]	Aux. fan power supply [R1, T1]	
						Main power input *2 [L1/R, L2/S, L3/T] Inverter's grounding [G]		Inverter outputs *2 [U, V, W]	DC reactor [P1, P(+)] *2	Braking resistor [P(+), DB] *2					
						W/ DCR	W/o DCR				W/ DCR				W/o DCR
Three-phase 200 V	0.4	FRN0.4G1■-2□	HD	5	5	1	1	1	1	1	0.65 to 0.82	2.5	—		
	0.75	FRN0.75G1■-2□			10									1.5	
	1.5	FRN1.5G1■-2□			10										2.5
	2.2	FRN2.2G1■-2□			20										
	3.7	FRN3.7G1■-2□			20									30	
	5.5	FRN5.5G1■-2□	HD	30	50	4	6	4	4						
	7.5	FRN7.5G1■-2□	LD	40	75	6	10	6	6						
			HD												
	11	FRN11G1■-2□	LD	50	100	10	16	10	16						
			HD												
	15	FRN15G1■-2□	LD	75	125	16	25	16	25						
			HD												
	18.5	FRN18.5G1■-2□	LD	100	150	25	35	25	35						
			HD												
	22	FRN22G1■-2□	LD	100	175	35	50	35	35						
			HD												
	30	FRN30G1■-2□	LD	150	200	50	70	50	70						
			HD												
	37	FRN37G1■-2□	LD	175	250	70	95	70	95						
			HD												
45	FRN45G1■-2□	LD	200	300	95	70×2	95	50×2							
		HD													
55	FRN55G1■-2□	LD	250	350	50×2	95×2	70×2	70×2							
		HD													
75	FRN55G1■-2□	LD	350	—	95×2	—	95×2	120×2	10						

**Note:** A box (■) in the above table replaces S or E depending on the enclosure.  
A box (□) in the above table replaces A or E depending on the shipping destination.

\*1 The frame size and model of the MCCB or RCD/ELCB (with overcurrent protection) will vary, depending on the power transformer capacity. Refer to the related technical documentation for details.

\*2 The recommended wire size for main circuits is for the 70°C 600 V PVC wires used at a surrounding temperature of 40°C.

Conformity to the Low Voltage Directive in the EU (Continued)

**CAUTION**

Power supply voltage	Nominal applied motor	Inverter type	HD/LD mode	MCCB or RCD/ELCB *1 Rated current		Recommended wire size (mm <sup>2</sup> )									
						Main terminal						Control circuit	Aux. control power supply [R0, T0]	Aux. fan power supply [R1, T1]	
						Main power input *2 [L1/R, L2/S, L3/T] Inverter's grounding [G]		Inverter outputs *2 [U, V, W]	DC reactor [P1, P(+)] *2	Braking resistor [P(+), DB] *2	Auxiliary supply				
						W/ DCR	W/o DCR				W/ DCR				W/o DCR
Three-phase 400 V	0.4	FRN0.4G1■-4□	HD	5	5	1	1	1	1	0.65 to 0.82	2.5	—			
	0.75	FRN0.75G1■-4□			5								1	1	1
	1.5	FRN1.5G1■-4□		10	10										
	2.2	FRN2.2G1■-4□			15										
	3.7	FRN3.7G1■-4A		20	15								1	1	
	(4.0)*	FRN4.0G1■-4E			20										
	5.5	FRN5.5G1■-4□	HD	15	30	1	1	1	1						
	7.5	FRN7.5G1■-4□	LD	20	40	1.5	4	2.5					2.5		
			HD												
	11	FRN11G1■-4□	LD	30	50	4	6	4					4		
			HD												
	15	FRN15G1■-4□	LD	40	60	6	10	6					6		
			HD												
	18.5	FRN18.5G1■-4□	LD	40	75	6	16	10					10		
			HD												
	22	FRN22G1■-4□	LD	50	100	10	16	10					16		
			HD												
	30	FRN30G1■-4□	LD	75	125	16	25	16					25		
			HD												
	37	FRN37G1■-4□	LD	100	150	25	35	25					25		
			HD												
	45	FRN45G1■-4□	LD	100	150	25	50	35					35		
			HD												
	55	FRN55G1■-4□	LD	125	200	35	70	50					70		
HD															
75	FRN75G1■-4□	LD	175	—	70	—	70	95							
		HD													
90	FRN90G1■-4□	LD	200	—	95	—	95	50×2		4					

\* 4.0 kW for the EU. The inverter type is FRN4.0G1■-4E.

**Note:** A box (■) in the above table replaces S or E depending on the enclosure.

A box (□) in the above table replaces A or E depending on the shipping destination.

\*1 The frame size and model of the MCCB or RCD/ELCB (with overcurrent protection) will vary, depending on the power transformer capacity. Refer to the related technical documentation for details.

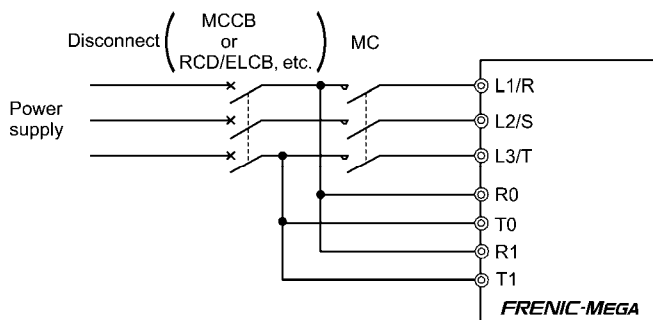
\*2 The recommended wire size for main circuits is for the 70°C 600 V PVC wires used at a surrounding temperature of 40°C.

### Conformity with UL standards and CSA standards (cUL-listed for Canada)

UL/cUL-listed inverters are subject to the regulations set forth by the UL standards and CSA standards (cUL-listed for Canada) by installation within precautions listed below.

## ⚠ CAUTION

1. Solid state motor overload protection (motor protection by electronic thermal overload relay) is provided in each model.  
Use function codes F10 to F12 to set the protection level.
2. Use Cu wire only.
3. Use Class 1 wire only for control circuits.
4. Short circuit rating  
"Suitable For Use On A Circuit Of Delivering Not More Than 100,000 rms Symmetrical Amperes, 240 Volts Maximum for 200V class input 22 kW or less, 230 Volts maximum for 200V class input 30 kW or above when protected by Class J Fuses or a Circuit Breaker having an interrupting rating not less than 100,000 rms Symmetrical Amperes, 240 Volts Maximum." Models FRN; rated for 200V class input.  
"Suitable For Use On A Circuit Of Delivering Not More Than 100,000 rms Symmetrical Amperes, 480 Volts Maximum when protected by Class J Fuses or a Circuit Breaker having an interrupting rating not less than 100,000 rms Symmetrical Amperes, 480 Volts Maximum." Models FRN; rated for 400V class input.  
"Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the National Electrical Code and any additional local codes."
5. Field wiring connections must be made by a UL Listed and CSA Certified closed-loop terminal connector sized for the wire gauge involved. Connector must be fixed using the crimp tool specified by the connector manufacturer.
6. All circuits with terminals L1/R, L2/S, L3/T, R0, T0, R1, T1 must have a common disconnect and be connected to the same pole of the disconnect if the terminals are connected to the power supply.



Conformity with UL standards and CSA standards (cUL-listed for Canada) (continued)

**CAUTION**

7. Install UL certified fuses or circuit breaker between the power supply and the inverter, referring to the table below.

Power supply voltage	Nominal applied motor	Inverter type	HD/LD mode	Class J fuse size	Circuit Breaker Trip Size (A)	Required torque lb-in (N·m)		
						Main terminal	Aux. Control Power Supply	Aux. Fan Power Supply
Three-phase 200 V	0.4	FRN0.4G1■-2□	HD	10	5	10.6 (1.2)	10.6 (1.2)	—
	0.75	FRN0.75G1■-2□		15	10			
	1.5	FRN1.5G1■-2□		20	15			
	2.2	FRN2.2G1■-2□		30	20	15.9 (1.8)		
	3.7	FRN3.7G1■-2□		40	30			
	5.5	FRN5.5G1■-2□	HD	60	50	30.9 (3.5)		
	7.5		LD	75	75			
		FRN7.5G1■-2□	HD					
	11	FRN11G1■-2□	LD	100	100			
			HD					
	15	FRN15G1■-2□	LD	150	125	51.3 (5.8)		
			HD					
	18.5	FRN18.5G1■-2□	LD	175	150			
			HD					
	22	FRN22G1■-2□	LD	200	175			
			HD					
	30	FRN30G1■-2□	LD	250	200	119.4 (13.5)		
			HD					
	37	FRN37G1■-2□	LD	350	250			
			HD					
45	FRN45G1■-2□	LD	400	300	238.9 (27)			
		HD						
55	FRN55G1■-2□	LD	450	350				
		HD						
75	FRN75G1■-2□	LD	500		10.6 (1.2)			

**Note:** A box (■) in the above table replaces S or E depending on the enclosure.  
A box (□) in the above table replaces A or E depending on the shipping destination.

Conformity with UL standards and CSA standards (cUL-listed for Canada) (addition)

**⚠ CAUTION**

Power supply voltage	Nominal applied motor	Inverter type	HD/LD mode	Wire size AWG (mm <sup>2</sup> )						Control circuit	Aux. Control Power Supply	Aux. Fan Power Supply
				Main terminal								
				L1/R, L2/S, L3/T			U, V, W					
				60°C Cu wire	75°C Cu wire	Remarks	60°C Cu wire	75°C Cu wire	Remarks			
Three-phase 200 V	0.4	FRN0.4G1■-2□	HD	14 (2.1)	14 (2.1)	—	14 (2.1)	14 (2.1)	—	19 or 18 (0.65 to 0.82)	14 (2.1) *1 *2	
	0.75	FRN0.75G1■-2□										
	1.5	FRN1.5G1■-2□										
	2.2	FRN2.2G1■-2□										
	3.7	FRN3.7G1■-2□	HD	10 (5.3)	10 (5.3)	*1	12 (3.3)	12 (3.3)	*1			
	5.5	FRN5.5G1■-2□										
	7.5	FRN7.5G1■-2□	LD	—	8 (8.4)	*2	—	8 (8.4)	*2			
	11		HD									
	15	FRN15G1■-2□	LD	3 (26.7)	4 (21.2)	—	4 (21.2)	6 (13.3)	—			
			HD									
	18.5	FRN18.5G1■-2□	LD	1 (42.4)	3 (26.7)	—	3 (26.7)	4 (21.2)	—			
			HD									
	22	FRN22G1■-2□	LD	—	2 (33.6)	—	2 (33.6)	3 (26.7)	—			
			HD									
	30	FRN30G1■-2□	LD	—	2/0 (67.4)	—	—	2 (33.6)	—			
			HD									
	37	FRN37G1■-2□	LD	—	3/0 (85)	*2	—	1 (42.4)	—			
			HD									
	45	FRN45G1■-2□	LD	—	4/0 (107.2)	—	—	1/0 (53.5)	*2			
			HD									
55	FRN55G1■-2□	LD	—	1/0×2 (53.5×2)	—	—	4/0 (107.2)	—				
		HD										
75	FRN55G1■-2□	LD	—	2/0×2 (67.4×2)	—	—	3/0×2 (85×2)	—				
		HD										

**Note:** A box (■) in the above table replaces S or E depending on the enclosure.  
A box (□) in the above table replaces A or E depending on the shipping destination.

\*1 No terminal end treatment is required for connection.

\*2 Use 75°C Cu wire only.

Conformity with UL standards and CSA standards (cUL-listed for Canada) (continued)

**CAUTION**

Power supply voltage	Nominal applied motor	Inverter type	HD/LD mode	Class J fuse size (A)	Circuit Breaker Trip Size (A)	Required torque lb-in (N·m)		
						Main terminal	Aux. Control Power Supply	Aux. Fan Power Supply
Three-phase 400 V	0.4	FRN0.4G1■-4□	HD	3	5	10.6	10.6 (1.2)	—
	0.75	FRN0.75G1■-4□		6		15.9 (1.8)		
	1.5	FRN1.5G1■-4□		10	10	30.9 (3.5)		
	2.2	FRN2.2G1■-4□		15	15			
	3.7 (4.0)*	FRN3.7G1■-4A FRN4.0G1■-4E		20	20	51.3 (5.8)		
	5.5	FRN5.5G1■-4□	30	30				
	7.5	FRN7.5G1■-4□	LD	40	40	119.4 (13.5)		
			HD	40	40			
	11	FRN11G1■-4□	LD	60	50	238.9 (27)		
			HD	60	50			
	15	FRN15G1■-4□	LD	70	60	10.6 (1.2)		
			HD	70	60			
	18.5	FRN18.5G1■-4□	LD	90	75	10.6 (1.2)		
			HD	90	75			
	22	FRN22G1■-4□	LD	100	100	10.6 (1.2)		
			HD	100	100			
	30	FRN30G1■-4□	LD	125	125	10.6 (1.2)		
			HD	125				
	37	FRN37G1■-4□	LD	175	150	10.6 (1.2)		
			HD	175				
45	FRN45G1■-4□	LD	200	200	10.6 (1.2)			
		HD	200			200		
55	FRN55G1■-4□	LD	250	175	10.6 (1.2)			
		HD				250	175	
75	FRN75G1■-4□	LD	300	200	10.6 (1.2)			

\* 4.0 kW for the EU. The inverter type is FRN4.0G1■-4E.

**Note:** A box (■) in the above table replaces S or E depending on the enclosure.  
A box (□) in the above table replaces A or E depending on the shipping destination.

Conformity with UL standards and CSA standards (cUL-listed for Canada) (addition)

**⚠ CAUTION**

Power supply voltage	Nominal applied motor	Inverter type	HD/LD mode	Wire size AWG (mm <sup>2</sup> )						Control circuit	Aux. Control Power Supply	Aux. Fan Power Supply
				Main terminal								
				L1/R, L2/S, L3/T			U, V, W					
				60°C Cu wire	75°C Cu wire	Remarks	60°C Cu wire	75°C Cu wire	Remarks			
Three-phase 400 V	0.4	FRN0.4G1■-4□	HD	14 (2.1)	14 (2.1)	—	14 (2.1)	14 (2.1)	—	19 or 18 (0.65 to 0.82)	14 (2.1) *1 *2	
	0.75	FRN0.75G1■-4□										
	1.5	FRN1.5G1■-4□										
	2.2	FRN2.2G1■-4□										
	3.7 (4.0)*	FRN3.7G1■-4A FRN4.0G1■-4E										
	5.5	FRN5.5G1■-4□	HD	—	12 (3.3)	*1	—	12 (3.3)	*1			
	7.5	FRN7.5G1■-4□	LD		10 (5.3)			*2				10 (5.3)
	11		HD	—	8 (8.4)	*2	8 (8.4)					
	15	FRN11G1■-4□	LD		6 (13.3)		6 (13.3)	—	6 (13.3)			—
	18.5	FRN15G1■-4□	HD	4 (21.2)		4 (21.2)						
	22	FRN18.5G1■-4□	LD		3 (26.7)		4 (21.2)	—	2 (33.6)			—
	30	FRN22G1■-4□	HD	2 (33.6)		3 (26.7)						
	37	FRN30G1■-4□	LD		—		2 (33.6)	*2	—			—
	45	FRN37G1■-4□	HD	—		2 (33.6)						
	55	FRN45G1■-4□	LD		—		1/0 (53.5)	*2	—			—
	75	FRN55G1■-4□	HD	—		2/0 (67.4)						
	90	FRN75G1■-4□	LD		—		—	*2	—			—

\* 4.0 kW for the EU. The inverter type is FRN4.0G1■-4E.

**Note:** A box (■) in the above table replaces S or E depending on the enclosure.  
A box (□) in the above table replaces A or E depending on the shipping destination.

\*1 No terminal end treatment is required for connection.

\*2 Use 75°C Cu wire only.

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## Chapter 1 BEFORE USING THE INVERTER

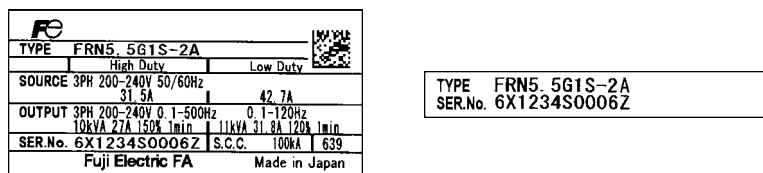
### 1.1 Acceptance Inspection

Unpack the package and check the following:

- (1) An inverter and instruction manual (this book) are contained in the package.

- Note**
- The inverter is not equipped with a keypad when it is shipped. Mount a separately ordered keypad on the inverter. This manual describes the inverter with a remote keypad. For inverters with a multi-function keypad, read the Multi-function Keypad Instruction Manual in conjunction with this manual.
  - Inverters with a capacity of 55 kW in LD mode and inverters with 75 kW or above require a DC reactor (DCR) to be connected. Be sure to connect a separately ordered DCR to those inverters.

- (2) The inverter has not been damaged during transportation—there should be no dents or parts missing.  
 (3) The inverter is the type you ordered. You can check the type and specifications on the main nameplate. (Main and sub nameplates are attached to the inverter and are located as shown on the next page.) For inverters with a capacity of 30 kW or above, the mass is printed on the main nameplate.

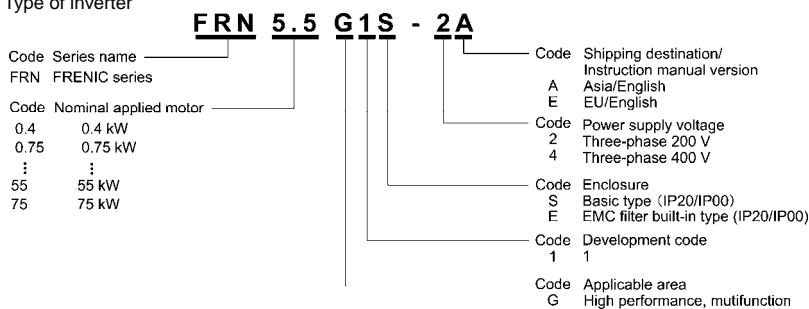


(a) Main Nameplate

(b) Sub Nameplate

Figure 1.1 Nameplates

TYPE: Type of inverter



**Note** In tables given in this manual, inverter types are denoted as "FRN\_ \_G1■-2□/4□." The boxes ■ and □ replace alphabetic letters depending on the enclosure and shipping destination, respectively.

The FRENIC-MEGA is available in two drive modes—High duty (HD) and Low duty (LD) modes. Either mode should be selected to match the load property of your system. Specifications in the HD and LD modes are printed each on the main nameplate. For details, see Chapter 8 "SPECIFICATIONS."

**High Duty:** HD mode designed for heavy duty load applications. Overload capability: 150% for 1 min, 200% for 3 s. Continuous ratings = Inverter ratings

**Low Duty:** LD mode designed for light duty load applications. Overload capability: 120% for 1 min. Continuous ratings = One rank higher capacity of inverters

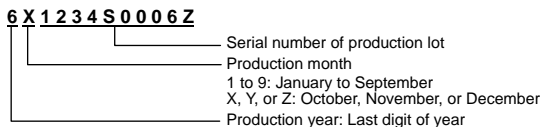
**SOURCE:** Number of input phases (three-phase: 3PH), input voltage, input frequency, input current (each for HD and LD modes)

**OUTPUT:** Number of output phases, rated output voltage, output frequency range, rated output capacity, rated output current, overload capability (each for HD and LD modes)

**S.C.C.:** Short-circuit capacity

**MASS:** Mass of the inverter in kilogram (30 kW or above)

**SER. No.:** Product number



If you suspect the product is not working properly or if you have any questions about your product, contact your Fuji Electric representative.

## 1.2 External View and Terminal Blocks

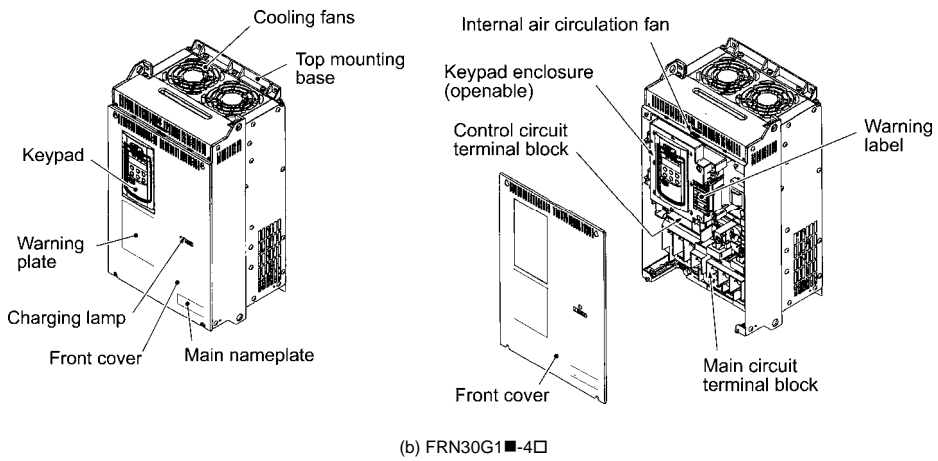
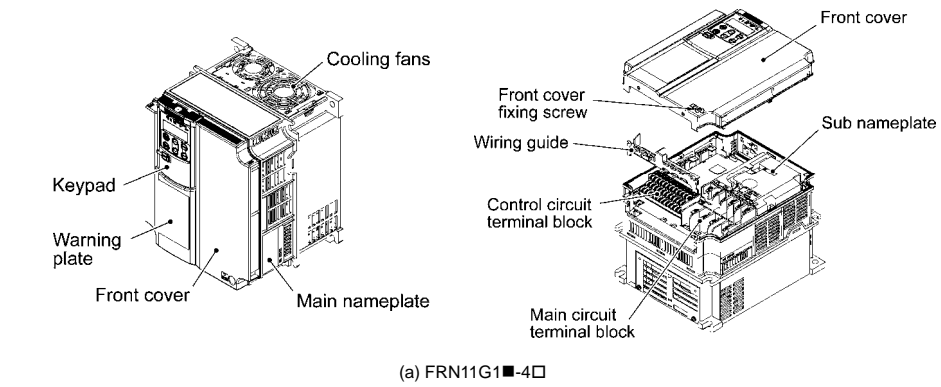


Figure 1.2 Outside and Inside Views of Inverters

**Note:** A box (■) in the above figures replaces S or E depending on the enclosure.  
 A box (□) in the above figures replaces A or E depending on the shipping destination.

### 1.3 Precautions for Using Inverters

#### 1.3.1 Precautions in introducing inverters

This section provides precautions in introducing inverters, e.g. precautions for installation environment, power supply lines, wiring, and connection to peripheral equipment. Be sure to observe those precautions.

##### ■ Installation environment

Install the inverter in an environment that satisfies the requirements listed in Table 2.1 in Chapter 2.

Fuji Electric strongly recommends installing inverters in a panel for safety reasons, in particular, when installing the ones whose enclosure rating is IP00.

When installing the inverter in a place out of the specified environmental requirements, it is necessary to derate the inverter or consider the panel engineering suitable for the special environment or the panel installation location. For details, refer to the Fuji Electric technical information "Engineering Design of Panels" or consult your Fuji Electric representative.

The special environments listed below require using the specially designed panel or considering the panel installation location.

Environments	Possible problems	Sample measures	Applications
Highly concentrated sulfidizing gas or other corrosive gases	Corrosive gases cause parts inside the inverter to corrode, resulting in an inverter malfunction.	Any of the following measures may be necessary. - Mount the inverter in a sealed panel with IP6X or air-purge mechanism. - Place the panel in a room free from influence of the gases.	Paper manufacturing, sewage disposal, sludge treatment, tire manufacturing, metal processing, and a particular process in textile factories.
A lot of conductive dust or foreign material (e.g., metal powders or shavings, carbon fibers, or carbon dust)	Entry of conductive dust into the inverter causes a short circuit.	Any of the following measures may be necessary. - Mount the inverter in a sealed panel. - Place the panel in a room free from influence of the conductive dust.	Wiredrawing machines, metal processing, extruding machines, printing presses, combustors, and industrial waste treatment.
A lot of fibrous or paper dust	Fibrous or paper dust accumulated on the heat sink lowers the cooling effect. Entry of dust into the inverter causes the electronic circuitry to malfunction.	Any of the following measures may be necessary. - Mount the inverter in a sealed panel that shuts out dust. - Ensure a maintenance space for periodical cleaning of the heat sink in panel engineering design. - Employ external cooling when mounting the inverter in a panel for easy maintenance and perform periodical maintenance.	Textile manufacturing and paper manufacturing.
High humidity or dew condensation	In an environment where a humidifier is used or where the air conditioner is not equipped with a dehumidifier, high humidity or dew condensation results, which causes a short-circuiting or malfunction of electronic circuitry inside the inverter.	- Put a heating module such as a space heater in the panel.	Outdoor installation. Film manufacturing line, pumps and food processing.
Vibration or shock exceeding the specified level	If a large vibration or shock exceeding the specified level is applied to the inverter, for example, due to a carrier running on seam joints of rails or blasting at a construction site, the inverter structure gets damaged.	- Insert shock-absorbing materials between the mounting base of the inverter and the panel for safe mounting.	Installation of an inverter panel on a carrier or self-propelled machine. Ventilating fan at a construction site or a press machine.
Fumigation for export packaging	Halogen compounds such as methyl bromide used in fumigation corrodes some parts inside the inverter.	- When exporting an inverter built in a panel or equipment, pack them in a previously fumigated wooden crate. When packing an inverter alone for export, use a laminated veneer lumber (LVL).	Exporting.

##### ■ Storage environment

The storage environment in which the inverter is stored after purchase is different from the operation environment. For details, refer to the FRENIC-MEGA User's Manual, Chapter 2.

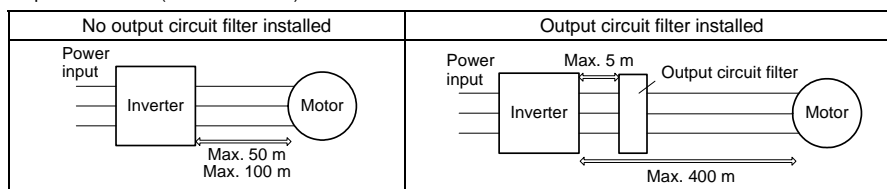
## ■ Wiring precautions

- (1) Route the wiring of the control circuit terminals as far from the wiring of the main circuit as possible. Otherwise electric noise may cause malfunctions.
- (2) 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).
- (3) If more than one motor is to be connected to a single inverter, the wiring length should be the sum of the length of the wires to the motors.
- (4) Precautions for high frequency leakage currents

If the wiring distance between an inverter and a motor is long, high frequency currents flowing through stray capacitance across wires of phases may cause an inverter overheat, overcurrent trip, increase of leakage current, or it may not assure the accuracy in measuring leakage current. Depending on the operating condition, an excessive leakage current may damage the inverter.

To avoid the above problems when directly connecting an inverter to a motor, keep the wiring distance 50 m or less for inverters with a capacity of 3.7 kW or below, and 100 m or less for inverters with a higher capacity.

If the wiring distance longer than the specified above is required, lower the carrier frequency or insert an output circuit filter (OFL-□□□-□A) as shown below.



For an inverter with an output circuit filter installed, the total secondary wiring length should be 400 m or less (100 m or less under the vector control).

If further longer secondary wiring is required, consult your Fuji Electric representative.

- (5) Precautions for surge voltage in driving a motor by an inverter (especially for 400 V class, general-purpose motors)
 

If the motor is driven by a PWM-type inverter, surge voltage 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. Implement any of the following measures.

  - Use a motor with insulation that withstands the surge voltage. (All Fuji standard motors feature reinforced insulation.)
  - Connect a surge suppressor unit (SSU50/100TA-NS) at the motor terminal.
  - Connect an output circuit filter (OFL-□□□-□A) to the output terminals (secondary circuits) of the inverter.
  - Minimize the wiring length between the inverter and motor (10 to 20 m or less).
- (6) When an output circuit filter is inserted in the secondary circuit or the wiring between the inverter and the motor is long, a voltage loss occurs due to reactance of the filter or wiring so that the insufficient voltage may cause output current oscillation or a lack of motor output torque. To avoid it, select the constant torque load by setting the function code F37 (Load Selection/Auto Torque Boost/Auto Energy Saving Operation 1) to "1" and keep the inverter output voltage at a higher level by configuring H50/H52 (Non-linear V/f Pattern, Frequency) and H51/H53 (Non-linear V/f Pattern, Voltage).

## ■ Precautions for connection of peripheral equipment

- (1) Phase-advancing capacitors for power factor correction

Do not mount a phase-advancing capacitor for power factor correction in the inverter's input (primary) or output (secondary) circuit. Mounting it in the input (primary) circuit takes no effect. To correct the inverter power factor, use an optional DC reactor (DCR). Mounting it in the output (secondary) circuit causes an overcurrent trip, disabling operation.

An overvoltage trip that occurs when the inverter is stopped or running with a light load is assumed to be due to surge current generated by open/close of phase-advancing capacitors in the power system. An optional DC/AC reactor (DCR/ACR) is recommended as a measure to be taken at the inverter side.

Input current to an inverter contains a harmonic component that may affect other motors and phase-advancing capacitors on the same power supply line. If the harmonic component causes any problems, connect an optional DCR/ACR to the inverter. In some cases, it is necessary to insert a reactor in series with the phase-advancing capacitors.

- (2) Power supply lines (Application of a DC/AC reactor)  
 Use an optional DC reactor (DCR) when the capacity of the power supply transformer is 500 kVA or more and is 10 times or more the inverter rated capacity or when there are thyristor-driven loads. If no DCR is used, the percentage-reactance of the power supply decreases, and harmonic components and their peak levels increase. These factors may break rectifiers or capacitors in the converter section of the inverter, or decrease the capacitance of the capacitors.

If the input voltage unbalance rate is 2% to 3%, use an optional AC reactor (ACR).

$$\text{Voltage unbalance (\%)} = \frac{\text{Max voltage (V)} - \text{Min voltage (V)}}{\text{Three-phase average voltage (V)}} \times 67 \text{ (IEC 61800-3)}$$

- (3) DC reactor (DCR) for correcting the inverter input power factor (for suppressing harmonics)  
 To correct the inverter input power factor (to suppress harmonics), use an optional DCR. Using a DCR increases the reactance of inverter's power source so as to decrease harmonic components on the power source lines and correct the power factor of the inverter.

DCR models	Input power factor	Remarks
DCR2/4-□□/□□A/□□B	Approx. 90% to 95%	The last letter identifies the capacitance.
DCR2/4-□□C	Approx. 86% to 90%	Exclusively designed for nominal applied motor of 37 kW or above.

**Note** Select a DCR matching not the inverter but the nominal applied motor. Therefore, for HD-mode inverters, arrange a DCR with the same capacity as the inverter; for LD-mode inverters, arrange a DCR with one rank higher capacity than the inverter.

- (4) PWM converter for correcting the inverter input power factor  
 Using a PWM converter (High power-factor, regenerative PWM converter, RHC series) corrects the inverter power factor up to nearly 100%. When combining an inverter with a PWM converter, disable the main power loss detection by setting the function code H72 to "0." If the main power loss detection is enabled (H72 = 1 by factory default), the inverter interprets the main power as being shut down, ignoring an entry of a run command.
- (5) Molded case circuit breaker (MCCB) or residual-current-operated protective device (RCD)/earth leakage circuit breaker (ELCB)  
 Install a recommended MCCB or RCD/ELCB (with overcurrent protection) in the primary circuit of the inverter to protect the wiring. Since using an MCCB or RCD/ELCB with a larger capacity than recommended ones breaks the protective coordination of the power supply system, be sure to select recommended ones. Also select ones with short-circuit breaking capacity suitable for the power source impedance.

Molded Case Circuit Breaker (MCCB) and Residual-Current-Operated Protective Device (RCD)/Earth Leakage Circuit Breaker (ELCB)

Power supply voltage	Nominal applied motor (kW)	Inverter type	HD/LD mode	Rated current of MCCB and RCD/ELCB (A)		Power supply voltage	Nominal applied motor (kW)	Inverter type	HD/LD mode	Rated current of MCCB and RCD/ELCB (A)	
				w/ DCR	w/o DCR					w/ DCR	w/o DCR
				Three-phase 200 V						Three-phase 400 V	
Three-phase 200 V	0.4	FRN0.4G1■-2□	HD	5	5	Three-phase 400 V	0.4	FRN0.4G1■-4□	HD	5	5
	0.75	FRN0.75G1■-2□			10		0.75	FRN0.75G1■-4□			10
	1.5	FRN1.5G1■-2□		10	15		1.5	FRN1.5G1■-4□		15	
	2.2	FRN2.2G1■-2□			20		2.2	FRN2.2G1■-4□		20	
	3.7	FRN3.7G1■-2□		20	30		3.7	FRN3.7G1■-4A		20	
	5.5	FRN5.5G1■-2□	30	50	4.0		FRN4.0G1■-4E*	20			
	7.5	FRN7.5G1■-2□	LD	40	75		5.5	FRN5.5G1■-4□	HD	15	30
			HD	50	100		7.5	FRN7.5G1■-4□	LD	20	40
	11	FRN11G1■-2□	LD				75	125	11	FRN11G1■-4□	HD
			HD	15	60				15	FRN15G1■-4□	LD
	18.5	FRN18.5G1■-2□	LD				100	175		18.5	FRN18.5G1■-4□
			HD	18.5	150				22	FRN22G1■-4□	LD
	22	FRN22G1■-2□	LD				150	200		22	FRN22G1■-4□
			HD	30	175				30	FRN30G1■-4□	LD
	30	FRN30G1■-2□	LD				175	250		30	FRN30G1■-4□
			HD	37	200				30	FRN37G1■-4□	LD
	37	FRN37G1■-2□	LD				200	300		37	FRN37G1■-4□
			HD	45	250				45	FRN45G1■-4□	LD
45	FRN45G1■-2□	LD	250			350	45	FRN45G1■-4□		HD	200
		HD		55	350		55	FRN55G1■-4□	LD	175	
55	FRN55G1■-2□	LD	350			---		55	FRN55G1■-4□		HD
		HD		75	---		75	FRN75G1■-4□	LD	200	---
75	FRN75G1■-2□	LD	350			---		75	FRN75G1■-4□		
		HD		90	---		90	FRN90G1■-4□	LD	200	---

\* 4.0 kW for the EU. The inverter type is FRN4.0G1■-4E.  
**Note:** A box (■) in the above table replaces S or E depending on the enclosure.  
 A box (□) in the above table replaces A or E depending on the shipping destination.





## ⚠ WARNING

If no zero-phase current (earth leakage current) detective device such as a ground-fault relay is installed in the upstream power supply line in order to avoid the entire power supply system's shutdown undesirable to factory operation, install a residual-current-operated protective device (RCD)/earth leakage circuit breaker (ELCB) individually to inverters to break the individual inverter power supply lines only.

**Otherwise, a fire could occur.**

(6) Magnetic contactor (MC) in the inverter input (primary) circuit

Avoid frequent ON/OFF operation of the magnetic contactor (MC) in the input circuit; otherwise, the inverter failure may result. If frequent start/stop of the motor is required, use **FWD/REV** terminal signals or the  /  keys on the inverter's keypad.

The frequency of the MC's ON/OFF should not be more than once per 30 minutes. To assure 10-year or longer service life of the inverter, it should not be more than once per hour.



- From the system's safety point of view, it is recommended to employ such a sequence that shuts down the magnetic contactor (MC) in the inverter input circuit with an alarm output signal **ALM** issued on inverter's programmable output terminals. The sequence minimizes the secondary damage even if the inverter breaks.

When the sequence is employed, connecting the MC's primary power line to the inverter's auxiliary control power input makes it possible to monitor the inverter's alarm status on the keypad.

- The breakdown of a braking unit or misconnection of an external braking resistor may trigger that of the inverter's internal parts (e.g., charging resistor). To avoid such a breakdown linkage, introduce an MC and configure a sequence that shuts down the MC if a DC link voltage establishment signal is not issued within three seconds after the MC is switched on.

For the braking transistor built-in type of inverters, assign a transistor error output signal **DBAL** on inverter's programmable output terminals to switch off the MC in the input circuit.

(7) Magnetic contactor (MC) in the inverter output (secondary) circuit

If a magnetic contactor (MC) is inserted in the inverter's output (secondary) circuit for switching the motor to a commercial power or for any other purposes, it should be switched on and off when both the inverter and motor are completely stopped. This prevents the contact point from getting rough due to a switching arc of the MC. The MC should not be equipped with any main circuit surge killer.

Applying a commercial power to the inverter's output circuit breaks the inverter. To avoid it, interlock the MC on the motor's commercial power line with the one in the inverter output circuit so that they are not switched ON at the same time.

(8) Surge absorber/surge killer

Do not install any surge absorber or surge killer in the inverter's output (secondary) lines.

### ■ Noise reduction

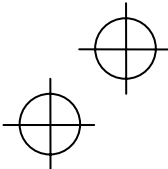
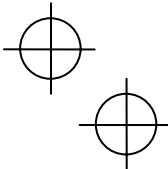
If noise generated from the inverter affects other devices, or that generated from peripheral equipment causes the inverter to malfunction, follow the basic measures outlined below.

(1) If noise generated from the inverter affects the other devices through power wires or grounding wires:

- Isolate the grounding terminals of the inverter from those of the other devices.
- Connect a noise filter to the inverter power wires.
- Isolate the power system of the other devices from that of the inverter with an insulated transformer.
- Decrease the inverter's carrier frequency (F26).

(2) If induction or radio noise generated from the inverter affects other devices:

- Isolate the main circuit wires from the control circuit wires and other device wires.
- Put the main circuit wires through a metal conduit pipe, and connect the pipe to the ground near the inverter.
- Install the inverter into the metal panel and connect the whole panel to the ground.
- Connect a noise filter to the inverter's power wires.
- Decrease the inverter's carrier frequency (F26).

- 
- 
- (3) When implementing measures against noise generated from peripheral equipment:
- For inverter's control signal wires, use twisted or shielded-twisted wires. When using shielded-twisted wires, connect the shield of the shielded wires to the common terminals of the control circuit.
  - Connect a surge absorber in parallel with magnetic contactor's coils or other solenoids (if any).

■ **Leakage current**

A high frequency current component generated by insulated gate bipolar transistors (IGBTs) switching on/off inside the inverter becomes leakage current through stray capacitance of inverter input and output wires or a motor. If any of the problems listed below occurs, take an appropriate measure against them.

Problem	Measures
An earth leakage circuit breaker* that is connected to the input (primary) side has tripped. *With overcurrent protection	1) Decrease the carrier frequency. 2) Make the wires between the inverter and motor shorter. 3) Use an earth leakage circuit breaker with lower sensitivity than the one currently used. 4) Use an earth leakage circuit breaker that features measures against the high frequency current component (Fuji SG and EG series).
An external thermal relay was activated.	1) Decrease the carrier frequency. 2) Increase the current setting of the thermal relay. 3) Use the electronic thermal overload protection built in the inverter, instead of the external thermal relay.

■ **Selecting inverter capacity**

- (1) To drive a general-purpose motor, select an inverter according to the nominal applied motor rating listed in the standard specifications table. When high starting torque is required or quick acceleration or deceleration is required, select an inverter with one rank higher capacity than the standard.
- (2) Special motors may have larger rated current than general-purpose ones. In such a case, select an inverter that meets the following condition.  
 Inverter rated current > Motor rated current

**1.3.2 Precautions in running inverters**

Precautions for running inverters to drive motors or motor-driven machinery are described below.

■ **Motor temperature**

When an inverter is used to run a general-purpose motor, the motor temperature becomes higher than when it is operated with a commercial power supply. In the low-speed range, the motor cooling effect will be weakened, so decrease the output torque of the motor when running the inverter in the low-speed range.

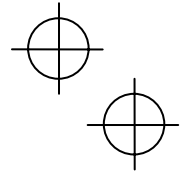
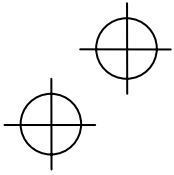
■ **Motor noise**

When a general-purpose motor is driven by an inverter, the noise level is higher than that when it is driven by a commercial power supply. To reduce noise, raise carrier frequency of the inverter. Operation at 60 Hz or higher can also result in higher noise level.

■ **Machine vibration**

When an inverter-driven motor is mounted to a machine, resonance may be caused by the natural frequencies of the motor-driven machinery. Driving a 2-pole motor at 60 Hz or higher may cause abnormal vibration. If it happens, do any of the following:

- Consider the use of a rubber coupling or vibration-proof rubber.
- Use the inverter's jump frequency control feature to skip the resonance frequency zone(s).
- Use the vibration suppression related function codes that may be effective. For details, refer to the description of H80 in Chapter 5 "FUNCTION CODES."



### 1.3.3 Precautions in using special motors

When using special motors, note the followings.

#### ■ Explosion-proof motors

When driving an explosion-proof motor with an inverter, use a combination of a motor and an inverter that has been approved in advance.

#### ■ Submersible motors and pumps

These motors have a larger rated current than general-purpose motors. Select an inverter whose rated output current is greater than that of the motor. These motors differ from general-purpose motors in thermal characteristics. Decrease the thermal time constant of the electronic thermal overload protection to match the motor rating.

#### ■ Brake motors

For motors equipped with parallel-connected brakes, their power supply for braking must be supplied from the inverter input (primary) circuit. If the power supply for braking is mistakenly connected to the inverter's output (secondary) circuit, the brake may not work when the inverter output is shut down. Do not use inverters for driving motors equipped with series-connected brakes.

#### ■ Geared motors

If the power transmission mechanism uses an oil-lubricated gearbox or speed changer/reducer, then continuous operation at low speed may cause poor lubrication. Avoid such operation.

#### ■ Synchronous motors

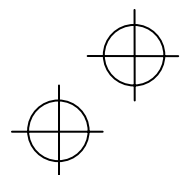
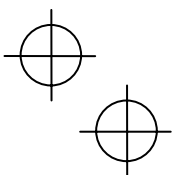
It is necessary to take special measures suitable for this motor type. Contact your Fuji Electric representative for details.

#### ■ Single-phase motors

Single-phase motors are not suitable for inverter-driven variable speed operation.

#### ■ High-speed motors

If the reference frequency is set to 120 Hz or higher to drive a high-speed motor, test-run the combination of the inverter and motor beforehand to check it for the safe operation.





## Chapter 2 MOUNTING AND WIRING 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
Surrounding temperature	-10 to +50°C (Note 1)
Relative humidity	5 to 95% (No condensation)
Atmosphere	The inverter must not be exposed to dust, direct sunlight, corrosive gases, flammable gases, oil mist, vapor or water drops. Pollution degree 2 (IEC60664-1) (Note 2) The atmosphere can contain a small amount 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. (Note 3)
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 clearance between them (22 kW or below), the surrounding 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 lint, cotton waste or moist dust or dirt which will clog the heat sink of the inverter. If the inverter is to be used in such an environment, install it in a dustproof panel of your system.

(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

Install the inverter on a base made of metal or other non-flammable material. Do not mount the inverter upside down or horizontally.

 <b>WARNING</b>
Install the inverter on a base made of metal or other non-flammable material. <b>Otherwise, a fire could occur.</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 surrounding temperature easily rises. Do not install the inverter in a small panel with poor ventilation.

##### ■ 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. When mounting them 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.

As long as the surrounding temperature is 40°C or lower, inverters with a capacity of 22 kW or below can be mounted side by side without any clearance between them.



\* For the inverters with a capacity of 1.5 kW or below and 30 kW or above, maintain 50 mm clearance to the right and left sides, 100 mm to the front.

Figure 2.1 Mounting Direction and Required Clearances

■ **When employing external cooling**

In external cooling, the heat sink, which dissipates about 70% of the total heat (total loss) generated into air, is situated outside the equipment or the panel. The external cooling, therefore, significantly reduces heat radiating inside the equipment or panel.

To employ external cooling for inverters with a capacity of 22 kW or below, use the external cooling attachment option; for those with a capacity of 30 kW or above, simply change the positions of the mounting bases.

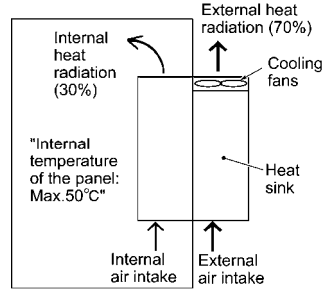


Figure 2.2 External Cooling

**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.

**Otherwise, a fire or accident could occur.**

To utilize external cooling for inverters with a capacity of 30 kW or above, change the positions of the top and bottom mounting bases from the edge to the center of the inverter as illustrated in Figure 2.3.

Screws differ in size, length and count for each inverter. Be sure to refer to the table below.

Table 2.3 Screw Count and Tightening Torque

Inverter type	Base fixing screw (Screw type and q'ty)	Case fixing screw (Screw type and q'ty)	Tightening torque (N·m)
FRN30G1 ■-2□/FRN37G1 ■-2□ FRN30G1 ■-4□ to FRN55G1 ■-4□	M6 x 20 5 pcs for upper side, 3 pcs for lower side	M6 x 20 2 pcs for upper side	5.8
FRN45G1 ■-2□/FRN55G1 ■-2□ FRN75G1 ■-4□	M6 x 20 3 pcs each for upper and lower sides	M6 x 12 3 pcs for upper side	5.8

**Note:** A box (■) in the above table replaces S or E depending on the enclosure.

A box (□) in the above table replaces A or E depending on the shipping destination.

- 1) Remove all of the base fixing screws from the top and bottom of the inverter. Also remove the case fixing screws from the top. (On the bottom are no case fixing screws.)
- 2) Move the top mounting base to the center of the inverter and secure it with the base fixing screws (2 or 3 pcs), using case fixing screw holes. (After the movement of the top mounting base, 5 or 3 screws are left unused.)
- 3) Move the bottom mounting base to the center of the inverter and secure it with the base fixing screws.

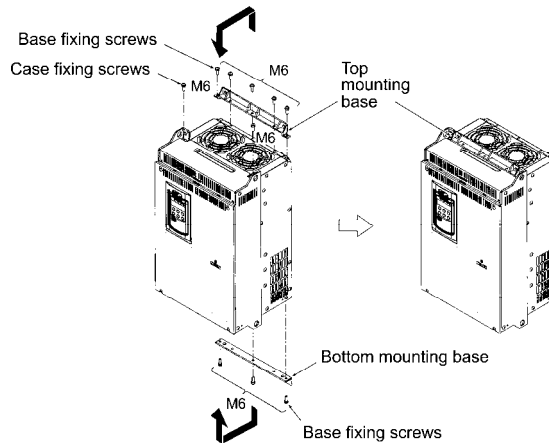


Figure 2.3 Changing the Positions of the Top and Bottom Mounting Bases

**CAUTION**

When changing the positions of the top and bottom mounting bases, use only the specified screws.  
**Otherwise, a fire or accident could occur.**

## 2.3 Wiring

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

### 2.3.1 Removing and mounting the front cover and the wiring guide

#### (1) For inverters with a capacity of 22 kW or below

- ① First loosen the front cover fixing screw, slide the cover downward holding its both sides, tilt it toward you, and then pull it upward, as shown below.
- ② While pressing the wiring guide upward, pull it out toward you.
- ③ After carrying out wiring (see Sections 2.3.2 through 2.3.7), put the wiring guide and the front cover back into place in the reverse order of removal.

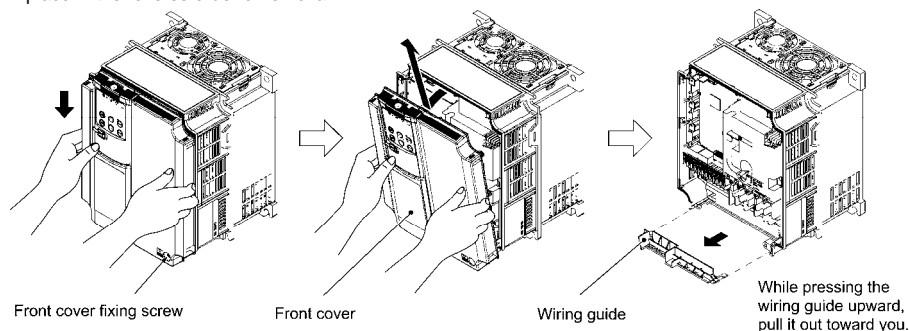


Figure 2.4 Removing the Front Cover and the Wiring Guide (FRN11G1-4□)

**Note:** A box (■) in the above figure replaces S or E depending on the enclosure.  
A box (□) in the above figure replaces A or E depending on the shipping destination.

#### (2) For inverters with a capacity of 30 to 75 kW

- ① Loosen the four front cover fixing screws, hold the cover with both hands, slide it upward slightly, and pull it toward you, as shown below.
- ② After carrying out wiring (see Sections 2.3.2 through 2.3.7), align the screw holes provided in the front cover with the screws on the inverter case, then put the front cover back into place in the reverse order of removal.

**Tip** To expose the control printed circuit board (control PCB), open the keypad enclosure.

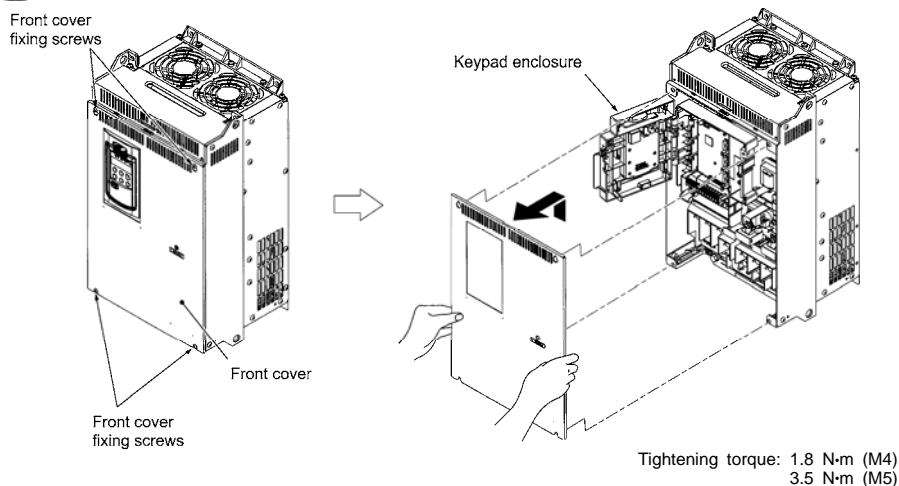


Figure 2.5 Removing the Front Cover (FRN30G1-4□)

**Note:** A box (■) in the above figure replaces S or E depending on the enclosure.  
A box (□) in the above figure replaces A or E depending on the shipping destination.

### 2.3.2 Terminal arrangement diagram and screw specifications

The table and figures given below show the terminal screw sizes, tightening torque and terminal arrangements. Note that the terminal arrangements differ depending on the inverter types. In each of the figures, two grounding terminals (⊕G) are not exclusive to the power supply wiring (primary circuit) or motor wiring (secondary circuit).

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

Table 2.4 Main Circuit Terminal Properties

Power supply voltage	Nominal applied motor (kW)	Inverter type	HD/LD mode	Terminal screw size	Tightening torque (N-m)	Grounding screw size	Tightening torque (N-m)	Refer to:
Three-phase 200 V	0.4	FRN0.4G1■-2□	HD	M3.5	1.2	M3.5	1.2	Figure A
	0.75	FRN0.75G1■-2□						
	1.5	FRN1.5G1■-2□						
	2.2	FRN2.2G1■-2□						
	3.7	FRN3.7G1■-2□						
	5.5	FRN5.5G1■-2□	HD	M5	3.5	M5	3.5	Figure C
	7.5	FRN7.5G1■-2□	LD					
	11		HD					
	15	FRN11G1■-2□	LD					
			HD					
	18.5	FRN15G1■-2□	LD	M6	5.8	M6	5.8	Figure D
	22	FRN18.5G1■-2□	HD					
			LD					
	30	FRN22G1■-2□	HD					
			LD					
	37	FRN30G1■-2□	HD	M8	13.5	M8	13.5	Figure E
	45	FRN37G1■-2□	LD					
			55	FRN45G1■-2□	HD	M10	27	M8
75	FRN55G1■-2□	LD						
		75	FRN55G1■-2□	HD				
75	FRN55G1■-2□			LD				
		Three-phase 400 V	0.4	FRN0.4G1■-4□	HD			
0.75	FRN0.75G1■-4□							
1.5	FRN1.5G1■-4□							
2.2	FRN2.2G1■-4□							
3.7 (4.0)*	FRN3.7G1■-4A FRN4.0G1■-4E							
5.5	FRN5.5G1■-4□		HD	M5	3.5	M5	3.5	Figure C
7.5	FRN7.5G1■-4□		LD					
			11					
15	FRN11G1■-4□		LD					
			HD					
18.5	FRN15G1■-4□		LD	M6	5.8	M6	5.8	Figure D
22	FRN18.5G1■-4□		HD					
			LD					
30	FRN22G1■-4□		HD					
			LD					

\* 4.0 kW for the EU. The inverter type is FRN4.0G1■-4E.

**Note:** A box (■) in the above table replaces S or E depending on the enclosure.

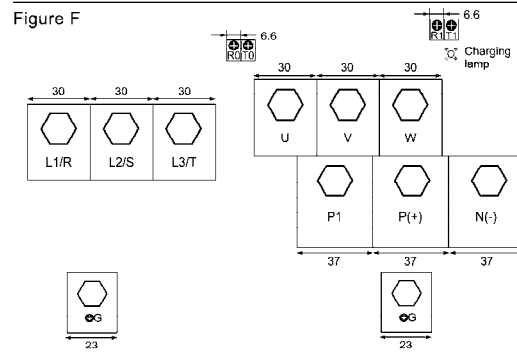
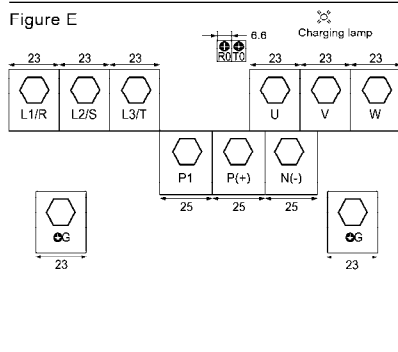
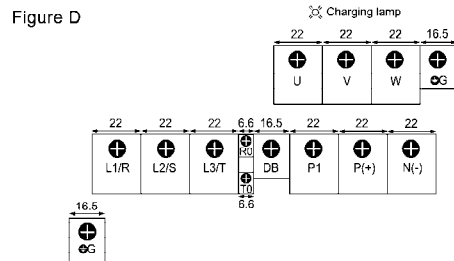
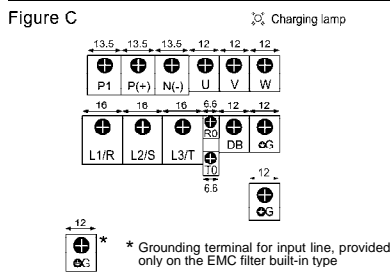
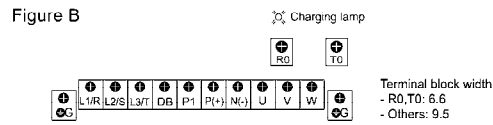
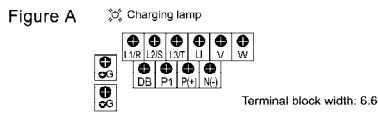
A box (□) in the above table replaces A or E depending on the shipping destination.

Table 2.4 Main Circuit Terminal Properties (Continued)

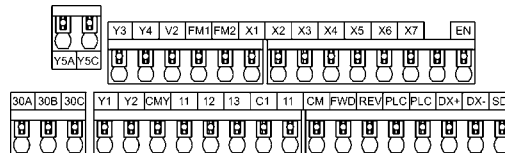
Power supply voltage	Nominal applied motor (kW)	Inverter type	HD/LD mode	Terminal screw size	Tightening torque (N-m)	Grounding screw size	Tightening torque (N-m)	Refer to:
Three-phase 400 V	30	FRN30G1■-4□	HD	M8	13.5	M8	13.5	Figure E
	37		LD					
	45	FRN37G1■-4□	HD					
			LD					
	55	FRN45G1■-4□	HD					
			LD					
75	FRN55G1■-4□	HD	M10	27		Figure F		
90		LD						

**Note:** A box (■) in the above table replaces S or E depending on the enclosure.  
A box (□) in the above table replaces A or E depending on the shipping destination.

Terminal R0, T0: Screw size M3.5, Tightening torque 1.2 N-m (common to all inverter types)  
Terminal R1, T1: Screw size M3.5, Tightening torque 1.2 N-m (for 200 V class series with 37 kW or above and for 400 V class series with 75 kW or above)



(2) Arrangement of control circuit terminals (common to all inverter types)



### 2.3.3 Recommended wire sizes

Tables 2.5 and 2.6 list the recommended wire sizes. Use crimp terminals covered with an insulation sheath or with an insulation tube. The recommended wire sizes for the main circuits are examples of using a single HIV wire (JIS C3317) (for 75°C) at a surrounding temperature of 50°C.

Table 2.5 Recommended Wire Sizes

Terminals common to all inverters	Recommended wire size (mm <sup>2</sup> )
Control circuit terminals	0.65 to 0.82 mm <sup>2</sup> (AWG19 or AWG18) *1
Auxiliary power input terminals for the control circuit R0 and T0	2.0
Auxiliary power input terminals for the fans R1 and T1	2.0 (200 V class series with 37 kW or above and 400 V class series with 75 kW or above)

\*1 Using wires exceeding the recommended sizes may lift the front cover depending upon the number of wires used, impeding keypad normal operation.

Table 2.6 Recommended Wire Sizes

Power supply voltage	Nominal applied motor (kW)	Inverter type	HD/LD mode	Recommended wire size (mm <sup>2</sup> )					
				Main circuit					
				Main circuit power input (L1/R, L2/S, L3/T)		Grounding [G]	Inverter output [U, V, W]	DCR [P1, P(+)]	Braking resistor [P(+), DB]
w/ DCR	w/o DCR								
Three-phase 200 V	0.4	FRN0.4G1■-2□	HD	2.0	2.0	2.0	2.0	2.0	2.0
	0.75	FRN0.75G1■-2□							
	1.5	FRN1.5G1■-2□							
	2.2	FRN2.2G1■-2□							
	3.7	FRN3.7G1■-2□							
	5.5	FRN5.5G1■-2□	HD	3.5	3.5	3.5	3.5		
	7.5	FRN7.5G1■-2□	LD						
	11	FRN11G1■-2□	HD	5.5	14	5.5	8.0	8.0	
			LD						
	15	FRN15G1■-2□	HD	14	22	8.0	14	14	
			LD						
	18.5	FRN18.5G1■-2□	HD	14	22	8.0	14	22	
			LD						
	22	FRN22G1■-2□	HD	22	38*2	14	22	22	
			LD						
	30	FRN30G1■-2□	HD	38*2	60*3	14	38*2	38*2	
			LD						
	37	FRN37G1■-2□	HD	38	60	22	38	60	
			LD						
	45	FRN45G1■-2□	HD	60	100	22	60	100	
LD									
55	FRN55G1■-2□	HD	100	-	22	100	100		
		LD							
75	FRN75G1■-2□	LD	150*4	-	22	150*4	150*4	5.5	

\*2 Use the crimp terminal model No. 38-6 manufactured by JST Mfg. Co., Ltd., or equivalent.

\*3 Use the crimp terminal model No. 60-6 manufactured by JST Mfg. Co., Ltd., or equivalent.

\*4 When using 150 mm<sup>2</sup> wires for main circuit terminals, use CB150-10 crimp terminals designed for low voltage appliances in JEM1399.

**Note:** A box (■) in the above table replaces S or E depending on the enclosure.  
A box (□) in the above table replaces A or E depending on the shipping destination.

Table 2.6 Recommended Wire Sizes (Continued)

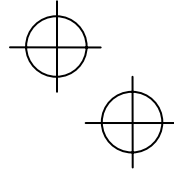
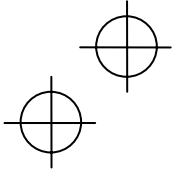
Power supply voltage	Nominal applied motor (kW)	Inverter type	HD/LD mode	Recommended wire size (mm <sup>2</sup> )					
				Main circuit					
				Main circuit power input (L1/R, L2/S, L3/T)		Grounding (E/G)	Inverter output [U, V, W]	DCR [P1, P(+)]	Braking resistor [P(+), DB]
w/ DCR	w/o DCR								
Three-phase 400 V	0.4	FRN0.4G1■-4□	HD	2.0	2.0	2.0	2.0	2.0	2.0
	0.75	FRN0.75G1■-4□							
	1.5	FRN1.5G1■-4□							
	2.2	FRN2.2G1■-4□							
	3.7 (4.0* <sup>5</sup> )	FRN3.7G1■-4A FRN4.0G1■-4E							
	5.5	FRN5.5G1■-4□	HD	2.0	2.0	2.0	2.0	2.0	
	7.5	FRN7.5G1■-4□	LD						
			HD	3.5	3.5	3.5	3.5		
	LD								
	11	FRN11G1■-4□	HD	3.5	5.5	3.5	3.5	3.5	
			LD						
	15	FRN15G1■-4□	HD	3.5	5.5	3.5	3.5	5.5	
			LD						
	18.5	FRN18.5G1■-4□	HD	5.5	8.0* <sup>6</sup>	5.5	5.5	5.5	
			LD						
	22	FRN22G1■-4□	HD	5.5	14	5.5	8.0* <sup>6</sup>	8.0* <sup>6</sup>	
			LD						
	30	FRN30G1■-4□	HD	14	22	8.0	14	14	
			LD						
	37	FRN37G1■-4□	HD	14	22	8.0	14	22	
LD									
45	FRN45G1■-4□	HD	22	38	14	22	22		
		LD							
55	FRN55G1■-4□	HD	22	38	14	38	38		
		LD							
75	FRN75G1■-4□	HD	38	-	14	60	60		
		LD							
90	FRN90G1■-4□	LD	60	-	14	60	100		

\*<sup>5</sup> 4.0 kW for the EU. The inverter type is FRN4.0G1■-4E.

\*<sup>6</sup> Use the crimp terminal model No. 8-L6 manufactured by JST Mfg. Co., Ltd., or equivalent.

**Note:** A box (■) in the above table replaces S or E depending on the enclosure.

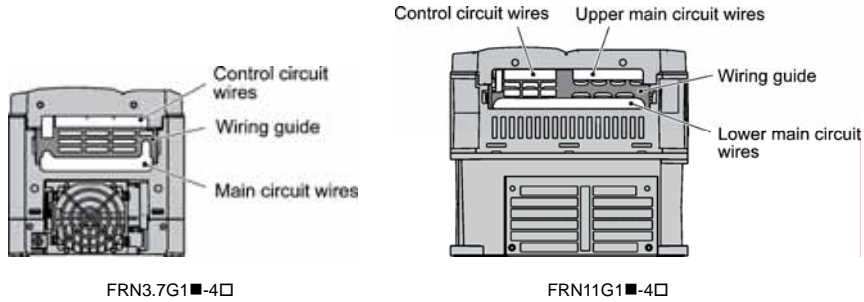
A box (□) in the above table replaces A or E depending on the shipping destination.



### 2.3.4 Wiring precautions

Follow the rules below when performing wiring for the inverter.

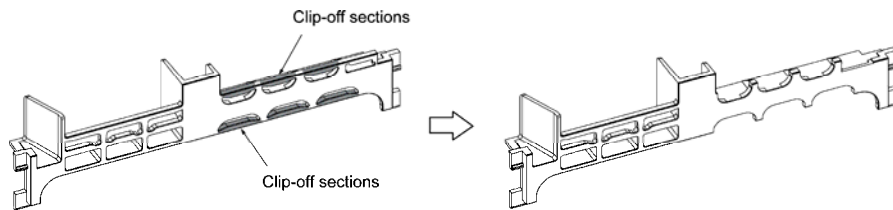
- (1) Make sure that the source voltage is within the rated voltage range specified on the nameplate.
- (2) Be sure to connect the three-phase power wires to the main circuit power input terminals L1/R, L2/S and L3/T of the inverter. If the power wires are connected to other terminals, the inverter will 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.
- (6) After removing a screw from the main circuit terminal block, be sure to restore the screw even if no wire is connected.
- (7) Use the wiring guide to separate wiring. For inverters with a capacity of 3.7 kW or below, the wiring guide separates the main circuit wires and the control circuit wires. For inverters with a capacity of 5.5 to 22 kW, it separates the upper and lower main circuit wires, and control circuit wires. Be careful about the wiring order.



**Note:** A box (■) in the above figure replaces S or E depending on the enclosure.  
A box (□) in the above figure replaces A or E depending on the shipping destination.

#### ■ Preparing for the wiring guide

Inverters with a capacity of 11 to 22 kW (three-phase 200 V class series) is sometimes lacking in wiring space for main circuit wires depending upon the wire materials used. To assure a sufficient wiring space, remove the clip-off sections (see below) as required with a nipper. Note that the enclosure rating of IP20 may not be ensured when the wiring guide itself is removed to secure a space for thick main circuit wiring.

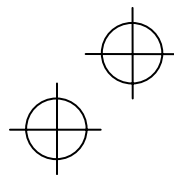
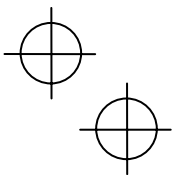


Before removal of clip-off sections

After removal of clip-off sections

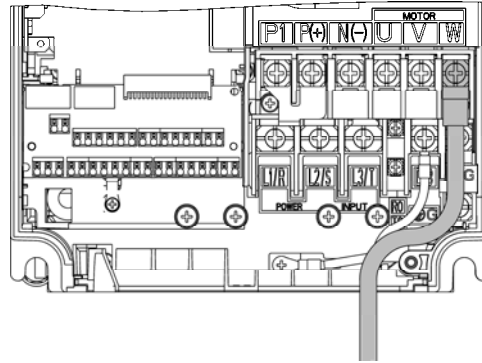
Wiring Guide (FRN15G1■-4□)

**Note:** A box (■) in the above figure replaces S or E depending on the enclosure.  
A box (□) in the above figure replaces A or E depending on the shipping destination.






- (8) In some types of inverters, the wires from the main circuit terminal block cannot be straight routed. Route such wires as shown below so that the front cover is set into place.



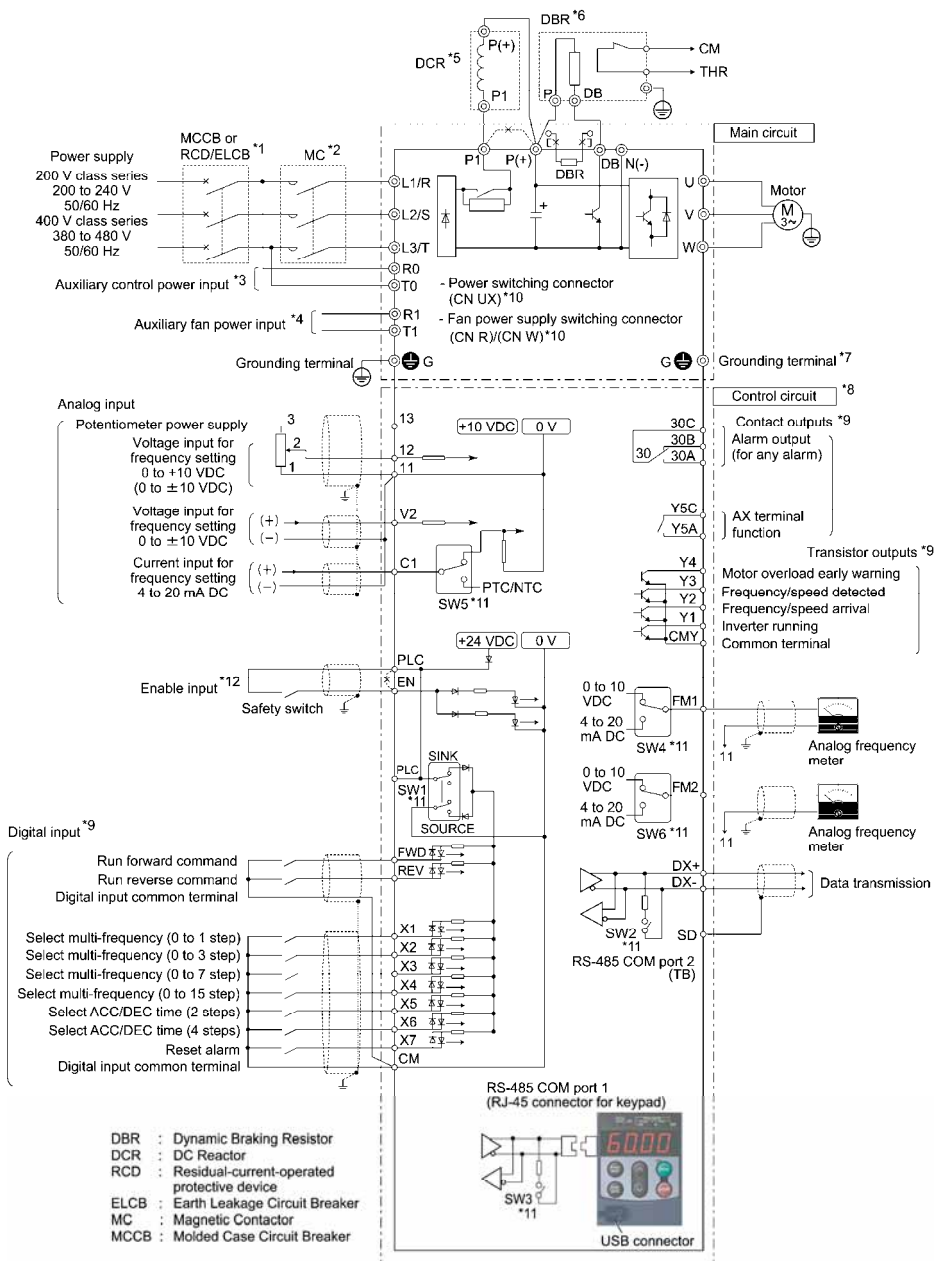
## **WARNING**

- 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 each pair of power lines to inverters. Use the recommended devices within the recommended current capacity.
- Be sure to use wires in the specified size.
- Tighten terminals with specified torque.  
**Otherwise, a fire could occur.**
- When there is more than one combination of an inverter and motor, do not use a multicore cable for the purpose of handling their wirings together.
- Do not connect a surge killer to the inverter's output (secondary) circuit.  
**Doing so could cause a fire.**
- Ground the inverter in compliance with the national or local electric code.
- Be sure to ground the inverter's grounding terminals G.  
**Otherwise, an electric shock or fire could occur.**
- Qualified electricians should carry out wiring.
- Be sure to perform wiring after turning the power OFF.  
**Otherwise, electric shock could occur.**
- Be sure to perform wiring after installing the inverter unit.  
**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, a fire or an accident could occur.**
- Do not connect the power source wires to inverter output terminals (U, V, and W).  
**Doing so could cause fire or an accident.**

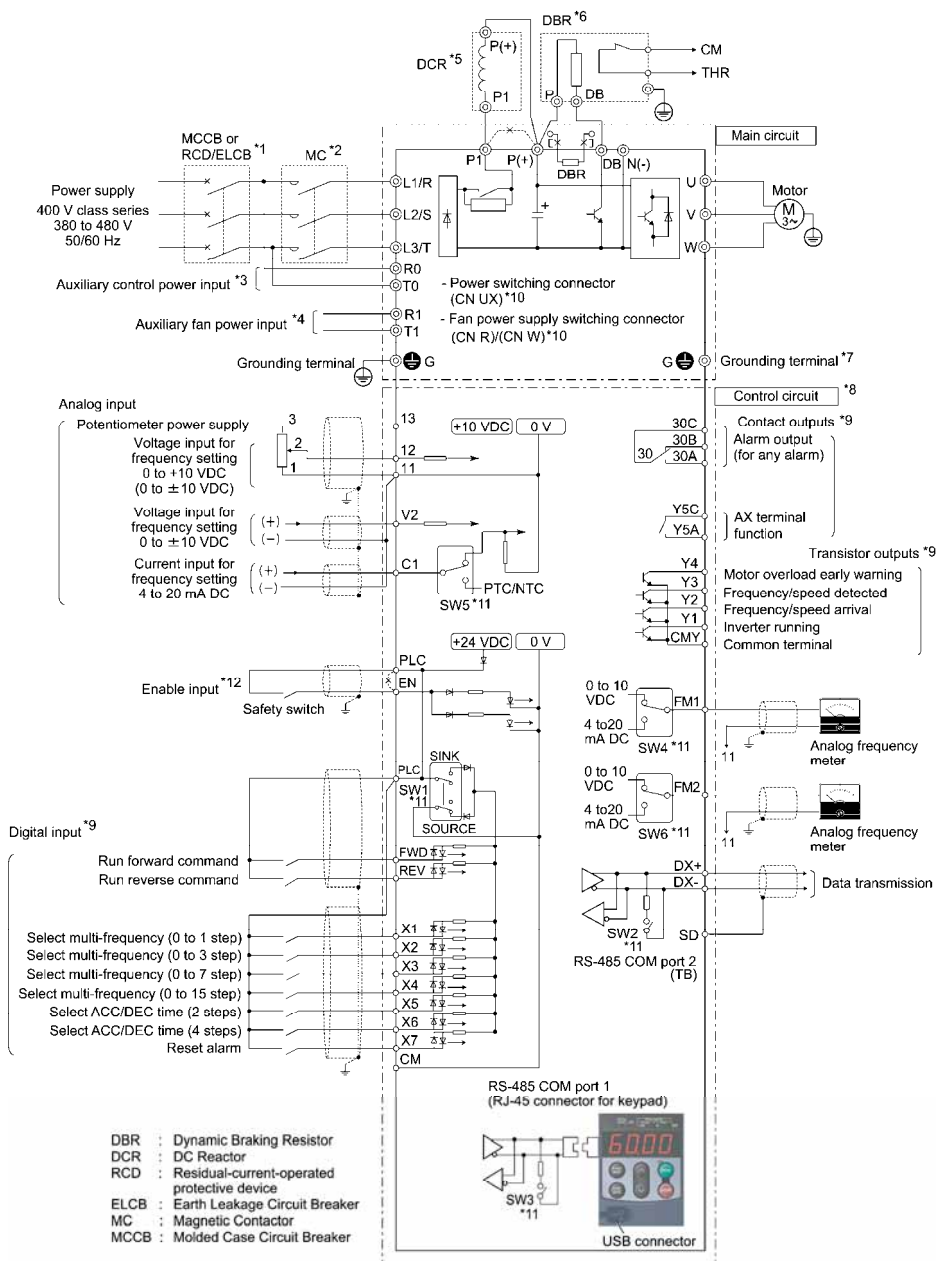
### 2.3.5 Wiring of main circuit terminals and grounding terminals

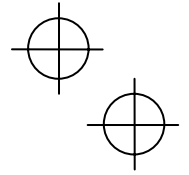
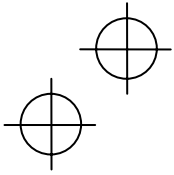
This section shows connection diagrams with the Enable input function used.

(1) FRN\_\_G1-2A/4A, with SINK mode input by factory default

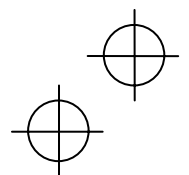
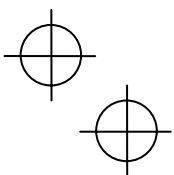


(2) FRN\_ \_G1-4E, with SOURCE mode input by factory default





- \*1 Install a recommended molded case circuit breaker (MCCB) or residual-current-operated protective device (RCD)/earth leakage circuit breaker (ELCB) (with overcurrent protection function) in the primary circuit of the inverter to protect wiring. Ensure that the circuit breaker capacity is equivalent to or lower than the recommended capacity.
- \*2 Install a magnetic contactor (MC) for each inverter to separate the inverter from the power supply, apart from the MCCB or RCD/ELCB, when necessary.  
Connect a surge absorber in parallel when installing a coil such as the MC or solenoid near the inverter.
- \*3 To retain an alarm output signal **ALM** issued on inverter's programmable output terminals by the protective function or to keep the keypad alive even if the main power has shut down, connect these terminals to the power supply lines. Without power supply to these terminals, the inverter can run.
- \*4 Normally no need to be connected. Use these terminals when the inverter is equipped with a high power-factor, regenerative PWM converter (RHC series).
- \*5 When connecting an optional DC reactor (DCR), remove the jumper bar from the terminals P1 and P(+).  
Inverters with a capacity of 55 kW in LD mode and inverters with 75 kW or above require a DCR to be connected. Be sure to connect it to those inverters.  
  
Use a DCR when the capacity of the power supply transformer exceeds 500 kVA and is 10 times or more the inverter rated capacity, or when there are thyristor-driven loads in the same power supply line.
- \*6 Inverters with a capacity of 7.5 kW or below have a built-in braking resistor (DBR) between the terminals P(+) and DB.  
When connecting an external braking resistor (DBR), be sure to disconnect the built-in one.
- \*7 A grounding terminal for a motor. Use this terminal if needed.
- \*8 For control signal wires, use twisted or shielded-twisted wires. When using shielded-twisted wires, connect the shield of them to the common terminals of the control circuit. 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 more). Never install them in the same wire duct. When crossing the control circuit wiring with the main circuit wiring, set them at right angles.
- \*9 The connection diagram shows factory default functions assigned to digital input terminals [X1] to [X7], [FWD] and [REV], transistor output terminals [Y1] to [Y4], and relay contact output terminals [Y5A/C] and [30A/B/C].
- \*10 Switching connectors in the main circuits. For details, refer to "⑥ Switching connectors" later in this section.
- \*11 Slide switches on the control printed circuit board (control PCB). Use these switches to customize the inverter operations. For details, refer to Section 2.3.7 "Setting up the slide switches."
- \*12 When using the Enable input function, be sure to remove the jumper wire from terminals [EN] and [PLC]. For opening and closing the hardware circuit between terminals [EN] and [PLC], use safety components such as safety relays and safety switches that comply with EN954-1, Category 3 or higher. Be sure to use shielded wires exclusive to terminals [EN] and [PLC]. (Do not put them together with any other control signal wire in the same shielded core.) Ground the shielding layer. For details, refer to Chapter 9, Section 9.6 "Compliance with EN954-1, Category 3."  
  
When not using the Enable input function, keep the terminals between [EN] and [PLC] short-circuited with the jumper wire (factory default).



① **Primary grounding terminal (⚡G) for inverter enclosure**

Two grounding terminals (⚡G) are not exclusive to the power supply wiring (primary circuit) or motor wiring (secondary circuit).

Be sure to ground either of the two grounding terminals for safety and noise reduction. The inverter is designed for use with safety grounding to avoid electric shock, fire and other disasters.

The grounding terminal for inverter enclosure should be grounded as follows:

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

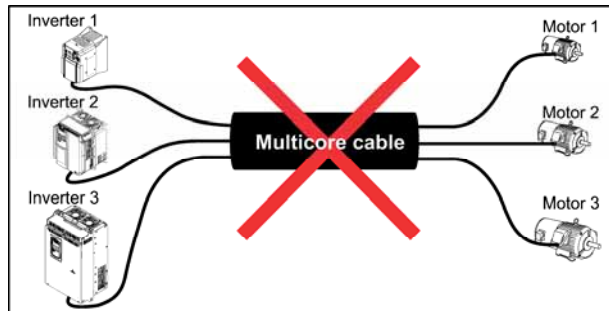
**Note** An EMC filter built-in type of inverters with a capacity of 5.5 to 11 kW (both 200 V and 400 V class series) has three grounding terminals. For effective noise suppression, connect grounding wires to the specified grounding terminals. (Refer to Chapter 9, Section 9.3.2 "Recommended installation procedure.")

② **Inverter output terminals U, V, and W and secondary grounding terminals (⚡G) for motor**

Inverter's output terminals should be connected as follows:

- 1) Connect the three wires of the 3-phase motor to terminals U, V, and W, aligning the phases each other.
- 2) Connect the secondary grounding wire to the grounding terminal (⚡G).

**Note** When there is more than one combination of an inverter and motor, do not use a multicore cable for the purpose of handling their wirings together.



③ **DC reactor terminals P1 and P(+)**

Connect a DC reactor (DCR) to these terminals for power factor correction.

- 1) Remove the jumper bar from terminals P1 and P(+).
- 2) Connect an optional DCR to those terminals.

**Note**

- The wiring length should be 10 m or below.
- Do not remove the jumper bar when a DCR is not used.
- Inverters with a capacity of 55 kW in LD mode and inverters with 75 kW or above require a DCR to be connected. Be sure to connect it to those inverters.
- If a PWM converter is connected to the inverter, no DCR is required.

**⚠ WARNING**

Be sure to connect an optional DC reactor (DCR) when the capacity of the power supply transformer exceeds 500 kVA and is 10 times or more the inverter rated capacity.

**Otherwise, a fire could occur.**

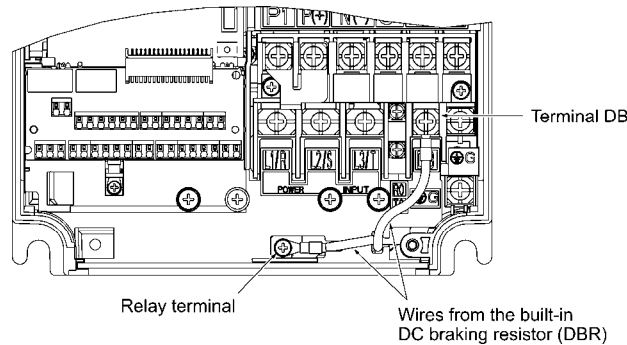
④ DC braking resistor terminals P(+) and DB (for inverters with a capacity of 22 kW or below)

Capacity (kW)	Braking transistor	Built-in DC braking resistor (DBR)	Optional devices	Option mounting steps required
0.4 to 7.5	Built-in	Built-in	External DC braking resistor (with a larger capacity)	1), 2), 3)
11 to 22	Built-in	No	External DC braking resistor	2), 3)

In inverters with a capacity of 7.5 kW or below, if the capacity of the built-in DC braking resistor (DBR) is insufficient since the inverter undergoes frequent start/stop or heavy inertial load, mount an optional external DC braking resistor (DBR) with a larger capacity to increase the braking capability. Before mounting the external DBR, remove the built-in DBR using the steps below.

- 1) For inverters with a capacity of 0.4 to 3.7 kW, disconnect the wiring of the built-in DBR from terminals P(+) and DB; for inverters with a capacity of 5.5 and 7.5 kW, disconnect the wiring from terminal DB and the internal relay terminal (see the figure below).

Insulate the terminals of the disconnected wires with insulating tape or other materials.



- 2) Connect an optional DBR to terminals P(+) and DB  
The internal relay terminal on inverters with a capacity of 5.5 and 7.5 kW is left unused.
- 3) Arrange the DBR and inverter so that the wiring length comes to 5 m or less and twist the two DBR wires or route them together in parallel.

⚠ WARNING
When connecting a DC braking resistor (DBR), never connect it to terminals other than terminals P(+) and DB. <b>Otherwise, a fire could occur.</b>

⑤ DC link bus terminals P(+) and N(-)

Capacity (kW)	Braking transistor	Built-in DC braking resistor (DBR)	Optional devices	Devices and terminals
30 to 75	No	No	Braking unit	Inverter—Braking unit: P(+) and N(-)
			DC braking resistor (DBR)	Braking unit—DBR: P(+) and DB

- 1) Connecting an optional braking unit or DC braking resistor (DBR)  
For inverters with a capacity of 30 kW or above, both a braking unit and DBR are necessary.  
Connect the terminals P(+) and N(-) of a braking unit to those on the inverter. Arrange the inverter and the braking unit so that the wiring length comes to 5 m or less and twist the two wires or route them together in parallel.  
Next, connect the terminals P(+) and DB of a DBR to those on the braking unit. Arrange the braking unit and DBR so that the wiring length comes to 10 m or less and twist the two wires or route them together in parallel.  
For details about the wiring, refer to the Braking Unit Instruction Manual.

2) Connecting other external devices

A DC link bus of other inverter(s) or a PWM converter is connectable to these terminals.

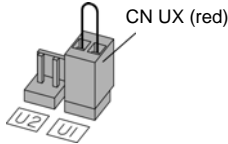
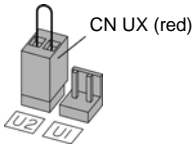
**Note** When you need to use the DC link bus terminals P(+) and N(-), consult your Fuji Electric representative.

⑥ Switching connectors

■ Power switching connectors (CN UX) (for 400 V class series with 75 kW or above)

The 400 V class series with 75 kW or above is equipped with a set of switching connectors (male) which should be configured according to the power source voltage and frequency. By factory default, a jumper (female connector) is set to U1. If the power supply to the main power inputs (L1/R, L2/S, L3/T) or the auxiliary fan power input terminals (R1, T1) matches the conditions listed below, change the jumper to U2.

For the switching instructions, see Figures 2.6 and 2.7.

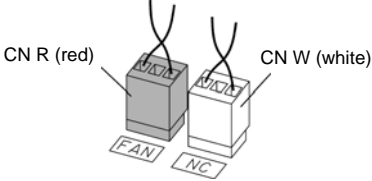
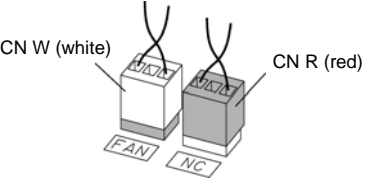
Connector configuration		
Power source voltage	398 to 440 V/50 Hz, 430 to 480 V/60 Hz (Factory default)	380 to 398 V/50 Hz 380 to 430 V/60 Hz

**Note** The allowable power input voltage fluctuation is within -15% to +10% of the power source voltage.

■ Fan power supply switching connectors (CN R and CN W) (for 200 V class series with 37 kW or above and 400 V class series with 75 kW or above)

The standard FRENIC-MEGA series accepts DC-linked power input in combination with a PWM converter. The 200 V class series with 37 kW or above and 400 V class series with 75 kW or above, however, contain AC-driven components such as AC fans. To supply AC power to those components, exchange the CN R and CN W connectors as shown below and connect the AC power line to the auxiliary fan power input terminals (R1, T1).

For the switching instructions, see Figures 2.6 and 2.7.

Connector configuration		
Use conditions	When not using terminal R1 or T1 (Factory default)	When using terminals R1 and T1 <ul style="list-style-type: none"> <li>• Feeding the DC-linked power</li> <li>• Combined with a PWM converter</li> </ul>

**Note** By factory default, the fan power supply switching connectors CN R and CN W are set on the **FAN** and **NC** positions, respectively. Do not exchange them unless you drive the inverter with a DC-linked power supply.

Wrong configuration of these switching connectors cannot drive the cooling fans, causing a heat sink overheat alarm *Oh1* or a charger circuit alarm *pbf*.

■ Location of the switching connectors

The switching connectors are located on the power printed circuit board (power PCB) as shown below.

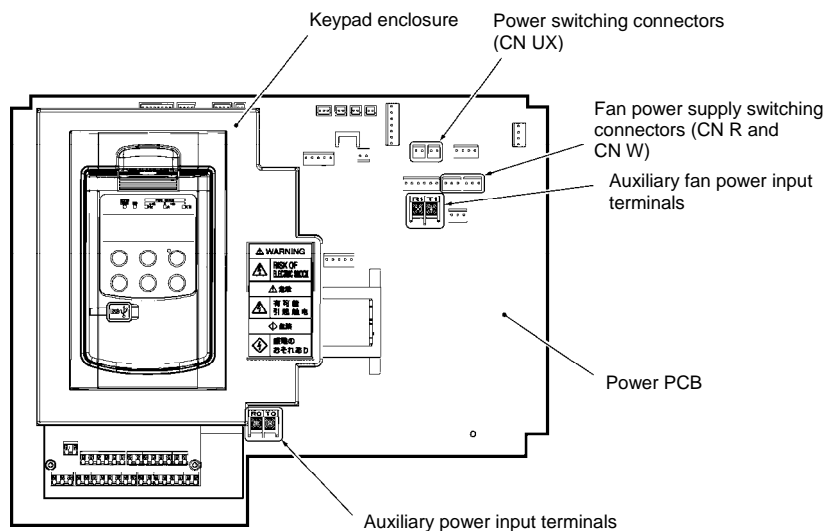


Figure 2.6 Location of Switching Connectors and Auxiliary Power Input Terminals

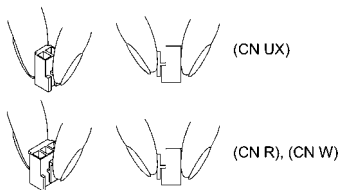


Figure 2.7 Inserting/Removing the Jumpers

**Note**

To remove each of the jumpers, pinch its upper side between your fingers, unlock its fastener, and pull it up. When mounting it, fit the jumper over the connector until it snaps into place.

⑦ **Main circuit power input terminals L1/R, L2/S, and L3/T (three-phase input)**

The three-phase input power lines are connected to these terminals.

- 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) to the input terminals of the inverter via an MCCB or residual-current-operated protective device (RCD)/earth leakage circuit breaker (ELCB)\*, and an 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 to insert a manually operable magnetic contactor (MC) that allows you to disconnect the inverter from the power supply in an emergency (e.g., when the protective function is activated), preventing a failure or accident from causing secondary disasters.

**Note**

To drive the inverter with single-phase input power, consult your Fuji Electric representative.



⑧ **Auxiliary control power input terminals R0 and T0  
(for inverters with a capacity of 1.5 kW or above)**

In general, the inverter runs normally without power supplied to the auxiliary control power input terminals R0 and T0. If the inverter main power is shut down, however, no power is supplied to the control circuit so that the inverter cannot issue a variety of output signals or display on the keypad.

To retain an alarm output signal **ALM** issued on inverter's programmable output terminals by the protective function or to keep the keypad alive even if the main power has shut down, connect the auxiliary control power input terminals R0 and T0 to the power supply lines. If a magnetic contactor (MC) is installed in the inverter's primary circuit, connect the primary circuit of the MC to these terminals R0 and T0.

**Note** When introducing a residual-current-operated protective device (RCD)/earth leakage circuit breaker (ELCB), connect its output (secondary) side to terminals R0 and T0. Connecting its input (primary) side to those terminals causes the RCD/ELCB to malfunction since the input power voltage to the inverter is three-phase but the one to terminals R0 and T0 is single-phase. To avoid such problems, be sure to insert an insulation transformer or auxiliary B contacts of a magnetic contactor in the location shown in Figure 2.8.

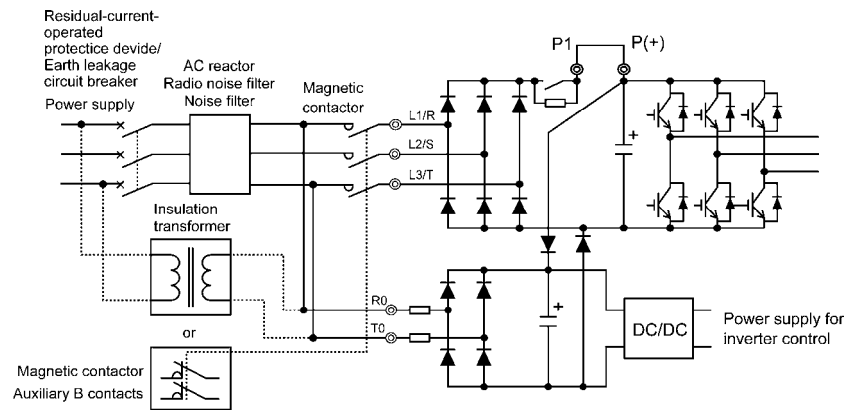


Figure 2.8 Connection Example of residual-current-operated protective device (RCD)/Earth Leakage Circuit Breaker (ELCB)

**Note** When connecting a PWM converter with an inverter, do not connect the power supply line directly to terminals R0 and T0. If a PWM is to be connected, insert an insulation transformer or auxiliary B contacts of a magnetic contactor at the power supply side.

For connection examples at the PWM converter side, refer to the PWM Converter Instruction Manual.

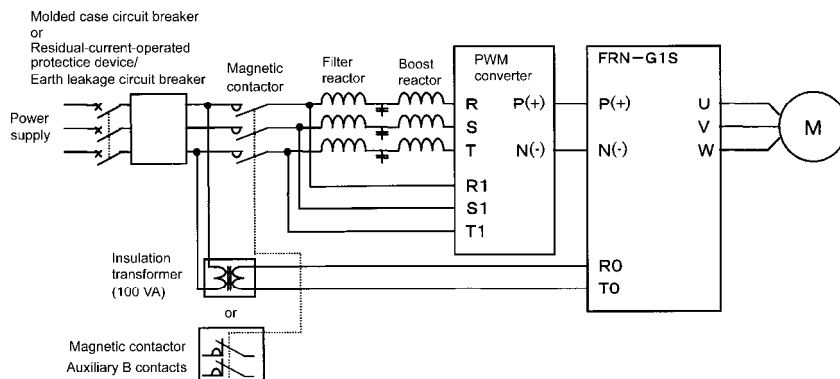
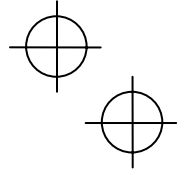
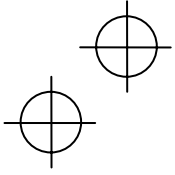


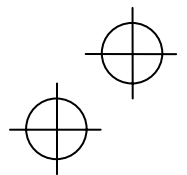
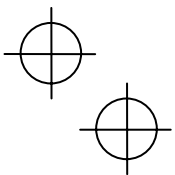
Figure 2.9 Connection Example of PWM Converter



⑨ Auxiliary fan power input terminals R1 and T1

The 200 V class series with 37 kW or above and 400 V class series with 75 kW or above are equipped with terminals R1 and T1. Only if the inverter works with the DC-linked power input whose source is a PWM converter, these terminals are used to feed AC power to the fans, while they are not used in any power system of ordinary configuration.

In this case, set up the fan power supply switching connectors (CN R and CN W).



### 2.3.6 Wiring for control circuit terminals

#### ⚠ WARNING

In general, the covers of the control signal wires are not specifically designed to withstand a high voltage (i.e., reinforced insulation is not applied). Therefore, if a control signal wire comes into direct contact with a live conductor of the main circuit, the insulation of 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 wires will not come into contact with live conductors of the main circuit.

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

#### ⚠ CAUTION

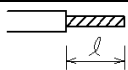
Noise may be emitted from the inverter, motor and wires.

Take appropriate measures to prevent the nearby sensors and devices from malfunctioning due to such noise.

**An accident could occur.**

#### ■ Connecting/disconnecting wires to/from a control circuit terminal

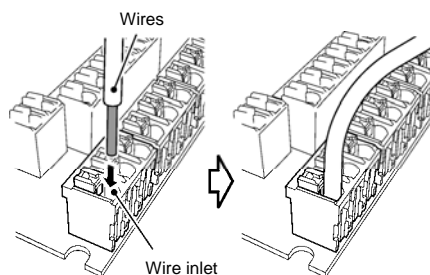
- ① Strip the wire end by 8 to 10 mm as shown below.

Strip length of wire end	8 to 10 mm	
Type of screwdriver (tip shape)	Flat (0.6 x 3.5 mm)	

**Note** For strand wires, the strip length specified above should apply after twisting of them.  
If the strip length is out of the specified range, the wire may not be firmly clamped or may be short-circuited with other wires.

- ② Twist the end of the stripped wires for easy insertion and insert it firmly into the wire inlet on the control circuit terminal. If the insertion is difficult, hold down the clamp release button on the terminal with a flat screwdriver.
- ③ When disconnecting the wires from the terminal, hold down the clamp release button on the terminal with a flat screwdriver and pull out the wires.

#### Connecting wire to terminal



#### Disconnecting wire from terminal

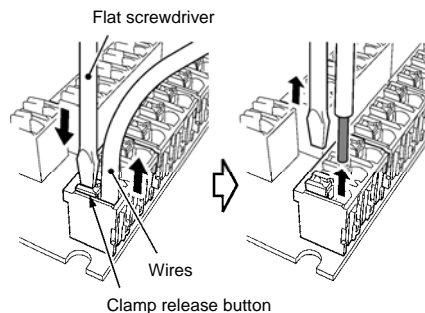


Table 2.7 lists the symbols, names and functions of the control circuit terminals. The wiring to the control circuit terminals differs depending upon the setting of the function codes, which reflects the use of the inverter. Route wires properly to reduce the influence of noise.

Table 2.7 Symbols, Names and Functions of the Control Circuit Terminals

Classification	Symbol	Name	Functions
Analog input	[13]	Power supply for the potentiometer	Power supply (+10 VDC) for frequency command potentiometer (Variable resistor: 1 to 5k $\Omega$ ) The potentiometer of 1/2 W rating or more should be connected.
	[12]	Analog setting voltage input	<ol style="list-style-type: none"> <li>(1) The frequency is commanded according to the external voltage input. <ul style="list-style-type: none"> <li>• 0 to <math>\pm 10</math> VDC/0 to <math>\pm 100\%</math> (Normal operation)</li> <li>• +10 to 0 VDC/0 to 100% (Inverse operation)</li> </ul> </li> <li>(2) In addition to frequency setting, PID command, PID feedback signal, auxiliary frequency command setting, ratio setting, torque limiter level setting, or analog input monitor can be assigned to this terminal.</li> <li>(3) Hardware specifications <ul style="list-style-type: none"> <li>• Input impedance: 22k<math>\Omega</math></li> <li>• The maximum input is <math>\pm 15</math> VDC, however, the voltage higher than <math>\pm 10</math> VDC is handled as <math>\pm 10</math> VDC.</li> <li>• Inputting a bipolar analog voltage (0 to <math>\pm 10</math> VDC) to terminal [12] requires setting function code C35 to "0."</li> </ul> </li> </ol>
	[C1]	Analog setting current input	<ol style="list-style-type: none"> <li>(1) The frequency is commanded according to the external current input. <ul style="list-style-type: none"> <li>• 4 to 20 mA DC/0 to 100% (Normal operation)</li> <li>• 20 to 4 mA DC/0 to 100 % (Inverse operation)</li> </ul> </li> <li>(2) In addition to frequency setting, PID command, PID feedback signal, auxiliary frequency command setting, ratio setting, torque limiter level setting, or analog input monitor can be assigned to this terminal.</li> <li>(3) Hardware specifications <ul style="list-style-type: none"> <li>• Input impedance: 250<math>\Omega</math></li> <li>• The maximum input is +30 mA DC, however, the current larger than +20 mA DC is handled as +20 mA DC.</li> </ul> </li> </ol>

Table 2.7 Symbols, Names and Functions of the Control Circuit Terminals (Continued)

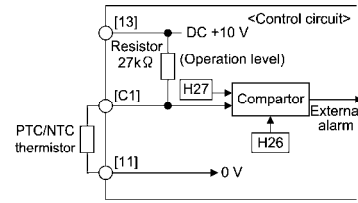
Classification	Symbol	Name	Functions
Analog input	[C1]	PTC/NTC thermistor input	<p>(1) Connects PTC (Positive Temperature Coefficient)/NTC (Negative Temperature Coefficient) thermistor for motor protection. Ensure that the slide switch SW5 on the control PCB is turned to the PTC/NTC position (see Section 2.3.7 "Setting up the slide switches").</p> <p>The figure shown at the right illustrates the internal circuit diagram where SW5 (switching the input of terminal [C1] between C1 and PTC/NTC) is turned to the PTC/NTC position. For details on SW5, refer to Section 2.3.7 "Setting up the slide switches." In this case, you must change data of the function code H26.</p>  <p style="text-align: center;">Figure 2.10 Internal Circuit Diagram (SW5 Selecting PTC/NTC)</p>
	[V2]	Analog setting voltage input	<p>(1) The frequency is commanded according to the external voltage input.</p> <ul style="list-style-type: none"> <li>• 0 to ±10 VDC/0 to ±100 % (Normal operation)</li> <li>• +10 to 0 VDC/0 to 100% (Inverse operation)</li> </ul> <p>(2) In addition to frequency setting, PID command, PID feedback signal, auxiliary frequency command setting, ratio setting, torque limiter level setting, or analog input monitor can be assigned to this terminal.</p> <p>(3) Hardware specifications</p> <ul style="list-style-type: none"> <li>• Input impedance: 22kΩ</li> <li>• The maximum input is ±15 VDC, however, the voltage higher than ±10 VDC is handled as ±10 VDC.</li> <li>• Inputting a bipolar analog voltage (0 to ±10 VDC) to terminal [V2] requires setting function code C45 to "0."</li> </ul>
	[11]	Analog common	Common for analog input/output signals ([13], [12], [C1], [V2], [FM1] and [FM2]). Isolated from terminals [CM] and [CMY].
<p><b>Note</b></p> <ul style="list-style-type: none"> <li>- Since low level analog signals are handled, these 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 2.11, be sure to 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 the analog signal, 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 the analog signal or connect a capacitor having the good cut-off characteristics for high frequency between control signal wires as shown in Figure 2.12.</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>			

Table 2.7 Symbols, Names and Functions of the Control Circuit Terminals (Continued)

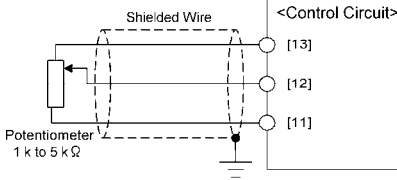
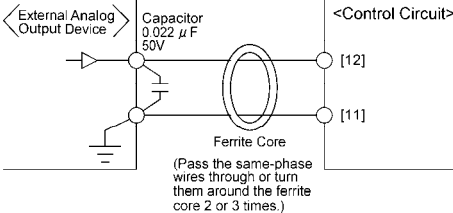
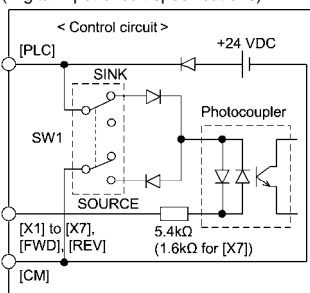
Classification	Symbol	Name	Functions																														
			  <p>Figure 2.11 Connection of Shielded Wire      Figure 2.12 Example of Electric Noise Reduction</p>																														
Digital input	[X1]	Digital input 1	<p>(1) Various signals such as "Coast to a stop," "Enable external alarm trip," and "Select multi-frequency" can be assigned to terminals [X1] to [X7], [FWD] and [REV] by setting function codes E01 to E07, E98, and E99. For details, refer to Chapter 5, Section 5.2 "Details of Function Codes."</p> <p>(2) Input mode, i.e. SINK/SOURCE, is changeable by using the slide switch SW1. (Refer to Section 2.3.7, "Setting up the slide switches.") The factory default for FRN_ _G1 ■-2A/4A is SINK, and for FRN_ _G1 ■-4E, SOURCE.</p> <p>(3) Switches the logic value (1/0) for ON/OFF of the terminals [X1] to [X7], [FWD], or [REV]. If the logic value for ON of the terminal [X1] is 1 in the normal logic system, for example, OFF is 1 in the negative logic system and vice versa.</p> <p>(4) Digital input terminal [X7] can be defined as a pulse train input terminal with the function codes.</p> <p>Maximum wiring length 20 m Maximum input pulse 30 kHz: When connected to a pulse generator with open collector transistor output (Needs a pull-up or pull-down resistor. See notes on page 2-24.) 100 kHz: When connected to a pulse generator with complementary transistor output</p> <p>For the settings of the function codes, refer to FRENIC-MEGA User's Manual, Chapter 5 "FUNCTION CODES."</p> <p>(Digital input circuit specifications)</p>  <table border="1"> <thead> <tr> <th colspan="2">Item</th> <th>Min.</th> <th>Max.</th> </tr> </thead> <tbody> <tr> <td rowspan="2">Operating 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">Operating 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 colspan="2">Operating current at ON (Input voltage is at 0 V) (For [X7])</td> <td>25 mA</td> <td>5 mA</td> </tr> <tr> <td colspan="2"></td> <td>(9.7 mA)</td> <td>(16 mA)</td> </tr> <tr> <td colspan="2">Allowable leakage current at OFF</td> <td>-</td> <td>0.5 mA</td> </tr> </tbody> </table> <p>Figure 2.13 Digital Input Circuit</p>	Item		Min.	Max.	Operating voltage (SINK)	ON level	0 V	2 V	OFF level	22 V	27 V	Operating voltage (SOURCE)	ON level	22 V	27 V	OFF level	0 V	2 V	Operating current at ON (Input voltage is at 0 V) (For [X7])		25 mA	5 mA			(9.7 mA)	(16 mA)	Allowable leakage current at OFF		-	0.5 mA
	Item			Min.	Max.																												
	Operating voltage (SINK)	ON level		0 V	2 V																												
		OFF level		22 V	27 V																												
	Operating voltage (SOURCE)	ON level		22 V	27 V																												
		OFF level		0 V	2 V																												
	Operating current at ON (Input voltage is at 0 V) (For [X7])			25 mA	5 mA																												
		(9.7 mA)	(16 mA)																														
Allowable leakage current at OFF		-	0.5 mA																														
[X2]	Digital input 2																																
[X3]	Digital input 3																																
[X4]	Digital input 4																																
[X5]	Digital input 5																																
[X6]	Digital input 6																																
[X7]	Digital input 7																																
[FWD]	Run forward command																																
[REV]	Run reverse command																																
[EN]	Enable input	<p>(1) Safety stop function that is compliant with EN954-1, Category 3. This terminal allows the hardware circuit to stop the inverter's output transistor and coast the motor to a stop.</p> <p>(2) This terminal is exclusively used for the source mode input. When it is short-circuited with terminal [PLC], the Enable input is ON (ready for inverter run); when it is opened, the inverter coasts the motor to a stop. (This terminal is not interlocked with the slide switch SW1.)</p> <p>(3) By factory default, terminals [EN] and [PLC] are short-circuited with each other using a jumper wire, disabling this function. To enable it, be sure to remove the jumper wire.</p> <p>For details of connection to this terminal and precautions, refer to Chapter 9, Section 9.6 "Compliance with EN954-1, Category 3."</p>																															

Table 2.7 Symbols, Names and Functions of the Control Circuit Terminals (Continued)

Classification	Symbol	Name	Functions																	
Digital input	[EN]	Enable input	<p>&lt;Terminal [EN] circuit specification&gt;</p> <table border="1"> <thead> <tr> <th>Item</th> <th>Min.</th> <th>Max.</th> </tr> </thead> <tbody> <tr> <td rowspan="2">Operating 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 rowspan="2">Operating current at ON (Input voltage is at 24 V)</td> <td></td> <td>5 mA</td> <td>10 mA</td> </tr> <tr> <td>Allowable leakage current at OFF</td> <td>-</td> <td>0.5 mA</td> </tr> </tbody> </table>	Item	Min.	Max.	Operating voltage (SOURCE)	ON level	22 V	27 V	OFF level	0 V	2 V	Operating current at ON (Input voltage is at 24 V)		5 mA	10 mA	Allowable leakage current at OFF	-	0.5 mA
	Item	Min.	Max.																	
	Operating voltage (SOURCE)	ON level	22 V	27 V																
OFF level		0 V	2 V																	
Operating current at ON (Input voltage is at 24 V)		5 mA	10 mA																	
	Allowable leakage current at OFF	-	0.5 mA																	
[PLC]	PLC signal power	<p>(1) Connects to PLC output signal power supply. Rated voltage: +24 VDC (Allowable range: +22 to +27 VDC), Maximum 100 mA DC</p> <p>(2) This terminal also supplies a power to the load connected to the transistor output terminals. Refer to "Transistor output" described later in this table for more.</p>																		
[CM]	Digital input common	<p>Two common terminals for digital input signals</p> <p>These terminals are electrically isolated from the terminals [11]s and [CMY].</p>																		
<p><b>Tip</b> ■ Using a relay contact to turn [X1] to [X7], [FWD], or [REV] ON or OFF</p> <p>Figure 2.14 shows two examples of a circuit that uses a relay contact to turn control signal input [X1] to [X7], [FWD], or [REV] ON or OFF. In circuit (a), the slide switch SW1 has been turned to SINK, whereas in circuit (b) it has been turned 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>(a) With the switch turned to SINK</p> <p>(b) With the switch turned to SOURCE</p> <p>Figure 2.14 Circuit Configuration Using a Relay Contact</p> <p><b>Tip</b> ■ Using a programmable logic controller (PLC) to turn [X1] to [X7], [FWD], or [REV] ON or OFF</p> <p>Figure 2.15 shows two examples of a circuit that uses a programmable logic controller (PLC) to turn control signal input [X1] to [X7], [FWD], or [REV] ON or OFF. In circuit (a), the slide switch SW1 has been turned to SINK, whereas in circuit (b) it has been turned 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 supply turns ON or OFF control signal [X1] to [X7], [FWD], or [REV]. When using this type of circuit, observe the following:</p> <ul style="list-style-type: none"> <li>- Connect the + node of the external power supply (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>																				

Table 2.7 Symbols, Names and Functions of the Control Circuit Terminals (Continued)

Classification	Symbol	Name	Functions																							
Digital input			<p>(a) With the switch turned to SINK</p> <p>(b) With the switch turned to SOURCE</p>																							
	<p>Figure 2.15 Circuit Configuration Using a PLC</p> <p> For details about the slide switch setting, refer to Section 2.3.7 "Setting up the slide switches."</p> <p><b>Note</b> ■ <b>For inputting a pulse train through the digital input terminal [X7]</b></p> <ul style="list-style-type: none"> <li>Inputting from a pulse generator with an open collector transistor output</li> </ul> <p>Stray capacity on the wiring between the pulse generator and the inverter may disable transmission of the pulse train. As a countermeasure against this problem, insert a pull-up resistor between the open collector output signal (terminal [X7]) and the power source terminal (terminal [PLC]) if the switch selects the SINK mode input; insert a pull-down resistor between the output signal and the digital common terminal (terminal [CM]) if the switch selects the SOURCE mode input.</p> <p>A recommended pull-up/down resistor is 1kΩ 2 W. Check if the pulse train is correctly transmitted because stray capacity is significantly affected by the wire types and wiring conditions.</p>																									
Analog output	[FM1] [FM2]	Analog monitor	<p>Both terminals output monitor signals for analog DC voltage (0 to +10 V) or analog DC current (+4 to +20 mA). The output form (VO/IO) for each of [FM1] and [FM2] can be switched with the slide switches on the control PCB and the function codes, as listed below.</p> <table border="1"> <thead> <tr> <th rowspan="2">Terminal</th> <th rowspan="2">Terminal function is specified by:</th> <th colspan="2">Output form</th> <th rowspan="2">Content is specified by:</th> </tr> <tr> <th>Analog DC voltage</th> <th>Analog DC current</th> </tr> </thead> <tbody> <tr> <td rowspan="2">[FM1]</td> <td>Slide switch SW4</td> <td>VO1</td> <td>IO1</td> <td rowspan="2">Function code F31</td> </tr> <tr> <td>Function code F29</td> <td>0</td> <td>1</td> </tr> <tr> <td rowspan="2">[FM2]</td> <td>Slide switch SW6</td> <td>VO2</td> <td>IO2</td> <td rowspan="2">Function code F35</td> </tr> <tr> <td>Function code F32</td> <td>0</td> <td>1</td> </tr> </tbody> </table> <p>The signal content can be selected from the following with function codes F31 and F35.</p> <ul style="list-style-type: none"> <li>Output frequency</li> <li>Output torque</li> <li>PID feedback amount</li> <li>Universal AO</li> <li>PID command</li> <li>Output current</li> <li>Load factor</li> <li>Speed (PG feedback value)</li> <li>Motor output</li> <li>PID output</li> <li>Output voltage</li> <li>Input power</li> <li>DC link bus voltage</li> <li>Calibration</li> </ul> <p>* Input impedance of the external device: Min. 5kΩ (at 0 to 10 VDC output) (While the terminal is outputting 0 to 10 VDC, it is capable of driving up to two analog voltmeters with 10 kΩ impedance.)</p> <p>* Input impedance of the external device: Max. 500Ω (at 4 to 20 mA DC output)</p> <p>* Adjustable range of the gain: 0 to 300%</p>	Terminal	Terminal function is specified by:	Output form		Content is specified by:	Analog DC voltage	Analog DC current	[FM1]	Slide switch SW4	VO1	IO1	Function code F31	Function code F29	0	1	[FM2]	Slide switch SW6	VO2	IO2	Function code F35	Function code F32	0	1
	Terminal	Terminal function is specified by:	Output form			Content is specified by:																				
Analog DC voltage			Analog DC current																							
[FM1]	Slide switch SW4	VO1	IO1	Function code F31																						
	Function code F29	0	1																							
[FM2]	Slide switch SW6	VO2	IO2	Function code F35																						
	Function code F32	0	1																							
[11]	Analog common	Two common terminals for analog input and output signals. These terminals are electrically isolated from terminals [CM] and [CMY].																								



Table 2.7 Symbols, Names and Functions of the Control Circuit Terminals (Continued)

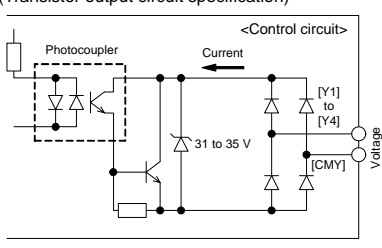
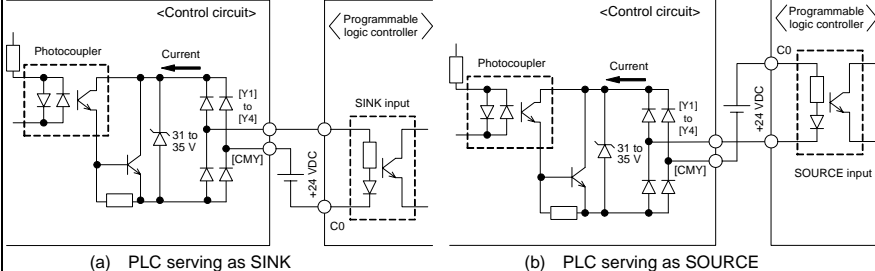
Classification	Symbol	Name	Functions											
Transistor output	[Y1]	Transistor output 1	(1) Various signals such as inverter running, speed/freq. arrival and overload early warning can be assigned to any terminals, [Y1] to [Y4] by setting function code E20 to E24. Refer to Chapter 5, Section 5.2 "Details of Function Codes" for details.											
	[Y2]	Transistor output 2	(2) Switches the logic value (1/0) for ON/OFF of the terminals between [Y1] to [Y4], and [CMY]. If the logic value for ON between [Y1] to [Y4] and [CMY] is 1 in the normal logic system, for example, OFF is 1 in the negative logic system and vice versa.											
	[Y3]	Transistor output 3	(Transistor output circuit specification)  <table border="1"> <thead> <tr> <th>Item</th> <th>Max.</th> </tr> </thead> <tbody> <tr> <td rowspan="2">Operation voltage</td> <td>ON level</td> <td>2 V</td> </tr> <tr> <td>OFF level</td> <td>27 V</td> </tr> <tr> <td>Maximum current at ON</td> <td>50 mA</td> </tr> <tr> <td>Leakage current at OFF</td> <td>0.1 mA</td> </tr> </tbody> </table>	Item	Max.	Operation voltage	ON level	2 V	OFF level	27 V	Maximum current at ON	50 mA	Leakage current at OFF	0.1 mA
	Item	Max.												
	Operation voltage	ON level	2 V											
OFF level		27 V												
Maximum current at ON	50 mA													
Leakage current at OFF	0.1 mA													
[Y4]	Transistor output 4	<p><b>Note</b></p> <ul style="list-style-type: none"> <li>- When a transistor output drives a control relay, connect a surge-absorbing diode across relay's coil terminals.</li> <li>- When any equipment or device connected to the transistor output needs to be supplied with DC power, feed the power (+24 VDC; allowable range: +22 to +27 VDC, 100 mA max.) through the [PLC] terminal. Short-circuit between the terminals [CMY] and [CM] in this case.</li> </ul>												
[CMY]	Transistor output common	Common terminal for transistor output signals This terminal is electrically isolated from terminals [CM] and [11]s.												
<p><b>Tip</b> ■ Connecting programmable logic controller (PLC) to terminal [Y1], [Y2], [Y3] or [Y4]</p> <p>Figure 2.17 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 output, whereas in example (b), it serves as a SOURCE for the output.</p>			 <p>(a) PLC serving as SINK</p> <p>(b) PLC serving as SOURCE</p>											
<p>Figure 2.17 Connecting PLC to Control Circuit</p>														
Relay output	[Y5A/C]	General purpose relay output	<p>(1) A general-purpose relay contact output usable as well as the function of the transistor output terminal [Y1], [Y2], [Y3] or [Y4]. Contact rating: <u>250 VAC 0.3 A, cos φ = 0.3</u>, <u>48 VDC, 0.5 A</u></p> <p>(2) Switching of the normal/negative logic output is applicable to the following two contact output modes: "Active ON" (Terminals [Y5A] and [Y5C] are closed (excited) if the signal is active.) and "Active OFF" (Terminals [Y5A] and [Y5C] are opened (non-excited) if the signal is active while they are normally closed.).</p>											

Table 2.7 Symbols, Names and Functions of the Control Circuit Terminals (Continued)

Classification	Symbol	Name	Functions
Relay output	[30A/B/C]	Alarm relay output (for any error)	<p>(1) Outputs a contact signal (SPDT) when a protective function has been activated to stop the motor. Contact rating: <math>250\text{ VAC}, 0.3\text{A}, \cos\phi = 0.3, 48\text{ VDC}, 0.5\text{A}</math></p> <p>(2) Any one of output signals assigned to terminals [Y1] to [Y4] can also be assigned to this relay contact to use it for signal output.</p> <p>(3) Switching of the normal/negative logic output is applicable to the following two contact output modes: "Active ON" (Terminals [30A] and [30C] are closed (excited) if the signal is active.) and "Active OFF" (Terminals [30A] and [30C] are opened (non-excited) if the signal is active while they are normally closed.).</p>
Communication	[DX+]/ [DX-]/ [SD]	RS-485 communications port 2 (Terminals on control PCB)	<p>A communications port transmits data through the RS-485 multipoint protocol between the inverter and a personal computer or other equipment such as a PLC.</p> <p>(For setting of the terminating resistor, refer to Section 2.3.7 "Setting up the slide switches.")</p>
	RJ-45 connector for the keypad	RS-485 communications port 1 (Standard RJ-45 connector)	<p>(1) Used to connect the inverter with the keypad. The inverter supplies the power to the keypad through the pins specified below. The extension cable for remote operation also uses wires connected to these pins for supplying the keypad power.</p> <p>(2) Remove the keypad from the standard RJ-45 connector and connect the RS-485 communications cable to control the inverter through the PC or PLC (Programmable Logic Controller). For setting of the terminating resistor, refer to Section 2.3.7 "Setting up the slide switches."</p> <div style="text-align: center;"> <p>Figure 2.18 RJ-45 Connector and its Pin Assignment*</p> </div> <p>* Pins 1, 2, 7, and 8 are exclusively assigned to power lines for the remote keypad and multi-function keypad, so do not use those pins for any other equipment.</p>
	USB connector	USB port (On the keypad)	<p>A USB port connector (Mini-B) that connects an inverter to a personal computer. FRENIC Loader (software*) running on the computer supports editing the function codes, transferring them to the inverter, verifying them, test-running an inverter and monitoring the inverter running status.</p> <p>* FRENIC Loader is available as a free download from our website at: <a href="http://web1.fujielectric.co.jp/Kiki-Info-EN/User/questlogin.asp">http://web1.fujielectric.co.jp/Kiki-Info-EN/User/questlogin.asp</a> (Fuji Electric FA Components &amp; Systems Co., Ltd. Technical Information site)</p> <p>On the Fuji website shown above, select "Technical Information"   "Drive Control Equipment"   "Inverters"   "Software libraries."</p> <p>Before downloading, you are requested to register as a member (free of charge).</p>



- Route the wiring of the control circuit terminals as far from the wiring of the main circuit as possible. Otherwise electric noise may cause malfunctions.
- Fix the control circuit wires with a cable tie 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 slide switches

## ⚠ WARNING

Before changing the switches or touching the control circuit terminal symbol plate, turn OFF the power and wait at least five minutes for inverters with a capacity of 22 kW or below, or at least ten minutes for inverters with a capacity of 30 kW or above. Make sure that the LED monitor and charging lamp are 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 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 bus capacitor even after the power has been turned OFF.**

Switching the slide switches located on the control PCB allows you to customize the operation mode of the analog output terminals, digital I/O terminals, and communications ports. The locations of those switches are shown in Figure 2.19.

To access the slide switches, remove the front cover so that you can see the control PCB. For inverters with a capacity of 30 kW or above, open also the keypad enclosure.


 For details on how to remove the front cover and how to open and close the keypad enclosure, refer to Section 2.3.1 "Removing and mounting the front cover and the wiring guide."

Table 2.8 lists function of each slide switch.

Table 2.8 Function of Each Slide Switch

Switch	Function				
SW1	Switches the service mode of the digital input terminals between SINK and SOURCE. <ul style="list-style-type: none"> <li>This switches the input mode of digital input terminals [X1] to [X7], [FWD] and [REV] to be used as the SINK or SOURCE mode.</li> <li>The factory default for FRN_ _ _G1■-2A/4A is SINK, for FRN_ _ _G1■-4E, SOURCE.</li> </ul>				
SW2	Switches the terminating resistor of RS-485 communications port on the inverter ON and OFF. (RS-485 communications port 2, on the control PCB) <ul style="list-style-type: none"> <li>If the inverter is connected to the RS-485 communications network as a terminating device, turn SW2 to ON.</li> </ul>				
SW3	Switches the terminating resistor of RS-485 communications port on the inverter ON and OFF. (RS-485 communications port 1, for connecting the keypad) <ul style="list-style-type: none"> <li>To connect a keypad to the inverter, turn SW3 to OFF. (Factory default)</li> <li>If the inverter is connected to the RS-485 communications network as a terminating device, turn SW3 to ON.</li> </ul>				
SW4/SW6	Switches the output form of analog output terminals [FM1] and [FM2] between voltage and current. When changing the setting of SW4 and SW6, also change the data of function codes F29 and F32, respectively.				
	Output form	[FM1]		[FM2]	
		SW4	Data of F29	SW6	Data of F32
	Voltage output (Factory default)	VO1	0	VO2	0
	Current output	IO1	1	IO2	1
SW5	Switches the property of the analog input terminal [C1] between analog setting current input, PTC thermistor input, and NTC thermistor input. When changing this switch setting, also change the data of function code H26.				
	Function	SW5	Data of H26		
	Analog setting current input (Factory default)	C1	0		
	PTC thermistor input	PTC/NTC	1 (alarm) or 2 (warning)		
	NTC thermistor input	PTC/NTC	3		

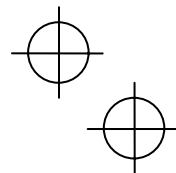
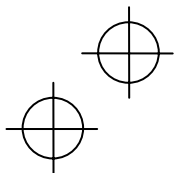


Figure 2.19 shows the location of slide switches on the control PCB for the input/output terminal configuration.

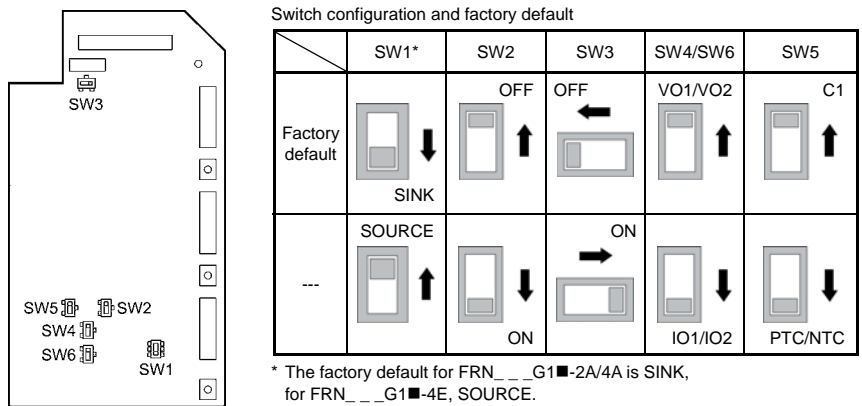
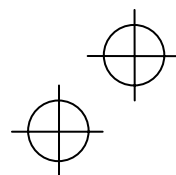
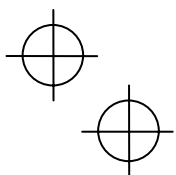


Figure 2.19 Location of the Slide Switches on the Control PCB

**Note** To move a switch slider, use a tool with a narrow tip (e.g., a tip of tweezers). Be careful not to touch other electronic parts, etc. If the slider is in an ambiguous position, the circuit is unclear whether it is turned ON or OFF and the digital input remains in an undefined state. Be sure to place the slider so that it contacts either side of the switch.



## 2.4 Mounting and Connecting a Keypad

You can mount a keypad on the panel wall or install one at a remote site (e.g. for operation on hand).

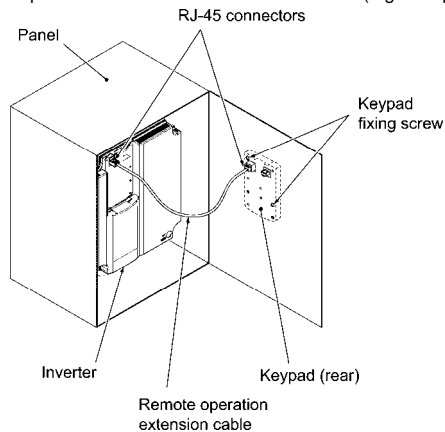


Figure 2.20 Mounting a Keypad on the Panel Wall

To mount/install a keypad on a place other than in an inverter, the parts listed below are needed.

Parts name	Model	Remarks
Extension cable (Note 1)	CB-5S, CB-3S and CB-1S	3 types available in length of 5 m, 3 m, and 1 m.
Fixing screw	M3 × □ (Note 2)	Two screws needed. Purchase off-the-shelf ones separately.

(Note 1) When using an off-the-shelf LAN cable, use a 10BASE-T/100BASE-TX straight type cable compliant with US ANSI/TIA/EIA-568A Category 5. (Less than 20m)

Recommended LAN cable

Manufacturer: Sanwa Supply Inc.

Model: KB-10T5-01K (1 m)

KB-STP-01K: (1 m) (Shielded LAN cable)

(Note 2) When mounting on a panel wall, use the screws with a length suitable for the wall thickness. (Depth of the screw holes on the keypad is 11 mm.)

### ■ Removing and mounting a keypad

To remove the keypad, pull it toward you while holding down the hook (pointed by the arrow in Figure 2.21). When mounting it, put the keypad back into place in the reverse order of removal.

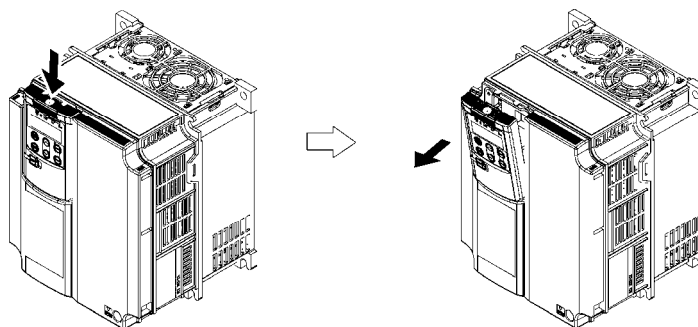


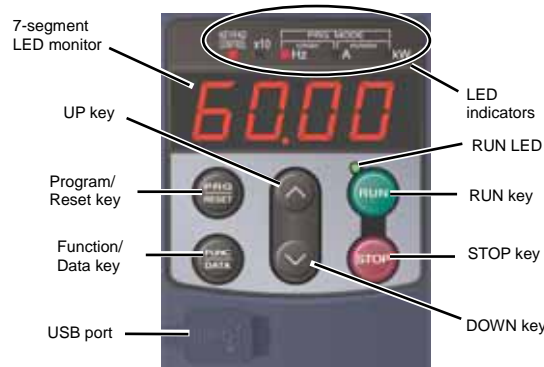
Figure 2.21 Removing a Keypad

## Chapter 3 OPERATION USING THE KEYPAD (in the case of remote keypad)

### 3.1 LED Monitor, Keys and LED Indicators on the Keypad

As shown at the right, the keypad consists of a four-digit LED monitor, six keys, and five LED indicators.

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







**Note** When using a multi-function keypad instead of a remote keypad, read the Multi-function Keypad Instruction Manual.

Table 3.1 Overview of Keypad Functions

Item	LED Monitor, Keys, and LED Indicators	Functions
LED Monitor		<p>Four-digit, 7-segment LED monitor which displays the followings 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) When a light alarm occurs, <i>l - a</i> is displayed.</li> <li>■ In Programming mode: Menus, function codes and their data</li> <li>■ In Alarm mode: Alarm code, which identifies the alarm factor when the protective function is activated.</li> </ul>
Operation Keys		<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 alarm factor will switch the inverter to Running mode.</li> </ul>
		<p>Function/Data key which switches the operations 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 (Hz), output current (A), output voltage (V), etc.). When a light alarm is displayed, holding down this key resets the light alarm and switches back to Running mode.</li> <li>■ In Programming mode: Pressing this key displays the function code or establishes the data entered with  and  keys.</li> <li>■ In Alarm mode: Pressing this key displays the details of the problem indicated by the alarm code that has come up on the LED monitor.</li> </ul>
		RUN key. Press this key to run the motor.
		STOP key. Press this key to stop the motor.
		UP and DOWN keys. Press these keys to select the setting items and change the function code data displayed on the LED monitor.

Table 3.1 Overview of Keypad Functions (Continued)

Item	LED Monitor, Keys, and LED Indicators	Functions
LED Indicators	RUN LED	Lights when running with a run command entered by the  key, by terminal command <b>FWD</b> or <b>REV</b> , or through the communications link.
	KEYPAD CONTROL LED	Lights when the inverter is ready to run with a run command entered by the  key (F02 = 0, 2, or 3). In Programming and Alarm modes, however, pressing the  key cannot run the inverter even if this indicator lights.
	Unit LEDs (3 LEDs)	<p>These three LED indicators identify the unit of numeral displayed on the LED monitor in Running mode by combination of lit and unlit states of them. Unit: Hz, A, kW, r/min and m/min Refer to Chapter 3, Section 3.3.1 "Monitoring the running status" for details.</p> <p>While the inverter is in Programming mode, the LEDs of Hz and kW light. ■ Hz □ A ■ kW</p>
	x10 LED	<p>Lights when the data to display exceeds 9999. When this LED lights, the "displayed value x 10" is the actual value.</p> <p>Example: If the LED monitor displays <i>1234</i> and the x10 LED lights, it means that the actual value is "1,234 × 10 = 12,340."</p>
USB port		The USB port with a mini B connector enables the inverter to connect with a PC with a USB cable.

### 3.2 Overview of Operation Modes

FRENIC-MEGA features the following three operation modes.

Table 3.2 Operation Modes

Operation mode	Description
Running mode	After powered ON, the inverter automatically enters this mode. This mode allows you to specify the reference frequency, PID command value and etc., and run/stop the motor with the  /  keys. It is also possible to monitor the running status in real time. If a light alarm occurs, the / - a / appears on the LED monitor.
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 condition arises, the inverter automatically enters Alarm mode in which you can view the corresponding alarm code* and its related information on the LED monitor. * Alarm code: Indicates the cause of the alarm condition. For details, first see Table 6.1 "Abnormal States Detectable ("Heavy Alarm" and "Light Alarm" Objects)" in Chapter 6, Section 6.1 "Protective Functions," and then read the troubleshooting of each alarm.

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

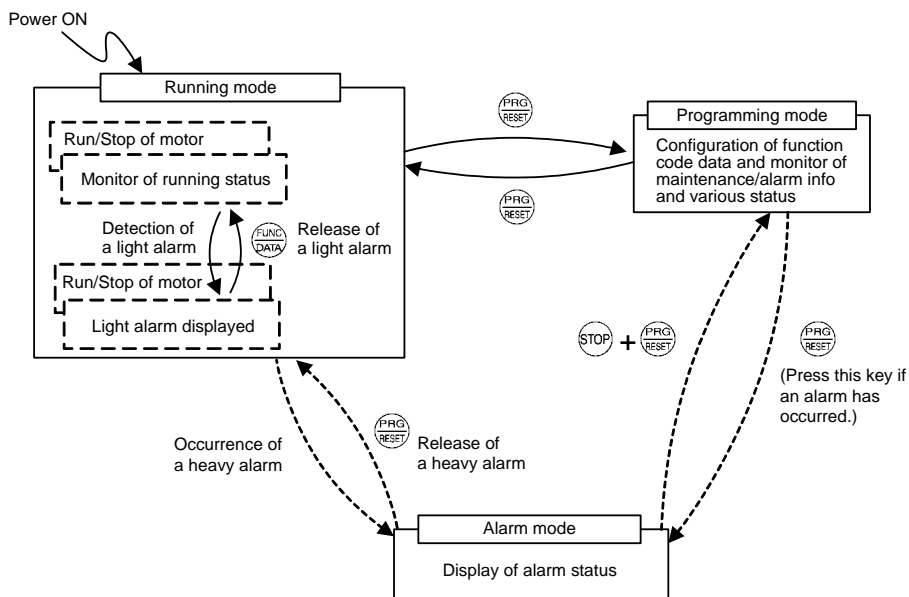


Figure 3.1 Status Transition between Operation Modes



#### Simultaneous keying

Simultaneous keying means pressing two keys at the same time. The simultaneous keying operation is expressed by a "+" letter between the keys throughout this manual.

For example, the expression " + keys" stands for pressing the key with the key held down.



### 3.3 Running Mode

#### 3.3.1 Monitoring the running status


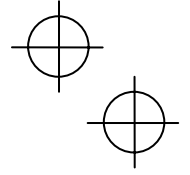
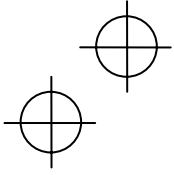
In Running mode, the fourteen items listed below can be monitored. Immediately after the inverter is turned ON, the monitor item specified by function code E43 is displayed. Press the  key to switch between these monitor items.

Table 3.3 Monitoring Items

Monitor items	Display sample on the LED monitor *1	LED indicator ■: ON, □: OFF	Unit	Meaning of displayed value	Function code data for E43
Speed monitor	Function code E48 specifies what to be displayed on the LED monitor and LED indicators.				0
Output frequency (before slip compensation)	5 * 00	■ Hz □ A □ kW	Hz	Frequency actually being output	(E48 = 0)
Output frequency (after slip compensation)	5 * 00	■ Hz □ A □ kW	Hz	Frequency actually being output	(E48 = 1)
Reference frequency	5 * 00	■ Hz □ A □ kW	Hz	Reference frequency being set	(E48 = 2)
Motor speed	1500	■ Hz ■ A □ kW	r/min	Output frequency (Hz) × $\frac{120}{P01}$	(E48 = 3)
Load shaft speed	30 * 0	■ Hz ■ A □ kW	r/min	Output frequency (Hz) × E50	(E48 = 4)
Line speed	30 * 0	□ Hz ■ A ■ kW	m/min	Output frequency (Hz) × E50	(E48 = 5)
Speed (%)	5 * 0	□ Hz □ A □ kW	%	$\frac{\text{Output frequency}}{\text{Maximum frequency}} \times 100$	(E48 = 7)
Output current	1 * 34	□ Hz ■ A □ kW	A	Current output from the inverter in RMS	3
Output voltage *2	200u	□ Hz □ A □ kW	V	Voltage output from the inverter in RMS	4
Calculated torque	50	□ Hz □ A □ kW	%	Motor output torque in % (Calculated value)	8
Input power	1 * 25	□ Hz □ A ■ kW	kW	Input power to the inverter	9
PID command *3, *4	1 * 0 *	□ Hz □ A □ kW	—	PID command/feedback amount transformed to that of virtual physical value of the object to be controlled (e.g. temperature)	10
PID feedback amount *3, *5	) 0 *	□ Hz □ A □ kW	—	Refer to function codes E40 and E41 for details.	12
PID output *3, *4	10 * *	□ Hz □ A □ kW	%	PID output in % as the maximum frequency (F03) being at 100%	14
Load factor *6	50;	□ Hz □ A □ kW	%	Load factor of the motor in % as the rated output being at 100%	15
Motor output *7	) 85	□ Hz □ A ■ kW	%	Motor output in kW	16
Analog input monitor *8	8 * 00	□ Hz □ A □ kW	—	An analog input to the inverter in a format suitable for a desired scale. Refer to function codes E40 and E41 for details.	17
Torque current *9	48	□ Hz □ A □ kW	%	Torque current command value or calculated torque current	23
Magnetic flux command *9	50	□ Hz □ A □ kW	%	Magnetic flux command value	24
Input watt-hour	10 * 0	□ Hz □ A □ kW	kWh	$\frac{\text{Input watt - hour (kWh)}}{100}$	25



- \*1 A value exceeding 9999 cannot be displayed as is on the 4-digit LED monitor screen, so the LED monitor displays one-tenth of the actual value with the x10 LED lit.
- \*2 When the LED monitor displays an output voltage, the 7-segment letter *u* in the lowest digit stands for the unit of the voltage "V."
- \*3 These PID related items appear only when the inverter drives the motor under the PID process control specified by function code J01 (= 1, 2 or 3).
- \*4 When the LED monitor displays a PID command or its output amount, the dot (decimal point) attached to the lowest digit of the 7-segment letter blinks.
- \*5 When the LED monitor displays a PID feedback amount, the dot (decimal point) attached to the lowest digit of the 7-segment letter lights.
- \*6 When the LED monitor displays a load factor, the 7-segment letter ; in the lowest digit stands for "%."
- \*7 When the LED monitor displays the motor output, the unit LED indicator "kW" blinks.
- \*8 The analog input monitor can appear only when the analog input monitor function is assigned to any of the analog input terminals by any of function codes E61 to E63 (= 20).
- \*9 These items appear only when the vector control is selected (F42 = 5 or 6).




Function code E42 (LED display filter) allows you to filter the monitoring signals for the monitor items such as output frequency and output current. Increase the E42 data if the monitored values are unstable and unreadable due to fluctuation of load.

### 3.3.2 Monitoring light alarms


The FRENIC-MEGA identifies abnormal states in two categories--Heavy alarm and Light alarm. If the former occurs, the inverter immediately trips; if the latter occurs, the inverter shows the *I - a /* on the LED monitor and blinks the KEYPAD CONTROL LED but it continues to run without tripping.

Which abnormal states are categorized as a light alarm ("Light alarm" object) should be defined with function codes H81 and H82 beforehand.

Assigning the **LALM** signal to any one of the digital output terminals with any of function codes E20 to E24 and E27 (= 98) enables the inverter to output the **LALM** signal on that terminal upon occurrence of a light alarm.

 For details of the light alarm objects, refer to Chapter 6 "TROUBLESHOOTING," Table 6.1.

#### ■ How to check a light alarm factor

When a light alarm occurs, *I - a /* appears on the LED monitor. To check the current light alarm factor, enter Programming mode by pressing the  key and select *5\_36* on Menu #5 "Maintenance Information."

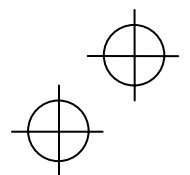
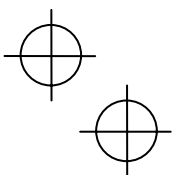
It is also possible to check the factors of the last three light alarms *5\_37* (last) to *5\_39* (3rd last).

For details of the menu transition of the maintenance information, refer to Section 3.4.6 "Reading maintenance information."

#### ■ How to remove the current light alarm

After checking the current light alarm factor, to switch the LED monitor back to the running status display (e.g., output frequency) from the *I - a /* indication, press the  key in Running mode.

If the light alarm factor has been removed, the KEYPAD CONTROL LED stops blinking and the **LALM** signal turns OFF. If not (e.g. DC fan lock), the KEYPAD CONTROL LED continues blinking and the **LALM** signal remains ON.



### 3.4 Programming Mode

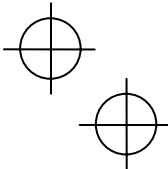
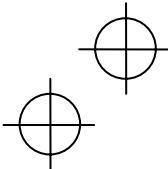
The Programming mode provides you with these functions--setting and checking function code data, monitoring maintenance information and checking input/output (I/O) signal status. The functions can be easily selected with the menu-driven system. Table 3.4 lists menus available in Programming mode. The leftmost digit (numerals) of each letter string on the LED monitor indicates the corresponding menu number and the remaining three digits indicate the menu contents.

When the inverter enters Programming mode from the second time on, the menu selected last in Programming mode will be displayed.

Table 3.4 Menus Available in Programming Mode

Menu #	Menu	LED monitor shows:	Main functions	Refer to:
0	"Quick Setup"	*fn:	Displays only basic function codes to customize the inverter operation.	Section 3.4.1
1	"Data Setting"	!f__	F codes (Fundamental functions)	Selecting each of these function codes enables its data to be displayed/changed.
		!e__	E codes (Extension terminal functions)	
		!c__	C codes (Control functions)	
		!p__	P codes (Motor 1 parameters)	
		!h__	H codes (High performance functions)	
		!a__	A codes (Motor 2 parameters)	
		!b__	b codes (Motor 3 parameters)	
		!r__	r codes (Motor 4 parameters)	
		!j__	J codes (Application functions 1)	
		!d__	d codes (Application functions 2)	
		!y__	y codes (Link functions)	
!o__	o codes (Optional functions) (Note)			
2	"Data Checking"	"rep	Displays only function codes that have been changed from their factory defaults. You can refer to or change those function code data.	Section 3.4.3
3	"Drive Monitoring"	#ope	Displays the running information required for maintenance or test running.	Section 3.4.4
4	"I/O Checking"	\$i_o	Displays external interface information.	Section 3.4.5
5	"Maintenance Information"	%che	Displays maintenance information including cumulative run time.	Section 3.4.6
6	"Alarm Information"	&a l	Displays the recent four alarm codes. You can refer to the running information at the time when the alarm occurred.	Section 3.4.7
7	"Data Copying"	'cpy	Allows you to read or write function code data, as well as verifying it. Saving the function code data of the currently running inverter into the keypad and connecting it to a PC running FRENIC Loader enables data checking on the PC.	Section 3.4.8

(Note) The o codes are displayed only when the corresponding option is mounted. For details, refer to the Instruction Manual for the corresponding option.



■ **Selecting menus to display**




The menu-driven system allows you to cycle through menus. To cycle through necessary menus only for simple operation, use function code E52 that provides a choice of three display modes as listed below.

The factory default (E52 = 0) is to display only three menus--Menu #0 "Quick Setup," Menu #1 "Data Setting" and Menu #7 "Data Copying," allowing no switching to any other menu.

Table 3.5 Keypad Display Mode Selection – Function Code E52

Data for E52	Mode	Menus selectable
0	Function code data editing mode (factory default)	Menu #0 "Quick Setup" Menu #1 "Data Setting" Menu #7 "Data Copying"
1	Function code data check mode	Menu #2 "Data Checking" Menu #7 "Data Copying"
2	Full-menu mode	Menus #0 through #7



Press the  key to enter Programming mode and display menus. While cycling through the menus with the  key, select the desired menu item with the  key. Once the entire menu has been cycled through, the display returns to the first menu item.

**3.4.1 Setting up basic function codes quickly -- Menu #0 "Quick Setup" --**

Menu #0 "Quick Setup" in Programming mode allows you to quickly display and set up a basic set of function codes specified in Chapter 5, Section 5.1, "Function Code Tables."

To use Menu #0 "Quick Setup," you need to set function code E52 to "0" (Function code data editing mode) or "2" (Full-menu mode).

The predefined set of function codes that are subject to quick setup are held in the inverter.

Figure 3.2 shows the menu transition in Menu #0 "Quick Setup" and function code data changing procedure.

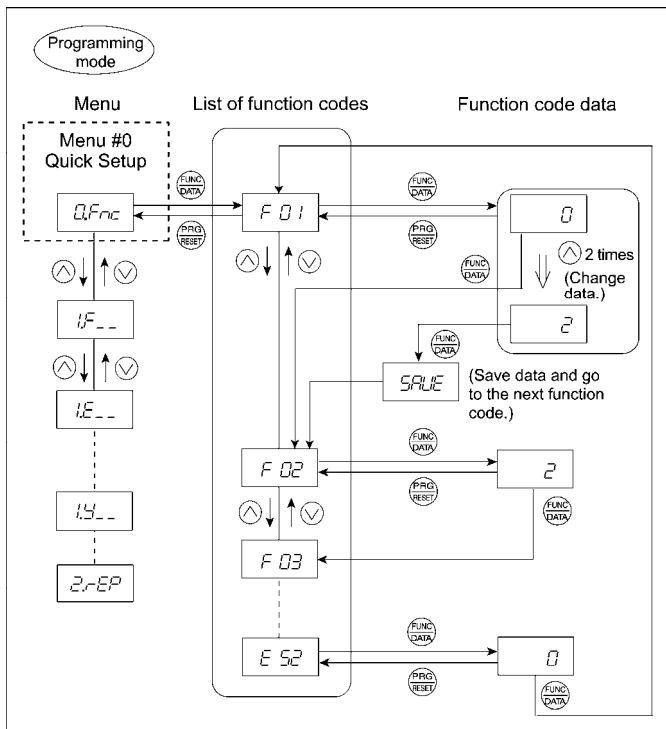


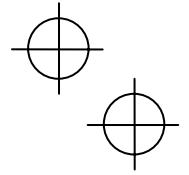
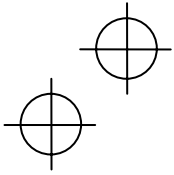
Figure 3.2 Menu Transition in Menu #0 "Quick Setup" and Function Code Data Changing Procedure

**Basic key operation**


This section gives a description of the basic key operation in "Quick Setup," following the example of the function code data changing procedure shown in Figure 3.2.

This example shows you how to change function code F01 data (Frequency command source) from the factory default "△/▽ keys on keypad (F01 = 0)" to "Current input to terminal [C1] (C1 function) (4 to 20 mA DC) (F01 = 2)."

- (1) Turn the inverter ON. It automatically enters Running mode. In that mode, press the key to switch to Programming mode. The function selection menu appears. (In this example, \*fn: is displayed.)
- (2) If anything other than \*fn: is displayed, use the and keys to display \*fn:.
- (3) Press the key to proceed to the list of function codes.
- (4) Use the and keys to display the desired function code (f 01 in this example), then press the key. The data of this function code appears. (In this example, data 0 of f 01 appears.)
- (5) Change the function code data using the and keys. (In this example, press the key two times to change data 0 to 2.)
- (6) Press the key to establish the function code data. The *save* appears and the data will be saved in the memory inside the inverter. The display will return to the function code list, then move to the next function code. (In this example, f 02.)  
 Pressing the key instead of the key cancels the change made to the data. The data reverts to the previous value, the display returns to the function code list, and the original function code reappears.
- (7) Press the key to return to the menu from the function code list.



#### Cursor movement

You can move the cursor when changing function code data by holding down the  key for 1 second or longer in the same way as with the frequency settings. This action is called "Cursor movement."



It is possible to change or add function code items subject to quick setup. For details, consult your Fuji Electric representatives.

### 3.4.2 Setting up function codes -- Menu #1 "Data Setting" --














Menu #1 "Data Setting" (! f\_\_ through ! y\_\_) in Programming mode allows you to set up all function codes.

To set function codes in this menu, it is necessary to set function code E52 to "0" (Function code data editing mode) or "2" (Full-menu mode).

The menu transition in Menu #1 "Data Setting" is just like that in Menu #0 "Quick Setup."

#### Basic key operation

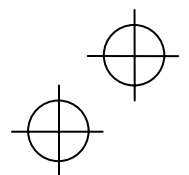
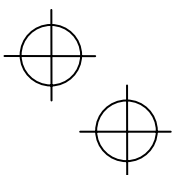
The basic key operation in Menu #1 "Data Setting" is just like that in Menu #0 "Quick Setup."

- (1) Turn the inverter ON. It automatically enters Running mode. In that mode, press the  key to switch to Programming mode. The function selection menu appears.
- (2) Use the  and  keys to display the desired function code group from the choices ! f\_\_ through ! y\_\_.
- (3) Press the  key to proceed to the list of function codes for the selected function code group.
- (4) Use the  and  keys to display the desired function code, then press the  key.  
The data of this function code appears.
- (5) Change the function code data using the  and  keys.
- (6) Press the  key to establish the function code data.  
The *save* appears and the data will be saved in the memory inside the inverter. The display will return to the function code list, then move to the next function code.  
Pressing the  key instead of the  key cancels the change made to the data. The data reverts to the previous value, the display returns to the function code list, and the original function code reappears.
- (7) Press the  key to return to the menu from the function code list.

### 3.4.3 Checking changed function codes -- Menu #2 "Data Checking" --

Menu #2 "Data Checking" in Programming mode allows you to check function codes that have been changed. Only the function codes whose data has been changed from the factory defaults are displayed on the LED monitor. You can refer to the function code data and change it again if necessary. To check function codes in Menu #2 "Data Checking," it is necessary to set function code E52 to "1" (Function code data check mode) or "2" (Full-menu mode).

The menu transition in Menu #2 "Data Checking" is just like that in Menu #0 "Quick Setup."



### 3.4.4 Monitoring the running status – Menu #3 "Drive Monitoring" –

Menu #3 "Drive Monitoring" is used to monitor the running status during maintenance and trial running. The display items for "Drive Monitoring" are listed in Table 3.6. Figure 3.3 shows the menu transition in Menu #3 "Drive Monitoring."

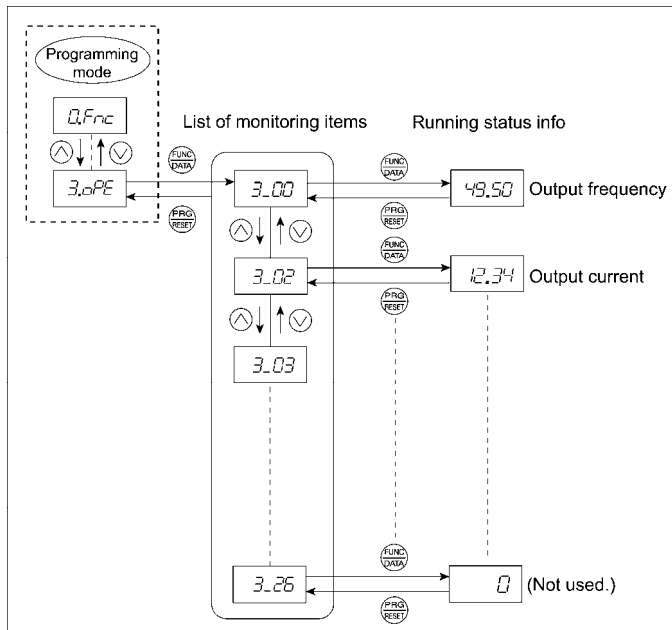


Figure 3.3 Menu Transition in Menu #3 "Drive Monitoring"

#### Basic key operation

To monitor the running status in "Drive monitoring," set function code E52 to "2" (Full-menu mode) beforehand.

- (1) Turn the inverter ON. It automatically enters Running mode. In that mode, press the key to switch to Programming mode. The function selection menu appears. (In this example, \*fn: is displayed.)
- (2) Use the and keys to display "Drive Monitoring" (#ope).
- (3) Press the key to proceed to a list of monitoring items (e.g. 3\_00).
- (4) Use the and keys to display the desired monitoring item, then press the key. The running status information for the selected item appears.
- (5) Press the key to return to the list of monitoring items. Press the key again to return to the menu.

Table 3.6 "Drive Monitoring" Display Items

LED monitor shows:	Item	Unit	Description
3_00	Output frequency	Hz	Output frequency before slip compensation
3_01	Output frequency	Hz	Output frequency after slip compensation
3_02	Output current	A	Output current
3_03	Output voltage	V	Output voltage
3_04	Calculated torque	%	Calculated output torque of the motor in %
3_05	Reference frequency	Hz	Frequency specified by a frequency command
3_06	Rotational direction	N/A	Rotational direction being outputted <i>f</i> : forward, <i>r</i> : reverse, - - - -: stop
3_07	Running status	N/A	Running status in 4-digit hexadecimal format Refer to "■ Displaying running status (3_07) and running status 2 (3_23)" on the next page.
3_08	Motor speed	r/min	Display value = (Output frequency Hz) × $\frac{120}{(\text{No. of poles})}$ If the value is 10000 or larger, the x10 LED turns ON and the LED monitor shows one-tenth of the value.
3_09	Load shaft speed	r/min	Display value = (Output frequency Hz) × (Function code E50: Coefficient for speed indication) If the value is 10000 or larger, the x10 LED turns ON and the LED monitor shows one-tenth of the value.
3_10	PID command value	N/A	Virtual physical value (e.g., temperature or pressure) of the object to be controlled, which is converted from the PID command value using function code E40 and E41 data (PID display coefficients A and B) Display value = (PID command value) × (Coefficient A - B) + B If PID control is disabled, "- - - -" appears.
3_11	PID feedback amount	N/A	Virtual physical value (e.g., temperature or pressure) of the object to be controlled, which is converted from the PID feedback amount using function code E40 and E41 data (PID display coefficients A and B) Display value = (PID feedback amount) × (Coefficient A - B) + B If PID control is disabled, "- - - -" appears.
3_12	Torque limit value	%	Driving torque limit value A (based on motor rated torque)
3_13	Torque limit value	%	Braking torque limit value B (based on motor rated torque)
3_14	Ratio setting	%	When this setting is 100%, the LED monitor shows 1.00 time of the value to be displayed. If no ratio setting is selected, "- - - -" appears.
3_15	Line speed	m/min	Display value = (Output frequency Hz) × (Function code E50: Coefficient for speed indication) If the value is 10000 or larger, the x10 LED turns ON and the LED monitor shows one-tenth of the value.



Table 3.6 "Drive Monitoring" Display Items (Continued)

LED monitor shows:	Item	Unit	Description
3_16	(Not used.)	—	—
3_17	(Not used.)	—	—
3_18	(Not used.)	—	—
3_19	(Not used.)	—	—
3_20	(Not used.)	—	—
3_21	PID output value	%	PID output value in %. (100% at the maximum frequency) If PID control is disabled, " . . . ." appears.
3_22	Flux command value	%	Flux command value in %.
3_23	Running status 2	N/A	Running status 2 in 4-digit hexadecimal format Refer to <b>■ Displaying running status (3_07) and running status 2 (3_23)</b> below.
3_24	Motor temperature	°C	Temperature detected by the NTC thermistor built in the motor (VG motor) If the NTC thermistor connectivity is disabled, " . . . ." appears.
3_25	(Not used.)	—	—
3_26	(Not used.)	—	—

**■ Displaying running status (3\_07) and running status 2 (3\_23)**

To display the running status and running status 2 in 4-digit hexadecimal format, each state has been assigned to bits 0 to 15 as listed in Tables 3.7 and 3.8. Table 3.9 shows the relationship between each of the status assignments and the LED monitor display.

Table 3.10 gives the conversion table from 4-bit binary to hexadecimal.

Table 3.7 Running Status (3\_07) Bit Assignment

Bit	Notation	Content	Bit	Notation	Content
15	BUSY	"1" when function code data is being written.	7	VL	"1" under voltage limiting control.
14	WR	Always "0."	6	TL	"1" under torque limiting control.
13		Always "0."	5	NUV	"1" when the DC link bus voltage is higher than the undervoltage level.
12	RL	"1" when communication is enabled (when ready for run and frequency commands via communications link).	4	BRK	"1" during braking.
11	ALM	"1" when an alarm has occurred.	3	INT	"1" when the inverter output is shut down.
10	DEC	"1" during deceleration.	2	EXT	"1" during DC braking.
9	ACC	"1" during acceleration.	1	REV	"1" during running in the reverse direction.
8	IL	"1" under current limiting control.	0	FWD	"1" during running in the forward direction.

Table 3.8 Running Status 2 (3\_23) Bit Assignment

Bit	Notation	Content	Bit	Notation	Content
15	—	(Not used.)	7	—	Speed limiting (under torque control)
14			6	—	(Not used.)
13			5	—	Motor selection 00: Motor 1 01: Motor 2 10: Motor 3 11: Motor 4
12			4	—	
11			3	—	Inverter drive control 0000: V/f control with slip compensation inactive 0001: Dynamic torque vector control 0010: V/f control with slip compensation active 0011: V/f control with speed sensor 0100: Dynamic vector control with speed sensor 0101: Vector control without speed sensor 0110: Vector control with speed sensor 1010: Torque control (Vector control without speed sensor) 1011: Torque control (Vector control with speed sensor)
10			2	—	
9			1	—	
8			0	—	

Table 3.9 Running Status Display

LED No.	LED4				LED3				LED2				LED1											
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0								
Notation	BUSY	WR		RL	ALM	DEC	ACC	IL	VL	TL	NUV	BRK	INT	EXT	REV	FWD								
Binary	1	0	0	0	0	0	1	1	0	0	1	0	0	0	0	1								
Example Hexa- decimal on the LED monitor	<table style="margin: auto;"> <thead> <tr> <th>LED4</th> <th>LED3</th> <th>LED2</th> <th>LED1</th> </tr> </thead> <tbody> <tr> <td style="font-size: 2em;">8</td> <td style="font-size: 2em;">3</td> <td style="font-size: 2em;">2</td> <td style="font-size: 2em;">1</td> </tr> </tbody> </table>																LED4	LED3	LED2	LED1	8	3	2	1
	LED4	LED3	LED2	LED1																				
8	3	2	1																					

■ **Hexadecimal expression**

A 4-bit binary number can be expressed in hexadecimal (1 hexadecimal digit). Table 3.10 shows the correspondence between the two notations. The hexadecimals are shown as they appear on the LED monitor.

Table 3.10 Binary and Hexadecimal Conversion

Binary				Hexadecimal	Binary				Hexadecimal
0	0	0	0	0	1	0	0	0	8
0	0	0	1	1	1	0	0	1	9
0	0	1	0	2	1	0	1	0	a
0	0	1	1	3	1	0	1	1	b
0	1	0	0	4	1	1	0	0	c
0	1	0	1	5	1	1	0	1	d
0	1	1	0	6	1	1	1	0	e
0	1	1	1	7	1	1	1	1	f

### 3.4.5 Checking I/O signal status -- Menu #4 "I/O Checking" --

Using Menu #4 "I/O Checking" displays the I/O status of external signals including digital and analog I/O signals without using a measuring instrument. Table 3.11 lists check items available. The menu transition in Menu #4 "I/O Checking" is shown in Figure 3.4.

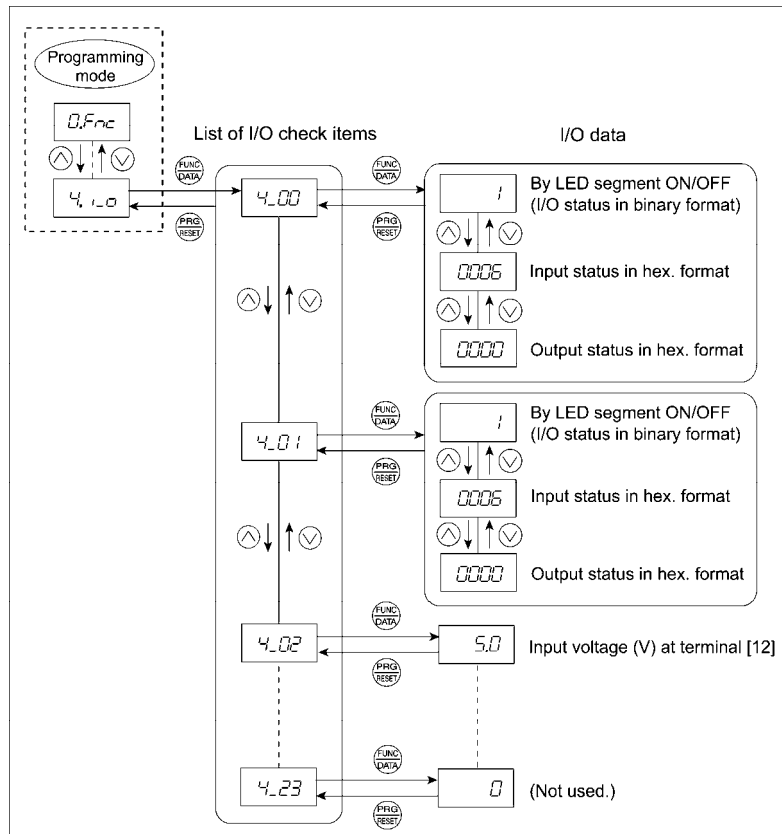


Figure 3.4 Menu Transition in Menu #4 "I/O Checking"

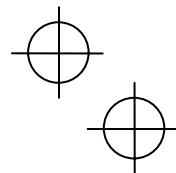
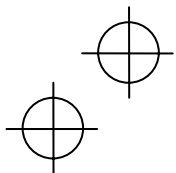
#### **Basic key operation**

To check the status of the I/O signals, set function code E52 to "2" (Full-menu mode) beforehand.

- (1) Turn the inverter ON. It automatically enters Running mode. In that mode, press the key to switch to Programming mode. The function selection menu appears.
- (2) Use the and keys to display "I/O Checking" ( \$ i \_ o ).
- (3) Press the key to proceed to a list of I/O check items (e.g. 4\_00 ).
- (4) Use the and keys to display the desired I/O check item, then press the key.  
The corresponding I/O check data appears. For the item 4\_00 or 4\_01, using the and keys switches the display method between the segment display (for external signal information in Table 3.12) and hexadecimal display (for I/O signal status in Table 3.13).
- (5) Press the key to return to the list of I/O check items. Press the key again to return to the menu.

Table 3.11 I/O Check Items

LED monitor shows:	Item	Description
4_00	I/O signals on the control circuit terminals	Shows the ON/OFF state of the digital I/O terminals. Refer to "■ <u>Displaying control I/O signal terminals</u> " on the next page for details.
4_01	I/O signals on the control circuit terminals under communications control	Shows the ON/OFF state of the digital I/O terminals that received a command via RS-485 and optional communications. Refer to "■ <u>Displaying control I/O signal terminals</u> " and "■ <u>Displaying control I/O signal terminals under communications control</u> " on the following pages for details.
4_02	Input voltage on terminal [12]	Shows the input voltage on terminal [12] in volts (V).
4_03	Input current on terminal [C1]	Shows the input current on terminal [C1] in milliamperes (mA).
4_04	Output voltage on terminal [FM1]	Shows the output voltage on terminal [FM1] in volts (V).
4_05	Output voltage on terminal [FM2]	Shows the output voltage on terminal [FM2] in volts (V).
4_07	Input voltage on terminal [V2]	Shows the input voltage on terminal [V2] in volts (V).
4_08	Output current on terminal [FM1]	Shows the output current on terminal [FM1] in milliamperes (mA).
4_09	Output current on terminal [FM2]	Shows the output current on terminal [FM2] in milliamperes (mA).
4_10	Option control circuit terminal (I/O)	Shows the ON/OFF state of the digital I/O terminals on the digital input and output interface cards. Refer to "■ <u>Displaying control I/O signal terminals on options</u> " on page 3-18 for details.
4_11	Terminal [X7] pulse input monitor	Shows the pulse rate of the pulse train signal on terminal [X7].
4_15	PG pulse rate (A/B phase signal from the reference PG)	Shows the pulse rate (p/s) of the A/B phase signal fed back from the reference PG.
4_16	PG pulse rate (Z phase signal from the reference PG)	Shows the pulse rate (p/s) of the Z phase signal fed back from the reference PG.
4_17	PG pulse rate (A/B phase signal from the slave PG)	Shows the pulse rate (p/s) of the A/B phase signal fed back from the slave PG.
4_18	PG pulse rate (Z phase signal from the slave PG)	Shows the pulse rate (p/s) of the Z phase signal fed back from the slave PG.
4_19	(Not used.)	—
4_20	(Not used.)	—
4_21	(Not used.)	—
4_22	(Not used.)	—
4_23	(Not used.)	—



**■ Displaying control I/O signal terminals**

The status of control I/O signal terminals may be displayed with ON/OFF of the LED segment or in hexadecimal.

- Displaying the I/O signal status with ON/OFF of each LED segment

As shown in Table 3.12 and the figure below, each of segments "a" to "dp" on LED1 and LED2 lights when the corresponding digital input terminal circuit ([FWD], [REV], [X1] to [X7]) is closed; it goes OFF when it is open. Each of segments "a" to "e" on LED3 lights when the circuit between output terminal [Y1], [Y2], [Y3] or [Y4] and terminal [CMY] or between terminals [Y5A] and [Y5C] is closed, respectively; it goes OFF when the circuit is open. Segment "a" on LED4 is for terminals [30A/B/C] and lights when the circuit between terminals [30C] and [30A] is short-circuited (ON) and goes OFF when it is open.


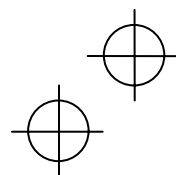
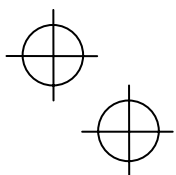
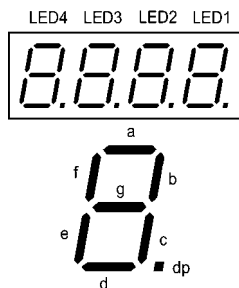
 **Tip** If all terminal signals are OFF (open), segments "g" on all of LED1 to LED4 will light ("----").

Table 3.12 Segment Display for External Signal Information

Segment	LED4	LED3	LED2	LED1
a	30A/B/C	Y1-CMY	X7	FWD
b	—	Y2-CMY	—	REV
c	—	Y3-CMY	—	X1
d	—	Y4-CMY	EN	X2
e	—	Y5A-Y5C	—	X3
f	—	—	(XF) *	X4
g	—	—	(XR) *	X5
dp	—	—	(RST) *	X6

—: No corresponding control circuit terminal exists

\* (XF), (XR), and (RST) are assigned for communications control. Refer to "■ Displaying control I/O signal terminals under communications control" on the next page.



● Displaying I/O signal status in hexadecimal

Each I/O terminal is assigned to bit 15 through bit 0 as shown in Table 3.13. An unassigned bit is interpreted as "0." Allocated bit data is displayed on the LED monitor as four hexadecimal digits (0 to f each).

On the FRENIC-MEGA, digital input terminals [FWD] and [REV] are assigned to bits 0 and 1, respectively. Terminals [X1] through [X7] are assigned to bits 2 through 10. The bit is set to "1" when the corresponding input terminal is short-circuited (ON), and it is set to "0" when the terminal is open (OFF). For example, when [FWD] and [X1] are ON (short-circuited) and all the others are OFF (open), 0005 is displayed on LED4 to LED1.

Digital output terminals [Y1] through [Y4] are assigned to bits 0 through 3. Each bit is set to "1" when the output terminal [Y1], [Y2], [Y3] or [Y4] is short-circuited with [CMY] (ON), and "0" when it is open (OFF).

The status of the relay contact output terminal [Y5A/C] is assigned to bit 4. It is set to "1" when the circuit between output terminals [Y5A] and [Y5C] is closed. The status of the relay contact output terminals [30A/B/C] is assigned to bit 8. It is set to "1" when the circuit between output terminals [30A] and [30C] is closed, and "0" when the circuit between [30A] and [30C] is open.

For example, if [Y1] is ON, [Y2] through [Y4] are OFF, the circuit between [Y5A] and [Y5C] is open, and the circuit between [30A] and [30C] is closed, then "0101" is displayed on the LED4 through LED1.

Table 3.13 presents bit assignment and an example of corresponding hexadecimal display on the 7-segment LED.

Table 3.13 Segment Display for I/O Signal Status in Hexadecimal (Example)

LED No.		LED4				LED3				LED2				LED1			
Bit		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Input terminal		(RST)*	(XR)*	(XF)*	-	EN	-	-	X7	X6	X5	X4	X3	X2	X1	REV	FWD
Output terminal		-	-	-	-	-	-	-	30A/B/C	-	-	-	Y5A/C	Y4	Y3	Y2	Y1
Example	Binary	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
	Hexadecimal on the LED monitor	<div style="display: flex; justify-content: center; gap: 10px;"> <span>LED4</span> <span>LED3</span> <span>LED2</span> <span>LED1</span> </div>															

- No corresponding control circuit terminal exists.

\* (XF), (XR), and (RST) are assigned for communications control. Refer to **■ Displaying control I/O signal terminals under communications control** below.

**■ Displaying control I/O signal terminals under communications control**

Under communications control, input commands (function code S06) sent via RS-485 or other optional communications can be displayed in two ways: "with ON/OFF of each LED segment" and "in hexadecimal." The content to be displayed is basically the same as that for the control I/O signal terminal status display; however, (XF), (XR), and (RST) are added as inputs. Note that under communications control, the I/O display is in normal logic (using the original signals not inverted)

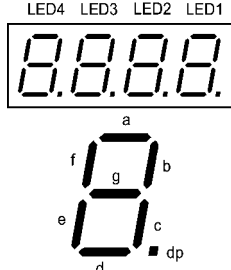
For details about input commands sent through the communications link, refer to the RS-485 Communication User's Manual and the instruction manual of communication-related options as well.

**■ Displaying control I/O signal terminals on options**

The LED monitor can also show the signal status of the terminals on the optional digital input and output interface cards, just like the signal status of the control circuit terminals.

Table 3.14 lists the assignment of digital I/O signals to the LED segments.

Table 3.14 Segment Display for External Signal Information



Segment	LED4	LED3	LED2	LED1
a	—	O1	I9	I1
b	—	O2	I10	I2
c	—	O3	I11	I3
d	—	O4	I12	I4
e	—	O5	I13	I5
f	—	O6	I14	I6
g	—	O7	I15	I7
dp	—	O8	I16	I8

LED No.	LED4				LED3				LED2				LED1			
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Input terminal	I16	I15	I14	I13	I12	I11	I10	I9	I8	I7	I6	I5	I4	I3	I2	I1
Output terminal	-	-	-	-	-	-	-	-	O8	O7	O6	O5	O4	O3	O2	O1

**3.4.6 Reading maintenance information -- Menu #5 "Maintenance Information" --**

Menu #5 "Maintenance Information" (%che) contains information necessary for performing maintenance on the inverter. The menu transition in Menu #5 "Maintenance Information" is just like that in Menu #3 "Drive Monitoring." (Refer to Section 3.4.4.)

**Basic key operation**

To view the maintenance information, set function code E52 to "2" (Full-menu mode) beforehand.










- (1) Turn the inverter ON. It automatically enters Running mode. In that mode, press the  key to switch to Programming mode. The function selection menu appears.
- (2) Use the  and  keys to display "Maintenance Information" (%che).
- (3) Press the  key to proceed to the list of maintenance items (e.g. 5.00).
- (4) Use the  and  keys to display the desired maintenance item, then press the  key. The data of the corresponding maintenance item appears.
- (5) Press the  key to return to the list of maintenance items. Press the  key again to return to the menu.

Table 3.15 Display Items in "Maintenance Information"

LED Monitor shows:	Item	Description
5_00	Cumulative run time	Shows the content of the cumulative power-ON time counter of the inverter. Counter range: 0 to 65,535 hours Display: Upper 2 digits and lower 3 digits are displayed alternately. Example: 0 ⇔ 535h (535 hours) 65 ⇔ 535h (65,535 hours) The lower 3 digits are displayed with <i>h</i> (hour). When the count exceeds 65,535, the counter will be reset to "0" and start over again.
5_01	DC link bus voltage	Shows the DC link bus voltage of the inverter main circuit. Unit: V (volts)
5_02	Max. temperature inside the inverter	Shows the maximum temperature inside the inverter for every hour. Unit: °C (Temperatures below 20°C are displayed as 20°C.)
5_03	Max. temperature of heat sink	Shows the maximum temperature of the heat sink for every hour. Unit: °C (Temperatures below 20°C are displayed as 20°C.)
5_04	Max. effective output current	Shows the maximum current in RMS for every hour. Unit: A (amperes)
5_05	Capacitance of the DC link bus capacitor	Shows the current capacitance of the DC link bus capacitor (reservoir capacitor) in %, based on the capacitance when shipping as 100%. Refer to Chapter 7 "MAINTENANCE AND INSPECTION" for details. Unit: %
5_06	Cumulative run time of electrolytic capacitors on the printed circuit boards	Shows the content of the cumulative run time counter of the electrolytic capacitors on the printed circuit boards, which is calculated by multiplying the cumulative run time count by the coefficient based on the surrounding temperature condition. Counter range: 0 to 99,990 hours Display range: 0 to 9999 The x10 LED turns ON. Actual cumulative run time of electrolytic capacitors on the printed circuit boards (hours) = Displayed value x 10 When the count exceeds 99,990 the counter stops and the LED monitor sticks to 9999.
5_07	Cumulative run time of the cooling fan	Shows the content of the cumulative run time counter of the cooling fan. This counter does not work when the cooling fan ON/OFF control (function code H06) is enabled and the fan stops. The display method is the same as for 5_06 above.
5_08	Number of startups	Shows the content of the motor 1 startup counter (i.e., the number of run commands issued). Counter range: 0 to 65,530 times Display range: 0 to 9999 If the count exceeds 10,000, the x10 LED turns ON and the LED monitor shows one-tenth of the value. When the count exceeds 65,530, the counter will be reset to "0" and start over again.
5_09	Input watt-hour	Shows the input watt-hour of the inverter. Display range: *001 to 9999 Input watt-hour = Displayed value × 100 kWh To reset the integrated input watt-hour and its data, set function code E51 to "0.000." When the input watt-hour exceeds 999,900 kWh, the counter will be reset to "0."
5_10	Input watt-hour data	Shows the value expressed by "input watt-hour (kWh) × E51 (whose data range is 0.000 to 9,999)." Unit: None. (Display range: *001 to 9999. The data cannot exceed 9999. (It will be fixed at 9,999 once the calculated value exceeds 9999.)) Depending on the value of integrated input watt-hour data, the decimal point on the LED monitor shifts to show it within the LED monitors' resolution. To reset the integrated input watt-hour data, set function code E51 to "0.000."



Table 3.15 Display Items in "Maintenance Information" (Continued)

LED Monitor shows:	Item	Description
5_11	Number of RS-485 communications errors (COM port 1)	Shows the total number of errors that have occurred in RS-485 communication (COM port 1, connection to keypad) after the power is turned ON. Once the count exceeds 9999, the counter will be reset to "0."
5_12	Content of RS-485 communications error (COM port 1)	Shows the latest error that has occurred in RS-485 communication (COM port 1) in decimal. For error contents, refer to the RS-485 Communication User's Manual.
5_13	Number of option errors 1	Shows the total number of errors that have occurred in the option being connected to the A-port. Once the count exceeds 9999, the counter will be reset to "0."
5_14	Inverter's ROM version	Shows the inverter's ROM version as a 4-digit code.
5_16	Keypad's ROM version	Shows the keypad's ROM version as a 4-digit code.
5_17	Number of RS-485 communications errors (COM port 2)	Shows the total number of errors that have occurred in RS-485 communication (COM port 2, connection to terminal block) after the power is turned ON. Once the count exceeds 9999, the counter will be reset to "0."
5_18	Content of RS-485 communications error (COM port 2)	Shows the latest error that has occurred in RS-485 communication (COM port 2, connection to terminal block) in decimal. For error contents, refer to the RS-485 Communication User's Manual.
5_19	Option's ROM version 1	Shows the ROM version of the option to be connected to A-Port as a 4-digit code. If the option has no ROM, "- - - -" appears on the LED monitor.
5_20	Option's ROM version 2	Shows the ROM version of the option to be connected to B-Port as a 4-digit code. If the option has no ROM, "- - - -" appears on the LED monitor.
5_21	Option's ROM version 3	Shows the ROM version of the option to be connected to C-Port as a 4-digit code. If the option has no ROM, "- - - -" appears on the LED monitor.
5_23	Cumulative run time of motor 1	Shows the content of the cumulative power-ON time counter of motor 1. Counter range: 0 to 99,990 hours Display range: 0 to 9999 The x10 LED turns ON. Actual cumulative motor run time (hours) = Displayed value x 10 When the count exceeds 99,990, the counter will be reset to "0" and start over again.
5_24	Temperature inside the inverter (real-time value)	Shows the current temperature inside the inverter. Unit: °C
5_25	Temperature of heat sink (real-time value)	Shows the current temperature of the heat sink inside the inverter. Unit: °C
5_26	Lifetime of DC link bus capacitor (elapsed hours)	Shows the cumulative time during which a voltage is applied to the DC link bus capacitor. When the main power is shut down, the inverter automatically measures the discharging time of the DC link bus capacitor and corrects the elapsed time. The display method is the same as for 5_06 above.
5_27	Lifetime of DC link bus capacitor (remaining hours)	Shows the remaining lifetime of the DC link bus capacitor, which is estimated by subtracting the elapsed time from the lifetime (10 years). The display method is the same as for 5_06 above.
5_28	Cumulative run time of motor 2	Shows the content of the cumulative power-ON time counter of motor 2. The display method is the same as for 5_23 above.
5_29	Cumulative run time of motor 3	Shows the content of the cumulative power-ON time counter of motor 3. The display method is the same as for 5_23 above.

Table 3.15 Display Items in "Maintenance Information" (Continued)

LED Monitor shows:	Item	Description
5_30	Cumulative run time of motor 4	Shows the content of the cumulative power-ON time counter of motor 4. The display method is the same as for 5_23 above.
5_31	Remaining time before the next motor 1 maintenance	Shows the time remaining before the next maintenance, which is estimated by subtracting the cumulative run time of motor 1 from the maintenance interval specified by H78. (This function applies to motor 1 only.) Display range: 0 to 9999 The x10 LED turns ON. Time remaining before the next maintenance (hour) = Displayed value × 10
5_32	Number of startups 2	Shows the content of the motor 2 startup counter (i.e., the number of run commands issued). The display method is the same as for 5_08 above.
5_33	Number of startups 3	Shows the content of the motor 3 startup counter (i.e., the number of run commands issued). The display method is the same as for 5_08 above.
5_34	Number of startups 4	Shows the content of the motor 4 startup counter (i.e., the number of run commands issued). The display method is the same as for 5_08 above.
5_35	Remaining startup times before the next maintenance	Shows the startup times remaining before the next maintenance, which is estimated by subtracting the number of startups from the preset startup count for maintenance specified by H79. (This function applies to motor 1 only.) The display method is the same as for 5_08 above.
5_36	Light alarm factor (Latest)	Shows the factor of the latest light alarm as an alarm code. For details, refer to Chapter 6, Section 6.1 "Protective Functions."
5_37	Light alarm factor (Last)	Shows the factor of the last light alarm as an alarm code. For details, refer to Chapter 6, Section 6.1 "Protective Functions."
5_38	Light alarm factor (2nd last)	Shows the factor of the 2nd last light alarm as an alarm code. For details, refer to Chapter 6, Section 6.1 "Protective Functions."
5_39	Light alarm factor (3rd last)	Shows the factor of the 3rd last light alarm as an alarm code. For details, refer to Chapter 6, Section 6.1 "Protective Functions."
5_40	Option error factor 1	Shows the factor of the error that has occurred in the option being connected to the A-port.
5_41	Number of option errors 2	Shows the total number of errors that have occurred in the option being connected to the B-port. Once the count exceeds 9999, the counter will be reset to "0."
5_42	Option error factor 2	Shows the factor of the error that has occurred in the option being connected to the B-port.
5_43	Number of option errors 3	Shows the total number of errors that have occurred in the option being connected to the C-port. Once the count exceeds 9999, the counter will be reset to "0."
5_44	Option error factor 3	Shows the factor of the error that has occurred in the option being connected to the C-port.

### 3.4.7 Reading alarm information -- Menu #6 "Alarm Information" --

Menu #6 "Alarm Information" shows the causes of the past 4 alarms in alarm code. Further, it is also possible to display alarm information that indicates the status of the inverter when the alarm occurred. Figure 3.5 shows the menu transition in Menu #6 "Alarm Information" and Table 3.16 lists the details of the alarm information.

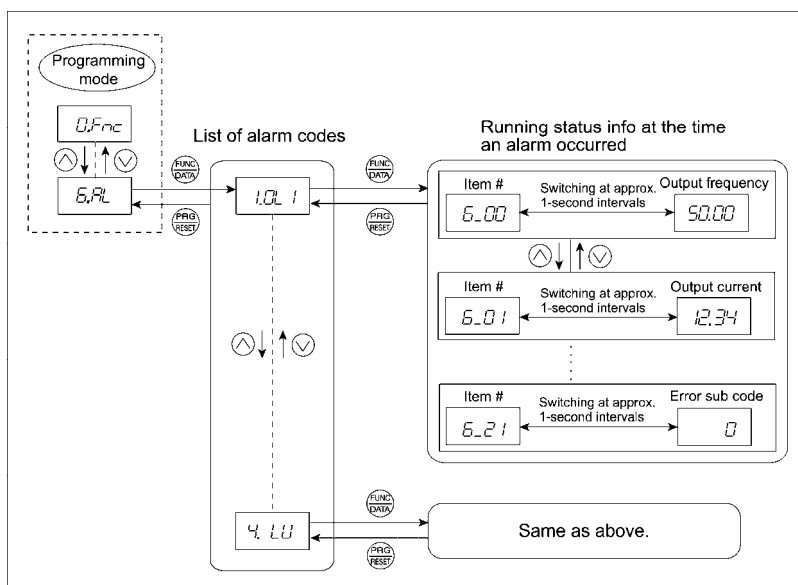


Figure 3.5 Menu Transition in Menu #6 "Alarm Information"

#### Basic key operation

To view the alarm information, set function code E52 to "2" (Full-menu mode) beforehand.

- (1) Turn the inverter ON. It automatically enters Running mode. In that mode, press the key to switch to Programming mode. The function selection menu appears.
- (2) Use the and keys to display "Alarm Information" ( & a I ).
- (3) Press the key to proceed to a list of alarm codes (e.g. ! 0 1 1 ).  
In the list of alarm codes, the alarm information for the last 4 alarms is saved as an alarm history.
- (4) Each time the or key is pressed, the last 4 alarms are displayed beginning with the most recent one in the order of ! , " , # and \$
- (5) Press the key with an alarm code being displayed.  
The item number (e.g. 6\_00 ) and the inverter status information (e.g. Output frequency) at the time of the alarm occurrence alternately appear at approx. 1-second intervals.  
Pressing the and keys displays other item numbers (e.g. 6\_01 ) and the status information (e.g. Output current) for that alarm code.
- (6) Press the key to return to the list of alarm codes. Press the key again to return to the menu.

Table 3.16 Display Items in "Alarm Information"

LED monitor shows: (item No.)	Item	Description
6_00	Output frequency	Output frequency before slip compensation
6_01	Output current	Output current
6_02	Output voltage	Output voltage
6_03	Calculated torque	Calculated motor output torque
6_04	Reference frequency	Frequency specified by frequency command
6_05	Rotational direction	Shows the rotational direction currently specified. <i>f</i> : forward, <i>r</i> : reverse, - - - : stop
6_06	Running status	Running status as four hexadecimal digits. Refer to "■ Displaying running status (3_07) and running status 2 (3_23)" in Section 3.4.4.
6_07	Cumulative run time	Shows the content of the cumulative power-ON time counter of the inverter. Counter range: 0 to 65,535 hours Display: Upper 2 digits and lower 3 digits are displayed alternately. Example: 0 ⇔ 535h (535 hours) 65 ⇔ 535h (65,535 hours) The lower 3 digits are displayed with <i>h</i> (hour). When the count exceeds 65,535, the counter will be reset to "0" and start over again.
6_08	No. of startups	Shows the content of the motor startup counter (i.e., the number of run commands issued). Counter range: 0 to 65,530 times Display range: 0 to 9999 If the count exceeds 10,000, the x10 LED turns ON and the LED monitor shows one-tenth of the value. When the count exceeds 65,530, the counter will be reset to "0" and start over again.
6_09	DC link bus voltage	Shows the DC link bus voltage of the inverter main circuit. Unit: V (volts)
6_10	Temperature inside the inverter	Shows the temperature inside the inverter. Unit: °C
6_11	Max. temperature of heat sink	Shows the temperature of the heat sink. Unit: °C
6_12	Terminal I/O signal status (displayed with the ON/OFF of LED segments)	Shows the ON/OFF state of the digital I/O terminals. Refer to "■ Displaying control I/O signal terminals" in Section 3.4.5 "Checking I/O signal status" for details.
6_13	Terminal input signal status (in hexadecimal)	
6_14	Terminal output signal status (in hexadecimal)	
6_15	No. of consecutive occurrences	Shows the number of times the same alarm occurs consecutively.
6_16	Multiple alarm 1	Simultaneously occurring alarm code (1) ("- - -" is displayed if no alarm has occurred.)
6_17	Multiple alarm 2	Simultaneously occurring alarm code (2) ("- - -" is displayed if no alarm has occurred.)

Table 3.16 Display Items in "Alarm Information" (Continued)

LED monitor shows: (item No.)	Item	Description
6_18	Terminal I/O signal status under communications control (displayed with the ON/OFF of LED segments)	Shows the ON/OFF state of the digital I/O terminals under RS-485 communications control. Refer to "■ <u>Displaying control I/O signal terminals under communications control</u> " in Section 3.4.5 "Checking I/O signal status" for details.
6_19	Terminal input signal status under communications control (in hexadecimal)	
6_20	Terminal output signal status under communications control (in hexadecimal)	
6_21	Error sub code	Secondary error code for the alarm.
6_22	Running status 2	Running status 2 as four hexadecimal digits. Refer to "■ <u>Displaying running status (3_07) and running status 2 (3_23)</u> " in Section 3.4.4.
6_23	Speed detected value	Speed detected value.

**Note** When the same alarm occurs repeatedly in succession, the alarm information for the first and the most recent occurrences will be preserved and the information for other occurrences in-between will be discarded. The number of consecutive occurrences will be preserved as the first alarm information.

#### 3.4.8 Copying data -- Menu #7 "Data Copying" --

Menu #7 "Data Copying" is used to read function code data out of an inverter for storing it in the keypad or writing it into another inverter. It is also used to verify the function code data stored in the keypad with the one configured in the inverter. The keypad serves as a temporary storage media.

In addition, using Menu #7 allows you to store the running status information in the keypad, detach the keypad from the inverter, connect it to a PC running FRENIC Loader at an office or off-site place, and check the inverter running status without removing the inverter itself.

To store the inverter running status information into the keypad, use "Read data" (*read*) or "Read inverter running information" (*chec*) function. For details on how to connect the keypad to a PC and check the inverter running status information stored in the keypad, refer to the FRENIC Loader Instruction Manual.

Figure 3.6 shows the menu transition in Menu #7 "Data Copying." The keypad can hold function code data for a single inverter.

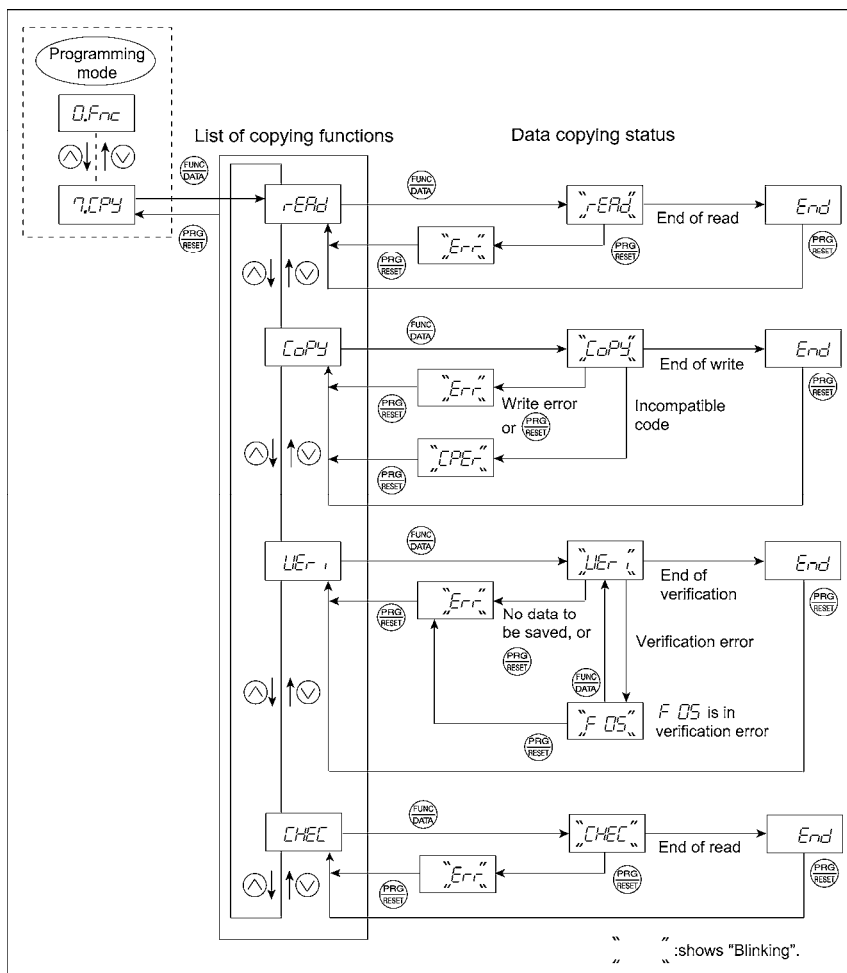








Figure 3.6 Menu Transition in Menu #7 "Data Copying"



**Basic keying operation**

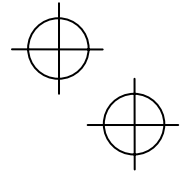
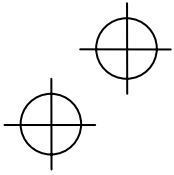
- (1) Turn the inverter ON. It automatically enters Running mode. In that mode, press the **PRG/RESET** key to switch to Programming mode. The function selection menu appears.
- (2) Use the **▲** and **▼** keys to display "Data Copying" ( *' cpy* ).
- (3) Press the **FUNC/DATA** key to proceed to the list of data copying functions (e.g. *read* ).
- (4) Use the **▲** and **▼** keys to select the desired function, then press the **FUNC/DATA** key to execute the selected function. (e.g. *read* will blink.)
- (5) When the selected function has been completed, *end* appears. Press the **PRG/RESET** key to return to the list of data copying functions. Press the **PRG/RESET** key again to return to the menu.

Table 3.17 below lists details of the data copying functions.

Table 3.17 List of Data Copying Functions

Display on LED Monitor	Function	Description
<i>read</i>	Read data	<p>Reads the function code data out of the inverter's memory and stores it into the keypad memory.</p> <p>Also reads out inverter's current running status information which can be checked by FRENIC Loader, such as information of I/O, system, alarm, and running status.</p> <p>Pressing the  key during a read operation (when <i>read</i> is blinking) immediately aborts the operation and displays <i>err</i> (blinking).</p> <p>If this happens, the entire contents of the memory of the keypad will be completely cleared.</p>
<i>copy</i>	Write data	<p>Writes data stored in the keypad memory into the inverter's memory.</p> <p>If you press the  key during a write operation (when <i>copy</i> is blinking), the write operation that is under way will be aborted and <i>err</i> will appear (blinking). If this happens, the contents of the inverter's memory (i.e., function code data) have been partly updated and remain partly old. Therefore, do not operate the inverter. Instead, perform initialization or rewrite the entire data.</p> <p>If this function does not work, refer to "■ If data copying does not work" on page 3-27.</p>
<i>veri</i>	Verify data	<p>Verifies (collates) the data stored in the keypad memory with that in the inverter's memory.</p> <p>If any mismatch is detected, the verify operation will be aborted, with the function code in disagreement displayed blinking. Pressing the  key again causes the verification to continue from the next function code.</p> <p>Pressing the  key during a verify operation (when <i>veri</i> is blinking) immediately aborts the operation and displays <i>err</i> (blinking).</p> <p><i>err</i> appears blinking also when the keypad does not contain any valid data.</p>
<i>prot</i>	Enable Data protection	<p>Enables the Data protection of data stored in the keypad's memory.</p> <p>In this state, you cannot read any data stored in the inverter's memory, but can write data into the memory and verify data in the memory.</p> <p>Upon pressing the  key the inverter immediately displays <i>err</i>.</p>
<i>chec</i>	Read inverter running information	<p>Reads out inverter's current running status information that can be checked by FRENIC Loader, such as information of I/O, system, alarm, and running status, excluding function code data.</p> <p>Use this command when the function code data saved in the PC should not be overwritten and it is necessary to keep the previous data.</p> <p>Pressing the  key during a read operation (<i>chec</i> blinking) immediately aborts the operation and displays <i>err</i> (blinking).</p>


 To get out of the error state indicated by a blinking *err* or *cperr*, press the  key.



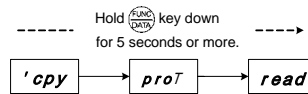
## ■ Data protection


You can protect data saved in the keypad from unexpected modifications. Enabling the data protection that was disabled changes the display *read* on the "Data Copying" function list to *proT*, and disables to read data from the inverter.

To enable or disable the data protection, follow the next steps.

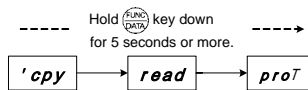
- (1) Select the "Data Copying" ( *'cpy* ) on the function selection menu in Programming mode.
- (2) Holding the  key down for 5 seconds or more alternates data protection status between enabled or disabled.


- Disabling the enabled data protection



While running the "Data Copying" ( *'cpy* ) function, holding down the  key for 5 seconds or more displays *read* after displaying *proT* for 5 seconds to complete disabling the data protection.

- Enabling the disabled data protection



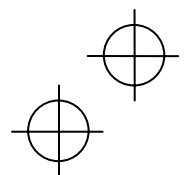
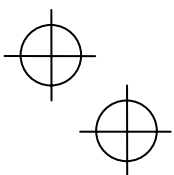
While running the "Data Copying" ( *'cpy* ) function, holding down the  key for 5 seconds or more displays *proT* after displaying *read* for 5 seconds to complete enabling the data protection.

The followings are restrictions and special notes concerning "Data Copying."

### ■ If data copying does not work

Check whether *err* or *cper* is blinking.

- (1) If *err* is blinking (a write error), any of the following problems has arisen:
  - No data exists in the keypad memory. (No data read operation has been performed since shipment, or a data read operation has been aborted.)
  - Data stored in the keypad memory contains any error.
  - The models of copy source and destination inverters are different.
  - A data write operation has been performed while the inverter is running.
  - The copy destination inverter is data-protected. (function code F00 = 1)
  - In the copy destination inverter, the "Enable write from keypad" command **WE-KP** is OFF.
  - A Read data operation has been performed for the inverter whose data protection was enabled.
- (2) If *cper* is blinking, any of the following problems has arisen:
  - The function codes stored in the keypad and ones registered in the inverter are not compatible with each other. (Either of the two may have been revised or upgraded in a non-standard or incompatible manner. Consult your Fuji Electric representative.)





### 3.5 Alarm Mode

If an abnormal condition arises, the protective function is invoked and issues an alarm, then the inverter automatically enters Alarm mode. At the same time, an alarm code appears on the LED monitor.

#### ■ Releasing the alarm and switching to Running mode

Remove the cause of the alarm and press the key to release the alarm and return to Running mode. The alarm can be removed using the key only when the alarm code is displayed.

#### ■ Displaying the alarm history

It is possible to display the most recent 3 alarm codes in addition to the one currently displayed. Previous alarm codes can be displayed by pressing the key while the current alarm code is displayed.

#### ■ Displaying the status of inverter at the time of alarm

When the alarm code is displayed, you may check various running status information (output frequency and output current, etc.) by pressing the key. The item number and data for each running information will be displayed alternately.

Further, you can view various pieces of information on the running status of the inverter using the key. The information displayed is the same as for Menu #6 "Alarm Information" in Programming mode. Refer to Table 3.16 in Section 3.4.7, "Reading alarm information."

Pressing the key while the running status information is displayed returns to the alarm code display.

**Note** When the running status information is displayed after removal of the alarm cause, pressing the twice returns to the alarm code display and releases the inverter from the alarm state. This means that the motor starts running if a run command has been received by this time.

#### ■ Switching to Programming mode

You can also switch to Programming mode by pressing "STOP + keys" simultaneously with the alarm displayed, and modify the function code data.

Figure 3.7 summarizes the possible transitions between different menu items.

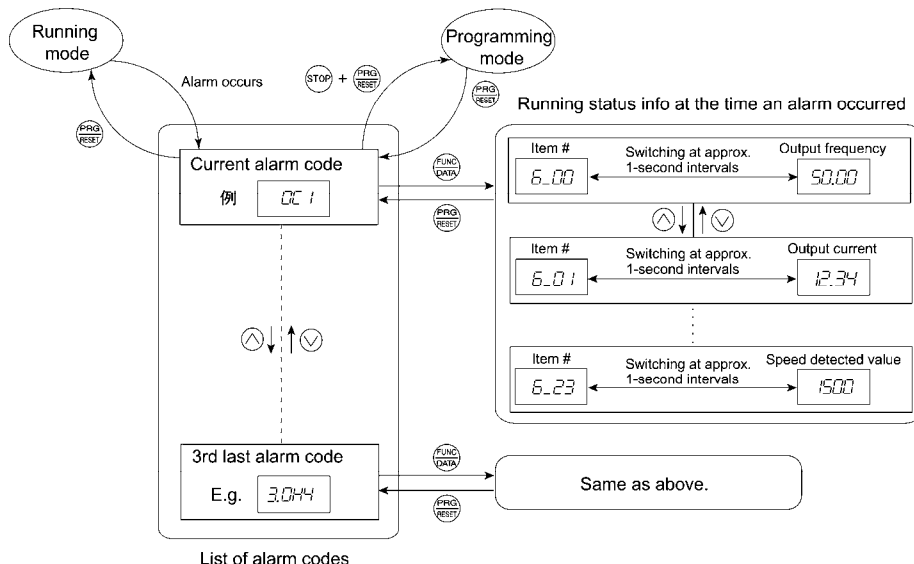
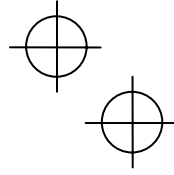
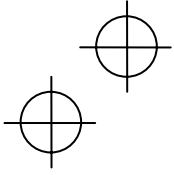


Figure 3.7 Menu Transition in Alarm Mode




### 3.6 USB Connectivity


The keypad has a USB port (mini B connector) on its face. To connect a USB cable, open the USB port cover as shown below.

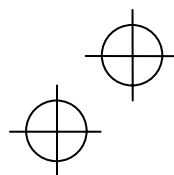
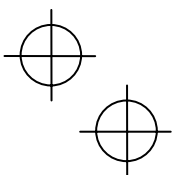


Connecting the inverter to a PC with a USB cable enables remote control from FRENIC Loader. On the PC running FRENIC Loader, it is possible to edit, check, manage, and monitor the function code data in real-time, to start or stop the inverter, and to monitor the running or alarm status of the inverter.

 For the instructions on how to use the FRENIC Loader, refer to the FRENIC Loader Instruction Manual.

In addition, using the keypad as a temporary storage media allows you to store the running status information in the keypad, detach the keypad from the inverter, connect it to a PC running FRENIC Loader at an office or off-site place.

 For details on how to store data into the keypad, refer to Section 3.4.8 "Data copying."



## Chapter 4 RUNNING THE MOTOR

### 4.1 Running the Motor for a Test

#### 4.1.1 Test run procedure

Make a test run of the motor using the flowchart given below.

This chapter describes the test run procedure with motor 1 dedicated function codes that are marked with an asterisk (\*). For motors 2 to 4, replace those asterisked function codes with respective motor dedicated ones. (Refer to Chapter 5, Table 5.7.)

 For the function codes dedicated to motors 2 to 4, see Chapter 5 "FUNCTION CODES."

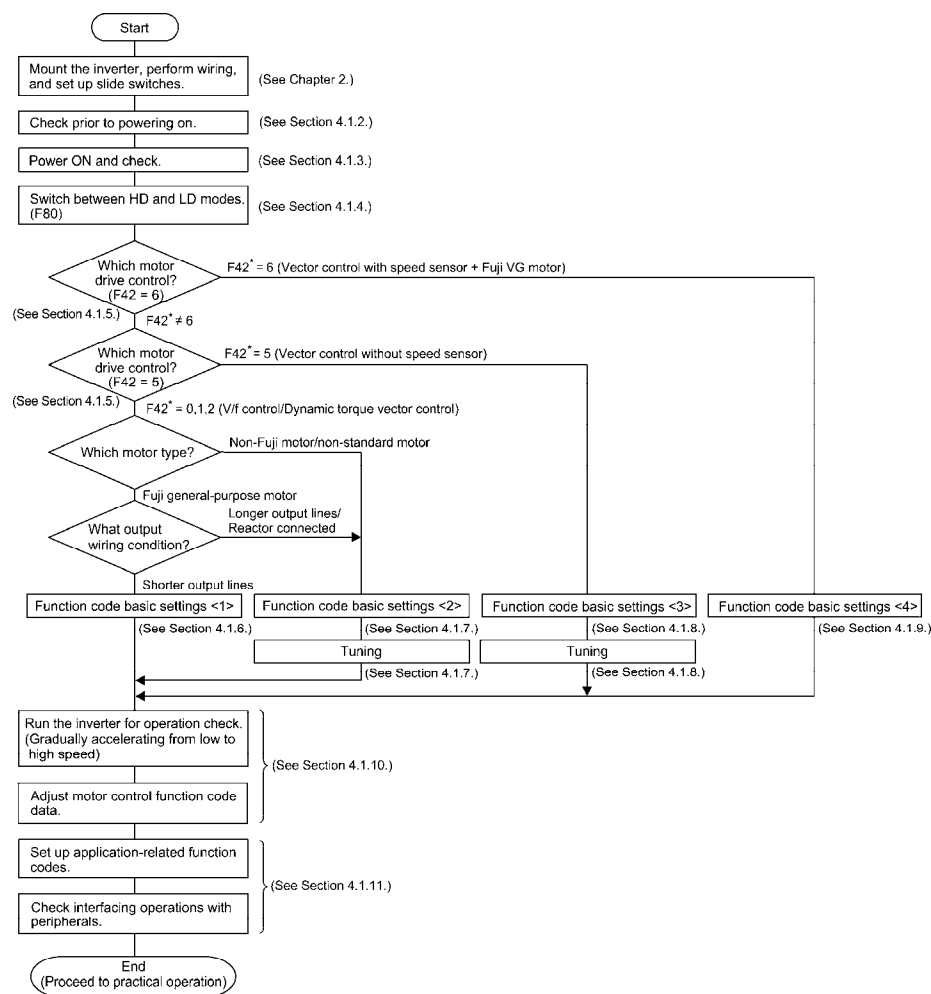


Figure 4.1 Test Run Procedure

#### 4.1.2 Checking prior to powering on

Check the following before powering on the inverter.

- (1) Check that the wiring is correct.

Especially check the wiring to the inverter input terminals L1/R, L2/S and L3/T and output terminals U, V, and W. Also check that the grounding wires are connected to the grounding terminals (⊕G) correctly. See Figure 4.2.

<b>⚠ WARNING</b>
<ul style="list-style-type: none"> <li>• Never connect power supply wires to the inverter output terminals U, V, and W. Doing so and turning the power ON breaks the inverter.</li> <li>• Be sure to connect the grounding wires of the inverter and the motor to the ground electrodes. <b>Otherwise, an electric shock could occur.</b></li> </ul>

- (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.

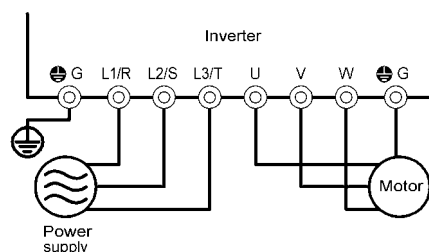


Figure 4.2 Connection of Main Circuit Terminals

#### 4.1.3 Powering ON and checking

<b>⚠ WARNING</b>
<ul style="list-style-type: none"> <li>• Be sure to mount the front cover before turning the power ON. Do not remove the cover when the inverter power is ON.</li> <li>• Do not operate switches with wet hands. <b>Otherwise, an electric shock could occur.</b></li> </ul>

Turn the power ON and check the following points. The following 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 reference frequency is 0 Hz) that is blinking. (See Figure 4.3.)  
If the LED monitor displays any number except \*00, press  /  key to set \*00 .
- (2) Check that the built-in cooling fans rotate. (Inverters with a capacity of 1.5 kW or below are not equipped with a cooling fan.)



Figure 4.3 Display of the LED Monitor after Power-on

#### 4.1.4 Switching between HD and LD drive modes

The FRENIC-MEGA series of inverters is applicable to two ratings--high duty (HD) for heavy load applications and low duty (LD) for light load ones. Function code F80 switches the FRENIC-MEGA between the HD and LD modes.

F80 data	Drive mode	Application	Continuous current rating level	Overload capability	Maximum frequency
0	HD (High Duty) mode (default)	Heavy load	Capable of driving a motor whose capacity is the <u>same</u> as the inverter's one.	150% for 1 min. 200% for 3 s	500 Hz
1	LD (Low Duty) mode	Light load	Capable of driving a motor whose capacity is <u>one rank higher</u> than the inverter's one.	120% for 1 min.	120 Hz

The LD-mode inverter brings out the continuous current rating level which enables the inverter to drive a motor with one rank higher capacity, but its overload capability (%) against the continuous current level decreases. For the rated current level, see Chapter 8 "SPECIFICATIONS."

The LD-mode inverter is subject to restrictions on the function code data setting range and internal processing as listed below.

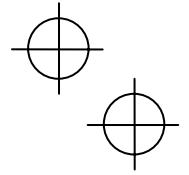
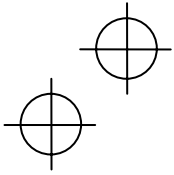
Function codes	Name	HD mode	LD mode	Remarks
F21*	DC braking (Braking level)	Setting range: 0 to 100%	Setting range: 0 to 80%	In the LD mode, a value out of the range, if specified, automatically changes to the maximum value allowable in the LD mode.
F26	Motor sound (Carrier frequency)	Setting range: 0.75 to 16 kHz (0.4 to 22 kW) 0.75 to 16 kHz (30 to 55 kW) 0.75 to 10 kHz (75 to 630 kW)	Setting range: 0.75 to 16 kHz (0.4 to 18.5 kW) 0.75 to 10 kHz (22 to 55 kW) 0.75 to 6 kHz (75 to 630 kW)	
F44	Current limiter (Level)	Initial value: 160%	Initial value: 130%	Switching the drive mode between HD and LD with function code F80 automatically initializes the F44 data to the value specified at left.
F03*	Maximum frequency	Setting range: 25 to 500 Hz Upper limit: 500 Hz	Setting range: 25 to 500 Hz Upper limit: 120 Hz	In the LD mode, if the maximum frequency exceeds 120 Hz, the actual output frequency is internally limited to 120 Hz.
—	Current indication and output	Based on the rated current level for HD mode	Based on the rated current level for LD mode	—

Switching to the LD mode does not automatically change the motor rated capacity (P02\*) to the one for the motor with one rank higher capacity, so configure the P02\* data to match the applied motor rating as required.

#### 4.1.5 Selecting a desired motor drive control

The FRENIC-MEGA supports the following motor drive control.

F42* data	Drive control	Basic control	Speed feedback	Speed control	Other restrictions
0	V/f control with slip compensation inactive	V/f control	Disable	Frequency control	—
1	Dynamic torque vector control			Frequency control with slip compensation	—
2	V/f control with slip compensation active			—	—
5	Vector control without speed sensor	Vector control	Estimated speed	Speed control with automatic speed regulator (ASR)	Maximum frequency: 120 Hz
6	Vector control with speed sensor		Enable	—	Maximum frequency: 200 Hz



■ **V/f control with slip compensation inactive**

Under this control, the inverter controls a motor with the voltage and frequency according to the V/f pattern specified by function codes. This control disables all automatically controlled features such as the slip compensation, so no unpredictable output fluctuation, enabling stable operation with constant output frequency.

■ **V/f control with slip compensation active**

Applying any load to an induction motor causes a rotational slip due to the motor characteristics, decreasing the motor rotation. The inverter's slip compensation function first presumes the slip value of the motor based on the motor torque generated and raises the output frequency to compensate for the decrease in motor rotation. This prevents the motor from decreasing the rotation due to the slip.

That is, this function is effective for improving the motor speed control accuracy.

The compensation value is specified by combination of function codes P12\* (Rated slip frequency), P09\* (Slip compensation gain for driving) and P11\* (Slip compensation gain for braking).

H68\* enables or disables the slip compensation function according to the motor driving conditions.

H68* data	Motor driving conditions		Motor driving frequency zone	
	Accel/Decel	Constant speed	Base frequency or below	Above the base frequency
0	Enable	Enable	Enable	Enable
1	Disable	Enable	Enable	Enable
2	Enable	Enable	Enable	Disable
3	Disable	Enable	Enable	Disable

■ **Dynamic torque vector control**

To get the maximal torque out of a motor, this control calculates the motor torque for the load applied and uses it to optimize the voltage and current vector output.

Selecting this control automatically enables the auto torque boost and slip compensation function.

This control is effective for improving the system response to external disturbances such as load fluctuation, and the motor speed control accuracy.

Note that the inverter may not respond to a rapid load fluctuation since this control is an open-loop V/f control that does not perform the current control, unlike the vector control. The advantages of this control include larger maximum torque per output current than that the vector control.

■ **Vector control without speed sensor**

This control estimates the motor speed based on the inverter's output voltage and current to use the estimated speed for speed control. In addition, it decomposes the motor drive current into the exciting and torque current components, and controls each of those components in vector. No PG (pulse generator) interface card is required. It is possible to obtain the desired response by adjusting the control constants (PI constants) using the speed regulator (PI controller).

Since this control controls the motor current, it is necessary to secure some voltage margin between the voltage that the inverter can output and the induced voltage of the motor, by keeping the former lower than the latter.

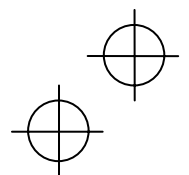
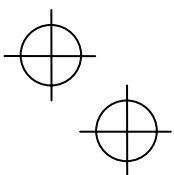
Although the voltage of the general-purpose motor has usually been adjusted to match the commercial power, keeping the motor terminal voltage low is necessary in order to secure the voltage margin. If the motor is driven under this control with the motor terminal voltage being kept low, however, the rated torque cannot be obtained even when the rated current originally specified for the motor is applied. To secure the rated torque, therefore, it is necessary to use a motor with higher rated current. (This also applies to the vector control with speed sensor.)

■ **Vector control with speed sensor**

This control requires an optional PG (pulse generator) and an optional PG interface card to be mounted on a motor shaft and an inverter, respectively. The inverter detects the motor's rotational position and speed from PG feedback signals and uses them for speed control. In addition, it decomposes the motor drive current into the exciting and torque current components, and controls each of components in vector.

The desired response can be obtained by adjusting the control constants (PI constants) and using the speed regulator (PI controller). This control enables the speed control with higher accuracy and quicker response than the vector control without speed sensor.

(A recommended motor for this control is a Fuji VG motor exclusively designed for vector control.)



**Note** Since slip compensation, dynamic torque vector control, and vector control with/without speed sensor use motor parameters, the following conditions should be satisfied; otherwise, full control performance may not be obtained.

- A single motor should be controlled per inverter.
- Motor parameters P02\*, P03\*, P06\* to P23\*, P55\* and P56\* are properly configured. Or, auto tuning (P04\*) is performed.  
(A Fuji VG motor requires no auto tuning, just requires selecting a Fuji VG motor with function code (P99\* = 2).)
- The capacity of the motor to be controlled should be two or more ranks lower than that of the inverter under the dynamic torque vector control; it should be the same as the inverter under the vector control with/without speed sensor. Otherwise, the inverter may not control the motor due to decrease of the current detection resolution.
- The wiring distance between the inverter and motor should be 50 m or less. If it is longer, the inverter may not control the motor due to leakage current flowing through stray capacitance to the ground or between wires. Especially, small capacity inverters whose rated current is also small may be unable to control the motor correctly even when the wiring is less than 50 m. In that case, make the wiring length as short as possible or use a wire with small stray capacitance (e.g., loosely-bundled cable) to minimize the stray capacitance.

■ **Performance comparison for drive controls (summary)**

Each drive control has advantages and disadvantages. The table below compares the drive controls, showing their relative performance in each characteristic.

Select the one that shows high performance in the characteristics that are important in your machinery. In rare cases, the performance shown below may not be obtained due to various conditions including motor characteristics or mechanical rigidity. The final performance should be determined by adjusting the speed control system or other elements with the inverter being connected to the machinery (load). If you have any questions, contact your Fuji Electric representative.

F42* data	Drive control	Output frequency stability	Speed control accuracy	Speed control response	Maximum torque	Load disturbance	Current control	Torque accuracy
0	V/f control with slip compensation inactive		—	—		—	—	
1	Dynamic torque vector control						—	
2	V/f control with slip compensation active						—	
5	Vector control without speed sensor							
6	Vector control with speed sensor							


Relative performance symbols : Excellent, : Good, : Effective, : Less effective, - : Not effective

#### 4.1.6 Function code basic settings < 1 >

Driving a Fuji general-purpose motor under the V/f control (F42\* = 0 or 2) or dynamic torque vector control (F42\* = 1) requires configuring the following basic function codes. (Refer to Figure 4.1 on page 4-1.)


Select Fuji standard 8- or 6-series motors with the function code P99\*.

Configure the function codes listed below according to the motor ratings and your machinery design values. For the motor ratings, check the ratings printed on the motor's nameplate. For your machinery design values, ask system designers about them.

 For details on how to modify the function code data, see Chapter 3, Section 3.4.2 "Setting up function codes -- Menu #1 "Data Setting" --."

Function code	Name	Function code data	Factory default	
			FRN__G1■-2A/4A	FRN__G1■-4E
<i>f 04</i> *	Base frequency 1	Motor ratings (printed on the nameplate of the motor)	200 V class series: 60.0 (Hz)	200 V class series: —
<i>f 05</i> *	Rated voltage at base frequency 1		400 V class series: 50.0 (Hz)	400 V class series: 50.0 (Hz)
<i>p 99</i> *	Motor 1 selection	0: Motor characteristics 0 (Fuji standard motors, 8-series) 3: Motor characteristics 3 (Fuji standard motors, 6-series)	0: Motor characteristics 0 (Fuji standard motors, 8-series)	
<i>p 02</i> *	Motor 1 (Rated capacity)	Capacity of motor connected	Nominal applied motor capacity	
<i>f 03</i> *	Maximum frequency 1	Machinery design values (Note) For a test-driving of the motor, increase values so that they are longer than your machinery design values. If the specified time is short, the inverter may not run the motor properly.	200 V class series: 60.0 (Hz)	200 V class series: —
<i>f 07</i> *	Acceleration time 1 (Note)		400 V class series: 50.0 (Hz)	400 V class series: 50.0 (Hz)
<i>f 08</i> *	Deceleration time 1 (Note)		6.00 (s)	6.00 (s)

After the above configuration, initialize motor 1 with the function code (H03 = 2). It automatically updates the motor parameters P01\*, P03\*, P06\* to P23\*, P53\* to P56\*, and H46.

 When accessing the function code P02\*, take into account that changing the P02\* data automatically updates the data of the function codes P03\*, P06\* to P23\*, P53\* to P56\*, and H46.

The motor rating should be specified properly when performing auto-torque boost, torque calculation monitoring, auto energy saving, torque limiting, automatic deceleration (anti-regenerative control), auto search for idling motor speed, slip compensation, torque vector control, droop control, or overload stop.

In any of the following cases, the full control performance may not be obtained from the inverter because the motor parameters differ from the factory defaults, so perform auto-tuning. (Refer to Section 4.1.7.)

- The motor to be driven is not a Fuji product or is a non-standard product.
- The wiring distance between the inverter and the motor is too long (generally 20 m or more).
- A reactor is inserted between the inverter and the motor.




#### 4.1.7 Function code basic settings and tuning < 2 >


Under the V/f control (F42\* = 0 or 2) or dynamic torque vector control (F42\* = 1), any of the following cases requires configuring the basic function codes given below and auto-tuning. (Refer to Figure 4.1 on page 4-1.)

- Driving a non-Fuji motor or non-standard motor
- Driving a Fuji general-purpose motor, provided that the wiring distance between the inverter and motor is long or a reactor is connected

Configure the function codes listed below according to the motor ratings and your machinery design values. For the motor ratings, check the ratings printed on the motor's nameplate. For your machinery design values, ask system designers about them.

 For details on how to modify the function code data, see Chapter 3, Section 3.4.2 "Setting up function codes -- Menu #1 "Data Setting" --."

Function code	Name	Function code data	Factory default	
			FRN__G1■-2A/4A	FRN__G1■-4E
f 04 *	Base frequency 1	Motor ratings (printed on the nameplate of the motor)	200 V class series: 60.0 (Hz)	200 V class series: —
f 05 *	Rated voltage at base frequency 1		400 V class series: 50.0 (Hz)	400 V class series: 50.0 (Hz)
p 02 *	Motor 1 (Rated capacity)		200 V class series: 220 (V)	200 V class series: —
p 03 *	Motor 1 (Rated current)		400 V class series: 415 (V)	400 V class series: 400 (V)
			Nominal applied motor capacity	
			Rated current of nominal applied motor	
f 03 *	Maximum frequency 1	Machinery design values (Note) For a test-driving of the motor, increase values so that they are longer than your machinery design values. If the specified time is short, the inverter may not run the motor properly.	200 V class series: 60.0 (Hz)	200 V class series: —
f 07 *	Acceleration time 1 (Note)		6.00 (s)	
f 08 *	Deceleration time 1 (Note)		6.00 (s)	

 **Note** When accessing the function code P02\*, take into account that changing the P02\* data automatically updates the data of the function codes P03\*, P06\* to P23\*, P53\* to P56\*, and H46.

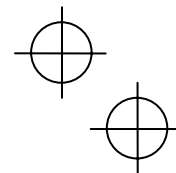
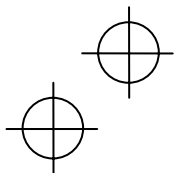
#### ■ Tuning procedure

##### (1) Selection of tuning type

Check the situation of the machinery and select "Tuning with the motor being stopped (P04\* = 1)" or "Tuning with the motor running (P04\* = 2)." For the latter tuning, adjust the acceleration and deceleration times (F07\* and F08\*) and specify the rotation direction that matches the actual rotation direction of the machinery.

P04* data	Motor parameters subjected to tuning:	Tuning type	Selection condition of tuning type
1 Tune while the motor stops.	Primary resistance (%R1) (P07*) Leakage reactance (%X) (P08*) Rated slip frequency (P12*) %X correction factor 1 and 2 (P53* and P54*)	Tuning <u>with the motor being stopped</u> .	Cannot rotate the motor.
2 Tune while the motor is rotating under V/f control	No-load current (P06*) Primary resistance (%R1) (P07*) Leakage reactance (%X) (P08*) Rated slip frequency (P12*) Magnetic saturation factors 1 to 5 Magnetic saturation extension factors "a" to "c" (P16* to P23*) %X correction factor 1 and 2 (P53* and P54*)	Tuning the %R1 and %X, <u>with the motor being stopped</u> . Tuning the no-load current and magnetic saturation factor, <u>with the motor running</u> at 50% of the base frequency. Tuning the rated slip frequency, <u>with the motor being stopped</u> .	Can rotate the motor, provided that it is safe. Note that little load should be applied during tuning. Tuning with load applied decreases the tuning accuracy.


The tuning results of motor parameters will be automatically saved into their respective function codes. If P04\* tuning is performed, for instance, the tuning results will be saved into P codes (Motor 1 parameters).



## (2) Preparation of machinery

Perform appropriate preparations on the motor and its load, such as disengaging the coupling from the motor and deactivating the safety devices.

## (3) Tuning

- ① Set function code P04\* to "1" or "2" and press the  key. (The blinking of 1 or 2 on the LED monitor will slow down.)
- ② Enter a run command. The factory default is "RUN" key on the keypad for forward rotation." To switch to reverse rotation or to select the terminal signal **FWD** or **REV** as a run command, change the data of function code F02.
- ③ The moment a run command is entered, the display of 1 or 2 lights up, and tuning starts with the motor being stopped.  
(Maximum tuning time: Approx. 40 s.)
- ④ If P04\* = 2, after the tuning in ③ above, the motor is accelerated to approximately 50% of the base frequency and then tuning starts. Upon completion of measurements, the motor will decelerate to a stop.  
(Estimated tuning time: Acceleration time + 20 s + Deceleration time)
- ⑤ If P04\* = 2, after the motor decelerates to a stop in ④ above, tuning will continue with the motor being stopped.  
(Maximum tuning time: Approx. 20 s.)
- ⑥ If the terminal signal **FWD** or **REV** is selected as a run command (F02 = 1), *end* will appear upon completion of the measurements. Turning the run command OFF completes the tuning.  
If the run command has been given through the keypad or the communications link, it automatically turns OFF upon completion of the measurements, which completes the tuning.
- ⑦ Upon completion of the tuning, the subsequent function code P06\* appears on the keypad.


### ■ Tuning errors

Improper tuning would negatively affect the operation performance and, in the worst case, could even cause hunting or deteriorate precision. Therefore, if the inverter finds any abnormality in the tuning results or any error in the tuning process, it displays *er7* and discards the tuning data.

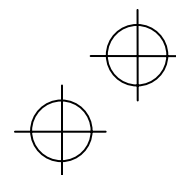
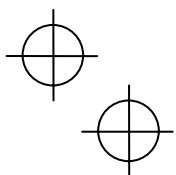
Listed below are possible causes that trigger tuning errors.

Possible tuning error causes	Details
Error in tuning results	- An interphase voltage unbalance or output phase loss has been detected. - Tuning has resulted in an abnormally high or low value of a parameter due to the output circuit opened.
Output current error	An abnormally high current has flown during tuning.
Sequence error	During tuning, a run command has been turned OFF, or <b>STOP</b> (Force to stop), <b>BX</b> (Coast to a stop), <b>DWP</b> (Protect from dew condensation), or other similar terminal command has been received.
Error due to limitation	- During tuning, any of the operation limiters has been activated. - The maximum frequency or the frequency limiter (high) has limited tuning operation.
Other errors	An undervoltage or any other alarm has occurred.

If any of these errors occurs, remove the error cause and perform tuning again, or consult your Fuji Electric representative.

 **Note** If a filter other than the Fuji optional output filter (OFL-□□□-□A) is connected to the inverter's output (secondary) circuit, the tuning result cannot be assured. When replacing the inverter connected with such a filter, make a note of the old inverter's settings for the primary resistance %R1, leakage reactance %X, no-load current, and rated slip frequency, and specify those values to the new inverter's function codes.


Vibration that may occur when the motor's coupling is elastic can be regarded as normal vibration due to the output voltage pattern applied in tuning. The tuning does not always result in an error; however, run the motor and check its running state.



#### 4.1.8 Function code basic settings < 3 >

Driving a motor under vector control without speed sensor (F42\* = 5) requires auto tuning, regardless of the motor type. (Refer to Figure 4.1 on page 4-1.) (Even driving a Fuji VG motor exclusively designed for vector control requires auto tuning.)

Configure the function codes listed below according to the motor ratings and your machinery design values. For the motor ratings, check the ratings printed on the motor's nameplate. For your machinery design values, ask system designers about them.

 For details on how to modify the function code data, see Chapter 3, Section 3.4.2 "Setting up function codes -- Menu #1 "Data Setting" --."

Function code	Name	Function code data	Factory default	
			FRN_ _G1■-2A/4A	FRN_ _G1■-4E
<i>f 04</i> *	Base frequency 1	Motor ratings (printed on the nameplate of the motor)	200 V class series: 60.0 (Hz) 400 V class series: 50.0 (Hz)	200 V class series: — 400 V class series: 50.0 (Hz)
<i>f 05</i> *	Rated voltage at base frequency 1		200 V class series: 220 (V) 400 V class series: 415 (V)	200 V class series: — 400 V class series: 400 (V)
<i>p 02</i> *	Motor 1 (Rated capacity)		Nominal applied motor capacity	
<i>p 03</i> *	Motor 1 (Rated current)		Rated current of nominal applied motor	
<i>f 03</i> *	Maximum frequency 1	Machinery design values (Note) For a test-driving of the motor, increase values so that they are longer than your machinery design values. If the specified time is short, the inverter may not run the motor properly.	200 V class series: 60.0 (Hz) 400 V class series: 50.0 (Hz)	200 V class series: — 400 V class series: 50.0 (Hz)
<i>f 07</i> *	Acceleration time 1 (Note)		6.00 (s)	
<i>f 08</i> *	Deceleration time 1 (Note)		6.00 (s)	

- Note**
- When accessing the function code P02\*, take into account that changing the P02\* data automatically updates the data of the function codes P03\*, P06\* to P23\*, P53\* to P56\*, and H46.
  - Specify the rated voltage at base frequency (F05) at the normal value, although the inverter controls the motor keeping the rated voltage (rated voltage at base frequency) low under vector control without speed sensor. After the auto tuning, the inverter automatically reduces the rated voltage at base frequency.

To drive a Fuji VG motor exclusively designed for vector control, configure the following basic function codes, initialize the motor 1 parameters with the function code (H03=2), and then perform auto tuning.

Function code	Name	Function code data	Factory default	
			FRN_ _G1■-2A/4A	FRN_ _G1■-4E
<i>p 99</i> *	Motor 1 selection	2: Motor characteristics 2 (VG motors)	0: Motor characteristics 0	
<i>p 02</i> *	Motor 1 (Rated capacity)	Same as that of the applied motor capacity	Nominal applied motor capacity	
<i>f 03</i> *	Maximum frequency 1	Machinery design values (Note) For a test-driving of the motor, increase values so that they are longer than your machinery design values. If the specified time is short, the inverter may not run the motor properly.	200 V class series: 60.0 (Hz) 400 V class series: 50.0 (Hz)	200 V class series: — 400 V class series: 50.0 (Hz)
<i>f 07</i> *	Acceleration time 1 (Note)		6.00 (s)	
<i>f 08</i> *	Deceleration time 1 (Note)		6.00 (s)	

- Note** Initializing the motor 1 parameters with the function code (H03=2) automatically updates the data of function codes P03\*, P06\* to P23\*, P53\* to P56\*, and H46. After that, perform the auto tuning.

■ **Tuning procedure**

**(1) Selection of tuning type**

Check the machinery conditions and perform the "tuning while the motor is rotating under vector control" (P04\* = 3). Adjust the acceleration and deceleration times (F07\* and F08\*) in view of the motor rotation. And specify the rotation direction that matches the actual rotation direction of the machinery.

**Note** If the "tuning while the motor is rotating under vector control (P04\*=3)" cannot be selected due to restrictions on the machinery, refer to the "If tuning while the motor is rotating cannot be selected" below.

Drive control abbreviation: "V/f" (V/f control), "w/o PG" (vector control without speed sensor), and "w/ PG" (vector control with speed sensor)

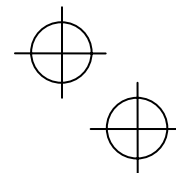
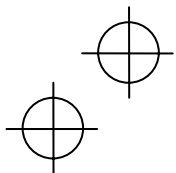
P04* data	Motor parameters subjected to tuning:	Tuning type	Selection condition of tuning type	Drive control		
				V/f	w/o PG	w/ PG
1 Tune while the motor stops.	Primary resistance (%R1) (P07*) Leakage reactance (%X) (P08*) Rated slip frequency (P12*) %X correction factor 1 and 2 (P53* and P54*)	Tuning <u>with the motor being stopped</u> .	Cannot rotate the motor.	Y	Y*	Y*
2 Tune while the motor is rotating under V/f control	No-load current (P06*) Primary resistance (%R1) (P07*) Leakage reactance (%X) (P08*) Rated slip frequency (P12*) Magnetic saturation factors 1 to 5 Magnetic saturation extension factors "a" to "c" (P16* to P23*) %X correction factor 1 and 2 (P53* and P54*)	Tuning the %R1 and %X, <u>with the motor being stopped</u> .  Tuning the no-load current and magnetic saturation factor, <u>with the motor running</u> at 50% of the base frequency.  Tuning the rated slip frequency again, <u>with the motor being stopped</u> .	Can rotate the motor, provided that it is safe.  Note that little load should be applied during tuning. Tuning with load applied decreases the tuning accuracy.	Y	N	N
3 Tune while the motor is rotating under vector control	No-load current (P06*) Primary resistance (%R1) (P07*) Leakage reactance (%X) (P08*) Rated slip frequency (P12*) Magnetic saturation factors 1 to 5 Magnetic saturation extension factors "a" to "c" (P16* to P23*) %X correction factor 1 and 2 (P53* and P54*)	Tuning the %R1, %X and rated slip frequency, <u>with the motor being stopped</u> .  Tuning the no-load current and magnetic saturation factor, <u>with the motor running</u> at 50% of the base frequency twice.	Can rotate the motor, provided that it is safe.  Note that little load should be applied during tuning. Tuning with load applied decreases the tuning accuracy.	N	Y	Y

Y: Tuning available unconditionally    Y\*: Tuning available conditionally    N: Tuning not available

The tuning results of motor parameters will be automatically saved into their respective function codes. If P04\* tuning is performed, for instance, the tuning results will be saved into P codes (Motor 1 parameters).

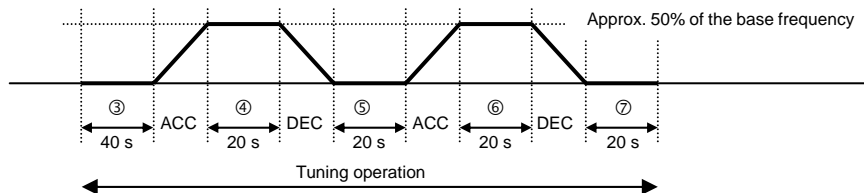
**(2) Preparation of machinery**

Perform appropriate preparations on the motor and its load, such as disengaging the coupling from the motor and deactivating the safety devices.



**(3) Tuning** (Tune while the motor is rotating under vector control)

- ① Set function code P04\* to "3" and press the key. (The blinking of 3 on the LED monitor will slow down.)
- ② Enter a run command. The factory default is " key on the keypad for forward rotation." To switch to reverse rotation or to select the terminal signal **FWD** or **REV** as a run command, change the data of function code F02.
- ③ The moment a run command is entered, the display of 3 lights up, and tuning starts with the motor being stopped.  
(Maximum tuning time: Approx. 40 s.)
- ④ Next, the motor is accelerated to approximately 50% of the base frequency and then tuning starts. Upon completion of measurements, the motor will decelerate to a stop.  
(Estimated tuning time: Acceleration time + 20 s + Deceleration time)
- ⑤ After the motor decelerates to a stop in ④ above, tuning will continue with the motor being stopped.  
(Maximum tuning time: Approx. 20 s.)
- ⑥ The motor is again accelerated to approximately 50% of the base frequency and then tuning starts. Upon completion of measurements, the motor will decelerate to a stop.  
(Estimated tuning time: Acceleration time + 20 s + Deceleration time)
- ⑦ After the motor decelerates to a stop in ⑥ above, tuning will continue with the motor being stopped.  
(Maximum tuning time: Approx. 20 s.)
- ⑧ If the terminal signal **FWD** or **REV** is selected as a run command (F02 = 1), *end* will appear upon completion of the measurements. Turning the run command OFF completes the tuning.  
If the run command has been given through the keypad or the communications link, it automatically turns OFF upon completion of the measurements, which completes the tuning.
- ⑨ Upon completion of the tuning, the subsequent function code P06\* appears on the keypad.



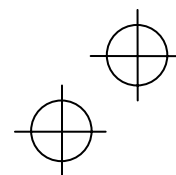
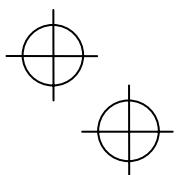
**Note** The default value of the speed regulator is set low to prevent causing a system oscillation (hunting). However, hunting may occur during tuning due to machinery-related conditions, which may cause a tuning error (*err*). If hunting occurs, reduce the gain for the speed regulator and perform the tuning again.

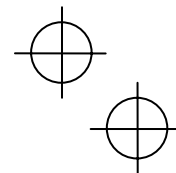
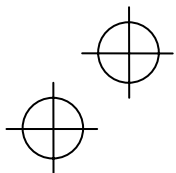
■ **If tuning while the motor is rotating cannot be selected**

If the "tuning while the motor is rotating under vector control (P04\*=3)" cannot be selected due to restrictions on the machinery, perform the "tuning with the motor stops (P04\*=1)" by following the procedure below. Compared to the former tuning, the latter may show rather inferior performance in the speed control accuracy or stability, perform sufficient tests beforehand by connecting the motor with the machinery.

**(1) For Fuji standard motors 8-series, 6-series, or Fuji VG motors exclusively designed for vector control**

- ① Specify the P99\* data according to the motor type.
- ② Initialize the motor 1 parameters by setting H03 data to "2."
- ③ Specify the F04\*, F05\*, P02\*, and P03\* data according to the motor rated values.
- ④ Perform the "tuning while the motor stops (P04\*=1)."







**(2) For motors whose motor ratings are unknown such as ones made by other manufacturers**

- ① Specify the F04\*, F05\*, P02\*, and P03\* data according to the motor rated values printed on the motor's nameplate.
- ② Specify motor ratings (the data of P06\*, P16\* to P23\*) by obtaining the appropriate values on the datasheet issued from the motor manufacturer.  
For details of conversion from data on the datasheet into ones to be entered as function code data, contact your Fuji Electric representative.
- ③ Perform the "tuning with the motor stops (P04\*=1)."

**(3) Tuning (Tune while the motor stops)**

- ① Set function code P04\* to "1" and press the  key. (The blinking of 1 on the LED monitor will slow down.)
- ② Enter a run command. The factory default is "  key on the keypad for forward rotation." To select the terminal signal **FWD** or **REV** as a run command, change the data of function code F02.
- ③ The moment a run command is entered, the display of 1 lights up, and tuning starts with the motor being stopped.  
(Maximum tuning time: Approx. 40 s.)
- ④ If the terminal signal **FWD** or **REV** is selected as a run command (F02 = 1), *end* will appear upon completion of the measurements. Turning the run command OFF completes the tuning.  
If the run command has been given through the keypad or the communications link, it automatically turns OFF upon completion of the measurements, which completes the tuning.
- ⑤ Upon completion of the tuning, the subsequent function code P06\* appears on the keypad.


**■ Tuning errors**

Improper tuning would negatively affect the operation performance and, in the worst case, could even cause hunting or deteriorate precision. Therefore, if the inverter finds any abnormality in the tuning results or any error in the tuning process, it displays *e r 7* and discards the tuning data.

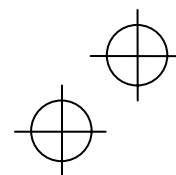
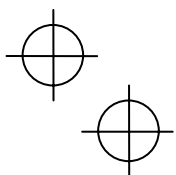
Listed below are possible causes that trigger tuning errors.

Possible tuning error causes	Details
Error in tuning results	- An interphase voltage unbalance or output phase loss has been detected. - Tuning has resulted in an abnormally high or low value of a parameter due to the output circuit opened.
Output current error	An abnormally high current has flown during tuning.
Sequence error	During tuning, a run command has been turned OFF, or <b>STOP</b> (Force to stop), <b>BX</b> (Coast to a stop), <b>DWP</b> (Protect from dew condensation), or other similar terminal command has been received.
Error due to limitation	- During tuning, any of the operation limiters has been activated. - The maximum frequency or the frequency limiter (high) has limited tuning operation.
Other errors	An undervoltage or any other alarm has occurred.

If any of these errors occurs, remove the error cause and perform tuning again, or consult your Fuji Electric representative.


 **Note** If a filter other than the Fuji optional output filter (OFL-□□□-□A) is connected to the inverter's output (secondary) circuit, the tuning result cannot be assured. When replacing the inverter connected with such a filter, make a note of the old inverter's settings for the primary resistance %R1, leakage reactance %X, no-load current, and rated slip frequency, and specify those values to the new inverter's function codes.

Vibration that may occur when the motor's coupling is elastic can be regarded as normal vibration due to the output voltage pattern applied in tuning. The tuning does not always result in an error; however, run the motor and check its running state.




#### 4.1.9 Function code basic settings < 4 >

Driving a Fuji VG motor exclusively designed for vector control under the vector control with speed sensor (F42\* = 6) requires configuring the following basic function codes. (Refer to Figure 4.1 on page 4-1.)


 For details on how to modify the function code data, see Chapter 3, Section 3.4.2 "Setting up function codes -- Menu #1 "Data Setting" --."

Function code	Name	Function code data	Factory default	
			FRN_ _ _ G1■-2A/4A	FRN_ _ _ G1■-4E
<i>p 99</i> *	Motor 1 selection	2: Motor characteristics 2 (VG motors)	0: Motor characteristics 0 (Fuji standard 8-series motors)	
<i>p 02</i> *	Motor 1 (Rated capacity)	Same as that of the applied motor capacity	Nominal applied motor capacity	
<i>h 26</i>	Thermistor (for motor) (Mode selection)	3: Enable (when NTC thermistor) Also turn SW5 on the control printed circuit board to the PTC/NTC side.	0: Disable	
<i>d 14</i>	Feedback input (Pulse train input)	2: A/B phase with 90 degree phase shift	2: A/B phase	
<i>d 15</i>	Feedback input (Encoder pulse resolution)	0400 (1024)	0400 (1024)	
<i>f 03</i> *	Maximum frequency 1	Machinery design values (Note) For a test-driving of the motor, increase values so that they are longer than your machinery design values. If the specified time is short, the inverter may not run the motor properly.	200 V class series: 60.0 (Hz)	200 V class series: —
<i>f 07</i> *	Acceleration time 1 (Note)		400 V class series: 50.0 (Hz)	400 V class series: 50.0 (Hz)
<i>f 08</i> *	Deceleration time 1 (Note)		6.00 (s)	6.00 (s)
<i>f 11</i> *	Electric thermal overload protection for motor 1 (Overload detection level)	0.00: Disable	Depending upon the inverter capacity	

After the above configuration, initialize motor 1 with the function code (H03 = 2). It automatically updates the data of the function codes F04\*, F05\*, P01\*, P03\*, P06\* to P23\*, P53\* to P56\*, and H46.

 When accessing the function code P02\*, take into account that changing the P02\* data automatically updates the data of the function codes F04\*, F05\*, P03\*, P06\* to P23\*, P53\* to P56\*, and H46.





#### 4.1.10 Running the inverter for motor operation check

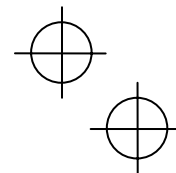
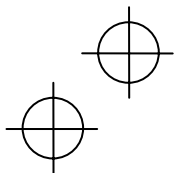
 <b>WARNING</b>
If the user configures the function codes wrongly without completely understanding this Instruction Manual and the FRENIC-MEGA User's Manual, the motor may rotate with a torque or at a speed not permitted for the machine. <b>Accident or injury may result.</b>

After completion of preparations for a test run as described above, start running the inverter for motor operation check using the following procedure.

 <b>CAUTION</b>
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 **RUN** 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.



**Tip** Depending on the settings of function codes, the motor speed may rise to an unexpectedly high and dangerous level, particularly, under vector control with/without speed sensor. To avoid such an event, the speed limiting function is provided.

If the user is unfamiliar with the function code settings (e.g., when the user starts up the inverter for the first time), it is recommended that the frequency limiter (high) (F15) and the torque control (speed limit 1/2) (d32/d33) be used. At the startup of the inverter, to ensure safer operation, specify small values to those function codes at first and gradually increase them while checking the actual operation.

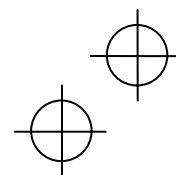
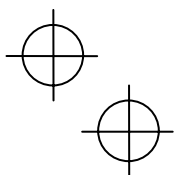
The speed limiting function serves as an overspeed level barrier, or as a speed limiter under torque control. For details of the speed limiting function, refer to the FRENIC-MEGA User's Manual.

**< Modification of motor control function code data >**

Modifying the current function code data sometimes can solve an insufficient torque or overcurrent incident. The table below lists the major function codes to be accessed. For details, see Chapter 5 "FUNCTION CODES" and Chapter 6 "TROUBLESHOOTING."

Function code	Name	Modification key points	Drive control		
			V/f	w/o PG	w/ PG
<i>f 07</i> *	Acceleration time 1	If the current limiter is activated due to a short acceleration time and large drive current, prolong the acceleration time.	Y	Y	Y
<i>f 08</i> *	Deceleration time 1	If an overvoltage trip occurs due to a short deceleration time, prolong the deceleration time.	Y	Y	Y
<i>f 09</i> *	Torque boost	If the starting motor torque is deficient, increase the torque boost. If the motor with no load is overexcited, decrease the torque boost.	Y	N	N
<i>f 44</i>	Current limiter (Mode selection)	If the stall prevention function is activated by the current limiter during acceleration or deceleration, increase the operation level.	Y	N	N
<i>p 09</i> *	Motor 1 (Slip compensation gain for driving)	For excessive slip compensation during driving, decrease the gain; for insufficient one, increase the gain.	Y	Y	N
<i>p 11</i> *	Motor 1 (Slip compensation gain for braking)	For excessive slip compensation during braking, decrease the gain; for insufficient one, increase the gain.	Y	Y	N
<i>h 80</i> *	Output current fluctuation damping gain 1 (For motor 1)	If the motor vibrates due to current fluctuation, increase the suppression gain.	Y	N	N

Y: Modification effective N: Modification ineffective





If any problem persists under vector control with/without speed sensor (selected in Section 4.1.8 or 4.1.9), modify the following function code data.

The vector control uses a PI controller for speed control. The PI constants are sometimes required to be modified because of the load inertia. The table below lists the main modification items. For details, see Chapter 5 "FUNCTION CODES" and Chapter 6 "TROUBLESHOOTING."

Function code	Name	Modification key points
d 01	Speed control (Speed command filter)	If an excessive overshoot occurs for a speed command change, increase the filter constant.
d 02	Speed control (Speed detection filter)	If ripples are superimposed on the speed detection signal so that the speed control gain cannot be increased, increase the filter constant to obtain a larger gain.
d 03	Speed control P (Gain)	If hunting is caused in the motor speed control, decrease the gain. If the motor response is slow, increase the gain.
d 04	Speed control I (Integral time)	If the motor response is slow, increase the integral time.

#### 4.1.11 Preparation for practical operation

After verifying normal motor running with the inverter in a test run, connect the motor with the machinery and perform wiring for practical operation.

(1) Configure the application related function codes that operate the machinery.

(2) Check interfacing with the peripheral circuits.

1) Mock alarm

Generate a mock alarm by pressing the "STOP" + "FUNC" keys" on the keypad for 5 seconds or more and check the alarm sequence. The inverter should stop and issue an alarm output signal (for any fault).

2) Judgment on the life of the DC link bus capacitor

When the multi-function keypad is used, it is necessary to set up the judgment reference level to be applied for the judgment on the life of the DC link bus capacitor.

When the remote keypad is used, the same setting-up is also necessary in order to judge the life of the DC link bus capacitor under the practical operating conditions.

For details, refer to Chapter 7 "MAINTENANCE AND INSPECTION."

3) I/O checking

Check interfacing with peripherals using Menu #4 "I/O Checking" on the keypad in Programming mode. For details, refer to Chapter 3 "OPERATION USING THE KEYPAD."

4) Analog input adjustment

Adjust the analog inputs on terminals [12], [C1] and [V2] using the function codes related to the offset, filter and gain that minimize analog input errors. For details, refer to Chapter 5 "FUNCTION CODES."

5) Calibrating the [FM] output

Calibrate the full scale of the analog meter connected to the terminals [FM1] and [FM2], using the reference voltage equivalent to +10 VDC. To output the reference voltage, it is necessary to select the analog output test with the function code (F31/F35 = 14).

6) Clearing the alarm history

Clear the alarm history saved during the system setup with the function code (H97 = 1).

**Note** Depending upon the situation of the practical operation, it may become necessary to modify the settings of the torque boost (F09\*), acceleration/deceleration times (F07\*/F08\*), and the PI controller for speed control under the vector control. Confirm the function code data and modify them properly.

## 4.2 Special Operations

### 4.2.1 Jogging operation

This section provides the procedure for jogging the motor.

(1) Making the inverter ready to jog with the steps below. The LED monitor should display *jog*.

- Switch the inverter to Running mode (see page 3-3).
- Press the "STOP" + "△" keys" simultaneously. The LED monitor displays the jogging frequency for approximately one second and then returns to *jog* again.



- Function code C20 specifies the jogging frequency. H54 and H55 specify the acceleration and deceleration times, respectively. These three function codes are exclusive to jogging operation.
- Using the input terminal command "Ready for jogging" **JOG** switches between the normal operation state and ready-to-jog state.
- Switching between the normal operation state and ready-to-jog state with the "STOP" + "△" keys" is possible only when the inverter is stopped.

(2) Jogging the motor.

Hold down the "RUN" key during which the motor continues jogging. To decelerate to stop the motor, release the key.

(3) Exiting the ready-to-jog state and returning to the normal operation state.

Press the "STOP" + "△" keys" simultaneously.

### 4.2.2 Remote and local modes

The inverter is available in either remote or local mode. In the remote mode that applies to ordinary operation, the inverter is driven under the control of the data settings stored in the inverter, whereas in the local mode that applies to maintenance operation, it is separated from the control system and is driven manually under the control of the keypad.

- Remote mode: Run and frequency commands are selected by function codes or source switching signals except "Select local (keypad) operation" **LOC**.
- Local mode: The command source is the keypad, regardless of the settings specified by function codes. The keypad takes precedence over the settings specified by communications link operation signals.

#### Run commands from the keypad in the local mode

The table below shows the input procedures of run commands from the keypad in the local mode.

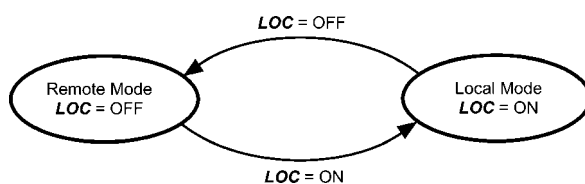
When F02 data (run command) is:	Input procedures of run commands from keypad
0: Enable "RUN" / "STOP" keys on keypad (Motor rotational direction from digital terminals [FWD]/[REV])	Pressing the "RUN" key runs the motor in the direction specified by command <b>FWD</b> or <b>REV</b> assigned to terminal [FWD] or [REV], respectively. Pressing the "STOP" key stops the motor.
1: Enable terminal command <b>FWD/REV</b>	Pressing the "RUN" key runs the motor in the forward direction only. Pressing the "STOP" key stops the motor.
2: Enable "RUN" / "STOP" keys on keypad (Forward)	No specification of the motor rotational direction is required.
3: Enable "RUN" / "STOP" keys on keypad (Reverse)	Pressing the "RUN" key runs the motor in the reverse direction only. Pressing the "STOP" key stops the motor. No specification of the motor rotational direction is required.

### Switching between remote and local modes

The remote and local modes can be switched by a digital input signal provided from the outside of the inverter. To enable the switching, you need to assign **LOC** as a digital input signal to any of terminals [X1] to [X7] by setting "35" to any of E01 to E07, E98 and E99.

Switching from remote to local mode automatically inherits the frequency settings used in remote mode. If the motor is running at the time of the switching from remote to local, the run command will be automatically turned ON so that all the necessary data settings will be carried over. If, however, there is a discrepancy between the settings used in remote mode and ones made on the keypad (e.g., switching from the reverse rotation in remote mode to the forward rotation only in local mode), the inverter automatically stops.

The transition paths between remote and local modes depend on the current mode and the value (ON/OFF) of **LOC**, as shown in the status transition diagram given below. Also, refer to above table for details.



Transition between Remote and Local Modes by **LOC**

### 4.2.3 External run/frequency command

By factory default, run and frequency commands are sourced from the keypad. This section provides other external command source samples--an external potentiometer (variable resistor) as a frequency command source and external run switches as run forward/reverse command sources.

Set up those external sources using the following procedure.

- (1) Configure the function codes as listed below.

Function code	Name	Data	Factory default
<i>f 01</i>	Frequency command 1	1: Analog voltage input to terminal [12]	0
<i>f 02</i>	Operation method	1: External digital input signal	2
<i>e 98</i>	Terminal [FWD] function	98: Run forward command <b>FWD</b>	98
<i>e 99</i>	Terminal [REV] function	99: Run reverse command <b>REV</b>	99

**Note** If terminal [FWD] and [REV] are ON, the F02 data cannot be changed. First turn those terminals OFF and then change the F02 data.

- (2) Wire the potentiometer to terminals across [13], [12], and [11].
- (3) Connect the run forward switch between terminals [FWD] and [CM] and the run reverse switch between [REV] and [CM].
- (4) To start running the inverter, rotate the potentiometer to give a voltage to terminal [12] and then turn the run forward or reverse switch ON (short-circuit).

For precautions in wiring, refer to Chapter 2 "MOUNTING AND WIRING THE INVERTER."

## Chapter 5 FUNCTION CODES

### 5.1 Function Code Tables

Function codes enable the FRENIC-MEGA 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 twelve 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, 3 and 4 Parameters (A, b and r codes), Application Functions 1 and 2 (J and d codes), Link Functions (y codes) and Option Functions (o codes). To determine the property of each function code, set data to the function code.

This manual does not contain the descriptions of Option Function (o codes). For Option Function (o codes), refer to the instruction manual for each option.

The following descriptions supplement those given in the function code tables on page 5-3 and subsequent pages.

#### ■ Changing, validating, and saving function code data when the inverter 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 with  and  keys, 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	Even if the data of the codes marked with Y is changed with  and  keys, the change will not take effect. Pressing the  key will make the change take effect and save it into the inverter's memory.
N	Impossible	—

#### ■ Copying data

The keypad is capable of copying 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 the 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. Whether data will be copied or not is detailed with the following symbols in the "Data copying" column of the function code tables given on page 5-3 and subsequent pages.

Y: Will be copied unconditionally.

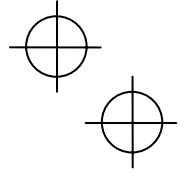
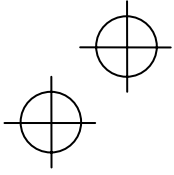
Y1: Will not be copied if the rated capacity differs from the source inverter.

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

N: Will not be copied. (The function code marked with "N" is not subject to the Verify operation, either.)



For details of how to set up or edit function codes, refer to Chapter 3 "OPERATION USING THE KEYPAD."



■ **Using negative logic for programmable I/O terminals**

The negative logic signaling system can be used for the digital input and 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 I/O 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 [X7] using any of function codes E01 through E07

Function code data	Description
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)

Some signals cannot switch to active-OFF depending upon their assigned functions.

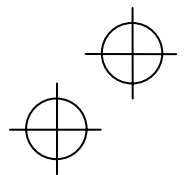
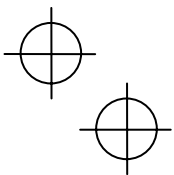
■ **Drive control**

The FRENIC-MEGA runs under V/f control, vector control without speed sensor, or vector control with speed sensor. Some function codes apply exclusively to the specific drive control, which is indicated by letters Y (Applicable) and N (Not applicable) in the "Drive control" column in the function code tables given on the following pages. Each drive control is indicated by the abbreviation "V/f" (V/f control), "w/o PG" (vector control without speed sensor) and "w/ PG" (vector control with speed sensor).

For details about the drive control, refer to Chapter 4 "RUNNING THE MOTOR."

**Note** The FRENIC-MEGA is a general-purpose inverter whose operation is customized by frequency-basis function codes, like conventional inverters. Under the speed-basis drive control, however, the control target is a motor speed, not a frequency, so convert the frequency to the motor speed according to the following expression.

$$\text{Motor speed (r/min)} = 120 \times \text{Frequency (Hz)} \div \text{Number of poles}$$



The following tables list the function codes available for the FRENIC-MEGA series of inverters.

**F codes: Fundamental Functions**

Code	Name	Data setting range	Changes when running	Data copying	Default setting	Drive control			Refer to page:
						V/f	w/o PG	w/ PG	
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	Y	Y	Y	5-25
F01	Frequency Command 1	0:   keys on keypad 1: Voltage input to terminal [12] (-10 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] 5: Voltage input to terminal [V2] (0 to 10 VDC) 7: Terminal command <b>UP/DOWN</b> control 8:   keys on keypad (balanceless-bumpless switching available) 11: Digital input interface card (option) 12: PG interface card	N	Y	0	Y	Y	Y	5-25
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	Y	Y	Y	5-27
F03	Maximum Frequency 1	25.0 to 500.0 Hz	N	Y	*1	Y	Y	Y	5-27
F04	Base Frequency 1	25.0 to 500.0 Hz	N	Y	50.0	Y	Y	Y	5-28
F05	Rated Voltage at Base Frequency 1	0: Output a voltage in proportion to input voltage 80 to 240 V: Output an AVR-controlled voltage (for 200 V class series) 160 to 500 V: Output an AVR-controlled voltage (for 400 V class series)	N	Y2	*1	Y	Y	Y	5-28
F06	Maximum Output Voltage 1	80 to 240 V: Output an AVR-controlled voltage (for 200 V class series) 160 to 500 V: Output an AVR-controlled voltage (for 400 V class series)	N	Y2	*1	Y	N	N	5-28
F07	Acceleration Time 1	0.00 to 6000 s	Y	Y	*2	Y	Y	Y	5-30
F08	Deceleration Time 1	Note: Entering 0.00 cancels the acceleration time, requiring external soft-start.	Y	Y	*2	Y	Y	Y	5-30
F09	Torque Boost 1	0.0% to 20.0% (percentage with respect to "Rated Voltage at Base Frequency 1")	Y	Y	*3	Y	N	N	5-30
F10	Electronic Thermal Overload Protection for Motor 1 (Select motor characteristics)	1: For a general-purpose motor with shaft-driven cooling fan 2: For an inverter-driven motor, non-ventilated motor, or motor with separately powered cooling fan	Y	Y	1	Y	Y	Y	5-32
F11	(Overload detection level)	0.00: Disable 1% to 135% of the rated current (allowable continuous drive current) of the motor	Y	Y1 Y2	*4	Y	Y	Y	5-32
F12	(Thermal time constant)	0.5 to 75.0 min	Y	Y	*5	Y	Y	Y	5-32
F14	Restart Mode after Momentary Power Failure (Mode selection)	0: Trip immediately 1: Trip after a recovery from power failure 2: Trip after decelerate-to-stop 3: Continue to run, for heavy inertia or general loads 4: Restart at the frequency at which the power failure occurred, for general loads 5: Restart at the starting frequency	Y	Y	1	Y	Y	Y	5-35
F15	Frequency Limiter (High)	0.0 to 500.0 Hz	Y	Y	70.0	Y	Y	Y	5-40
F16	(Low)	0.0 to 500.0 Hz	Y	Y	0.0	Y	Y	Y	5-40
F18	Bias (Frequency command 1)	-100.00% to 100.00%	Y*	Y	0.00	Y	Y	Y	5-40
F20	DC Braking 1 (Braking starting frequency)	0.0 to 60.0 Hz	Y	Y	0.0	Y	Y	Y	5-42
F21	(Braking level)	0% to 100% (HD mode), 0% to 80% (LD mode)	Y	Y	0	Y	Y	Y	5-42
F22	(Braking time)	0.00 (Disable); 0.01 to 30.00 s	Y	Y	0.00	Y	Y	Y	5-42
F23	Starting Frequency 1	0.0 to 60.0 Hz	Y	Y	0.5	Y	Y	Y	5-43
F24	(Holding time)	0.00 to 10.00 s	Y	Y	0.00	Y	Y	Y	5-43
F25	Stop Frequency	0.0 to 60.0 Hz	Y	Y	0.2	Y	Y	Y	5-43

The shaded function codes (   ) are applicable to the quick setup.

\*1 The factory default differs depending upon the shipping destination. See Table 5.1.

\*2 6.00 s for inverters with a capacity of 22 kW or below; 20.00 s for those with 30 kW or above

\*3 The factory default differs depending upon the inverter's capacity. See Table 5.2.

\*4 The motor rated current is automatically set. See Table 5.3 (function code P03).

\*5 5.0 min for inverters with a capacity of 22 kW or below; 10.0 min for those with 30 kW or above

Code	Name	Data setting range	Change when running	Data copying	Default setting	Drive control			Refer to page:
						V/f	w/o PG	w/ PG	
F26	Motor Sound (Carrier frequency)	0.75 to 16 kHz (HD-mode inverters with 55 kW or below and LD-mode ones with 18.5 kW or below) 0.75 to 10 kHz (HD-mode inverters with 75 to 630 kW and LD-mode ones with 22 to 55 kW) 0.75 to 6 kHz (LD-mode inverters with 75 to 630 kW)	Y	Y	2 (Asia) 15 (EU)	Y	Y	Y	5-44
F27	(Tone)	0: Level 0 (inactive) 1: Level 1 2: Level 2 3: Level 3	Y	Y	0	Y	N	N	—
F29	Analog Output [FM1] (Mode selection)	0: Output in voltage (0 to 10 VDC) 1: Output in current (4 to 20 mA DC)	Y	Y	0	Y	Y	Y	5-45
F30	(Voltage adjustment)	0% to 300%	Y*	Y	100	Y	Y	Y	5-45
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 4: Output torque 5: Load factor 6: Input power 7: PID feedback amount 8: PG feedback value 9: DC link bus voltage 10: Universal AO 13: Motor output 14: Calibration (+) 15: PID command (SV) 16: PID output (MV)	Y	Y	0	Y	Y	Y	5-45
F32	Analog Output [FM2] (Mode selection)	0: Output in voltage (0 to 10 VDC) 1: Output in current (4 to 20 mA DC)	Y	Y	0	Y	Y	Y	5-45
F34	(Voltage adjustment)	0% to 300%	Y*	Y	100	Y	Y	Y	5-45
F35	(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 4: Output torque 5: Load factor 6: Input power 7: PID feedback amount 8: PG feedback value 9: DC link bus voltage 10: Universal AO 13: Motor output 14: Calibration 15: PID command (SV) 16: PID output (MV)	Y	Y	0	Y	Y	Y	5-45
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 (Variable torque load during ACC/DEC) 4: Auto energy saving (Constant torque load during ACC/DEC) 5: Auto energy saving (Auto torque boost during ACC/DEC)	N	Y	1	Y	N	Y	5-30
F38	Stop Frequency (Detection mode)	0: Detected speed 1: Commanded speed	N	Y	0	N	N	Y	—
F39	(Holding Time)	0.00 to 10.00 s	Y	Y	0.00	Y	Y	Y	5-43
F40	Torque Limiter 1-1	-300% to 300%; 999 (Disable)	Y	Y	999	Y	Y	Y	5-47
F41	1-2	-300% to 300%; 999 (Disable)	Y	Y	999	Y	Y	Y	5-47
F42	Drive Control Selection 1	0: V/f control with slip compensation inactive 1: Dynamic torque vector control 2: V/f control with slip compensation active 5: Vector control without speed sensor 6: Vector control with speed sensor	N	Y	0	Y	Y	Y	5-48
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	Y	N	N	5-48
F44	(Level)	20% to 200% (The data is interpreted as the rated output current of the inverter for 100%.)	Y	Y	160	Y	N	N	5-48
F50	Electronic Thermal Overload Protection for Braking Resistor (Discharging capability)	0 (Braking resistor built-in type), 1 to 9000 kW, OFF (Disable)	Y	Y1 Y2	*6	Y	Y	Y	5-49
F51	(Allowable average loss)	0.001 to 99.99 kW	Y	Y1 Y2	0.001	Y	Y	Y	5-49
F52	(Resistance)	0.01 to 999Ω	Y	Y1 Y2	0.01	Y	Y	Y	5-49
F80	Switching between HD and LD drive modes	0: HD (High Duty) mode 1: LD (Low Duty) mode	N	Y	0	Y	Y	Y	5-51

The shaded function codes ( ) are applicable to the quick setup.

\*6 0 for inverters with a capacity of 7.5 kW or below; OFF for those with 11 kW or above

**E codes: Extension Terminal Functions**

Code	Name	Data setting range	Change when running	Data copying	Default setting	Drive control			Refer to page:
						V/f	w/o PG	w/ PG	
E01	Terminal [X1] Function	Selecting function code data assigns the corresponding function to terminals [X1] to [X7] as listed below.	N	Y	0				5-52
E02	Terminal [X2] Function		N	Y	1				5-52
E03	Terminal [X3] Function	0 (1000): Select multi-frequency (0 to 1 steps) (SS1)	N	Y	2	Y	Y	Y	5-52
E04	Terminal [X4] Function	1 (1001): Select multi-frequency (0 to 3 steps) (SS2)	N	Y	3	Y	Y	Y	5-52
E05	Terminal [X5] Function	2 (1002): Select multi-frequency (0 to 7 steps) (SS4)	N	Y	4	Y	Y	Y	5-52
E06	Terminal [X6] Function	3 (1003): Select multi-frequency (0 to 15 steps) (SS8)	N	Y	5	Y	Y	Y	5-52
E07	Terminal [X7] Function	4 (1004): Select ACC/DEC time (2 steps) (RT1)	N	Y	8	Y	Y	Y	5-52
		5 (1005): Select ACC/DEC time (4 steps) (RT2)				Y	Y	Y	
		6 (1006): Enable 3-wire operation (HLD)				Y	Y	Y	
		7 (1007): Coast to a stop (BX)				Y	Y	Y	
		8 (1008): Reset alarm (RST)				Y	Y	Y	
		9 (1009): Enable external alarm trip (THR) (9 = Active OFF, 1009 = Active ON)				Y	Y	Y	
		10 (1010): Ready for jogging (JOG)				Y	Y	Y	
		11 (1011): Select frequency command 2/1 (Hz2/Hz1)				Y	Y	Y	
		12 (1012): Select motor 2 (M2)				Y	Y	Y	
		13: Enable DC braking (DCBRK)				Y	Y	Y	
		14 (1014): Select torque limiter level 2/1 (TL2/TL1)				Y	Y	Y	
		15: Switch to commercial power (50 Hz) (SW50)				Y	N	N	
		16: Switch to commercial power (60 Hz) (SW60)				Y	N	N	
		17 (1017): UP (Increase output frequency) (UP)				Y	Y	Y	
		18 (1018): DOWN (Decrease output frequency) (DOWN)				Y	Y	Y	
		19 (1019): Enable data change with keypad (WE-KP)				Y	Y	Y	
		20 (1020): Cancel PID control (Hz/PID)				Y	Y	Y	
		21 (1021): Switch normal/inverse operation (IVS)				Y	Y	Y	
		22 (1022): Interlock (IL)				Y	Y	Y	
		24 (1024): Enable communications link via RS-485 or fieldbus (option) (LE)				Y	Y	Y	
		25 (1025): Universal DI (U-DI)				Y	Y	Y	
		26 (1026): Enable auto search for idling motor speed at starting (STM)				Y	N	N	
		30 (1030): Force to stop (STOP) (30 = Active OFF, 1030 = Active ON)				Y	Y	Y	
		32 (1032): Pre-excitation (EXITE)				N	Y	Y	
		33 (1033): Reset PID integral and differential components (PID-RST)				Y	Y	Y	
		34 (1034): Hold PID integral component (PID-HLD)				Y	Y	Y	
		35 (1035): Select local (keypad) operation (LOC)				Y	Y	Y	
		36 (1036): Select motor 3 (M3)				Y	Y	Y	
		37 (1037): Select motor 4 (M4)				Y	Y	Y	
		39: Protect motor from dew condensation (DWP)				Y	Y	Y	
		40: Enable integrated sequence to switch to commercial power (50 Hz) (ISW50)				Y	N	N	
		41: Enable integrated sequence to switch to commercial power (60 Hz) (ISW60)				Y	N	N	
		47 (1047): Servo-lock command (LOCK)				N	N	Y	
		48: Pulse train input (available only on terminal [X7] (E07)) (PIN)				Y	Y	Y	
		49 (1049): Pulse train sign (available on terminals except [X7] (E01 to E06)) (SIGN)				Y	Y	Y	
		72 (1072): Count the run time of commercial power-driven motor 1 (CRUN-M1)				Y	N	N	
		73 (1073): Count the run time of commercial power-driven motor 2 (CRUN-M2)				Y	N	N	
		74 (1074): Count the run time of commercial power-driven motor 3 (CRUN-M3)				Y	N	N	
		75 (1075): Count the run time of commercial power-driven motor 4 (CRUN-M4)				Y	N	N	
		76 (1076): Select droop control (DROOP)				Y	Y	Y	
		77 (1077): Cancel PG alarm (PG-CCL)				N	N	Y	
		Setting the value of 1000s in parentheses ( ) shown above assigns a negative logic input to a terminal.							
E10	Acceleration Time 2	0.00 to 6000 s	Y	Y	*2	Y	Y	Y	5-30
E11	Deceleration Time 2	Note: Entering 0.00 cancels the acceleration time, requiring external soft-start and -stop.	Y	Y	*2	Y	Y	Y	5-30
E12	Acceleration Time 3		Y	Y	*2	Y	Y	Y	5-30
E13	Deceleration Time 3		Y	Y	*2	Y	Y	Y	5-30
E14	Acceleration Time 4		Y	Y	*2	Y	Y	Y	5-30
E15	Deceleration Time 4		Y	Y	*2	Y	Y	Y	5-30
E16	Torque Limiter 2-1	-300% to 300%; 999 (Disable)	Y	Y	999	Y	Y	Y	5-47
E17	Torque Limiter 2-2	-300% to 300%; 999 (Disable)	Y	Y	999	Y	Y	Y	5-47


\*2 6.00 s for inverters with a capacity of 22 kW or below; 20.00 s for those with 30 kW or above



Code	Name	Data setting range	Change when running	Data copying	Default setting	Drive control			Refer to page:	
						V/f	w/o PG	w/ PG		
E20	Terminal [Y1] Function	Selecting function code data assigns the corresponding function to terminals [Y1] to [Y5A/C] and [30A/B/C] as listed below.	N	Y	0				5-62	
E21	Terminal [Y2] Function		N	Y	1				5-62	
E22	Terminal [Y3] Function		N	Y	2				5-62	
E23	Terminal [Y4] Function	0 (1000): Inverter running ( <i>RUN</i> )	N	Y	7	Y	Y	Y	5-62	
E24	Terminal [Y5A/C] Function	1 (1001): Frequency (speed) arrival signal ( <i>FAR</i> )	N	Y	15	Y	Y	Y	5-62	
E27	Terminal [30A/B/C] Function (Relay output)	2 (1002): Frequency (speed) detected ( <i>FDT</i> )	N	Y	99	Y	Y	Y	5-62	
		3 (1003): Undervoltage detected (Inverter stopped) ( <i>LU</i> )				Y	Y	Y		
		4 (1004): Torque polarity detected ( <i>B/D</i> )				Y	Y	Y		
		5 (1005): Inverter output limiting ( <i>IOL</i> )				Y	Y	Y		
		6 (1006): Auto-restarting after momentary power failure ( <i>IPF</i> )				Y	Y	Y		
		7 (1007): Motor overload early warning ( <i>OL</i> )				Y	Y	Y		
		8 (1008): Keypad operation enabled ( <i>KP</i> )				Y	Y	Y		
		10 (1010): Inverter ready to run ( <i>RDY</i> )				Y	Y	Y		
		11: Switch motor drive source between commercial power and inverter output (For MC on commercial line) ( <i>SW88</i> )				Y	N	N		
		12: Switch motor drive source between commercial power and inverter output (For secondary side) ( <i>SW52-2</i> )				Y	N	N		
		13: Switch motor drive source between commercial power and inverter output (For primary side) ( <i>SW52-1</i> )				Y	N	N		
		15 (1015): Select <i>AX</i> terminal function (For MC on primary side) ( <i>AX</i> )				Y	N	N		
		22 (1022): Inverter output limiting with delay ( <i>IOL2</i> )				Y	Y	Y		
		25 (1025): Cooling fan in operation ( <i>FAN</i> )				Y	Y	Y		
		26 (1026): Auto-resetting ( <i>TRY</i> )				Y	Y	Y		
		27 (1027): Universal DO ( <i>U-DO</i> )				Y	Y	Y		
		28 (1028): Heat sink overheat early warning ( <i>OH</i> )				Y	Y	Y		
		30 (1030): Lifetime alarm ( <i>LIFE</i> )				Y	Y	Y		
		31 (1031): Frequency (speed) detected 2 ( <i>FDT2</i> )				Y	Y	Y		
		33 (1033): Reference loss detected ( <i>REF OFF</i> )				Y	Y	Y		
		35 (1035): Inverter output on ( <i>RUN2</i> )				Y	Y	Y		
		36 (1036): Overload prevention control ( <i>OLP</i> )				Y	Y	Y		
		37 (1037): Current detected ( <i>ID</i> )				Y	Y	Y		
		38 (1038): Current detected 2 ( <i>ID2</i> )				Y	Y	Y		
		39 (1039): Current detected 3 ( <i>ID3</i> )				Y	Y	Y		
		41 (1041): Low current detected ( <i>IDL</i> )				Y	Y	Y		
		42 (1042): PID alarm ( <i>PID-ALM</i> )				Y	Y	Y		
		43 (1043): Under PID control ( <i>PID-CTL</i> )				Y	Y	Y		
		44 (1044): Motor stopped due to slow flowrate under PID control ( <i>PID-STP</i> )				Y	Y	Y		
		45 (1045): Low output torque detected ( <i>U-TL</i> )				Y	Y	Y		
		46 (1046): Torque detected 1 ( <i>TD1</i> )				Y	Y	Y		
		47 (1047): Torque detected 2 ( <i>TD2</i> )				Y	Y	Y		
		48 (1048): Motor 1 selected ( <i>SWM1</i> )				Y	Y	Y		
		49 (1049): Motor 2 selected ( <i>SWM2</i> )				Y	Y	Y		
		50 (1050): Motor 3 selected ( <i>SWM3</i> )				Y	Y	Y		
		51 (1051): Motor 4 selected ( <i>SWM4</i> )				Y	Y	Y		
		52 (1052): Running forward ( <i>FRUN</i> )				Y	Y	Y		
		53 (1053): Running reverse ( <i>RRUN</i> )				Y	Y	Y		
		54 (1054): In remote operation ( <i>RMT</i> )				Y	Y	Y		
		56 (1056): Motor overheat detected by thermistor ( <i>THM</i> )				Y	Y	Y		
		57 (1057): Brake signal ( <i>BRKS</i> )				Y	Y	Y		
		58 (1058): Frequency (speed) detected 3 ( <i>FDT3</i> )				Y	Y	Y		
		59 (1059): Terminal [C1] wire break ( <i>C1OFF</i> )				Y	Y	Y		
		70 (1070): Speed valid ( <i>DNZS</i> )				N	Y	Y		
		71 (1071): Speed agreement ( <i>DSAG</i> )				N	Y	Y		
		72 (1072): Frequency (speed) arrival signal 3 ( <i>FAR3</i> )				Y	Y	Y		
		76 (1076): PG error detected ( <i>PG-ERR</i> )				N	Y	Y		
		82 (1082): Positioning completion signal ( <i>PSET</i> )				N	N	Y		
		84 (1084): Maintenance timer ( <i>MNT</i> )				Y	Y	Y		
		98 (1098): Light alarm ( <i>L-ALM</i> )				Y	Y	Y		
		99 (1099): Alarm output (for any alarm) ( <i>ALM</i> )				Y	Y	Y		
		101 (1101): Enable circuit failure detected ( <i>DECF</i> )				Y	Y	Y		
		102 (1102): Enable input OFF ( <i>EN OFF</i> )				Y	Y	Y		
		105 (1105): Braking transistor broken ( <i>DBAL</i> )				Y	Y	Y		
		Setting the value of 1000s in parentheses ( ) shown above assigns a negative logic input to a terminal.								
E30	Frequency Arrival (Hysteresis width)	0.0 to 10.0 Hz	Y	Y	2.5	Y	Y	Y	—	
E31	Frequency Detection 1 (Level)	0.0 to 500.0 Hz	Y	Y	*1	Y	Y	Y	—	
E32	(Hysteresis width)	0.0 to 500.0 Hz	Y	Y	1.0	Y	Y	Y	—	
E34	Overload Early Warning/Current Detection (Level)	0.00 (Disable); Current value of 1% to 200% of the inverter rated current	Y	Y1 Y2	*4	Y	Y	Y	—	
E35	(Timer)	0.01 to 600.00s	Y	Y	10.00	Y	Y	Y	—	

\*1 The factory default differs depending upon the shipping destination. See Table 5.1.

\*4 The motor rated current is automatically set. See Table 5.3 (function code P03).

Code	Name	Data setting range	Change when running	Data copying	Default setting	Drive control			Refer to page:
						V/f	w/o PG	w/ PG	
E36	Frequency Detection 2 (Level)	0.0 to 500.0 Hz	Y	Y	*1	Y	Y	Y	—
E37	Current Detection 2/ Low Current Detection (Level)	0.00 (Disable); Current value of 1% to 200% of the inverter rated current	Y	Y1 Y2	*4	Y	Y	Y	—
E38	(Timer)	0.01 to 600.00 s	Y	Y	10.00	Y	Y	Y	—
E40	PID Display Coefficient A	-999 to 0.00 to 9990	Y	Y	100	Y	Y	Y	—
E41	PID Display Coefficient B	-999 to 0.00 to 9990	Y	Y	0.00	Y	Y	Y	—
E42	LED Display Filter	0.0 to 5.0 s	Y	Y	0.5	Y	Y	Y	—
E43	LED Monitor (Item selection)	0: Speed monitor (select by E48) 3: Output current 4: Output voltage 8: Calculated torque 9: Input power 10: PID command 12: PID feedback amount 14: PID output 15: Load factor 16: Motor output 17: Analog input 23: Torque current (%) 24: Magnetic flux command (%) 25: Input watt-hour	Y	Y	0	Y	Y	Y	—
E44	(Display when stopped)	0: Specified value 1: Output value	Y	Y	0	Y	Y	Y	—
E45	LCD Monitor (Item selection)	0: Running status, rotational direction and operation guide 1: Bar charts for output frequency, current and calculated torque	Y	Y	0	Y	Y	Y	—
E46	(Language selection)	Multi-function keypad (option) Type: TP-G1      Type: TP-G1C 0: Japanese      0: Chinese 1: English        1: English 2: German        2: Japanese 3: French         3: Korean 4: Spanish 5: Italian	Y	Y	1	Y	Y	Y	—
E47	(Contrast control)	0 (Low) to 10 (High)	Y	Y	5	Y	Y	Y	—
E48	LED Monitor (Speed monitor item)	0: Output frequency (Before slip compensation) 1: Output frequency (After slip compensation) 2: Reference frequency 3: Motor speed in r/min 4: Load shaft speed in r/min 5: Line speed in m/min 7: Display speed in %	Y	Y	0	Y	Y	Y	—
E50	Coefficient for Speed Indication	0.01 to 200.00	Y	Y	30.00	Y	Y	Y	—
E51	Display Coefficient for Input Watt-hour Data	0.000 (Cancel/reset), 0.001 to 9999	Y	Y	0.010	Y	Y	Y	—
E52	Keypad (Menu display mode)	0: Function code data editing mode (Menus #0, #1, and #7) 1: Function code data check mode (Menu #2 and #7) 2: Full-menu mode	Y	Y	0	Y	Y	Y	—
E54	Frequency Detection 3 (Level)	0.0 to 500.0 Hz	Y	Y	*1	Y	Y	Y	—
E55	Current Detection 3 (Level)	0.00 (Disable); Current value of 1% to 200% of the inverter rated current	Y	Y1 Y2	*4	Y	Y	Y	—
E56	(Timer)	0.01 to 600.00 s	Y	Y	10.00	Y	Y	Y	—
E61	Terminal [I2] Extended Function	0: None	N	Y	0	Y	Y	Y	—
E62	Terminal [C1] Extended Function	1: Auxiliary frequency command 1	N	Y	0	Y	Y	Y	—
E63	Terminal [V2] Extended Function	2: Auxiliary frequency command 2 3: PID command 1 5: PID feedback amount 6: Ratio setting 7: Analog torque limit value A 8: Analog torque limit value B 20: Analog input monitor	N	Y	0	Y	Y	Y	—
E64	Saving of Digital Reference Frequency	0: Automatic saving (when main power is turned OFF) 1: Saving by pressing  key	Y	Y	1	Y	Y	Y	—
E65	Reference Loss Detection (Continuous running frequency)	0: Decelerate to stop, 20% to 120%, 999: Disable	Y	Y	999	Y	Y	Y	—
E78	Torque Detection 1 (Level)	0% to 300%	Y	Y	100	Y	Y	Y	—
E79	(Timer)	0.01 to 600.00 s	Y	Y	10.00	Y	Y	Y	—
E80	Torque Detection 2/ Low Torque Detection (Level)	0% to 300%	Y	Y	20	Y	Y	Y	—
E81	(Timer)	0.01 to 600.00 s	Y	Y	20.00	Y	Y	Y	—

The shaded function codes (  ) are applicable to the quick setup.

\*1 The factory default differs depending upon the shipping destination. See Table 5.1.

\*4 The motor rated current is automatically set. See Table 5.3 (function code P03).

Code	Name	Data setting range	Change when running	Data copying	Default setting	Drive control			Refer to page:
						V/f	w/o PG	w/ PG	
E98	Terminal [FWD] Function	Selecting function code data assigns the corresponding function to terminals [FWD] and [REV] as listed below.	N	Y	98				5-52
E99	Terminal [REV] Function	0 (1000): Select multi-frequency (0 to 1 steps) (SS1) 1 (1001): Select multi-frequency (0 to 3 steps) (SS2) 2 (1002): Select multi-frequency (0 to 7 steps) (SS4) 3 (1003): Select multi-frequency (0 to 15 steps) (SS8) 4 (1004): Select ACC/DEC time (2 steps) (RT1) 5 (1005): Select ACC/DEC time (4 steps) (RT2) 6 (1006): Enable 3-wire operation (HLD) 7 (1007): Coast to a stop (BX) 8 (1008): Reset alarm (RST) 9 (1009): Enable external alarm trip (THR) (9 = Active OFF, 1009 = Active ON) 10 (1010): Ready for jogging (JOG) 11 (1011): Select frequency command 2/1 (Hz2/Hz1) 12 (1012): Select motor 2 (M2) 13: Enable DC braking (DCBRK) 14 (1014): Select torque limiter level 2/1 (TL2/TL1) 15: Switch to commercial power (50 Hz) (SW50) 16: Switch to commercial power (60 Hz) (SW60) 17 (1017): UP (Increase output frequency) (UP) 18 (1018): DOWN (Decrease output frequency) (DOWN) 19 (1019): Enable data change with keypad (WE-KP) 20 (1020): Cancel PID control (Hz/PID) 21 (1021): Switch normal/inverse operation (IVS) 22 (1022): Interlock (IL) 24 (1024): Enable communications link via RS-485 or fieldbus (LE) 25 (1025): Universal DI (U-DI) 26 (1026): Enable auto search for idling motor speed at starting (STM) 30 (1030): Force to stop (STOP) (30 = Active OFF, 1030 = Active ON) 32 (1032): Pre-excitation (EXITE) 33 (1033): Reset PID integral and differential components (PID-RST) 34 (1034): Hold PID integral component (PID-HLD) 35 (1035): Select local (keypad) operation (LOC) 36 (1036): Select motor 3 (M3) 37 (1037): Select motor 4 (M4) 39: Protect motor from dew condensation (DWP) 40: Enable integrated sequence to switch to commercial power (50 Hz) (ISW50) 41: Enable integrated sequence to switch to commercial power (60 Hz) (ISW60) 47 (1047): Servo-lock command (LOCK) 49 (1049): Pulse train sign (SIGN) 72 (1072): Count the run time of commercial power-driven motor 1 (CRUN-M1) 73 (1073): Count the run time of commercial power-driven motor 2 (CRUN-M2) 74 (1074): Count the run time of commercial power-driven motor 3 (CRUN-M3) 75 (1075): Count the run time of commercial power-driven motor 4 (CRUN-M4) 76 (1076): Select droop control (DROOP) 77 (1077): Cancel PG alarm (PG-CCL) 98: Run forward (FWD) 99: Run reverse (REV)	N	Y	99	Y	Y	Y	5-52
		Setting the value of 1000s in parentheses ( ) shown above assigns a negative logic input to a terminal.							

### C codes: Control Functions of Frequency

Code	Name	Data setting range	Change when running	Data copying	Default setting	Drive control			Refer to page:
						V/f	w/o PG	w/ PG	
C01	Jump Frequency 1	0.0 to 500.0 Hz	Y	Y	0.0	Y	Y	Y	—
C02	2		Y	Y	0.0	Y	Y	Y	—
C03	3		Y	Y	0.0	Y	Y	Y	—
C04	(Hysteresis width)	0.0 to 30.0 Hz	Y	Y	3.0	Y	Y	Y	—
C05	Multi-frequency 1	0.00 to 500.00 Hz	Y	Y	0.00	Y	Y	Y	—
C06	2		Y	Y	0.00	Y	Y	Y	—

Code	Name	Data setting range	Change when running	Data copying	Default setting	Drive control			Refer to page:
						V/f	w/o PG	w/ PG	
C07	Multi-frequency 3	0.00 to 500.00 Hz	Y	Y	0.00	Y	Y	Y	—
C08	4		Y	Y	0.00	Y	Y	Y	—
C09	5		Y	Y	0.00	Y	Y	Y	—
C10	6		Y	Y	0.00	Y	Y	Y	—
C11	7		Y	Y	0.00	Y	Y	Y	—
C12	8		Y	Y	0.00	Y	Y	Y	—
C13	9		Y	Y	0.00	Y	Y	Y	—
C14	10		Y	Y	0.00	Y	Y	Y	—
C15	11		Y	Y	0.00	Y	Y	Y	—
C16	12		Y	Y	0.00	Y	Y	Y	—
C17	13		Y	Y	0.00	Y	Y	Y	—
C18	14		Y	Y	0.00	Y	Y	Y	—
C19	15		Y	Y	0.00	Y	Y	Y	—
C20	Jogging Frequency	0.00 to 500.00 Hz	Y	Y	0.00	Y	Y	Y	—
C30	Frequency Command 2	0: Enable  /  keys on the keypad 1: Voltage input to terminal [12] (-10 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] 5: Voltage input to terminal [V2] (0 to 10 VDC) 7: Terminal command <b>UP/DOWN</b> control 8: Enable  /  keys on the keypad (balanceless-bumpless switching available) 11: Digital input interface card (option) 12: PG interface card	N	Y	2	Y	Y	Y	5-25
C31	Analog Input Adjustment for [12] (Offset)	-5.0% to 5.0%	Y*	Y	0.0	Y	Y	Y	—
C32	(Gain)	0.00% to 200.00%	Y*	Y	100.0	Y	Y	Y	5-40
C33	(Filter time constant)	0.00 to 5.00 s	Y	Y	0.05	Y	Y	Y	—
C34	(Gain base point)	0.00% to 100.00%	Y*	Y	100.00	Y	Y	Y	5-40
C35	(Polarity)	0: Bipolar 1: Unipolar	N	Y	1	Y	Y	Y	5-40
C36	Analog Input Adjustment for [C1] (Offset)	-5.0% to 5.0%	Y*	Y	0.0	Y	Y	Y	—
C37	(Gain)	0.00% to 200.00%	Y*	Y	100.00	Y	Y	Y	5-40
C38	(Filter time constant)	0.00 to 5.00s	Y	Y	0.05	Y	Y	Y	—
C39	(Gain base point)	0.00% to 100.00%	Y*	Y	100.00	Y	Y	Y	5-40
C41	Analog Input Adjustment for [V2] (Offset)	-5.0% to 5.0%	Y*	Y	0.0	Y	Y	Y	—
C42	(Gain)	0.00% to 200.00%	Y*	Y	100.00	Y	Y	Y	5-40
C43	(Filter time constant)	0.00 to 5.00 s	Y	Y	0.05	Y	Y	Y	—
C44	(Gain base point)	0.00% to 100.00%	Y*	Y	100.00	Y	Y	Y	5-40
C45	(Polarity)	0: Bipolar 1: Unipolar	N	Y	1	Y	Y	Y	5-40
C50	Bias (Frequency command 1) (Bias base point)	0.00% to 100.00%	Y*	Y	0.00	Y	Y	Y	5-40
C51	Bias (PID command 1) (Bias value)	-100.00% to 100.00%	Y*	Y	0.00	Y	Y	Y	—
C52	(Bias base point)	0.00% to 100.00%	Y*	Y	0.00	Y	Y	Y	—
C53	Selection of Normal/Inverse Operation (Frequency command 1)	0: Normal operation 1: Inverse operation	Y	Y	0	Y	Y	Y	—

#### P codes: Motor 1 Parameters

Code	Name	Data setting range	Change when running	Data copying	Default setting	Drive control			Refer to page:
						V/f	w/o PG	w/ PG	
P01	Motor 1 (No. of poles)	2 to 22 poles	N	Y1 Y2	4	Y	Y	Y	5-70
P02	(Rated capacity)	0.01 to 1000 kW (when P99 = 0, 2, 3 or 4) 0.01 to 1000 HP (when P99 = 1)	N	Y1 Y2	*7	Y	Y	Y	5-70
P03	(Rated current)	0.00 to 2000 A	N	Y1 Y2	*7	Y	Y	Y	5-70
P04	(Auto-tuning)	0: Disable 1: Tune while the motor stops. (%R1, %X and rated slip frequency) 2: Tune while the motor is rotating under V/f control (%R1, %X, rated slip frequency, no-load current, magnetic saturation factors 1 to 5, and magnetic saturation extension factors "a" to "c") 3: Tune while the motor is rotating under vector control (%R1, %X, rated slip frequency, no-load current, magnetic saturation factors 1 to 5, and magnetic saturation extension factors "a" to "c." Available when the vector control is enabled.)	N	N	0	Y	Y	Y	5-71

The shaded function codes (   ) are applicable to the quick setup.

\*7 The motor constant is automatically set, depending upon the inverter's capacity and shipping destination. See Table 5.3.

Code	Name	Data setting range	Change when running	Data copying	Default setting	Drive control			Refer to page:
						V/f	w/o PG	w/ PG	
P06	(No-load current)	0.00 to 2000 A	N	Y1 Y2	*7	Y	Y	Y	5-71
P07	(%R1)	0.00% to 50.00%	Y	Y1 Y2	*7	Y	Y	Y	5-71
P08	(%X)	0.00% to 50.00%	Y	Y1 Y2	*7	Y	Y	Y	5-71
P09	(Slip compensation gain for driving)	0.0% to 200.0%	Y*	Y	100.0	Y	Y	Y	5-72
P10	(Slip compensation response time)	0.01 to 10.00 s	Y	Y1 Y2	0.12	Y	N	N	5-72
P11	(Slip compensation gain for braking)	0.0% to 200.0%	Y*	Y	100.0	Y	Y	Y	5-72
P12	(Rated slip frequency)	0.00 to 15.00 Hz	N	Y1 Y2	*7	Y	Y	Y	5-71
P13	(Iron loss factor 1)	0.00% to 20.00%	Y	Y1 Y2	*7	Y	Y	Y	—
P14	(Iron loss factor 2)	0.00% to 20.00%	Y	Y1 Y2	0.00	Y	Y	Y	—
P15	(Iron loss factor 3)	0.00% to 20.00%	Y	Y1 Y2	0.00	Y	Y	Y	—
P16	(Magnetic saturation factor 1)	0.0% to 300.0%	Y	Y1 Y2	*7	Y	Y	Y	—
P17	(Magnetic saturation factor 2)	0.0% to 300.0%	Y	Y1 Y2	*7	Y	Y	Y	—
P18	(Magnetic saturation factor 3)	0.0% to 300.0%	Y	Y1 Y2	*7	Y	Y	Y	—
P19	(Magnetic saturation factor 4)	0.0% to 300.0%	Y	Y1 Y2	*7	Y	Y	Y	—
P20	(Magnetic saturation factor 5)	0.0% to 300.0%	Y	Y1 Y2	*7	Y	Y	Y	—
P21	(Magnetic saturation extension factor "a")	0.0% to 300.0%	Y	Y1 Y2	*7	Y	Y	Y	—
P22	(Magnetic saturation extension factor "b")	0.0% to 300.0%	Y	Y1 Y2	*7	Y	Y	Y	—
P23	(Magnetic saturation extension factor "c")	0.0% to 300.0%	Y	Y1 Y2	*7	Y	Y	Y	—
P53	(%X correction factor 1)	0% to 300%	Y	Y1 Y2	100	Y	Y	Y	—
P54	(%X correction factor 2)	0% to 300%	Y	Y1 Y2	100	Y	Y	Y	—
P55	(Torque current under vector control)	0.00 to 2000 A	N	Y1 Y2	*7	N	Y	Y	—
P56	(Induced voltage factor under vector control)	50% to 100%	N	Y1 Y2	85	N	Y	Y	—
P57	Reserved *9	0.000 to 20.000 s	Y	Y1 Y2	0.082	-	-	-	—
P99	Motor 1 Selection	0: Motor characteristics 0 (Fuji standard motors, 8-series) 1: Motor characteristics 1 (HP rating motors) 2: Motor characteristics 2 (Fuji motors exclusively designed for vector control) 3: Motor characteristics 3 (Fuji standard motors, 6-series) 4: Other motors	N	Y1 Y2	0	Y	Y	Y	5-72

#### H codes: High Performance Functions

Code	Name	Data setting range	Change when running	Data copying	Default setting	Drive control			Refer to page:
						V/f	w/o PG	w/ PG	
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 4: Initialize motor 3 parameters 5: Initialize motor 4 parameters	N	N	0	Y	Y	Y	5-73
H04	Auto-reset (Times)	0: Disable; 1 to 10	Y	Y	0	Y	Y	Y	—
H05	(Reset interval)	0.5 to 20.0 s	Y	Y	5.0	Y	Y	Y	—
H06	Cooling Fan ON/OFF Control	0: Disable (Always in operation) 1: Enable (ON/OFF controllable)	Y	Y	0	Y	Y	Y	—
H07	Acceleration/Deceleration Pattern	0: Linear 1: S-curve (Weak) 2: S-curve (Arbitrary, according to H57 to H60 data) 3: Curvilinear	Y	Y	0	Y	Y	Y	—
H08	Rotational Direction Limitation	0: Disable 1: Enable (Reverse rotation inhibited) 2: Enable (Forward rotation inhibited)	N	Y	0	Y	Y	Y	—
H09	Starting Mode (Auto search)	0: Disable 1: Enable (At restart after momentary power failure) 2: Enable (At restart after momentary power failure and at normal start)	N	Y	0	Y	N	N	—
H11	Deceleration Mode	0: Normal deceleration 1: Coast-to-stop	Y	Y	0	Y	Y	Y	—
H12	Instantaneous Overcurrent Limiting (Mode selection)	0: Disable 1: Enable	Y	Y	1	Y	N	N	5-48
H13	Restart Mode after Momentary Power Failure (Restart time)	0.1 to 10.0 s	Y	Y1 Y2	*3	Y	Y	Y	5-35
H14	(Frequency fall rate)	0.00: Deceleration time selected by F08, 0.01 to 100.00 Hz/s, 999: Follow the current limit command	Y	Y	999	Y	Y	Y	5-35
H15	(Continuous running level)	200 to 300 V for 200 V class series 400 to 600 V for 400 V class series	Y	Y2	235 470	Y	Y	Y	—

The shaded function codes ( ) are applicable to the quick setup.

\*3 The factory default differs depending upon the inverter's capacity. See Table 5.2.

\*7 The motor constant is automatically set, depending upon the inverter's capacity and shipping destination. See Table 5.3.

\*9 These function codes are reserved for particular manufacturers. Unless otherwise specified, do not access these function codes.

Code	Name	Data setting range	Changes when running	Data copying	Default setting	Drive control			Refer to page:
						V/f	w/o PG	w/ PG	
H16	Restart Mode after Momentary Power Failure (Allowable momentary power failure time)	0.0 to 30.0 s 999: Automatically determined by inverter	Y	Y	999	Y	Y	Y	5-35
H26	Thermistor (for motor) (Mode selection)	0: Disable 1: PTC (The inverter immediately trips with <i>Oh4</i> displayed.) 2: PTC (The inverter issues output signal <i>THM</i> and continues to run.) 3: NTC (When connected)	Y	Y	0	Y	Y	Y	—
H27	(Level)	0.00 to 5.00 V	Y	Y	0.35	Y	Y	Y	—
H28	Droop Control	-60.0 to 0.0 Hz	Y	Y	0.0	Y	Y	Y	—
H30	Communications Link Function (Mode selection)	Frequency command      Run command 0: F01/C30                      F02 1: RS-485 (Port 1)              F02 2: F01/C30                      RS-485 (Port 1) 3: RS-485 (Port 1)              RS-485 (Port 1) 4: RS-485 (Port 2)              F02 5: RS-485 (Port 2)              RS-485 (Port 1) 6: F01/C30                      RS-485 (Port 2) 7: RS-485 (Port 1)              RS-485 (Port 2) 8: RS-485 (Port 2)              RS-485 (Port 2)	Y	Y	0	Y	Y	Y	—
H42	Capacitance of DC Link Bus Capacitor	Indication for replacement of DC link bus capacitor 0000 to FFFF (hex.)	Y	N	-	Y	Y	Y	—
H43	Cumulative Run Time of Cooling Fan	Indication for replacement of cooling fan (in units of 10 hours)	Y	N	-	Y	Y	Y	—
H44	Startup Counter for Motor 1	Indication of cumulative startup count 0000 to FFFF (hex.)	Y	N	-	Y	Y	Y	5-75
H45	Mock Alarm	0: Disable 1: Enable (Once a mock alarm occurs, the data automatically returns to 0.)	Y	N	0	Y	Y	Y	5-78
H46	Starting Mode (Auto search delay time 2)	0.1 to 10.0 s	Y	Y1 Y2	*7	Y	Y	N	—
H47	Initial Capacitance of DC Link Bus Capacitor	Indication for replacement of DC link bus capacitor 0000 to FFFF (hex.)	Y	N	-	Y	Y	Y	—
H48	Cumulative Run Time of Capacitors on Printed Circuit Boards	Indication for replacement of capacitors (The cumulative run time can be modified or reset in units of 10 hours.)	Y	N	-	Y	Y	Y	—
H49	Starting Mode (Auto search delay time 1)	0.0 to 10.0 s	Y	Y	0.0	Y	Y	Y	—
H50	Non-linear V/f Pattern 1 (Frequency)	0.0: Cancel, 0.1 to 500.0 Hz	N	Y	*8	Y	N	N	5-28
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)	N	Y2	*8	Y	N	N	5-28
H52	Non-linear V/f Pattern 2 (Frequency)	0.0: Cancel, 0.1 to 500.0 Hz	N	Y	0.0	Y	N	N	5-28
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)	N	Y2	0	Y	N	N	5-28
H54	Acceleration Time (Jogging)	0.00 to 6000 s	Y	Y	*2	Y	Y	Y	—
H55	Deceleration Time (Jogging)	0.00 to 6000 s	Y	Y	*2	Y	Y	Y	—
H56	Deceleration Time for Forced Stop	0.00 to 6000 s	Y	Y	*2	Y	Y	Y	—
H57	1st S-curve acceleration range (Leading edge)	0% to 100%	Y	Y	10	Y	Y	Y	—
H58	2nd S-curve acceleration range (Trailing edge)	0% to 100%	Y	Y	10	Y	Y	Y	—
H59	1st S-curve deceleration range (Leading edge)	0% to 100%	Y	Y	10	Y	Y	Y	—
H60	2nd S-curve deceleration range (Trailing edge)	0% to 100%	Y	Y	10	Y	Y	Y	—
H61	<b>UP/DOWN</b> Control (Initial frequency setting)	0: 0.00 Hz 1: Last <b>UP/DOWN</b> command value on releasing the run command	N	Y	1	Y	Y	Y	—
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	Y	Y	Y	5-40

\*2 6.00 s for inverters with a capacity of 22 kW or below; 20.00 s for those with 30 kW or above

\*7 The motor constant is automatically set, depending upon the inverter's capacity and shipping destination. See Table 5.3.

\*8 The factory default differs depending upon the inverter's capacity. See the table under "■ Non-linear V/f Patterns 1, 2 and 3 for Voltage" in the description of F04.

Code	Name	Data setting range	Checks when running	Data copying	Default setting	Drive control			Refer to page:
						V/f	w/o PG	w/ PG	
H64	Low Limiter (Lower limiting frequency)	0.0: Depends on F16 (Frequency limiter, Low) 0.1 to 60.0 Hz	Y	Y	1.6	Y	N	N	—
H65	Non-linear V/f Pattern 3 (Frequency)	0.0: Cancel, 0.1 to 500.0 Hz	N	Y	0.0	Y	N	N	5-28
H66	(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)	N	Y2	0	Y	N	N	5-28
H67	Auto Energy Saving Operation (Mode selection)	0: Enable during running at constant speed 1: Enable in all modes	Y	Y	0	Y	N	Y	—
H68	Slip Compensation 1 (Operating conditions)	0: Enable during ACC/DEC and at base frequency or above 1: Disable during ACC/DEC and enable at base frequency or above 2: Enable during ACC/DEC and disable at base frequency or above 3: Disable during ACC/DEC and at base frequency or above	N	Y	0	Y	N	N	5-48
H69	Automatic Deceleration (Mode selection)	0: Disable 2: Torque limit control with Force-to-stop if actual deceleration time exceeds three times the specified one 3: DC link bus voltage control with Force-to-stop if actual deceleration time exceeds three times the specified one 4: Torque limit control with Force-to-stop disabled 5: DC link bus voltage control with Force-to-stop disabled	Y	Y	0	Y	Y	Y	5-74
H70	Overload Prevention Control	0.00: Follow the deceleration time selected 0.01 to 100.0 Hz/s 999: Cancel	Y	Y	999	Y	Y	Y	—
H71	Deceleration Characteristics	0: Disable 1: Enable	Y	Y	0	Y	N	N	—
H72	Main Power Down Detection (Mode selection)	0: Disable 1: Enable	Y	Y	1	Y	Y	Y	—
H73	Torque Limiter (Operating conditions)	0: Enable during ACC/DEC and running at constant speed 1: Disable during ACC/DEC and enable during running at constant speed 2: Enable during ACC/DEC and disable during running at constant speed	N	Y	0	Y	Y	Y	5-47
H76	(Frequency increment limit for braking)	0.0 to 500.0 Hz	Y	Y	5.0	Y	N	N	5-47 5-74
H77	Service Life of DC Link Bus Capacitor (Remaining time)	0 to 8760 (in units of 10 hours)	Y	N	-	Y	Y	Y	—
H78	Maintenance Interval (M1)	0: Disable; 1 to 9999 (in units of 10 hours)	Y	N	8760	Y	Y	Y	5-75
H79	Preset Startup Count for Maintenance (M1)	0000: Disable; 0001 to FFFF (hex.)	Y	N	0	Y	Y	Y	5-75
H80	Output Current Fluctuation Damping Gain for Motor 1	0.00 to 0.40	Y	Y	0.20 *10	Y	N	N	—
H81	Light Alarm Selection 1	0000 to FFFF (hex.)	Y	Y	0	Y	Y	Y	5-76
H82	Light Alarm Selection 2	0000 to FFFF (hex.)	Y	Y	0	Y	Y	Y	5-76
H84	Pre-excitation (Initial level)	100% to 400%	Y	Y	100	N	Y	Y	—
H85	(Time)	0.00: Disable; 0.01 to 30.00 s	Y	Y	0.00	N	Y	Y	—
H86	Reserved *9	0 to 2	Y	Y1Y2	0 *11	-	-	-	—
H87	Reserved *9	25.0 to 500.0 Hz	Y	Y	25.0	-	-	-	—
H88	Reserved *9	0 to 3; 999	Y	N	0	-	-	-	—
H89	Reserved *9	0, 1	Y	Y	0	-	-	-	—
H90	Reserved *9	0, 1	Y	Y	0	-	-	-	—
H91	PID Feedback Wire Break Detection	0.0: Disable alarm detection 0.1 to 60.0 s	Y	Y	0.0	Y	Y	Y	—
H92	Continuity of Running (P)	0.000 to 10.000 times; 999	Y	Y1Y2	999	Y	Y	Y	—
H93	(I)	0.010 to 10.000 s; 999	Y	Y1Y2	999	Y	Y	Y	—
H94	Cumulative Motor Run Time 1	0 to 9999 (The cumulative run time can be modified or reset in units of 10 hours.)	N	N	-	Y	Y	Y	5-75
H95	DC Braking (Braking response mode)	0: Slow 1: Quick	Y	Y	1	Y	N	N	5-42
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	0	Y	Y	Y	—

\*9 These function codes are reserved for particular manufacturers. Unless otherwise specified, do not access these function codes.

\*10 0.10 for 200 V class series of inverters with a capacity of 37 kW or above.

\*11 2 for 200 V class series of inverters with a capacity of 37 kW or above.

Code	Name	Data setting range	Changes when running	Data copying	Default setting	Drive control			Refer to page:
						V/f	w/o PG	w/ PG	
H97	Clear Alarm Data	0: Disable 1: Enable (Setting "1" clears alarm data and then returns to "0.")	Y	N	0	Y	Y	Y	5-78
H98	Protection/Maintenance Function (Mode selection)	0 to 255: Display data in decimal format Bit 0: Lower the carrier frequency automatically (0: Disabled; 1: Enabled) Bit 1: Detect input phase loss (0: Disabled; 1: Enabled) Bit 2: Detect output phase loss (0: Disabled; 1: Enabled) 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: Disabled; 1: Enabled) Bit 5: Detect DC fan lock (0: Enabled; 1: Disabled) Bit 6: Detect braking transistor error (for 22 kW or below) (0: Disabled; 1: Enabled) Bit 7: Switch IP20/IP40 enclosure (0: IP20; 1: IP40)	Y	Y	83	Y	Y	Y	5-79

#### A codes: Motor 2 Parameters

Code	Name	Data setting range	Changes when running	Data copying	Default setting	Drive control			Refer to page:
						V/f	w/o PG	w/ PG	
A01	Maximum Frequency 2	25.0 to 500.0 Hz	N	Y	*1	Y	Y	Y	—
A02	Base Frequency 2	25.0 to 500.0 Hz	N	Y	50.0	Y	Y	Y	—
A03	Rated Voltage at Base Frequency 2	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)	N	Y2	*1	Y	Y	Y	—
A04	Maximum Output Voltage 2	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)	N	Y2	*1	Y	N	N	—
A05	Torque Boost 2	0.0% to 20.0% (percentage with respect to *A03: Rated Voltage at Base Frequency 2*)	Y	Y	*3	Y	N	N	—
A06	Electronic Thermal Overload Protection for Motor 2 (Select motor characteristics)	1: For a general-purpose motor with shaft-driven cooling fan 2: For an inverter-driven motor, non-ventilated motor, or motor with separately powered cooling fan	Y	Y	1	Y	Y	Y	—
A07	(Overload detection level)	0.00: Disable 1% to 135% of the rated current (allowable continuous drive current) of the motor	Y	Y1 Y2	*4	Y	Y	Y	—
A08	(Thermal time constant)	0.5 to 75.0 min	Y	Y	*5	Y	Y	Y	—
A09	DC Braking 2 (Braking starting frequency)	0.0 to 60.0 Hz	Y	Y	0.0	Y	Y	Y	—
A10	(Braking level)	0% to 100% (HD mode), 0% to 80% (LD mode)	Y	Y	0	Y	Y	Y	—
A11	(Braking time)	0.00: Disable; 0.01 to 30.00 s	Y	Y	0.00	Y	Y	Y	—
A12	Starting Frequency 2	0.0 to 60.0 Hz	Y	Y	0.5	Y	Y	Y	—
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	Y	N	Y	—
A14	Drive Control Selection 2	0: V/f control with slip compensation inactive 1: Dynamic torque vector control 2: V/f control with slip compensation active 5: Vector control without speed sensor 6: Vector control with speed sensor	N	Y	0	Y	Y	Y	—
A15	Motor 2 (No. of poles)	2 to 22 poles	N	Y1 Y2	4	Y	Y	Y	—
A16	(Rated capacity)	0.01 to 1000 kW (when A39 = 0, 2, 3 or 4) 0.01 to 1000 HP (when A39 = 1)	N	Y1 Y2	*7	Y	Y	Y	—
A17	(Rated current)	0.00 to 2000 A	N	Y1 Y2	*7	Y	Y	Y	—

\*1 The factory default differs depending upon the shipping destination. See Table 5.1.

\*3 The factory default differs depending upon the inverter's capacity. See Table 5.2.

\*4 The motor rated current is automatically set. See Table 5.3 (function code P03).

\*5 5.0 min for inverters with a capacity of 22 kW or below; 10.0 min for those with 30 kW or above

\*7 The motor constant is automatically set, depending upon the inverter's capacity and shipping destination. See Table 5.3.



Code	Name	Data setting range	Change when running	Data copying	Default setting	Drive control			Refer to page:
						V/f	w/o PG	w/ PG	
A18	Motor 2 (Auto-tuning)	0: Disable 1: Tune while the motor stops. (%R1, %X and rated slip frequency) 2: Tune while the motor is rotating under V/f control (%R1, %X, rated slip frequency, no-load current, magnetic saturation factors 1 to 5, and magnetic saturation extension factors "a" to "c") 3: Tune while the motor is rotating under vector control (%R1, %X, rated slip frequency, no-load current, magnetic saturation factors 1 to 5, and magnetic saturation extension factors "a" to "c." Available when the vector control is enabled.)	N	N	0	Y	Y	Y	—
A20	(No-load current)	0.00 to 2000 A	N	Y1 Y2	*7	Y	Y	Y	—
A21	(%R1)	0.00% to 50.00%	Y	Y1 Y2	*7	Y	Y	Y	—
A22	(%X)	0.00% to 50.00%	Y	Y1 Y2	*7	Y	Y	Y	—
A23	(Slip compensation gain for driving)	0.0% to 200.0%	Y*	Y	100.0	Y	Y	Y	—
A24	(Slip compensation response time)	0.01 to 10.00s	Y	Y1 Y2	0.12	Y	N	N	—
A25	(Slip compensation gain for braking)	0.0% to 200.0%	Y*	Y	100.0	Y	Y	Y	—
A26	(Rated slip frequency)	0.00 to 15.00 Hz	N	Y1 Y2	*7	Y	Y	Y	—
A27	(Iron loss factor 1)	0.00% to 20.00%	Y	Y1 Y2	*7	Y	Y	Y	—
A28	(Iron loss factor 2)	0.00% to 20.00%	Y	Y1 Y2	0.00	Y	Y	Y	—
A29	(Iron loss factor 3)	0.00% to 20.00%	Y	Y1 Y2	0.00	Y	Y	Y	—
A30	(Magnetic saturation factor 1)	0.0% to 300.0%	Y	Y1 Y2	*7	Y	Y	Y	—
A31	(Magnetic saturation factor 2)	0.0% to 300.0%	Y	Y1 Y2	*7	Y	Y	Y	—
A32	(Magnetic saturation factor 3)	0.0% to 300.0%	Y	Y1 Y2	*7	Y	Y	Y	—
A33	(Magnetic saturation factor 4)	0.0% to 300.0%	Y	Y1 Y2	*7	Y	Y	Y	—
A34	(Magnetic saturation factor 5)	0.0% to 300.0%	Y	Y1 Y2	*7	Y	Y	Y	—
A35	(Magnetic saturation extension factor "a")	0.0% to 300.0%	Y	Y1 Y2	*7	Y	Y	Y	—
A36	(Magnetic saturation extension factor "b")	0.0% to 300.0%	Y	Y1 Y2	*7	Y	Y	Y	—
A37	(Magnetic saturation extension factor "c")	0.0% to 300.0%	Y	Y1 Y2	*7	Y	Y	Y	—
A39	Motor 2 Selection	0: Motor characteristics 0 (Fuji standard motors, 8-series) 1: Motor characteristics 1 (HP rating motors) 2: Motor characteristics 2 (Fuji motors exclusively designed for vector control) 3: Motor characteristics 3 (Fuji standard motors, 6-series) 4: Other motors	N	Y1 Y2	0	Y	Y	Y	—
A40	Slip Compensation 2 (Operating conditions)	0: Enable during ACC/DEC and at base frequency or above 1: Disable during ACC/DEC and enable at base frequency or above 2: Enable during ACC/DEC and disable at base frequency or above 3: Disable during ACC/DEC and at base frequency or above	N	Y	0	Y	N	N	—
A41	Output Current Fluctuation Damping Gain for Motor 2	0.00 to 0.40	Y	Y	0.20	Y	N	N	—
A42	Motor/Parameter Switching 2 (Mode selection)	0: Motor (Switch to the 2nd motor) 1: Parameter (Switch to particular A codes)	N	Y	0	Y	Y	Y	5-81
A43	Speed Control 2 (Speed command filter)	0.000 to 5.000 s	Y	Y	0.020	N	Y	Y	—
A44	(Speed detection filter)	0.000 to 0.100 s	Y*	Y	0.005	N	Y	Y	—
A45	P (Gain)	0.1 to 200.0 times	Y*	Y	10.0	N	Y	Y	—
A46	I (Integral time)	0.001 to 1.000 s	Y*	Y	0.100	N	Y	Y	—
A48	(Output filter)	0.000 to 0.100 s	Y	Y	0.020	N	Y	Y	—
A51	Cumulative Motor Run Time 2	0 to 9999 (The cumulative run time can be modified or reset in units of 10 hours.)	N	N	-	Y	Y	Y	—
A52	Startup Counter for Motor 2	Indication of cumulative startup count 0000 to FFFF (hex.)	Y	N	-	Y	Y	Y	—
A53	Motor 2 (%X correction factor 1)	0% to 300%	Y	Y1 Y2	100	Y	Y	Y	—
A54	(%X correction factor 2)	0% to 300%	Y	Y1 Y2	100	Y	Y	Y	—
A55	(Torque current under vector control)	0.00 to 2000 A	N	Y1 Y2	*7	N	Y	Y	—
A56	(Induced voltage factor under vector control)	50 to 100	N	Y1 Y2	85	N	Y	Y	—
A57	Reserved *9	0.000 to 20.000 s	N	Y1 Y2	0.082	-	-	-	—

\*7 The motor constant is automatically set, depending upon the inverter's capacity and shipping destination. See Table 5.3.

\*9 These function codes are reserved for particular manufacturers. Unless otherwise specified, do not access these function codes.

### b codes: Motor 3 Parameters

Code	Name	Data setting range	Change when running	Data copying	Default setting	Drive control			Refer to page:
						V/f	w/o PG	w/ PG	
b01	Maximum Frequency 3	25.0 to 500.0 Hz	N	Y	*1	Y	Y	Y	—
b02	Base Frequency 3	25.0 to 500.0 Hz	N	Y	50.0	Y	Y	Y	—
b03	Rated Voltage at Base Frequency 3	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)	N	Y2	*1	Y	Y	Y	—
b04	Maximum Output Voltage 3	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)	N	Y2	*1	Y	N	N	—
b05	Torque Boost 3	0.0% to 20.0% (percentage with respect to *b03: Rated Voltage at Base Frequency 3)	Y	Y	*3	Y	N	N	—
b06	Electronic Thermal Overload Protection for Motor 3 (Select motor characteristics)	1: For a general-purpose motor with shaft-driven cooling fan 2: For an inverter-driven motor, non-ventilated motor, or motor with separately powered cooling fan	Y	Y	1	Y	Y	Y	—
b07	(Overload detection level)	0.00: Disable 1% to 135% of the rated current (allowable continuous drive current) of the motor	Y	Y1 Y2	*4	Y	Y	Y	—
b08	(Thermal time constant)	0.5 to 75.0 min	Y	Y	*5	Y	Y	Y	—
b09	DC Braking 3 (Braking starting frequency)	0.0 to 60.0 Hz	Y	Y	0.0	Y	Y	Y	—
b10	(Braking level)	0% to 100% (HD mode), 0% to 80% (LD mode)	Y	Y	0	Y	Y	Y	—
b11	(Braking time)	0.00: Disable; 0.01 to 30.00 s	Y	Y	0.00	Y	Y	Y	—
b12	Starting Frequency 3	0.0 to 60.0 Hz	Y	Y	0.5	Y	Y	Y	—
b13	Load Selection/ Auto Torque Boost/ Auto Energy Saving Operation 3	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	Y	N	Y	—
b14	Drive Control Selection 3	0: V/f control with slip compensation inactive 1: Dynamic torque vector control 2: V/f control with slip compensation active 5: Vector control without speed sensor 6: Vector control with speed sensor	N	Y	0	Y	Y	Y	—
b15	Motor 3 (No. of poles)	2 to 22 poles	N	Y1 Y2	4	Y	Y	Y	—
b16	(Rated capacity)	0.01 to 1000 kW (when b39 = 0, 2, 3 or 4) 0.01 to 1000 HP (when b39 = 1)	N	Y1 Y2	*7	Y	Y	Y	—
b17	(Rated current)	0.00 to 2000 A	N	Y1 Y2	*7	Y	Y	Y	—
b18	(Auto-tuning)	0: Disable 1: Tune while the motor stops. (%R1, %X and rated slip frequency) 2: Tune while the motor is rotating under V/f control (%R1, %X, rated slip frequency, no-load current, magnetic saturation factors 1 to 5, and magnetic saturation extension factors "a" to "c") 3: Tune while the motor is rotating under vector control (%R1, %X, rated slip frequency, no-load current, magnetic saturation factors 1 to 5, and magnetic saturation extension factors "a" to "c." Available when the vector control is enabled.)	N	N	0	Y	Y	Y	—
b20	(No-load current)	0.00 to 2000 A	N	Y1 Y2	*7	Y	Y	Y	—
b21	(%R1)	0.00% to 50.00%	Y	Y1 Y2	*7	Y	Y	Y	—
b22	(%X)	0.00% to 50.00%	Y	Y1 Y2	*7	Y	Y	Y	—
b23	(Slip compensation gain for driving)	0.0% to 200.0%	Y*	Y	100.0	Y	Y	Y	—
b24	(Slip compensation response time)	0.01 to 10.00 s	Y	Y1 Y2	0.12	Y	N	N	—
b25	(Slip compensation gain for braking)	0.0% to 200.0%	Y*	Y	100.0	Y	Y	Y	—
b26	(Rated slip frequency)	0.00 to 15.00 Hz	N	Y1 Y2	*7	Y	Y	Y	—
b27	(Iron loss factor 1)	0.00% to 20.00%	Y	Y1 Y2	*7	Y	Y	Y	—
b28	(Iron loss factor 2)	0.00% to 20.00%	Y	Y1 Y2	0.00	Y	Y	Y	—
b29	(Iron loss factor 3)	0.00% to 20.00%	Y	Y1 Y2	0.00	Y	Y	Y	—

\*1 The factory default differs depending upon the shipping destination. See Table 5.1.

\*3 The factory default differs depending upon the inverter's capacity. See Table 5.2.

\*4 The motor rated current is automatically set. See Table 5.3 (function code P03).

\*5 5.0 min for inverters with a capacity of 22 kW or below; 10.0 min for those with 30 kW or above

\*7 The motor constant is automatically set, depending upon the inverter's capacity and shipping destination. See Table 5.3.

Code	Name	Data setting range	Change when running	Data copying	Default setting	Drive control			Refer to page:
						V/f	w/o PG	w/ PG	
b30	Motor 3	0.0% to 300.0%	Y	Y1 Y2	*7	Y	Y	Y	—
	(Magnetic saturation factor 1)								
b31	(Magnetic saturation factor 2)	0.0% to 300.0%	Y	Y1 Y2	*7	Y	Y	Y	—
b32	(Magnetic saturation factor 3)	0.0% to 300.0%	Y	Y1 Y2	*7	Y	Y	Y	—
b33	(Magnetic saturation factor 4)	0.0% to 300.0%	Y	Y1 Y2	*7	Y	Y	Y	—
b34	(Magnetic saturation factor 5)	0.0% to 300.0%	Y	Y1 Y2	*7	Y	Y	Y	—
b35	(Magnetic saturation extension factor "a")	0.0% to 300.0%	Y	Y1 Y2	*7	Y	Y	Y	—
b36	(Magnetic saturation extension factor "b")	0.0% to 300.0%	Y	Y1 Y2	*7	Y	Y	Y	—
b37	(Magnetic saturation extension factor "c")	0.0% to 300.0%	Y	Y1 Y2	*7	Y	Y	Y	—
b39	Motor 3 Selection	0: Motor characteristics 0 (Fuji standard motors, 8-series) 1: Motor characteristics 1 (HP rating motors) 2: Motor characteristics 2 (Fuji motors exclusively designed for vector control) 3: Motor characteristics 3 (Fuji standard motors, 6-series) 4: Other motors	N	Y1 Y2	0	Y	Y	Y	—
b40	Slip Compensation 3 (Operating conditions)	0: Enable during ACC/DEC and at base frequency or above 1: Disable during ACC/DEC and enable at base frequency or above 2: Enable during ACC/DEC and disable at base frequency or above 3: Disable during ACC/DEC and at base frequency or above	N	Y	0	Y	N	N	—
b41	Output Current Fluctuation Damping Gain for Motor 3	0.00 to 0.40	Y	Y	0.20	Y	N	N	—
b42	Motor/Parameter Switching 3 (Mode selection)	0: Motor (Switch to the 3rd motor) 1: Parameter (Switch to particular b codes)	N	Y	0	Y	Y	Y	5-81
b43	Speed Control 3 (Speed command filter)	0.000 to 5.000 s	Y	Y	0.020	N	Y	Y	—
b44	(Speed detection filter)	0.000 to 0.100 s	Y*	Y	0.005	N	Y	Y	—
b45	P (Gain)	0.1 to 200.0 times	Y*	Y	10.0	N	Y	Y	—
b46	I (Integral time)	0.001 to 1.000 s	Y*	Y	0.100	N	Y	Y	—
b48	(Output filter)	0.000 to 0.100 s	Y	Y	0.020	N	Y	Y	—
b51	Cumulative Motor Run Time 3	0 to 9999 (The cumulative run time can be modified or reset in units of 10 hours.)	N	N	-	Y	Y	Y	—
b52	Startup Counter for Motor 3	Indication of cumulative startup count 0000 to FFFF (hex.)	Y	N	-	Y	Y	Y	—
b53	Motor 3 (%X correction factor 1)	0% to 300%	Y	Y1 Y2	100	Y	Y	Y	—
b54	(%X correction factor 2)	0% to 300%	Y	Y1 Y2	100	Y	Y	Y	—
b55	(Torque current under vector control)	0.00 to 2000 A	N	Y1 Y2	*7	N	Y	Y	—
b56	(Induced voltage factor under vector control)	50 to 100	N	Y1 Y2	85	N	Y	Y	—
b57	Reserved *9	0.000 to 20.000 s	N	Y1 Y2	0.082	-	-	-	—

#### r codes: Motor 4 Parameters

Code	Name	Data setting range	Change when running	Data copying	Default setting	Drive control			Refer to page:
						V/f	w/o PG	w/ PG	
r01	Maximum Frequency 4	25.0 to 500.0 Hz	N	Y	*1	Y	Y	Y	—
r02	Base Frequency 4	25.0 to 500.0 Hz	N	Y	50.0	Y	Y	Y	—
r03	Rated Voltage at Base Frequency 4	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)	N	Y2	*1	Y	Y	Y	—
r04	Maximum Output Voltage 4	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)	N	Y2	*1	Y	Y	N	—
r05	Torque Boost 4	0.0% to 20.0% (percentage with respect to *r03: Rated Voltage at Base Frequency 4)	Y	Y	*3	Y	N	N	—

\*1 The factory default differs depending upon the shipping destination. See Table 5.1.

\*3 The factory default differs depending upon the inverter's capacity. See Table 5.2.

\*7 The motor constant is automatically set, depending upon the inverter's capacity and shipping destination. See Table 5.3.

\*9 These function codes are reserved for particular manufacturers. Unless otherwise specified, do not access these function codes.

Code	Name	Data setting range	Change when running	Data copying	Default setting	Drive control			Refer to page:
						V/f	w/o PG	w/ PG	
r06	Electronic Thermal Overload Protection for Motor 4 (Select motor characteristics)	1: For a general-purpose motor with shaft-driven cooling fan 2: For an inverter-driven motor, non-ventilated motor, or motor with separately powered cooling fan	Y	Y	1	Y	Y	Y	—
r07	(Overload detection level)	0.00: Disable 1% to 135% of the rated current (allowable continuous drive current) of the motor	Y	Y1 Y2	*4	Y	Y	Y	—
r08	(Thermal time constant)	0.5 to 75.0 min	Y	Y	*5	Y	Y	Y	—
r09	DC Braking 4 (Braking starting frequency)	0.0 to 60.0 Hz	Y	Y	0.0	Y	Y	Y	—
r10	(Braking level)	0% to 100% (HD mode), 0% to 80% (LD mode)	Y	Y	0	Y	Y	Y	—
r11	(Braking time)	0.00: Disable; 0.01 to 30.00 s	Y	Y	0.00	Y	Y	Y	—
r12	Starting Frequency 4	0.0 to 60.0 Hz	Y	Y	0.5	Y	Y	Y	—
r13	Load Selection/ Auto Torque Boost/ Auto Energy Saving Operation 4	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	Y	N	Y	—
r14	Drive Control Selection 4	0: V/f control with slip compensation inactive 1: Dynamic torque vector control 2: V/f control with slip compensation active 5: Vector control without speed sensor 6: Vector control with speed sensor	N	Y	0	Y	Y	Y	—
r15	Motor 4 (No. of poles)	2 to 22 poles	N	Y1 Y2	4	Y	Y	Y	—
r16	(Rated capacity)	0.01 to 1000 kW (when r39 = 0, 2, 3 or 4) 0.01 to 1000 HP (when r39 = 1)	N	Y1 Y2	*7	Y	Y	Y	—
r17	(Rated current)	0.00 to 2000 A	N	Y1 Y2	*7	Y	Y	Y	—
r18	(Auto-tuning)	0: Disable 1: Tune while the motor stops. (%R1, %X and rated slip frequency) 2: Tune while the motor is rotating under V/f control (%R1, %X, rated slip frequency, no-load current, magnetic saturation factors 1 to 5, and magnetic saturation extension factors "a" to "c") 3: Tune while the motor is rotating under vector control (%R1, %X, rated slip frequency, no-load current, magnetic saturation factors 1 to 5, and magnetic saturation extension factors "a" to "c." Available when the vector control is enabled.)	N	N	0	Y	Y	Y	—
r20	(No-load current)	0.00 to 2000 A	N	Y1 Y2	*7	Y	Y	Y	—
r21	(%R1)	0.00% to 50.00%	Y	Y1 Y2	*7	Y	Y	Y	—
r22	(%X)	0.00% to 50.00%	Y	Y1 Y2	*7	Y	Y	Y	—
r23	(Slip compensation gain for driving)	0.0% to 200.0%	Y*	Y	100.0	Y	Y	Y	—
r24	(Slip compensation response time)	0.01 to 10.00 s	Y	Y1 Y2	0.12	Y	N	N	—
r25	(Slip compensation gain for braking)	0.0% to 200.0%	Y*	Y	100.0	Y	Y	Y	—
r26	(Rated slip frequency)	0.00 to 15.00 Hz	N	Y1 Y2	*7	Y	Y	Y	—
r27	(Iron loss factor 1)	0.00% to 20.00%	Y	Y1 Y2	*7	Y	Y	Y	—
r28	(Iron loss factor 2)	0.00% to 20.00%	Y	Y1 Y2	0.00	Y	Y	Y	—
r29	(Iron loss factor 3)	0.00% to 20.00%	Y	Y1 Y2	0.00	Y	Y	Y	—
r30	(Magnetic saturation factor 1)	0.0% to 300.0%	Y	Y1 Y2	*7	Y	Y	Y	—
r31	(Magnetic saturation factor 2)	0.0% to 300.0%	Y	Y1 Y2	*7	Y	Y	Y	—
r32	(Magnetic saturation factor 3)	0.0% to 300.0%	Y	Y1 Y2	*7	Y	Y	Y	—
r33	(Magnetic saturation factor 4)	0.0% to 300.0%	Y	Y1 Y2	*7	Y	Y	Y	—
r34	(Magnetic saturation factor 5)	0.0% to 300.0%	Y	Y1 Y2	*7	Y	Y	Y	—
r35	(Magnetic saturation extension factor "a")	0.0% to 300.0%	Y	Y1 Y2	*7	Y	Y	Y	—
r36	(Magnetic saturation extension factor "b")	0.0% to 300.0%	Y	Y1 Y2	*7	Y	Y	Y	—
r37	(Magnetic saturation extension factor "c")	0.0% to 300.0%	Y	Y1 Y2	*7	Y	Y	Y	—

\*4 The motor rated current is automatically set. See Table 5.3 (function code P03).

\*5 5.0 min for inverters with a capacity of 22 kW or below; 10.0 min for those with 30 kW or above

\*7 The motor constant is automatically set, depending upon the inverter's capacity and shipping destination. See Table 5.3.

Code	Name	Data setting range	Change when running	Data copying	Default setting	Drive control			Refer to page:
						V/f	w/o PG	w/ PG	
r39	Motor 4 Selection	0: Motor characteristics 0 (Fuji standard motors, 8-series) 1: Motor characteristics 1 (HP rating motors) 2: Motor characteristics 2 (Fuji motors exclusively designed for vector control) 3: Motor characteristics 3 (Fuji standard motors, 6-series) 4: Other motors	N	Y1 Y2	0	Y	Y	Y	—
r40	Slip Compensation 4 (Operating conditions)	0: Enable during ACC/DEC and at base frequency or above 1: Disable during ACC/DEC and enable at base frequency or above 2: Enable during ACC/DEC and disable at base frequency or above 3: Disable during ACC/DEC and at base frequency or above	N	Y	0	Y	N	N	—
r41	Output Current Fluctuation Damping Gain for Motor 4	0.00 to 0.40	Y	Y	0.20	Y	N	N	—
r42	Motor/Parameter Switching 4 (Mode selection)	0: Motor (Switch to the 4th motor) 1: Parameter (Switch to particular r codes)	N	Y	0	Y	Y	Y	5-81
r43	Speed Control 4 (Speed command filter)	0.000 to 5.000 s	Y	Y	0.020	N	Y	Y	—
r44	(Speed detection filter)	0.000 to 0.100 s	Y*	Y	0.005	N	Y	Y	—
r45	P (Gain)	0.1 to 200.0 times	Y*	Y	10.0	N	Y	Y	—
r46	I (Integral time)	0.001 to 1.000 s	Y*	Y	0.100	N	Y	Y	—
r48	(Output filter)	0.000 to 0.100 s	Y	Y	0.020	N	Y	Y	—
r51	Cumulative Motor Run Time 4	0 to 9999 (The cumulative run time can be modified or reset in units of 10 hours.)	N	N	-	Y	Y	Y	—
r52	Startup Counter for Motor 4	Indication of cumulative startup count 0000 to FFFF (hex.)	Y	N	-	Y	Y	Y	—
r53	Motor 4 (%X correction factor 1)	0% to 300%	Y	Y1 Y2	100	Y	Y	Y	—
r54	(%X correction factor 2)	0% to 300%	Y	Y1 Y2	100	Y	Y	Y	—
r55	(Torque current under vector control)	0.00 to 2000 A	N	Y1 Y2	*7	N	Y	Y	—
r56	(Induced voltage factor under vector control)	50 to 100	N	Y1 Y2	85	N	Y	Y	—
r57	Reserved *9	0.000 to 20.000 s	N	Y1 Y2	0.082	-	-	-	—

#### J codes: Application Functions 1

Code	Name	Data setting range	Change when running	Data copying	Default setting	Drive control			Refer to page:
						V/f	w/o PG	w/ PG	
J01	PID Control (Mode selection)	0: Disable 1: Enable (Process control, normal operation) 2: Enable (Process control, inverse operation) 3: Enable (Dancer control)	N	Y	0	Y	Y	Y	—
J02	(Remote command SV)	0:  keys on keypad 1: PID process command 1 (Analog input terminals [12], [C1], and [V2]) 3: UP/DOWN 4: Command via communications link	N	Y	0	Y	Y	Y	—
J03	P (Gain)	0.000 to 30.000 times	Y	Y	0.100	Y	Y	Y	—
J04	I (Integral time)	0.0 to 3600.0 s	Y	Y	0.0	Y	Y	Y	—
J05	D (Differential time)	0.00 to 600.00 s	Y	Y	0.00	Y	Y	Y	—
J06	(Feedback filter)	0.0 to 900.0 s	Y	Y	0.5	Y	Y	Y	—
J08	(Pressurization starting frequency)	0.0 to 500.0 Hz	Y	Y	0.0	Y	Y	Y	—
J09	(Pressurizing time)	0 to 60 s	Y	Y	0	Y	Y	Y	—
J10	(Anti reset windup)	0% to 200%	Y	Y	200	Y	Y	Y	—
J11	(Select alarm output)	0: Absolute-value alarm 1: Absolute-value alarm (with Hold) 2: Absolute-value alarm (with Latch) 3: Absolute-value alarm (with Hold and Latch) 4: Deviation alarm 5: Deviation alarm (with Hold) 6: Deviation alarm (with Latch) 7: Deviation alarm (with Hold and Latch)	Y	Y	0	Y	Y	Y	—
J12	(Upper level alarm (AH))	-100% to 100%	Y	Y	100	Y	Y	Y	—
J13	(Lower level alarm (AL))	-100% to 100%	Y	Y	0	Y	Y	Y	—
J15	(Stop frequency for slow flowrate)	0.0: Disable; 1.0 to 500.0 Hz	Y	Y	0.0	Y	Y	Y	—

\*7 The motor constant is automatically set, depending upon the inverter's capacity and shipping destination. See Table 5.3.

\*9 These function codes are reserved for particular manufacturers. Unless otherwise specified, do not access these function codes.

Code	Name	Data setting range	Change when running	Data copying	Default setting	Drive control			Refer to page:
						V/f	w/o PG	w/ PG	
J16	PID Control (Slow flowrate level stop latency)	0 to 60 s	Y	Y	30	Y	Y	Y	—
J17	(Starting frequency)	0.0 to 500.0 Hz	Y	Y	0.0	Y	Y	Y	—
J18	(Upper limit of PID process output)	-150% to 150%; 999: Depends on setting of F15	Y	Y	999	Y	Y	Y	—
J19	(Lower limit of PID process output)	-150% to 150%; 999: Depends on setting of F16	Y	Y	999	Y	Y	Y	—
J21	Dew Condensation Prevention (Duty)	1% to 50%	Y	Y	1	Y	Y	Y	—
J22	Commercial Power Switching Sequence	0: Keep inverter operation (Stop due to alarm) 1: Automatically switch to commercial-power operation	N	Y	0	Y	Y	Y	—
J56	PID Control (Speed command filter)	0.00 to 5.00 s	Y	Y	0.10	Y	Y	Y	—
J57	(Dancer reference position)	-100% to 0% to 100%	Y	Y	0	Y	Y	Y	—
J58	(Detection width of dancer position deviation)	0: Disable switching PID constant 1% to 100% (Manually set value)	Y	Y	0	Y	Y	Y	—
J59	P (Gain) 2	0.000 to 30.000 times	Y	Y	0.100	Y	Y	Y	—
J60	I (Integral time) 2	0.0 to 3600.0 s	Y	Y	0.0	Y	Y	Y	—
J61	D (Differential time) 3	0.00 to 600.00 s	Y	Y	0.00	Y	Y	Y	—
J62	(PID control block selection)	0 to 3 bit 0: PID output polarity 0: Plus (add), 1: Minus (subtract) bit 1: Select compensation factor for PID output 0 = Ratio (relative to the main setting) 1 = Speed command (relative to maximum frequency)	N	Y	0	Y	Y	Y	—
J68	Brake Signal (Brake-OFF current)	0% to 300%	Y	Y	100	Y	Y	Y	—
J69	(Brake-OFF frequency/speed)	0.0 to 25.0 Hz	Y	Y	1.0	Y	Y	Y	—
J70	(Brake-OFF timer)	0.0 to 5.0 s	Y	Y	1.0	Y	Y	Y	—
J71	(Brake-ON frequency/speed)	0.0 to 25.0 Hz	Y	Y	1.0	Y	Y	Y	—
J72	(Brake-ON timer)	0.0 to 5.0 s	Y	Y	1.0	Y	Y	Y	—
J95	(Brake-OFF torque)	0% to 300%	Y	Y	100	Y	Y	Y	—
J96	(Speed selection)	0: Detected speed 1: Commanded speed	Y	Y	0	Y	Y	Y	—
J97	Servo-lock (Gain)	0.00 to 10.00	Y	Y	0.10	N	N	Y	—
J98	(Completion timer)	0.000 to 1.000 s	Y	Y	0.100	N	N	Y	—
J99	(Completion width)	0 to 9999	Y	Y	10	N	N	Y	—

#### d codes: Application Functions 2

Code	Name	Data setting range	Change when running	Data copying	Default setting	Drive control			Refer to page:
						V/f	w/o PG	w/ PG	
d01	Speed control 1 (Speed command filter)	0.000 to 5.000 s	Y	Y	0.020	N	Y	Y	—
d02	(Speed detection filter)	0.000 to 0.100 s	Y*	Y	0.005	N	Y	Y	—
d03	P (Gain)	0.1 to 200.0 times	Y*	Y	10.0	N	Y	Y	—
d04	I (Integral time)	0.001 to 1.000 s	Y*	Y	0.100	N	Y	Y	—
d06	(Output filter)	0.000 to 0.100 s	Y	Y	0.002	N	Y	Y	—
d09	Speed control (Jogging) (Speed command filter)	0.000 to 5.000 s	Y	Y	0.020	N	Y	Y	—
d10	(Speed detection filter)	0.000 to 0.100 s	Y*	Y	0.005	N	Y	Y	—
d11	P (Gain)	0.1 to 200.0 times	Y*	Y	10.0	N	Y	Y	—
d12	I (Integral time)	0.001 to 1.000 s	Y*	Y	0.100	N	Y	Y	—
d13	(Output filter)	0.000 to 0.100 s	Y	Y	0.002	N	Y	Y	—
d14	Feedback Input (Pulse input property)	0: Pulse train sign/Pulse train input 1: Forward rotation pulse/Reverse rotation pulse 2: A/B phase with 90 degree phase shift	N	Y	2	N	N	Y	—
d15	(Encoder pulse resolution)	0014 to EA60 (hex.) (20 to 60000 pulses)	N	Y	0400 (1024)	N	N	Y	—
d16	(Pulse count factor 1)	1 to 9999	N	Y	1	N	N	Y	—
d17	(Pulse count factor 2)	1 to 9999	N	Y	1	N	N	Y	—
d21	Speed Agreement/PG Error (Hysteresis width)	0.0% to 50.0%	Y	Y	10.0	N	Y	Y	—
d22	(Detection timer)	0.00 to 10.00 s	Y	Y	0.50	N	Y	Y	—
d23	PG Error Processing	0: Continue to run 1: Stop running with alarm 1 2: Stop running with alarm 2	N	Y	2	N	Y	Y	—

Code	Name	Data setting range	Change when running	Data copying	Default setting	Drive control			Refer to page:
						V/f	w/o PG	w/ PG	
d24	Zero Speed Control	0: Not permit at startup 1: Permit at startup	N	Y	0	N	Y	Y	—
d25	ASR Switching Time	0.000 to 1.000 s	Y	Y	0.000	N	Y	Y	—
d32	Torque control (Speed limit 1)	0 to 110 %	Y	Y	100	N	Y	Y	—
d33	(Speed limit 2)	0 to 110 %	Y	Y	100	N	Y	Y	—
d51	Reserved *9	0 to 500	N	Y	*12	-	-	-	—
d52	Reserved *9	0 to 500	N	Y	*12	-	-	-	—
d53	Reserved *9	0 to 500	N	Y	*12	-	-	-	—
d54	Reserved *9	0 to 500	N	Y	*12	-	-	-	—
d55	Reserved *9	0: Enable factorization 1: Disable factorization	N	Y	0	-	-	-	—
d59	Command (Pulse Rate Input) (Pulse input property)	0: Pulse train sign/Pulse train input 1: Forward rotation pulse/Reverse rotation pulse 2: A/B phase with 90 degree phase shift	N	Y	0	Y	Y	Y	—
d61	(Filter time constant)	0.000 to 5.000 s	Y	Y	0.005	Y	Y	Y	—
d62	(Pulse count factor 1)	1 to 9999	N	Y	1	Y	Y	Y	—
d63	(Pulse count factor 2)	1 to 9999	N	Y	1	Y	Y	Y	—
d67	Starting Mode (Auto search)	0: Disable 1: Enable (At restart after momentary power failure) 2: Enable (At restart after momentary power failure and at normal start)	N	Y	2	N	Y	N	—
d68	Reserved *9	0.0 to 10.0 Hz	N	Y	40	-	-	-	—
d99	Reserved *9	0 to 7	Y	Y	0	-	-	-	—

#### y codes: LINK Functions

Code	Name	Data setting range	Change when running	Data copying	Default setting	Drive control			Refer to page:
						V/f	w/o PG	w/ PG	
y01	RS-485 Communication 1 (Station address)	1 to 255	N	Y	1	Y	Y	Y	—
y02	(Communications error processing)	0: Immediately trip with alarm <i>erB</i> 1: Trip with alarm <i>erB</i> after running for the period specified by timer y03 2: Retry during the period specified by timer y03. If the retry fails, trip with alarm <i>erB</i> . If it succeeds, continue to run. 3: Continue to run	Y	Y	0	Y	Y	Y	—
y03	(Timer)	0.0 to 60.0 s	Y	Y	2.0	Y	Y	Y	—
y04	(Baud rate)	0: 2400 bps 1: 4800 bps 2: 9600 bps 3: 19200 bps 4: 38400 bps	Y	Y	3	Y	Y	Y	—
y05	(Data length)	0: 8 bits 1: 7 bits	Y	Y	0	Y	Y	Y	—
y06	(Parity check)	0: None (2 stop bits) 1: Even parity (1 stop bit) 2: Odd parity (1 stop bit) 3: None (1 stop bit)	Y	Y	0	Y	Y	Y	—
y07	(Stop bits)	0: 2 bits 1: 1 bit	Y	Y	0	Y	Y	Y	—
y08	(No-response error detection time)	0: No detection; 1 to 60 s	Y	Y	0	Y	Y	Y	—
y09	(Response interval)	0.00 to 1.00 s	Y	Y	0.01	Y	Y	Y	—
y10	(Protocol selection)	0: Modbus RTU protocol 1: FRENIC Loader protocol (SX protocol) 2: Fuji general-purpose inverter protocol	Y	Y	1	Y	Y	Y	—
y11	RS-485 Communication 2 (Station address)	1 to 255	N	Y	1	Y	Y	Y	—
y12	(Communications error processing)	0: Immediately trip with alarm <i>erP</i> 1: Trip with alarm <i>erP</i> after running for the period specified by timer y13 2: Retry during the period specified by timer y13. If the retry fails, trip with alarm <i>erP</i> . If it succeeds, continue to run. 3: Continue to run	Y	Y	0	Y	Y	Y	—
y13	(Timer)	0.0 to 60.0 s	Y	Y	2.0	Y	Y	Y	—

\*9 These function codes are reserved for particular manufacturers. Unless otherwise specified, do not access these function codes.

\*12 The factory default differs depending upon the inverter's capacity.

5 for inverters with a capacity of 3.7 kW (4.0 kW for the EU) or below; 10 for those with 5.5 kW to 22 kW; 20 for those with 30 kW or above

Code	Name	Data setting range	Change when running	Data copying	Default setting	Drive control			Refer to page:
						V/f	w/o PG	w/ PG	
y14	RS-485 Communication 2 (Baud rate)	0: 2400 bps 1: 4800 bps 2: 9600 bps 3: 19200 bps 4: 38400 bps	Y	Y	3	Y	Y	Y	—
y15	(Data length)	0: 8 bits      1: 7 bits	Y	Y	0	Y	Y	Y	—
y16	(Parity check)	0: None (2 stop bits) 1: Even parity (1 stop bit) 2: Odd parity (1 stop bit) 3: None (1 stop bit)	Y	Y	0	Y	Y	Y	—
y17	(Stop bits)	0: 2 bits      1: 1 bit	Y	Y	0	Y	Y	Y	—
y18	(No-response error detection time)	0: No detection; 1 to 60 s	Y	Y	0	Y	Y	Y	—
y19	(Response interval)	0.00 to 1.00 s	Y	Y	0.01	Y	Y	Y	—
y20	(Protocol selection)	0: Modbus RTU protocol 2: Fuji general-purpose inverter protocol	Y	Y	0	Y	Y	Y	—
y97	Communication Data Storage Selection	0: Save into nonvolatile storage (Rewritable times limited) 1: Write into temporary storage (Rewritable times unlimited) 2: Save all data from temporary storage to nonvolatile one (After saving data, the data automatically returns to "1.")	Y	Y	0	Y	Y	Y	—
y98	Bus Link Function (Mode selection)	Frequency command      Run command 0: Follow H30 data      Follow H30 data 1: Via fieldbus option      Follow H30 data 2: Follow H30 data      Via fieldbus option 3: Via fieldbus option      Via fieldbus option	Y	Y	0	Y	Y	Y	—
y99	Loader Link Function (Mode selection)	Frequency command      Run command 0: Follow H30 and y98 data      Follow H30 and y98 data 1: Via RS-485 link      Follow H30 and y98 data (FRENIC Loader) 2: Follow H30 and y98 data      Via RS-485 link (FRENIC Loader) 3: Via RS-485 link      Via RS-485 link (FRENIC Loader)      (FRENIC Loader)	Y	N	0	Y	Y	Y	—

Table 5.1 Factory Default According to Shipping Destination

Function code	Name	Shipping destination		
		Asia		EU
		FRN_ _ _G1■-2A	FRN_ _ _G1■-4A	FRN_ _ _G1■-4E
		200 V class series	400 V class series	400 V class series
F03, A01, b01, r01 E31, E36, E54	Maximum frequency Frequency detection (Level)	60.0 Hz	50.0 Hz	50.0 Hz
F05, A03, b03, r03 F06, A04, b04, r04	Rated voltage at base frequency Maximum output voltage	220 V	415 V	400 V

**Note:** A box (■) in the above table replaces S or E depending on the enclosure.

Table 5.2 Factory Defaults Depending upon Inverter Capacity

Inverter capacity (kW)	Torque boost 1 to 4 F09/A05/b05/r05	Auto-restart after momentary power failure H13	Inverter capacity (kW)	Torque boost 1 to 4 F09/A05/b05/r05	Auto-restart after momentary power failure H13
0.4	7.1	0.5	18.5	2.2	1.0
0.75	6.8		22		
1.5			30		
2.2			37		
3.7			45	0.0	
5.5	4.9		55		
7.5	4.4	75			
11	3.5	90			
15	2.8	1.0			1.5



Table 5.3 Motor Parameters

This table lists the function codes dedicated to motor 1. For motors 2 to 4, replace the function codes with the ones dedicated to the respective motor.

Three-phase 200 V class series for Asia (FRN\_ \_ \_G1■-2A)

Motor capacity (kW)	Nominal applied motor (kW)	Rated current (A)	No-load current (A)	%R1	%X	Rated slip frequency (Hz)	Iron loss factor 1 (%)	Magnetic saturation factor 1 (%)	Magnetic saturation factor 2 (%)
P02		P03	P06	P07	P08	P12	P13	P16	P17
0.01 to 0.09	0.06	0.40	0.37	11.40	9.71	1.77	14.00	93.8	87.5
0.10 to 0.19	0.1	0.62	0.50	10.74	10.50	1.77	14.00	93.3	86.1
0.20 to 0.39	0.2	1.18	0.97	10.69	10.66	2.33	12.60	89.7	81.9
0.40 to 0.74	0.4	2.10	1.52	8.47	11.34	2.40	9.88	88.7	81.3
0.75 to 1.49	0.75	3.29	2.11	7.20	8.94	2.33	7.40	88.3	77.7
1.50 to 2.19	1.5	5.56	2.76	5.43	9.29	2.00	5.85	92.1	82.8
2.20 to 3.69	2.2	8.39	4.45	5.37	9.09	1.80	5.91	85.1	74.6
3.70 to 5.49	3.7	13.67	7.03	4.80	9.32	1.93	5.24	86.0	76.9
5.50 to 7.49	5.5	20.50	10.08	4.37	11.85	1.40	4.75	88.6	79.2
7.50 to 10.99	7.5	26.41	11.46	3.73	12.15	1.57	4.03	87.7	80.0
11.00 to 14.99	11	38.24	16.23	3.13	12.49	1.07	3.92	91.3	83.3
15.00 to 18.49	15	50.05	18.33	2.69	13.54	1.13	3.32	90.5	83.5
18.50 to 21.99	18.5	60.96	19.62	2.42	13.71	0.87	3.34	90.7	83.0
22.00 to 29.99	22	70.97	23.01	2.23	13.24	0.90	3.28	89.7	81.3
30.00 to 36.99	30	97.38	35.66	2.18	12.38	0.80	3.10	90.2	81.6
37.00 to 44.99	37	118.2	38.04	2.28	13.56	0.80	2.30	88.7	78.9
45.00 to 54.99	45	141.9	43.54	2.09	13.36	0.80	2.18	89.0	79.7
55.00 to 74.99	55	172.8	53.72	1.94	13.39	0.94	2.45	89.2	79.3
75.00 to 89.99	75	236.5	76.27	1.64	13.97	0.80	2.33	88.1	78.0
90.00 to 109.9	90	282.0	90.93	1.43	13.26	0.80	2.31	88.8	79.0
110.0 or above	110	342.0	83.60	1.65	17.25	0.66	1.73	90.5	82.6

Motor capacity (kW)	Nominal applied motor (kW)	Magnetic saturation factor 3 (%)	Magnetic saturation factor 4 (%)	Magnetic saturation factor 5 (%)	Magnetic saturation extension factor "a" (%)	Magnetic saturation extension factor "b" (%)	Magnetic saturation extension factor "c" (%)	Torque current under vector control (A)	Starting mode (Auto search delay time 2)
P02		P18	P19	P20	P21	P22	P23	P55	H46
0.01 to 0.09	0.06	75.0	62.5	50.0	106.3	112.5	118.8	0.19	0.5
0.10 to 0.19	0.1	74.4	63.6	50.7	108.8	118.7	129.6	0.31	
0.20 to 0.39	0.2	66.9	54.5	43.3	111.0	129.3	148.4	0.62	
0.40 to 0.74	0.4	67.0	55.2	43.8	112.1	126.5	144.3	1.23	
0.75 to 1.49	0.75	62.6	51.8	41.1	112.4	129.2	148.4	2.32	
1.50 to 2.19	1.5	71.1	58.1	46.2	111.4	126.1	143.9	4.63	
2.20 to 3.69	2.2	61.7	50.3	39.8	115.7	133.5	150.6	6.79	0.6
3.70 to 5.49	3.7	61.3	49.5	39.1	115.6	133.2	154.1	11.42	0.8
5.50 to 7.49	5.5	64.9	52.7	41.8	114.3	133.1	155.6	16.98	1.0
7.50 to 10.99	7.5	67.1	56.1	45.6	111.7	128.4	149.2	23.16	1.2
11.00 to 14.99	11	69.9	58.0	47.0	114.1	130.2	147.9	33.96	1.3
15.00 to 18.49	15	72.1	60.7	49.5	109.0	121.3	137.8	46.31	2.0
18.50 to 21.99	18.5	70.7	59.9	48.7	112.1	127.9	147.5	57.12	
22.00 to 29.99	22	68.9	59.1	48.4	114.1	130.2	151.8	67.92	
30.00 to 36.99	30	68.7	57.2	45.8	114.8	132.3	153.9	92.62	2.3
37.00 to 44.99	37	65.4	54.2	43.4	112.2	126.4	143.6	114.2	2.5
45.00 to 54.99	45	66.8	55.4	44.4	112.3	126.0	141.8	138.9	
55.00 to 74.99	55	64.7	53.6	43.1	117.2	136.2	157.8	169.8	2.6
75.00 to 89.99	75	64.3	54.2	42.9	114.9	129.8	144.6	231.6	2.8
90.00 to 109.9	90	65.0	54.0	44.0	115.0	130.0	145.0	277.9	3.2
110.0 or above	110	70.7	58.7	47.8	112.2	126.1	142.4	339.6	3.5

Note: A box (■) replaces S or E depending on the enclosure.

Table 5.3 Motor Parameters (Continued)

This table lists the function codes dedicated to motor 1. For motors 2 to 4, replace the function codes with the ones dedicated to the respective motor.

Three-phase 400 V class series for Asia (FRN\_ \_ \_G1■-4A)

Motor capacity (kW)	Nominal applied motor (kW)	Rated current (A)	No-load current (A)	%R1	%X	Rated slip frequency (Hz)	Iron loss factor 1 (%)	Magnetic saturation factor 1 (%)	Magnetic saturation factor 2 (%)
P02		P03	P06	P07	P08	P12	P13	P16	P17
0.01 to 0.09	0.06	0.23	0.21	13.90	11.84	1.77	14.00	93.8	87.5
0.10 to 0.19	0.1	0.35	0.28	12.49	12.21	1.77	14.00	93.3	86.1
0.20 to 0.39	0.2	0.66	0.55	12.67	12.64	2.33	12.60	89.7	81.9
0.40 to 0.74	0.4	1.15	0.86	9.83	13.17	2.40	9.88	88.7	81.3
0.75 to 1.49	0.75	1.79	1.19	8.31	10.31	2.33	7.40	88.3	77.7
1.50 to 2.19	1.5	3.04	1.57	6.19	10.60	2.00	5.85	92.1	82.8
2.20 to 3.69	2.2	4.53	2.52	6.15	10.41	1.80	5.91	85.1	74.6
3.70 to 5.49	3.7	7.37	3.98	5.48	10.66	1.93	5.24	86.0	76.9
5.50 to 7.49	5.5	11.28	5.71	4.99	13.53	1.40	4.75	88.6	79.2
7.50 to 10.99	7.5	14.18	6.48	4.24	13.84	1.57	4.03	87.7	80.0
11.00 to 14.99	11	20.52	9.18	3.56	14.21	1.07	3.92	91.3	83.3
15.00 to 18.49	15	26.79	10.38	3.05	15.37	1.13	3.32	90.5	83.5
18.50 to 21.99	18.5	33.03	11.10	2.73	15.52	0.87	3.34	90.7	83.0
22.00 to 29.99	22	37.90	13.07	2.53	14.99	0.90	3.28	89.7	81.3
30.00 to 36.99	30	52.59	20.23	2.48	14.04	0.80	3.10	90.2	81.6
37.00 to 44.99	37	63.16	21.58	2.58	15.37	0.80	2.30	88.7	78.9
45.00 to 54.99	45	75.73	24.69	2.37	15.12	0.80	2.18	89.0	79.7
55.00 to 74.99	55	92.26	30.40	2.20	15.16	0.94	2.45	89.2	79.3
75.00 to 89.99	75	126.3	43.16	1.85	15.82	0.80	2.33	88.1	78.0
90.00 to 109.9	90	150.5	51.46	1.62	15.00	0.80	2.31	88.8	79.0
110.0 or above	110	182.0	47.31	1.86	19.47	0.66	1.73	90.5	82.6

Motor capacity (kW)	Nominal applied motor (kW)	Magnetic saturation factor 3 (%)	Magnetic saturation factor 4 (%)	Magnetic saturation factor 5 (%)	Magnetic saturation extension factor "a" (%)	Magnetic saturation extension factor "b" (%)	Magnetic saturation extension factor "c" (%)	Torque current under vector control (A)	Starting mode (Auto search delay time 2)
P02		P18	P19	P20	P21	P22	P23	P55	H46
0.01 to 0.09	0.06	75.0	62.5	50.0	106.3	112.5	118.8	0.10	0.5
0.10 to 0.19	0.1	74.4	63.6	50.7	108.8	118.7	129.6	0.16	
0.20 to 0.39	0.2	66.9	54.5	43.3	111.0	129.3	148.4	0.33	
0.40 to 0.74	0.4	67.0	55.2	43.8	112.1	126.5	144.3	0.65	
0.75 to 1.49	0.75	62.6	51.8	41.1	112.4	129.2	148.4	1.23	
1.50 to 2.19	1.5	71.1	58.1	46.2	111.4	126.1	143.9	2.46	
2.20 to 3.69	2.2	61.7	50.3	39.8	115.7	133.5	150.6	3.60	0.6
3.70 to 5.49	3.7	61.3	49.5	39.1	115.6	133.2	154.1	6.06	0.8
5.50 to 7.49	5.5	64.9	52.7	41.8	114.3	133.1	155.6	9.00	1.0
7.50 to 10.99	7.5	67.1	56.1	45.6	111.7	128.4	149.2	12.28	1.2
11.00 to 14.99	11	69.9	58.0	47.0	114.1	130.2	147.9	18.00	1.3
15.00 to 18.49	15	72.1	60.7	49.5	109.0	121.3	137.8	24.55	2.0
18.50 to 21.99	18.5	70.7	59.9	48.7	112.1	127.9	147.5	30.28	
22.00 to 29.99	22	68.9	59.1	48.4	114.1	130.2	151.8	36.01	
30.00 to 36.99	30	68.7	57.2	45.8	114.8	132.3	153.9	49.10	2.3
37.00 to 44.99	37	65.4	54.2	43.4	112.2	126.4	143.6	60.56	2.5
45.00 to 54.99	45	66.8	55.4	44.4	112.3	126.0	141.8	73.65	1.0
55.00 to 74.99	55	64.7	53.6	43.1	117.2	136.2	157.8	90.02	2.6
75.00 to 89.99	75	64.3	54.2	42.9	114.9	129.8	144.6	122.8	2.8
90.00 to 109.9	90	65.0	54.0	44.0	115.0	130.0	145.0	147.3	3.2
110.0 or above	110	70.7	58.7	47.8	112.2	126.1	142.4	180.0	3.5

Note: A box (■) replaces S or E depending on the enclosure.

Table 5.3 Motor Parameters (Continued)

This table lists the function codes dedicated to motor 1. For motors 2 to 4, replace the function codes with the ones dedicated to the respective motor.

Three-phase 400 V class series for EU (FRN\_ \_ \_G1■-4E)

Motor capacity (kW)	Nominal applied motor (kW)	Rated current (A)	No-load current (A)	%R1	%X	Rated slip frequency (Hz)	Iron loss factor 1 (%)	Magnetic saturation factor 1 (%)	Magnetic saturation factor 2 (%)
P02		P03	P06	P07	P08	P12	P13	P16	P17
0.01 to 0.09	0.06	0.22	0.20	13.79	11.75	1.77	14.00	93.8	87.5
0.10 to 0.19	0.1	0.35	0.27	12.96	12.67	1.77	14.00	93.3	86.1
0.20 to 0.39	0.2	0.65	0.53	12.95	12.92	2.33	12.60	89.7	81.9
0.40 to 0.74	0.4	1.15	0.83	10.20	13.66	2.40	9.88	88.7	81.3
0.75 to 1.49	0.75	1.80	1.15	8.67	10.76	2.33	7.40	88.3	77.7
1.50 to 2.19	1.5	3.10	1.51	6.55	11.21	2.00	5.85	92.1	82.8
2.20 to 3.69	2.2	4.60	2.43	6.48	10.97	1.80	5.91	85.1	74.6
3.70 to 5.49	4.0	7.50	3.84	5.79	11.25	1.93	5.24	86.0	76.9
5.50 to 7.49	5.5	11.50	5.50	5.28	14.31	1.40	4.75	88.6	79.2
7.50 to 10.99	7.5	14.50	6.25	4.50	14.68	1.57	4.03	87.7	80.0
11.00 to 14.99	11	21.00	8.85	3.78	15.09	1.07	3.92	91.3	83.3
15.00 to 18.49	15	27.50	10.00	3.25	16.37	1.13	3.32	90.5	83.5
18.50 to 21.99	18.5	34.00	10.70	2.92	16.58	0.87	3.34	90.7	83.0
22.00 to 29.99	22	39.00	12.60	2.70	16.00	0.90	3.28	89.7	81.3
30.00 to 36.99	30	54.00	19.50	2.64	14.96	0.80	3.10	90.2	81.6
37.00 to 44.99	37	65.00	20.80	2.76	16.41	0.80	2.30	88.7	78.9
45.00 to 54.99	45	78.00	23.80	2.53	16.16	0.80	2.18	89.0	79.7
55.00 to 74.99	55	95.00	29.30	2.35	16.20	0.94	2.45	89.2	79.3
75.00 to 89.99	75	130.0	41.60	1.98	16.89	0.80	2.33	88.1	78.0
90.00 to 109.9	90	155.0	49.60	1.73	16.03	0.80	2.31	88.8	79.0
110.0 or above	110	188.0	45.60	1.99	20.86	0.66	1.73	90.5	82.6

Motor capacity (kW)	Nominal applied motor (kW)	Magnetic saturation factor 3 (%)	Magnetic saturation factor 4 (%)	Magnetic saturation factor 5 (%)	Magnetic saturation extension factor "a" (%)	Magnetic saturation extension factor "b" (%)	Magnetic saturation extension factor "c" (%)	Torque current under vector control (A)	Starting mode (Auto search delay time 2)
P02		P18	P19	P20	P21	P22	P23	P55	H46
0.01 to 0.09	0.06	75.0	62.5	50.0	106.3	112.5	118.8	0.10	0.5
0.10 to 0.19	0.1	74.4	63.6	50.7	108.8	118.7	129.6	0.17	
0.20 to 0.39	0.2	66.9	54.5	43.3	111.0	129.3	148.4	0.34	
0.40 to 0.74	0.4	67.0	55.2	43.8	112.1	126.5	144.3	0.68	
0.75 to 1.49	0.75	62.6	51.8	41.1	112.4	129.2	148.4	1.27	
1.50 to 2.19	1.5	71.1	58.1	46.2	111.4	126.1	143.9	2.55	
2.20 to 3.69	2.2	61.7	50.3	39.8	115.7	133.5	150.6	3.74	0.6
3.70 to 5.49	4.0	61.3	49.5	39.1	115.6	133.2	154.1	6.28	0.8
5.50 to 7.49	5.5	64.9	52.7	41.8	114.3	133.1	155.6	9.34	1.0
7.50 to 10.99	7.5	67.1	56.1	45.6	111.7	128.4	149.2	12.74	1.2
11.00 to 14.99	11	69.9	58.0	47.0	114.1	130.2	147.9	18.68	1.3
15.00 to 18.49	15	72.1	60.7	49.5	109.0	121.3	137.8	25.47	2.0
18.50 to 21.99	18.5	70.7	59.9	48.7	112.1	127.9	147.5	31.41	
22.00 to 29.99	22	68.9	59.1	48.4	114.1	130.2	151.8	37.36	
30.00 to 36.99	30	68.7	57.2	45.8	114.8	132.3	153.9	50.94	
37.00 to 44.99	37	65.4	54.2	43.4	112.2	126.4	143.6	62.83	
45.00 to 54.99	45	66.8	55.4	44.4	112.3	126.0	141.8	76.41	1.0
55.00 to 74.99	55	64.7	53.6	43.1	117.2	136.2	157.8	93.39	2.6
75.00 to 89.99	75	64.3	54.2	42.9	114.9	129.8	144.6	127.4	2.8
90.00 to 109.9	90	65.0	54.0	44.0	115.0	130.0	145.0	152.8	3.2
110.0 or above	110	70.7	58.7	47.8	112.2	126.1	142.4	186.8	3.5

Note: A box (■) replaces S or E depending on the enclosure.

## 5.2 Details of Function Codes

This section provides the details of the function codes. The descriptions are, in principle, arranged in the order of function code groups and in numerical order. However, highly relevant function codes are collectively described where one of them first appears.

In this manual, only basic function codes are described in detail. For the function codes for vector control and applied functions, refer to the FRENIC-MEGA User's Manual.

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### F00 Data Protection


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F00 specifies whether to protect function code data (except F00) and digital reference data (such as frequency command and PID command) from accidentally getting changed by pressing the  $\wedge$ / $\vee$  keys on the keypad.

Data for F00	Function
0	Disable both data protection and digital reference protection, allowing you to change both function code data and digital reference data with the $\wedge$ / $\vee$ keys.
1	Enable data protection and disable digital reference protection, allowing you to change digital reference data with the $\wedge$ / $\vee$ keys. But you cannot change function code data (except F00).
2	Disable data protection and enable digital reference protection, allowing you to change function code data with the $\wedge$ / $\vee$ keys. But you cannot change digital reference data.
3	Enable both data protection and digital reference protection, not allowing you to change function code data or digital reference data with the $\wedge$ / $\vee$ keys.

Enabling the protection disables the  $\wedge$ / $\vee$  keys to change function code data.

To change F00 data, simultaneous keying of "STOP" +  $\wedge$  (from 0 to 1) or "STOP" +  $\vee$  (from 1 to 0) keys is required.

 Even when F00 = 1 or 3, function code data can be changed via the communications link. For similar purposes, **WE-KP**, a signal enabling editing of function code data from the keypad is provided as a terminal command for digital input terminals. (Refer to the descriptions of E01 through E07.)

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### F01 , C30 Frequency Command 1 and 2

---

F01 or C30 sets the command source that specifies reference frequency 1 or reference frequency 2, respectively.

Data for F01, C30	Function
0	Enable $\wedge$ / $\vee$ keys on the keypad.
1	Enable the voltage input to terminal [12] (0 to $\pm 10$ VDC, maximum frequency obtained at $\pm 10$ VDC).
2	Enable the current input to terminal [C1] (+4 to +20 mA DC, maximum frequency obtained at +20 mA DC). (SW5 on the control PCB should be turned to the C1 side (factory default).)
3	Enable the sum of voltage (0 to +10 VDC) and current inputs (+4 to +20 mA DC) given to terminals [12] and [C1], respectively. See the two items listed above for the setting range and the value required for maximum frequencies. (SW5 on the control PCB should be turned to the C1 side (factory default).) Note: If the sum exceeds the maximum frequency (F03), the maximum frequency will apply.


Data for F01, C30	Function
5	Enable the voltage input to terminal [V2] (0 to +10 VDC, maximum frequency obtained at 10 VDC).
7	Enable <b>UP</b> and <b>DOWN</b> commands assigned to the digital input terminals. The <b>UP</b> command (any of E01 to E07 = 17) and <b>DOWN</b> command (any of E01 to E07 = 18) should be assigned to any of digital input terminals [X1] to [X7]. For details, refer to the descriptions of E01 through E07.
8	Enable $\wedge/\vee$ keys on the keypad (balanceless-bumpless switching available).
11	Enable a digital input interface card (option).
12	Enable the <b>PIN</b> command assigned to digital input terminal [X7]. The <b>PIN</b> command (any of E01 to E07 = 48) should be assigned to digital input terminal [X7]. For details, refer to the descriptions of E01 through E07.

 Using the terminal command **Hz2/Hz1** assigned to one of the digital input terminals switches between frequency command 1 (F01) and frequency command 2 (C30). Refer to function codes E01 through E07.

#### ■ Setting up a reference frequency


Using the keypad (F01 = 0 (factory default) or 8)

- (1) Set F01 data to "0" or "8." This can be done only when the inverter is in Running mode.
- (2) Press the  $\wedge/\vee$  key to display the current reference frequency. The lowest digit on the LED monitor will blink.
- (3) To change the reference frequency, press the  $\wedge/\vee$  key again. To save the new setting into the inverter's memory, press the  $\text{FUNC}/\text{DATA}$  key (when E64 = 1 (factory default)). When the power is turned ON next time, the new setting will be used as an initial reference frequency.

-  In addition to the saving with the  $\text{FUNC}/\text{DATA}$  key described above, auto-saving is also available (when E64 = 0).
- If you have set F01 data to "0" or "8," but have selected a frequency command source other than frequency command 1 (i.e., frequency command 2, frequency command via communication, or multi-frequency command), then the  $\wedge$  and  $\vee$  keys are disabled to change the current frequency command even in Running mode. Pressing either of these keys just displays the current reference frequency.
  - When you start specifying the reference frequency or any other parameter with the  $\wedge/\vee$  key, the least significant digit on the display blinks; that is, the cursor lies in the least significant digit. Holding down the  $\wedge/\vee$  key changes data in the least significant digit and generates a carry, while the cursor remains in the least significant digit.
  - While the least significant digit is blinking by pressing the  $\wedge/\vee$  key, holding down the  $\text{PRG}/\text{REF}$  key for more than 1 second moves the cursor from the least significant digit to the most significant digit. Further holding it down moves the cursor to the next lower digit. This cursor movement allows you to easily move the cursor to the desired digit and change the data in higher digits.
  - Setting F01 data to "8" enables the balanceless-bumpless switching. When the frequency command source is switched to the keypad from any other source, the inverter inherits the current frequency that has applied before switching, providing smooth switching and shockless running.

#### Using analog input (F01 = 1 to 3, or 5)

- Applying the gain and bias to analog inputs (voltage inputs to terminals [12] and [V2], and current input to terminal [C1]) enables the frequency to be set within an arbitrary range (frequency vs. analog input level).


 Refer to the description of F18.

- Noise reduction filters are applicable to these analog inputs.

 For details, refer to the descriptions of C33, C38 and C43.

- The normal/inverse operation for the frequency command 1 setting (F01) can be selected with function code C53 and be switched between them with the terminal command *IVS* assigned to any of the digital input terminals.

 For details, refer to the descriptions of E01 through E07.







-  **Note**
- To input bipolar analog voltage (0 to  $\pm 10$  VDC) to terminals [12] and [V2], set C35 and C45 data to "0." Setting C35 and C45 data to "1" enables the voltage range from 0 to +10 VDC and interprets the negative polarity input from 0 to -10 VDC as 0 V.
  - A reference frequency can be specified not only with the frequency (Hz) but also with other menu items, depending on the setting of function code E48 (= 3 to 5, or 7).


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#### F02 Operation Method

---

F02 selects the source that specifies a run command.

Data for F02	Run Command Source	Description
0	Keypad (Rotation direction specified by terminal command)	Enables the  /  keys to run and stop the motor. The rotation direction of the motor is specified by terminal command <i>FWD</i> or <i>REV</i> .
1	External signal	Enables terminal command <i>FWD</i> or <i>REV</i> to run the motor.
2	Keypad (Forward rotation)	Enables  /  keys to run and stop the motor. Note that this run command enables only the forward rotation. There is no need to specify the rotation direction.
3	Keypad (Reverse rotation)	Enables  /  keys to run and stop the motor. Note that this run command enables only the reverse rotation. There is no need to specify the rotation direction.

-  **Note**
- When function code F02 = 0 or 1, the "Run forward" *FWD* and "Run reverse" *REV* terminal commands must be assigned to terminals [FWD] and [REV], respectively.
  - When the *FWD* or *REV* is ON, the F02 data cannot be changed.
  - When changing terminal command assignments to terminals [FWD] and [REV] from commands other than the *FWD* and *REV* to the *FWD* or *REV* with F02 being set to "1," be sure to turn the target terminal OFF beforehand; otherwise, the motor may unintentionally rotate.

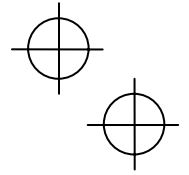
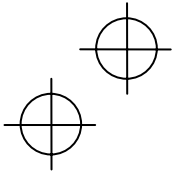
In addition to the run command sources described above, higher priority command sources including remote and local mode (see Section 4.2.2) and communications link are provided. For details, refer to the block diagrams in Chapter 6 in FRENIC-MEGA User's Manual.

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#### F03 Maximum Frequency 1

---

F03 specifies the maximum frequency to limit the output frequency. Specifying the maximum frequency exceeding the rating of the equipment driven by the inverter may cause damage or a dangerous situation. Make sure that the maximum frequency setting matches the equipment rating.



- Note**
- For LD-mode inverters, set the maximum frequency at 120 Hz or below.
  - Under vector control with speed sensor, set the maximum frequency at 200 Hz or below, and under vector control without speed sensor, at 120 Hz or below.

## **WARNING**

The inverter can easily accept high-speed operation. When changing the speed setting, carefully check the specifications of motors or equipment beforehand.  
**Otherwise injuries could occur.**

- Note** Modifying F03 data to allow a higher reference frequency requires also changing F15 data specifying a frequency limiter (high).

F04 to F06	Base Frequency 1, Rated Voltage at Base Frequency 1, Maximum Output Voltage 1
H50 to H53 ,H65 ,H66	Non-linear V/f Pattern 1, 2 and 3 (Frequency and Voltage)

These function codes specify the base frequency and the voltage at the base frequency essentially required for running the motor properly. If combined with the related function codes H50 through H53, H65 and H66, these function codes may profile the non-linear V/f pattern by specifying increase or decrease in voltage at any point on the V/f pattern.

The following description includes setups required for the non-linear V/f pattern.

At high frequencies, the motor impedance may increase, resulting in an insufficient output voltage and a decrease in output torque. To prevent this problem, use F06 (Maximum Output Voltage 1) to increase the voltage. Note, however, that the inverter cannot output voltage exceeding its input power voltage.

■ Base Frequency 1 (F04)

Set the rated frequency printed on the nameplate labeled on the motor.

■ Rated Voltage at Base Frequency 1 (F05)

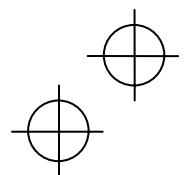
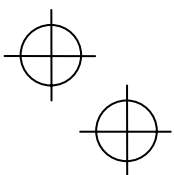
Set "0" or the rated voltage printed on the nameplate labeled on the motor.

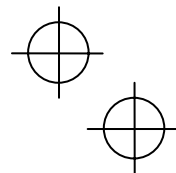
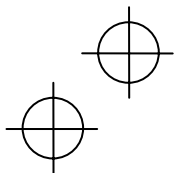
- If F05 = 0, the rated voltage at base frequency is determined by the power source of the inverter. The output voltage will fluctuate in line with the input voltage fluctuation.
- If F05 = an arbitrary value other than 0, the inverter automatically keeps the output voltage constant in line with the setting. When any of the auto torque boost, auto energy saving, etc. is enabled, the F05 data should be equal to the rated voltage of the motor.

■ Non-linear V/f Patterns 1, 2 and 3 for Frequency (H50, H52 and H65)

Set the frequency component at an arbitrary point in the non-linear V/f pattern.

- Note** Setting "0.0" to H50, H52 or H65 disables the non-linear V/f pattern operation.





■ Non-linear V/f Patterns 1, 2 and 3 for Voltage (H51, H53 and H66)

Sets the voltage component at an arbitrary point in the non-linear V/f pattern.

**Note** The factory default values for H50 and H51 differ depending on the inverter capacity. For inverters with a capacity of 22 kW or below, H50 = 0.0 (Hz) and H51 = 0 (V). For those with a capacity of 30 kW or above, refer to the table below.

Destination	Asia		EU
Inverter type	FRN_ _G1■-2A	FRN_ _G1■-4A	FRN_ _G1■-4E
Voltage	200 V class series	400 V class series	400 V class series
H50	6.0 (Hz)	5.0 (Hz)	5.0 (Hz)
H51	22 (V)	42 (V)	40 (V)

**Note:** A box (■) in the above table replaces S or E depending on the enclosure.

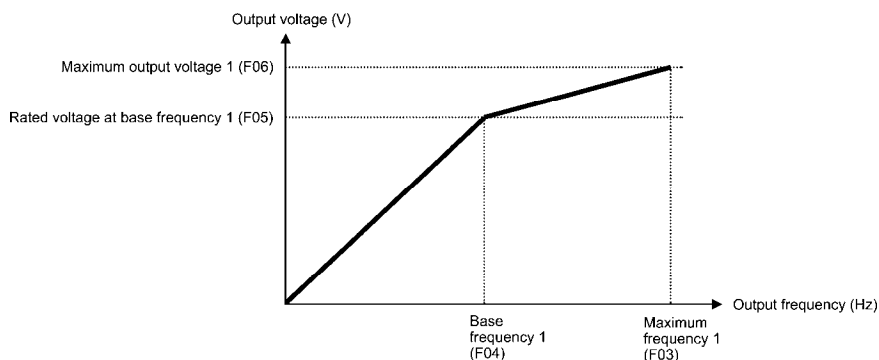
■ Maximum Output Voltage 1 (F06)

Set the voltage for the maximum frequency 1 (F03).

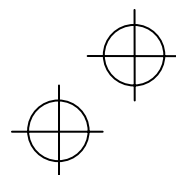
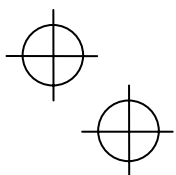
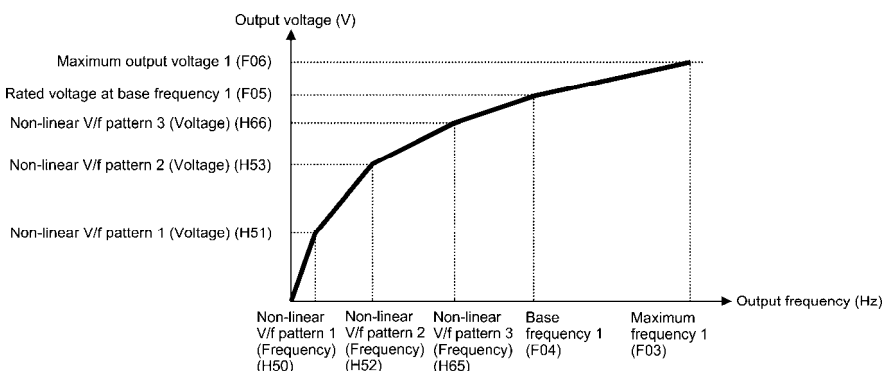
- Note**
- If F05 (Rated Voltage at Base Frequency 1) is set to "0," settings of H50 through H53, H65, H66 and F06 do not take effect. (When the non-linear point is below the base frequency, the linear V/f pattern applies; when it is above, the output voltage is kept constant.)
  - When the auto torque boost (F37) is enabled, the non-linear V/f pattern takes no effect.

Examples:

■ Normal (linear) V/f pattern



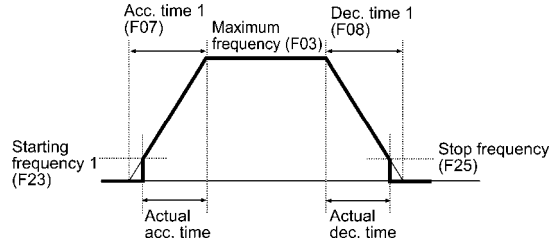
■ V/f pattern with three non-linear points





F07, E10, E12, E14 Acceleration Time 1, 2, 3 and 4  
 F08, E11, E13, E15 Deceleration Time 1, 2, 3 and 4

F07 specifies the acceleration time, the length of time the frequency increases from 0 Hz to the maximum frequency. F08 specifies the deceleration time, the length of time the frequency decreases from the maximum frequency down to 0 Hz.



- Note**
- If you choose S-curve acceleration/deceleration or curvilinear acceleration/deceleration in Acceleration/Deceleration Pattern (H07), the actual acceleration/deceleration times are longer than the specified times.
  - Specifying an improperly short acceleration/deceleration time may activate the current limiter, torque limiter, or anti-regenerative control, resulting in a longer acceleration/deceleration time than the specified one.

**Tip** Four different acceleration time and deceleration time can be specified for each. The combinations of ON/OFF states of the two terminal commands **RT2** and **RT1** offer four choices of acceleration/deceleration time 1 to 4, as listed below. If no terminal command is assigned, only the acceleration/deceleration time 1 (F07/F08) is effective.

Terminal command <b>RT2</b>	Terminal command <b>RT1</b>	Acceleration/deceleration time
OFF	OFF	Acceleration/ deceleration time 1 (F07/F08)
OFF	ON	Acceleration/ deceleration time 2 (E10/E11)
ON	OFF	Acceleration/ deceleration time 3 (E12/E13)
ON	ON	Acceleration/ deceleration time 4 (E14/E15)

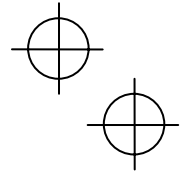
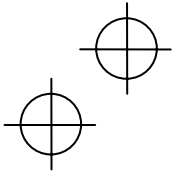
F09 Torque Boost 1  
 F37 Load Selection/Auto Torque Boost/Auto Energy Saving Operation 1

F09 specifies the torque boost level in order to assure sufficient starting torque.

F37 specifies V/f pattern, torque boost type, and auto energy saving operation in accordance with the characteristics of the load.

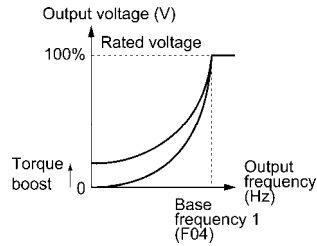
Data for F37	V/f pattern	Torque boost	Auto energy saving	Applicable load
0	Variable torque V/f pattern	Torque boost specified by F09	Disable	Variable torque load (General-purpose fans and pumps)
1	Linear V/f pattern	Auto torque boost		Constant torque load
2			Constant torque load (To be selected if a motor may be over-excited at no load.)	
3	Variable torque V/f pattern	Torque boost specified by F09	Enable	Variable torque load (General-purpose fans and pumps)
4	Linear V/f pattern	Auto torque boost		Constant torque load
5				Constant torque load (To be selected if a motor may be over-excited at no load.)

**Note:** If a required "load torque + acceleration torque" is more than 50% of the constant torque, it is recommended to select the linear V/f pattern (factory default).

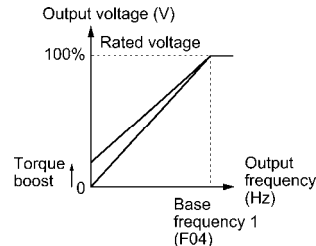


■ V/f characteristics

The FRENIC-MEGA series of inverters offers a variety of V/f patterns and torque boosts, which include V/f patterns suitable for variable torque load such as general fans and pumps and for constant torque load (including special pumps requiring high starting torque). Two types of torque boosts are available: manual and automatic.



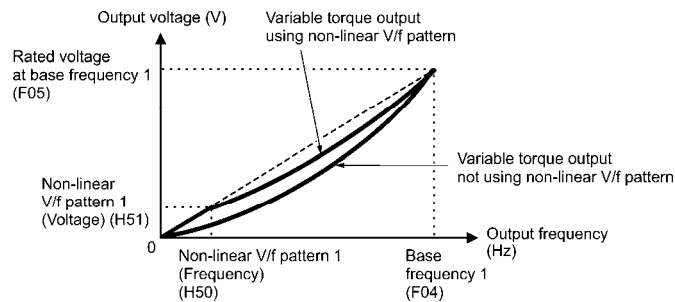
Variable torque V/f pattern (F37 = 0)



Linear V/f pattern (F37 = 1)

**Tip** When the variable torque V/f pattern is selected (F37 = 0 or 3), the output voltage may be low at a low frequency zone, resulting in insufficient output torque, depending on the characteristics of the motor and load. In such a case, it is recommended to increase the output voltage at the low frequency zone using the non-linear V/f pattern.

Recommended value: H50 = 1/10 of the base frequency  
H51 = 1/10 of the voltage at base frequency



■ Torque boost

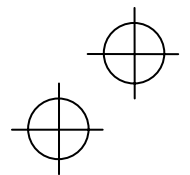
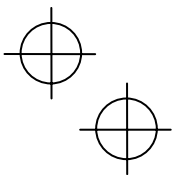
- Manual torque boost (F09)

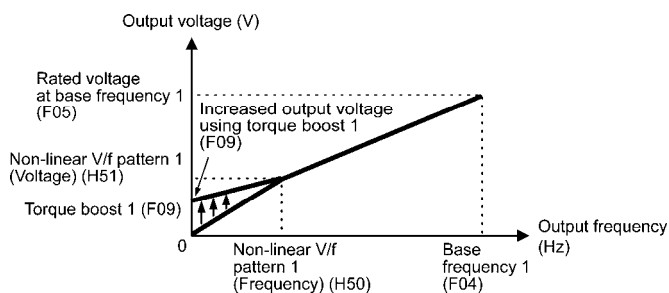
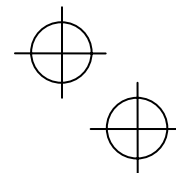
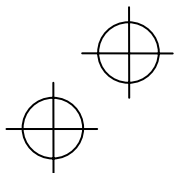
In torque boost using F09, constant voltage is added to the basic V/f pattern, regardless of the load. To secure a sufficient starting torque, manually adjust the output voltage to optimally match the motor and its load by using F09. Specify an appropriate level that guarantees smooth start-up and yet does not cause over-excitation at no or light load.

Torque boost per F09 ensures high driving stability since the output voltage remains constant regardless of the load fluctuation.

Specify the F09 data in percentage to the rated voltage at base frequency 1 (F05). At factory shipment, F09 is preset to a level that assures approx. 100% of starting torque.

- Note**
- Specifying a high torque boost level will generate a high torque, but may cause overcurrent due to over-excitation at no load. If you continue to drive the motor, it may overheat. To avoid such a situation, adjust torque boost to an appropriate level.
  - When the non-linear V/f pattern and the torque boost are used together, the torque boost takes effect below the frequency on the non-linear V/f pattern's point.





- Auto torque boost

This function automatically optimizes the output voltage to fit the motor with its load. Under light load, auto torque boost decreases the output voltage to prevent the motor from over-excitation. Under heavy load, it increases the output voltage to increase the output torque of the motor.

- **Note** Since this function relies also on the characteristics of the motor, set the base frequency 1 (F04), the rated voltage at base frequency 1 (F05), and other pertinent motor parameters (P01 through P03 and P06 through P99) in line with the motor capacity and characteristics, or else perform auto-tuning (P04).
- When a special motor is driven or the load does not have sufficient rigidity, the maximum torque might decrease or the motor operation might become unstable. In such cases, do not use auto torque boost but choose manual torque boost per F09 (F37 = 0 or 1).

- Auto energy saving operation

This feature automatically controls the supply voltage to the motor to minimize the total power loss of motor and inverter. (Note that this feature may not be effective depending upon the motor or load characteristics. Check the advantage of energy saving before you actually apply this feature to your machinery.)

This feature applies to constant speed operation only. During acceleration/deceleration, the inverter will run with manual torque boost (F09) or auto torque boost, depending on the F37 data. If auto energy saving operation is enabled, the response to a motor speed change from constant speed operation may be slow. Do not use this feature for such machinery that requires quick acceleration/deceleration.

- **Note** Use auto energy saving only where the base frequency is 60 Hz or lower. If the base frequency is set at 60 Hz or higher, you may get a little or no energy saving advantage. The auto energy saving operation is designed for use with the frequency lower than the base frequency. If the frequency becomes higher than the base frequency, the auto energy saving operation will be invalid.
- Since this function relies also on the characteristics of the motor, set the base frequency 1 (F04), the rated voltage at base frequency 1 (F05), and other pertinent motor parameters (P01 through P03 and P06 through P99) in line with the motor capacity and characteristics, or else perform auto-tuning (P04).

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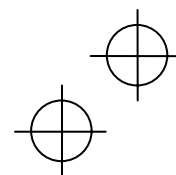
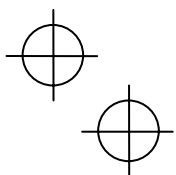
### F10 to F12 Electronic Thermal Overload Protection for Motor 1 (Select motor characteristics, Overload detection level, and Thermal time constant)

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F10 through F12 specify the thermal characteristics of the motor for its electronic thermal overload protection that is used to detect overload conditions of the motor.

F10 selects the motor cooling mechanism to specify its characteristics, F11 specifies the overload detection current, and F12 specifies the thermal time constant.

- **Note** Thermal characteristics of the motor specified by F10 and F12 are also used for the overload early warning. Even if you need only the overload early warning, set these characteristics data to these function codes.  
To disable the electronic thermal overload protection, set F11 data to "0.00."

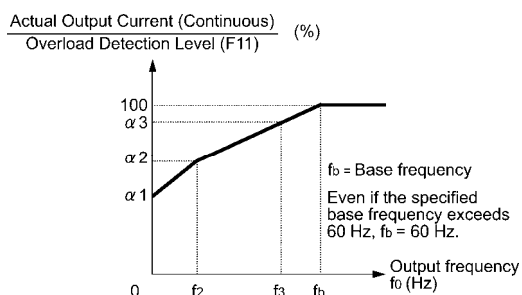


■ Select motor characteristics (F10)

F10 selects the cooling mechanism of the motor--shaft-driven or separately powered cooling fan.

Data for F10	Function
1	For a general-purpose motor with shaft-driven cooling fan (The cooling effect will decrease in low frequency operation.)
2	For an inverter-driven motor, non-ventilated motor, or motor with separately powered cooling fan (The cooling effect will be kept constant regardless of the output frequency.)

The figure below shows operating characteristics of the electronic thermal overload protection when F10 = 1. The characteristic factors  $\alpha_1$  through  $\alpha_3$  as well as their corresponding switching frequencies  $f_2$  and  $f_3$  vary with the characteristics of the motor. The tables below list the factors of the motor selected by P99 (Motor 1 Selection).



Cooling Characteristics of Motor with Shaft-driven Cooling Fan

Nominal Applied Motor and Characteristic Factors when P99 (Motor 1 selection) = 0 or 4

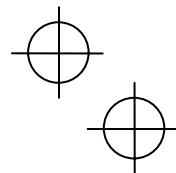
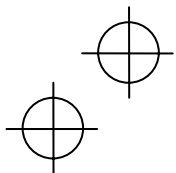
Nominal applied motor (kW)	Thermal time constant $\tau$ (Factory default)	Reference current for setting the thermal time constant (Imax)	Output frequency for motor characteristic factor		Characteristic factor (%)		
			f2	f3	$\alpha_1$	$\alpha_2$	$\alpha_3$
0.4, 0.75	5 min	Allowable continuous current $\times$ 150%	5 Hz	7 Hz	75	85	100
1.5 to 3.7 (4.0) *					85	85	100
5.5 to 11				6 Hz	90	95	100
15				7 Hz	85	85	100
18.5, 22				5 Hz	92	100	100
30 to 45	10 min		Base frequency $\times$ 33%	Base frequency $\times$ 83%	54	85	95
55 to 90			51	95	95		
110 or above			53	85	90		

\* 4.0 kW for the EU.

Nominal Applied Motor and Characteristic Factors when P99 (Motor 1 Selection) = 1 or 3

Nominal applied motor (kW)	Thermal time constant $\tau$ (Factory default)	Reference current for setting the thermal time constant (Imax)	Output frequency for motor characteristic factor		Characteristic factor (%)		
			f2	f3	$\alpha_1$	$\alpha_2$	$\alpha_3$
0.2 to 22	5 min	Allowable continuous current $\times$ 150%	Base frequency $\times$ 33%	Base frequency $\times$ 33%	69	90	90
30 to 45	10 min				Base frequency $\times$ 33%	Base frequency $\times$ 83%	54
55 to 90			51	95			95
110 or above			53	85			90

If F10 is set to "2," changes of the output frequency do not affect the cooling effect. Therefore, the overload detection level (F11) remains constant.



■ Overload detection level (F11)

F11 specifies the level at which the electronic thermal overload protection becomes activated.

In general, set the F11 data to the allowable continuous current of motor when driven at the base frequency (i.e. 1.0 to 1.1 multiple of the rated current of the motor.) To disable the electronic thermal overload protection, set the F11 data to "0.00."

■ Thermal time constant (F12)

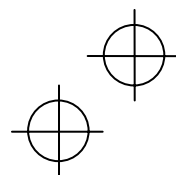
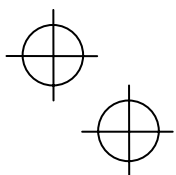
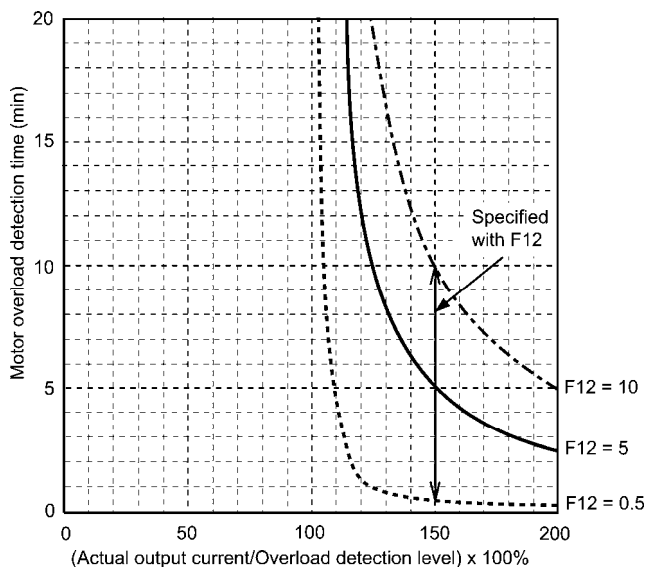
F12 specifies the thermal time constant of the motor. If the current of 150% of the overload detection level specified by F11 flows for the time specified by F12, the electronic thermal overload protection becomes activated to detect the motor overload. The thermal time constant for general-purpose motors including Fuji motors is approx. 5 minutes for motors of 22 kW or below and 10 minutes for motors of 30 kW or above by factory default.

(Example) When the F12 data is set at 5 minutes

As shown below, the electronic thermal overload protection is activated to detect an alarm condition (alarm code 011) when the output current of 150% of the overload detection level (specified by F11) flows for 5 minutes, and 120% for approx. 12.5 minutes.

The actual time required for issuing a motor overload alarm tends to be shorter than the specified value, taking into account the time period from when the output current exceeds the rated current (100%) until it reaches 150% of the overload detection level.

Example of Operating Characteristics




F14, H13, Restart Mode after Momentary Power Failure  
H14, H16 (Mode selection, Restart time, Frequency fall rate and Allowable momentary power failure time)

F14 specifies the action to be taken by the inverter such as trip and restart in the event of a momentary power failure.

■ Restart mode after momentary power failure (Mode selection) (F14)

Data for F14	Mode	Description
0	Trip immediately	As soon as the DC link bus voltage drops below the undervoltage detection level due to a momentary power failure, the inverter issues undervoltage alarm /u and shuts down its output so that the motor enters a coast-to-stop state.
1	Trip after recovery from power failure	As soon as the DC link bus voltage drops below the undervoltage detection level due to a momentary power failure, the inverter shuts down its output so that the motor enters a coast-to-stop state, but it does not enter the undervoltage state or issue undervoltage alarm /u. The moment the power is restored, an undervoltage alarm /u is issued, while the motor remains in a coast-to-stop state.
2	Trip after decelerate-to-stop	As soon as the DC link bus voltage drops below the continuous running level due to a momentary power failure, decelerate-to-stop control is invoked. Decelerate-to-stop control regenerates kinetic energy from the load's moment of inertia, slowing down the motor and continuing the deceleration operation. After decelerate-to-stop operation, an undervoltage alarm /u is issued.
3	Continue to run (for heavy inertia or general loads)	As soon as the DC link bus voltage drops below the continuous running level due to a momentary power failure, continuous running control is invoked. Continuous running control regenerates kinetic energy from the load's moment of inertia, continues running, and waits the recovery of power. When an undervoltage condition is detected due to a lack of energy to be regenerated, the output frequency at that time is saved, the output of the inverter is shut down, and the motor enters a coast-to-stop state.  When power is restored, if a run command has been input, restart begins at the output frequency saved during the power failure processing. This setting is ideal for fan applications with a large moment of inertia.
4	Restart at the frequency at which the power failure occurred (for general loads)	As soon as the DC link bus voltage drops below the undervoltage detection level due to a momentary power failure, the inverter saves the output frequency at that time and shuts down the output so that the motor enters a coast-to-stop state.  When power is restored, if a run command has been input, restart begins at the output frequency saved during the power failure processing.  This setting is ideal for applications with a moment of inertia large enough not to slow down the motor quickly, such as fans, even after the motor enters a coast-to-stop state upon occurrence of a momentary power failure.
5	Restart at the starting frequency	After a momentary power failure, restoring power and then entering a run command restarts the inverter at the starting frequency specified by function code F23.  This setting is ideal for heavy load applications such as pumps, having a small moment of inertia, in which the motor speed quickly goes down to zero as soon as it enters a coast-to-stop state upon occurrence of a momentary power failure.

 When the motor restarts after a momentary power failure, the auto search mode can apply, which detects the idling motor speed and runs the idling motor without stopping it. Refer to the description of H09 and d67.

Data for F14	Restart mode after momentary power failure	V/f control		Vector control without speed sensor		Vector control with speed sensor	
		Auto search: Disable (H09 = 0)	Auto search: Enable (H09 = 1 or 2)	Auto search: Disable (d67 = 0)	Auto search: Enable (d67 = 1 or 2)		
0	Disable	Trip immediately					
1	Disable	Trip after recovery from power failure					
2	Disable	Decelerate-to-stop					
3	Enable	Continue to run		Do not continue to run			
		If failed, restart at the output frequency saved during the power failure processing.	If failed, search for idling motor speed and restart at the searched speed.	Restart at the reference frequency saved during the previous power failure processing.	Search for idling motor speed and restart at the searched speed.	Restart at the speed detected by the speed sensor.	
		Restart at the reference frequency saved during the previous power failure processing.	Search for idling motor speed and restart at the searched speed.				
4	Enable	Restart at the reference frequency saved during the previous power failure processing.	Search for idling motor speed and restart at the searched speed.	Restart at the reference frequency saved during the previous power failure processing.	Search for idling motor speed and restart at the searched speed.	Restart at the speed detected by the speed sensor.	
5	Enable	Restart at the starting frequency.	Search for idling motor speed and restart at the searched speed.	Restart at the starting frequency.	Search for idling motor speed and restart at the searched speed.	Restart at the speed detected by the speed sensor.	

## WARNING

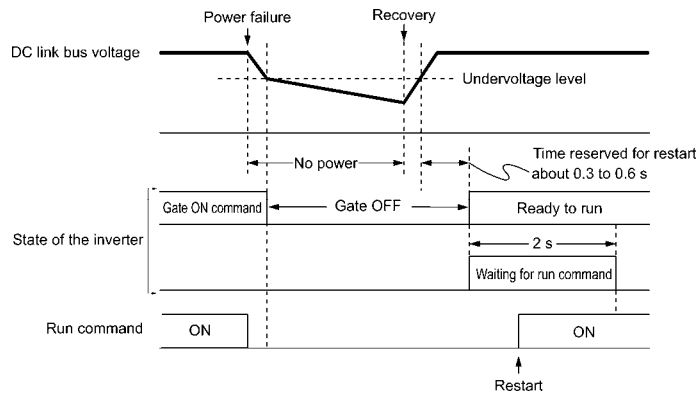
If you enable the "Restart mode after momentary power failure" (Function code F14 = 3 to 5), the inverter automatically restarts the motor running when the power is restored. Design the machinery or equipment so that human safety is ensured after restarting.  
**Otherwise an accident could occur.**

### ■ Restart mode after momentary power failure (Basic operation)

The inverter recognizes a momentary power failure upon detecting the condition that DC link bus voltage goes below the undervoltage detection level, while the inverter is running. If the load of the motor is light and the duration of the momentary power failure is extremely short, the voltage drop may not be great enough for a momentary power failure to be recognized, and the motor may continue to run uninterrupted.

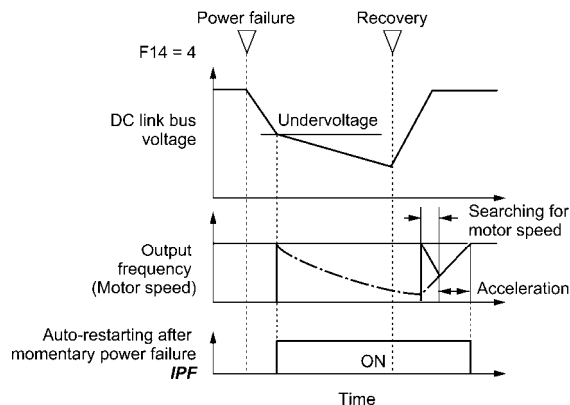
Upon recognizing a momentary power failure, the inverter enters the restart mode (after a recovery from momentary power failure) and prepares for restart. When power is restored, the inverter goes through an initial charging stage and enters the ready-to-run state. When a momentary power failure occurs, the power supply voltage for external circuits such as relay sequence circuits may also drop so as to turn the run command OFF. In consideration of such a situation, the inverter waits 2 seconds for a run command input after the inverter enters a ready-to-run state. If a run command is received within 2 seconds, the inverter begins the restart processing in accordance with the F14 data (Mode selection). If no run command has been received within 2-second wait period, the inverter cancels the restart mode (after a recovery from momentary power failure) and needs to be started again from the ordinary starting frequency. Therefore, ensure that a run command is entered within 2 seconds after a recovery of power, or install a mechanical latch relay.

When run commands are entered via the keypad, the above operation is also necessary for the mode (F02 = 0) in which the rotational direction is determined by the terminal command, **FWD** or **REV**. In the modes where the rotational direction is fixed (F02 = 2 or 3), it is retained inside the inverter so that the restart will begin as soon as the inverter enters the ready-to-run state.



- Note**
- When the power is restored, the inverter will wait 2 seconds for input of a run command. However, if the allowable momentary power failure time (H16) elapses after the power failure was recognized, even within the 2 seconds, the restart time for a run command is canceled. The inverter will start operation in the normal starting sequence.
  - If the "Coast to a stop" terminal command **BX** is entered during the power failure, the inverter gets out of the restart mode and enters the normal running mode. If a run command is entered with power supply applied, the inverter will start from the normal starting frequency.
  - The inverter recognizes a momentary power failure by detecting an undervoltage condition whereby the voltage of the DC link bus goes below the lower limit. In a configuration where a magnetic contactor is installed on the output side of the inverter, the inverter may fail to recognize a momentary power failure because the momentary power failure shuts down the operating power of the magnetic contactor, causing the contactor circuit to open. When the contactor circuit is open, the inverter is cut off from the motor and load, and the voltage drop in the DC link bus is not great enough to be recognized as a power failure. In such an event, restart after a recovery from momentary power failure does not work properly as designed. To solve this, connect the interlock command **IL** line to the auxiliary contact of the magnetic contactor, so that a momentary power failure can sure be detected. For details, refer to the descriptions of E01 through E07.

During a momentary power failure, the motor slows down. After power is restored, the inverter restarts at the frequency just before the momentary power failure. Then, the current limiting function works and the output frequency of the inverter automatically decreases. When the output frequency matches the motor speed, the motor accelerates up to the original output frequency. See the figure below. In this case, the instantaneous overcurrent limiting must be enabled (H12 = 1).

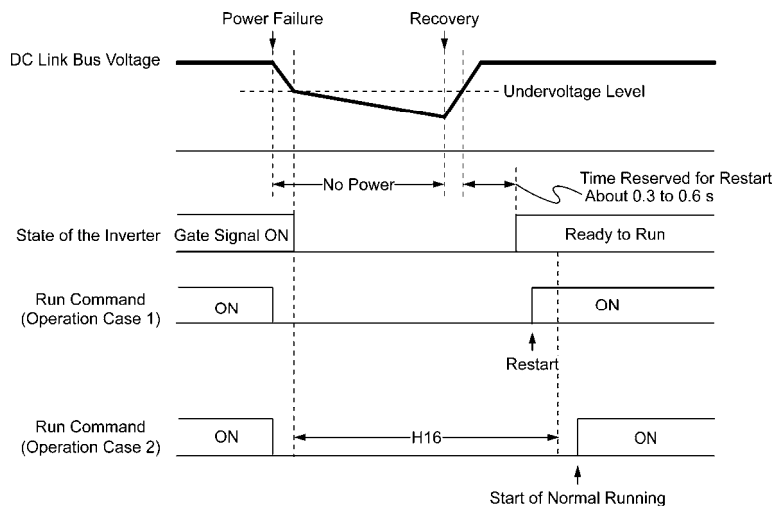




■ Restart mode after momentary power failure (Allowable momentary power failure time) (H16)

H16 specifies the maximum allowable duration (0.0 to 30.0 seconds) from an occurrence of a momentary power failure (undervoltage) until the inverter is to be restarted. Specify the coast-to-stop time during which the machine system and facility can be tolerated.

If the power is restored within the specified duration, the inverter restarts in the restart mode specified by F14. If the power is restored after the specified duration, the inverter recognizes that the power has been shut down so that it does not restart but starts (normal starting).



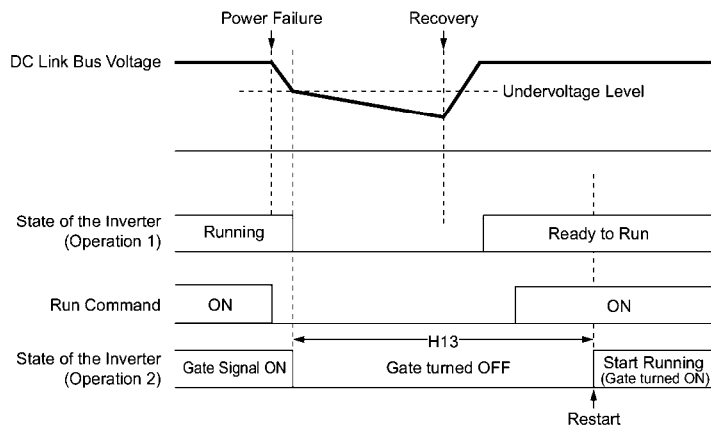
If H16 (Allowable momentary power failure time) is set to "999," restart will take place until the DC link bus voltage drops down to the allowable voltage for restart after a momentary power failure (50 V for 200 V class series and 100 V for 400 V class series). If the DC link bus voltage drops below the allowable voltage, the inverter recognizes that the power has been shut down so that it does not restart but starts (normal starting).

**Note** The time required from when the DC link bus voltage drops from the threshold of undervoltage until it reaches the allowable voltage for restart after a momentary power failure, greatly varies depending on the inverter capacity, the presence of options, and other factors.

■ Restart mode after momentary power failure (Restart time) (H13)

H13 specifies the time period from momentary power failure occurrence until the inverter reacts for restarting process.

If the inverter starts the motor while motor's residual voltage is still in a high level, a large inrush current may flow or an overvoltage alarm may occur due to an occurrence of temporary regeneration. For safety, therefore, it is advisable to set H13 to a certain level so that the restart will take place only after the residual voltage has dropped to a low level. Note that even when power is restored, restart will not take place until the restart time (H13) has elapsed.



**Factory default**

By factory default, H13 is set to the value suitable for the standard motor (see Table 5.2). Basically, it is not necessary to change H13 data. However, if the long restart time causes the flow rate of the pump to overly decrease or causes any other problem, you might as well reduce the setting to about a half of the default value. In such a case, make sure that no alarm occurs.

**Note** Function code H13 (Restart mode after momentary power failure -- Restart time) also applies to the switching operation between line and inverter (refer to the descriptions of E01 through E07).

■ Restart mode after momentary power failure (Frequency fall rate) (H14)

During restart after a momentary power failure, if the inverter output frequency and the idling motor speed cannot be harmonized with each other, an overcurrent will flow, activating the overcurrent limiter. If it happens, the inverter automatically reduces the output frequency to match the idling motor speed according to the reduction rate (Frequency fall rate: Hz/s) specified by H14.

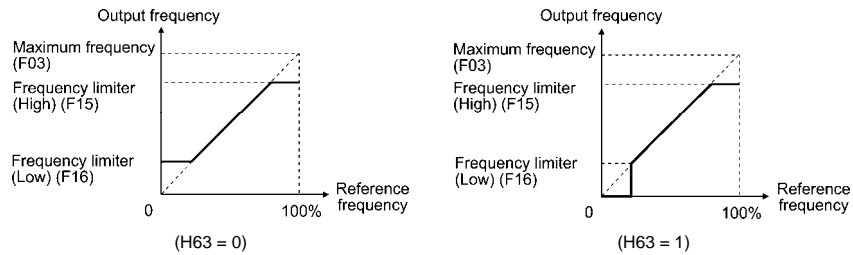
Data for H14	Inverter's action for the output frequency fall
0.00	Follow the deceleration time specified
0.01 to 100.00 (Hz/s)	Follow data specified by H14
999	Follow the setting of the PI controller in the current limiter. (The PI constant is prefixed inside the inverter.)

**Note** If the frequency fall rate is too high, regeneration may take place at the moment the motor rotation matches the inverter output frequency, causing an overvoltage trip. On the contrary, if the frequency fall rate is too low, the time required for the output frequency to match the motor speed (duration of current limiting action) may be prolonged, triggering the inverter overload prevention control.

F15, F16, Frequency Limiter (High and Low)  
H63 Low Limiter (Mode selection)

F15 and F16 specify the upper and lower limits of the output frequency, respectively.  
H63 specifies the operation to be carried out when the reference frequency drops below the low level specified by F16, as follows:

- If H63 = 0, the output frequency will be held at the low level specified by F16.
- If H63 = 1, the inverter decelerates to stop the motor.



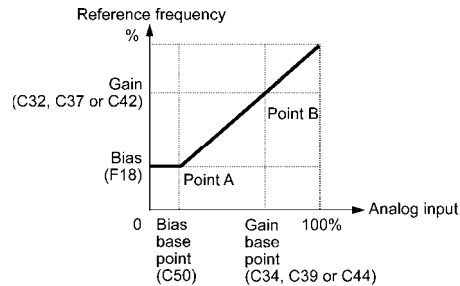
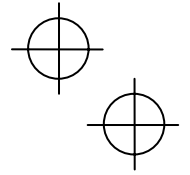
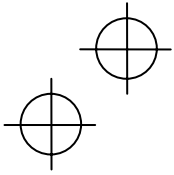
- Note**
- When you change the frequency limiter (High) (F15) in order to raise the reference frequency, be sure to change the maximum frequency (F03) accordingly.
  - Maintain the following relationship among the data for frequency control:  
 $F15 > F16$ ,  $F15 > F23$ , and  $F15 > F25$   
 $F03 > F16$   
 where, F23 and F25 specify the starting and stop frequencies, respectively.  
 If you specify any wrong data for these function codes, the inverter may not run the motor at the desired speed, or cannot start it normally.

F18, Bias (Frequency command 1)  
C50 Bias (for Frequency 1) (Bias base point)  
C32, C34 Analog Input Adjustment for [12] (Gain, Gain base point)  
C37, C39 Analog Input Adjustment [C1] (Gain, Gain base point)  
C42, C44 Analog Input Adjustment [V2] (Gain, Gain base point)  
C35, C45 Analog Input Adjustment for [12] and [V2] (Polarity)

When any analog input for frequency command 1 (F01) is used, it is possible to define the relationship between the analog input and the reference frequency by multiplying the gain and adding the bias specified by F18. Terminals [12] and [V2] can be used for bipolar input (-10 V to +10 V) by polarity setting.

Gain and bias for frequency command 1

Terminal	Bias	Bias base point	Gain	Gain base point	Polarity
		-100.00 to 100.00	0.00 to 200.00	0.00 to 200.00	0.00 to 100.00
12	F18	C50	C32	C34	C35
C1			C37	C39	—
V2			C42	C44	C45



- In the case of unipolar input (terminal [12] with C35 = 1, terminal [C1], terminal [V2] with C45 = 1)

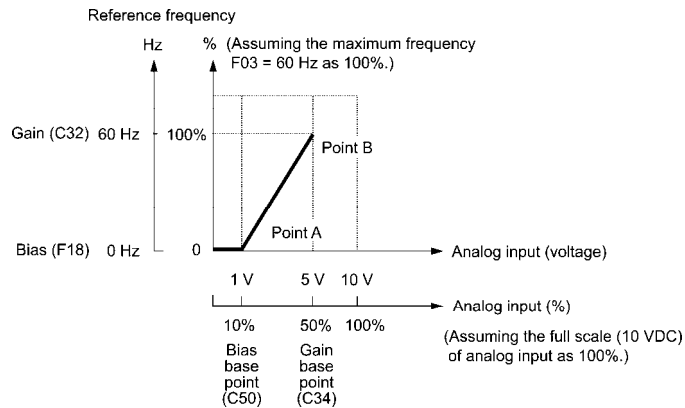
As shown in the graph above, the relationship between the analog input and the reference frequency specified by frequency command 1 can arbitrarily be determined by points "A" and "B." Point "A" is defined by the combination of the bias (F18) and its base point (C50); Point "B," by the combination of the gain (C32, C37 or C42) and its base point (C34, C39 or C44).

The combination of C32 and C34 applies to terminal [12], that of C37 and C39, to [C1] (C1 function), and that of C42 and C44, to [C1] (V2 function).

Configure the bias (F18) and gain (C32, C37 or C42), assuming the maximum frequency as 100%, and the bias base point (C50) and gain base point (C34, C39 or C44), assuming the full scale (10 VDC or 20 mA DC) of analog input as 100%.

- The analog input less than the bias base point (C50) is limited by the bias value (F18).
- Specifying that the data of the bias base point (C50) is equal to or greater than that of each gain base point (C34, C39 or C44) will be interpreted as invalid, so the inverter will reset the reference frequency to 0 Hz.

Example: Setting the bias, gain and their base points when the reference frequency 0 to 60 Hz follows the analog input of 1 to 5 VDC to terminal [12] (in frequency command 1).



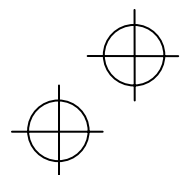
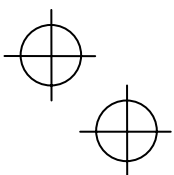
(Point A)

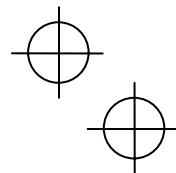
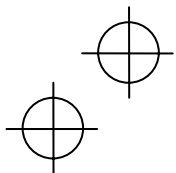
To set the reference frequency to 0 Hz for an analog input being at 1 V, set the bias to 0% (F18 = 0). Since 1 V is the bias base point and it is equal to 10% of 10 V (full scale of terminal [12]), set the bias base point to 10% (C50 = 10).

(Point B)

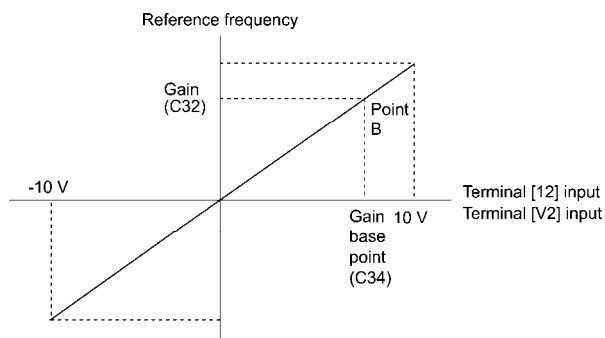
To make the maximum frequency equal to the reference frequency for an analog input being at 5 V, set the gain to 100% (C32 = 100). Since 5 V is the gain base point and it is equal to 50% of 10 V (full scale of terminal [12]), set the gain base point to 50% (C34 = 50).

- The setting procedure for specifying a gain or bias alone without changing any base points is the same as that of Fuji conventional inverters of FRENIC5000G11S/P11S series, FVR-E11S series, etc.





■ In the case of bipolar input (terminal [12] with C35 = 0, terminal [V2] with C45 = 0)  
 Setting C35 and C45 data to "0" enables terminal [12] and [V2] to be used for bipolar input (-10 V to +10 V) respectively.  
 When both F18 (Bias) and C50 (Bias base point) are set to "0," the negative and positive voltage inputs produce reference frequencies symmetric about the origin point as shown below.




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**F20 to F22, DC Braking 1 (Braking starting frequency, Braking level, and Braking time)**  
**H95 DC Braking (Braking response mode)**

---

F20 through F22 specify the DC braking that prevents motor 1 from running by inertia during decelerate-to-stop operation.

If the motor enters a decelerate-to-stop operation by turning OFF the run command or by decreasing the reference frequency below the stop frequency, the inverter activates the DC braking by flowing a current at the braking level (F21) during the braking time (F22) when the output frequency goes down to the DC braking starting frequency (F20).

Setting the braking time to "0.0" (F22 = 0) disables the DC braking.

■ **Braking starting frequency (F20)**

F20 specifies the frequency at which the DC braking starts its operation during motor decelerate-to-stop state.

■ **Braking level (F21)**

F21 specifies the output current level to be applied when the DC braking is activated. The function code data should be set, assuming the rated output current of the inverter as 100%, in increments of 1%.

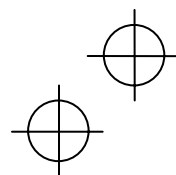
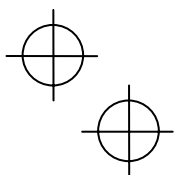
■ **Braking time (F22)**

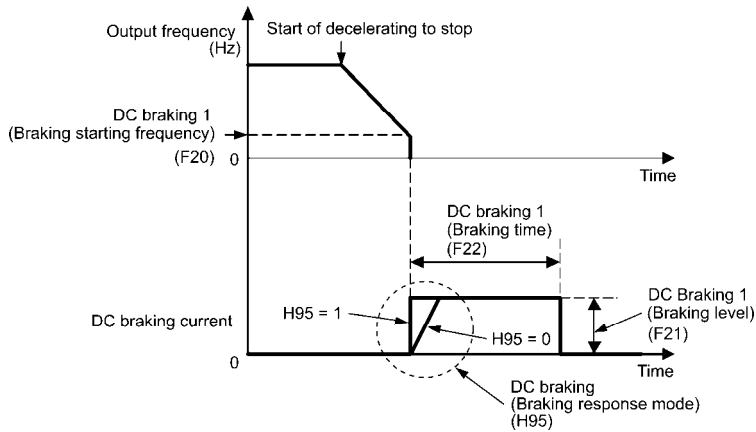
F22 specifies the braking period that activates DC braking.

■ **Braking response mode (H95)**

H95 specifies the DC braking response mode.

Data for H95	Characteristics	Note
0	Slow response. Slows the rising edge of the current, thereby preventing reverse rotation at the start of DC braking.	Insufficient braking torque may result at the start of DC braking.
1	Quick response. Quickens the rising edge of the current, thereby accelerating the build-up of the braking torque.	Reverse rotation may result depending on the moment of inertia of the mechanical load and the coupling mechanism.





**Tip** It is also possible to use an external digital input signal as an "Enable DC braking" terminal command **DCBRK**.  
 As long as the **DCBRK** command is ON, the inverter performs DC braking, regardless of the braking time specified by F22.  
 Turning the **DCBRK** command ON even when the inverter is in a stopped state activates the DC braking. This feature allows the motor to be excited before starting, resulting in smoother acceleration (quicker build-up of acceleration torque) (under V/f control).

**Note** In general, specify data of function code F20 at a value close to the rated slip frequency of motor. If you set it at an extremely high value, control may become unstable and an overvoltage alarm may result in some cases.

**⚠ CAUTION**

The DC brake function of the inverter does not provide any holding mechanism.  
**Injuries could occur.**

F23	Starting Frequency 1
F24	Starting Frequency 1 (Holding time)
F25	Stop Frequency
F39	Stop Frequency (Holding time)

At the startup of an inverter, the initial output frequency is equal to the starting frequency 1 specified by F23. The inverter stops its output when the output frequency reaches the stop frequency specified by F25.

Set the starting frequency to a level at which the motor can generate enough torque for startup. Generally, set the motor's rated slip frequency as the starting frequency.

In addition, F24 specifies the holding time for the starting frequency 1 in order to compensate for the delay time for the establishment of a magnetic flux in the motor. F39 specifies the holding time for the stop frequency in order to stabilize the motor speed at the stop of the inverter.

■ Starting frequency 1 (F23)

F23 specifies the starting frequency at the startup of an inverter.

Under V/f control, even if the starting frequency is set at 0.0 Hz, the inverter starts at 0.1 Hz.

■ Starting frequency 1 (Holding time) (F24)

F24 specifies the holding time for the starting frequency 1.

■ Stop frequency (F25)

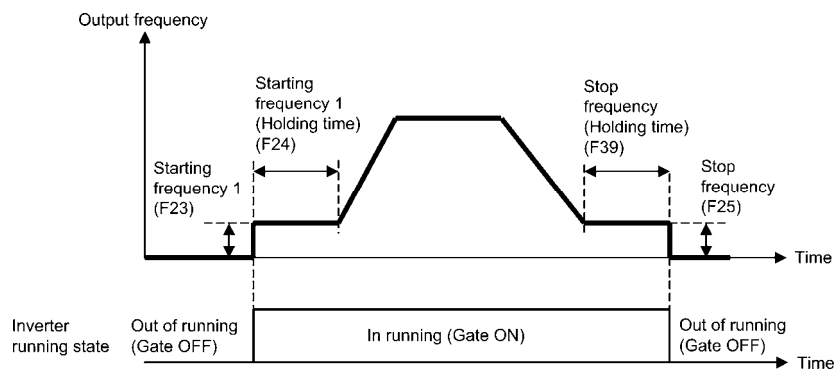
F25 specifies the stop frequency at the stop of the inverter.

Under V/f control, even if the stop frequency is set at 0.0 Hz, the inverter stops at 0.1 Hz.

■ Stop frequency (Holding time) (F39)

F39 specifies the holding time for the stop frequency.

**Note** If the starting frequency is lower than the stop frequency, the inverter will not output any power as long as the reference frequency does not exceed the stop frequency.



F26 Motor Sound (Carrier frequency)

F26 controls the carrier frequency so as to reduce an audible noise generated by the motor or electromagnetic noise from the inverter itself, and to decrease a leakage current from the main output (secondary) wirings.

Item	Characteristics	Remarks
Carrier frequency	0.75 to 16 kHz	0.4 to 55 kW (HD mode) 5.5 to 18.5 kW (LD mode)
	0.75 to 10 kHz	75 kW (HD mode) 22 to 55 kW (LD mode)
	0.75 to 6 kHz	75 kW (LD mode)
Motor sound noise emission	High ↔ Low	
Motor temperature (due to harmonics components)	High ↔ Low	
Ripples in output current waveform	Large ↔ Small	
Leakage current	Low ↔ High	
Electromagnetic noise emission	Low ↔ High	
Inverter loss	Low ↔ High	

**Note** Specifying a too low carrier frequency will cause the output current waveform to have a large amount of ripples. As a result, the motor loss increases, causing the motor temperature to rise. Furthermore, the large amount of ripples tends to cause a current limiting alarm. When the carrier frequency is set to 1 kHz or below, therefore, reduce the load so that the inverter output current comes to be 80% or less of the rated current.

When a high carrier frequency is specified, the temperature of the inverter may rise due to a surrounding temperature rise or an increase of the load. If it happens, the inverter automatically decreases the carrier frequency to prevent the inverter overload alarm  $0 / u$ . With consideration for motor noise, the automatic reduction of carrier frequency can be disabled. Refer to the description of H98.

F29 to F31  
 F32, F34, Analog Output [FM1] and [FM2] (Mode selection, Voltage adjustment, Function)  
 F35

These function codes allow terminals [FM1] and [FM2] to output monitored data such as the output frequency and the output current in an analog DC voltage or current. The magnitude of such analog voltage or current is adjustable.

■ Mode selection (F29 and F32)

F29 and F32 specify the property of the output to terminals [FM1] and [FM2], respectively. You need to set the slide switches on the control printed circuit board (control PCB). Refer to Chapter 2 "Mounting and Wiring of the Inverter."

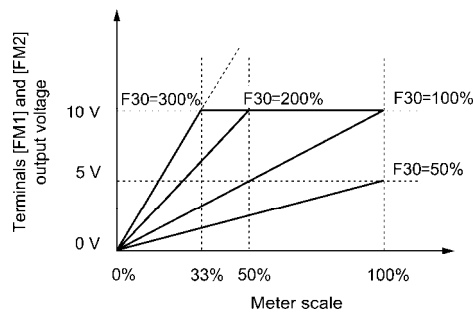
Output form	Terminal [FM1]		Terminal [FM2]	
	Data for F29	Position of slide switch SW4 on the control PCB	Data for F32	Position of slide switch SW6 on the control PCB
Voltage (0 to +10 VDC)	0	VO1	0	VO2
Current (4 to +20 mA DC)	1	IO1	1	IO2

**Note** The output current is not isolated from analog input, and does not have an isolated power supply. Therefore, if an electrical potential relationship between the inverter and peripheral equipment has been established, e.g., by connecting an analog, cascade connection of a current output device is not available.

Keep the connection wire length as short as possible.

■ Voltage adjustment (F30 and F34)

F30 allows you to adjust the output voltage within the range of 0 to 300%.



■ Function (F31 and F35)

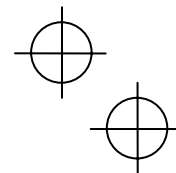
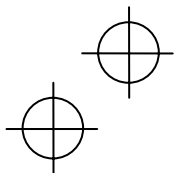
F31 specifies what is output to analog output terminals [FM1] and [FM2].

Data for F31/F35	[FM1]/[FM2] output	Function (Monitor the following)	Meter scale (Full scale at 100%)
0	Output frequency (before slip compensation)	Output frequency of the inverter (Equivalent to the motor synchronous speed)	Maximum frequency (F03)
1	Output frequency (after slip compensation)	Output frequency of the inverter	Maximum frequency (F03)
2	Output current	Output current (RMS) of the inverter	Twice the inverter rated current
3	Output voltage	Output voltage (RMS) of the inverter	250 V for 200 V class series, 500 V for 400 V class series
4	Output torque	Motor shaft torque	Twice the rated motor torque



Data for F31/F35	[FM1]/[FM2] output	Function (Monitor the following)	Meter scale (Full scale at 100%)
5	Load factor	Load factor (Equivalent to the indication of the load meter)	Twice the rated motor load
6	Input power	Input power of the inverter	Twice the rated output of the inverter
7	PID feedback amount	Feedback amount under PID control	100% of the feedback amount
8	PG feedback value (speed)	Speed detected through the PG interface, or estimated speed	Maximum speed as 100%
9	DC link bus voltage	DC link bus voltage of the inverter	500 V for 200 V class series, 1000 V for 400 V class series
10	Universal AO	Command via communications link (Refer to the RS-485 Communication User's Manual.)	20000 as 100%
13	Motor output	Motor output (kW)	Twice the rated motor output
14	Calibration	Full scale output of the meter calibration	This always outputs the full-scale (100%).
15	PID command (SV)	Command value under PID control	100% of the feedback amount
16	PID output (MV)	Output level of the PID controller under PID control (Frequency command)	Maximum frequency (F03)

**Note** If F31/F35 = 16 (PID output), J01 = 3 (Dancer control), and J62 = 2 or 3 (Ratio compensation enabled), the PID output is equivalent to the ratio against the primary reference frequency and may vary within  $\pm 300\%$  of the frequency. The monitor displays the PID output in a converted absolute value. To indicate the value up to the full-scale of 300%, set F30/F34 data to "33" (%).




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F40, F41	Torque Limiter 1-1, Torque Limiter 1-2
E16, E17	Torque Limiter 2-1, Torque Limiter 2-2
H73, H76	Torque Limiter (Operating conditions, Frequency increment limit for braking)

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If the inverter's output torque exceeds the specified levels of the torque limiters (F40, F41, E16, and E17), the inverter controls the output frequency and limits the output torque for preventing a stall.

H73 specifies whether the torque limiter is enabled or disabled during acceleration/deceleration and running at constant speed.

In braking, the inverter increases the output frequency to limit the output torque. Depending on the conditions during operation, the output frequency could dangerously increase. H76 (Frequency increment limit for braking) is provided to limit the increasing frequency component.

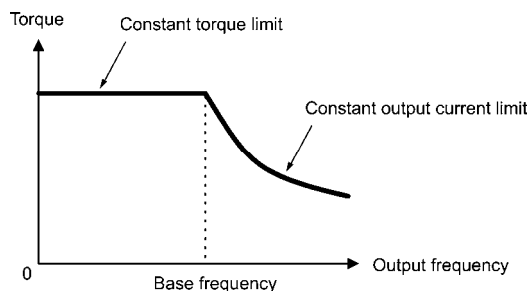
■ Torque limiter 1-1, 1-2, 2-1 and 2-2 (F40, F41, E16 and E17)

These function codes specify the operation level at which the torque limiters become activated, as the percentage of the motor rated torque.

Function code	Name	Torque limit feature
F40	Torque limiter 1-1	Driving torque current limiter 1
F41	Torque limiter 1-2	Braking torque current limiter 1
E16	Torque limiter 2-1	Driving torque current limiter 2
E17	Torque limiter 2-2	Braking torque current limiter 2

Torque current limit: Equivalent to limiting torque current flowing across the motor.

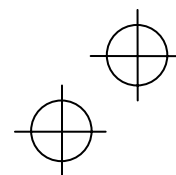
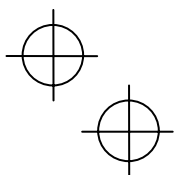
The graph below shows relationship between the torque and the output frequency at the constant torque current limit.



**Tip** To switch between torque limiter 1 and torque limiter 2, use the terminal command **TL2/TL1** assigned to any of the digital input terminals. (Refer to the descriptions of E01 through E07.)

**Note** Although the data setting range for F40, F41, E16, and E17 is from positive to negative values (-300% to +300%), specify positive values in practice. If a negative value is specified, the inverter interprets it as an absolute value.

The torque limiter determined depending on the overload current actually limits the torque current output. Therefore, the torque current output is automatically limited at a value lower than 300%, the maximum setting value.



■ Torque limiter (Operating conditions) (H73)

H73 specifies whether the torque limiter is enabled or disabled during acceleration/deceleration and running at constant speed.

Data for H73	During accelerating/decelerating	During running at constant speed
0	Enable	Enable
1	Disable	Enable
2	Enable	Disable

■ Torque limiter (Frequency increment limit for braking) (H76)

H76 specifies the increment limit of the frequency in limiting torque for braking. The factory default is 5.0 Hz. If the increasing frequency during braking reaches the limit value, the torque limiters no longer function, resulting in an overvoltage trip. Such a problem may be avoided by increasing the setting of H76.

**Note** The torque limiter and current limiter are very similar function each other. If both are activated concurrently, they may conflict each other and cause hunting in the system. Avoid concurrent activation of these limiters.

**F42** Drive Control Selection 1  
**H68** Slip Compensation 1 (Operating conditions)

F42 specifies the motor drive control.

Data for F42	Drive control	Basic control	Speed feedback	Speed control
0	V/f control with slip compensation inactive	V/f control	Disable	Frequency control
1	Dynamic torque vector control (with slip compensation and auto torque boost)			Frequency control with slip compensation
2	V/f control with slip compensation active			
5	Vector control without speed sensor	Vector control	Speed estimation	Speed control with speed regulator
6	Vector control with speed sensor		Enable	

For details about the motor drive control, refer to Chapter 4 "RUNNING THE MOTOR."

**F43, F44** Current Limiter (Mode selection, Level)  
**H12** Instantaneous Overcurrent Limiting (Mode selection)

When the output current of the inverter exceeds the level specified by the current limiter (F44), the inverter automatically manages its output frequency to prevent a stall and limit the output current.

The default setting is 160% and 130% for HD-mode inverters and LD-mode inverters respectively. (Once the HD-mode or LD-mode is selected by F80, the current limit for each mode is automatically specified.)

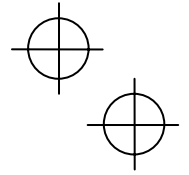
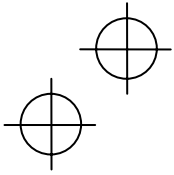
If 160% (or 130%) or over of overcurrent instantaneously flows and the output frequency decreases by this current limit that is undesired, consider increasing the current limit level.

If F43 = 1, the current limiter is enabled only during constant speed operation. If F43 = 2, the current limiter is enabled during both of acceleration and constant speed operation. Choose F43 = 1 if you need to run the inverter at full capability during acceleration and to limit the output current during constant speed operation.

■ Mode selection (F43)

F43 selects the motor running state in which the current limiter will be active.

Data for F43	Running states that enable the current limiter		
	During acceleration	During constant speed	During deceleration
0	Disable	Disable	Disable
1	Disable	Enable	Disable
2	Enable	Enable	Disable



■ Level (F44)

F44 specifies the operation level at which the output current limiter becomes activated, in ratio to the inverter rating.

■ Instantaneous Overcurrent Limiting (Mode selection) (H12)

H12 specifies whether the inverter invokes the current limit processing or enters the overcurrent trip when its output current exceeds the instantaneous overcurrent limiting level. Under the current limit processing, the inverter immediately turns OFF its output gate to suppress the further current increase and continues to control the output frequency

Data for H12	Function
0	Disable An overcurrent trip occurs at the instantaneous overcurrent limiting level.
1	Enable

If any problem occurs in use of the equipment or machine is expected when the motor torque temporarily drops during current limiting processing, it is necessary to cause an overcurrent trip (H12 = 0) and actuate a mechanical brake at the same time.

- Note**
- Since the current limit operation with F43 and F44 is performed by software, it may cause a delay in control. If you need a quick response current limiting, also enable the instantaneous overcurrent limiting with H12.
  - If an excessive load is applied when the current limiter operation level is set extremely low, the inverter will rapidly lower its output frequency. This may cause an overvoltage trip or dangerous turnover of the motor rotation due to undershooting. Depending on the load, extremely short acceleration time may activate the current limiting to suppress the increase of the inverter output frequency, causing the system oscillation (hunting) or activating the inverter overvoltage trip (alarm *ou* ). When specifying the acceleration time, therefore, you need to take into account machinery characteristics and moment of inertia of the load.
  - The torque limiter and current limiter are very similar function each other. If both are activated concurrently, they may conflict each other and cause hunting in the system. Avoid concurrent activation of these limiters.

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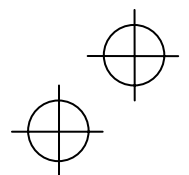
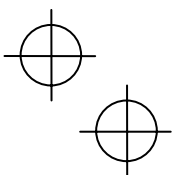
**F50 to F52** Electronic Thermal Overload Protection for Braking Resistor  
(Discharging capability, Allowable average loss and Resistance)

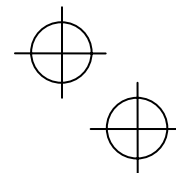
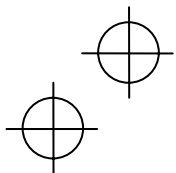
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These function codes specify the electronic thermal overload protection feature for the braking resistor. Set the discharging capability, allowable average loss and resistance to F50, F51 and F52, respectively. These values are determined by the inverter and braking resistor models. For the discharging capability, allowable average loss and resistance, refer to FRENIC-MEGA User's Manual, Chapter 4 "SELECTING PERIPHERAL EQUIPMENT." The values listed in the manual are for standard models and 10% ED models of the braking resistors which Fuji Electric provides. If you use a braking resistor of other maker, confirm the corresponding values with the maker, and set the function codes accordingly.

**Note** Depending on the thermal marginal characteristics of the braking resistor, the electronic thermal overload protection feature may act so that the inverter issues the overheat protection alarm *dbh* even if the actual temperature rise is not large enough. If it happens, review the relationship between the performance index of the braking resistor and settings of related function codes.

**Tip** The standard models of braking resistor can output temperature detection signal for overheat. Assign an "Enable external alarm trip" terminal command **THR** to any of digital input terminals [X1] to [X7], [FWD] and [REV] and connect that terminal and its common terminal to braking resistor's terminals 2 and 1.





**Calculating the discharging capability and allowable average loss of the braking resistor and configuring the function code data**

When using any non-Fuji braking resistor, inquire of the resistor manufacturer about the resistor rating and then configure the related function codes.

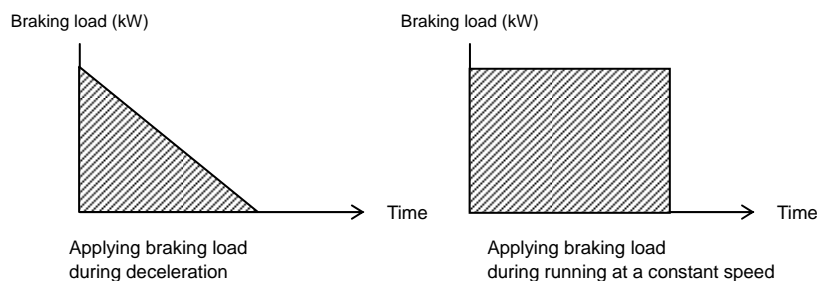
The calculation procedures for the discharging capability and allowable average loss of the braking resistor differ depending on the application of the braking load as shown below.

**Applying braking load during deceleration**

In usual deceleration, the braking load decreases as the speed slows down. In the deceleration with constant torque, the braking load decreases in proportion to the speed. Use Expressions (1) and (3) given below.

**Applying braking load during running at a constant speed**

Different from during deceleration, in applications where the braking load is externally applied during running at a constant speed, the braking load is constant. Use Expressions (2) and (4) given below.



■ Discharging capability (F50)

The discharging capability refers to kW allowable for a single braking cycle, which is obtained based on the braking time and the motor rated capacity.


Data for F50	Function
0	To be applied to the braking resistor built-in type
1 to 9000	1 to 9000 (kW)
OFF	Disable the electronic thermal overload protection

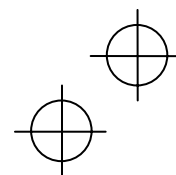
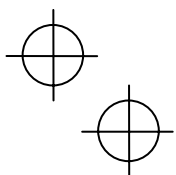
During deceleration:

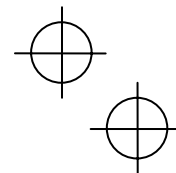
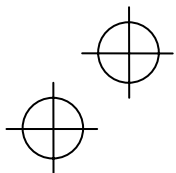
$$\text{Discharging capability (kW)} = \frac{\text{Braking time (s)} \times \text{Motor rated capacity (kW)}}{2} \quad \text{Expression (1)}$$

During running at a constant speed:

$$\text{Discharging capability (kW)} = \text{Braking time (s)} \times \text{Motor rated capacity (kW)} \quad \text{Expression (2)}$$

 When the F50 data is set to "0" (To be applied to the braking resistor built-in type), no specification of the discharging capability is required.





■ Allowable average loss (F51)

The allowable average loss refers to a tolerance for motor continuous operation, which is obtained based on the %ED (%) and motor rated capacity (kW).

Data for F51	Function
0.001 to 99.99	0.001 to 99.99 (kW)

During deceleration:

$$\text{Allowable average loss (kWs)} = \frac{\frac{\%ED(\%)}{100} \times \text{Motor rated capacity (kW)}}{2} \quad \text{Expression (3)}$$

During constant speed operation:

$$\text{Allowable average loss (kWs)} = \frac{\%ED(\%)}{100} \times \text{Motor rated capacity (kW)} \quad \text{Expression (4)}$$

■ Resistance (F52)

F52 specifies the resistance of the braking resistor.

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**F80**      Switching between HD and LD drive modes

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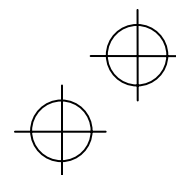
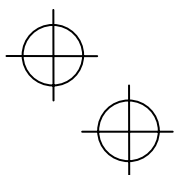
F80 specifies whether to drive the inverter in the high duty (HD) or low duty (LD) mode..

To change the F80 data, it is necessary to press the "STOP" + "▲" keys" or "STOP" + "▼" keys" (simultaneous keying).

Data for F80	Drive mode	Application	Continuous current rating level	Overload capability	Maximum frequency
0	HD (High Duty) mode (default)	Heavy load	Capable of driving a motor whose capacity is the <u>same</u> as the inverter's.	150% for 1 min. 200% for 3 s	500 Hz
1	LD (Low Duty) mode	Light load	Capable of driving a motor whose capacity is <u>one rank higher</u> than the inverter's.	120% for 1 min.	120 Hz

For details, refer to Chapter 4 "RUNNING THE MOTOR."

The LD-mode inverter brings out the rated current level which enables the inverter to drive a motor with one rank higher capacity, but its overload capability (%) against the continuous current rating level decreases. For the rated current level, see Chapter 8 "SPECIFICATIONS."



E01 to E07 Terminal [X1] to [X7] Function  
 E98, E99 Terminal [FWD] and [REV] Function

Function codes E01 to E07, E98 and E99 allow you to assign commands to terminals [X1] to [X7], [FWD], and [REV] which are general-purpose, programmable, digital input terminals.

These function codes may also switch the logic system between normal and negative to define how the inverter logic interprets either ON or OFF status of each terminal. The default setting is normal logic system "Active ON." So, explanations that follow are given in normal logic system "Active ON."

## ⚠ CAUTION

When the inverter is controlled with the digital input signals, switching run or frequency command sources with the related terminal commands (e.g., **SS1**, **SS2**, **SS4**, **SS8**, **Hz2/Hz1**, **Hz/PID**, **IVS**, and **LE**) may cause a sudden motor start or an abrupt change in speed.

**An accident or physical injury may result.**

Function code data		Terminal commands assigned	Symbol
Active ON	Active OFF		
0	1000	Select multi-frequency (0 to 15 steps)	<b>SS1</b>
1	1001		<b>SS2</b>
2	1002		<b>SS4</b>
3	1003		<b>SS8</b>
4	1004	Select ACC/DEC time (2 steps)	<b>RT1</b>
5	1005	Select ACC/DEC time (4 steps)	<b>RT2</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>
1009	9	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	<b>M2</b>
13	—	Enable DC braking	<b>DCBRK</b>
14	1014	Select torque limiter level 2/1	<b>TL2/TL1</b>
15	—	Switch to commercial power (50 Hz)	<b>SW50</b>
16	—	Switch to commercial power (60 Hz)	<b>SW60</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>
22	1022	Interlock	<b>IL</b>
24	1024	Enable communications link via RS-485 or fieldbus (option)	<b>LE</b>
25	1025	Universal DI	<b>U-DI</b>
26	1026	Enable auto search for idling motor speed at starting	<b>STM</b>
1030	30	Force to stop	<b>STOP</b>
32	1032	Pre-excitation	<b>EXITE</b>
33	1033	Reset PID integral and differential components	<b>PID-RST</b>
34	1034	Hold PID integral component	<b>PID-HLD</b>

Function code data		Terminal commands assigned	Symbol
Active ON	Active OFF		
35	1035	Select local (keypad) operation	<b>LOC</b>
36*	1036	Select motor 3	<b>M3</b>
37*	1037	Select motor 4	<b>M4</b>
39	—	Protect motor from dew condensation	<b>DWP</b>
40	—	Enable integrated sequence to switch to commercial power (50 Hz)	<b>ISW50</b>
41	—	Enable integrated sequence to switch to commercial power (60 Hz)	<b>ISW60</b>
47	1047	Servo-lock command	<b>LOCK</b>
48	—	Pulse train input (available only on terminal [X7])	<b>PIN</b>
49	1049	Pulse train sign (available on terminals except [X7])	<b>SIGN</b>
72	1072	Count the run time of commercial power-driven motor 1	<b>CRUN-M1</b>
73	1073	Count the run time of commercial power-driven motor 2	<b>CRUN-M2</b>
74	1074	Count the run time of commercial power-driven motor 3	<b>CRUN-M3</b>
75	1075	Count the run time of commercial power-driven motor 4	<b>CRUN-M4</b>
76	1076	Select droop control	<b>DROOP</b>
77	1077	Cancel PG alarm	<b>PG-CCL</b>
98	—	Run forward (Exclusively assigned to [FWD] and [REV] terminals by E98 and E99)	<b>FWD</b>
99	—	Run reverse (Exclusively assigned to [FWD] and [REV] terminals by E98 and E99)	<b>REV</b>

\* For data "36" and "37," refer to the description about data "12."

**Note** Any negative logic (Active OFF) command cannot be assigned to the functions marked with "—" in the "Active OFF" column.

The "Enable external alarm trip" and "Force to stop" are fail-safe terminal commands. For example, when data = 9 in "Enable external alarm trip," "Active OFF" (alarm is triggered when OFF); when data = 1009, "Active ON" (alarm is triggered when ON).



### Terminal function assignment and data setting

- Select multi-frequency (0 to 15 steps) -- **SS1**, **SS2**, **SS4**, and **SS8**  
(Function code data = 0, 1, 2, and 3)

The combination of the ON/OFF states of digital input signals **SS1**, **SS2**, **SS4** and **SS8** selects one of 16 different frequency commands defined beforehand by 15 function codes C05 to C19 (Multi-frequency 0 to 15). With this, the inverter can drive the motor at 16 different preset frequencies.

The table below lists the frequencies that can be obtained by the combination of switching **SS1**, **SS2**, **SS4** and **SS8**. In the "Function code to specify multi-frequency" column, "Other than multi-frequency" represents the reference frequency sourced by frequency command 1 (F01), frequency command 2 (C30), or others.

<b>SS8</b>	<b>SS4</b>	<b>SS2</b>	<b>SS1</b>	Function code to specify multi-frequency
OFF	OFF	OFF	OFF	None (Other than multi-frequency)
OFF	OFF	OFF	ON	C05 (Multi-frequency 1)
OFF	OFF	ON	OFF	C06 (Multi-frequency 2)
OFF	OFF	ON	ON	C07 (Multi-frequency 3)
OFF	ON	OFF	OFF	C08 (Multi-frequency 4)
OFF	ON	OFF	ON	C09 (Multi-frequency 5)
OFF	ON	ON	OFF	C10 (Multi-frequency 6)
OFF	ON	ON	ON	C11 (Multi-frequency 7)
ON	OFF	OFF	OFF	C12 (Multi-frequency 8)
ON	OFF	OFF	ON	C13 (Multi-frequency 9)
ON	OFF	ON	OFF	C14 (Multi-frequency 10)
ON	OFF	ON	ON	C15 (Multi-frequency 11)
ON	ON	OFF	OFF	C16 (Multi-frequency 12)
ON	ON	OFF	ON	C17 (Multi-frequency 13)
ON	ON	ON	OFF	C18 (Multi-frequency 14)
ON	ON	ON	ON	C19 (Multi-frequency 15)

- Select ACC/DEC time -- **RT1** and **RT2** (Function code data = 4 and 5)

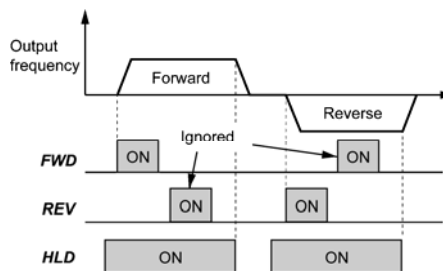
These terminal commands switch between ACC/DEC times 1 to 4 (F07, F08 and E10 through E15). For details, refer to the descriptions of F07 and F08.

- Enable 3-wire operation -- **HLD** (Function code data = 6)

Turning this terminal command ON self-holds the forward **FWD** or reverse **REV** run command, to enable 3-wire inverter operation.

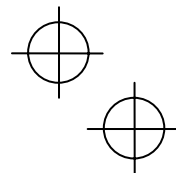
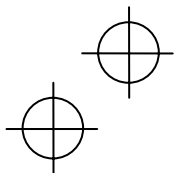
Short-circuiting the terminals between **HLD** and [CM] (i.e., when **HLD** is ON) self-holds the first **FWD** or **REV** command at its rising edge. Turning **HLD** OFF releases the self-holding.

When **HLD** is not assigned, 2-wire operation involving only **FWD** and **REV** takes effect.



- Coast to a stop -- **BX** (Function code data = 7)

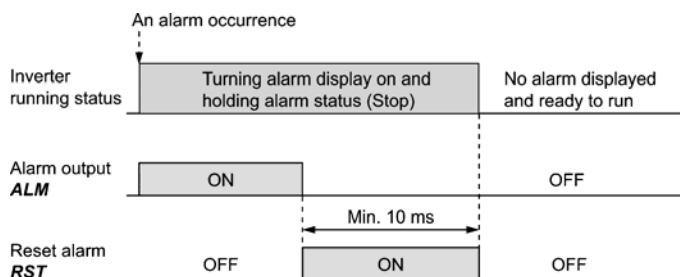
Turning this terminal command ON immediately shuts down the inverter output so that the motor coasts to a stop without issuing any alarms.



■ Reset alarm -- **RST** (Function code data = 8)

Turning this terminal command ON clears the **ALM** state--alarm output (for any fault). Turning it OFF erases the alarm display and clears the alarm hold state.

When you turn the **RST** command ON, keep it ON for 10 ms or more. This command should be kept OFF for the normal inverter operation.



■ Enable external alarm trip -- **THR** (Function code data = 9)

Turning this terminal command OFF immediately shuts down the inverter output (so that the motor coasts to a stop), displays the alarm *Oh2*, and outputs the alarm relay (for any fault) **ALM**. The **THR** command is self-held, and is reset when an alarm reset takes place.



Use this alarm trip command from external equipment when you have to immediately shut down the inverter output in the event of an abnormal situation in peripheral equipment.

■ Ready for jogging -- **JOG** (Function code data = 10)

This terminal command is used to jog or inch the motor for positioning a work piece.

Turning this command ON makes the inverter ready for jogging.

Simultaneous keying "STOP + RUN" keys" on the keypad is functionally equivalent to this command; however, it is restricted by the run command source as listed below.

When the run command source is the keypad (F02 = 0, 2 or 3):

Terminal command <b>JOG</b>	STOP + RUN keys on the keypad	Inverter running state
ON	—	Ready for jogging
OFF	Pressing these keys toggles between the "normal operation" and "ready for jogging."	Normal operation Ready for jogging

When the run command source is digital input (F02 = 1):

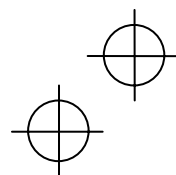
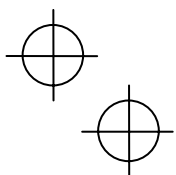
Terminal command <b>JOG</b>	STOP + RUN keys on the keypad	Inverter running state
ON	Disable	Ready for jogging
OFF		Normal operation

Jogging operation

Pressing the RUN key or turning the **FWD** or **REV** terminal command ON starts jogging.

For the jogging by the keypad, the inverter jogs only when the RUN key is held down. Releasing the RUN key decelerates to stop.

During jogging, the frequency specified by C20 (Jogging Frequency) and the acceleration/deceleration time specified by H54 and H55 (ACC/DEC Time) apply.



- Note**
- The inverter's status transition between "ready for jogging" and "normal operation" is possible only when the inverter is stopped.
  - To start jogging operation with the **JOG** terminal command and a run command (e.g., **FWD**), the input of the **JOG** should not be delayed 100 ms or more from that of the run command. If the delay exceeds 100 ms, the inverter does not jog the motor but runs it ordinarily until the next input of the **JOG**.

■ Select frequency command 2/1 -- **H<sub>z2</sub>/H<sub>z1</sub>** (Function code data = 11)

Turning this terminal command ON and OFF switches the frequency command source between frequency command 1 (F01) and frequency command 2 (C30).

If no **H<sub>z2</sub>/H<sub>z1</sub>** terminal command is assigned, the frequency sourced by F01 takes effect by default.

Terminal command <b>H<sub>z2</sub>/H<sub>z1</sub></b>	Frequency command source
OFF	Follow F01 (Frequency command 1)
ON	Follow C30 (Frequency command 2)

For details of other frequency command sources, refer to the block diagrams in Chapter 6 in FRENIC-MEGA User's Manual.

■ Select motor 2, 3 and 4 -- **M<sub>2</sub>**, **M<sub>3</sub>**, and **M<sub>4</sub>** (Function code data = 12, 36 and 37)

The combination of digital input terminal commands **M<sub>2</sub>**, **M<sub>3</sub>** and **M<sub>4</sub>** switches to any of the 1st to 4th motors. When the motor is switched, the function code group with which the inverter drives the motor is also switched to the one corresponding to the motor.

Terminal command			Inverter driven motor selected (Function code group enabled)	Output signal			
<b>M<sub>2</sub></b>	<b>M<sub>3</sub></b>	<b>M<sub>4</sub></b>		<b>SWM1</b>	<b>SWM2</b>	<b>SWM3</b>	<b>SWM4</b>
OFF	OFF	OFF	1st Motor (Default codes)	ON	OFF	OFF	OFF
ON	-	-	2nd Motor (A codes)	OFF	ON	OFF	OFF
OFF	ON	-	3rd Motor (b codes)	OFF	OFF	ON	OFF
OFF	OFF	ON	4th Motor (r codes)	OFF	OFF	OFF	ON

Switching the motors automatically switches the applicable function code group. The inverter drives the motor with those function codes. For details of precautions for switching motors and of applicable function codes, refer to the description of A42.

■ Enable DC braking -- **DCBRK** (Function code data = 13)

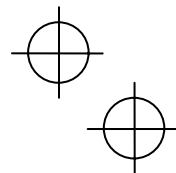
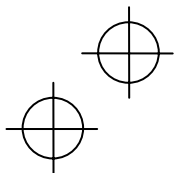
This terminal command gives the inverter a DC braking command through the inverter's digital input. (Refer to the descriptions of F20 to F22 for DC braking.)

■ Select torque limiter level 2/1 -- **TL<sub>2</sub>/TL<sub>1</sub>** (Function code data = 14)

This terminal command switches between torque limiter (F40 and F41) and torque limiter 2 (E16 and E17) as listed below.

If no **TL<sub>2</sub>/TL<sub>1</sub>** terminal command is assigned, torque limiter levels 1-1 and 1-2 (F40 and F41) take effect by default.

Terminal command <b>TL<sub>2</sub>/TL<sub>1</sub></b>	Torque limiter level
OFF	Torque limiter levels 1-1 and 1-2 (F40 and F41)
ON	Torque limiter levels 2-1 and 2-2 (E16 and E17)



■ Switch to commercial power for 50 Hz or 60 Hz -- **SW50** and **SW60** (Function code data = 15 and 16)

When an external sequence switches the motor drive power from the commercial line to the inverter, inputting the terminal command **SW50** or **SW60** at the specified timing enables the inverter to start running the motor with the current commercial power frequency, regardless of settings of the reference/output frequency in the inverter. A running motor driven by commercial power is carried on into inverter operation. This command helps you smoothly switch the motor drive power source, when the motor is being driven by commercial power, from the commercial power to the inverter power.

📖 For details, refer to Chapter 5 in FRENIC-MEGA User's Manual.

■ UP (Increase output frequency) and DOWN (Decrease output frequency) commands -- **UP** and **DOWN** (Function code data = 17, and 18)

- Frequency setting

When the **UP/DOWN** control is selected for frequency setting with a run command ON, turning the **UP** or **DOWN** terminal command ON causes the output frequency to increase or decrease, respectively, within the range from 0 Hz to the maximum frequency as listed below.

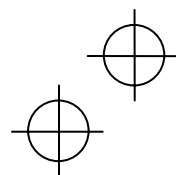
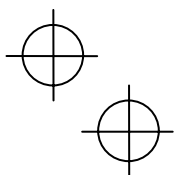
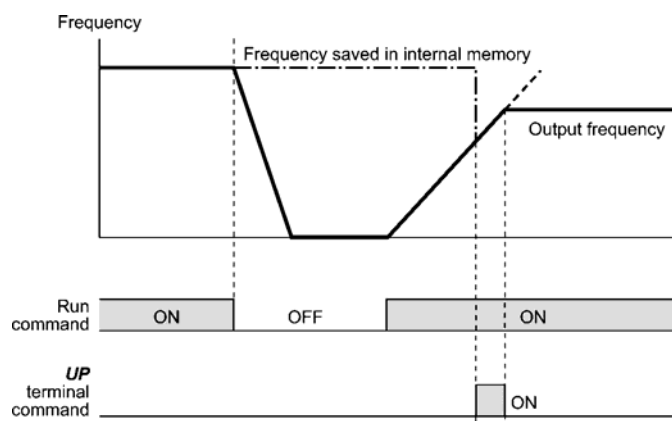
<b>UP</b> Data = 17	<b>DOWN</b> Data = 18	Function
OFF	OFF	Keep the current output frequency.
ON	OFF	Increase the output frequency with the acceleration time currently specified.
OFF	ON	Decrease the output frequency with the deceleration time currently specified.
ON	ON	Keep the current output frequency.

The **UP/DOWN** control is available in two modes--one mode (H61 = 0) in which the initial value of the reference frequency is fixed to "0.00" at the start of the **UP/DOWN** control and the other mode (H61 = 1) in which the reference frequency applied in the previous **UP/DOWN** control applies as the initial value.

When H61 = 0, the reference frequency applied by the previous **UP/DOWN** control has been cleared to "0," so at the next restart (including powering ON), use the **UP** terminal command to accelerate the speed as needed.

When H61 = 1, the inverter internally holds the current output frequency set by the **UP/DOWN** control and applies the held frequency at the next restart (including powering ON).

**Note** At the time of restart, if an **UP** or **DOWN** terminal command is entered before the internal frequency reaches the output frequency saved in the memory, the inverter saves the current output frequency into the memory and starts the **UP/DOWN** control with the new frequency. Pressing one of these keys overwrites the frequency held in the inverter.



Initial frequency for the **UP/DOWN** control when the frequency command source is switched

When the frequency command source is switched to the **UP/DOWN** control from other sources, the initial frequency for the **UP/DOWN** control is as listed below:

Frequency command source	Switching command	Initial frequency for <b>UP/DOWN</b> control	
		H61 = 0	H61 = 1
Other than <b>UP/DOWN</b> (F01, C30)	Select frequency command 2/1 ( <b>Hz2/Hz1</b> )	Reference frequency given by the frequency command source used just before switching	
PID control	Cancel PID control ( <b>Hz/PID</b> )	Reference frequency given by PID control (PID controller output)	
Multi-frequency	Select multi-frequency ( <b>SS1, SS2, SS4 and SS8</b> )	Reference frequency given by the frequency command source used just before switching	Reference frequency at the time of previous UP/DOWN control
Communications link	Enable communications link via RS-485 or fieldbus ( <b>LE</b> )	Reference frequency at the time of previous UP/DOWN control	

**Note** To enable the **UP** and **DOWN** terminal commands, you need to set frequency command 1 (F01) or frequency command 2 (C30) to "7" beforehand.

■ Enable data change with keypad -- **WE-KP** (Function code data = 19)

Turning this terminal command OFF disables changing of function code data from the keypad.

Only when this command is ON, you can change function code data from the keypad according to the setting of function code F00 as listed below.

Terminal command <b>WE-KP</b>	F00	Function
OFF	—	Disable editing of all function code data except that of F00.
ON	0, 2	Enable editing of all function code data
	1, 3	Inhibit editing of all function code data except that of F00

If the **WE-KP** command is not assigned to any terminal, the inverter will interpret **WE-KP** to be always ON by default.

- Note**
- If you mistakenly assign a **WE-KP** terminal command, you no longer edit or modify function code data. In such a case, temporarily turn this **WE-KP**-assigned terminal ON and reassign the **WE-KP** terminal command to a correct command.
  - **WE-KP** is only a signal that permits you to change function code data, so it does not protect the frequency settings specified by the  $\Delta$  and  $\nabla$  keys or PID command.

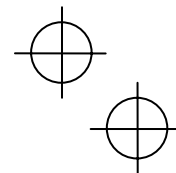
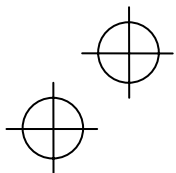
■ Cancel PID control -- **Hz/PID** (Function code data = 20)

Turning this terminal command ON disables the PID control.

If the PID control is disabled with this command, the inverter runs the motor with the reference frequency manually set by any of the multi-frequency, keypad, analog input, etc.

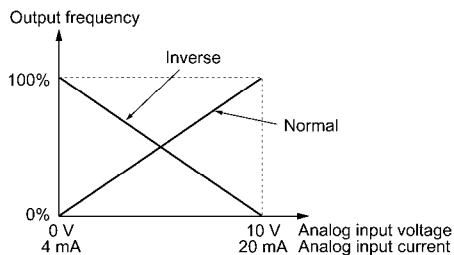
Terminal command <b>Hz/PID</b>	Function
OFF	Enable PID control
ON	Disable PID control/Enable manual frequency settings

(Refer to the descriptions of J codes.)



■ Switch normal/inverse operation -- **IVS** (Function code data = 21)

This terminal command switches the output frequency control between normal (proportional to the input value) and inverse in analog frequency setting or under PID process control. To select the inverse operation, turn the **IVS ON**.



**Tip** The normal/inverse switching operation is useful for air-conditioners that require switching between cooling and heating. In cooling, the speed of the fan motor (output frequency of the inverter) is increased to lower the temperature. In heating, it is reduced to lower the temperature. This switching is realized by this **IVS** terminal command.

- When the inverter is driven by an external analog frequency command sources (terminals [12], [C1] and [V2]):

Switching normal/inverse operation can apply only to the analog frequency command sources (terminals [12], [C1] and [V2]) in frequency command 1 (F01) and does not affect frequency command 2 (C30) or UP/DOWN control.

As listed below, the combination of the "Selection of normal/inverse operation for frequency command 1" (C53) and the **IVS** terminal command determines the final operation.

Combination of C53 and **IVS**

Data for C53	<b>IVS</b>	Final operation
0: Normal operation	OFF	Normal
	ON	Inverse
1: Inverse operation	OFF	Inverse
	ON	Normal

■ Interlock -- **IL** (Function code data = 22)

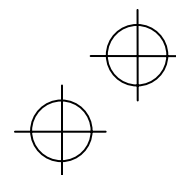
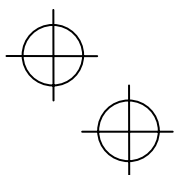
In a configuration where a magnetic contactor (MC) is installed in the power output (secondary) circuit of the inverter, the momentary power failure detection feature provided inside the inverter may not be able to accurately detect a momentary power failure by itself. Using a digital signal input with the interlock command **IL** assures the accurate detection. (For details, refer to the description of F14.)

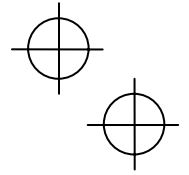
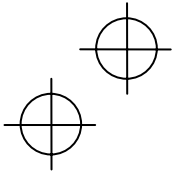
Terminal command <b>IL</b>	Meaning
OFF	No momentary power failure has occurred.
ON	A momentary power failure has occurred. (Restart after a momentary power failure enabled)

■ Enable communications link via RS-485 or fieldbus (option)-- **LE** (Function code data = 24)

Turning this terminal command ON gives priorities to frequency commands or run commands received via the RS-485 communications link (H30) or the fieldbus option (y98).


No **LE** assignment is functionally equivalent to the **LE** being ON. (Refer to the descriptions of H30 (Communications link function) and y98 (Bus link function).)





■ Universal DI -- **U-DI** (Function code data = 25)

Using **U-DI** enables the inverter to monitor digital signals sent from the peripheral equipment via an RS-485 communications link or a fieldbus option by feeding those signals to the digital input terminals. Signals assigned to the universal DI are simply monitored and do not operate the inverter.

 For an access to universal DI via the RS-485 or fieldbus communications link, refer to their respective Instruction Manuals.

■ Enable auto search for idling motor speed at starting -- **STM** (Function code data = 26)

This digital terminal command determines, at the start of operation, whether or not to search for idling motor speed and follow it. (Refer to the description of H09.)

■ Force to stop -- **STOP** (Function code data = 30)

Turning this terminal command OFF causes the motor to decelerate to a stop in accordance with the H56 data (Deceleration time for forced stop). After the motor stops, the inverter enters the alarm state with the alarm *err6* displayed.

■ Pre-excitation -- **EXITE** (Function code data = 32)

Turning **EXCITE** ON activates the pre-exciting feature. Even if the pre-excitation command is not assigned, specifying H85 (Pre-excitation: Time) data to other than "0.00" enables the inverter to automatically start pre-exciting of the motor when it is turned ON. (Refer to the descriptions of H84 and H85.)

■ Reset PID integral and differential components -- **PID-RST** (Function code data = 33)

Turning this terminal command ON resets the integral and differential components of the PID processor. (For details, refer to the descriptions of J codes.)

■ Hold PID integral component -- **PID-HLD** (Function code data = 34)

Turning this terminal command ON holds the integral components of the PID processor. (For details, refer to the descriptions of J codes.)

■ Select local (keypad) operation -- **LOC** (Function code data = 35)

This terminal command switches the source of the run command and frequency command between remote and local by an external digital input signal.


■ Protect motor from dew condensation -- **DWP** (Function code data = 39)

Turning this terminal command ON supplies a DC current to the motor that is on halt in order to generate heat, preventing dew condensation.

(For details, refer to the description of J21.)

■ Enable integrated sequence to switch to commercial power (50 Hz) and (60 Hz) -- **ISW50** and **ISW60** (Function code data = 40 and 41)

With the terminal command **ISW50** or **ISW60** assigned, the inverter controls the magnetic contactor that switches the motor drive source between the commercial power and the inverter output according to the integrated sequence.

 For details, refer to Chapter 5 in FRENIC-MEGA User's Manual.

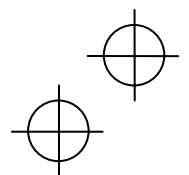
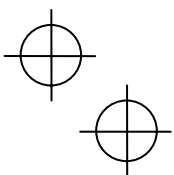
■ Servo-lock command -- **LOCK** (Function code data = 47)

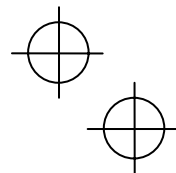
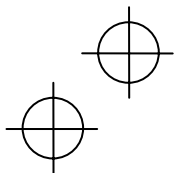
Turning this terminal command ON makes the inverter ready for servo-lock operation. When the actual speed becomes zero, e.g., by turning the run command OFF, the inverter starts the servo-lock operation.

(For details, refer to the descriptions of J97 to J99.)

 **WARNING**

Even if the run command is set to OFF, voltage is output to inverter output terminals U, V, and W if the servo-lock command is ON.  
**An electric shock may occur.**



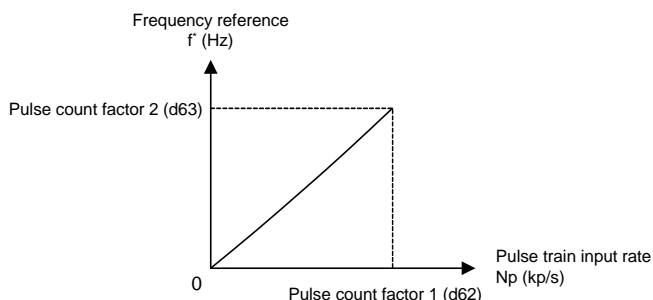


- Pulse train input -- **PIN** (available only on terminal [X7]) (Function code data = 48)  
 Pulse train sign -- **SIGN** (available on terminals except [X7]) (Function code data = 49)

Assigning the command **PIN** to digital input terminal [X7] enables the frequency command by the pulse train input. Assigning the command **SIGN** to one of the digital input terminals except [X7] enables the pulse train sign input to specify the polarity of frequency command.

(Refer to the description of F01.)

For the pulse train input, function codes d62 (Command (Pulse rate input), (Pulse count factor 1)) and d63 (Command (Pulse rate input), (Pulse count factor 2)) define the relationship between the input pulse rate and the frequency command (Reference).



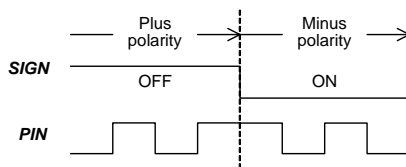
Relationship between the Pulse Train Input Rate and Frequency Command (Reference)

As shown in the figure above, enter the pulse train input rate into function code d62 (Command (Pulse rate input), (Pulse count factor 1)), and enter the frequency reference defined by d62 into d63 (Command (Pulse rate input), (Pulse count factor 2)). The relationship between the pulse train input rate (kp/s) inputted to the **PIN** terminal and the frequency reference  $f^*$  (Hz) (or speed command) is given by the expression below.

$$f^* \text{ (Hz)} = N_p \text{ (kp/s)} \times \frac{\text{Pulse count factor 2 (d63)}}{\text{Pulse count factor 1 (d62)}}$$

where,  $f^*$  (Hz): Frequency reference  
 $N_p$  [kp/s]: Pulse train rate inputted to the **PIN** terminal

The terminal input **SIGN** defines the polarity of the pulse train input to the **PIN** terminal. Combination of the input **SIGN** and the **FWD/REV** command determines the rotational direction of the motor. The table below shows the relationship between them.

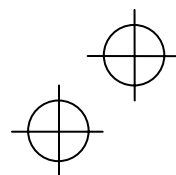
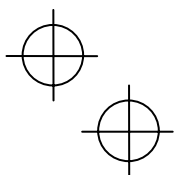


Switching the Pulse Train Input Polarity

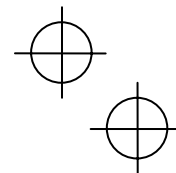
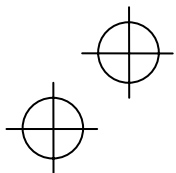
Pulse train input polarity and motor rotation direction

Pulse train polarity	Run command	Motor rotation direction
Plus	<b>FWD</b> (Run forward command)	Forward
Plus	<b>REV</b> (Run reverse command)	Reverse
Minus	<b>FWD</b> (Run forward command)	Reverse
Minus	<b>REV</b> (Run reverse command)	Forward

**Note** Mounting an optional PG interface card automatically switches the pulse train input source to the card and disables the input from the terminal [X7] (**PIN**).







- Count the run time of commercial power-driven motor 1, 2, 3 and 4 -- **CRUN-M1**, **CRUN-M2**, **CRUN-M3** and **CRUN-M4** (Function code data = 72, 73, 74 and 75)

Each of these terminal commands allows the inverter to count the run time of the corresponding motor being driven by a commercial power, as well as counting the run time of the motor being driven through the inverter.

When any of these terminal commands is ON, the inverter interprets it as the corresponding motor being driven by a commercial power and counts its run time.

- Select droop control -- **DROOP** (Function code data = 76)

This terminal command **DROOP** is to switch enabling or disabling the droop control.

<b>DROOP</b>	Droop control	Remarks
ON	Enable	If H28 data is other than "0," the droop control is enabled even if <b>DROOP</b> is not assigned.
OFF	Disable	

(Refer to the description of H28.)

- Cancel PG alarm-- **PG-CCL** (Function code data = 77)

When this terminal command is ON, the PG wire break alarm is ignored. Use this terminal command when switching PG wires for switching motors, for example, to prevent it from being detected as PG wire break.

- Run forward -- **FWD** (Function code data = 98)

Turning this terminal command ON runs the motor in the forward direction; turning it OFF decelerates it to stop.

This terminal command can be assigned only by E98 or E99.

- Run reverse -- **REV** (Function code data = 99)

Turning this terminal command ON runs the motor in the reverse direction; turning it OFF decelerates it to stop.

This terminal command can be assigned only by E98 or E99.

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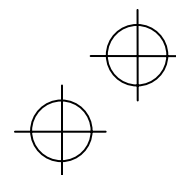
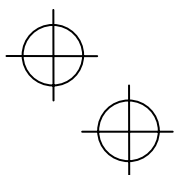
**E20 to E23** Terminal [Y1] to [Y4] Function  
**E24, E27** Terminal [Y5A/C] and [30A/B/C] Function (Relay output)

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E20 through E23, E24 and E27 assign output signals (listed on the next page) to general-purpose, programmable output terminals [Y1], [Y2], [Y3], [Y4], [Y5A/C] and [30A/B/C]. These function codes can also switch the logic system between normal and negative to define the property of those output terminals so that the inverter logic can interpret either the ON or OFF status of each terminal as active. The factory default settings are "Active ON."

Terminals [Y1], [Y2], [Y3] and [Y4] are transistor outputs and terminals [Y5A/C] and [30A/B/C] are relay contact outputs. In normal logic, if an alarm occurs, the relay will be energized so that [30A] and [30C] will be closed, and [30B] and [30C] opened. In negative logic, the relay will be deenergized so that [30A] and [30C] will be opened, and [30B] and [30C] closed. This may be useful for the implementation of failsafe power systems.

- Note**
- When a negative logic is employed, all output signals are active (e.g. an alarm would be recognized) while the inverter is powered OFF. To avoid causing system malfunctions by this, interlock these signals to keep them ON using an external power supply. Furthermore, the validity of these output signals is not guaranteed for approximately 1.5 seconds after power-ON, so introduce such a mechanism that masks them during the transient period.
  - Terminals [Y5A/C] and [30A/B/C] use mechanical contacts that cannot stand frequent ON/OFF switching. Where frequent ON/OFF switching is anticipated (for example, limiting a current by using signals subjected to inverter output limit control such as switching to commercial power line or direct-on-line starting), use transistor outputs [Y1], [Y2], [Y3] and [Y4] instead. The service life of a relay is approximately 200,000 times if it is switched ON and OFF at one-second intervals.



The table below lists functions that can be assigned to terminals [Y1], [Y2], [Y3], [Y4], [Y5A/C], and [30A/B/C].

To make the explanations simpler, the functions listed below are all written for the normal logic (Active ON).

Function code data		Functions assigned	Symbol
Active ON	Active OFF		
0	1000	Inverter running	<b><i>RUN</i></b>
1	1001	Frequency (speed) arrival signal	<b><i>FAR</i></b>
2	1002	Frequency (speed) detected	<b><i>FDT</i></b>
3	1003	Undervoltage detected (Inverter stopped)	<b><i>LU</i></b>
4	1004	Torque polarity detected	<b><i>B/D</i></b>
5	1005	Inverter output limiting	<b><i>IOL</i></b>
6	1006	Auto-restarting after momentary power failure	<b><i>IPF</i></b>
7	1007	Motor overload early warning	<b><i>OL</i></b>
8	1008	Keypad operation enabled	<b><i>KP</i></b>
10	1010	Inverter ready to run	<b><i>RDY</i></b>
11	-	Switch motor drive source between commercial power and inverter output (For MC on commercial line)	<b><i>SW88</i></b>
12	-	Switch motor drive source between commercial power and inverter output (For secondary side)	<b><i>SW52-2</i></b>
13	-	Switch motor drive source between commercial power and inverter output (For primary side)	<b><i>SW52-1</i></b>
15	1015	Select AX terminal function (For MC on primary side)	<b><i>AX</i></b>
22*	1022	Inverter output limiting with delay	<b><i>IOL2</i></b>
25	1025	Cooling fan in operation	<b><i>FAN</i></b>
26	1026	Auto-resetting	<b><i>TRY</i></b>
27	1027	Universal DO	<b><i>U-DO</i></b>
28	1028	Heat sink overheat early warning	<b><i>OH</i></b>
30	1030	Lifetime alarm	<b><i>LIFE</i></b>
31*	1031	Frequency (speed) detected 2	<b><i>FDT2</i></b>
33	1033	Reference loss detected	<b><i>REF OFF</i></b>
35*	1035	Inverter output on	<b><i>RUN2</i></b>
36	1036	Overload prevention control	<b><i>OLP</i></b>
37	1037	Current detected	<b><i>ID</i></b>
38	1038	Current detected 2	<b><i>ID2</i></b>
39	1039	Current detected 3	<b><i>ID3</i></b>
41	1041	Low current detected	<b><i>IDL</i></b>
42	1042	PID alarm	<b><i>PID-ALM</i></b>
43	1043	Under PID control	<b><i>PID-CTL</i></b>
44	1044	Motor stopped due to slow flowrate under PID control	<b><i>PID-STP</i></b>
45	1045	Low output torque detected	<b><i>U-TL</i></b>
46	1046	Torque detected 1	<b><i>TD1</i></b>
47	1047	Torque detected 2	<b><i>TD2</i></b>
48	1048	Motor 1 selected	<b><i>SWM1</i></b>
49	1049	Motor 2 selected	<b><i>SWM2</i></b>

\* For data "22," "31," and "35," refer to the description about data "5," "2," and "0," respectively.

Function code data		Functions assigned	Symbol
Active ON	Active OFF		
50	1050	Motor 3 selected	<b>SWM3</b>
51	1051	Motor 4 selected	<b>SWM4</b>
52	1052	Running forward	<b>FRUN</b>
53	1053	Running reverse	<b>RRUN</b>
54	1054	In remote operation	<b>RMT</b>
56	1056	Motor overheat detected by thermistor	<b>THM</b>
57	1057	Brake signal	<b>BRKS</b>
58*	1058	Frequency (speed) detected 3	<b>FDT3</b>
59	1059	Terminal [C1] wire break	<b>C1OFF</b>
70	1070	Speed valid	<b>DNZS</b>
71	1071	Speed agreement	<b>DSAG</b>
72*	1072	Frequency (speed) arrival signal 3	<b>FAR3</b>
76	1076	PG error detected	<b>PG-ERR</b>
82	1082	Positioning completion signal	<b>PSET</b>
84	1084	Maintenance timer	<b>MNT</b>
98	1098	Light alarm	<b>L-ALM</b>
99	1099	Alarm output (for any alarm)	<b>ALM</b>
101	1101	Enable circuit failure detected	<b>DECF</b>
102	1102	Enable input OFF	<b>EN OFF</b>
105	1105	Braking transistor broken	<b>DBAL</b>

\* For data "58" and "72," refer to the description of data "2" and "1," respectively.

**Note** Any negative logic (Active OFF) command cannot be assigned to the functions marked with "—" in the "Active OFF" column.

- Inverter running -- **RUN** (Function code data = 0)  
Inverter output on -- **RUN2** (Function code data = 35)

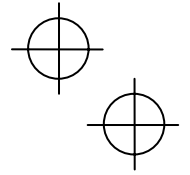
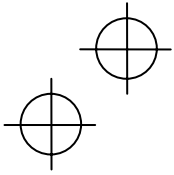
These output signals tell the external equipment that the inverter is running at a starting frequency or higher. If assigned in negative logic (Active OFF), these signals can be used to tell the "Inverter being stopped" state.

Output signal	Operating condition 1	Operating condition 2
<b>RUN</b>	Comes ON if the inverter output frequency exceeds the starting frequency, and OFF if it drops below the stop frequency.	Comes OFF even during DC braking.
<b>RUN2</b>		Comes ON even during DC braking, pre-exciting, zero speed control, or dew condensation prevention.

- Frequency (speed) arrival signal -- **FAR** (Function code data = 1)  
Frequency (speed) arrival signal 3 -- **FAR3** (Function code data = 72)

These output signals come ON when the difference between the output frequency (detected speed) and reference frequency (commanded speed) comes within the frequency arrival hysteresis width specified by E30. (Refer to the description of E30.)

Output signal	Operating condition 1	Operating condition 2
<b>FAR</b>	Comes ON when difference between the output frequency (detected speed) and the reference frequency (commanded speed) comes within the frequency arrival hysteresis width specified by E30.	Comes OFF when all the run commands are OFF or speed command value is "0."
<b>FAR3</b>		Comes ON even if all the run commands are OFF, interpreting that the speed command is "0," when the output frequency is within "0 ± the frequency arrival hysteresis width specified by E30."



- Frequency (speed) detected -- **FDT** (Function code data = 2)  
 Frequency (speed) detected 2 -- **FDT2** (Function code data = 31)  
 Frequency (speed) detected 3 -- **FDT3** (Function code data = 58)

The output signal **FDT**, **FDT2** or **FDT3** comes ON when the output frequency (detected speed) exceeds the frequency detection level specified by E31, E36 or E54, respectively, and it goes OFF when the output frequency (detected speed) drops below the "Frequency detection level (E31, E36 or E54) - Hysteresis width (E32)."

- Undervoltage detected (Inverter stopped) -- **LU** (Function code data = 3)

This output signal comes ON when the DC link bus voltage of the inverter drops below the specified undervoltage level, and it goes OFF when the voltage exceeds the level.

This signal is ON also when the undervoltage protective function is activated so that the motor is in an abnormal stop state (e.g., tripped).

When this signal is ON, a run command is disabled if given.

- Torque polarity detected -- **B/D** (Function code data = 4)

The inverter issues the driving or braking polarity signal to this digital output judging from the internally calculated torque or torque command. This signal goes OFF when the detected torque is a driving one, and it goes ON when it is a braking one.

- Inverter output limiting -- **IOL** (Function code data = 5)  
 Inverter output limiting with delay -- **IOL2** (Function code data = 22)

The output signal **IOL** comes ON when the inverter is limiting the output frequency by activating any of the following actions (minimum width of the output signal: 100 ms). The output signal **IOL2** comes ON when any of the following output limiting operation continues for 20 ms or more.

- Torque limiting (F40, F41, E16 and E17)
- Current limiting by software (F43 and F44)
- Instantaneous overcurrent limiting by hardware (H12 = 1)
- Automatic deceleration (Anti-regenerative control) (H69)

**Note** When the **IOL** signal is ON, it may mean that the output frequency may have deviated from the frequency specified by the frequency command because of this limiting function.

- Auto-restarting after momentary power failure -- **IPF** (Function code data = 6)

This output signal is ON either during continuous running after a momentary power failure or during the period from when the inverter has detected an undervoltage condition, shut down the output and wait until restart has been completed (the output has reached the reference frequency).

(Refer to the description of F14.)

- Motor overload early warning -- **OL** (Function code data = 7)

This output signal is used to issue a motor overload early warning that enables you to take a corrective action before the inverter detects a motor overload alarm **O11** and shuts down its output. (Refer to the description of E34.)

**Note** Function code E34 is shared with another feature.

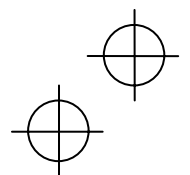
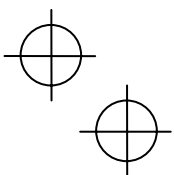
Function code	Related feature 1	Related feature 2
E34	Motor overload early warning <b>OL</b>	Current detected <b>ID</b>

- Keypad operation enabled -- **KP** (Function code data = 8)

This output signal comes ON when the  /  keys are specified as the run command source.

- Inverter ready to run -- **RDY** (Function code data = 10)

This output signal comes ON when the inverter becomes ready to run by completing hardware preparation (such as initial charging of DC link bus capacitors and initialization of the control circuit) and no protective functions are activated.



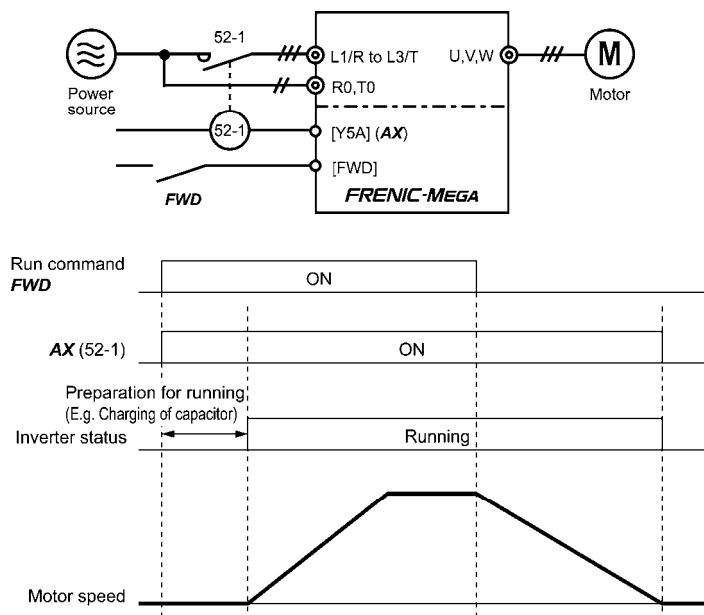
- Switch motor drive source between commercial power and inverter output -- **SW88**, **SW52-2** and **SW52-1** (Function code data = 11, 12, and 13)

Assigning these output signals to transistor output terminals [Y1], [Y2], [Y3] and [Y4] enables an **ISW50** or **ISW60** terminal command that controls the magnetic contactor for switching the motor drive source between the commercial power and the inverter output according to the integrated sequence. (Refer to the descriptions of E01 through E07. (Function code data = 40 and 41.))

- Select **AX** terminal function -- **AX** (Function code data = 15)

In response to a run command **FWD**, this output signal controls the magnetic contactor on the commercial-power supply side. It comes ON when the inverter receives a run command and it goes OFF after the motor decelerates to stop with a stop command received.

This signal immediately goes OFF upon receipt of a coast-to-stop command or when an alarm occurs.



- Cooling fan in operation -- **FAN** (Function code data = 25)

Under the cooling fan ON/OFF control enabled (H06 = 1), this output signal is ON when the cooling fan is in operation, and OFF when it is stopped. This signal can be used to make the cooling system of peripheral equipment interlocked for an ON/OFF control.

- Auto-resetting -- **TRY** (Function code data = 26)

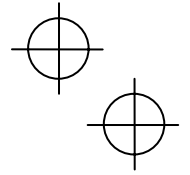
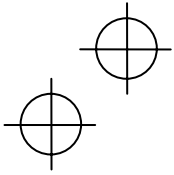
This output signal comes ON when auto resetting (resetting alarms automatically) is in progress. (Refer to the descriptions of H04 and H05.)

- Universal DO -- **U-DO**  
(Function code data = 27)

Assigning this output signal to an inverter's output terminal and connecting the terminal to a digital input terminal of peripheral equipment via the RS-485 communications link or the fieldbus, allows the inverter to send commands to the peripheral equipment.

The universal DO can also be used as an output signal independent of the inverter operation.

For the procedure for access to Universal DO via the RS-485 communications link or fieldbus, refer to the respective instruction manual.



■ Heat sink overheat early warning -- **OH** (Function code data = 28)

This output signal is used to issue a heat sink overheat early warning that enables you to take a corrective action before an overheat trip *Oh1* actually happens.

This signal comes ON when the temperature of the heat sink exceeds the "overheat trip temperature minus 5°C," and it goes OFF when it drops down to the "overheat trip temperature minus 8°C."

This signal comes ON also when the internal air circulation DC fan (45 kW or above for 200 V class series or 75 kW or above for 400 V class series) has locked.

■ Lifetime alarm -- **LIFE** (Function code data = 30)

This output signal comes ON when it is judged that the service life of any one of capacitors (DC link bus capacitors and electrolytic capacitors on the printed circuit boards) and cooling fan has expired.

This signal should be used as a guide for replacement of the capacitors and cooling fan. If this signal comes ON, use the specified maintenance procedure to check the service life of these parts and determine whether the parts should be replaced or not. (Refer to Chapter 7, Section 7.3.1 "Judgment on service life.")

This signal comes ON also when the internal air circulation DC fan (45 kW or above for 200 V class series or 75 kW or above for 400 V class series) has locked.

■ Reference loss detected -- **REF OFF** (Function code data = 33)

This output signal comes ON when an analog input used as a frequency command source is in a reference loss state (as specified by E65) due to a wire break or a weak connection. This signal goes OFF when the normal operation under the analog input is resumed. (Refer to the description of E65.)

■ Overload prevention control -- **OLP** (Function code data = 36)

This output signal comes ON when the overload prevention control is activated. The minimum ON-duration is 100 ms. (Refer to the description of H70.)

■ Current detected -- **ID** (Function code data = 37)


Current detected 2 -- **ID2** (Function code data = 38)

Current detected 3 -- **ID3** (Function code data = 39)

The output signal **ID**, **ID2** or **ID3** comes ON when the output current of the inverter exceeds the level specified by E34, E37 or E55 (Current detection (Level)) for the period specified by E35, E38 or E56 (Current detection (Timer)), respectively. The minimum ON-duration is 100 ms.

The **ID**, **ID2** or **ID3** goes OFF when the output current drops below 90% of the rated operation level.

Two output signals **ID** and **ID2** can be assigned to two different digital output terminals independently if necessary.

 The function codes listed below are shared with another feature.

Function code	Related feature 1	Related feature 2
E34	Current detected <b>ID</b>	Motor overload early warning <b>OL</b>
E37, E38	Current detected 2 <b>ID2</b>	Low level current detected <b>IDL</b>

■ Low current detected -- **IDL** (Function code data = 41)

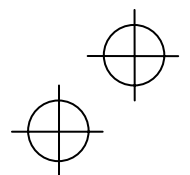
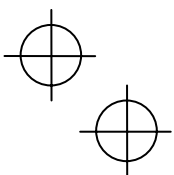
This output signal comes ON when the output current drops below the low current detection level specified by E37 and remains at the low level for the low current detection period specified by E38. This signal goes OFF when the output current exceeds the low current detection level specified by E37 by at least 5% of the inverter rated current. The minimum ON-duration is 100 ms.

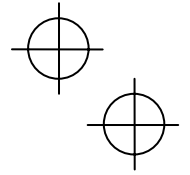
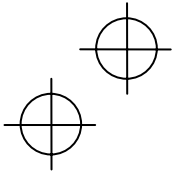
■ PID alarm -- **PID-ALM** (Function code data = 42)

Assigning this output signal enables PID control specified by J11 through J13 to output absolute-value alarm and deviation alarm. (Refer to the descriptions of J11 through J13.)

■ Under PID control -- **PID-CTL** (Function code data = 43)

This output signal comes ON when PID control is enabled ("Cancel PID control" (Hz/PID) = OFF) and a run command is ON. (Refer to the descriptions of J codes.)





■ Motor stopped due to slow flowrate under PID control -- **PID-STP** (Function code data = 44)  
 This output signal is ON when the inverter is in a stopped state due to the slow flowrate stopping function under PID control. (Refer to the descriptions of J15 through J17.)

■ Low output torque detected -- **U-TL** (Function code data = 45)  
 This output signal comes ON when the torque value calculated by the inverter or torque command drops below the level specified by E80 (Detect low torque (Level)) for the period specified by E81 (Detect low torque (Timer)). The minimum ON-duration is 100 ms. (Refer to the descriptions of E80 and E81.)

■ Torque detected 1 -- **TD1** (Function code data = 46)  
 Torque detected 2 -- **TD2** (Function code data = 47)  
 This output signal **TD1** or **TD2** comes ON when the torque value calculated by the inverter or torque command exceeds the level specified by E78 or E80 (Torque detection (Level)) for the period specified by E79 or E81 (Torque detection (Timer)), respectively. The minimum ON-duration is 100 ms. (Refer to the descriptions of E78 through E81.)

**Note** The function codes listed below are shared with another feature.

Function code	Related feature 1	Related feature 2
E80, E81	Low output torque detected <b>U-TL</b>	Torque detected 2 <b>TD2</b>

■ Motor 1, 2, 3 and 4 selected -- **SWM1, SWM2, SWM3** and **SWM4**  
 (Function code data = 48, 49, 50 and 51)  
 The output signal **SWM1, SWM2, SWM3** or **SWM4** comes ON when motor 1, 2, 3 or 4 is selected, respectively. (Refer to the descriptions of E01 through E07 (Function code data = 12, 36 and 37).)

■ Running forward -- **FRUN** (Function code data = 52)  
 Running reverse -- **RRUN** (Function code data = 53)

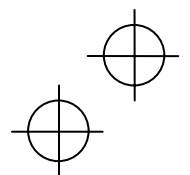
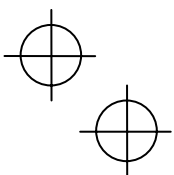
Output signal	Running forward	Running reverse	Inverter stopped
<b>FRUN</b>	ON	OFF	OFF
<b>RRUN</b>	OFF	ON	OFF

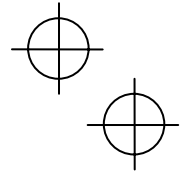
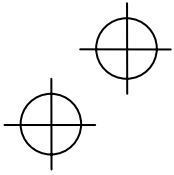
■ In remote operation -- **RMT** (Function code data = 54)  
 This output signal comes ON when the inverter switches from local to remote mode. (Refer to Chapter 4, Section 4.2.2 "Remote and local modes.")

■ Motor overheat detected by thermistor -- **THM** (Function code data = 56)  
 Even when the PTC thermistor on the motor detects an overheat, the inverter turns this signal ON and continues to run, without entering the alarm *oh4* state. This feature applies only when H26 data is set to "2." (Refer to the descriptions of H26 and H27.)

■ Brake signal -- **BRKS** (Function code data = 57)  
 This signal outputs a brake control command that releases or activates the brake. (Refer to the descriptions of J68 through J72.)

■ Terminal [C1] wire break -- **C1OFF** (Function code data = 59)  
 This output signal comes ON when the inverter detects that the input current to terminal [C1] drops below 2 mA interpreting it as the terminal [C1] wire broken.





■ Speed valid -- **DNZS** (Function code data = 70)

This output signal comes ON when the speed command or the detected speed exceeds the stop frequency specified by function code F25. It goes OFF when the speed is below the stop frequency for 100 ms or longer. F38 selects the decision criteria between the speed command and the detected speed. (Refer to the descriptions of F25 and F38.)

■ Speed agreement -- **DSAG** (Function code data = 71)

This output signal comes ON when the deviation of the detected speed from the speed command output of acceleration/deceleration processor is within the allowable range specified by d21. It goes OFF when the deviation is outside the range for longer than the period specified by d22. This feature allows you to check whether the speed controller externally installed is working correctly. (Refer to the descriptions of d21 and d22.)

■ PG error detected -- **PG-ERR** (Function code data = 76)

This output signal comes ON when the inverter detects a PG error with the d23 (PG error processing) data being set to "0: Continue to run," in which the inverter does not enter the alarm state. (Refer to the descriptions of d21 through d23.)

■ Positioning completion signal -- **PSET** (Function code data = 82)

This output signal comes ON when the inverter has been servo-locked so that the motor is held within the positioning completion range specified by J99 (Servo-lock (Completion width)) for the period specified by J98 (Servo-lock (Completion timer)).

(Refer to the descriptions of J97 to J99.)

■ Maintenance timer -- **MNT** (Function code data = 84)

Once the inverter's cumulative run time or the startup times for the motor 1 exceeds the previously specified count, this output signal comes ON. (Refer to the descriptions of H78 and H79.)

■ Light alarm -- **L-ALM** (Function code data = 98)

This output signal comes ON when a light alarm occurs.

(Refer to the descriptions of H81 and H82, Section 3.3.2 "Monitoring light alarms" in Chapter 3, and Chapter 6 "TROUBLESHOOTING.")

■ Alarm output (for any alarm) -- **ALM** (Function code data = 99)

This output signal comes ON if any of the protective functions is activated and the inverter enters Alarm mode.

(Refer to Chapter 3, Section 3.5 "Alarm Mode," and Chapter 6 "TROUBLESHOOTING.")

■ Enable circuit failure detected -- **DECF** (Function code data = 101)

This output signal comes ON when the inverter judges that the terminal [EN] status detection circuit is faulty. (Refer to Chapter 6 "TROUBLESHOOTING.")

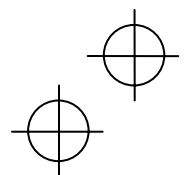
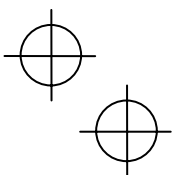
■ Enable input OFF -- **EN OFF** (Function code data = 102)

This output signal comes ON when the terminal [EN] input is turned OFF.

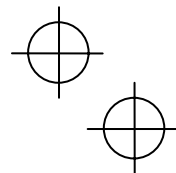
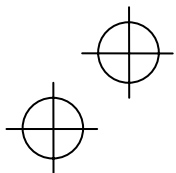
■ Braking transistor broken -- **DBAL** (Function code data = 105)

Breakdown of the braking transistor could lead to the secondary breakdown of the braking resistor and inverter's internal units. Use this output signal **DBAL** to detect abnormal operation of the built-in braking transistor and to cut off power to the magnetic contactor in inverter primary circuits, for preventing spread of the damage. If the inverter detects a breakdown of the braking transistor, it issues the braking transistor alarm (*dba*) and also the output signal **DBAL**. Detection of braking transistor broken can be cancelled by H98.

(Refer to the description of H98.) (200 V class series/ 400 V class series, 22 kW or below)







**P codes (Motor 1 parameters)**

The FRENIC-MEGA drives the motor under V/f control, vector control with speed sensor, or other drive control, which can be selected with function codes.

To use the integrated automatic control functions such as auto torque boost, torque calculation monitoring, auto energy saving operation, torque limiter, automatic deceleration (anti-regenerative control), auto search for idling motor speed, slip compensation, torque vector control, droop control, and overload stop, it is necessary to build a motor model in the inverter by specifying proper motor parameters including the motor capacity and rated current. Specify the motor parameters correctly, referring to this section and Chapter 4, Section 4.1 "Running the Motor for a Test."

The FRENIC-MEGA provides built-in motor parameters for Fuji standard motors 8-series, 6-series, and Fuji motors exclusively designed for vector control. To use these Fuji motors, it is enough to specify motor parameters for P99 (Motor 1 Selection). If the cabling between the inverter and the motor is long (generally, 20 m or longer) or a reactor is inserted between the motor and the inverter, however, the apparent motor parameters are different from the actual ones, so auto-tuning or other adjustments are necessary. For the auto-tuning procedure, refer to Chapter 4, Section 4.1 "Running the Motor for a Test."

When using a motor made by other manufacturers or a Fuji non-standard motor, obtain the datasheet of the motor and specify the motor parameters manually or perform auto-tuning.

To specify the motor parameters correctly, select the motor type with P99 (Motor 1 Selection), specify the motor rated capacity with P02, and then initialize the motor parameters with H03. This procedure also applies when the inverter is switched to the LD mode and a motor with one rank higher capacity is used. When switching the motor between the 1st to 4th motors, specify the corresponding function codes. (Refer to the description of A42.)

Usually, it is not necessary to specify the motor parameters with P13 through P56 (such as iron loss factors and magnetic saturation factors) for individual motors.

---

**P01**      Motor 1 (No. of poles)

---

P01 specifies the number of poles of the motor. Enter the value given on the nameplate of the motor. This setting is used to display the motor speed on the LED monitor and to control the speed (refer to E43). The following expression is used for the conversion.

$$\text{Motor speed (r/min)} = \frac{120}{\text{No. of poles}} \times \text{Frequency (Hz)}$$

- Data setting range:    2 to 22 (poles)

---

**P02**      Motor 1 (Rated capacity)

---

P02 specifies the rated capacity of the motor. Enter the rated value given on the nameplate of the motor.

Data for P02	Unit	Function
0.01 to 1000	kW	When P99 (Motor 1 Selection) = 0, 2, 3 or 4
	HP	When P99 (Motor 1 Selection) = 1

**Note** When accessing function code P02 with the keypad, take into account that the P02 data automatically updates the data of function codes P03, P06 through P23, P53 through P56, and H46.

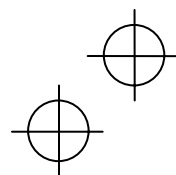
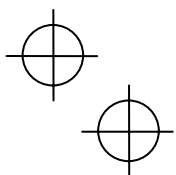
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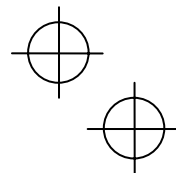
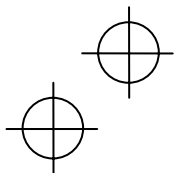
**P03**      Motor 1 (Rated current)

---

P03 specifies the rated current of the motor. Enter the rated value given on the nameplate of the motor.

- Data setting range:    0.00 to 2000 (A)






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**P04 Motor 1 (Auto-tuning)**

---

The inverter automatically detects the motor parameters and saves them in its internal memory. Basically, it is not necessary to perform tuning when using a Fuji standard motor with a standard connection with the inverter.

In any of the following cases, perform auto-tuning since the motor parameters are different from those of Fuji standard motors so that the best performance cannot be obtained under any of these controls--auto torque boost, torque calculation monitoring, auto energy saving operation, torque limiter, automatic deceleration (anti-regenerative control), auto search for idling motor speed, slip compensation, torque vector control, droop control, or overload stop.

- The motor to be driven is a non-Fuji motor or a non-standard motor.
- Cabling between the motor and the inverter is long. (Generally, 20 m or longer)
- A reactor is inserted between the motor and the inverter.

For details of auto-tuning, refer to Chapter 4, Section 4.1 "Running the Motor for a Test."

Data for P04	Auto-tuning	Operation	Motor parameters to be tuned
0	Disable	N/A	N/A
1	Tune while the motor stops	The inverter performs tuning while the motor is stopped.	Primary resistance (%R1) (P07) Leakage reactance (%X) (P08) Rated slip frequency (P12) %X correction factors 1 and 2 (P53 and P54)
2	Tune while the motor is rotating under V/f control	After tuning while the motor is stopped, the inverter performs tuning again, with the motor running at 50% of the base frequency.	No-load current (P06) Primary resistance (%R1) (P07) Leakage reactance (%X) (P08) Rated slip frequency (P12) Magnetic saturation factors 1 to 5 (P16 through P20) Magnetic saturation extension factors "a" to "c" (P21 through P23) %X correction factors 1 and 2 (P53 and P54)
3	Tune while the motor is rotating under vector control	After tuning while the motor is stopped, the inverter performs tuning, with the motor running at 50% of the base frequency twice.	No-load current (P06) Primary resistance (%R1) (P07) Leakage reactance (%X) (P08) Rated slip frequency (P12) Magnetic saturation factors 1 to 5 (P16 through P20) Magnetic saturation extension factors "a" to "c" (P21 through P23) %X correction factors 1 and 2 (P53 and P54)

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**P06, P07  
P08, P12 Motor 1 (No-load current, %R1, %X and Rated slip frequency)**

---

P06 through P08 and P12 specify no-load current, %R1, %X, and rated slip frequency, respectively. Obtain the appropriate values from the test report of the motor or by calling the manufacturer of the motor.

Performing auto-tuning automatically sets these parameters.

- No-load current (P06): Enter the value obtained from the motor manufacturer.
- %R1 (P07): Enter the value calculated by the following expression.

$$\%R1 = \frac{R1 + \text{Cable } R1}{V / (\sqrt{3} \times I)} \times 100 (\%)$$

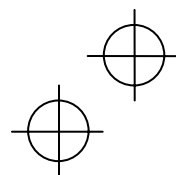
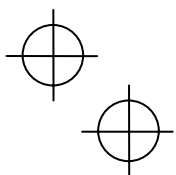
where,

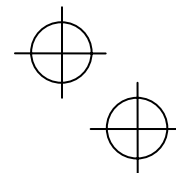
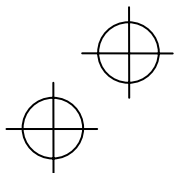
R1: Primary resistance of the motor (Ω)

Cable R1: Resistance of the output cable (Ω)

V: Rated voltage of the motor (V)

I: Rated current of the motor (A)





■ %X (P08): Enter the value calculated by the following expression.

$$\%X = \frac{X1 + X2 \times XM / (X2 + XM) + \text{Cable X}}{V / (\sqrt{3} \times I)} \times 100 (\%)$$


where,

- X1: Primary leakage reactance of the motor ( $\Omega$ )
- X2: Secondary leakage reactance of the motor (converted to primary) ( $\Omega$ )
- XM: Exciting reactance of the motor ( $\Omega$ )
- Cable X: Reactance of the output cable ( $\Omega$ )
- V: Rated voltage of the motor (V)
- I: Rated current of the motor (A)

■ Rated slip frequency (P12)

Convert the value obtained from the motor manufacturer to Hz using the following expression and enter the converted value. (Note: The motor rating given on the nameplate sometimes shows a larger value.)

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

 **Note** For reactance, choose the value at the base frequency 1 (F04).

---

P09	Motor 1 (Slip compensation gain for driving)
P10	(Slip compensation response time)
P11	(Slip compensation gain for braking)

---

P09 and P11 determine the slip compensation amount in % for driving and braking individually. Specification of 100% fully compensates for the rated slip of the motor. Excessive compensation (P09, P11 > 100%) may cause a system oscillation, so carefully check the operation on the actual machine.

For Fuji motors exclusively designed for vector control, the rated slip of the motor for driving or braking is compensated by P09 or P11, respectively, to improve output torque accuracy.

P10 determines the response time for slip compensation. Basically, there is no need to modify the default setting. If you need to modify it, consult your Fuji Electric representatives.

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P99	Motor 1 Selection
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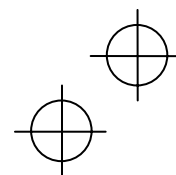
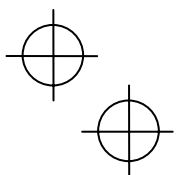
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P99 specifies the motor type to be used.

Data for P99	Motor type
0	Motor characteristics 0 (Fuji standard motors, 8-series)
1	Motor characteristics 1 (HP rating motors)
2	Motor characteristics 2 (Fuji motors exclusively designed for vector control)
3	Motor characteristics 3 (Fuji standard motors, 6-series)
4	Other motors

To select the motor drive control or to run the inverter with the integrated automatic control functions such as auto torque boost and torque calculation monitoring, it is necessary to specify the motor parameters correctly. First select the motor type with P99 (Motor 1 selection) from Fuji standard motors 8-series, 6-series, and Fuji motors exclusively designed for vector control, next specify the motor rated capacity with P02, and then initialize the motor parameters with H03. This process automatically configures the related motor parameters (P01, P03, P06 through P23, P53 through P56, and H46).

The data of F09 (Torque boost 1), H13 (Restart Mode after Momentary Power Failure (Restart time)), and F11 (Electronic thermal overload protection for motor 1 (Overload detection level)) depends on the motor capacity (refer to Table 5.2), but the process stated above does not change them. Specify and adjust the data during a test run if needed.



### H03 Data Initialization

H03 initializes the current function code data to the factory defaults or initializes the motor parameters. To change the H03 data, it is necessary to press the **STOP** + **▲** keys or **STOP** + **▼** keys (simultaneous keying).

Data for H03	Function
0	Disable initialization (Settings manually made by the user will be retained.)
1	Initialize all function code data to the factory defaults
2	Initialize motor 1 parameters in accordance with P02 (Rated capacity) and P99 (Motor 1 selection)
3	Initialize motor 2 parameters in accordance with A16 (Rated capacity) and A39 (Motor 2 selection)
4	Initialize motor 3 parameters in accordance with b16 (Rated capacity) and b39 (Motor 3 selection)
5	Initialize motor 4 parameters in accordance with r16 (Rated capacity) and r39 (Motor 4 selection)

- To initialize the motor parameters, set the related function codes as follows.

Step	Item	Action	Function code			
			1st motor	2nd motor	3rd motor	4th motor
(1)	Motor selection	Selects the motor type	P99	A39	b39	r39
(2)	Motor (rated capacity)	Sets the motor capacity (kW)	P02	A16	b16	r16
(3)	Data initialization	Initialize motor parameters	H03 = 2	H03 = 3	H03 = 4	H03 = 5
Function code data to be initialized		If "Data = 0, 1, 3, or 4" in Step (1)	P01, P03, P06 to P23, P53 to P56, H46	A15, A17, A20 to A37, A53 to A56	b15, b17, b20 to b37, b53 to b56	r15, r17, r20 to r37, r53 to r56
		If "Data = 2" in Step (1), function codes listed at the right are also initialized	F04, F05	A02, A03	b02, b03	r02, r03

- Upon completion of the initialization, the H03 data reverts to "0" (factory default).
- If P02, A16, b16 or r16 data is set to a value other than the nominal applied motor rating, data initialization with H03 internally converts the specified value forcibly to the standard nominal applied motor rating.
- Motor parameters to be initialized are for motors listed below under V/f control. When the base frequency, rated voltage, and the number of poles are different from those of the listed motors, or when non-Fuji motors or non-standard motors are used, change the rated current data to that printed on the motor nameplate.

Motor selection		V/f control data	
Data = 0 or 4	Fuji standard motors, 8-series	4 poles	220 V/60 Hz, 415 V/50 Hz (400 V/50 Hz)*
Data = 2	Fuji motors exclusively designed for vector control	4 poles	—/50 Hz, —/50 Hz
Data = 3	Fuji standard motors, 6-series	4 poles	220 V/60 Hz, 415 V/50 Hz (400 V/50 Hz)*
Data = 1	HP rating motors	4 poles	230 V/60 Hz, 460 V/60 Hz

\* 400 V/50 Hz for the FRN\_ \_ \_G1■-4E

**Note** When accessing function code P02 with the keypad, take into account that P02 data automatically updates data of function codes P03, P06 through P23, P53 through P56, and H46. Also, when accessing function code A16, b16 or r16, data of related function codes for each are automatically updated.

H69 Automatic Deceleration (Anti-regenerative control) (Mode selection)  
H76 Torque Limiter (Frequency increment limit for braking)

H69 enables or disables the anti-regenerative control.

In the inverter not equipped with a PWM converter or braking unit, if the regenerative energy returned exceeds the inverter's braking capability, an overvoltage trip occurs.

To avoid such an overvoltage trip, enable the automatic deceleration (anti-regenerative control) with this function code, and the inverter controls the output frequency to keep the braking torque around 0 N·m in both the deceleration and constant speed running phases.

Data for H69	Function	
	Control mode	Force-to-stop with actual deceleration time exceeding three times the specified one
0	Disable automatic deceleration	—
2	Torque limit control	Enable
3	DC link bus voltage control	Enable
4	Torque limit control	Disable
5	DC link bus voltage control	Disable

FRENIC-MEGA series of inverters have two braking control modes; torque limit control and DC link bus voltage control.

Control mode	Control process	Operation mode	Features
Torque limit control	Controls the output frequency to keep the braking torque at approx. "0."	Enabled during acceleration, running at the constant speed, and deceleration.	Quick response. Causes less overvoltage trips even with a heavy impact load.
DC link bus voltage control	Control the output frequency to lower the DC link bus voltage if the voltage exceeds the limiting level.	Enabled during deceleration. Disabled during running at the constant speed.	Shorter deceleration time by making good use of the inverter's regenerative capability.

Since increasing the output frequency too much in the torque limit control mode is dangerous, the inverter has a torque limiter (Frequency increment limit for braking) that can be specified by H76. The torque limiter limits the inverter's output frequency to less than "Reference frequency + H76 setting."

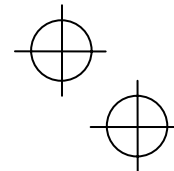
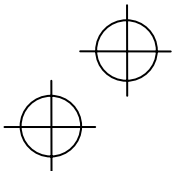
Note that the torque limiter activated restrains the anti-regenerative control, resulting in a trip with an overvoltage alarm in some cases. Increasing the H76 data (0.0 to 400.0 Hz) makes the anti-regenerative control capability high.

In addition, during deceleration triggered by turning the run command OFF, the anti-regenerative control increases the output frequency so that the inverter may not stop the load depending on the load state (huge moment of inertia, for example). To avoid that, H69 provides a choice of cancellation of the anti-regenerative control to apply when three times the specified deceleration time is elapsed, thus decelerating the motor forcibly.

**Note** Enabling the automatic deceleration (anti-regenerative control) may automatically increase the deceleration time.

When a brake unit is connected, disable the anti-regenerative control. The automatic deceleration control may be activated at the same time when a braking unit starts operation, which may make the deceleration time fluctuate.

In case the set deceleration time is so short, the DC link bus voltage of the inverter rises quickly, and consequently, the automatic deceleration may not follow the voltage rise. In such a case, prolong the deceleration time.



---

H78	Maintenance Interval (M1)
H94	Cumulative Motor Run Time 1

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H78 (Maintenance interval (M1)) specifies the maintenance interval in units of ten hours. When the cumulative motor run time 1 (H94) reaches the time specified by H78 (Maintenance interval (M1)), the inverter outputs the maintenance timer signal **MNT** to remind the user of the need of system maintenance. To enable this function, assign the maintenance timer signal **MNT** to one of the digital output terminals (function code data = 84).

The setting is in units of 10 hours. The maximum setting is  $9999 \times 10$  hours.

- Data setting range: 0 (Disable); 1 to 9999 (in increments of 10 hours)

**Note** After the current maintenance interval time has elapsed, set a new interval for the next maintenance.  
This function exclusively applies to the 1st motor.

Operating the keypad can display the cumulative run time of motor 1. This feature is useful for management and maintenance of the mechanical system. H94 allows you to set the cumulative run time of the motor to the desired value. For example, specifying "0" clears the cumulative run time of the motor.

Even when a motor is driven by commercial power, not by the inverter, it is possible to count the cumulative run time of the motor by detecting the ON/OFF state of the auxiliary contact of the magnetic contactor for switching to the commercial power line. To enable this function, assign **CRUN-M1** through **CRUN-M4** (Commercial power driving status of motor 1 through 4, function code data = 72 through 75) to one of the digital input terminals.

**Note** H94 data is in hexadecimal notation. It appears, however, in decimal notation on the keypad.

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H79	Preset Startup Count for Maintenance (M1)
H44	Startup Counter for Motor 1

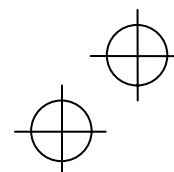
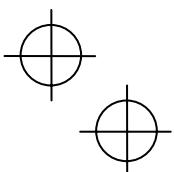
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H79 (Preset startup count for maintenance (M1)) specifies the number of inverter startup times to determine the next maintenance timing, e.g., for replacement of a belt. When the count of the startup counter for motor 1 (H44) reaches the number specified by H79 (Preset startup count for maintenance (M1)), the inverter outputs the maintenance timer signal **MNT** to remind the user of the need of system maintenance.

To enable this function, assign the maintenance timer signal **MNT** to one of the digital output terminals (function code data = 84). Set the H79 and H44 data in hexadecimal. The maximum setting count is 65,535 (FFFF in hexadecimal.)

- Data setting range: 0000 (Disable); 0001 to FFFF (Hexadecimal)

**Note** After the current setting has expired, set a value for the next maintenance in H79 and press the  key so that the output signal is reset and counting restarts.  
This function is exclusively applies to the 1st motor.



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## H81 , H82 Light Alarm Selection 1 and 2

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If the inverter detects a minor abnormal state "light alarm", it can continue the current operation without tripping while displaying the "light alarm" indication / - a / on the LED monitor. In addition to the indication / - a /, the inverter blinks the KEYPAD CONTROL LED and outputs the "light alarm" signal **L-ALM** to a digital output terminal to alert the peripheral equipment to the occurrence of a light alarm. (To use the **L-ALM**, it is necessary to assign the signal to any of the digital output terminals by setting any of function codes E20 through E24 and E27 to "98.")

Function codes H81 and H82 specify which alarms should be categorized as "light alarm."

The table below lists alarms selectable as "light alarm."

Code	Name	Refer to:
<i>oh1</i>	Heat sink overheat	Chapter 6, page 6-14
<i>oh2</i>	External alarm	Chapter 6, page 6-14
<i>oh3</i>	Inverter internal overheat	Chapter 6, page 6-15
<i>dbh</i>	Braking resistor overheated	Chapter 6, page 6-16
<i>o11</i> to <i>o14</i>	Overload of motor 1 through 4	Chapter 6, page 6-17
<i>er4</i>	Option communications error	Chapter 6, page 6-20
<i>er5</i>	Option error	Chapter 6, page 6-20
<i>er8</i> <i>erp</i>	RS-485 communications error (COM port 1) RS-485 communications error (COM port 2)	Chapter 6, page 6-21
<i>ere</i>	Speed mismatch or excessive speed deviation	Chapter 6, page 6-22
<i>fal</i>	DC fan locked	Function code H98, bit 5
<i>o1</i>	Motor overload early warning	Function code E20, data = 7
<i>oh</i>	Heat sink overheat early warning	Function code E20, data = 28
<i>lif</i>	Lifetime alarm	Function code E20, data = 30
<i>ref</i>	Reference command loss detected	Function code E20, data = 33
<i>pid</i>	PID alarm	Function code E20, data = 42
<i>uTl</i>	Low torque output	Function code E20, data = 45
<i>pTc</i>	PTC thermistor activated	Function code E20, data = 56
<i>rTe</i>	Inverter life (Cumulative motor run time)	Function code E20, data = 84 (Function code H78)
<i>cnT</i>	Inverter life (Number of startups)	Function code E20, data = 84 (Function code H79)

Set data for selecting "light alarm"s in hexadecimal. For details on how to select the codes, refer to the next page.

- Data setting range: 0000 to FFFF (Hexadecimal)

### ■ Selecting light alarm factors

To set and display the light alarm factors in hexadecimal format, each light alarm factor has been assigned to bits 0 to 15 as listed in Tables 5.4 and 5.5. Set the bit that corresponds to the desired light alarm factor to "1." Table 5.6 shows the relationship between each of the light alarm factor assignments and the LED monitor display.

Table 5.7 gives the conversion table from 4-bit binary to hexadecimal.

Table 5.4 Light Alarm Selection 1 (H81), Bit Assignment of Selectable Factors

Bit	Code	Content	Bit	Code	Content
15	—	—	7	<i>013</i>	Overload of motor 3
14	—	—	6	<i>012</i>	Overload of motor 2
13	<i>erp</i>	RS-485 communications error (COM port 2)	5	<i>011</i>	Overload of motor 1
12	<i>er8</i>	RS-485 communications error (COM port 1)	4	<i>dbh</i>	Braking resistor overheated
11	<i>er5</i>	Option error	3	—	—
10	<i>er4</i>	Option communications error	2	<i>oh3</i>	Inverter internal overheat
9	—	—	1	<i>oh2</i>	External alarm
8	<i>014</i>	Overload of motor 4	0	<i>oh1</i>	Heat sink overheat

Table 5.5 Light Alarm Selection 2 (H82), Bit Assignment of Selectable Factors

Bit	Code	Content	Bit	Code	Content
15	—	—	7	<i>lif</i>	Lifetime alarm
14	—	—	6	<i>oh</i>	Heat sink overheat early warning
13	<i>cnT</i>	Inverter life (Number of startups)	5	<i>01</i>	Motor overload early warning
12	<i>rTe</i>	Inverter life (Cumulative motor run time)	4	<i>fal</i>	DC fan locked
11	<i>pTc</i>	PTC thermistor activated	3	—	—
10	<i>uTl</i>	Low torque output	2	—	—
9	<i>pid</i>	PID alarm	1	—	—
8	<i>ref</i>	Reference command loss detected	0	<i>ere</i>	Speed mismatch or excessive speed deviation



Table 5.6 Display of Light Alarm Factor

(Example) Light alarm factors "RS-485 communications error (COM port 2)," "RS-485 communications error (COM port 1)," "Option communications error," "Overload of motor 1" and "Heat sink overhear" are selected by H81.

LED No.	LED4				LED3				LED2				LED1											
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0								
Code	—	—	<i>erp</i>	<i>er8</i>	<i>er5</i>	<i>er4</i>	—	<i>o14</i>	<i>o13</i>	<i>o12</i>	<i>o11</i>	<i>dbh</i>	—	<i>oh3</i>	<i>oh2</i>	<i>oh1</i>								
Binary	0	0	1	1	0	1	0	0	0	0	1	0	0	0	0	1								
Example	Hexadecimal (See Table 5.7.)				Hexadecimal (See Table 5.7.)				Hexadecimal (See Table 5.7.)				Hexadecimal (See Table 5.7.)											
	3				4				2				1											
Hexadecimal on the LED monitor	<table style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <tr> <td style="text-align: center;">LED4</td> <td style="text-align: center;">LED3</td> <td style="text-align: center;">LED2</td> <td style="text-align: center;">LED1</td> </tr> <tr> <td style="text-align: center; border: 1px solid black;">3</td> <td style="text-align: center; border: 1px solid black;">4</td> <td style="text-align: center; border: 1px solid black;">2</td> <td style="text-align: center; border: 1px solid black;">1</td> </tr> </table>																LED4	LED3	LED2	LED1	3	4	2	1
LED4	LED3	LED2	LED1																					
3	4	2	1																					

■ **Hexadecimal expression**



A 4-bit binary number can be expressed in hexadecimal format (1 hexadecimal digit). The table below shows the correspondence between the two notations. The hexadecimals are shown as they appear on the LED monitor.

Table 5.7 Binary and Hexadecimal conversion

Binary				Hexadecimal	Binary				Hexadecimal
0	0	0	0	0	1	0	0	0	8
0	0	0	1	1	1	0	0	1	9
0	0	1	0	2	1	0	1	0	a
0	0	1	1	3	1	0	1	1	b
0	1	0	0	4	1	1	0	0	c
0	1	0	1	5	1	1	0	1	d
0	1	1	0	6	1	1	1	0	e
0	1	1	1	7	1	1	1	1	f

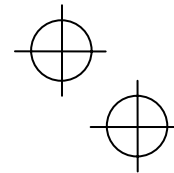
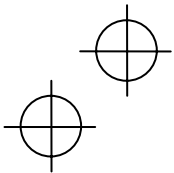
**Note** When H26 data is set to "1" (PTC (The inverter immediately trips with *Oh4* displayed)), if the PTC thermistor is activated, the inverter stops without displaying *l-a1*, blinking the KEYPAD CONTROL LED, or outputting **L-ALM** signal, regardless of the assignment of bit 11 (PTC thermistor activated) by H82 (Light Alarm Selection 2).

H97 Clear Alarm Data  
H45 Mock Alarm

H97 clears alarm data (alarm history and relevant information) stored in the inverter. To clear alarm data, simultaneous keying of  key +  key" is required.

H45 causes the inverter to generate a mock alarm in order to check whether external sequences function correctly at the time of machine setup. Mock alarm data can also be cleared by H97.

Data for H97	Function
0	Disable
1	Enable (Setting "1" clears alarm data and then returns to "0.")



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**H98** Protection/Maintenance Function (Mode selection)

H98 specifies whether to enable or disable automatic lowering of carrier frequency, input phase loss protection, output phase loss protection, judgment threshold on the life of DC link bus capacitor, judgment on the life of DC link bus capacitor, DC fan lock detection, braking transistor error detection, and IP20/IP40 switching, in combination (Bit 0 to Bit 7).

Automatic lowering of carrier frequency (Bit 0)

This function should be used for important machinery that requires keeping the inverter running.

Even if a heat sink overheat or overload occurs due to excessive load, abnormal surrounding temperature, or cooling system failure, enabling this function lowers the carrier frequency to avoid tripping (*Oh1*, *Oh3* or *Ouv*). Note that enabling this function results in increased motor noise.

Input phase loss protection (*lin*) (Bit 1)

Upon detection of an excessive stress inflicted on the apparatus connected to the main circuit due to phase loss or line-to-line voltage unbalance in the three-phase power supplied to the inverter, this feature stops the inverter and displays an alarm *lin*.

**Note** In configurations where only a light load is driven or a DC reactor is connected, phase loss or line-to-line voltage unbalance may not be detected because of the relatively small stress on the apparatus connected to the main circuit.

Output phase loss protection (*opl*) (Bit 2)

Upon detection of phase loss in the output while the inverter is running, this feature stops the inverter and displays an alarm *opl*.

**Note** Where a magnetic contactor is installed in the inverter output circuit, if the magnetic contactor goes OFF during operation, all the phases will be lost. In such a case, this protection feature does not work.

Judgment threshold on the life of DC link bus capacitor (Bit 3)

Bit 3 is used to select the threshold for judging the life of the DC link bus capacitor--the factory default level or user-setup level.

**Note** If the multi-function keypad is mounted, the inverter does not perform automatic capacitance measurement of the DC link bus capacitor using the factory default level since the inverter's conditions are different from the ones applied at shipment. It is, therefore, necessary to select the user-setup level. Using the user-setup level requires performing the setup procedure for the user ordinary operation beforehand.

(Refer to Chapter 7, Section 7.3.1 "Judgment on service life.")

Judgment on the life of DC link bus capacitor (Bit 4)

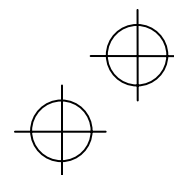
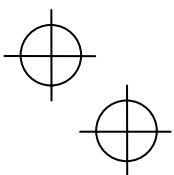
Whether the DC link bus capacitor has reached its life is determined by measuring the length of time for discharging after power OFF. The discharging time is determined by the capacitance of the DC link bus capacitor and the load inside the inverter. Therefore, if the load inside the inverter fluctuates significantly, the discharging time cannot be accurately measured, and as a result, it may be mistakenly determined that the life has been reached. To avoid such an error, you can disable the judgment on the life of the DC link bus capacitor.

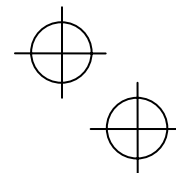
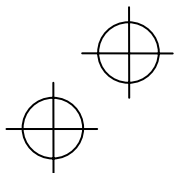
Since load may vary significantly in the following cases, disable the judgment on the life during operation. Either conduct the measurement with the judgment enabled under appropriate conditions during periodical maintenance or conduct the measurement under the operating conditions matching the actual ones.

- Auxiliary input for control power is used.
- An option card or multi-function keypad is used.
- Another inverter or equipment such as a PWM converter is connected to terminals of the DC link bus.

DC fan lock detection (Bit 5) (200 V class series: 45 kW or above, 400 V class series: 75 kW or above)

An inverter of 45 kW or above (200 V class series), or of 75 kW or above (400 V class series) is equipped with the internal air circulation DC fan. When the inverter detects that the DC fan is locked by a failure or other cause, you can select either continuing the inverter operation or entering into alarm state.





Entering alarm state: The inverter issues the alarm *Oh1* and coasts to stop the motor.  
 Continuing operation: The inverter does not enter the alarm mode, and continues operation of the motor.  
 Note that, however, the inverter turns ON the **OH** and **LIFE** signals on the transistor output terminals whenever the DC fan lock is detected regardless of your selection.

**Note** If the ON/OFF control of the cooling fan is enabled (H06 = 1), the cooling fan may stop depending on operating condition of the inverter. In this case, the DC fan lock detection feature is considered normal (e.g.; the cooling fan is normally stopped by the stop fan command.) so that the inverter may turn OFF the **LIFE** or **OH** signal output, or enable to cancel the alarm *Oh1*, even if the internal air circulation DC fan is locked due to a failure etc. (When you start the inverter in this state, it automatically issues the run fan command, then the inverter detects the DC fan lock state, and turn ON the **LIFE** or **OH** output or enters the alarm *Oh1* state.)

Note that, operating the inverter under the condition that the DC fan is locked for long time may shorten the life of electrolytic capacitors on the PCBs due to local high temperature inside the inverter. Be sure to check with the **LIFE** signal etc., and replace the broken fan as soon as possible.

Braking transistor error detection (Bit 6) (*dba*: 22 kW or below)

Upon detection of a built-in braking transistor error, this feature stops the inverter and displays an alarm *dba*. Set data of this bit to "0" when the inverter does not use a braking transistor and there is no need of entering an alarm state.

Switch IP20/IP40 enclosure (Bit 7) (22 kW or below)

Mounting an IP40 option to inverters with a capacity of 22 kW or below enables them to conform to IP40. In such a case, switch Bit 7 to "1" for the protection coordination. For details, refer to the instruction manual of the IP40 option.

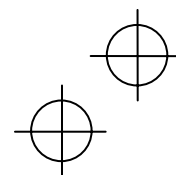
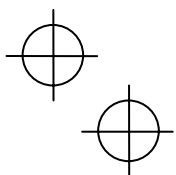
To set data of function code H98, assign the setting of each function to each bit and then convert the 8-bit binary to the decimal number.

Refer to the assignment of each function to each bit and a conversion example below.

Bit	Function	Bit data = 0	Bit data = 1	Factory default
0	Lower the carrier frequency automatically	Disable	Enable	1: Enable
1	Detect input phase loss	Continue to run	Enter alarm processing	1: Enter alarm processing
2	Detect output phase loss	Continue to run	Enter alarm processing	0: Continue to run
3	Select life judgment threshold of DC link bus capacitor	Factory default	User-defined setting	0: Factory default
4	Judge the life of DC link bus capacitor	Disable	Enable	1: Enable
5	Detect DC fan lock	Enter alarm processing	Continue to run	0: Enter alarm processing
6	Detect braking transistor error	Continue to run	Enter alarm processing	1: Enter alarm processing
7	Switch IP20/IP40 enclosure	IP20	IP40	0: IP20

An example of conversion from binary to decimal (for the number configured by the factory default setting shown above)

$$\begin{aligned}
 \text{Decimal} &= \text{Bit } 7 \times 2^7 + \text{Bit } 6 \times 2^6 + \text{Bit } 5 \times 2^5 + \text{Bit } 4 \times 2^4 + \text{Bit } 3 \times 2^3 + \text{Bit } 2 \times 2^2 + \text{Bit } 1 \times 2^1 + \text{Bit } 0 \times 2^0 \\
 &= \text{Bit } 7 \times 128 + \text{Bit } 6 \times 64 + \text{Bit } 5 \times 32 + \text{Bit } 4 \times 16 + \text{Bit } 3 \times 8 + \text{Bit } 2 \times 4 + \text{Bit } 1 \times 2 + \text{Bit } 0 \times 1 \\
 &= 0 \times 128 + 1 \times 64 + 0 \times 32 + 1 \times 16 + 0 \times 8 + 0 \times 4 + 1 \times 2 + 1 \times 1 \\
 &= 64 + 16 + 2 + 1 \\
 &= 83
 \end{aligned}$$



A42, b42  
r42 Motor/Parameter Switching 2, 3, and 4 (Mode selection)

The combination of digital input terminal commands **M2**, **M3** and **M4** switches to any of the 1st to 4th motors. When the motor is switched, the function code group with which the inverter drives the motor is also switched to the one corresponding to the motor.

Terminal command			Inverter driven motor selected (Function code group enabled)	Motor/parameter switching code	Output signal turned ON
<b>M2</b>	<b>M3</b>	<b>M4</b>			
OFF	OFF	OFF	1st Motor (Default codes)	—	<b>SWM1</b>
ON	—	—	2nd Motor (A codes)	A42	<b>SWM2</b>
OFF	ON	—	3rd Motor (b codes)	b42	<b>SWM3</b>
OFF	OFF	ON	4th Motor (r codes)	r42	<b>SWM4</b>

**Note** From the point of view of signal timing, a combination of **M2**, **M3** and **M4** must be determined at least 2 ms before the signal of a run command is established.

Data setting of function codes A42, b42 or r42 selects the object of switching by a combination of **M2**, **M3** and **M4** between the motor (2nd, 3rd or 4th) and the particular parameters (A codes, b codes or r codes).

Data for A42, b42 or r42	Function	Switching is available when the inverter is:
0	Motor (Switch to the 2nd, 3rd or 4th motor)	In a stopped state (all the run commands are OFF)
1	Parameter (Switch to particular A codes, b codes or r codes)	Running

If data of function code A42, b42 or r42 is set to "0: Motor (Switch to the 2nd, 3rd or 4th motor)," a combination of **M2**, **M3** and **M4** switches the motor to any of the 2nd to 4th motors and also switches the function code group enabled to the one corresponding to the selected motor, as listed in Table 5.8. Note that, however, the functions listed in Table 5.9 are unavailable when any of the 2nd to 4th motors are selected.

If data of function code A42, b42 or r42 is set to "1: Parameter (Switch to particular A codes, b codes or r codes)," a combination of **M2**, **M3** and **M4** switches the particular parameters marked with Y in the "Object of parameter switching" column in Table 5.8.

Table 5.8 Function Codes to be Switched

Name	Function code				Object of parameter switching
	1st motor	2nd motor	3rd motor	4th motor	
Maximum frequency	F03	A01	b01	r01	
Base frequency	F04	A02	b02	r02	
Rated voltage at base frequency	F05	A03	b03	r03	
Maximum output voltage	F06	A04	b04	r04	
Torque boost	F09	A05	b05	r05	
Electronic thermal overload protection for motor (Select motor characteristics) (Overload detection level) (Thermal time constant)	F10	A06	b06	r06	
	F11	A07	b07	r07	
	F12	A08	b08	r08	
DC braking (Braking starting frequency) (Braking level) (Braking time)	F20	A09	b09	r09	
	F21	A10	b10	r10	
	F22	A11	b11	r11	
Starting frequency	F23	A12	b12	r12	

Table 5.8 Function Codes to be Switched (Continued)

Name	Function code				Object of parameter switching
	1st motor	2nd motor	3rd motor	4th motor	
Load selection/ Auto torque boost/ Auto energy saving operation	F37	A13	b13	r13	Y
Drive control selection	F42	A14	b14	r14	
Motor (No. of poles)	P01	A15	b15	r15	
(Rated capacity)	P02	A16	b16	r16	
(Rated current)	P03	A17	b17	r17	
(Auto-tuning)	P04	A18	b18	r18	
(No-load current)	P06	A20	b20	r20	
(%R1)	P07	A21	b21	r21	
(%X)	P08	A22	b22	r22	
(Slip compensation gain for driving)	P09	A23	b23	r23	Y
(Slip compensation response time)	P10	A24	b24	r24	Y
(Slip compensation gain for braking)	P11	A25	b25	r25	Y
(Rated slip frequency)	P12	A26	b26	r26	
(Iron loss factor 1)	P13	A27	b27	r27	
(Iron loss factor 2)	P14	A28	b28	r28	
(Iron loss factor 3)	P15	A29	b29	r29	
(Magnetic saturation factor 1)	P16	A30	b30	r30	
(Magnetic saturation factor 2)	P17	A31	b31	r31	
(Magnetic saturation factor 3)	P18	A32	b32	r32	
(Magnetic saturation factor 4)	P19	A33	b33	r33	
(Magnetic saturation factor 5)	P20	A34	b34	r34	
(Magnetic saturation extension factor "a")	P21	A35	b35	r35	
(Magnetic saturation extension factor "b")	P22	A36	b36	r36	
(Magnetic saturation extension factor "c")	P23	A37	b37	r37	
Motor selection	P99	A39	b39	r39	
Slip compensation (Operating conditions)	H68	A40	b40	r40	Y
Output current fluctuation damping gain for motor	H80	A41	b41	r41	Y
Speed control (Speed command filter)	d01	A43	b43	r43	Y
(Speed detection filter)	d02	A44	b44	r44	Y
P (Gain)	d03	A45	b45	r45	Y
I (Integral time)	d04	A46	b46	r46	Y
(Output filter)	d06	A48	b48	r48	Y
Reserved	d51	d52	d53	d54	
Cumulative motor run time	H94	A51	b51	r51	
Startup counter for motor	H44	A52	b52	r52	
Motor (%X correction factor 1)	P53	A53	b53	r53	
(%X correction factor 2)	P54	A54	b54	r54	
(Torque current under vector control)	P55	A55	b55	r55	
(Induced voltage factor under vector control)	P56	A56	b56	r56	

Table 5.9 Function Codes Unavailable for the 2nd to 4th Motors

Name	Function codes	Operation in 2nd to 4th motors
Non-linear V/f pattern	H50 to H53, H65, H66	Disabled
Starting frequency 1 (Holding time)	F24	Disabled
Stop frequency (Holding time)	F39	Disabled
Overload early warning/ Current detection	E34, E35	Disabled
Droop control	H28	Disabled
<b>UP/DOWN</b> control (Initial frequency setting)	H61	Fixed at the initial setting (0 Hz)
PID control	J01 to J06, J08 to J13, J15 to J19, J56 to J62, E40, E41, H91	Disabled
Brake signal	J68 to J72, J95, J96	Disabled
Current limiter	F43, F44	Disabled
Rotational direction limitation	H08	Disabled
Pre-excitation	H84, H85	Disabled
Maintenance Interval/ Preset Startup Count for Maintenance	H78, H79	Disabled
NTC thermistor	H26, H27	Disabled

## Chapter 6 TROUBLESHOOTING

### 6.1 Protective functions

The FRENIC-MEGA series of inverters has various protective functions as listed below to prevent the system from going down and reduce system downtime. The protective functions marked with an asterisk (\*) in the table are disabled by factory default. Enable them according to your needs.

The protective functions include, for example, the "heavy alarm" detection function which, upon detection of an abnormal state, displays the alarm code on the LED monitor and causes the inverter to trip, the "light alarm" detection function which displays the alarm code but lets the inverter continue the current operation, and other warning signal output functions.

If any problem arises, understand the protective functions listed below and follow the procedures given in Sections 6.2 and onwards for troubleshooting.

Protective function	Description	Related function code
"Heavy alarm" detection	This function detects an abnormal state, displays the corresponding alarm code, and causes the inverter to trip. The "heavy alarm" codes are check-marked in the "Heavy alarm" object column in Table 6.1. For details of each alarm code, see the corresponding item in the troubleshooting. The inverter retains the last four alarm codes and their factors together with their running information applied when the alarm occurred, so it can display them.	H98
"Light alarm" detection*	This function detects an abnormal state categorized as a "light alarm," displays / - a / and lets the inverter continue the current operation without tripping. It is possible to define which abnormal states should be categorized as a "light alarm" using function codes H81 and H82. The "light alarm" codes are check-marked in the "Light alarm" object column in Table 6.1. For how to check and release light alarms, see Section 6.5 "If the "Light Alarm" Indication ( / - a / ) Appears on the LED Monitor."	H81 H82
Stall prevention	When the output current exceeds the current limiter level (F44) during acceleration/ deceleration or constant speed running, this function decreases the output frequency to avoid an overcurrent trip.	F44
Overload prevention control*	Before the inverter trips due to a heat sink overheat (Oh1) or inverter overload (Ou), this function decreases the output frequency to reduce the load.	H70
Automatic deceleration* (Anti-regenerative control)	If regenerative energy returned exceeds the inverter's braking capability, this function automatically increases the deceleration time or controls the output frequency to avoid an overvoltage trip.	H69
Deceleration characteristics* (Excessive regenerative energy proof braking capability)	During deceleration, this function increases the motor energy loss and decreases the regenerative energy returned to avoid an overvoltage trip (Ou).	H71
Reference loss detection*	This function detects a reference frequency loss (due to a broken wire, etc.), continues the inverter operation at the specified frequency, and issues the "Command loss detected" signal <b>REF OFF</b> .	E65
Automatic lowering of carrier frequency	Before the inverter trips due to an abnormal surrounding temperature or output current, this function automatically lowers the carrier frequency to avoid a trip.	H98
Dew condensation prevention*	Even when the inverter is in stopped state, this function feeds DC current across the motor at certain intervals to raise the motor temperature for preventing dew condensation.	J21
Motor overload early warning*	When the inverter output current has exceeded the specified level, this function issues the "Motor overload early warning" signal <b>OL</b> before the thermal overload protection function causes the inverter to trip for motor protection. This function exclusively applies to the 1st motor.	E34 E35
Auto-reset*	When the inverter has stopped because of a trip, this function allows the inverter to automatically reset and restart itself. (The number of retries and the latency between stop and reset can be specified.)	H04 H05
Forced stop*	Upon receipt of the "Force to stop" terminal command <b>STOP</b> , this function interrupts the run and other commands currently applied in order to forcibly decelerate the inverter to a stop.	H56
Surge protection	This function protects the inverter from a surge voltage invaded between main circuit power lines and the ground.	--

Table 6.1 Abnormal States Detectable ("Heavy Alarm" and "Light Alarm" Objects)

Code	Name	"Heavy alarm" objects	"Light alarm" objects	Remarks	Ref. page
<i>Oc1, Oc2, Oc3</i>	Instantaneous overcurrent	√	--		6-11
<i>ef</i>	Ground fault	√	--	30 kW or above	6-12
<i>Ou1, Ou2, Ou3</i>	Overvoltage	√	--		6-12
<i>lu</i>	Undervoltage	√	--		6-13
<i>lin</i>	Input phase loss	√	--		6-13
<i>op1</i>	Output phase loss	√	--		6-14
<i>oh1</i>	Heat sink overheat	√	√		6-14
<i>oh2</i>	External alarm	√	√		6-14
<i>oh3</i>	Inverter internal overheat	√	√		6-15
<i>oh4</i>	Motor protection (PTC/NTC thermistor)	√	--		6-15
<i>dbh</i>	Braking resistor overheat	√	√	22 kW or below	6-16
<i>fu5</i>	Fuse blown	√	--	200 V class series with 75 kW or above, 400 V class series with 90 kW or above	6-16
<i>pbf</i>	Charger circuit fault	√	--	200 V class series with 37 kW or above, 400 V class series with 75 kW or above	6-16
<i>O11 to O14</i>	Overload of motor 1 through 4	√	√		6-17
<i>O1u</i>	Inverter overload	√	--		6-17
<i>O5</i>	Overspeed	√	--		6-18
<i>pg</i>	PG wire break	√	--		6-18
<i>er1</i>	Memory error	√	--		6-19
<i>er2</i>	Keypad communications error	√	--		6-19
<i>er3</i>	CPU error	√	--		6-19
<i>er4</i>	Option communications error	√	√		6-20
<i>er5</i>	Option error	√	√		6-20
<i>er6</i>	Operation protection	√	--		6-20
<i>er7</i>	Tuning error	√	--		6-20
<i>er8</i>	RS-485 communications error (COM port 1)	√	√		6-21
<i>erp</i>	RS-485 communications error (COM port 2)	√	√		6-21
<i>erf</i>	Data saving error during undervoltage	√	--		6-22
<i>erh</i>	Hardware error	√	--	200 V class series with 37 kW or above, 400 V class series with 45 kW or above	6-22
<i>ere</i>	Speed mismatch or excessive speed deviation	√	√		6-22
<i>nrb</i>	NTC wire break error	√	--		6-23
<i>err</i>	Mock alarm	√	--		6-23
<i>cof</i>	PID feedback wire break	√	√		6-24
<i>dba</i>	Braking transistor broken	√	--		6-24
<i>ero</i>	Positioning control error	√	--		6-24
<i>ecf</i>	Enable circuit failure	√	--		6-24
<i>l-al</i>	Light alarm	--	--		--
<i>fal</i>	DC fan locked	--	√	200 V class series with 45 kW or above, 400 V class series with 75 kW or above	--
<i>O1</i>	Motor overload early warning	--	√		--
<i>Oh</i>	Heat sink overheat early warning	--	√		--
<i>lif</i>	Lifetime alarm	--	√		--
<i>ref</i>	Reference command loss detected	--	√		--
<i>pid</i>	PID alarm	--	√		--
<i>uTl</i>	Low torque output	--	√		--
<i>pTc</i>	PTC thermistor activated	--	√		--
<i>rTe</i>	Inverter life (Motor cumulative run time)	--	√		--
<i>cnT</i>	Inverter life (Number of startups)	--	√		--



## 6.2 Before Proceeding with Troubleshooting

### **WARNING**

If any of the protective functions has been activated, first remove the cause. Then, after checking that the all run commands are set to OFF, release the alarm. If the alarm is released while any run commands are set to ON, the inverter may supply the power to the motor, running the motor.

**Injury may occur.**

- Even if the inverter has interrupted power to the motor, if the voltage is applied to the main circuit input terminals L1/R, L2/S and L3/T, voltage may be output to inverter output terminals U, V, and W.
- Turn OFF the power and wait at least five minutes for inverters with a capacity of 22 kW or below, or at least ten minutes for inverters with a capacity of 30 kW or above. Make sure that the LED monitor and charging lamp are 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 to the safe level (+25 VDC or below).

**Electric shock may occur.**

Follow the procedure below to solve problems.

(1) First, check that the inverter is correctly wired, referring to Chapter 2, Section 2.3.5 "Wiring of main circuit terminals and grounding terminals."

(2) Check whether an alarm code or the "light alarm" indication ( / - a / ) is displayed on the LED monitor.

- If neither an alarm code nor "light alarm" indication ( / - a / ) appears on the LED monitor

Abnormal motor operation → Go to Section 6.3.1.

- [1] The motor does not rotate.
- [2] The motor rotates, but the speed does not increase.
- [3] The motor runs in the opposite direction to the command.
- [4] Speed fluctuation or current oscillation (e.g., hunting) occurs during running at constant speed.
- [5] Grating sound is heard from the motor or the motor sound fluctuates.
- [6] The motor does not accelerate or decelerate within the specified time.
- [7] The motor does not restart even after the power recovers from a momentary power failure.
- [8] The motor abnormally heats up.
- [9] The motor does not run as expected.

Problems with inverter settings → Go to Section 6.3.2.

- [1] Nothing appears on the LED monitor.
- [2] The desired menu is not displayed.
- [3] Data of function codes cannot be changed.
- If an alarm code appears on the LED monitor → Go to Section 6.4.
- If the "light alarm" indication ( / - a / ) appears on the LED monitor → Go to Section 6.5.
- If an abnormal pattern appears on the LED monitor → Go to Section 6.6.  
while neither an alarm code nor "light alarm" indication ( / - a / ) is displayed

If any problems persist after the above recovery procedure, contact your Fuji Electric representative.

### 6.3 If Neither an Alarm Code Nor "Light Alarm" Indication ( / - a / ) Appears on the LED Monitor

This section describes the troubleshooting procedure based on function codes dedicated to motor 1 which are marked with an asterisk (\*). For motors 2 to 4, replace those asterisked function codes with respective motor dedicated ones (refer to Chapter 5, Table 5.7).

 For the function codes dedicated to motors 2 to 4, see Chapter 5 "FUNCTION CODES."

#### 6.3.1 Abnormal motor operation

##### [ 1 ] The motor does not rotate.





Possible Causes	What to Check and Suggested Measures
(1) No power supplied to the inverter.	<p>Check the input voltage and interphase voltage unbalance.</p> <ul style="list-style-type: none"> <li>→ Turn ON a molded case circuit breaker (MCCB), a residual-current-operated protective device (RCD)/earth leakage circuit breaker (ELCB) (with overcurrent protection) or a magnetic contactor (MC).</li> <li>→ Check for voltage drop, phase loss, poor connections, or poor contacts, and fix them if necessary.</li> <li>→ If only the auxiliary control power input is supplied, also supply the main power to the inverter.</li> </ul>
(2) No run forward/reverse command was inputted, or both the commands were inputted simultaneously (external signal operation).	<p>Check the input status of the forward/reverse command with Menu #4 "I/O Checking" using the keypad.</p> <ul style="list-style-type: none"> <li>→ Input a run command.</li> <li>→ Set either the forward or reverse operation command to off if both commands are being inputted.</li> <li>→ Correct the run command source. (Set F02 data to "1.")</li> <li>→ Correct the assignment of commands <b>FWD</b> and <b>REV</b> with function codes E98 and E99.</li> <li>→ Connect the external circuit wires to control circuit terminals [FWD] and [REV] correctly.</li> <li>→ Make sure that the sink/source slide switch (SW1) on the control printed circuit board (control PCB) is properly configured.</li> </ul>
(3) No Enable input	<p>Check the input status of terminal [EN] with Menu #4 "I/O Checking" using the keypad.</p> <ul style="list-style-type: none"> <li>→ Correct the external circuit wiring to control circuit terminal [EN].</li> </ul>
(4) No rotation direction command (keypad operation).	<p>Check the input status of the forward/reverse rotation direction command with Menu #4 "I/O Checking" using the keypad.</p> <ul style="list-style-type: none"> <li>→ Input the rotation direction (F02 = 0), or select the keypad operation with which the rotation direction is fixed (F02 = 2 or 3).</li> </ul>
(5) The inverter could not accept any run commands from the keypad since it was in Programming mode.	<p>Check which operation mode the inverter is in, using the keypad.</p> <ul style="list-style-type: none"> <li>→ Shift the operation mode to Running mode and enter a run command.</li> </ul>
(6) A run command with higher priority than the one attempted was active, and the run command was stopped.	<p>Referring to the block diagram of the frequency command block (refer to the FRENIC-MEGA User's Manual, Chapter 6), check the higher priority run command with Menu #2 "Data Checking" and Menu #4 "I/O Checking" using the keypad.</p> <ul style="list-style-type: none"> <li>→ Correct any incorrect function code data settings (in H30, y98, etc.) or cancel the higher priority run command.</li> </ul>
(7) No analog frequency command input.	<p>Check whether the analog frequency command (reference frequency) is correctly inputted, using Menu #4 "I/O Checking" on the keypad.</p> <ul style="list-style-type: none"> <li>→ Connect the external circuit wires to terminals [13], [12], [11], [C1], and [V2] correctly.</li> <li>→ When terminal [C1] is used, check the slider position of terminal [C1] property switch (SW5) and the setting of the thermistor mode selection (H26).</li> </ul>

Possible Causes	What to Check and Suggested Measures
(8) The reference frequency was below the starting or stop frequency.	<p>Check that a reference frequency has been entered correctly, using Menu #4 "I/O Checking" on the keypad.</p> <ul style="list-style-type: none"> <li>→ Set the reference frequency at the same or higher than that of the starting and stop frequencies (F23* and F25).</li> <li>→ Reconsider the starting and stop frequencies (F23* and F25), and if necessary, change them to the lower values.</li> <li>→ Inspect the external potentiometer (for frequency setting), signal converters, switches, and relay contacts. Replace any ones that are faulty.</li> <li>→ Connect the external circuit wires to terminals [13], [12], [11], [C1], and [V2] correctly.</li> </ul>
(9) A frequency command with higher priority than the one attempted was active.	<p>Check the higher priority run command with Menu #2 "Data Checking" and Menu #4 "I/O Checking" using the keypad, referring to the block diagram of the frequency command block (refer to the FRENIC-MEGA User's Manual, Chapter 6).</p> <ul style="list-style-type: none"> <li>→ Correct any incorrect function code data (e.g. cancel the higher priority run command).</li> </ul>
(10) The upper and lower frequencies for the frequency limiters were set incorrectly.	<p>Check the data of function codes F15 (Frequency limiter (High)) and F16 (Frequency limiter (Low)).</p> <ul style="list-style-type: none"> <li>→ Change the settings of F15 and F16 to the correct ones.</li> </ul>
(11) The coast-to-stop command was effective.	<p>Check the data of function codes E01 through E07, E98, and E99 and the input signal status, using Menu #4 "I/O Checking" on the keypad.</p> <ul style="list-style-type: none"> <li>→ Release the coast-to-stop command setting.</li> </ul>
(12) Broken wires, incorrect connection or poor contact with the motor.	<p>Check the wiring (Measure the output current).</p> <ul style="list-style-type: none"> <li>→ Repair the wires to the motor, or replace them.</li> </ul>
(13) Overload	<p>Measure the output current.</p> <ul style="list-style-type: none"> <li>→ Reduce the load (In winter, the load tends to increase.)</li> </ul> <p>Check whether any mechanical brake is activated.</p> <ul style="list-style-type: none"> <li>→ Release the mechanical brake, if any.</li> </ul>
(14) Torque generated by the motor was insufficient.	<p>Check that the motor starts running if the value of torque boost (F09*) is increased.</p> <ul style="list-style-type: none"> <li>→ Increase the value of torque boost (F09*) and try to run the motor.</li> </ul> <p>Check the data of function codes F04*, F05*, H50, H51, H52, H53, H65, and H66.</p> <ul style="list-style-type: none"> <li>→ Change the V/f pattern to match the motor's characteristics.</li> </ul> <p>Check that the motor switching signal (selecting motor 1, 2, 3 or 4) is correct and the data of function codes matches each motor.</p> <ul style="list-style-type: none"> <li>→ Correct the motor switching signal.</li> <li>→ Modify the function code data to match the connected motor.</li> </ul> <p>Check whether the reference frequency is below the slip-compensated frequency of the motor.</p> <ul style="list-style-type: none"> <li>→ Change the reference frequency so that it becomes higher than the slip-compensated frequency of the motor.</li> </ul>
(15) Wrong connection or poor contact of DC reactor (DCR)	<p>Check the wiring.</p> <p>Inverters with a capacity of 55 kW in LD mode and inverters with 75 kW or above require a DCR to be connected. Without a DCR, these inverters cannot run.</p> <ul style="list-style-type: none"> <li>→ Connect the DCR correctly. Repair or replace DCR wires.</li> </ul>

**[ 2 ] The motor rotates, but the speed does not increase.**

Possible Causes	What to Check and Suggested Measures
(1) The maximum frequency currently specified was too low.	Check the data of function code F03* (Maximum frequency). → Correct the F03* data.
(2) The data of frequency limiter (High) currently specified was too low.	Check the data of function code F15 (Frequency limiter (High)). → Correct the F15 data.
(3) The reference frequency currently specified was too low.	Check that the reference frequency has been entered correctly, using Menu #4 "I/O Checking" on the keypad. → Increase the reference frequency. → Inspect the external potentiometer (for frequency setting), signal converters, switches, and relay contacts. Replace any ones that are faulty. → Connect the external circuit wires to terminals [13], [12], [11], [C1], and [V2] correctly.
(4) A frequency command (e.g., multi-frequency or via communications) with higher priority than the one attempted was active and its reference frequency was too low.	Check the data of the relevant function codes and what frequency commands are being received, through Menu #1 "Data Setting," Menu #2 "Data Checking" and Menu #4 "I/O Checking," on the keypad by referring to the block diagram of the frequency command (refer to the FRENIC-MEGA User's Manual, Chapter 6). → Correct any incorrect data of function codes (e.g. cancel the higher priority frequency command).
(5) The acceleration time was too long or too short.	Check the data of function codes F07, E10, E12, and E14 (Acceleration time). → Change the acceleration time to match the load.
(6) Overload.	Measure the output current. → Reduce the load. Check whether any mechanical brake is activated. → Release the mechanical brake.
(7) Function code settings do not agree with the motor characteristics.	If auto-torque boost or auto-energy saving operation is specified, check whether the data of P02*, P03*, P06*, P07*, and P08* agree with the parameters of the motor. → Perform auto-tuning of the inverter for the motor to be used.
(8) The output frequency does not increase due to the current limiter operation.	Make sure that F43 (Current limiter (Mode selection)) is set to "2" and check the data of F44 (Current limiter (Level)). → Correct the F44 data. Or, if the current limiter operation is not needed, set F43 to "0" (disabled). Decrease the value of torque boost (F09*), then run the motor again and check if the speed increases. → Adjust the value of the torque boost (F09*). Check the data of function codes F04*, F05*, H50, H51, H52, H53, H65, and H66 to ensure that the V/f pattern setting is right. → Match the V/f pattern setting with the motor ratings.
(9) The output frequency does not increase due to the torque limiter operation.	Check whether data of torque limiter related function codes (F40, F41, E16 and E17) is correctly configured and the "Select torque limiter level" terminal command <b>TL2/TL1</b> is correct. → Correct data of F40, F41, E16 and E17 or reset them to the factory defaults (disable). → Set the <b>TL2/TL1</b> correctly.
(10) Bias and gain incorrectly specified.	Check the data of function codes F18, C50, C32, C34, C37, C39, C42, and C44. → Readjust the bias and gain to appropriate values.

**[ 3 ] The motor runs in the opposite direction to the command.**

Possible Causes	What to Check and Suggested Measures
(1) Wiring to the motor is incorrect.	Check the wiring to the motor. → Connect terminals U, V, and W of the inverter to the U, V, and W terminals of the motor, respectively.
(2) Incorrect connection and settings for run commands and rotation direction commands <b>FWD</b> and <b>REV</b> .	Check the data of function codes E98 and E99 and the connection to terminals [FWD] and [REV]. → Correct the data of the function codes and the connection.
(3) A run command (with fixed rotational direction) from the keypad is active, but the rotational direction setting is incorrect.	Check the data of function code F02 (Run command). → Change the data of function code F02 to "2:  /  keys on keypad (forward)" or "3:  /  keys on keypad (reverse)."
(4) The rotation direction specification of the motor is opposite to that of the inverter.	The rotation direction of IEC-compliant motors is opposite to that of in-compliant motors. → Switch the <b>FWD/REV</b> signal setting.

**[ 4 ] Speed fluctuation or current oscillation (e.g., hunting) occurs during running at constant speed.**

Possible Causes	What to Check and Suggested Measures
(1) The frequency command fluctuates.	Check the signals for the frequency command with Menu #4 "I/O Checking" using the keypad. → Increase the filter constants (C33, C38, and C43) for the frequency command.
(2) An external potentiometer is used for frequency setting.	Check that there is no noise in the control signal wires from external sources. → Isolate the control signal wires from the main circuit wires as far as possible. → Use shielded or twisted wires for control signals.  Check whether the external potentiometer for frequency setting is malfunctioning due to noise from the inverter. → Connect a capacitor to the output terminal of the potentiometer or set a ferrite core on the signal wire. (Refer to Chapter 2.)
(3) Frequency switching or multi-frequency command was enabled.	Check whether the relay signal for switching the frequency command is chattering. → If the relay contact is defective, replace the relay.
(4) The wiring length between the inverter and the motor is too long.	Check whether auto-torque boost, auto-energy saving operation, or dynamic torque vector control is enabled. → Perform auto-tuning of the inverter for every motor to be used. → Disable the automatic control systems by setting F37* to "1" (Constant torque load) and F42* to "0" (V/f control with slip compensation active), then check that the motor vibration stops. → Make the output wires as short as possible.
(5) The machinery is hunting due to vibration caused by low rigidity of the load. Or the current is irregularly oscillating due to special motor parameters.	Once disable all the automatic control systems such as auto torque boost, auto energy saving operation, overload prevention control, current limiter, torque limiter, automatic deceleration (anti-regenerative control), auto search for idling motor speed, slip compensation, dynamic torque vector control, droop control, overload stop function, speed control, online tuning, notch filter, observer, and then check that the motor vibration comes to a stop. → Disable the functions causing the vibration. → Readjust the output current fluctuation damping gain (H80*). → Readjust the speed control systems. (d01* through d06*)  Check that the motor vibration is suppressed if you decrease the level of F26 (Motor sound (Carrier frequency)) or set F27 (Motor sound (Tone)) to "0." → Decrease the carrier frequency (F26) or set the tone to "0" (F27 = 0).

**[ 5 ] Grating sound is heard from the motor or the motor sound fluctuates.**

Possible Causes	What to Check and Suggested Measures
(1) The specified carrier frequency is too low.	<p>Check the data of function codes F26 (Motor sound (Carrier frequency)) and F27 (Motor sound (Tone)).</p> <p>→ Increase the carrier frequency (F26).</p> <p>→ Change the setting of F27 to appropriate value.</p>
(2) The surrounding temperature of the inverter was too high (when automatic lowering of the carrier frequency was enabled by H98).	<p>Measure the temperature inside the panel where the inverter is mounted.</p> <p>→ If it is over 40°C, lower it by improving the ventilation.</p> <p>→ Lower the temperature of the inverter by reducing the load. (For fans or pumps, decrease the frequency limiter value (F15).)</p> <p><b>Note:</b> If you disable H98, an <i>Oh1</i>, <i>Oh3</i>, or <i>O1u</i> alarm may occur.</p>
(3) Resonance with the load.	<p>Check the machinery mounting accuracy or check whether there is resonance with the mounting base.</p> <p>→ Disconnect the motor from the machinery and run it alone, then find where the resonance comes from. Upon locating the cause, improve the characteristics of the source of the resonance.</p> <p>→ Adjust the settings of C01 (Jump frequency 1) to C04 (Jump frequency (Hysteresis width)) so as to avoid continuous running in the frequency range causing resonance.</p> <p>→ Enable the speed control (notch filter) (d07*, d08*) and the observer (d18 to d20) to suppress vibration. (Depending on the characteristics of the load, this may take no effect.)</p>

**[ 6 ] The motor does not accelerate or decelerate within the specified time.**

Possible Causes	What to Check and Suggested Measures
(1) The inverter runs the motor with S-curve or curvilinear pattern.	<p>Check the data of function code H07 (Acceleration/deceleration pattern).</p> <p>→ Select the linear pattern (H07 = 0).</p> <p>→ Shorten the acceleration/deceleration time (F07, F08, E10 through E15).</p>
(2) The current limiting operation prevented the output frequency from increasing (during acceleration).	<p>Make sure that F43 (Current limiter (Mode selection)) is set to "2: Enable during acceleration and at constant speed," then check that the setting of F44 (Current limiter (Level)) is reasonable.</p> <p>→ Readjust the setting of F44 to appropriate value, or disable the function of current limiter with F43.</p> <p>→ Increase the acceleration/deceleration time (F07, F08, E10 through E15).</p>
(3) The automatic deceleration (Anti-regenerative control) is enabled during deceleration.	<p>Check the data of function code H69 (Automatic deceleration (Mode selection)).</p> <p>→ Increase the deceleration time (F08, E11, E13, and E15).</p>
(4) Overload.	<p>Measure the output current.</p> <p>→ Reduce the load (For fans or pumps, decrease the frequency limiter value (F15).) (In winter, the load tends to increase.)</p>
(5) Torque generated by the motor was insufficient.	<p>Check that the motor starts running if the value of the torque boost (F09*) is increased.</p> <p>→ Increase the value of the torque boost (F09*).</p>
(6) An external potentiometer is used for frequency setting.	<p>Check that there is no noise in the control signal wires from external sources.</p> <p>→ Isolate the control signal wires from the main circuit wires as far as possible.</p> <p>→ Use shielded or twisted wires for control signals.</p> <p>→ Connect a capacitor to the output terminal of the potentiometer or set a ferrite core on the signal wire. (Refer to Chapter 2.)</p>

Possible Causes	What to Check and Suggested Measures
(7) The output frequency is limited by the torque limiter.	<p>Check whether data of torque limiter related function codes (F40, F41, E16 and E17) is correctly configured and the <b>TL2/TL1</b> terminal command ("Select torque limiter level 2/1") is correct.</p> <p>→ Correct the data of F40, F41, E16 and E17 or reset them to the factory defaults.</p> <p>→ Set the <b>TL2/TL1</b> correctly.</p> <p>→ Increase the acceleration/deceleration time (F07, F08, E10 through E15).</p>
(8) The specified acceleration or deceleration time was incorrect.	<p>Check the terminal commands <b>RT1</b> and <b>RT2</b> for acceleration/deceleration times.</p> <p>→ Correct the <b>RT1</b> and <b>RT2</b> settings.</p>

**[ 7 ] The motor does not restart even after the power recovers from a momentary power failure.**

Possible Causes	What to Check and Suggested Measures
(1) The data of function code F14 is either "0," "1," or "2."	<p>Check if an undervoltage trip ( / <i>u</i>) occurs.</p> <p>→ Change the data of function code F14 (Restart mode after momentary power failure (Mode selection)) to "3," "4," or "5."</p>
(2) The run command remains OFF even after the power has been restored.	<p>Check the input signal with Menu #4 "I/O Checking" using the keypad.</p> <p>→ Check the power recovery sequence with an external circuit. If necessary, consider the use of a relay that can keep the run command ON.</p> <p>In 3-wire operation, the power to the control printed circuit board (control PCB) has been shut down once because of a long momentary power failure time, or the "Enable 3-wire operation" signal <b>HOLD</b> has been turned OFF once.</p> <p>→ Change the design or the setting so that a run command can be issued again within 2 seconds after the power has been restored.</p>

**[ 8 ] The motor abnormally heats up.**

Possible Causes	What to Check and Suggested Measures
(1) Excessive torque boost specified.	<p>Check whether decreasing the torque boost (F09*) decreases the output current but does not stall the motor.</p> <p>→ If no stall occurs, decrease the torque boost (F09*).</p>
(2) Continuous running in extremely slow speed.	<p>Check the running speed of the inverter.</p> <p>→ Change the speed setting or replace the motor with a motor exclusively designed for inverters.</p>
(3) Overload.	<p>Measure the inverter output current.</p> <p>→ Reduce the load (For fans or pumps, decrease the frequency limiter value (F15).) (In winter, the load tends to increase.)</p>

**[ 9 ] The motor does not run as expected.**

Possible Causes	What to Check and Suggested Measures
(1) Incorrect setting of function code data.	<p>Check that function codes are correctly configured and no unnecessary configuration has been done.</p> <p>→ Configure all the function codes correctly.</p> <p>Make a note of function code data currently configured and then initialize all function code data using H03.</p> <p>→ After the above process, reconfigure function codes one by one, checking the running status of the motor.</p>

### 6.3.2 Problems with inverter settings




#### [ 1 ] Nothing appears on the LED monitor.

Possible Causes	What to Check and Suggested Measures
(1) No power (neither main power nor auxiliary control power) supplied to the inverter.	<p>Check the input voltage and interphase voltage unbalance.</p> <ul style="list-style-type: none"> <li>→ Turn ON a molded case circuit breaker (MCCB), a residual-current-operated protective device (RCD)/earth leakage circuit breaker (ELCB) (with overcurrent protection) or a magnetic contactor (MC).</li> <li>→ Check for voltage drop, phase loss, poor connections, or poor contacts and fix them if necessary.</li> </ul>
(2) The power for the control PCB did not reach a sufficiently high level.	<p>Check if the jumper bar has been removed between terminals P1 and P(+) or if there is a poor contact between the jumper bar and those terminals.</p> <ul style="list-style-type: none"> <li>→ Mount a jumper bar or a DC reactor between terminals P1 and P(+). For poor contact, tighten up the screws.</li> </ul>
(3) The keypad was not properly connected to the inverter.	<p>Check whether the keypad is properly connected to the inverter.</p> <ul style="list-style-type: none"> <li>→ Remove the keypad, put it back, and see whether the problem recurs.</li> <li>→ Replace the keypad with another one and check whether the problem recurs.</li> </ul> <p>When running the inverter remotely, ensure that the extension cable is securely connected both to the keypad and to the inverter.</p> <ul style="list-style-type: none"> <li>→ Disconnect the cable, reconnect it, and see whether the problem recurs.</li> <li>→ Replace the keypad with another one and check whether the problem per recurs.</li> </ul>

#### [ 2 ] The desired menu is not displayed.

Possible Causes	Check and Measures
(1) The menu display mode is not selected appropriately.	<p>Check the data of function code E52 (Keypad (Menu display mode)).</p> <ul style="list-style-type: none"> <li>→ Change the E52 data so that the desired menu appears.</li> </ul>

#### [ 3 ] Data of function codes cannot be changed.

Possible Causes	What to Check and Suggested Measures
(1) An attempt was made to change function code data that cannot be changed when the inverter is running.	<p>Check if the inverter is running with Menu #3 "Drive Monitoring" using the keypad and then confirm whether the data of the function codes can be changed when the motor is running by referring to the function code tables.</p> <ul style="list-style-type: none"> <li>→ Stop the motor then change the data of the function codes.</li> </ul>
(2) The data of the function codes is protected.	<p>Check the data of function code F00 (Data Protection).</p> <ul style="list-style-type: none"> <li>→ Change the F00 data from "Enable data protection" (1 or 3) to "Disable data protection" (0 or 2).</li> </ul>
(3) The <b>WE-KP</b> terminal command ("Enable data change with keypad") is not entered, though it has been assigned to a digital input terminal.	<p>Check the data of function codes E01 through E07, E98 and E99 and the input signal status with Menu #4 "I/O Checking" using the keypad.</p> <ul style="list-style-type: none"> <li>→ Input a <b>WE-KP</b> command through a digital input terminal.</li> </ul>
(4) The  key was not pressed.	<p>Check whether you have pressed the  key after changing the function code data.</p> <ul style="list-style-type: none"> <li>→ Press the  key after changing the function code data.</li> <li>→ Check that <i>save</i> is displayed on the LED monitor.</li> </ul>
(5) The data of function codes F02, E01 through E07, E98, and E99 cannot be changed.	<p>Either one of the <b>FWD</b> and <b>REV</b> terminal commands is turned ON.</p> <ul style="list-style-type: none"> <li>→ Turn OFF both <b>FWD</b> and <b>REV</b>.</li> </ul>



Possible Causes	What to Check and Suggested Measures
(6) The function code(s) to be changed does not appear.	<p>If Menu #0 "Quick Setup" ( *fn:) is selected, only the particular function codes appear.</p> <p>→ With Menu #0 "Quick Setup" ( *fn:) being selected, press the <math>\wedge</math> key to call up the desired menu from !f__ to !y__. Then select the desired function code and change its data. For details, refer to Chapter 3, Table 3.4 "Menus Available in Programming Mode."</p>

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

##### [ 1 ] *Ocn* Instantaneous overcurrent

Problem The inverter momentary output current exceeded the overcurrent level.

*Oc1* Overcurrent occurred during acceleration.

*Oc2* Overcurrent occurred during deceleration.

*Oc3* Overcurrent occurred during running at a constant speed.

Possible Causes	What to Check and Suggested Measures
(1) The inverter output lines were short-circuited.	<p>Disconnect the wiring from the inverter output terminals ([U], [V] and [W]) and measure the interphase resistance of the motor wiring. Check if the resistance is too low.</p> <p>→ Remove the short-circuited part (including replacement of the wires, relay terminals and motor).</p>
(2) Ground faults have occurred at the inverter output lines.	<p>Disconnect the wiring from the output terminals ([U], [V] and [W]) and perform a Megger test.</p> <p>→ Remove the grounded parts (including replacement of the wires, relay terminals and motor).</p>
(3) Overload.	<p>Measure the motor current with a measuring device to trace the current trend. Then, use this data to judge if the trend is over the calculated load value for your system design.</p> <p>→ If the load is too heavy, reduce it or increase the inverter capacity.</p> <p>Trace the current trend and check if there are any sudden changes in the current.</p> <p>→ If there are any sudden changes, make the load fluctuation smaller or increase the inverter capacity.</p> <p>→ Enable instantaneous overcurrent limiting (H12 = 1).</p>
(4) Excessive torque boost specified. (when F37* = 0, 1, 3, or 4)	<p>Check whether decreasing the torque boost (F09*) decreases the output current but does not stall the motor.</p> <p>→ If no stall occurs, decrease the torque boost (F09*).</p>
(5) The acceleration/ deceleration time was too short.	<p>Check that the motor generates enough torque required during acceleration/deceleration. That torque is calculated from the moment of inertia for the load and the acceleration/deceleration time.</p> <p>→ Increase the acceleration/deceleration time (F07, F08, E10 through E15, and H56).</p> <p>→ Enable the current limiter (F43) and torque limiter (F40, F41, E16, and E17).</p> <p>→ Increase the inverter capacity.</p>
(6) Malfunction caused by noise.	<p>Check if noise control measures are appropriate (e.g., correct grounding and routing of control and main circuit wires).</p> <p>→ Implement noise control measures. For details, refer to the FRENIC-MEGA User's Manual, "Appendix A."</p> <p>→ Enable the Auto-reset (H04).</p> <p>→ Connect a surge absorber to magnetic contactor's coils or other solenoids (if any) causing noise.</p>

## [ 2 ] *ef* Ground fault

Problem A ground fault current flew from the output terminal of the inverter.

Possible Causes	What to Check and Suggested Measures
(1) Inverter output terminal(s) grounded (ground fault).	Disconnect the wiring from the output terminals ([U], [V], and [W]) and perform a Megger test. → Remove the grounded parts (including replacement of the wires, relay terminals and motor).

## [ 3 ] *Oun* Overvoltage

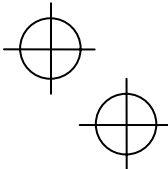
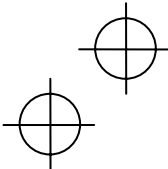
Problem The DC link bus voltage was over the detection level of overvoltage.

*Ou1* Overvoltage occurred during acceleration.

*Ou2* Overvoltage occurred during deceleration.

*Ou3* Overvoltage occurred during running at constant speed.

Possible Causes	What to Check and Suggested Measures
(1) The power supply voltage exceeded the inverter's specification range.	Measure the input voltage. → Decrease the voltage to within the specified range.
(2) A surge current entered the input power supply.	In the same power line, if a phase-advancing capacitor is turned ON/OFF or a thyristor converter is activated, a surge (momentary large increase in the voltage or current) may be caused in the input power. → Install a DC reactor.
(3) The deceleration time was too short for the moment of inertia for load.	Recalculate the deceleration torque based on the moment of inertia for the load and the deceleration time. → Increase the deceleration time (F08, E11, E13, E15, and H56). → Enable the automatic deceleration (anti-regenerative control) (H69), or deceleration characteristics (H71). → Enable torque limiter (F40, F41, E16, E17, and H73). → Set the rated voltage (at base frequency) (F05*) to "0" to improve the braking capability. → Consider the use of a braking resistor.
(4) The acceleration time was too short.	Check if the overvoltage alarm occurs after rapid acceleration. → Increase the acceleration time (F07, E10, E12, and E14). → Select the S-curve pattern (H07). → Consider the use of a braking resistor.
(5) Braking load was too heavy.	Compare the braking torque of the load with that of the inverter. → Set the rated voltage (at base frequency) (F05*) to "0" to improve the braking capability. → Consider the use of a braking resistor.
(6) Malfunction caused by noise.	Check if the DC link bus voltage was below the protective level when the overvoltage alarm occurred. → Implement noise control measures. For details, refer to the FRENIC-MEGA User's Manual, "Appendix A." → Enable the auto-reset (H04). → Connect a surge absorber to magnetic contactor's coils or other solenoids (if any) causing noise.



#### [ 4 ] /u Undervoltage


Problem DC link bus voltage has dropped below the undervoltage detection level.

Possible Causes	What to Check and Suggested Measures
(1) A momentary power failure occurred.	→ Release the alarm. → If you want to restart running the motor without treating this condition as an alarm, set F14 to "3," "4," or "5," depending on the load type.
(2) The power to the inverter was switched back to ON too soon (when F14 = 1).	Check if the power to the inverter was switched back to ON while the control power was still alive. (Check whether the LEDs on the keypad light.) → Turn the power ON again after all LEDs on the keypad go off.
(3) The power supply voltage did not reach the inverter's specification range.	Measure the input voltage. → Increase the voltage to within the specified range.
(4) Peripheral equipment for the power circuit malfunctioned, or the connection was incorrect.	Measure the input voltage to find which peripheral equipment malfunctioned or which connection is incorrect. → Replace any faulty peripheral equipment, or correct any incorrect connections.
(5) Any other loads connected to the same power supply has required a large starting current, causing a temporary voltage drop.	Measure the input voltage and check the voltage fluctuation. → Reconsider the power supply system configuration.
(6) Inverter's inrush current caused the power voltage drop because the power supply transformer capacity was insufficient.	Check if the alarm occurs when a molded case circuit breaker (MCCB), residual-current-operated protective device (RCD)/earth leakage circuit breaker (ELCB) (with overcurrent protection) or magnetic contactor (MC) is turned ON. → Reconsider the capacity of the power supply transformer.

#### [ 5 ] /in Input phase loss

Problem Input phase loss occurred, or interphase voltage unbalance rate was large.

Possible Causes	What to Check and Suggested Measures
(1) Breaks in wiring to the main power input terminals.	Measure the input voltage. → Repair or replace the main circuit power input wires or input devices (MCCB, MC, etc.).
(2) The screws on the main power input terminals are loosely tightened.	Check if the screws on the main power input terminals have become loose. → Tighten the terminal screws to the recommended torque.
(3) Interphase voltage unbalance between three phases was too large.	Measure the input voltage. → Connect an AC reactor (ACR) to lower the voltage unbalance between input phases. → Increase the inverter capacity.
(4) Overload cyclically occurred.	Measure the ripple wave of the DC link bus voltage. → If the ripple is large, increase the inverter capacity.
(5) Single-phase voltage was input to the three-phase input inverter.	Check the inverter type. → Apply three-phase power. The FRENIC-MEGA of three-phase input cannot be driven by single-phase power.

 **Note** The input phase loss protection can be disabled with the function code H98 (Protection/Maintenance Function).

**[ 6 ] Op1 Output phase loss**

Problem Output phase loss occurred.

Possible Causes	What to Check and Suggested Measures
(1) Inverter output wires are broken.	Measure the output current. → Replace the output wires.
(2) The motor winding is broken.	Measure the output current. → Replace the motor.
(3) The terminal screws for inverter output were not tight enough.	Check if any screws on the inverter output terminals have become loose. → Tighten the terminal screws to the recommended torque.
(4) A single-phase motor has been connected.	→ Single-phase motors cannot be used. Note that the FRENIC-MEGA only drives three-phase induction motors.

**[ 7 ] Oh1 Heat sink overheat**

Problem Temperature around heat sink has risen abnormally.

Possible Causes	What to Check and Suggested Measures
(1) Temperature around the inverter exceeded the inverter's specification range.	Measure the temperature around the inverter. → Lower the temperature around the inverter (e.g., ventilate the panel where the inverter is mounted).
(2) Ventilation path is blocked.	Check if there is sufficient clearance around the inverter. → Change the mounting place to ensure the clearance.
	Check if the heat sink is not clogged. → Clean the heat sink.
(3) Cooling fan's airflow volume decreased due to the service life expired or failure.	Check the cumulative run time of the cooling fan. Refer to Chapter 3, Section 3.4.6 "Reading maintenance information – Menu #5 "Maintenance Information"." → Replace the cooling fan.
	Visually check whether the cooling fan rotates normally. → Replace the cooling fan.
(4) Overload.	Measure the output current. → Reduce the load (e.g. Use the heat sink overheat early warning (E01 through E07) or the overload early warning (E34) and reduce the load before the overload protection is activated.). → Decrease the motor sound (carrier frequency) (F26). → Enable the overload prevention control (H70).

**[ 8 ] Oh2 External alarm**

Problem External alarm was inputted (**THR**).  
(when the "Enable external alarm trip" **THR** has been assigned to any of digital input terminals)

Possible Causes	What to Check and Suggested Measures
(1) An alarm function of external equipment was activated.	Check the operation of external equipment. → Remove the cause of the alarm that occurred.
(2) Wrong connection or poor contact in external alarm signal wiring.	Check if the external alarm signal wiring is correctly connected to the terminal to which the "Enable external alarm trip" terminal command <b>THR</b> has been assigned (Any of E01 through E07, E98, and E99 should be set to "9"). → Connect the external alarm signal wire correctly.

Possible Causes	What to Check and Suggested Measures
(3) Incorrect setting of function code data.	<p>Check whether the "Enable external alarm trip" terminal command <b>THR</b> has been assigned to an unavailable terminal (with E01 through E07, E98, or E99).</p> <p>→ Correct the assignment.</p> <p>Check whether the normal/negative logic of the external signal matches that of the <b>THR</b> command specified by any of E01 through E07, E98, and E99.</p> <p>→ Ensure the matching of the normal/negative logic.</p>

#### [ 9 ] Oh3 Inverter internal overheat

Problem Temperature inside the inverter has exceeded the allowable limit.

Possible Causes	What to Check and Suggested Measures
(1) The surrounding temperature exceeded the inverter's specification limit.	<p>Measure the surrounding temperature.</p> <p>→ Lower the temperature around the inverter (e.g., ventilate the panel where the inverter is mounted).</p>

#### [ 10 ] Oh4 Motor protection (PTC/NTC thermistor)

Problem Temperature of the motor has risen abnormally.

Possible Causes	What to Check and Suggested Measures
(1) The temperature around the motor exceeded the motor's specification range.	<p>Measure the temperature around the motor.</p> <p>→ Lower the temperature.</p>
(2) Cooling system for the motor defective.	<p>Check if the cooling system of the motor is operating normally.</p> <p>→ Repair or replace the cooling system of the motor.</p>
(3) Overload.	<p>Measure the output current.</p> <p>→ Reduce the load (e.g. Use the heat sink overheat early warning (E01 through E07) or the overload early warning (E34) and reduce the load before the overload protection is activated.). (In winter, the load tends to increase.)</p> <p>→ Lower the temperature around the motor.</p> <p>→ Increase the motor sound (Carrier frequency) (F26).</p>
(4) The activation level (H27) of the PTC thermistor for motor overheat protection was set inadequately.	<p>Check the PTC thermistor specifications and recalculate the detection voltage.</p> <p>→ Modify the data of function code H27.</p>
(5) Settings for the PTC/NTC thermistor are improper.	<p>Check the setting of the thermistor mode selection (H26) and the slider position of terminal [C1] property switch SW5.</p> <p>→ Change the H26 data in accordance with the thermistor used and set the SW5 to the PTC/NTC position.</p>
(6) Excessive torque boost specified. (F09*)	<p>Check whether decreasing the torque boost (F09*) does not stall the motor.</p> <p>→ If no stall occurs, decrease the F09* data.</p>
(7) The V/f pattern did not match the motor.	<p>Check if the base frequency (F04*) and the rated voltage at base frequency (F05*) match the values on the motor's nameplate.</p> <p>→ Match the function code data with the values on the motor's nameplate.</p>
(8) Incorrect setting of function code data.	<p>Although no PTC/NTC thermistor is used, the thermistor mode is enabled (H26).</p> <p>→ Set the H26 data to "0" (Disable).</p>

### [ 11 ] *dbh* Braking resistor overheated

Problem The electronic thermal protection for the braking resistor has been activated.

Possible Causes	What to Check and Suggested Measures
(1) Braking load is too heavy.	<p>Reconsider the relationship between the braking load estimated and the real load.</p> <ul style="list-style-type: none"> <li>→ Lower the real braking load.</li> <li>→ Review the selection of the braking resistor and increase the braking capability (Modification of related function code data (F50, F51, and F52) is also required.)</li> </ul>
(2) Specified deceleration time is too short.	<p>Recalculate the deceleration torque and time needed for the load currently applied, based on a moment of inertia for the load and the deceleration time.</p> <ul style="list-style-type: none"> <li>→ Increase the deceleration time (F08, E11, E13, E15, and H56).</li> <li>→ Review the selection of the braking resistor and increase the braking capability. (Modification of related function code data (F50, F51, and F52) is also required.)</li> </ul>
(3) Incorrect setting of function code data F50, F51, and F52.	<p>Recheck the specifications of the braking resistor.</p> <ul style="list-style-type: none"> <li>→ Review data of function codes F50, F51, and F52, then modify them.</li> </ul>

**Note:** The inverter issues an overheat alarm of the braking resistor by monitoring the magnitude of the braking load, not by measuring its surface temperature.

When the braking resistor is frequently used so as to exceed the settings made by function codes F50, F51, and F52, therefore, the inverter issues an overheat alarm even if the surface temperature of the braking resistor does not rise. To squeeze out full performance of the braking resistor, configure function codes F50, F51, and F52 while actually measuring the surface temperature of the braking resistor.

### [ 12 ] *fus* Fuse blown

Problem The fuse inside the inverter blew.

Possible Causes	What to Check and Suggested Measures
(1) The fuse blew due to short-circuiting inside the inverter.	<p>Check whether there has been any excess surge or noise coming from outside.</p> <ul style="list-style-type: none"> <li>→ Take measures against surges and noise.</li> <li>→ Have the inverter repaired.</li> </ul>

### [ 13 ] *pbf* Charger circuit fault

Problem The magnetic contactor for short-circuiting the charging resistor failed to work.

Possible Causes	What to Check and Suggested Measures
(1) The control power was not supplied to the magnetic contactor intended for short-circuiting the charging resistor.	<p>Check that, in normal connection of the main circuit (not a connection via the DC link bus), the connector (CN R) on the power printed circuit board (power PCB) is not inserted to <b>[NC]</b>.</p> <ul style="list-style-type: none"> <li>→ Insert the connector (CN R) to <b>[FAN]</b>.</li> </ul> <p>Check whether you quickly turned the circuit breaker ON and OFF to confirm safety after cabling/wiring.</p> <ul style="list-style-type: none"> <li>→ Wait until the DC link bus voltage has dropped to a sufficiently low level and then release the current alarm. After that, turn ON the power again. (Do not turn the circuit breaker ON and OFF quickly.)</li> </ul> <p>(Turning ON the circuit breaker supplies power to the control circuit to the operation level (lighting the LEDs on the keypad) in a short period. Immediately turning it OFF even retains the control circuit power for a time, while it shuts down the power to the magnetic contactor intended for short-circuiting the charging resistor since the contactor is directly powered from the main power.</p> <p>Under such conditions, the control circuit can issue a turn-on command to the magnetic contactor, but the contactor not powered can produce nothing. This state is regarded as abnormal, causing an alarm.)</p>

#### [ 14 ] *O/n* Overload of motor 1 through 4

Problem Electronic thermal protection for motor 1, 2, 3, or 4 activated.

- O/1* Motor 1 overload
- O/2* Motor 2 overload
- O/3* Motor 3 overload
- O/4* Motor 4 overload

Possible Causes	What to Check and Suggested Measures
(1) The electronic thermal characteristics do not match the motor overload characteristics.	Check the motor characteristics. → Reconsider the data of function codes (P99*, F10* and F12*). → Use an external thermal relay.
(2) Activation level for the electronic thermal protection was inadequate.	Check the continuous allowable current of the motor. → Reconsider and change the data of function code F11*.
(3) The specified acceleration/ deceleration time was too short.	Recalculate the acceleration/deceleration torque and time needed for the load, based on the moment of inertia for the load and the acceleration/deceleration time. → Increase the acceleration/ deceleration time (F07, F08, E10 through E15, and H56).
(4) Overload.	Measure the output current. → Reduce the load (e.g. Use the overload early warning (E34) and reduce the load before the overload protection is activated.). (In winter, the load tends to increase.)
(5) Excessive torque boost specified (F09*)	Check whether decreasing the torque boost (F09*) does not stall the motor. → If no stall occurs, decrease the F09* data.

#### [ 15 ] *O/u* Inverter overload

Problem Temperature inside inverter has risen abnormally.

Possible Causes	What to Check and Suggested Measures
(1) Temperature around the inverter exceeded the inverter's specification range.	Measure the temperature around the inverter. → Lower the temperature (e.g., ventilate the panel where the inverter is mounted).
(2) Excessive torque boost specified (F09*)	Check whether decreasing the torque boost (F09*) does not stall the motor. → If no stall occurs, decrease the F09* data.
(3) The specified acceleration/ deceleration time was too short.	Recalculate the acceleration/deceleration torque and time needed for the load, based on the moment of inertia for the load and the acceleration/deceleration time. → Increase the acceleration/deceleration time (F07, F08, E10 through E15, and H56).
(4) Overload.	Measure the output current. → Reduce the load (e.g., Use the overload early warning (E34) and reduce the load before the overload protection is activated.). (In winter, the load tends to increase.). → Decrease the motor sound (Carrier frequency) (F26). → Enable overload prevention control (H70).
(5) Ventilation paths are blocked.	Check if there is sufficient clearance around the inverter. → Change the mounting place to ensure the clearance. Check if the heat sink is not clogged. → Clean the heat sink.

Possible Causes	What to Check and Suggested Measures
(6) Cooling fan's airflow volume decreased due to the service life expired or failure.	Check the cumulative run time of the cooling fan. Refer to Chapter 3, Section 3.4.6 "Reading maintenance information – Menu #5 "Maintenance Information". → Replace the cooling fan. Visually check that the cooling fan rotates normally. → Replace the cooling fan.
(7) The wires to the motor are too long, causing a large leakage current from them.	Measure the leakage current. → Insert an output circuit filter (OFL).

#### [ 16 ] 05 Overspeed

Problem The motor rotates in an excessive speed (Motor speed  $\geq$  (F03 data)  $\times$  (d32 data, d33 data)  $\times$  1.2)

Possible Causes	What to Check and Suggested Measures
(1) Incorrect setting of function code data.	Check the motor parameter "Number of poles" (P01*). → Specify the P01* data in accordance with the motor to be used. Check the maximum frequency setting (F03*). → Specify the F03* data in accordance with the output frequency. Check the setting of speed limit function (d32 and d33). → Disable the speed limit function (d32 and d33).
(2) Insufficient gain of the speed controller.	Check whether the actual speed overshoots the commanded one in higher speed operation. → Increase the speed controller gain (d03*.) (Depending on the situations, reconsider the setting of the filter constant or the integral time.)
(3) Noises superimposed on the PG wire.	Check whether appropriate noise control measures have been implemented (e.g., correct grounding and routing of signal wires and main circuit wires). → Implement noise control measures. For details, refer to the FRENIC-MEGA User's Manual, "Appendix A."

#### [ 17 ] pg PG wire break



Problem The pulse generator (PG) wire has been broken somewhere in the circuit.

Possible Causes	What to Check and Suggested Measures
(1) The wire between the pulse generator (PG) and the option card has been broken.	Check whether the pulse generator (PG) is correctly connected to the option card or any wire is broken. → Check whether the PG is connected correctly. Or, tighten up the related terminal screws. → Check whether any joint or connecting part bites the wire sheath. → Replace the wire.
(2) PG related circuit affected by strong electrical noise.	Check if appropriate noise control measures have been implemented (e.g., correct grounding and routing of signal wires, communication cables, and main circuit wires). → Implement noise control measures. → Separate the signal wires from the main power wires as far as possible.



### [ 18 ] *er1* Memory error

Problem Error occurred in writing the data to the memory in the inverter.

Possible Causes	What to Check and Suggested Measures
(1) When writing data (especially initializing or copying data), the inverter was shut down so that the voltage to the control PCB has dropped.	Initialize the function code data with H03 (= 1). After initialization, check if pressing the  key releases the alarm. → Revert the initialized function code data to their previous settings, then restart the operation.
(2) Inverter affected by strong electrical noise when writing data (especially initializing or copying data).	Check if appropriate noise control measures have been implemented (e.g., correct grounding and routing of control and main circuit wires). Also, perform the same check as described in (1) above. → Implement noise control measures. Revert the initialized function code data to their previous settings, then restart the operation.
(3) The control PCB failed.	Initialize the function code data by setting H03 to "1," then reset the alarm by pressing the  key and check that the alarm goes on. → The control PCB (on which the CPU is mounted) is defective. Contact your Fuji Electric representative.

### [ 19 ] *er2* Keypad communications error

Problem A communications error occurred between the remote keypad or the multi-function keypad and the inverter.

Possible Causes	What to Check and Suggested Measures
(1) Broken communications cable or poor contact.	Check continuity of the cable, contacts and connections. → Re-insert the connector firmly. → Replace the cable.
(2) Connecting many control wires hinders the front cover from being mounted, lifting the keypad.	Check the mounting condition of the front cover. → Use wires of the recommended size (0.65 to 0.82 mm <sup>2</sup> ) for wiring. → Change the wiring layout inside the unit so that the front cover can be mounted firmly.
(3) Inverter affected by strong electrical noise.	Check if appropriate noise control measures have been implemented (e.g., correct grounding and routing of communication cables and main circuit wires). → Implement noise control measures. For details, refer to the FRENIC-MEGA User's Manual, "Appendix A."
(4) A keypad failure occurred.	Replace the keypad with another one and check whether a keypad communications error ( <i>er2</i> ) occurs. → Replace the keypad.

### [ 20 ] *er3* CPU error

Problem A CPU error (e.g. erratic CPU operation) occurred.

Possible Causes	What to Check and Suggested Measures
(1) Inverter affected by strong electrical noise.	Check if appropriate noise control measures have been implemented (e.g. correct grounding and routing of signal wires, communications cables, and main circuit wires). → Implement noise control measures.

### [ 21 ] *er4* Option communications error

Problem A communications error occurred between the option card and the inverter.



Possible Causes	What to Check and Suggested Measures
(1) There was a problem with the connection between the option card and the inverter.	Check whether the connector on the option card is properly engaged with that of the inverter. → Reload the option card into the inverter.
(2) Strong electrical noise.	Check whether appropriate noise control measures have been implemented (e.g. correct grounding and routing of signal wires, communications cables, and main circuit wires). → Implement noise control measures.

### [ 22 ] *er5* Option error

An error detected by the option card. Refer to the instruction manual of the option card for details.

### [ 23 ] *er6* Operation protection

Problem An incorrect operation was attempted.


Possible Causes	What to Check and Suggested Measures
(1) The  key was pressed when H96 = 1 or 3.	Check that the  key was pressed when a run command had been entered from the input terminal or through the communications port. → If this was not intended, check the setting of H96.
(2) The start check function was activated when H96 = 2 or 3.	Check that any of the following operations has been performed with a run command being entered. - Turning the power ON - Releasing the alarm - Switching the enable communications link <b>LE</b> operation → Review the running sequence to avoid input of a Run command when this error occurs. If this was not intended, check the setting of H96. (Turn the run command OFF before releasing the alarm.)
(3) The forced stop digital input <b>STOP</b> was turned OFF.	Check that turning the <b>STOP</b> OFF decelerated the inverter to stop. → If this was not intended, check the settings of E01 through E07 for terminals [X1] through [X7].

### [ 24 ] *er7* Tuning error

Problem Auto-tuning failed.

Possible Causes	What to Check and Suggested Measures
(1) A phase was missing (There was a phase loss) in the connection between the inverter and the motor.	→ Properly connect the motor to the inverter.
(2) V/f or the rated current of the motor was not properly set.	Check whether the data of function codes (F04*, F05*, H50 through H53, H65, H66, P02*, and P03*) matches the motor specifications.
(3) The wiring length between the inverter and the motor was too long.	Check whether the wiring length between the inverter and the motor exceeds 50 m. (Small capacity inverters are greatly affected by the wiring length.) → Review, and if necessary, change the layout of the inverter and the motor to shorten the connection wire. Alternatively, minimize the wiring length without changing the layout. → Disable both auto-tuning and auto-torque boost (set data of F37* to "1").

Possible Causes	What to Check and Suggested Measures
(4) The rated capacity of the motor was significantly different from that of the inverter.	Check whether the rated capacity of the motor is three or more ranks lower, or two or more ranks higher than that of the inverter. → Replace the inverter with one with an appropriate capacity. → Manually specify the values for the motor parameters P06*, P07*, and P08*. → Disable both auto-tuning and auto-torque boost (set data of F37* to "1").
(5) The motor was a special type such as a high-speed motor.	→ Disable both auto-tuning and auto-torque boost (set data of F37* to "1").
(6) A tuning operation involving motor rotation (P04* = 2 or 3) was attempted while the brake was applied to the motor.	→ Specify the tuning that does not involve the motor rotation (P04* = 1). → Release the brake before tuning that involves the motor rotation (P04* = 2 or 3).

 For details of tuning errors, refer to Chapter 4, Section 4.1.7 "Function code basic settings and tuning < 2 >," ■ Tuning errors."

Preparation before running the motor for a test – Setting function code data."



**[ 25 ] *err* RS-485 communications error (COM port 1)  
*erp* RS-485 communications error (COM port 2)**

Problem A communications error occurred during RS-485 communications.

Possible Causes	What to Check and Suggested Measures
(1) Communications conditions of the inverter do not match that of the host equipment.	Compare the settings of the y codes (y01 to y10, y11 to y20) with those of the host equipment. → Correct any settings that differ.
(2) Even though no-response error detection time (y08, y18) has been set, communications is not performed within the specified cycle.	Check the host equipment. → Change the settings of host equipment software or disable the no-response error detection (y08, y18 = 0).
(3) The host equipment did not operate due to defective software, settings, or defective hardware.	Check the host equipment (e.g., PLCs and personal computers). → Remove the cause of the equipment error.
(4) The RS-485 converter did not operate due to incorrect connections and settings, or defective hardware.	Check the RS-485 converter (e.g., check for poor contact). → Change the various RS-485 converter settings, reconnect the wires, or replace hardware with recommended devices as appropriate.
(5) Broken communications cable or poor contact.	Check the continuity of the cables, contacts and connections. → Replace the cable.
(6) Inverter affected by strong electrical noise.	Check if appropriate noise control measures have been implemented (e.g., correct grounding and routing of communications cables and main circuit wires). → Implement noise control measures. → Implement noise reduction measures on the host side. → Replace the RS-485 converter with a recommended insulated one.
(7) Terminating resistor not properly configured.	Check that the inverter serves as a terminating device in the network. → Configure the terminating resistor switch(es) (SW2/SW3) for RS-485 communication correctly. (That is, turn the switch(es) to ON.)

### [ 26 ] *erf* Data saving error during undervoltage

**Problem** The inverter failed to save data such as the frequency commands and PID commands (which are specified through the keypad), or the output frequencies modified by the **UP/DOWN** terminal commands when the power was turned OFF.

Possible Causes	What to Check and Suggested Measures
(1) During data saving performed when the power was turned OFF, the voltage fed to the control PCB dropped in an abnormally short period due to the rapid discharge of the DC link bus.	<p>Check how long it takes for the DC link bus voltage to drop to the preset voltage when the power is turned OFF.</p> <p>→ Remove whatever is causing the rapid discharge of the DC link bus voltage. After pressing the  key and releasing the alarm, return the data of the relevant function codes (such as the frequency commands and PID commands (specified through the keypad) or the output frequencies modified by the <b>UP/DOWN</b> terminal commands) back to the original values and then restart the operation.</p>
(2) Inverter operation affected by strong electrical noise when the power was turned OFF.	<p>Check if appropriate noise control measures have been implemented (e.g., correct grounding and routing of control and main circuit wires).</p> <p>→ Implement noise control measures. After pressing the  key and releasing the alarm, return the data of the relevant function codes (such as the frequency commands and PID commands (specified through the keypad) or the output frequencies modified by the <b>UP/DOWN</b> terminal commands) back to the original values and then restart the operation.</p>
(3) The control circuit failed.	<p>Check if <i>erf</i> occurs each time the power is turned ON.</p> <p>→ The control PCB (on which the CPU is mounted) is defective. Contact your Fuji Electric representative.</p>

### [ 27 ] *erh* Hardware error

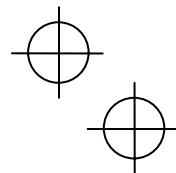
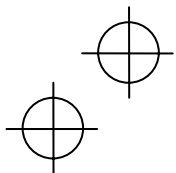
**Problem** The LSI on the power printed circuit board malfunctions.

Possible Causes	What to Check and Suggested Measures
(1) The inverter capacity setting on the control printed circuit board is wrong.	<p>It is necessary to set the inverter capacity correctly.</p> <p>→ Contact your Fuji Electric representative.</p>
(2) Data stored in the power printed circuit board memory is corrupted.	<p>It is necessary to replace the power printed circuit board.</p> <p>→ Contact your Fuji Electric representative.</p>
(3) The control printed circuit board is misconnected to the power printed circuit board.	<p>It is necessary to replace the power or control printed circuit board.</p> <p>→ Contact your Fuji Electric representative.</p>

### [ 28 ] *ere* Speed mismatch or excessive speed deviation

**Problem** An excessive deviation appears between the speed command and the detected speed.

Possible Causes	What to Check and Suggested Measures
(1) Incorrect setting of function code data.	<p>Check the following function code data; P01* (Motor (No. of poles)), d15 (Feedback encoder pulse count/rev), and d16 and d17 (Feedback pulse correction factor 1 and 2).</p> <p>→ Specify data of function codes P01*, d15, d16, and d17 in accordance with the motor and PG.</p>
(2) Overload.	<p>Measure the inverter output current.</p> <p>→ Reduce the load.</p>
	<p>Check whether any mechanical brake is working.</p> <p>→ Release the mechanical brake.</p>



Possible Causes	What to Check and Suggested Measures
(3) The motor speed does not rise due to the current limiter operation.	<p>Check the data of function code F44 (Current limiter (Level)).</p> <p>→ Change the F44 data correctly. Or, set the F43 data to "0" (Disable) if the current limiter operation is not needed.</p> <p>Check the data of function codes F04*, F05*, and P01* through P12* to ensure that the V/f pattern setting is right.</p> <p>→ Match the V/f pattern setting with the motor ratings.</p> <p>→ Change the function code data in accordance with the motor parameters.</p>
(4) Function code settings do not match the motor characteristics.	<p>Check whether the data of P01*, P02*, P03*, P06*, P07*, P08*, P09*, P10* and P12* match the parameters of the motor.</p> <p>→ Perform auto-tuning of the inverter, using the function code P04*.</p>
(5) Wrong wiring between the pulse generator (PG) and the inverter.	<p>Check the wiring between the PG and the inverter.</p> <p>→ Correct the wiring.</p> <p>Check that the relationships between the PG feedback signal and the run command are as follows:</p> <ul style="list-style-type: none"> <li>• For the FWD command: the B phase pulse is in the High level at rising edge of the A phase pulse</li> <li>• For the REV command: the B phase pulse is in the Low level at rising edge of the A phase pulse</li> </ul> <p>→ If the relationship is wrong, interchange the A and B phase wires.</p>
(6) Wiring to the motor is incorrect.	<p>Check the wiring to the motor.</p> <p>→ Connect the inverter output terminals U, V, and W to the motor input terminals U, V, and W, respectively.</p>
(7) The motor speed does not rise due to the torque limiter operation.	<p>Check the data of F40 (Torque limiter 1-1).</p> <p>→ Correct the F40 data. Or, set the F40 data to "999" (Disable) if the torque limiter operation is not needed.</p>




#### [ 29 ] *nrb* NTC wire break error

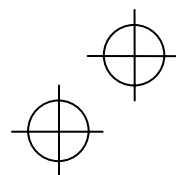
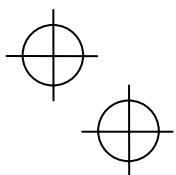
Problem A wire break is found in the NTC thermistor detection circuit.

Possible Causes	What to Check and Suggested Measures
(1) The NTC thermistor cable is broken.	<p>Check whether the motor cable is broken.</p> <p>→ Replace the motor cable.</p>
(2) The temperature around the motor is extremely low (lower than -30°C).	<p>Measure the temperature around the motor.</p> <p>→ Reconsider the use environment of the motor.</p>
(3) The NTC thermistor is broken.	<p>Measure the resistance of the NTC thermistor.</p> <p>→ Replace the motor.</p>

#### [ 30 ] *err* Mock alarm

Problem The LED displays the alarm *err*.

Possible Causes	What to Check and Suggested Measures
(1) The  +  keys were held down for more than 5 seconds.	<p>→ To escape from this alarm state, press the  key.</p>





**[ 31 ] *cof* PID feedback wire break**

Problem: The PID feedback wire is broken.

Possible Causes	What to Check and Suggested Measures
(1) The PID feedback signal wire is broken.	Check whether the PID feedback signal wires are connected correctly. → Check whether the PID feedback signal wires are connected correctly. Or, tighten up the related terminal screws. → Check whether any contact part bites the wire sheath.
(2) PID feedback related circuit affected by strong electrical noise.	Check if appropriate noise control measures have been implemented (e.g., correct grounding and routing of signal wires, communication cables, and main circuit wires). → Implement noise control measures. → Separate the signal wires from the main power wires as far as possible.

**[ 32 ] *dba* Braking transistor error**

Problem: A braking transistor error is detected.

Possible Causes	What to Check and Suggested Measures
(1) The braking transistor is broken.	Check whether resistance of the braking resistor is correct or there is a misconnection of the resistor. → Consult your Fuji Electric representative for repair.

**[ 33 ] *ero* Positioning control error**


Problem: An excessive positioning deviation has occurred when the servo-lock function was activated.

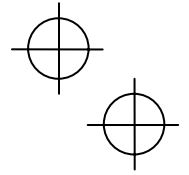
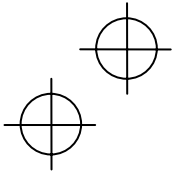
Possible Causes	What to Check and Suggested Measures
(1) Insufficient gain in positioning control system	Readjust the settings of J97 (Servo-lock (Gain)) and d03 (Speed control 1 P (Gain)).
(2) Incorrect control completion width	Check whether the setting of J99 (Servo-lock (Completion width)) is correct. → Correct the setting of J99.

**[ 34 ] *ecf* Enable circuit failure**

Problem: The circuit that detects the status of the enable circuit (safety stop circuit) is broken.

Possible Causes	What to Check and Suggested Measures
(1) Circuit related to the Enable circuit affected by strong electrical noise.	Check if appropriate noise control measures have been implemented (e.g., correct grounding and routing of signal wires, communication cables, and main circuit wires). → Implement noise control measures. → Separate the signal wires from the main power wires as far as possible.

 **Note** The "Reset alarm" terminal command **RST** cannot reset this alarm *ecf*. If even a power-off reset cannot restore the inverter state, the inverter needs to be repaired.





## 6.5 If the "Light Alarm" Indication ( / - a / ) Appears on the LED Monitor

If the inverter detects a minor abnormal state "light alarm", it can continue the current operation without tripping while displaying the "light alarm" indication / - a / on the LED monitor. In addition to the indication / - a /, the inverter blinks the KEYPAD CONTROL LED and outputs the "light alarm" signal **L-ALM** to a digital output terminal to alert the peripheral equipment to the occurrence of a light alarm. (To use the **L-ALM**, it is necessary to assign the signal to any of the digital output terminals by setting any of function codes E20 through E24 and E27 to "98.") Function codes H81 and H82 specify which alarms should be categorized as "light alarm." The available "light alarm" codes are check-marked in the "Light alarm" object column in Table 6.1.

To display the "light alarm" factor and escape from the light alarm state, follow the instructions below.



### ■ Displaying the light alarm factor

- 1) Press the  key to enter Programming mode.
- 2) Check the light alarm factor in 5\_36 (Light alarm factor (latest)) under Menu #5 "Maintenance Information" in Programming mode. The light alarm factor is displayed in alarm codes. For details about the alarm codes, see Table 6.1 "Abnormal States Detectable ("Heavy alarm" and "Light alarm" objects)."

 For details about the menu transition in Menu #5 "Maintenance Information", see Chapter 3, Section 3.4.6 "Reading maintenance information – Menu #5 "Maintenance Information." It is possible to display the factors of most recent 3 light alarms in 5\_37 (Light alarm factor (last)) to 5\_39 (Light alarm factor (3rd last)).

### ■ Switching the LED monitor from the light alarm to normal display

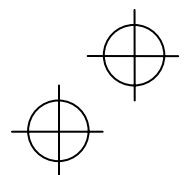
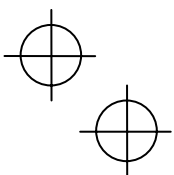
If it is necessary to return the LED monitor to the normal display state (showing the running status such as reference frequency) before the light alarm factor is removed (e.g., when it takes a long time to remove the light alarm factor), follow the steps below.

- 1) Press the  key to return the LED monitor to the light alarm indication ( / - a / ).
- 2) With / - a / being displayed, press the  key. The LED monitor returns to the normal display state while the KEYPAD CONTROL LED continues blinking.

### ■ Releasing the light alarm

- 1) Remove the light alarm factor that has been checked in 5\_36 (Light alarm factor (latest)) under Menu #5 "Maintenance Information" in Programming mode, in accordance with the troubleshooting procedure. The reference page for the troubleshooting corresponding to each light alarm factor is shown in "Ref. page" column in Table 6.1.
- 2) Once the light alarm factor is removed, the "light alarm" indication / - a / on the LED monitor disappears and the KEYPAD CONTROL LED stops blinking. If the KEYPAD CONTROL LED continues blinking, it means that any light alarm factor has not completely been removed and the inverter is still in the light alarm status. Proceed to other troubleshooting procedures.



When all of the light alarm factors have been removed, the digital output **L-ALM** is also turned OFF automatically.




## 6.6 If an Abnormal Pattern Appears on the LED Monitor while Neither an Alarm Code nor "Light Alarm" Indication ( / - a / ) is Displayed

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

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

Possible Causes	What to Check and Suggested Measures
(1) When PID control had been disabled (J01 = 0), you changed E43 (LED Monitor (Item selection)) to 10 or 12. With the PID being enabled (J01 = 1, 2, or 3), you disabled PID control (J01 = 0) when the LED monitor had been set to display the PID command or PID feedback amount by pressing the  key.	Make sure that when you wish to view other monitor items, E43 is not set to "10: PID command" or "12: PID feedback amount." → Set E43 to a value other than "10" or "12." Make sure that when you wish to view a PID command or a PID feedback amount, J01 (PID control) is not set to "0: Disable." → Set J01 to "1: Enable (Process control normal operation)," "2: Enable (Process control inverse operation)," or "3: Enable (Dancer control)."
(2) The keypad was poorly connected.	Prior to proceed, 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 cable.

### [ 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 voltage of the DC link bus was low.	Select <i>5_01</i> under Menu #5 "Maintenance Information" in Programming mode on the keypad, then check the voltage of the DC link bus which 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.
(2) The main power is not ON, while the auxiliary input power to the control circuit is supplied.	Check whether the main power is turned ON. → Turn the main power ON.
(3) Although power is supplied not via the commercial power line but via the DC link bus, the main power down detection is enabled (H72 = 1).	Check the connection to the main power and check if the H72 data is set to "1" (factory default). → Correct the H72 data.

### [ 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 99999. → Correct the E50 data.



## Chapter 7 MAINTENANCE AND INSPECTION

Perform daily and periodic inspections 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/inspection jobs, turn OFF the power and wait at least five minutes for inverters with a capacity of 22 kW or below, or at least ten minutes for inverters with a capacity of 30 kW or above. Make sure that the LED monitor and charging lamp are 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 to 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 specification) 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 inspections according to the items listed in Table 7.1. Before performing periodic inspections, be sure to stop the motor and remove the front cover with the inverter power OFF.

Table 7.1 List of Periodic Inspections

Check part	Check item	How to inspect	Evaluation criteria
Environment	1) Check the surrounding 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 specifications must be satisfied. 2) No foreign or dangerous objects are left.
Input voltage	Check that the input voltages of the main and control circuit are correct.	Measure the input voltages using a multimeter or the like.	The standard specifications must be satisfied.
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 frame and cover	Check for: 1) Abnormal noise or excessive vibration 2) Loose bolts (at clamp sections). 3) Deformation and breakage 4) Discoloration caused by overheat 5) Contamination and accumulation of dust or dirt	1) Visual or auditory inspection 2) Retighten. 3), 4), 5) Visual inspection	1), 2), 3), 4), 5) No abnormalities

Table 7.1 List of Periodic Inspections (Continued)

Check part	Check item	How to inspect	Evaluation criteria	
Main circuit	Common	<ol style="list-style-type: none"> <li>1) Check that bolts and screws are tight and not missing.</li> <li>2) Check the devices and insulators for deformation, cracks, breakage and discoloration caused by overheat or deterioration.</li> <li>3) Check for contamination or accumulation of dust or dirt.</li> </ol>	<ol style="list-style-type: none"> <li>1) Retighten.</li> <li>2), 3) Visual inspection</li> </ol>	<ol style="list-style-type: none"> <li>1), 2), 3) No abnormalities</li> </ol>
	Conductors and wires	<ol style="list-style-type: none"> <li>1) Check conductors for discoloration and distortion caused by overheat.</li> <li>2) Check the sheath of the wires for cracks and discoloration.</li> </ol>	<ol style="list-style-type: none"> <li>1), 2) Visual inspection</li> </ol>	<ol style="list-style-type: none"> <li>1), 2) No abnormalities</li> </ol>
	Terminal blocks	Check that the terminal blocks are not damaged.	Visual inspection	No abnormalities
	Braking resistor	<ol style="list-style-type: none"> <li>1) Check for abnormal odor or cracks in insulators caused by overheat.</li> <li>2) Check for wire breakage.</li> </ol>	<ol style="list-style-type: none"> <li>1) Olfactory and visual inspection</li> <li>2) Check the wires visually, or disconnect either wire and measure the conductivity with a multimeter.</li> </ol>	<ol style="list-style-type: none"> <li>1) No abnormalities</li> <li>2) Within <math>\pm 10\%</math> of the resistance of the braking resistor</li> </ol>
	DC link bus capacitor	<ol style="list-style-type: none"> <li>1) Check for electrolyte leakage, discoloration, cracks and swelling of the casing.</li> <li>2) Check that the safety valve does not protrude remarkably.</li> <li>3) Measure the capacitance if necessary.</li> </ol>	<ol style="list-style-type: none"> <li>1), 2) Visual inspection</li> <li>3) Measure the discharge time with capacitance probe.</li> </ol>	<ol style="list-style-type: none"> <li>1), 2) No abnormalities</li> <li>3) The discharge time should not be shorter than the one specified by the replacement manual.</li> </ol>
	Transformer and reactor	Check for abnormal roaring noise and odor.	Auditory, visual, and olfactory inspection	No abnormalities
Control circuit	Magnetic contactor and relay	<ol style="list-style-type: none"> <li>1) Check for chatters during operation.</li> <li>2) Check that contact surface is not rough.</li> </ol>	<ol style="list-style-type: none"> <li>1) Auditory inspection</li> <li>2) Visual inspection</li> </ol>	<ol style="list-style-type: none"> <li>1), 2) No abnormalities</li> </ol>
	Printed circuit board	<ol style="list-style-type: none"> <li>1) Check for loose screws and connectors.</li> <li>2) Check for odor and discoloration.</li> <li>3) Check for cracks, breakage, deformation and remarkable rust.</li> <li>4) Check the capacitors for electrolyte leaks and deformation.</li> </ol>	<ol style="list-style-type: none"> <li>1) Retighten.</li> <li>2) Olfactory and visual inspection</li> <li>3), 4) Visual inspection</li> </ol>	<ol style="list-style-type: none"> <li>1), 2), 3), 4) No abnormalities</li> </ol>
Cooling system	Cooling fan	<ol style="list-style-type: none"> <li>1) Check for abnormal noise and excessive vibration.</li> <li>2) Check for loose bolts.</li> <li>3) Check for discoloration caused by overheat.</li> </ol>	<ol style="list-style-type: none"> <li>1) Auditory and visual inspection, or turn manually (be sure to turn the power OFF).</li> <li>2) Retighten.</li> <li>3) Visual inspection</li> </ol>	<ol style="list-style-type: none"> <li>1) Smooth rotation</li> <li>2), 3) No abnormalities</li> </ol>
	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 Periodic Replacement Parts

Each part of the inverter has its own service life that will vary according to the environmental and operating conditions. It is recommended that the following parts be replaced at the specified intervals.

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 printed circuit boards	10 years
Cooling fans	10 years
Fuse	10 years (90 kW or above)

(Note) These replacement intervals are based on the inverter's service life estimated at a surrounding temperature of 40°C at 100% (HD-mode inverters) or 80% (LD-mode inverters) of full load. In environments with a surrounding 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.

#### 7.3.1 Judgment on service life

The inverter has the life prediction function for some parts which measures the discharging time or counts the voltage applied time, etc. The function allows you to monitor the current lifetime state on the LED monitor and judge whether those parts are approaching the end of their service life.

The life prediction function can also issue early warning signals if the life time alarm command **LIFE** is assigned to any of the digital output terminals. (Refer to "[ 3 ] Early warning of lifetime alarm" later in this section.)

Table 7.3 lists the parts whose service life can be predicted and details the life prediction function. The predicted values should be used only as a guide since the actual service life is influenced by the surrounding temperature and other usage environments.

Table 7.3 Life Prediction

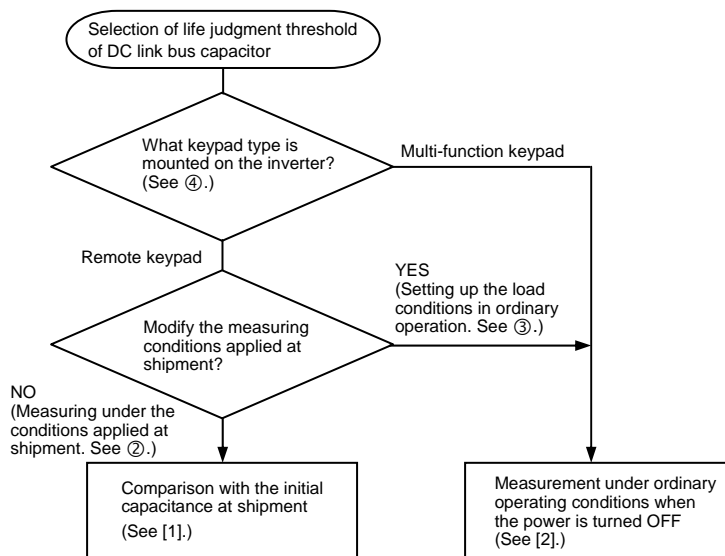
Object of life prediction	Prediction function	End-of-life criteria	Prediction timing	On the LED monitor
DC link bus capacitor	<u>Measurement of discharging time</u> Measures the discharging time of the DC link bus capacitor when the main power is shut down and calculates the capacitance.	85% or lower of the initial capacitance at shipment (See "[ 1 ] Measuring the capacitance of DC link bus capacitor in comparison with initial one at shipment" on page 7-5.)	At periodic inspection (H98: Bit 3 = 0)	5_05 (Capacitance)
		85% or lower of the reference capacitance under ordinary operating conditions at the user site (See "[ 2 ] Measuring the capacitance of DC link bus capacitor under ordinary operating conditions" on page 7-6.)	During ordinary operation (H98: Bit 3 = 1)	5_05 (Capacitance)
	<u>ON-time counting</u> Counts the time elapsed when the voltage is applied to the DC link bus capacitor, while correcting it according to the capacitance measured above.	Exceeding 87,600 hours (10 years)	During ordinary operation	5_26 (Elapsed time) 5_27 (Time remaining before the end of life)
Electrolytic capacitors on printed circuit boards	Counts the time elapsed when the voltage is applied to the capacitors, while correcting it according to the surrounding temperature.	Exceeding 87,600 hours (10 years)	During ordinary operation	5_06 (Cumulative run time)
Cooling fans	Counts the run time of the cooling fans.	Exceeding 87,600 hours (10 years)	During ordinary operation	5_07 (Cumulative run time)

■ Notes for the judgment on the service life of the DC link bus capacitor

The service life of the DC link bus capacitor can be judged by the "measurement of discharging time" (① to ④) or "ON-time counting" (⑤).

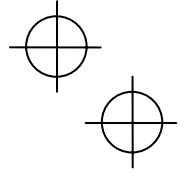
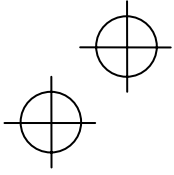
- ① The discharging time of the DC link bus capacitor depends largely on the inverter's internal load conditions, e.g. options attached or ON/OFF of digital I/O signals. If actual load conditions are so different from the ones at which the initial/reference capacitance is measured that the measurement result falls out of the accuracy level required, then the inverter does not perform measuring.
- ② The capacitance measuring conditions at shipment are extremely restricted--e.g., with the remote keypad mounted and all input terminals being OFF--in order to stabilize the load and measure the capacitance accurately. Those conditions are, therefore, different from the actual operating conditions in almost all cases. If the actual operating conditions are the same as those at shipment, shutting down the inverter power automatically measures the discharging time; however, if they are different, no automatic measurement is performed. To perform it, put those conditions back to the factory default ones and shut down the inverter. For the measuring procedure, see [ 1 ] given on the next page.
- ③ To measure the capacitance of the DC link bus capacitor *under ordinary operating conditions* when the power is turned OFF, it is necessary to set up the load conditions for ordinary operation and measure the reference capacitance (initial setting) when the inverter is introduced. For the reference capacitance setup procedure, see [ 2 ] given on the next page. Performing the setup procedure automatically detects and saves the measuring conditions of the DC link bus capacitor.  
Setting bit 3 of H98 data to 0 restores the inverter to the measurement in comparison with the initial capacitance measured at shipment.
- ④ If the multi-function keypad is mounted, the inverter does not measure the discharging time automatically since the inverter's conditions are different from the ones applied at shipment. It is, therefore, necessary to perform the setup procedure mentioned in ③ above to enable the measurement under ordinary operating conditions.

To make an accurate judgment on the service life of the DC link bus capacitor (accurate measurement of the capacitance), select the judgment procedure according to the keypad type and the measuring conditions, following the flowchart given below.



- ⑤ In a machine system where the inverter main power is rarely shut down, the inverter does not measure the discharging time. For such an inverter, the ON-time counting is provided. The ON-time counting result can be represented as "elapsed time" (5\_26) and "time remaining before the end of life" (5\_27) as shown in Table 7.3, "On the LED monitor."

**Note** When the inverter uses an auxiliary control power input, the load conditions widely differ so that the discharging time cannot be accurately measured. To prevent unintended measuring, the discharging time measurement can be disabled with the function code H98 (Bit 4 = 0).





### [ 1 ] Measuring the capacitance of DC link bus capacitor in comparison with initial one at shipment

When bit 3 of H98 data is 0, the measuring procedure given below measures the capacitance of DC link bus capacitor in comparison with initial one at shipment when the power is turned OFF. The measuring result can be displayed on the keypad as a ratio (%) to the initial capacitance.


#### ----- Capacitance measuring procedure -----

- 1) To ensure validity in the comparative measurement, put the condition of the inverter back to the state at factory shipment.
  - Remove the option card (if already in use) from the inverter.
  - In case another inverter is connected via the DC link bus to the P(+) and N(-) terminals of the main circuit, disconnect the wires. (You do not need to disconnect a DC reactor (optional), if any.)
  - Disconnect power wires for the auxiliary input to the control circuit (R0, T0).
  - Mount the remote keypad on the inverter.
  - Turn OFF all the digital input signals fed to terminals [FWD], [REV], and [X1] through [X7] of the control circuit.
  - If a potentiometer is connected to terminal [13], disconnect it.
  - If an external apparatus is attached to terminal [PLC], disconnect it.
  - Ensure that transistor output signals ([Y1] to [Y4]) and relay output signals ([Y5A] - [Y5C], and [30A/B/C]) will not be turned ON.
  - Disable the RS-485 communications link.

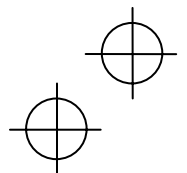
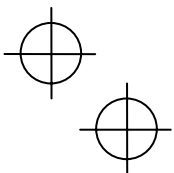
 **Tip** It is recommended that terminal [EN] be short-circuited for the measurement of the capacitance.

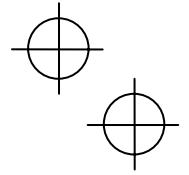
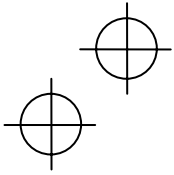
 **Note** If negative logic is specified for the transistor output and relay output signals, they are considered ON when the inverter is not running. Specify positive logic for them.

- Keep the surrounding temperature within  $25 \pm 10^{\circ}\text{C}$ .
- 2) Turn ON the main circuit power.
  - 3) Confirm that the cooling fan is rotating and the inverter is in stopped state.
  - 4) Turn OFF the main circuit power.
  - 5) The inverter automatically starts the measurement of the capacitance of the DC link bus capacitor. Make sure that " . . . . " appears on the LED monitor.

 **Note** If " . . . . " does not appear on the LED monitor, the measurement has not started. Check the conditions listed in 1).

- 6) After " . . . . " has disappeared from the LED monitor, turn ON the main circuit power again.
- 7) Select Menu #5 "Maintenance Information" in Programming mode and note the reading (relative capacitance (%)) of the DC link bus capacitor).





## [ 2 ] Measuring the capacitance of the DC link bus capacitor under ordinary operating conditions

When bit 3 of H98 data is 1, the inverter automatically measures the capacitance of the DC link bus capacitor under ordinary operating conditions when the power is turned OFF. This measurement requires setting up the load conditions for ordinary operation and measuring the reference capacitance when the inverter is introduced to the practical operation, using the setup procedure given below.

### ----- Reference capacitance setup procedure -----

- 1) Set function code H98 (Protection/maintenance function) to enable the user to specify the judgment criteria for the service life of the DC link bus capacitor (Bit 3 = 1) (refer to function code H98).
- 2) Turn OFF all run commands.
- 3) Make the inverter ready to be turned OFF under ordinary operating conditions.
- 4) Set both function codes H42 (Capacitance of DC link bus capacitor) and H47 (Initial capacitance of DC link bus capacitor) to "0000."
- 5) Turn OFF the inverter, and the following operations are automatically performed.  
The inverter measures the discharging time of the DC link bus capacitor and saves the result in function code H47 (Initial capacitance of DC link bus capacitor).  
The conditions under which the measurement has been conducted will be automatically collected and saved. During the measurement, ". . . ." will appear on the LED monitor.
- 6) Turn ON the inverter again.  
Confirm that H42 (Capacitance of DC link bus capacitor) and H47 (Initial capacitance of DC link bus capacitor) hold right values. Shift to Menu #5 "Maintenance Information" and confirm that the relative capacitance (ratio to full capacitance) is 100%.

**Note** If the measurement has failed, "0001" is entered into both H42 and H47. Remove the factor of the failure and conduct the measurement again.

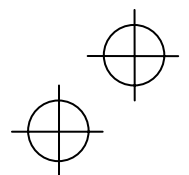
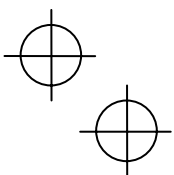
Hereafter, each time the inverter is turned OFF, it automatically measures the discharging time of the DC link bus capacitor if the above conditions are met. Periodically check the relative capacitance of the DC link bus capacitor (%) with Menu #5 "Maintenance Information" in Programming mode.

**Note** The condition given above produces a rather large measurement error. If this mode gives you a lifetime alarm, set H98 (Maintenance operation) back to the default setting (Bit 3 (Select life judgment threshold of DC link bus capacitor) = 0) and conduct the measurement under the condition at the time of factory shipment.

## [ 3 ] Early warning of lifetime alarm

For the components listed in Table 7.3, the inverter can issue an early warning of lifetime alarm *LIFE* at one of the transistor output terminals ([Y1] to [Y4]) and the relay contact terminals ([Y5A] - [Y5C], and [30A/B/C]) as soon as any of the levels specified in Table 7.3 has been exceeded.

The early warning signal is also turned ON when a lock condition on the internal air circulation DC fan (provided on 200 V class series inverters with a capacity of 45 kW or above; on 400 V class series inverters with a capacity of 75 kW or above) has been detected.



#### 7.4 Measurement of Electrical Amounts in Main Circuit

Because the voltage and current of the power supply (input, primary circuit) of the main circuit of the inverter and those of the motor (output, secondary circuit) contain harmonic components, the readings may vary with the type of the meter. Use meters indicated in Table 7.4 when measuring with meters for commercial frequencies.

The power factor cannot be measured by a commercially available power-factor meter that measures the phase difference between the voltage and current. To obtain the power factor, measure the power, voltage and current on each of the input and output sides and use the following formula.

■ Three-phase input

$$\text{Power factor} = \frac{\text{Electric power (W)}}{\sqrt{3} \times \text{Voltage (V)} \times \text{Current (A)}} \times 100 \%$$

Table 7.4 Meters for Measurement of Main Circuit

Item	Input (primary) side			Output (secondary) side			DC link bus voltage (P(+)-N(-))
Waveform	Voltage 	Current 		Voltage 	Current 		
Name of meter	Ammeter AR, AS, AT	Voltmeter VR, VS, VT	Wattmeter WR, WT	Ammeter Au, Av, Aw	Voltmeter Vu, Vv, Vw	Wattmeter Wu, Wv, Ww	DC voltmeter V
Type of meter	Moving iron type	Rectifier or moving iron type	Digital AC power meter	Digital AC power meter	Digital AC power meter	Digital AC power meter	Moving coil type
Symbol of meter			—	—	—	—	

**Note** It is not recommended that meters other than a digital AC power meter be used for measuring the output voltage or output current since they may cause larger measurement errors or, in the worst case, they may be damaged.

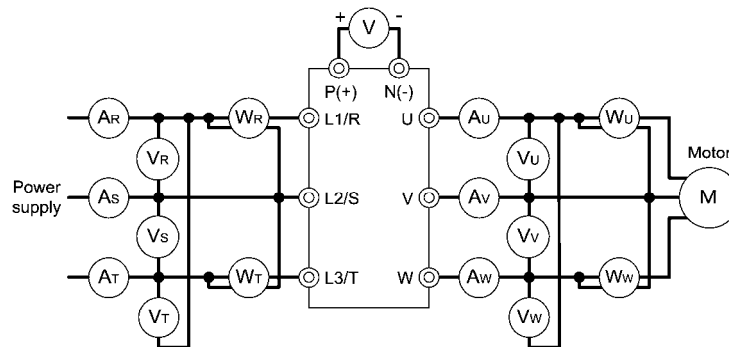
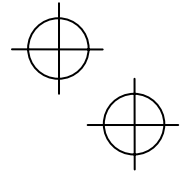
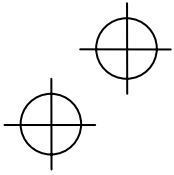


Figure 7.1 Connection of Meters



## 7.5 Insulation Test

Since the inverter has undergone an insulation test before shipment, avoid making a Megger test at the customer's site.

If a Megger test is unavoidable for the main circuit, observe the following instructions; otherwise, the inverter may be damaged.

A withstand voltage test may also damage the inverter if the test procedure is wrong. When the withstand voltage test is necessary, consult your Fuji Electric representative.

### (1) Megger test of main circuit

- 1) Use a 500 VDC Megger and shut off the main power supply without fail before measurement.
- 2) If the test voltage leaks to the control circuit due to the wiring, disconnect all the wiring from the control circuit.
- 3) Connect the main circuit terminals with a common line as shown in Figure 7.2.
- 4) The Megger test must be limited to across the common line of the main circuit and the ground (⊕).
- 5) Value of 5 M $\Omega$  or more displayed on the Megger indicates a correct state. (The value is measured on an inverter alone.)

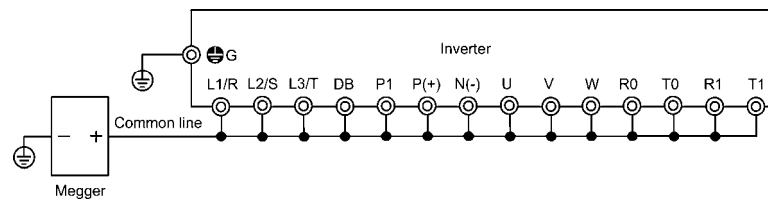


Figure 7.2 Main Circuit Terminal Connection for Megger Test

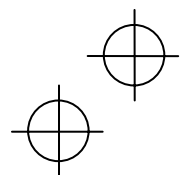
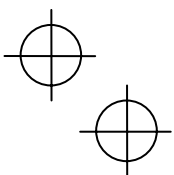
### (2) Insulation test of control circuit

Do not make a Megger test or withstand voltage test for the control circuit. Use a high resistance range tester for the control circuit.

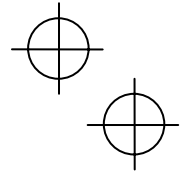
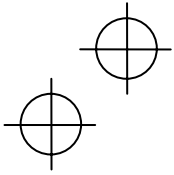
- 1) Disconnect all the external wiring from the control circuit terminals.
- 2) Perform a continuity test to the ground. One M $\Omega$  or a larger measurement indicates a correct state.

### (3) Insulation test of external main circuit and sequence control circuit

Disconnect all the wiring connected to the inverter so that the test voltage is not applied to the inverter.







## 7.6 Inquiries about Product and Guarantee

### 7.6.1 When making an inquiry

Upon breakage of the product, uncertainties, failure or inquiries, inform your Fuji Electric 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 (Refer to Chapter 3, Section 3.4.3.)
- 4) ROM version (Refer to Chapter 3, Section 3.4.6.)
- 5) Date of purchase
- 6) Inquiries (for example, point and extent of breakage, uncertainties, failure phenomena, and other circumstances)

### 7.6.2 Product warranty

**To all our customers who purchase Fuji Electric FA Components & Systems' products:**

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.

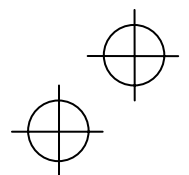
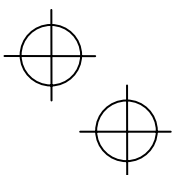
[ 1 ] Free of charge warranty period and warranty range

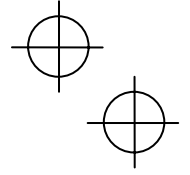
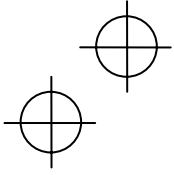
(1) Free of charge warranty period

- 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 Fuji Electric'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 Fuji Electric, Fuji Electric 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.
  - ① 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.
  - ② The breakdown was caused by the product other than the purchased or delivered Fuji's product.
  - ③ The breakdown was caused by the product other than Fuji's product, such as the customer's equipment or software design, etc.
  - ④ Concerning the Fuji'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.
  - ⑤ The breakdown was caused by modifications or repairs affected by a party other than Fuji Electric.
  - ⑥ The breakdown was caused by improper maintenance or replacement using consumables, etc. specified in the operation manual or catalog, etc.
  - ⑦ 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.
  - ⑧ The product was not used in the manner the product was originally intended to be used.





⑨ 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.

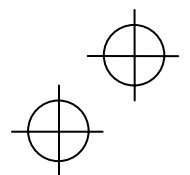
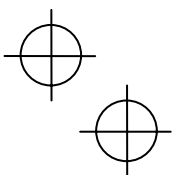
[ 5 ] Service contents

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 Fuji for the detail separately.



## Chapter 8 SPECIFICATIONS

### 8.1 Standard Model 1 (Basic Type)

#### 8.1.1 Three-phase 200 V class series (HD- and LD-mode inverters)

Item		Specifications															
Type (FRN_ _G1S-2□)		0.4	0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55	
Nominal applied motor (kW) *1	HD	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55	
	LD	—	—	—	—	—	7.5	11	15	18.5	22	30	37	45	55	75	
Rated capacity (kVA) *2	HD	1.1	1.9	3.0	4.2	6.8	10	14	18	24	28	34	45	55	68	81	
	LD	—	—	—	—	—	11	16	20	25	30	43	55	68	81	107	
Rated voltage (V) *3	Three-phase 200 to 240 V (with AVR function)											Three-phase 200 to 230 V (with AVR function)					
	HD	3	5	8	11	18	27	37	49	63	76	90	119	146	180	215	
Rated current (A) *4	LD	—	—	—	—	—	31.8 (29)	46.2 (42)	59.4 (55)	74.8 (68)	88 (80)	115 (107)	146	180	215	283	
	Overload capability	HD	150%-1 min, 200%-3.0 s														
LD	—											120%-1 min					
Voltage, frequency	200 to 240 V, 50/60 Hz											200 to 220 V, 50 Hz, 200 to 230 V, 60 Hz					
	Allowable voltage/frequency	Voltage: +10 to -15% (Interphase voltage unbalance: 2% or less) *5, Frequency: +5 to -5%															
Required capacity (with DCR) (kVA) *6	HD	0.6	1.2	2.2	3.1	5.2	7.4	10	15	20	25	30	40	48	58	71	
	LD	—	—	—	—	—	10	15	20	25	30	40	48	58	71	98	
Torque (%) *7	HD	150%				100%				20%				10 to 15%			
	LD	—				70%				15%				7 to 12%			
Braking transistor	Built-in																
	Built-in braking resistor	HD	5 s														—
Braking time (s)	LD	—						3.7 s		3.4 s		—					
	Duty cycle (%ED)	HD	5	3	5	3	2	3	2	—							
LD	—						2.2		1.4		—						
DC reactor (DCR)	Option *8																
Applicable safety standards	UL508C, C22.2No.14, EN50178:1997																
Enclosure (IEC60529)	IP20, UL open type											IP00, UL open type					
Cooling method	Natural cooling						Fan cooling										
Weight / Mass (kg)	1.7	2.0	2.8	3.0	3.0	6.5	6.5	5.8	9.5	9.5	10	25	32	42	43		

\*1 Fuji 4-pole standard motor

\*2 Rated capacity is calculated assuming the rated output voltage as 220 V for 200 V class series and 440 V for 400 V class series.

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

\*4 To use the inverter with the carrier frequency of 3 kHz or more at the surrounding temperature of 40°C or higher, manage the load so that the current comes to be within the rated ones enclosed in parentheses ( ) in continuous running.

\*5 Voltage unbalance (%) =  $\frac{\text{Max. voltage (V)} - \text{Min. voltage (V)}}{\text{Three-phase average voltage (V)}} \times 67$  (IEC 61800-3)

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

\*6 Required when a DC reactor (DCR) is used.

\*7 Average braking torque for the motor running alone. (It varies with the efficiency of the motor.)

\*8 A DC reactor (DCR) is an option. However, inverters with a capacity of 55 kW in LD mode require a DCR to be connected. Be sure to connect it to those inverters.

**Note:** A box (□) in the above table replaces A or E depending on the shipping destination.

### 8.1.2 Three-phase 400 V class series (HD- and LD-mode inverters)

Item		Specifications															
Type (FRN_ _ _G1S-4□)		0.4	0.75	1.5	2.2	3.7 (4.0)*1	5.5	7.5	11	15	18.5	22	30	37	45	55	75
Nominal applied motor (kW)	HD	0.4	0.75	1.5	2.2	3.7 (4.0)*1	5.5	7.5	11	15	18.5	22	30	37	45	55	75
	LD	-	-	-	-	-	7.5	11	15	18.5	22	30	37	45	55	75	90
Rated capacity (kVA)	HD	1.1	1.9	2.8	4.1	6.8	10	14	18	24	29	34	45	57	69	85	114
	LD	-	-	-	-	-	12	17	22	28	33	45	57	69	85	114	134
Rated voltage (V)	Three-phase 380 to 480 V (with AVR function)																
	*4																
Rated current (A)	HD	1.5	2.5	4.0	5.5	9.0	13.5	18.5	24.5	32	39	45	60	75	91	112	150
	LD	-	-	-	-	-	16.5	23	30.5	37	45	60	75	91	112	150	176
Overload capability	HD	150%-1 min, 200%-3.0 s															
	LD	-								120%-1 min							
Voltage, frequency	380 to 480 V, 50/60 Hz																
	*5																
Allowable voltage/frequency		Voltage: +10 to -15% (Interphase voltage unbalance: 2% or less)*6, Frequency: +5 to -5%															
Required capacity (with DCR) (kVA)	HD	0.6	1.2	2.1	3.2	5.2	7.4	10	15	20	25	30	40	48	58	71	96
	LD	-	-	-	-	-	10	15	20	25	30	40	48	58	71	96	114
Torque (%)	HD	150%				100%				20%				10 to 15%			
	LD	-				70%				15%				7 to 12%			
Braking transistor		Built-in															
Built-in braking resistor	5 s																
	-																
Braking time (s)	LD	-				3.7 s		3.4 s		-							
	-																
Duty cycle (%ED)	HD	5	3	5	3	2	3	2	-								
	LD	-				2.2		1.4		-							
DC reactor (DCR)		Option *9															
Applicable safety standards		UL508C, C22.2No.14, EN50178:1997															
Enclosure (IEC60529)		IP20, UL open type										IP00, UL open type					
Cooling method		Natural cooling				Fan cooling											
Weight / Mass (kg)		1.7	2.0	2.6	2.7	3.0	6.5	6.5	5.8	9.5	9.5	10	25	26	31	33	42

\*1 4.0 kW for the EU. The inverter type is FRN4.0G1S-4E.

\*2 Fuji 4-pole standard motor

\*3 Rated capacity is calculated assuming the rated output voltage as 220 V for 200 V class series and 440 V for 400 V class series.

\*4 Output voltage cannot exceed the power supply voltage.

\*5 380 to 440 V, 50 Hz; 380 to 480 V, 60 Hz

\*6 
$$\text{Voltage unbalance (\%)} = \frac{\text{Max. voltage (V)} - \text{Min. voltage (V)}}{\text{Three-phase average voltage (V)}} \times 67 \text{ (IEC 61800-3)}$$

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

\*7 Required when a DC reactor (DCR) is used.

\*8 Average braking torque for the motor running alone. (It varies with the efficiency of the motor.)

\*9 A DC reactor (DCR) is an option. However, inverters with a capacity of 55 kW in LD mode and inverters with 75 kW or above require a DCR to be connected. Be sure to connect it to those inverters.

**Note:** A box (□) in the above table replaces A or E depending on the shipping destination.

## 8.2 Standard Model 2 (EMC Filter Built-in Type)

### 8.2.1 Three-phase 200 V class series (HD- and LD-mode inverters)

Item	Specifications															
Type (FRN__ _G1E-2□)	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55	
Nominal applied motor (kW) *1	HD	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55
	LD	-	-	-	-	-	7.5	11	15	18.5	22	30	37	45	55	75
Rated capacity (kVA) *2	HD	1.1	1.9	3.0	4.2	6.8	10	14	18	24	28	34	45	55	68	81
	LD	-	-	-	-	-	11	16	20	25	30	43	55	68	81	107
Rated voltage (V) *3	Three-phase 200 to 240 V (with AVR function)											Three-phase 200 to 230 V (with AVR function)				
	HD	3	5	8	11	18	27	37	49	63	76	90	119	146	180	215
Rated current (A) *4	LD	-	-	-	-	-	31.8 (29)	46.2 (42)	59.4 (55)	74.8 (68)	88 (80)	115 (107)	146	180	215	283
	Overload capability	HD	150%-1 min, 200%-3.0 s													
	LD	-														
Input power	Voltage, frequency	200 to 240 V, 50/60 Hz											200 to 220 V, 50 Hz, 200 to 230 V, 60 Hz			
	Allowable voltage/frequency	Voltage: +10 to -15% (Interphase voltage unbalance: 2% or less) *5, Frequency: +5 to -5%														
	Required capacity (with DCR) (kVA) *6	HD	0.6	1.2	2.2	3.1	5.2	7.4	10	15	20	25	30	40	48	58
	LD	-	-	-	-	-	10	15	20	25	30	40	48	58	71	98
Torque (%) *7	HD	150%					100%					20%			10 to 15%	
	LD	-					70%					15%			7 to 12%	
Braking	Braking transistor	Standard														
	Built-in braking resistor Braking time (s)	HD	5 s													
		LD	-					3.7 s		3.4 s		-				
	Duty cycle (%ED)	HD	5	3	5	3	2	3	2	-						
LD		-					2.2		1.4		-					
EMC filter	Compliant with EMC Directives, Emission and Immunity: Category C3 (2nd Env.) (EN61800-3:2004)															
DC reactor (DCR)	Option *8															
Applicable safety standards	UL508C, C22.2No.14, EN50178:1997															
Enclosure (IEC60529)	IP20, UL open type											IP00, UL open type				
Cooling method	Natural cooling					Fan cooling										
Weight / Mass (kg)	1.8	2.1	3.0	3.1	3.2	6.7	7.0	6.4	10.9	10.9	11	25	32	42	43	

\*1 Fuji 4-pole standard motor

\*2 Rated capacity is calculated assuming the rated output voltage as 220 V for 200 V class series and 440 V for 400 V class series.

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

\*4 To use the inverter with the carrier frequency of 3 kHz or more at the surrounding temperature of 40°C or higher, manage the load so that the current comes to be within the rated ones enclosed in parentheses ( ) in continuous running.

\*5 
$$\text{Voltage unbalance (\%)} = \frac{\text{Max. voltage (V)} - \text{Min. voltage (V)}}{\text{Three-phase average voltage (V)}} \times 67 \text{ (IEC 61800-3)}$$

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

\*6 Required when a DC reactor (DCR) is used.

\*7 Average braking torque for the motor running alone. (It varies with the efficiency of the motor.)

\*8 A DC reactor (DCR) is an option. However, inverters with a capacity of 55 kW in LD mode require a DCR to be connected. Be sure to connect it to those inverters.

**Note:** A box (□) in the above table replaces A or E depending on the shipping destination.

### 8.2.2 Three-phase 400 V class series (HD- and LD-mode inverters)

Item	Specifications																	
Type (FRN__G1E-4□)	0.4	0.75	1.5	2.2	3.7 (4.0)*1	5.5	7.5	11	15	18.5	22	30	37	45	55	75		
Nominal applied motor (kW) *2	HD	0.4	0.75	1.5	2.2	3.7 (4.0)*1	5.5	7.5	11	15	18.5	22	30	37	45	55	75	
	LD	—	—	—	—	—	7.5	11	15	18.5	22	30	37	45	55	75	90	
Rated capacity (kVA) *3	HD	1.1	1.9	2.8	4.1	6.8	10	14	18	24	29	34	45	57	69	85	114	
	LD	—	—	—	—	—	12	17	22	28	33	45	57	69	85	114	134	
Output ratings	Rated voltage (V) *4	Three-phase 380 to 480 V (with AVR function)																
	Rated current (A)	HD	1.5	2.5	4.0	5.5	9.0	13.5	18.5	24.5	32	39	45	60	75	91	112	150
		LD	—	—	—	—	—	16.5	23	30.5	37	45	60	75	91	112	150	176
Overload capability	HD	150%-1 min, 200%-3.0 s																
	LD	— 120%-1 min																
Input power	Voltage, frequency	380 to 480 V, 50/60 Hz															*5	
	Allowable voltage/frequency	Voltage: +10 to -15% (Interphase voltage unbalance: 2% or less) *6, Frequency: +5 to -5%																
	Required capacity (with DCR) (kVA) *7	HD	0.6	1.2	2.1	3.2	5.2	7.4	10	15	20	25	30	40	48	58	71	96
LD		—	—	—	—	—	10	15	20	25	30	40	48	58	71	96	114	
Braking	Torque (%) *8	HD	150%			100%			20%			10 to 15%						
		LD	—			70%			15%			7 to 12%						
	Braking transistor	Built-in																
	Built-in braking resistor Braking time (s)	HD	5 s															
		LD	—			3.7 s			3.4 s			—						
	Duty cycle (%ED)	HD	5	3	5	3	2	3	2	—								
LD		—			2.2			1.4			—							
EMC filter	Compliant with EMC Directives, Emission and Immunity: Category C3 (2nd Env.) (EN61800-3:2004)																	
DC reactor (DCR)	Option *9																	
Applicable safety standards	UL508C, C22.2No.14, EN50178:1997																	
Enclosure (IEC60529)	IP20, UL open type												IP00, UL open type					
Cooling method	Natural cooling						Fan cooling											
Weight / Mass (kg)	1.8	2.1	2.7	2.9	3.2	6.8	6.9	6.2	10.5	10.5	11.2	26	27	32	33	42		

\*1 4.0 kW for the EU. The inverter type is FRN4.0G1E-4E.

\*2 Fuji 4-pole standard motor

\*3 Rated capacity is calculated assuming the rated output voltage as 220 V for 200 V class series and 440 V for 400 V class series.

\*4 Output voltage cannot exceed the power supply voltage.

\*5 380 to 440 V, 50 Hz; 380 to 480 V, 60 Hz

\*6 Voltage unbalance (%) =  $\frac{\text{Max. voltage (V)} - \text{Min. voltage (V)}}{\text{Three-phase average voltage (V)}} \times 67$  (IEC 61800-3)

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

\*7 Required when a DC reactor (DCR) is used.

\*8 Average braking torque for the motor running alone. (It varies with the efficiency of the motor.)

\*9 A DC reactor (DCR) is an option. However, inverters with a capacity of 55 kW in LD mode and inverters with 75 kW or above require a DCR to be connected. Be sure to connect it to those inverters.

**Note:** A box (□) in the above table replaces A or E depending on the shipping destination.

### 8.3 Common Specifications

Item		Explanation
Output frequency	Setting range	Maximum frequency 25 to 500 Hz (120 Hz for inverters in LD mode) (120 Hz under vector control without speed sensor, 200 Hz under vector control with speed sensor)
		Base frequency 25 to 500 Hz (in conjunction with the maximum frequency)
		Starting frequency 0.1 to 60.0 Hz (0.0 Hz under vector control with/without speed sensor)
		Carrier frequency • 0.75 to 16 kHz (HD mode: 0.4 to 55 kW, LD mode: 5.5 to 18.5 kW) • 0.75 to 10 kHz (HD mode: 75 kW, LD mode: 22 to 55 kW) • 0.75 to 6 kHz (HD mode: --, LD mode: 75 kW) <b>Note:</b> The carrier frequency may automatically drop depending upon the surrounding temperature or output current to protect the inverter. (The automatic drop function can be disabled.)
	Accuracy (Stability)	• Analog setting: $\pm 0.2\%$ of maximum frequency (at $25 \pm 10^\circ\text{C}$ ) • Keypad setting: $\pm 0.01\%$ of maximum frequency (at $-10$ to $+50^\circ\text{C}$ )
	Setting resolution	• Analog setting: 1/3000 of maximum frequency (1/1500 for V2 input) • Keypad setting: 0.01 Hz (99.99 Hz or less), 0.1 Hz (100.0 to 500.0 Hz) • Link operation setting: Selectable from the following two types - 1/20000 of maximum frequency - 0.01 Hz (fixed)
	Speed control range (under vector control without speed sensor)	• 1 : 200 (Minimum speed: Base speed, 4P, 7.5 to 1500 r/min) • 1 : 2 (Constant torque range: Constant output range)
	Speed control accuracy (under vector control without speed sensor)	• Analog setting: $\pm 0.5\%$ of base speed (at $25 \pm 10^\circ\text{C}$ ) • Digital setting: $\pm 0.5\%$ of base speed (at $-10$ to $+50^\circ\text{C}$ )
	Speed control range (under vector control with speed sensor)	• 1 : 1500 (Minimum speed: Base speed, 4P, 1 to 1500 r/min, 1024 p/r) • 1 : 4 (Constant torque range: Constant output range)
	Speed control accuracy (under vector control with speed sensor)	• Analog setting: $\pm 0.2\%$ of maximum frequency (at $25 \pm 10^\circ\text{C}$ ) • Digital setting: $\pm 0.01\%$ of maximum frequency (at $-10$ to $+50^\circ\text{C}$ )
Control	Control method	• V/f control • Dynamic torque vector control • Vector control without speed sensor • Vector control with speed sensor (with an optional PG interface card mounted)
	V/f characteristics	• Possible to set output voltage at base frequency and at maximum frequency • AVR control ON/OFF selectable. Non-linear V/f pattern with three arbitrary points.
	Torque boost	• Auto torque boost (for constant torque load) • Manual torque boost: Desired torque boost (0.0 to 20.0%) can be set. • Select application load with function code F37. (Variable torque load or constant torque load)
	Starting torque	22 kW or below: 200% or over, 30 kW or above: 180% or over Reference frequency: 0.3 Hz with slip compensation and auto torque boost
	Start/stop operation	• Keypad (run) and (stop) keys, external signals (run forward (run reverse) command etc.), Communications link (RS-485/fieldbus (option)) • Remote/local operation

Item	Explanation
Enable input (Safety stop function)	Opening the circuit between terminals [EN] and [PLC] stops the inverter's output transistor (coast-to-stop). (Compliant with EN954-1 Cat.3)
Frequency command	<ul style="list-style-type: none"> <li>Keypad: ⏪ and ⏩ keys</li> <li>Analog input (Analog input can be set with external voltage/current input): 0 to ± 10 VDC/0 to ± 100% (terminals [12], [V2]) +4 to +20 mA DC/0 to 100% (terminal [C1])</li> <li>UP/DOWN operation: Multi-frequency (16 steps), 16-bit parallel</li> <li>Pulse train input (standard): Pulse input = [X7] terminal, Rotational direction = One of the digital input terminals except [X7]</li> <li>Link operation: Various buses (option)</li> <li>Reference frequency switching, Remote/local mode switching, Auxiliary frequency setting, Proportional operation setting, and Inverse operation</li> </ul>
Acceleration/ deceleration time	0.00 to 6000 s Linear/S-curve/curvilinear, Acceleration/deceleration time settings 1 to 4 switchable
Stop control	<ul style="list-style-type: none"> <li>Running continued at the stop frequency, coast-to-stop, or force to stop.</li> <li>DC braking: Braking starting frequency (up to 60 Hz), time (up to 30.0 s), and operation level (up to 100%)</li> <li>Zero speed control (under vector control with speed sensor.)</li> </ul>
Auto-restart after momentary power failure	<ul style="list-style-type: none"> <li>Trip immediately, trip after recovery from power failure, trip after deceleration to stop</li> <li>Continue to run, restart at the frequency at which the power failure occurred, restart at the starting frequency, restart after searching for idling motor speed</li> </ul>
Hardware current limiter	<ul style="list-style-type: none"> <li>Current limiter operation level (20 to 200%)</li> <li>Overcurrent limiting by hardware (This can be canceled.)</li> </ul>
Torque limiter	<ul style="list-style-type: none"> <li>Torque limit value (±300%)</li> <li>Torque limiter 1/2, torque limiter enabled/disabled, analog torque limit value</li> </ul>
Control functions	<ul style="list-style-type: none"> <li>Analog input adjustment (gain/offset/filter time constant), frequency limiter (high and low), bias frequency, jump frequency, jogging operation, pre-excitation, switch to commercial power, commercial power switching sequence, cooling fan ON/OFF control, select motor 2 to 4, protect motor from dew condensation, universal DI, universal DO, universal AO, rotational direction limitation</li> <li>Overload prevention control, auto search, slip compensation, automatic deceleration (anti-regenerative control), droop control, PID process control, PID dancer control, Deceleration characteristics (improving braking capability), auto energy saving function</li> <li>Offline tuning</li> <li>Life early warning, cumulative inverter run time, cumulative motor run time</li> <li>Light alarm, retry, command loss detection</li> </ul>
Digital input	Run forward command, run reverse command, select multi-frequency (0 to 15 steps), select ACC/DEC time (ACC/DEC time 1 to 4), enable 3-wire operation, coast to a stop, reset alarm, enable external alarm trip, ready for jogging, select frequency command 2/1, select motor 1 to 4, enable DC braking, select torque limiter level, switch to commercial power (50 Hz), switch to commercial power (60 Hz), UP (increase output frequency), DOWN (decrease output frequency), enable data change with keypad, cancel PID control, switch normal/inverse operation, interlock, enable communications link via RS-485 or fieldbus (option), universal DI, enable auto search for idling motor speed at starting, force to stop, pre-excitation, reset PID integral and differential components, hold PID integral component, select local (keypad) operation, protect the motor from dew condensation, enable internal sequence to commercial lines (50 Hz), enable internal sequence to commercial lines (60 Hz), pulse train input, pulse train sign, switch to commercial power operation (motor 1 to 4), select droop control, servo-lock command (under PG vector control), cancel PG alarm (under PG vector control)



	Item	Explanation
Control	Transistor output	Inverter running, frequency arrival signal 1/3, frequency detected (3 points), undervoltage detected (inverter stopped), torque polarity detected, inverter output limiting, auto-restarting after momentary power failure, motor overload early warning, keypad operation, inverter ready to run, switch motor power between commercial line and inverter output (inverter input/output/commercial power), select the AX terminal function (primary side MC), inverter output limiting with delay, cooling fan in operation, auto-resetting, universal DO, heat sink overheat early warning, service lifetime alarm, reference loss detected, inverter output on, overload prevention control, current detected (3 points), low level current detected, PID alarm, under PID control, PID control stopped due to slow flowrate, low output torque detected, torque detected (2 points), switched to motor 1 to 4, run forward signal, run reverse signal, inverter in remote operation, PTC status detection enabled, brake signal, analog frequency reference loss on the terminal [C1], inverter keeping speed output, speed arrived, PG error detected, maintenance timer, light alarm, alarm relay contact output (for any fault), braking resistor broken, positioning completion signal, Enable circuit failure detected
	Analog output	Terminals [FM1] and [FM2]: Output a selected signal with analog DC voltage (0 to +10 V) or analog DC current (4 to 20 mA)  Selectable output signals: Output frequency (before slip compensation, after slip compensation), output current, output voltage, output torque, load factor, input power, PID feedback amount (PV), speed (PG feedback value), DC link bus voltage, universal AO, motor output, calibration, PID command (SV), PID output (MV)
Indication	Running/stopping	Speed monitor (reference frequency (Hz), output frequency, motor speed, load shaft speed, line speed, speed in %)  Output current, output voltage, torque calculation value, input power, PID command value, PID feedback amount, PID output, load factor, motor output, torque current, flux command, analog signal input monitor, input watt-hour  Life early warning, cumulative inverter run time, cumulative motor run time, input watt-hour, number of startups  I/O checking, energy-saving monitor (input power, input power x coefficient (charges for input power))
	Trip mode	Trip history: Saves and displays the last 4 trip factors and their detailed description.
Other features	Communications	RS-485 COM port 1 (for keypad connection), RS-485 COM port 2 (on terminal board), and USB port (on the keypad face)
	Protection against momentary power failure	Upon detection of a momentary power failure lasting more than 15 ms, this function stops the inverter output. If restart after momentary power failure is selected, this function invokes a restart process if power is restored within a predetermined period (allowable momentary power failure time).

## 8.4 External Dimensions

### 8.4.1 Standard models

Inverter type FRN___G1■-2□/4□		Dimensions (mm)										
200 V	400 V	W	W1	W2	H	H1	H2	D	D1	D2	D3	A
0.4	0.4	110	96	6	260	246	7	132	113	19	3	6
0.75	0.75							145		32		
1.5	1.5							195		90		
2.2	2.2							220		105		
3.7	3.7 (4.0)*	150	136	10	400	378	11	195	105	90	10	10
5.5	5.5											
7.5	7.5											
11	11											
15	15	250	226	10	400	378	11	195	105	90	10	10
18.5	18.5											
22	22											
30	30											
37	37	320	240	10	550	530	12	255	115	140	4	10
	45				615	595		270		155		
	-				675	655						
	45				740	720						
	55				75	355		275				

\* 4.0 kW for the EU. The inverter type is FRN4.0G1S-4E.

**Note** A box (■) in the above table replaces S or E depending on the enclosure.

A box (□) in the above table replaces A or E depending on the shipping destination.

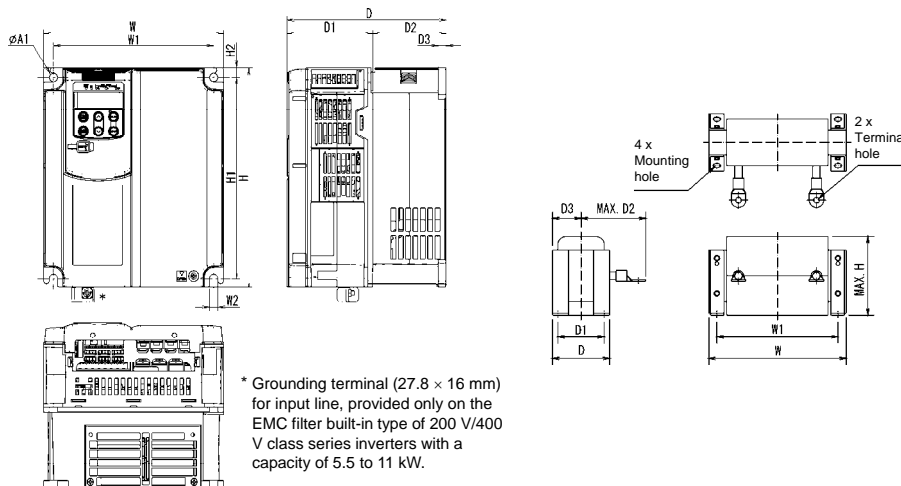
### 8.4.2 DC reactor

Power supply voltage	Inverter type FRN___G1■-2□/4□		Reactor	Dimensions (mm)									Mass (kg)
	W	W1		D	D1	D2	D3	H	Mounting hole	Terminal hole			
200 V	55	LD	DCR2-75C	255±10	225	106±2	86	145	53±1	145	M6	M12	11.4
400 V	55	LD	DCR4-75C	255±10	225	106±2	86	125	53±1	145	M6	M10	12.4
	75	HD	DCR4-90C	255±10	225	116±2	96	140	58±1	145	M6	M12	14.7
		LD											

**Note 1:** A box (■) in the above table replaces S or E depending on the enclosure.

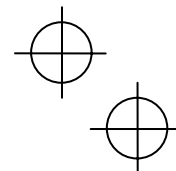
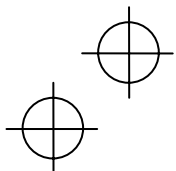
A box (□) in the above table replaces A or E depending on the shipping destination.

**Note 2:** Inverters with a capacity of 55 kW in LD mode and inverters with 75 kW or above require a DCR to be connected.



Inverter (Typical example)

DC reactor (DCR)



## Chapter 9 CONFORMITY WITH STANDARDS

### 9.1 Compliance with UL Standards and Canadian Standards (cUL certification)

#### 9.1.1 General

Originally, the UL standards were established by Underwriters Laboratories, Inc. as private criteria for inspections/investigations pertaining to fire/accident insurance in the USA. Later, these standards were authorized as the official standards to protect operators, service personnel and the general populace from fires and other accidents in the USA.

cUL certification means that UL has given certification for products to clear CSA Standards. cUL certified products are equivalent to those compliant with CSA Standards.

#### 9.1.2 Considerations when using FRENIC-MEGA in systems to be certified by UL and cUL

If you want to use the FRENIC-MEGA series of inverters as a part of UL Standards or CSA Standards (cUL certified) certified product, refer to the related guidelines described on pages vi to xiii.

### 9.2 Compliance with European Standards

The CE marking on Fuji products indicates that they comply with the essential requirements of the Electromagnetic Compatibility (EMC) Directive 2004/108/EC and Low Voltage Directive 73/23/EEC which are issued by the Council of the European Communities

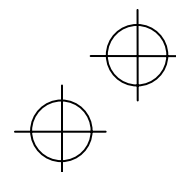
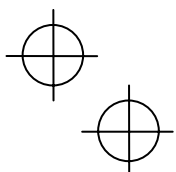
#### The products comply with the following standards

	Basic type	EMC filter built-in type
EMC Directives	Depends upon a filter dedicated to Fuji inverters*	EN61800-3 : 2004 Immunity : Second environment (Industrial) Emission : Category C3
Low Voltage Directive	EN50178 : 1997	
Safety Standard	EN954-1 : Category 3	

\* If connected with an external EMC filter dedicated to Fuji inverters, the basic type of inverters that bear a CE marking but have no built-in EMC filter becomes compliant with these EMC Directives.

#### CAUTION

The EMC filter built-in type of the FRENIC-MEGA inverters is categorized as "Category C3" of the EN61800-3. It is not designed for use in a domestic environment. It may interfere with the operations of home appliances or office equipment due to noise emitted from it.



## 9.3 Compliance with EMC Standards

### 9.3.1 General

The CE marking on inverters does not ensure that the entire equipment including our CE-marked products is compliant with the EMC Directive. Therefore, CE marking for the equipment shall be the responsibility of the equipment manufacturer. For this reason, Fuji's CE mark is indicated under the condition that the product shall be used within equipment meeting all requirements for the relevant Directives. Instrumentation of such equipment shall be the responsibility of the equipment manufacturer.

Generally, machinery or equipment includes not only our products but other devices as well. Manufacturers, therefore, shall design the whole system to be compliant with the relevant Directives.

In addition, to satisfy the requirements noted above, use the EMC filter built-in type of inverters or the combination of the basic type of inverters that have no built-in EMC filter and an external filter (option) dedicated to Fuji inverters. In either case, mount inverters in accordance with the installation procedure given below. To ensure the compliance, it is recommended that inverters be mounted in a metal panel.

**Tip** Our EMC compliance test is performed under the following conditions.  
Wiring length (of the shielded cable) between the inverter (EMC filter built-in type) and motor: 5m

**Note** To use Fuji inverters in combination with a PWM converter, the basic type of inverters having no built-in EMC filter should be used. Use of an EMC filter built-in type may increase heat of capacitors in the inverter, resulting in a break. In addition, the effect of the EMC filter can no longer be expected.

### 9.3.2 Recommended installation procedure

To make the machinery or equipment fully compliant with the EMC Directive, have certified technicians wire the motor and inverter in strict accordance with the procedure described below.

#### ■ In the case of EMC filter built-in type of inverter

- 1) Mount the inverter on a grounded panel or metal plate. Use shielded wires for the motor cable and route the cable as short as possible. Firmly camp the shield to the metal plate to ground it. Further, connect the shielding layer electrically to the grounding terminal of the motor.

For the inverters with a capacity of 5.5 to 11 kW, connect the input grounding to the grounding terminal at the front, left-hand side, and the output grounding to that on the main circuit terminal block. Use wiring guides to separate the input and output wires as far as possible. (Refer to Figure 9.1.)

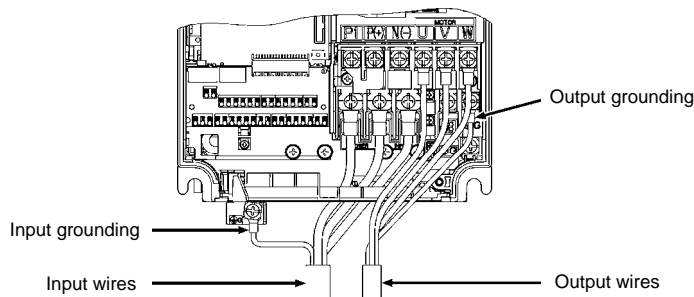


Figure 9.1 Wiring for EMC Filter Built-in Type Inverters with a Capacity of 5.5 to 11 kW

- 2) For connection to inverter's control terminals and for connection of the RS-485 communication signal cable, use shielded wires. As with the motor, clamp the shields firmly to a grounded panel.
- 3) If noise from the inverter exceeds the permissible level, enclose the inverter and its peripherals within a metal panel as shown in Figure 9.2.

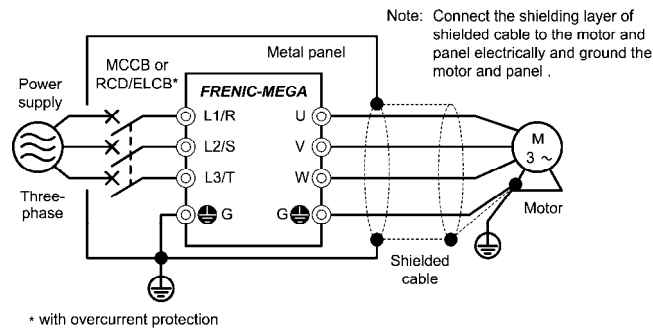


Figure 9.2 Mounting the Inverter in a Metal Panel

- In case an EMC-compliant filter (optional) is externally used
- 1) Mount the inverter and the filter on a grounded panel or metal plate. Use shielded wires for the motor cable and route the cable as short as possible. Firmly clamp the shields to the metal plate to ground them. Further, connect the shielding layers electrically to the grounding terminal of the motor.
  - 2) For connection to inverter's control terminals and for connection of the RS-485 communication signal cable, use shielded wires. As with the motor, clamp the shields firmly to a grounded panel.
  - 3) If noise from the inverter exceeds the permissible level, enclose the inverter and its peripherals within a metal panel as shown in Figure 9.3.

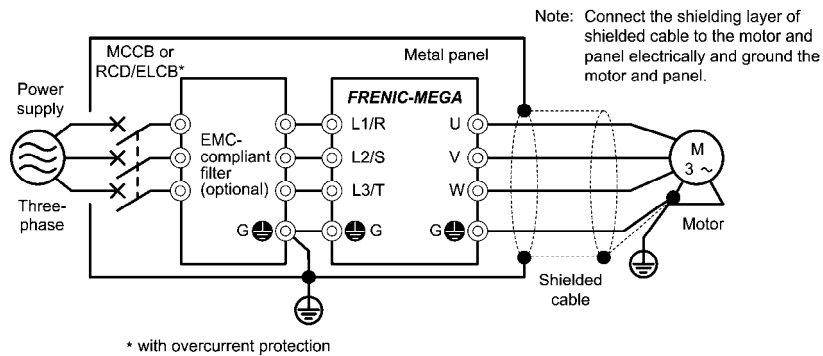


Figure 9.3 Mounting the Inverter with EMC-compliant Filter in a Metal Panel

### 9.3.3 Leakage current of EMC-filter built-in type of inverters

An EMC filter uses grounding capacitors for noise suppression which increase leakage current. When using an EMC-filter built-in type of inverters, therefore, check whether there is no problem with electrical systems.

Table 9.1 Leakage Current of EMC Filter Built-in Type of Inverters

Input Power	Inverter type *1)	Leakage current (mA)
Three-phase 200 V *2)	FRN0.4G1E-2□	2
	FRN0.75G1E-2□	
	FRN1.5G1E-2□	4
	FRN2.2G1E-2□	
	FRN3.7G1E-2□	
	FRN5.5G1E-2□	23
	FRN7.5G1E-2□	
	FRN11G1E-2□	
	FRN15G1E-2□	25
	FRN18.5G1E-2□	
	FRN22G1E-2□	
	FRN30G1E-2□	
	FRN37G1E-2□	
	FRN45G1E-2□	
FRN55G1E-2□		
Three-phase 400 V *3)	FRN0.4G1E-4□	3
	FRN0.75G1E-4□	2
	FRN1.5G1E-4□	
	FRN2.2G1E-4□	
	FRN3.7G1E-4A FRN4.0G1E-4E*	4
	FRN5.5G1E-4□	
	FRN7.5G1E-4□	
	FRN11G1E-4□	
	FRN15G1E-4□	11
	FRN18.5G1E-4□	
	FRN22G1E-4□	
	FRN30G1E-4□	
	FRN37G1E-4□	5
	FRN45G1E-4□	
	FRN55G1E-4□	
FRN75G1E-4□		

\* FRN4.0G1E-4E for the EU in which the nominal applied motor rating is 4.0 kW.

\*1) A box (□) in the above table replaces A or E depending on the shipping destination.

\*2) Calculated based on these measuring conditions: 240 V, 60 Hz, grounding of a single wire in delta connection, interphase voltage unbalance ratio 2%.

\*3) Calculated based on these measuring conditions: 480 V, 60 Hz, neutral grounding in Y-connection, interphase voltage unbalance ratio 2%.

## 9.4 Harmonic Component Regulation in the EU

### 9.4.1 General comments

When you use general-purpose industrial inverters in the EU, the harmonics emitted from the inverter to power lines are strictly regulated as stated below.

If an inverter whose rated input is 1 kW or less is connected to public low-voltage power supply, it is regulated by the harmonics emission regulations from inverters to power lines (with the exception of industrial low-voltage power lines). Refer to Figure 9.4 below for details.

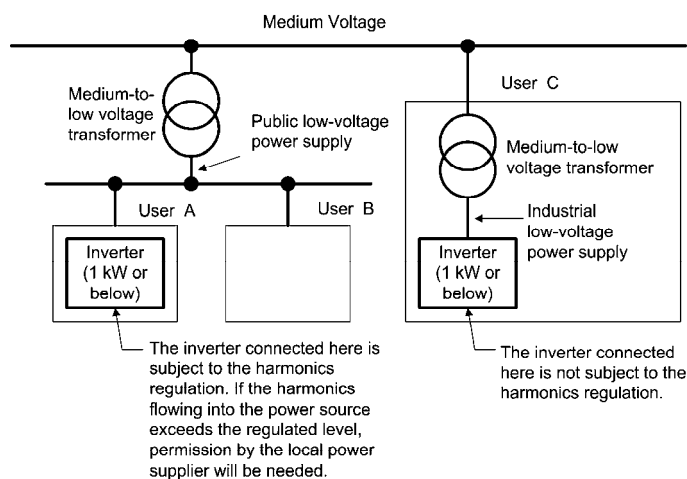


Figure 9.4 Power Source and Regulation

### 9.4.2 Compliance with the harmonic component regulation

Table 9.2 Compliance with Harmonic Component Regulation

Power supply voltage	Inverter type	w/o DC reactor	w/ DC reactor	Applicable DC reactor type
Three-phase 200 V	FRN0.4G1■-2□	√*	√*	DCR2-0.4
	FRN0.75G1■-2□	√*	√*	DCR2-0.75
Three-phase 400 V	FRN0.4G1■-4□	—	√	DCR4-0.4
	FRN0.75G1■-4□	—	√	DCR4-0.75

\* When supplying three-phase 200 VAC power stepped down from a three-phase 400 VAC power line using a transformer, the level of harmonic flow from the 400 VAC line will be regulated.

Note 1) A box (■) in the above table replaces S or E depending on the enclosure.

A box (□) in the above table replaces A or E depending on the shipping destination.

Note 2) Inverter types marked with √ in the table above are compliant with the EN61000-3-2 (+A14), so they may be connected to public low-voltage power supply unconditionally.

Conditions apply when connecting models marked with "—". To connect them to public low-voltage power supply, you need to obtain permission from the local electric power supplier. In general, you will need to provide the supplier with the harmonics current data of the inverter. To obtain the data, contact your Fuji Electric representative.

## 9.5 Compliance with the Low Voltage Directive in the EU

### 9.5.1 General

General-purpose inverters are regulated by the Low Voltage Directive in the EU. Fuji Electric states that all our inverters with CE marking are compliant with the Low Voltage Directive.

### 9.5.2 Points for consideration when using the FRENIC-MEGA series in a system to be certified by the Low Voltage Directive in the EU

If you want to use the FRENIC-MEGA series of inverters in systems/equipment in the EU, refer to the guidelines on pages vi to viii.

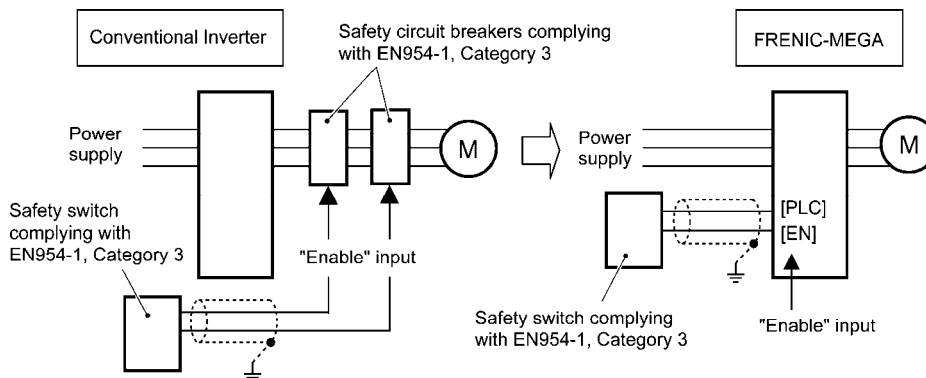
## 9.6 Compliance with EN954-1, Category 3

### 9.6.1 General

In FRENIC-MEGA series of inverters, opening the hardware circuit between terminals [EN] and [PLC] stops the output transistor, coasting the motor to a stop. (EN: Enable input) This is the safety stop function prescribed in EN60204-1, Category 0 (Uncontrolled stop) and compliant with EN954-1, Category 3.

**Note:** Depending on applications, additional measures may be necessary (for end-user) to apply such as 'brake function' to prevent movement and motor terminal protection against possible electrical hazard(s).

Use of terminals [EN] and [PLC] eliminates the need of external safety circuit breakers while conventional inverters need those breakers to configure the EN954-1 Category 3 compliant safety system.



### 9.6.2 EN954-1

European Standard EN954-1 (Safety of machinery—Safety related parts of control systems) prescribes the basic safety requirements for machinery categorized according to the requirement level. Category 3 represents the requirements that the machinery shall be designed with redundancy so that a single fault does not lead to the loss of the safety function. Table 9.3 shows an outline of the category levels and their safety requirements. (For detailed requirements refer to EN 954-1)



Table 9.3

Category	Summary of requirements	System behavior
B	Safety related parts of control systems and/or their safety devices and their components shall be designed, constructed, selected, assembled and combined in accordance with the relevant standards so that they can withstand the expected influence.	The occurrence of a fault can lead to the loss of the safety function.
1	Requirements of Category B shall apply. Well-ried safety principles and well-ried components shall be used.	The occurrence of a fault can lead to the loss of the safety function, but the probability of occurrence is lower than for Category B.
2	Requirements of Category 1 shall apply. The safety function shall be checked at intervals suitable for the machinery.	The occurrence of a fault can lead to the loss of the safety function between the checks.
3	Requirements of Category 1 shall apply. Safety-related parts shall be designed, so that: - a single fault in any of these parts does not lead to the loss of the safety function, and - a single fault is detected whenever reasonably practicable.	When the single fault occurs, the safety function is still maintained. Accumulation of undetected faults can lead to the loss of the safety function.
4	Requirements of Category 1 shall apply. Safety-related parts shall be designed, so that a single fault is detected during or prior to the next demand on the safety function. If this is not possible, an accumulation of faults shall not lead to the loss of the safety function.	When faults occur, the safety function is still maintained.

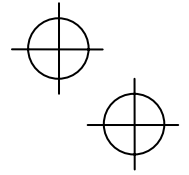
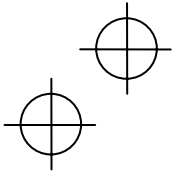
### 9.6.3 Notes

#### (1) Wiring for terminal [EN]

- When using terminal [EN], be sure to remove the short-circuit wire from terminals [EN] and [PLC], which has been connected at the shipment.
- '[EN] & [PLC]' terminals are safety related wire connections and therefore careful installation practices shall be applied to ensure no 'short-circuit(s)' can occur to these connections.
- For opening and closing the hardware circuit between terminals [EN] and [PLC], use safety approved components such as safety switches and safety relays that comply with EN954-1, Category 3 or higher to ensure a complete shutoff.
- Be sure to use shielded wires for connecting terminals [EN] and [PLC] and ground the shielding layer. Do not connect/mix any other control signal wire within the same shielded core.
- It is the responsibility of the machinery manufacturer to guarantee that a short-circuiting or other fault does not occur in wiring of external safety components between terminals [EN] and [PLC].

Fault examples:

- Terminals [EN] and [PLC] are short-circuited due to the wiring being caught in the door of the control panel so that a current continues to flow in terminal [EN] although the safety component is OFF and therefore the safety function will/may NOT operate
- The wiring is in contact with any other wire so that a current continues to flow in terminal [EN] and therefore the safety function will/may NOT operate



(2) Other notes

- When configuring the product safety system with this safety stop function, make a risk assessment of not only the external equipment and wiring connected to terminal [EN] but also the whole system including other equipment, devices and wiring against the product safety system required by the machinery manufacturer under the manufacturer's responsibility in order to confirm that the whole system conforms to the product safety system required by the machinery manufacturer.

In addition, as preventive maintenance, the machinery manufacturer must perform periodical inspections to check that the product safety system properly functions.

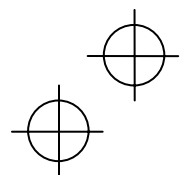
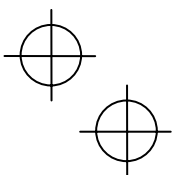
- To make the inverter compliant with EN954-1, Category 3, it is necessary to install the inverter on a control panel with the enclosure rating of IP54 or above.

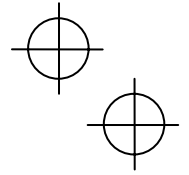
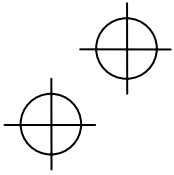
This safety stop function coasts the motor to a stop. When a mechanical brake is used to stop or hold the motor for the sake of the product safety system of whole system, do not use the inverter's control signals such as output from terminal [Y]. (Using control signals does not satisfy the safety standards because of software intervention.) Use safety components complying with EN954-1, Category 3 or higher to activate mechanical brakes.

- The safety shutdown circuit between terminal [EN] input section and inverter's output shutdown section is dual-configured (redundant circuit) so that an occurrence of a single fault does not detract the safety stop function.

If a single fault is detected in the safety shutdown circuit, the inverter coasts the motor to a stop even with the terminal [EN]-[PLC] state being ON, as well as outputting an alarm to external equipment. (Note that the alarm output function is not guaranteed to all of single faults.)

- This safety stop function may not completely shut off the power supply to the motor electrically. Before performing wiring or maintenance jobs, be sure to disconnect/isolate the input power to the inverter and wait at least 5 minutes for 22 kW or below of inverters, and at least 10 minutes for 30 kW or above.





High Performance, Multifunction Inverter

# ***FRENIC-MEGA***

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## **Instruction Manual**

First Edition, October 2007

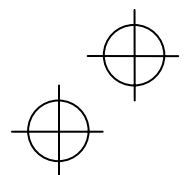
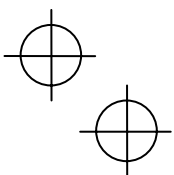
Second Edition, December 2007

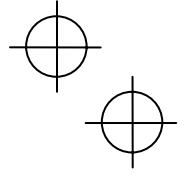
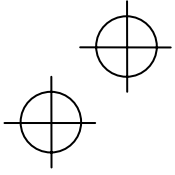
Fuji Electric FA Components & Systems Co., Ltd.

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The purpose of this instruction manual is to provide accurate information in handling, setting up and operating of the FRENIC-MEGA 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 Fuji Electric FA Components & Systems Co., Ltd. be liable for any direct or indirect damages resulting from the application of the information in this manual.





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