



Designed for Elevating Machinery

FRENIC-Lift

ACAUTION

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

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



Preface

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

FRENIC-Lift is an inverter designed to drive a three-phase induction motor (hereafter called an induction motor) and a three-phase permanent magnet synchronous motor (hereafter called a synchronous motor) for exclusively controlling elevating machinery.

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

To drive a synchronous motor, a PG interface card option involving a pulse encoder is needed. For derails, refer to the instruction manual of PG Interface Card.

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

Multi-function Keypad "TP-G1-CLS" Instruction Manual (INR-SI47-1092-E)
 FRENIC-Lift Reference Manual (INR-SI47-1068-E)
 About compliance with standards (INR-SI47-1148-E)

The 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.

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

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

Application

↑ WARNING

- FRENIC-Lift is equipment designed to drive induction motors and synchronous motors for exclusively
 controlling elevating machinery. Do not use it for single-phase motors or for other purposes.
 - Fire or accident could occur.
- FRENIC-Lift may not be used for a life-support system or other purposes directly related to the human safety.
- Though FRENIC-Lift is manufactured under strict quality control, install safety devices for applications
 where serious accidents or material losses are foreseen in relation to the failure of it

An accident could occur.

i

↑ WARNING

· Install the inverter on a nonflammable material such as metal

Otherwise fire could occur.

· Do not place flammable matter nearby.

Doing so could cause fire.

 Using an optional DC reactor makes human body easily touch any live parts of inverters. In this case, take countermeasures such as installing the inverter in a place that easily protects human body from electric shock.

Otherwise, electric shock or injuries could occur.

↑CAUTION

 Do not touch the printed circuit boards in the product directly. Electronic devices on those boards are easily affected by static electricity.

When touching those boards, put on a grounding wrist band and perform the job on a static mat.

Static electricity charged in your body may damage the product.

• Do not support the inverter by its terminal block cover during transportation.

Doing so could cause a drop of the inverter and injuries.

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

Otherwise, a fire or an accident might result.

• Do not install or operate an inverter that is damaged or lacking parts.

Doing so could cause fire, an accident or injuries.

- Do not get on a shipping box.
- Do not stack shipping boxes higher than the indicated information printed on those boxes.
 Doing so could cause injuries.

Wiring

↑ WARNING

- When wiring the inverter to the power source, insert a recommended molded case circuit breaker (MCCB) or residual-current-operated protective device (RCD)/earth leakage circuit breaker (ELCB) (with overcurrent protection) in the path of power lines. Use the devices within the recommended current range.
- · Use wires in the specified size.

Otherwise, fire could occur.

- Do not use one multicore cable in order to connect several inverters with motors.
- · Do not connect a surge killer to the inverter's output (secondary) circuit.

Doing so could cause fire.

· Install inverters in compliance with the local regulation.

Otherwise, 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 body.

Otherwise, electric shock or injuries could occur.

△ WARNING

 Ensure that the number of input phases and the rated voltage of the product match the number of phases and the voltage of the AC power supply to which the product is to be connected.

Otherwise fire or an accident could occur.

• Do not connect the power source wires to output terminals (U, V, and W).

Doing so could cause fire or an accident.

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

Otherwise, an accident or electric shock could occur.

↑ CAUTION

- Wire the three-phase motor to terminals U, V, and W of the inverter, aligning phases each other.
 Otherwise injuries could occur.
- The inverter, motor and wiring generate electric noise. Take care of malfunction of the nearby sensors and devices. To prevent the motor from malfunctioning, implement noise control measures.

Otherwise an accident could occur.

Operation

↑ WARNING

 Be sure to install the terminal block cover and the front cover before turning the power ON. Do not remove the covers while power is applied.

Otherwise electric shock could occur.

- Do not operate switches with wet hands.
 - Doing so could cause electric shock.
- If the retry function has been selected, the inverter may automatically restart and drive the motor depending on the cause of tripping.
 - (Design the machinery or equipment so that human safety is ensured after restarting.)
- If the stall prevention function (current limiter), automatic deceleration, and overload prevention control
 have been selected, the inverter may operate at an acceleration/deceleration time or frequency different from the commanded ones. Design the machine so that safety is ensured even in such cases.

Otherwise an accident could occur.

If an alarm reset is made with the Run command signal turned ON, a sudden start will occur. Ensure that
the Run command signal is turned OFF in advance.

Otherwise an accident could occur.

- If you set the function codes wrongly or without completely understanding this instruction manual and the FRENIC-Lift Reference Manual (INR-SI47-1068-E), the motor may rotate with a torque or at a speed not permitted for the machine.
- In the tuning process of the inverter, no motor torque control for braking of the machinery takes effect.
 Tune the inverter for the motor after disconnecting it from the machinery, or after mechanically brakes the machinery. Anyway, do it after suppressing any dangerous factors.

An accident or injuries could occur.

- Never touch the inverter terminals while the power is applied to the inverter even if the inverter stops.
- Never touch the printed circuit boards in the product while the power is applied to the inverter. High
 voltage is applied to those boards.

Doing so could cause electric shock.

↑ CAUTION

- Do not turn the main circuit power (circuit breaker) ON or OFF in order to start or stop inverter operation.
 Doing so could cause failure.
- · Do not touch the heat sink because they become very hot.

Doing so could cause burns.

- Setting the inverter to high speeds is easy. Before changing the frequency (speed) setting, check the specifications of the motor and machinery.
- The brake function of the inverter does not provide mechanical holding means.
 Injuries could occur.

Setting control switches

⚠ WARNING

Before setting up any internal control switches, turn OFF the power, and wait for more than five minutes.
 Further, check that the LED monitor is unlit, and make sure, using a multimeter or a similar instrument,
 that the DC link bus voltage between the terminals P (+) and N (-) has dropped below a safe voltage
 (+25 VDC).

Otherwise electric shock could occur.

Maintenance and inspection, and parts replacement

↑ WARNING

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

Otherwise, electric shock could occur.

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

Otherwise, electric shock or injuries could occur.

Disposal

∆CAUTION

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

Others

△WARNING

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

GENERAL PRECAUTIONS

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

■ Precautions for use

	Driving a 400V general-purpose motor	When driving a 400V general-purpose motor with an inverter using extremely long wires, damage to the insulation of the motor may occur. Apply the inverter after consulting the motor maker.		
	Torque characte- ristics and tem- perature rise	When the inverter is used to run a general-purpose motor, the temperature of the motor becomes higher than when it is operated using a commercial power supply. In the low-speed range, the cooling effect will be weakened, so decrease the output torque of the motor.		
In running general-		When an inverter-driven motor is mounted to a machine, resonance may be caused by the natural frequencies of the machine system.		
purpose motors	Vibration	Note that operation of a 2-pole motor at 60 Hz or higher may cause abnormal vibration.		
	Vibration	* The use of a rubber coupling or vibration dampening rubber is recommended.		
		* Run your machinery including FRENIC-Lift inverter so as to skip its resonance frequency zone/s.		
	Noise	When an inverter is used with a general-purpose motor, the motor noise level is higher than that with 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.		
	Brake motors	For motors equipped with parallel-connected brakes, their braking power must be supplied from the primary circuit. If the brake power is connected to the inverter's output circuit by mistake, the brake will not work.		
		Do not use inverters for driving motors equipped with series-connected brakes.		
In running special mo- tors	Geared motors	If the power transmission mechanism uses an oil-lubricated gearbox or speed changer/reducer, then continuous motor operation at low speed may cause poor lubrication. Avoid such operation.		
	Synchronous motors	The PG interface card (option) corresponding to the pulse encoder spec fication is necessary. Read PG interface card (option) manual.		
	Single-phase motors	Single-phase motors are not suitable for inverter-driven variable speed operation. Use three-phase motors.		
		Use the inverter within the ambient temperature range from -10 to +45°C.		
Environ- mental con- ditions	Installation loca- tion	The heat sink and braking resistor of the inverter may become hot under certain operating conditions, so install the inverter on nonflammable material such as metal.		
		Ensure that the installation location meets the environmental conditions specified in Chapter 2, Section 2.1 "Operating Environment."		

	Installing an MCCB or RCD/ELCB	Install a recommended molded case circuit breaker (MCCB) or residual-current-operated protective device (RCD)/earth leakage circuit breaker (ELCB) (with overcurrent protection) in the primary circuit of the inverter to protect the wiring. Ensure that the circuit breaker capacity is equivalent to or lower than the recommended capacity.		
Combination with peripheral devices	Installing an MC in the secondary circuit	If a magnetic contactor (MC) is mounted in the inverter's output (secondary) circuit, ensure that both the inverter and the motor are completely stopped before you turn the MC on or off. Remove a surge killer built-in the MC.		
	Installing an MC in the primary circuit	Do not turn the magnetic contactor (MC) in the primary circuit ON or OFF more than once an hour as an inverter failure may result. If frequent starts or stops are required during motor operation, use <i>FWD / REV</i> signals.		
	Protecting the	The electronic thermal function of the inverter can protect the motor. The operation level and the motor type (general-purpose motor, inverter motor) should be set. For high-speed motors or water-cooled motors, set a small value for the thermal time constant and protect the motor.		
	motor	If you connect the motor thermal relay to the motor with a long wire, a high-frequency current may flow into the wiring stray capacitance. This may cause the relay to trip at a current lower than the set value for the thermal relay. If this happens, lower the carrier frequency.		
	Discontinuance of power-factor correcting capa- citor	Do not mount power-factor correcting capacitors in the inverter's primary circuit. (Use the DC reactor to improve the inverter power factor.) Do not use power-factor correcting capacitors in the inverter's output (secondary) circuit. An overcurrent trip will occur, disabling motor operation.		
	Discontinuance of surge killer	Do not connect a surge killer to the inverter's output (secondary) circuit.		
	Reducing noise	Use of a filter and shielded wires is typically recommended to satisfy EMC Directives.		
	Measures against surge currents	If an overvoltage trip occurs while the inverter is stopped or operated under a light load, it is assumed that the surge current is generated by open/close of the phase-advancing capacitor in the power system. * Connect a DC reactor to the inverter.		
	Megger test	When checking the insulation resistance of the inverter, use a 500 V megger and follow the instructions contained in Chapter 7, Section 7.5 "Insulation Test."		
	Control circuit wiring length	When using remote control, limit the wiring length between the inverter and operator box to 20 m or less and use twisted pair or shielded wire.		
Wiring	Wiring length between inverter and motor	If long wiring is used between the inverter and the motor, the inverter will overheat or trip as a result of overcurrent (high-frequency current flowing into the stray capacitance) in the wires connected to the phases. Ensure that the wiring is shorter than 20 m. If this length must be exceeded, lower the carrier frequency.		
-	Wiring size	Select wires with a sufficient capacity by referring to the current value or recommended wire size.		
	Wiring type	When several inverters drive motors, do not use one multicore cable in order to connect several inverters with motors.		
	Grounding	Securely ground the inverter using the grounding terminal.		

	Driving gener- al-purpose motor	Select an inverter according to the applicable motor ratings listed in the standard specifications table for the inverter. When high starting torque is required or quick acceleration or deceleration is required, select an inverter with a capacity one size greater than the	
inverter capacity		standard.	
	Driving special	Select an inverter that meets the following condition:	
	motors	Inverter rated current > Motor rated current	
Transpor- tation and	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).		
storage	When transporting or storing inverters, follow the procedures and select locations that meet the environmental conditions listed in Chapter 1, Section 1.3 "Transportation" and Section 1.4 "Storage Environment."		

How this manual is organized

This manual is made up of chapters 1 through 9.

Chapter 1 BEFORE USING THE INVERTER

This chapter describes acceptance inspection and precautions for transportation and storage of the inverter.

Chapter 2 MOUNTING AND WIRING OF THE INVERTER

This chapter provides operating environment, precautions for installing the inverter, wiring instructions for the motor and inverter.

Chapter 3 OPERATION USING THE KEYPAD

The FRENIC-Lift has no standard keypad. Operating the FRENIC-Lift from a keypad requires an optional multi-function keypad. For details in operations, refer to the Multi-function Keypad "TP-G1-CLS" Instruction Manual (INR-S147-1092-E).

Chapter 4 RUNNING THE MOTOR

This chapter describes preparation to be made before running the motor for a test and practical operation.

Chapter 5 FUNCTION CODES

This chapter provides a list of the function codes. For details of function codes, refer to the FRENIC-Lift Reference Manual (INR-S147-1068-E.)

Chapter 6 TROUBLESHOOTING

This chapter describes troubleshooting procedures to be followed when the inverter malfunctions or detects an alarm condition. In this chapter, first check whether any alarm code is displayed or not, and then proceed to the troubleshooting items.

Chapter 7 MAINTENANCE AND INSPECTION

This chapter describes inspection, measurement and insulation test which are required for safe inverter operation. It also provides information about periodical replacement parts and guarantee of the product.

Chapter 8 SPECIFICATIONS

This chapter lists specifications including output ratings, control system, external dimensions and protective functions.

Chapter 9 LIST OF PERIPHERAL EQUIPMENT AND OPTIONS

This chapter describes main peripheral equipment and options which can be connected to the FRENIC-Lift series of inverters.

Icons

The following icons are used throughout this manual.



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.



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

This icon indicates a reference to more detailed information.

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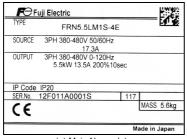
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Chapter 1 **BEFORE USING THE INVERTER**

1.1 Acceptance Inspection

Unpack the package and check that:

- (1) An inverter and accessories below are contained in the package.
 - Cooling fan mounting screws (5.5 to 22 kW)
 - Rubber bushes for cable guide plate (5.5 to 22 kW)
 - Encoder wiring plug
- (2) The inverter has not been damaged during transportation—there should be no dents or parts missing.
- (3) The inverter is the model you ordered. You can check the model name and specifications on the main nameplate. (Main and sub nameplates are attached to the inverter and are located as shown on the following page.) For the inverter whose capacity is 37 kW or above, the mass of that is printed on the nameplate.



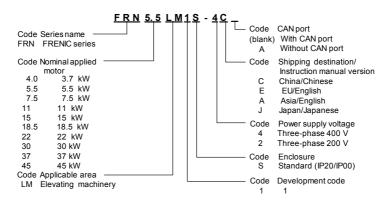
FRN5.5LM1S-4E SER.No. 12F011A0001S

(a) Main Nameplate

(b) Sub Nameplate

Figure 1.1 Nameplates

TYPE: Inverter model



SOURCE: Number of input phases (three-phase: 3PH), input voltage, input frequency, input current

OUTPUT: Number of output phases, rated output capacity, rated output voltage, output frequency range, rated output current, overload capacity

SER. No.: Product number

manufacturing date

12F011A0001S 1 17 Production week

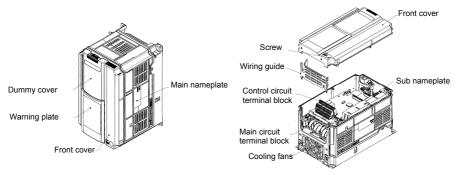
This indicates the week number that is numbered from 1st week of January.

The 1st week of January is indicated as '01'. Production year: Last digit of year

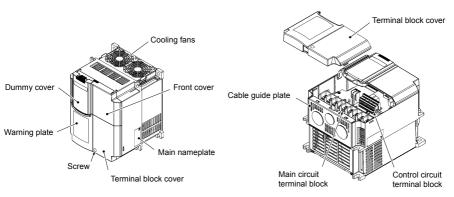
If you suspect the product is not working properly or if you have any questions about your product, contact your Fuji Electric representative.

1.2 External View and Terminal Blocks

(1) Outside and terminal block views



(a) FRN2.2LM1S-7□. FRN4.0LM1S-4□



(b) FRN15LM1S-4□

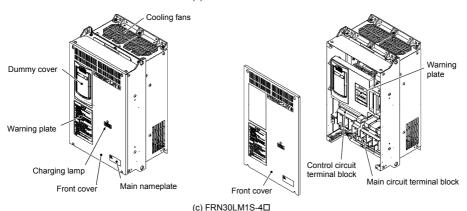


Figure 1.2 Outside and Terminal Block Views of Inverters

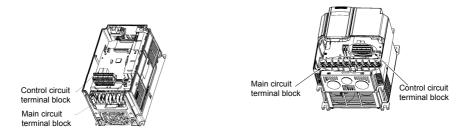
Note: A box (\square) in the above figure replaces C, E, A or J depending on the shipping destination.

(2) Warning plates



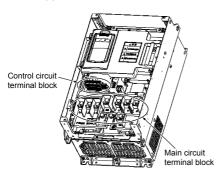
Figure 1.3 Warning Plates

(3) Terminal block location



(b) FRN15LM1S-4□

(a) FRN2.2LM1S-7□, FRN4.0LM1S-4□



(c) FRN30LM1S-4□

Figure 1.4 Main and Control Circuit Terminal Block Location

Note: A box (□) in the above figure replaces C, E, A or J depending on the shipping destination.

1.3 Transportation

When carrying an inverter, always support its bottom at the front and rear sides with both hands. Do not hold
covers or individual parts only. You may drop the inverter or break it.

1.4 Storage Environment

1.4.1 Temporary storage

Store the inverter in an environment that satisfies the requirements listed in Table 1.1.

Table 1.1 Environmental Requirements for Storage and Transportation

Item	Requirements		
Storage temperature *1	-25 to +65°C A location where the inverter is not subject to abrupt changes in		
Relative humidity	5 to 95% *2	temperature that would result in the formation of condensation or ice.	
Atmosphere	The inverter must not be exposed to dust, direct sunlight, corrosive or flammable gases, oil mist, vapor, water drops or vibration. The atmosphere must contain only a low level of salt. (0.01 mg/cm² or less per year)		
Atmospheric pressure	86 to 106 kPa (in storage)		
	70 to 106 kPa (during transportation)		

^{*1} Assuming a comparatively short storage period (e.g., during transportation or the like).

Precautions for temporary storage

- (1) Do not leave the inverter directly on the floor.
- (2) If the environment does not satisfy the specified requirements, wrap the inverter in an airtight vinyl sheet or the like for storage.
- (3) If the inverter is to be stored in an environment with a high level of humidity, put a drying agent (such as silica gel) in the airtight package described in item (2).

1.4.2 Long-term storage

The long-term storage methods for the inverter vary largely according to the environment of the storage site. General storage methods are described below.

- (1) The storage site must satisfy the requirements specified for temporary storage. However, for storage exceeding three months, the ambient temperature should be within the range from -10 to +30 °C. This is to prevent the electrolytic capacitors in the inverter from deteriorating.
- (2) The inverter must be stored in a package that is airtight to protect it from moisture. Include a drying agent inside the package to maintain the relative humidity inside the package to within 70%.
- (3) If the inverter has been installed in the equipment or control board at a construction site where it may be subjected to humidity, dust or dirt, then remove the inverter and store it in a suitable environment specified in Table 1.1.

Precautions for storage over 1 year

If the inverter will not be powered on for a long time, the property of the electrolytic capacitors may deteriorate. Power the inverters on once a year and keep them on for 30 to 60 minutes. Do not connect the inverters to motors or run the motor.

Even if the humidity is within the specified requirements, avoid such places where the inverter will be subjected to sudden changes in temperature that will cause condensation to form.

Chapter 2 MOUNTING AND WIRING OF THE INVERTER

2.1 Operating Environment

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

Table 2.1 Environmental Requirements

Item	Specifications		
Site location	Indoors		
Ambient temperature	-10 to +45°C		
Relative humidity	5 to 95% (No condensation	on)	
Atmosphere	The inverter must not be exposed to dust, direct sunlight, corrosive gases, flammable gas, oil mist, vapor or water drops. (Note 1)		
	The atmosphere must contain only a low level of salt.		
	(0.01 mg/cm ² 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 2)		
Atmospheric pressure	86 to 106 kPa		
Vibration	3 mm (Max. amplitude)	2 to less than 9 Hz	
	9.8 m/s ²	9 to less than 20 Hz	
	2 m/s ²	20 to less than 55 Hz	
	1 m/s ²	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) Do not install the inverter in an environment where it may be exposed to cotton waste or moist dust or dirt which will clog the heat sink in the inverter. If the inverter is to be used in such an environment, install it in the enclosure of your system or other dustproof containers.

(Note 2) If you use the inverter in an altitude above 1000 m, you should apply an output current derating factor as listed in Table 2.2.

2.2 Installing the Inverter

(1) Mounting base

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

↑ WARNING

Install the inverter on a base constructed from metal or other non-flammable material.

A fire may result with other material.

(2) Clearances

Ensure that the minimum clearances indicated in Figure 2.1 are maintained at all times. When installing the inverter in the enclosure of your system, take extra care with ventilation inside the enclosure as the temperature around the inverter will tend to increase. Do not install the inverter in a small enclosure with poor ventilation.

Further, do not install two or more inverters in single equipment or in an enclosure.

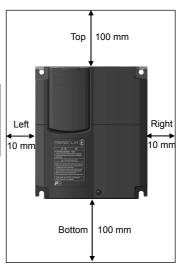


Figure 2.1 Mounting Direction and Required Clearances

■ When employing external cooling

At the shipment time, the inverter is set up for mount inside your equipment or enclosure so that cooling is done all internally.

To improve cooling efficiently, you can take the heat sink out of the equipment or the enclosure (as shown on the right) so that cooling is done both internally and externally (this is called "external cooling").

To set up inverters with a capacity of 22 kW or below for "external cooling," add the optional mounting adapter; to set up ones with a capacity of 30 kW or above, change the position of the top and bottom mounting bases as shown below.

For details about the optional mounting adapter, refer to the Mounting Adapter for External Cooling "PB-F1" Installation Manual (INR-SI47-0880).

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 enclosure. As a result, much less heat is radiated inside the equipment or the enclosure.

In an environment with high humidity or a lot of fibrous dust, however, do not use external cooling, which tends to clog the heat sink.

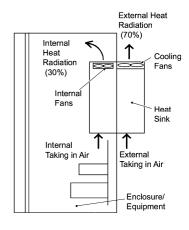


Figure 2.2 External Cooling

↑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.

This may result in a fire or accident.

To utilize external cooling for inverters with a capacity of 30 kW, change the position of the top and bottom mounting bases from the edge to the center of the inverter as instructed on the next page.

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

Power supply voltage	Inverter type	Base fixing screw (Count)	Case fixing screw (Count)	Tightening torque (N•m)
Three-phase 400 V	FRN30LM1S-4□ to FRN45LM1S-4□	M6 × 20 (3 pcs each for upper and lower sides)	M6 × 12 (3 pcs for upper side)	5.8

Note: A box (□) in the above table replaces C (China), E (EU), A (Asia) or J (Japan) depending on the shipping destination.

- Remove all of the base fixing screws from the top and bottom of the inverter. Also remove the case fixing screws from the top. (The case fixing screws are not necessary in external cooling. Store them for future use. On the bottom are no case fixing screws.)
- Secure the top mounting base to the center of the inverter with the base fixing screws, using case fixing screw holes.
- 3) Secure the bottom mounting base to the center of the inverter with the base fixing screws.

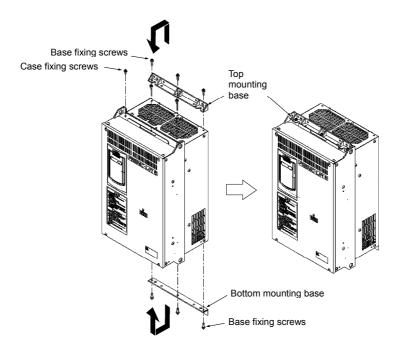


Figure 2.3 Relocating the Top and Bottom Mounting Bases

↑CAUTION

Please use a specified screw for the change of Bottom mounting base.

Fire or accident could occur.

(3) Mounting direction

Horizontal layout is recommended when two or more inverters are to be installed in an equipment or enclosure. As long as the ambient temperature is 40°C or lower, inverters may be mounted side-by-side without any gap between them. If it is necessary to mount the inverters vertically, install a partition plate or the like between the inverters so that any heat radiating from an inverter will not affect the one/s above.

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

(4) Solving abnormal vibration after installation

If any vibration in the surroundings reaches the inverter and causes abnormal vibration to the cooling fan(s) or the keypad, fix them firmly using the fixing screws provided as accessories.

■ Fixing the cooling fan(s)

Table 2.4 Fixing Screws

Power supply voltage	Applicable motor rating (kW)	Inverter type	Screw size (accessory)	Tightening torque (N·m)	Refer to:
	5.5	FRN5.5LM1S-2□		0.8	Figure A
	7.5	FRN7.5LM1S-2□	M4x35 (4 pcs)		
Three- phase	11	FRN11LM1S-2□			
200 V	15	FRN15LM1S-2□	M4x50 (2 pcs)	0.8	Figure B
	18.5	FRN18.5LM1S-2□			
	22	FRN22LM1S-2□			
	5.5	FRN5.5LM1S-4□			
	7.5	FRN7.5LM1S-4□	M4x35 (4 pcs)	0.8	Figure A
Three-	11	FRN11LM1S-4□			
phase 400 V	15	FRN15LM1S-4□		0.8	Figure B
	18.5	FRN18.5LM1S-4□	M4x50 (2 pcs)		
	22	FRN22LM1S-4□			

Note: A box (□) in the above table replaces C (China), E (EU), A (Asia) or J (Japan) depending on the shipping destination.

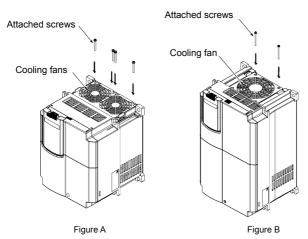


Figure 2.4 Fixing the Cooling Fan(s)

2.3 Wiring

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

2.3.1 Removing and mounting the terminal block (TB) cover and the front cover

(1) For inverter with a capacity of 4.0 kW and Single Phase 2.2kW.

- 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.
- 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.

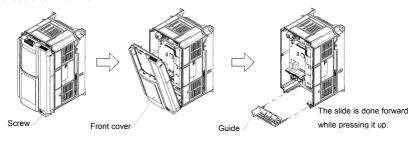


Figure 2.5 Removing the covers and wiring guide

(2) For inverters with a capacity from 5.5 to 22 kW

■ Removing the covers

- To remove the TB cover, loosen the fastening screw on it, hold the dimple (labeled "PULL"), and pull it up toward you.
- To remove the front cover, hold it with both hands, slide it downward, disengage the latch at the top from the inverter, tilt the front cover toward you, and pull it upward.

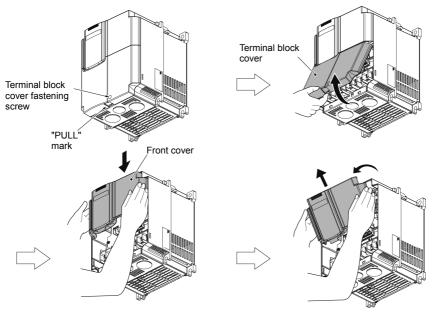


Figure 2.6 Removing the Covers

■ Mounting the covers

- ① Put the front cover to the inverter case so that its bottom engages with the hinges provided on both sides of the case. Push the front cover against the case of the inverter and slide it upward until the latch at its top engages with the case.
- ② Mount the TB cover onto the case of the inverter so that the latch at the top of the TB cover engages with a hole provided at the bottom of the front cover.
- ③ Tighten the screw on the TB cover. (Tightening torque: 1.8 N·m)

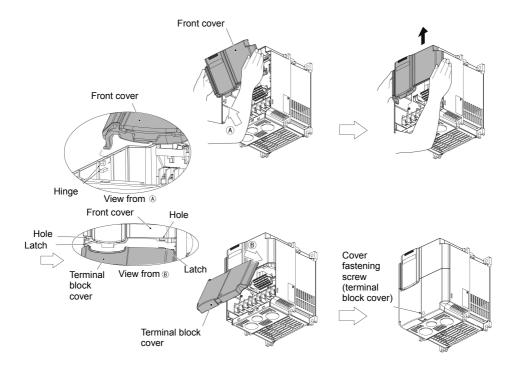


Figure 2.7 Mounting the Covers

(3) For inverters with a capacity of 30 kW or above

- Removing and mounting the cover
- ① To remove the front cover, loosen the four fastening screws, hold it with both hands, and slide it upward. (Refer to Figure 2.7.)
- ② Put the front cover back in reverse order of ①. Make sure to properly match the position of the screw holes on both of the front cover and inverter case.

Table 2.5 Screw Count and Tightening Torque

Power supply voltage	Inverter type	Front cover screw	Tightening torque (N·m)
Three-phase 400 V	FRN30LM1S-4□ to FRN45LM1S-4□	M4 x 8 (4 pcs)	1.8

Note: A box (

) in the above table replaces C (China), E (EU), A (Asia) or J (Japan) depending on the shipping destination.

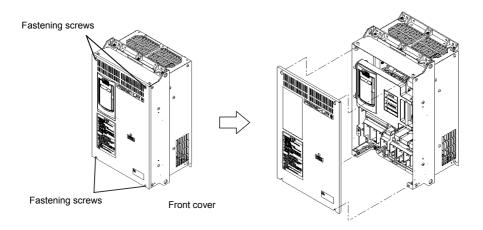


Figure 2.8 Removing and Mounting the Cover (FRN30LM1S-4□)

2.3.2 Removing and retracting the cable guide plate

To secure the protective structure IP20, FRENIC-Lift builds in the cable guide plate for external wiring connections. To use it follow the steps listed below.

■ Removing the cable guide plate

Before to proceed, remove the terminal block cover as shown below left.

Remove the screw fastening the cable guide plate, and pull out the plate.

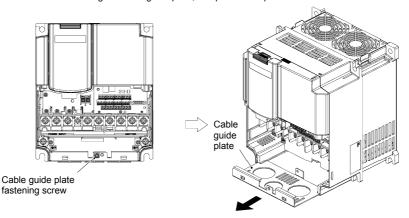


Figure 2.9 Removing the Cable Guide Plate

- Opening half-punched holes and mounting rubber bushes
- Tap an inside face of the half-punched hole by using a screwdriver grip end or the like to punch it out. Punch out all 3 holes.
 - Note Be careful not to injure yourself by sharp cutting edges of parts.
- ② Set 3 attached rubber bushes in the holes and cut in them by a cutting tool to make cut-outs as shown below. All cables of an inverter should pass through any of cut-outs

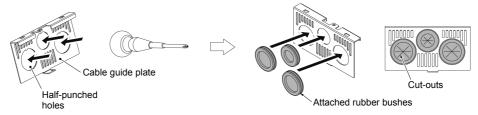


Figure 2.10 Punching out the Holes and Mounting the Rubber Bushes

MARNING

Be sure to use the rubber bushes. If not, a sharp cutting edge of the cable guide plate hole may damage the cable sheath. This may induce a short-circuit fault or ground fault.

A fire or an accident may be caused.

■ Retracting the cable guide plate

Retract the cable guide plate following the steps illustrated in Figure 2.9 in reverse. (Tightening torque: 1.8 N•m)

2.3.3 Terminal arrangement and screw specifications

The figures below show the arrangement of the main and control circuit terminals which differs according to inverter type. The two terminals prepared for grounding, which are indicated by the symbol \(\bigsecolor{1}{3}\)G in Figures A to C, make no distinction between the power supply side (primary circuit) and the motor side (secondary circuit).

(1) Arrangement of the main circuit terminals

Table 2.6 Main Circuit Terminals

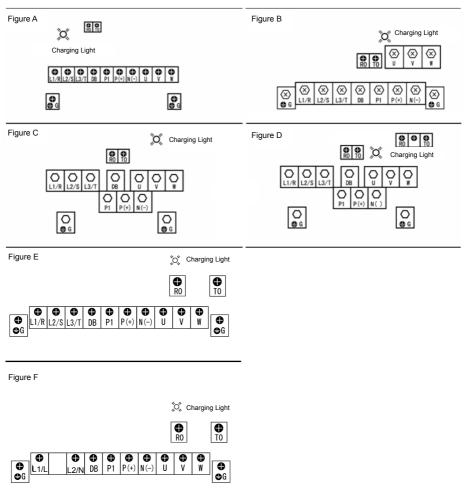
Power supply voltage	Applicable motor rating (kW)	Inverter type	Terminal screw size	Tightening torque (N·m)	Grounding screw size	Tightening torque (N·m)	Refer to:
	5.5	FRN5.5LM1S-2□	M5	3.8	M5	3.8	
	7.5	FRN7.5LM1S-2□	IVIO	3.0	IVIO	3.6	Figure A
Three- phase	11	FRN11LM1S-2□					
200 V	15	FRN15LM1S-2□	M6	5.8	M6	5.8	
	18.5	FRN18.5LM1S-2□	(*1)	(*1)	IVIO	5.6	Figure B
	22	FRN22LM1S-2□					
	3.7	FRN4.0LM1S-4□	M4	1.8	M4	1.8	Figure E
	5.5	FRN5.5LM1S-4□	M5	3.8	M5	3.8	Figure A
	7.5	FRN7.5LM1S-4□	IVIO	3.0			
	11	FRN11LM1S-4□				5.8	
Three- phase	15	FRN15LM1S-4□	M6	5.8	MC		
400 V	18.5	FRN18.5LM1S-4□	(*1)	(*1)	M6		Figure B
	22	FRN22LM1S-4□					
	30	FRN30 LM1S-4□			M8	13.5	Figure C
	37	FRN37 LM1S-4□	M8	13.5			
	45	FRN45 LM1S-4□					Figure D
Single- phase 200 V	2.2	FRN2.2LM1S-7□	M4	1.8	M4	1.8	Figure F

^(*1) Terminal DB on FRN11-LM1S-2/-4: Screw size M5, Tightening torque 3.8 N·m

Terminal R0, T0 (Common to all types): Screw size M3.5, Tightening torque 1.2 N·m

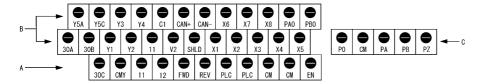
Note: A box (□) in the above table replaces C (China), E (EU), A (Asia) or J (Japan) depending on the shipping destination.

Terminal board illustrated in except Figure A. Take an attention for this structure to connect wires to main output (secondary) terminals.

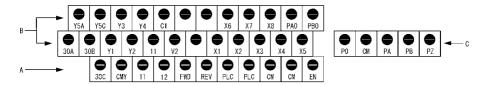


(2) The control circuit terminals (common to all models)

1) For inverters with CAN port (FRN _ _ _ LM1S-2C, -2E, -2A and -2J) (FRN _ _ _ LM1S-4C, -4E, -4A and -4J)



2) For inverters without CAN port (FRN _ _ _ LM1S-2EA, -2AA and -2JA) (FRN _ _ _ LM1S-4EA, -4AA and -4JA)



Screw size: M3 Screw size: M2

Tightening torque: 0.5 to 0.7 (N·m)

Tightening torque: 0.22 to 0.25 (N·m)

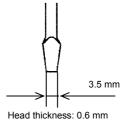
Table 2.7 Control Circuit Terminals

Terminal group	Screwdriver to be used (Head style)	Allowable wire size	Bared wire length	Dimension of openings in the control circuit terminals for ferrule (for Europe type terminal block)*
А	Flat head (0.6 mm x 3.5 mm)	AWG26 to AWG16 (0.14 to 1.5 mm ²)	6 mm	2.51 mm (W) x 1.76 mm (H)
В	Flat head (0.6 mm x 3.5 mm)	AWG26 to AWG16 (0.14 to 1.5 mm ²)	7 mm	2.75 mm (W) x 2.86 mm (H)
С	Flat head (0.4 mm x 2.5 mm)	AWG28 to AWG16 (0.08 to 1.5 mm ²)	7 mm	1.72 mm (W) x 2.7 mm (H)

Manufacturer of ferrules: Phoenix Contact Inc. Refer to Table 2.8.

Table 2.8 Recommended Ferrule Terminals

Screw size	Тур	pe
Screw Size	With insulated collar	Without insulated collar
AWG24 (0.25 mm ²)	AI0.25-6BU	-
AWG22 (0.34 mm ²)	AI0.34-6TQ	A0.34-7
AWG20 (0.5 mm ²)	AI0.5-6WH	A0.5-6
AWG18 (0.75 mm ²)	AI0.75-6GY	A0.75-6
AWG16 (1.25 mm ²)	AI1.5-6BK	A1.5-7



Head thickness: 0.6 mr Screwdriver head style

2.3.4 Recommended wire sizes

Table 2.9 lists the recommended wire sizes. The recommended wire sizes for the main circuits are examples of using HIV single wire (for 75°C) at an ambient temperature of 50°C.

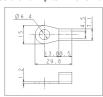
Table 2.9 Recommended Wire Sizes

					Recom	mended w	ire size (mr	Recommended wire size (mm ²) *1						
λlc	Appli-		Main circuit											
Power supply voltage	motor rating (kW)	otor Inverter type ing	Main circuit power input (L1/R, L2/S, L3/T)		Grounding [♣G]	Inverter output	Auxiliary Power Input	Braking resistor	DCR [P1, P (+)]	Control circuit				
	(1007)		w/ DCR	w/ DCR	.0 /	[U, V, W]	(Ctrl. cct.) [R0, T0]	[DB]	. , , , ,	රි				
_	5.5	FRN5.5LM1S-2□	2	3.5	3.5	3.5			3.5					
000	7.5	FRN7.5LM1S-2□	3.5	5.5	5.5	5.5		2	5.5					
sse 2	11	FRN11LM1S-2□	5.5	14	5.5	8	2		8	1.05				
Three-phase 200 V	15	FRN15LM1S-2□	14	22	8	14	2	3.5	14	1.25				
hree	18.5	FRN18.5LM1S-2□	14	22	0	14			22					
-	22	FRN22LM1S-2□	22	38	14	22		5.5	22					
	3.7	FRN4.0LM1S-4□		2	2	2	2	3.5	2	-				
	5.5	FRN5.5LM1S-4□	ا ا											
_	7.5	FRN7.5LM1S-4□		2										
001	11	FRN11LM1S-4□		3.5	3.5				3.5					
Three-phase 400 V	15	FRN15LM1S-4□	3.5	5.5		3.5			5.5	1 25				
-bha	18.5	FRN18.5LM1S-4□	5.5	8 *2	5.5	5.5			5.5	1.25				
hree	22	FRN22LM1S-4□	5.5	14	5.5	8 *2			8 *2					
	30	FRN30LM1S-4□	14	14	8	14			14					
	37	FRN37LM1S-4□	14	14 22					22					
	45	FRN45LM1S-4□	22	38		22		5.5	22					
Single-phase 200 V	2.2	FRN2.2LM1S-7□	2	3.5	2	2	2	2	2	1.25				

DCR: DC reactor

Note: A box (\square) in the above table replaces C (China), E (EU), A (Asia) or J (Japan) depending on the shipping destination.

^{*2} Use the "crimp terminal 8-L6 manufactured by J.S.T. Mfg Co., Ltd." or equivalent. (See the figure below.)



Dimensions of the crimp terminal 8-L6

Use the crimp terminal with an insulation sheath or with processing by the insulation tube. Use the wire of 75°C, 600 V, HIV-insulated. This selection assumes the inverter is used in ambient temperature at 50°C.

^{*1} Recommended wire sizes are calculated based on the specifications in Chapter 8.

2.3.5 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.

MARNING

- When wiring the inverter to the power source, insert a recommended molded case circuit breaker (MCCB) or earth leakage circuit breaker (ELCB) (with overcurrent protection) in the path of each pair of power lines to inverters. Use the devices recommended ones within the related current range.
- · Use wires in the specified size.
- · Tighten terminals with recommended torque.

Otherwise, fire could occur.

- · Use a multi-core power cable (3- or 4-wires) to wire the inverter with a motor.
- · Do not connect a surge killer to the inverter's output circuit.

Doing so could cause fire.

- According to the input power series install FRENIC-Lift in compliance with local regulations.
 Otherwise, 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.

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.
- Do not connect the power source wires to output terminals (U, V, and W).

Doing so could cause fire or an accident.

2.3.6 Wiring for main circuit terminals and grounding terminals

Table 2.10 shows the main circuit power terminals and grounding terminals.

Table 2.10 Symbols, Names and Functions of the Main Circuit Power Terminals

Symbol	Name	Functions
L1/R, L2/S, L3/T and L1/L, L2/N	Main power inputs	Connect the 3-phase input power lines or Single-phase input power lines.
U, V, W	Inverter outputs	Connect a 3-phase motor.
R0, T0	Auxiliary power input for the control circuit	For the models of 200 V series 22 kW or below, and 400 V series 30 kW or below.
		For a backup of the control circuit power supply, connect AC power lines same as that of the main power input.
		For the models of 400 V series 37 kW or above.
		For a control circuit, fan and contact a power supply, connect AC power lines same as that of the main power input.
P1, P(+)	DC reactor connection	Connect a DC reactor (DCR) for improving power factor.
P(+), N(-)	DC link bus	Connect an optional regenerative converter or the equivalent.
P(+), DB	Braking resistor connection	Connect a braking resistor.
♣ G × 2	Grounding for inverter and motor	Grounding terminals for the inverter's chassis (or case) and motor. Earth one of the terminals and connect the grounding terminal of the motor. Inverters provide a pair of grounding terminals that function equivalently.

Follow the procedure below for wiring and configuration of the inverter. Figure 2.11 illustrates the wiring procedure with peripheral equipment.

Wiring procedure

- ① Grounding terminals (�G)
- 3 DC reactor connection terminals (P1 and P(+))*
- (4) DC link bus terminals (P(+) and N(-))*
- (5) Main circuit power input terminals (L1/R, L2/S and L3/T or L1/L, L2/N)
- 6 Auxiliary power input terminals for the control circuit (R0 and T0)*
- The state of th

* Perform wiring as necessary

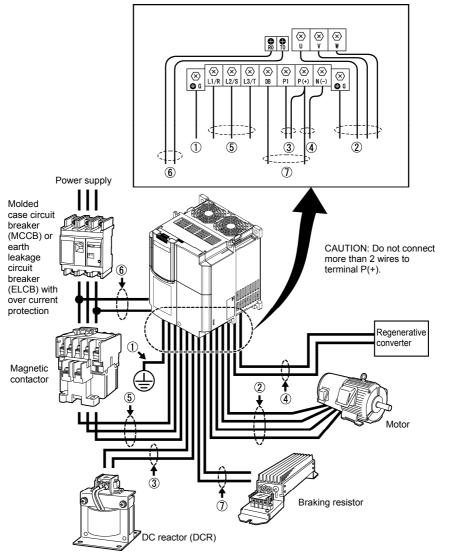


Figure 2.11 Wiring Procedure for Peripheral Equipment

Grounding terminals (GG)

Be sure to ground either of the two grounding terminals for safety and noise reduction.

Install FRENIC-Lift in compliance with the local regulations, Described below for an example, a procedure shows an installation of the inverter in compliance with regulations in Japan.

E.g. grounding terminals should be grounded as follows:

- 1) For the 200 V or 400 V series of inverters, connect the grounding terminal to a ground electrode on which class D or C grounding work has been completed, respectively, with conformity to the Electric Facility Technical Standard.
- 2) Connect a thick grounding wire with a large surface area and which meets the grounding resistance requirements listed in Table 2.11. Keep the wiring length as short as possible.

Table 2.11 Grounding Stipulated in the Electric Facility Technical Standard

Supply voltage	Grounding work class	Grounding resistance
Single-phase 200V	Class D	100 Ω or less
Three-phase 200 V		
Three-phase 400 V	Class C	10 Ω or less

(2) Inverter output terminals, U, V, W and grounding terminals (G)

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 phases each other.
- 2) Connect the secondary grounding wire to the grounding terminal (G).



- The wiring length between the inverter and motor should not exceed 50 m, when they are connected directly.
- Do not connect a power factor correcting capacitor or surge absorber to the inverter's output lines (secondary circuit).
- · If the wiring length is long, the stray capacitance between the wires will increase, resulting in an outflow of the leakage current. It will activate the overcurrent protection, increase the leakage current, or will not assure the accuracy of the current display. In the worst case, the inverter could be damaged.
- · Do not drive two or more motors by single inverter.

Note Driving 400 V series motor

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

③ DC reactor terminals, P1 and P (+)

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



- · The wiring length should be 10 m or below.
- Do not remove the short bar installed across P1 and P(+) terminals if a DC reactor is not to be used.

4 DC link bus terminals, P (+) and N (-)

These are provided for the DC link bus powered system. Connect these terminals with terminals P(+) and N (-) of an optional regenerative converter or the equivalent.

Note Consult your Fuji Electric representative if these terminals are to be used.

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

- 1) For safety, make sure that the molded case circuit breaker (MCCB) or magnetic contactor (MC) is turned off before wiring the main circuit power input terminals.
- 2) Connect the main circuit power supply wires (L1/R, L2/S and L3/T or L1/L, L2/N (single-phase)) to the input terminals of the inverter via an MCCB or residual-current-operated protective device (RCD)/earth leakage circuit breaker (ELCB)*, and MC if necessary.
 - It is not necessary to align phases of the power supply wires and the input terminals of the inverter with each other.
 - * With overcurrent protection



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

6 Auxiliary power input terminals R0 and T0 for the control circuit

For the models of single-phase 200V, 200V series 22kW or below, and 400V series 30kW or below

In general, the inverter will run normally without power supplied to the auxiliary power input for the control circuit. However, if you share the input power for the control circuit with that for the main circuit, you would be lost when, in the event of an error or alarm, you turn OFF the magnetic contactor between the inverter and the commercial power supply. If the magnetic contactor is turned OFF, the input power to the control circuit is shut OFF, causing the alarm signals (30A/B/C) to be lost and the display on the keypad to disappear. To secure input power to the control circuit at all times, supply the power from the primary side of the magnetic contactor to control power auxiliary input terminals R0 and T0. The method of connecting auxiliary power input terminals for the control circuit refer to Section 2.3.8 "Setting up slide switches."

For the models of 400 V series 37 kW or above

The inverter will not run normally without power supplied to the auxiliary power input for the control circuit. However, if you share the input power for the control circuit with that for the main circuit, you would be lost when, in the event of an error or alarm, you turn OFF the magnetic contactor between the inverter and the commercial power supply. If the magnetic contactor is turned OFF, the input power to the control circuit is shut OFF, causing the alarm signals (30A/B/C) to be lost and the display on the keypad to disappear. To secure input power to the control circuit at all times, supply the power from the primary side of the magnetic contactor to control power auxiliary input terminals R0 and T0. The method of connecting auxiliary power input terminals for the control circuit refer to Section 2.3.8 "Setting up slide switches."

When the DC power input is used, auxiliary power input terminals is used. The connected AC power is:

Single phase 380 to 460 V/50 Hz or 60 Hz for 400 V series 37 kW or above

Note: Allowable power input voltage range should be within – 15% to +10% of power source voltage.



Note Connect the power supply with R0 and T0 if the inverter of 37 kW or above is used, and the main power supply is connected.

If you do not connect the power supply with Auxiliary power input terminals, the cooling fan will not run, causing a heat sink overheating alarm " or a charger circuit error alarm " causing a heat sink overheating a heat sink overhea

(7) Braking resistor connection terminals, P(+) and DB

- 1) Connect terminals P and DB of an external braking resistor to terminals P(+) and DB on the main circuit terminal block. (For the braking resistor built-in type, refer to the next page.)
- 2) When using an external braking resistor, arrange the inverter and braking resistor to keep the wiring length to 5 m or less and twist the two wires or route them together in parallel.

⚠ WARNING

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

Doing so could cause fire.

Power switching connectors [CN UX] (for the models of 400 V series 37 kW or above)

An inverter of 400 V series 37 kW or above is equipped with a set of switching connectors CN UX (male) which should be configured with a jumper according to the power source voltage and frequency. Set the jumper to U1 or U2 depending upon the power source voltage applied to the auxiliary power input terminals (R0, T0), as shown in Figure 2.13. Power switching connectors [CN UX] is arranged in the power supply printed wiring board in the right part of the control printed wiring board. Please refer to figure 2.12 and Figure 2.13 for details.

Table 2.12 Voltage in which connection of Power switching connectors is changed

Frequency (Hz)	Power supply voltage(V)
50	420~480
60	430~480

Note

click sound.





Figure 2.12 Inserting/Removing the Jumpers

To remove the jumper, pinch its upper side between your fingers, unlock its fastener and pull it up. To insert it, pull it down as firmly as it locks with the connector until you will have heard a

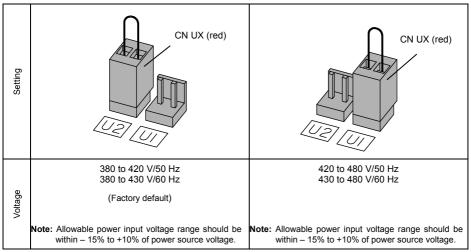


Figure 2.13 Setting up the power switching connector [CN UX].

⚠WARNING

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

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

ACAUTION

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

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

An accident could occur.

Table 2.13 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.

Table 2.13 Symbols, Names and Functions of the Control Circuit Terminals

Classifi- cation	Symbol	Name	Functions
	[12]	Voltage input	(1) The reference speed (frequency) follows the input voltage level on terminal [12]. - 0 to ±10 VDC/0 to ±100 (%) - Definition of 100%: Maximum speed (F03)
			(2) The reference torque bias follows the input voltage level on terminal [12]. - 0 to ±10 VDC/0 to ±100 (%) - Definition of the 100% torque bias: Rated output torque of the motor
			(3) The reference torque current follows the input voltage level on terminal [12]. - 0 to ±10 VDC/0 to ±100 (%) - Definition of 100% torque current: Rated overcurrent of the inverter
	[C1]	Current input	(1) The reference speed (frequency) follows the input current level on terminal [C1]. - +4 to +20 mA DC/0 to 100 (%) - Definition of 100%: Maximum speed (F03)
			(2) The reference torque bias follows the input current level on terminal [C1]. - +4 to +20 mA DC/0 to 100 (%) - Definition of the 100% torque bias: Rated output torque of the motor
			(3) The reference torque current follows the input current level on terminal [C1]. - +4 to +20 mA DC/0 to 100 (%) - Definition of 100% torque current: Rated overcurrent of the inverter * Input impedance: 250Ω * Allowable input current is +30 mA DC. If the input current exceeds +20 mA DC, the inverter will limit it at +20 mA DC.
Analog input	[V2]	Voltage input	(1) The reference speed (frequency) follows the input voltage level on terminal [V2]. - 0 to ±10 VDC/0 to ±100 (%) - Definition of 100%: Maximum speed (F03)
Analo			(2) The reference torque bias follows the input voltage level on terminal [V2]. - 0 to ±10 VDC/0 to ±100 (%) - Definition of the 100% torque bias: Rated output torque of the motor
			(4) This terminal is also used to connect a PTC (Positive Temperature Coefficient) thermistor to protect the motor from an overheat failure. To do so, switch SW4 on the control PCB to PTC side.
			Figure shown at the right illustrates the internal circuit diagram where the slide switch SW4 (switching the input of terminal [V2] between V2 and PTC) selects PTC. For details of SW4 refer to Section 2.3.8 "Setting up slide switches." In this case, you must change data of the function code H26.
			$Figure~2.14 Internal~Circuit~Diagram~(SW4~Selecting~PTC)\\ {}^* Input~impedance:~22~k\Omega\\ {}^* Allowable~input~voltage~is~+15~VDC.~If~the~input~voltage~exceeds~+10~VDC,\\ however,~the~inverter~will~limit~it~at~+10~VDC.\\ \label{eq:particle}$

			Table 2.13 Continued				
Classifi- cation	Symbol	Name	Functions				
	[11] (Two terminals)	Analog common	Two common terminals for analog input and output signal terminals [12], [C1], and [V2]. These terminal are electrically isolated from terminals [CM]s and [CMY].				
	Note	noise e principle conside	ow level analog signals are handled, these signals are especially susceptible to the external effects. Route the wiring as short as possible (within 20 m) and use shielded wires. In e, ground the shielding layer of the shielded wires; if effects of external inductive noises are trable, connection to terminal [11] may be effective. As shown in Figure 2.15, ground the end of the shield to enhance the shielding effect.				
	 Use a twin contact relay for low level signals if the relay is used in the control circuit. Do the relay's contact to terminal [11]. 						
Analog input		may be circums analog	the inverter is connected to an external device outputting the analog signal, a malfunction is caused by electric noise generated by the inverter. If this happens, according to the stances, connect a ferrite core (a toroidal core or an equivalent) to the device outputting the signal and/or connect a capacitor having the good cut-off characteristics for high frequency tents between control signal wires as shown in Figure 2.16.				
An		- Do not a	apply a voltage of +7.5 VDC or higher to terminal [C1]. Doing so could damage the internal circuit.				
	Externa Analog	I Device Output	Shielded Wire Control Circuit> [13] [14] [15] [17] [18] [18] [19] [19] [10] [11] [11] [11] [11] [11] [11] [11] [12] [12] [12] [12] [12] [12] [12] [13] [14] [15] [15] [16] [17] [17] [18] [18] [18] [19] [10] [10] [11] [11] [11] [11] [12] [12] [12] [12] [13] [14] [15] [15] [16] [17] [17] [18]				

Figure 2.16 Example of Electric Noise Reduction

Figure 2.15 Connection of Shielded Wire

Table 2.13 Continued

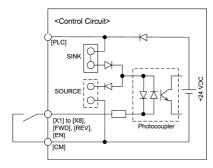
[X1] Digital input 1 (1) The various signals such as coast-to-stop, alarm from external equimulistep speed commands can be assigned to terminals [X1] to [Xi and [EN]] by setting function codes E01 to E08, E98, and E99. For of Chapter 5, Section 5.2 "Overview of Function Codes." (2) Input mode, i.e. Sink/Source, is changeable by using the internal sli and [EN] Digital input 4 (X5] Digital input 5 (X6] Digital input 5 (X7] Digital input 7 (X8] Digital input 7 (X8] Digital input 9 (X7) Digital input 9 (X8) Digital input 6 (X8) Digital input 7 (X8) Digital input 6 (X8) Digital input 6 (X8) Digital input 7 (X8) Digital input 6 (X8) Digital input 6 (X8) Digital input 7 (X8) Digital input 6 (X8) Digital input 6 (X8) Digital input 6 (X8) Digital input 7 (X8) Digital input 6 (X8) Digital input 6 (X8) Digital input 6 (X8) Digital input 6 (X8) Digital input 7 (X8) Digital input 6 (X8) Digital input 7 (X8) Digital input 6 (X8) Digital input 7 (X8) Digital input 6 (X8) Digital input 6 (X8) Digital input 7 (X8) Digital input 6 (X8) Digital input 6 (X8) Digital input 7 (X8) Digital input 6 (X8) Digital input 6 (X8) Digital input 7 (X8) Digital input 6 (X8)										
multistep speed commands can be assigned to terminals [X1] to [Xi and [EN] by setting function codes E01 to E08, E98, and E99. For a Chapter 5, Section 5.2 "Overview of Function Codes." [X3] Digital input 3 [X4] Digital input 4 [X5] Digital input 4 [X5] Digital input 5 [X6] Digital input 5 [X6] Digital input 6 [X7] Digital input 7 [X8] Digital input 6 [X7] Digital input circuit specifications) [X9] Photocoupler ovoltage (SOURCE) OFF level Operation current at ON (Input voltage is at OV) Allowable leakage current at OFF [X9] Photocoupler operation of the inverter.	Classifi- cation	Symbol	Name	Functions						
X2 Digital input 2 Chapter 5, Section 5.2 "Overview of Function Codes." (2) Input mode, i.e. Sink/Source, is changeable by using the internal sli input 3 (3) Switches the logic value (1/0) for ON/OFF of the terminals between [FWD], [REV], or [EN] and [CM]. If the logic value for ON between [in the normal logic system, for example, OFF is 1 in the negative logic signaling cannot be applicable to some signals s [REV]. (4) The negative logic signaling cannot be applicable to some signals s [REV]. (5) Digital input 6 (7) Digital input 5 (7) Digital input 5 (7) Digital input 6 (7) Digital input circuit specifications) (7) Digital input 9 (7) Digital input 9 (7) Digital input 9 (8) Digital input 9 (9) Digital input		[X1]		(1) The various signals such as coast-to-stop, alarm from external equipment, and multistep speed commands can be assigned to terminals [X1] to [X8], [FWD], [REV], and [FN] by setting function codes F01 to F08, F08, and F09. For details, refer to						
[X3] Digital input 3 [X4] Digital input 4 [X5] Digital input 5 [X6] Digital input 6 [X7] Digital input 7 [X8] Digital input 9 [FWD] Run forward command input 9 [REV] Run reverse command [REV] Run reverse command [REV] Run reverse command [REV] Enable [EN] Enable [EN] Enable (3) Switches the logic value (1/0) for ON/OFF of the terminals between [FVD], IREV], or [EN] and [CM]. If the logic value for ON between [In the normal logic system, for example, OFF is 1 in the negative logic signaling cannot be applicable to some signals some s		[X2]		Chapter 5, Section 5.2 "Overview of Function Codes."						
X4 Digital input 4 (4) The negative logic signaling cannot be applicable to some signals s [REV]. (5) Digital input 5 (7) Digital input 6 (7) Digital input 7 (7) Digital input 7 (8) Digital input 9 Digital		[X3]		(3) Switches the logic value (1/0) for ON/OFF of the terminals between [X1] to [X8], [FWD], [REV], or [EN] and [CM]. If the logic value for ON between [X1] and [CM] is 1 in the normal logic system, for example, OFF is 1 in the negative logic system and vice versa.						
[REV] Digital input 5 [X6] Digital input 6 [X7] Digital input 7 [X8] Digital input 9 [FWD] Run forward command [REV] Run reverse command [REV] Enable [EN] Enable [REV]. (Digital input circuit specifications) [Item Operation ON level voltage (SINK) OFF level Operation ovltage (SOURCE) OFF level Operation current at ON (Input voltage is at 0V) Allowable leakage current at OFF Control Circuit		[X4]								
FWD Run Feverse command		[X5]								
[X7] Digital input 7 [X8] Digital input 9 [FWD] Run forward command [REV] Run reverse command [EN] Enable Enable If this terminal signal turns off, the inverter shut its power output down to operation of the inverter.		[X6]		Control Circuit						
[X8] Digital input 9 [FWD] Run forward command [REV] Run reverse command [EN] Enable [EN] Enable [EN] Enable [IN] Enable [IN] Enable [IN] Enable [IN] Digital input 9 [IN] Photocoupler (SOURCE) [IN] Photocoupler (SOURCE) [IN] Operation voltage (SOURCE) [IN] Operation current at ON (Input voltage is at 0V) [IN] Allowable leakage current at OFF [IN] Enable [IN] Enable [IN] Enable [IN] Enable [IN] Figure 2.17 Digital Input Circuit [IN] Figure 2.17 Digital Input Circuit [IN] Photocoupler (Control Circuit) [IN] Photocoupler (Control Circuit) [IN] Photocoupler (Control Circuit) [IN] Photocoupler (Control Circuit)		[X7]	_	[PLC] +24 VDC voltage						
[FWD] Run forward command [REV] Run reverse command [EN] Enable Figure 2.17 Digital Input Circuit		[X8]	Digital	SINK O Photocounter Operation ON level 21 V 27 V						
Figure 2.17 Digital Input Circuit [EN] Enable If this terminal signal turns off, the inverter shut its power output down to operation of the inverter.		IEWDI								
Figure 2.17 Digital Input Circuit [EN] Enable If this terminal signal turns off, the inverter shut its power output down to operation of the inverter.		[, 112]	forward	O Delation current at ON 25 mA 5 mA						
Figure 2.17 Digital Input Circuit [EN] Enable If this terminal signal turns off, the inverter shut its power output down to operation of the inverter. Control Circuit> Figure 2.17 Digital Input Circuit Figure 2.17 Digital Input Circuit SINK Photocoupler SOURCE	Digital input	[REV]	reverse	[FWD], [RÊV] 5.4 kΩ current at OFF - 0.5 mA						
Figure 2.18 Digital Input Circuit [PLC] PLC (Two signal terminals) power [CM] Digital Common terminals for digital input signal terminals		[PLC] (Two terminals)	PLC signal power Digital	If this terminal signal turns off, the inverter shut its power output down to absolutely stop operation of the inverter. Control Circuit> Flucy Photocoupler 2.7 kΩ Figure 2.18 Digital Input Circuit Connects to PLC output signal power supply. (Rated voltage: +24 VDC: Allowable range: +22 to +27 VDC)						

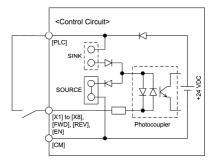
(Tip

■ Turning on or off [X1] to [X8], [FWD], [REV], or [EN] using a relay contact

Figure 2.19 shows two examples of a circuit that turns on or off control signal input [X1] to [X8], [FWD], [REV], or [EN] using a relay contact. In the circuit (a), the slide switch SW1 has been turned to SINK, whereas in the circuit (b) it has been turned to SOURCE.

NOTE: To configure this kind of circuit, use a highly reliable relay (Recommended product: Fuji control relay Model HH54PW.)





(a) With the switch turned to SINK

(b) With the switch turned to SOURCE

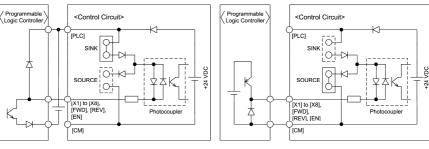
Figure 2.19 Circuit Configuration Using a Relay Contact

■ Turning on or off [X1] to [X8], [FWD], [REV], or [EN] using a programmable logic controller (PLC)

Figure 2.20 shows two examples of a circuit that turns on or off control signal input [X1] to [X8], [FWD], [REV], or [EN] using a programmable logic controller (PLC). In the circuit (a), the switch SW1 has been turned to SINK, whereas in the circuit (b) it has been turned to SOURCE.

In circuit (a) below, short-circuiting or opening the transistor's open collector circuit in the PLC using an external power source turns on or off control signal [X1] to [X8], [FWD], [REV], or [EN]. When using this type of circuit, observe the following:

- Connect the + node of the external power source (which should be isolated from the PLC's power) to terminal [PLC] of the inverter.
- Do not connect terminal [CM] of the inverter to the common terminal of the PLC.



(a) With the switch turned to SINK

(b) With the switch turned to SOURCE

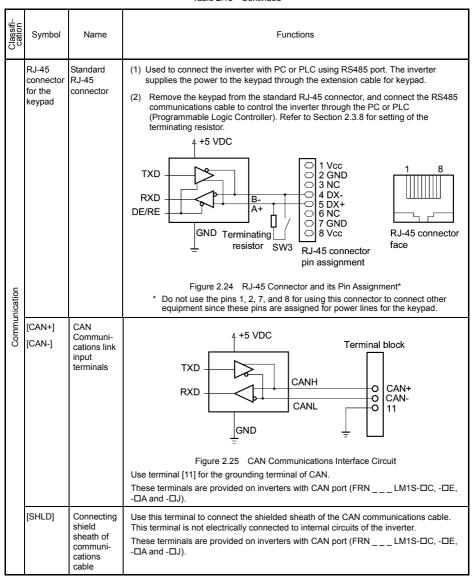
Figure 2.20 Circuit Configuration Using a PLC

For details about the slide switch setting, refer to Section 2.3.8 "Setting up slide switches."

Digital input

Classifi- cation	Symbol	Name	Functions				
	[Y1]	Transistor output 1	(1) Various signals such as inverter running, spee warning can be assigned to the terminal [Y1] I Refer to Chapter 5, Section 5.2 "Overview of F (2) Switches the logic value (1/0) for ON/OFF of the [CMY]. If the logic value for ON between [Y1] i logic system, for example, OFF is 1 in the neg Transistor output circuit specification	to E23. to [Y4] and e normal			
	[Y2]	Transistor output 2	Control Circuit> Photocoupler Current	Iter	m	Max.	
		·		Operation	ON level	3 V	
			X [Y1] to [Y4]	voltage	OFF level	27 V	
	[Y3]	Transistor output 3	31 to 35 V	Maximum loa at ON	ad current	50 mA	
		output o		Leakage cur	Leakage current at OFF		
			Figure 2.21 Transistor Output Circuit Figure 2.21 shows examples of connection between	en the control	circuit and a	PLC.	
Transistor output	[Y4]	Transistor output 4	Check the polarity of the external power inputs. When connecting a control relay, connect a surge-absorbing diode coil of the relay. When any equipment or device connected to the transistor output r supplied with DC power, feed the power (+24 VDC: allowable range VDC, 50 mA max.) through the [PLC] terminal. Short-circuit between terminals [CMY] and [CM] in this case.				
	[CMY]	Transistor output common	Common terminal for transistor output signal terminals This terminal is electrically isolated from terminals, [CM]s and [11]s.				
	Tip Figure 2.22 shows two examples of circuit connection between the transistor output of the inverter's control circuit and a PLC. In the example (a), the input circuit of the PLC serves as the sink for the control circuit output, whereas in the example (b), it serves as the source for the output.						
	Photocoupler Current Photocoupler Current SINK Input SINK INPUT					Programmable Logic Controller CO SOURCE Input	
		(a) F	-	b) PLC servi	ng as Source	,	
	Figure 2.22 Connecting PLC to Control Circuit						

		I				
Classifi- cation	Symbol	Name		Functions		
	[PAO]	A-phase pulse output			from the pulse encoder head-to-head in	
Pulse encoder outputs	[PBO]	B-phase pulse output	PAO PBO PAO PBO PAO PBO PAO PBO PBO PBO PBO PBO PBO PBO PBO PBO PB		Pulse Encoder (a pair of PA/PB) Remarks Measured between terminals PA0 or PB0 and CM. Sink current of terminals PA0 and PB0	
Note Length of the wire may affect distortion of the signals. The lower resistance in a circuit the larger or pull-up resistor with lower resistance as po current limit 50 mA for a stable operation.		e larger current flow there. Choose a nce as possible within the allowable				
	[CM](Two terminals)	Digital common	Common terminals for dig	· -	erminals [11] and [CM]	
output	[Y5A/C]	General purpose relay output	(1) A general-purpose relay contact output usable as well as the function of th transistor output terminal [Y1], [Y2], [Y3], or [Y4].			
Relay contact o	[30A/B/C]	Alarm relay output (for any error)	 (1) Outputs a contact signal (SPDT) when a protective function has been activated to stop the motor. Contact rating: [250 VAC, 0.3A, cos ∮ = 0.3]. [48 VDC, 0.5A] (2) A command similar to terminals [Y1] to [Y4] can be assigned for this relay contact and use it for signal output. (3) Switching of the normal/negative logic output is applicable to the following two contact outputs: "Terminals [30A] and [30C] are short-circuited for ON signal output (Active ON)" or "the terminals [30B] and [30C] are short-circuited (non-excited) for ON signal output (Active OFF)." 			





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

Table 2.13 Continued

Classifi- cation	Symbol	Name		Functions	
	[PO]	Power terminal for the pulse encoder	inverter.		
	[PA]	Pulse encoder input A		+15 or +12 VD	c
	[PB]	Pulse encoder input B	7.7.7 (Sq)	PA,PB, PZ	\\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\
Pulse encoder	[PZ]	Pulse encoder input Z		gth: Less than 20 m	± Circuite
			Specifications	ure 2.26 Pulse Encoder Inpu	it Circuits
			Item	Specific	cations
			Pulse encoder output system	Open collector	Complementary
			Allowable input pulse frequency (rate)	25 kHz max.	100 kHz max.
			Wiring length	20 m c	or less
	[CM]	Pulse encoder common terminal	Located on the encoder to pulse encoder.	erminal block is the common ((grounding) terminal for the



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

2.3.8 Setting up slide switches

⚠ WARNING

Before setting up any internal control switches, turn the power OFF. For the inverters with a capacity of 22 kW or below, wait at least 5 minutes; for the inverters with a capacity of 30 kW or above, wait at least 10 minutes. Further, check that the charge lamp is unlit, and make sure that the DC link bus voltage between the terminals P(+) and N(-) has dropped below a safe voltage (+25 VDC) using a multimeter or a similar instrument.

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

■ Setting up the slide switches

To switch the slide switches, remove the front and terminal block covers, so that you can access the control PCB that contains the switches.

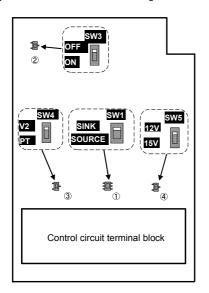
For details of removing the front cover, terminal block cover, and dummy cover, refer to Section 2.3.1 "Removing and mounting the terminal block (TB) cover and the front cover."

Table 2.14 lists function of each slide switch.

Table 2.14 Function of Each Slide Switch

Switch	Fu	Function		
① SW1	Switches service mode of the digital input terminals for SINK or SOURCE. To make the digital input terminal [X1] to [X8], [FWD], [REV], or [EN] serve as a current sink, switch SW1 to SINK. (Factory defaults on inverters destined for China, Asia and Japan) To make them serve as a current source, to SOURCE. (Factory defaults on inverters destined for the EU)			
② SW3 ③ SW4	Switches on/off the terminating resistor of RS485 communications port of the inverter. To connect a keypad to the inverter switch SW3 to OFF (Factory defaults.) If the inverter is connected to the RS485 communications network as a termination device, switch it to ON. Switches property of the analog input terminal V2 for V2 or PTC. When switching this switch, change data of the function code H26.			
4 SW5	PTC thermistor input PTC 1 or 2 Switches the voltage of the power source to the pulse encoder between 12 VDC and 15 VDC (Factory defaults: 12 VDC.)			

Figure 2.27 shows location of the configuration slide switches.



Switching example

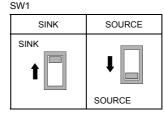


Figure 2.27 Location of the Slide Switches

2.4 Cautions Relating to Harmonic Component, Noise, and Leakage Current

(1) Harmonic component

Input current to an inverter includes harmonic components, which may affect other loads and power factor correcting capacitors that are connected to the same power source as the inverter. If harmonic components cause any problems, connect a DC reactor (option) to the inverter. It may also be necessary to connect an AC reactor serially to the power factor correcting capacitors.

(2) Noise

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 grounded metal frames 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.
- If induction or radio noise generated from the inverter affects other devices through power wires or grounding wires:
 - Isolate the main circuit wires from the control circuit wires and other device wires.
 - Put the main circuit wires through a metal conduit and connect the pipe to the ground near the inverter.
 - Install the inverter onto the metal switchboard and connect the whole board to the ground.
 - Connect a noise filter to the inverter power wires.
- 3) When implementing measures against noise generated from peripheral equipment:
 - For the control signal wires, use twisted or shielded-twisted wires. When using shielded-twisted wires, connect the wire sheath shield to the common terminals of the control circuit or ground.
 - Connect a surge absorber in parallel with a coil or solenoid of the magnetic contactor.

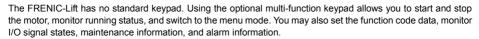
(3) Leakage current

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

Table 2.15 Leakage Current Countermeasures

Problem	Measures
An earth leakage circuit breaker* that is connected to the input (primary) has tripped. * With overcurrent protection	 Decrease the carrier frequency. Make the wires between the inverter and motor shorter. Use an earth leakage circuit breaker that has a longer sensitive current than one currently being used. Use an earth leakage circuit breaker that features measures against harmonic component (Fuji SG and EG series).
An external thermal relay was activated.	Decrease the carrier frequency. Increase the settling current of the thermal relay. Use the electronic thermal motor overheat protection built in the inverter, instead of an external thermal relay.

Chapter 3 OPERATION USING THE KEYPAD



For details of the multi-function keypad, refer to the Multi-function Keypad "TP-G1-CLS" Instruction Manual (INR-S147-1092-E).

Chapter 4 RUNNING THE MOTOR

4.1 Running the Motor for a Test

4.1.1 Inspection and preparation prior to powering on

(1) Check if connection is correct.

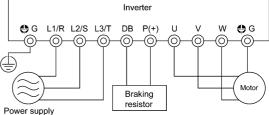
Especially check if the power wires are connected to the inverter input terminals L1/R, L2/S and L3/T or L1/L, L2/N, and output terminals U, V and W respectively and that the grounding wires are connected to the ground electrodes correctly. Note that FRENIC-Lift series is designed for three phase input and driving three phase motors.

riangle WARNING

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

Otherwise, electric shock may occur.

- (2) Check for short circuits between terminals and exposed live parts and ground faults.
- Check for loose terminals, connectors and screws.
- (4) Check if the motor is separated from mechanical equipment.
- (5) Make sure that the switches are OFF so that the inverter does not start or operate erroneously at power-on.
- (6) Check if safety measures are taken against runaway of the system, e.g., a defense to protect people from unexpectedly approaching your power system.



<for 3-phase power supply>
Figure 4.1 Connection of Main Circuit Termin

Figure 4.1 Connection of Main Circuit Terminals

- (7) Make sure that the signal wires from the pulse encoder mounted on the motor or external equipment are connected to control signal input terminals (PA, PB, PO, CM and PZ if any) correctly.
- (8) Make sure that the power source voltage (P0) to the pulse encoder satisfies the specifications.

4.1.2 Turning ON power and checking

⚠ WARNING

- Be sure to install the covers for both the main circuit terminal block, control circuit terminal block and the front cover if any before turning the power ON.
 Do not remove any cover while powering on.
- Do not operate switches with wet hands.

Otherwise electric shock could occur.

Turn the power ON and check the following points. The following assumes that no function code data is changed from the factory defaults.

(1) Check if a built-in cooling fan rotates.

(The cooling fan does not rotate if the control power only is supplied while the main power is shut down.)

4.1.3 Preparation before running the motor for a test--Setting function code data

Before starting running the motor, set function code data specified in Table 4.1 to the motor ratings and your system design values. For the motor, check the rated values printed on the nameplate of the motor. For your system design values, ask system designers about them.

To set up function code, you need to use the multi-function keypad (option) or to access their data via communications link. For details of the multi-function keypad and communications link, refer to the Multi-function Keypad Instruction Manual (INR-SI47-1092-E) and RS485 Communications FRENIC-Lift Reference Manual (INR-SI47-1068-E) respectively. For the factory defaults for the motor parameter, refer to the Chapter 5 " Appendix Factory Defaults ". If the parameter for your motor differs from the default, change it by using the function code.

Table 4.1 Settings of Function Code Data before Driving the Motor for a Test

Function code	Name	Function code data	Factory defaults	
F04	Rated Speed		1500 (r/min)	
F05	Rated Voltage		190 (V) / 380 (V)	
P01	Motor (No. of poles)		4 (P)	
P02	Motor (Rated Capacity)		Applicable motor rated capacity	
P03	Motor (Rated current)	Motor ratings (printed on the	Rated current of applicable motor	
P06	Motor (No-load current)	nameplate of the motor)	No load current of the standard motor	
P07	Motor (%R1)		Primary resistance of the standard motor	
P08	Motor (%X)		Leakage reactance of the standard motor	
P12	Motor (Rated slip)		0.00 (Hz)*1 *1 The rated slip of the standard motor is applied.	
L01	Pulse Encoder (Selection)	Depending on data sheet of the pulse encoder.	L01 = 0: 12/15 V complimentary, open collector output circuit. or 5 V line driver	
L02	Pulse Encoder (Resolution)		1024 (p/r) (pulses/rev)	
L04	Magnetic Pole Position Offset (Offset angle)		0.00 (deg)	
F03	Maximum Speed	System design values	1800 (r/min)	
F42	Control Mode	 For a test-driving of the motor, increase values so that they are longer than your system design 	F42 = 0: Vector control with PG (induction motor)	
C21	Speed Command Unit	values. If the set time is short, the inverter may not start	C21 = 0: r/min (Speed data format)	
L31	Elevator Parameter (Speed)	running the motor.	60.0 (m/min)	



- Note In any of the following cases, the factory defaults may not produce the best results for auto torque boost. torque calculation monitoring, or auto energy saving, since the standard settings of motor parameters for Fuji motors are not applicable. Tune the motor parameters according to the procedure set forth below.
 - The motor to be driven is not a Fuji product or is a non-standard product.
 - The cabling between the motor and the inverter is long.
 - A reactor is inserted between the motor and the inverter.
 - To drive a synchronous motor, you need to tune the inverter for the offset angle of magnet pole before running the motor.

To drive a synchronous motor, use the option card to be ordered separately.

· Please set the function codes in the following order.

ROM version	The setting order
0300, 0500	C21, P02, P01, F03, L31, and other function codes.
Not listed above	C21, P01, F03, L31, and other function codes.

Please refer to section 5.1 "Function Codes Requiring Modification".

■ Tuning procedure

What follows gives you a tuning procedure of the inverter for a motor using a multi-function keypad (option.)

1) Preparation

Referring to the rating plate on the motor, set the following function codes to their nominal ratings:

- F04: Rated Speed
- · F05: Rated Voltage
- · P02: Motor (rated capacity)
- · P03: Motor (rated current)

2) Selection of Tuning Process

Data for P04	Motor parameters subject to tuning:	Action	Choose the process when:
1	Primary resistance %R1 (P07) Leakage reactance %X (P08)	Measure %R1 and %X while the motor is stopped.	Apply this step if parameters of the no load current and rated slip are known.
2	Primary resistance %R1 (P07) Leakage reactance %X (P08) No-load current (P06) Rated slip (P12)	Lay %R1, %X, no load current, rated slip off while stopping the motor.	Apply this step if parameters of the no load current and rated slip are unknown.

Upon completion of the tuning, the primary resistance %R1 will be automatically saved into P07, the leakage reactance %X into P08, the no-load current into P06, and .the rated slip into P12.

3) Preparation of Machine System

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

- 4) Perform tuning
- 1) Set function code P04 to "1" or "2" and press the (key.
- ② Tuning takes place while the motor is stopped. (Time for the tuning: Around 15 seconds max. if P04 = 1, 25 seconds max. if P04 = 2)
- ③ "Command off" is displayed on the LCD screen of a multi-function keypad.
- The Run command is turned OFF and the tuning completes, with the next function code P06 displayed on the multi-function keypad. (the Run command given through the keypad or the communications link is automatically turned OFF).

\triangle WARNING

In the tuning process of the inverter, no motor torque control for braking of the machinery takes effect. Tune the inverter for the motor after disconnecting it from the machinery, or after setting mechanical brake of the machinery. Anyway, do it after suppressing any dangerous factors.

An accident or injuries could occur.

⚠CAUTION

Tuning of the motor parameter using the function code H04 is exclusively designed for induction motors. Do not apply this to any synchronous motors.

■ Errors during tuning

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 results of the tuning or any error in the process of the tuning, it will display \mathcal{E}_{r} 7 and discard the tuning data.

Listed below are the abnormal or error conditions that can be recognized during tuning.

Abnormal/error condition	Description
Abnormal result of tuning	An inter-phase imbalance has been detected;
Abhornar result of turning	Tuning has resulted in an abnormally high or low value of a parameter.
Abnormal output current	An abnormally high current has been caused during tuning.
Sequence error	This will occur during tuning if the run command/EN terminal input/forced-to-decelerate terminal command <i>DRS</i> turns off, or the coast-to-stop terminal command <i>BX</i> turns on, where status of <i>DRS</i> and <i>BX</i> is expressed in normal logic.
	During tuning, a certain limitation has been reached or exceeded;
Limitation exceeded	The maximum output frequency or the peak limiter for output frequency has been reached or exceeded.
Other alarm condition	An undervoltage or an alarm has been occurred.

If any of these conditions has occurred, either eliminate the abnormal or error factor(s) and perform tuning again, or contact your Fuji Electric representative.

■ Tuning offset angle of the magnet pole

Before to proceed to running a synchronous motor, be sure to tune offset angle of the magnet pole. For the tuning procedure, refer to the instruction manual of the option card.

To apply a synchronous motor, use the option card in a separate ordering. For details, refer to the instruction manual of the option card.

ACAUTION

Running a synchronous motor without tuning of the offset angle may result in an unexpected operation.

An accident or injuries could occur.

⚠ WARNING

If the user set the function codes wrongly or without completely understanding this Instruction Manual and the FRENIC-Lift Reference Manual (INR-SI-47-1068-E), the motor may rotate with a torque or at a speed not permitted for the machine.

Accident or injury may result.

Follow the descriptions of the previous Section 4.1.1, "Inspection and preparation prior to powering on" to Section 4.1.3, "Preparation before running the motor for a test," and begin test-driving of the motor.



Note Turn on the terminal [EN] before running the motor.

If sink/source change switch (SW1) is a sink side, connect terminal [EN] and terminal [CM].

If sink/source change switch (SW1) is a source side, connect terminal [EN] and terminal [PLC].

If terminal [EN] and [CM] don't connect, the motor doesn't rotate.

↑ CAUTION

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

------ Test running using the multi-function keypad (option)-----

- (1) Turn the power ON and check that the LED monitor blinks while indicating the CCC reference speed (frequency).
- (2) Enter the local mode by holding down the key for at least 1 second. Pressing this key toggles between Local and Remote.
- (3) Select a low reference speed around at 150 r/min by using the key. Be sure of that the reference speed blinks on the LED monitor.
- (4) Press the (w) key to start running the motor in the forward direction. (Check that the reference speed is displayed on the LED monitor correctly.)
- (5) To stop the motor, press the (STOP) key.
- (6) Press the (REV) key to start running the motor in the reverse direction. (Check that the reference speed is displayed on the LED monitor correctly.)
- (7) To stop the motor, press the (STOP) key.

<Check the following points>

Be sure of that:

- Pressing the (FWD) key runs the motor forward.
- Pressing the (REV) key runs the motor reverse.
- · Check for smooth rotation without motor humming or excessive vibration.
- · Check for smooth acceleration and deceleration.

When no abnormality is found, press the $\stackrel{\text{(w)}}{\text{(w)}}$ or $\stackrel{\text{(le)}}{\text{(le)}}$ key again to start driving the motor and increase the motor speed using $\stackrel{\text{(le)}}{\text{(le)}}$ keys. Check the above points again.

For details of the multi-function keypad, refer to the Multi-function Keypad "TP-G1-CLS" Instruction Manual (INR-S147-1092-E.)

4.2 Operation

After confirming ordinary operation by performing a test run, make mechanical connections (connections of the machine system) and electrical connections (wiring and cabling), and set the necessary parameters properly before starting a production run.

Note Before to proceed running the inverter in operations check the related function code data again and reconfigure it if needed.

Chapter 5 FUNCTION CODES

5.1 Function Code Tables

Function codes enable the FRENIC-Lift inverters to be set up to match your system requirements.

Each function code consists of a 3-letter 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 seven groups: Fundamental Functions (F codes), Extension Terminal Functions (E codes), Control Functions (C codes), Motor Parameters (P codes), High Performance Functions (H codes), Link Function (y codes) and Lift Functions (L codes). For details of function codes, refer to the FRENIC-Lift Reference Manual (INR-S147-1068-E). To determine the property of each function code, set data to the function code. The following descriptions supplement those given in the function code tables

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

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

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

■ Copying data

Connecting the multi-function keypad (option) to an inverter via the RS485 Communications Card (option) allows copying the 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. Therefore, you need to set up the uncopied code data individually as necessary. Whether data will be copied or not is detailed with the following symbols in the "Data copying" column of the function code tables given below.

- Y Will be copied unconditionally.
- Y1 Will not be copied if the rated capacity differs from the source inverter.
- Y2 Will not be copied if the rated input voltage differs from the source inverter.
- N Will not be copied. (The function code marked "N" is not subject to the Verify operation, either.)



For details of how to set up or edit function codes, refer to the Multi-function Keypad "TP-G1-CLS" Instruction Manual (INR-S147-1092-E.)

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

Example: "Coast to a stop" command BX assigned to any of digital input terminals using function code E01

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

■ Description on the control mode of FRENIC-Lift

FRENIC-Lift runs in following control modes

- A: Vector control with PG (asynchronous motor)
- B: Vector control with PG (synchronous motor)
- C: V/f control (asynchronous motor)
- D: Torque vector control (asynchronous motor)

You can select the control mode between them combining data of function codes, F42 and H18, and the terminal command **PG/Hz** as listed below.

F42	H18	PG/Hz *1	Selected control mode
0	0	ON	Vector control with PG (asynchronous motor)/speed control
0	0	OFF	Torque vector control (asynchronous motor)*4/speed control
0	1	ON	Vector control with PG (asynchronous motor)/torque control
0	1	OFF	Vector control with PG (asynchronous motor)/torque control
1	0	ON	Vector control with PG (synchronous motor)*2/speed control
1	0	OFF	V/f control (asynchronous motor)/speed control ^{*3}
1	1	ON	Vector control with PG (synchronous motor) *2/speed control
1	1	OFF	Vector control with PG (synchronous motor)*2/speed control
2	0/1	ON / OFF	Torque vector control (asynchronous motor)/speed control

^{*1} ON/OFF state is expressed in the normal logic. If no terminal command is assigned to any terminals, then the default value is ON.

^{*2} An optional card is needed in a separate ordering. For details of operation, refer to the instruction manual of the optional card.

^{*3} Apply this only for a test run. Do not apply this for the inverter in operations. Note that in this mode the inverter may not run in normal performance depending on a running condition.

^{*4} When the version that the torque vector control doesn't correspond is used, it becomes V/f control (asynchronous motor)/speed control. V/F control setting should apply to a test run only. Applying the setting to an inverter operation with an actual load is dangerous. With this setting, the inverter may not run in sufficient performance depending upon running conditions.

ACAUTION

 The torque vector control is available from 4.0 to 22kW of 400V series. Please do not use it with other products.

Otherwise injuries could occur.

In the torque control, data of some function codes related to the control may be enabled or disabled. Marks to classify these situations in the torque control column of the function code table on the following pages as shown below.

- Y: Code data is enabled and affects the inverter operations.
- N: Code data is disabled and does not affect the inverter operations.

■ Function Codes Requiring Modification

ACAUTION

Specifying Order of Function Codes

Function codes C21 (Speed Command Unit) and P01 (Motor, No. of poles) should be specified preceding other function codes. This is because depending upon those code data, the setting ranges and units of some function codes differ as listed below.

Next, F03 (Maximum Speed) and L31 (Elevator Parameter, Speed) should be specified.

Changing any data of C21, P01, F03 and L31 requires modifying the data of the function codes listed below again.

	Function Codes Requiring Modification
C21 Depending upon the data of C21 (Speed Command Unit), the setting ranges and units of the function codes listed at the right differ. F03 or L31 (when C21 = 1) Depending upon the data of F03 (Maximum Speed) or L31 (Elevator Parameter, Speed) when C21 = 1, the setting ranges of the function codes listed at the right differ.	F04 (Rated Speed) F20(DC Braking Starting Speed) F23 (Starting Speed) F25 (Stop Speed) E30 (Speed Arrival, Hysteresis) E31 (Speed Detection, Detection level) E32 (Speed Detection, Hysteresis) C03 (Battery Operation Speed) C04 (Zero Speed) to C11 (High Speed) C20 (Jogging speed) H74 (Speed Agreement, Hysteresis) L30 (Short Floor Operation, Allowable speed) L40 (ASR, Switching speed 1) L41 (ASR, Switching speed 2) L87 (Door Control, Door open starting speed)
P01 Depending upon the data of P01 (Motor, No. of poles), the setting ranges of the function codes listed at the right differ.	Function codes listed above plus F03 (Maximum Speed)

When configuring function codes, observe the following order.

ROM version	Configuration order
0300, 0500	C21→P02→P01→F03→L31→Other function codes
Other versions	C21→P01→F03→L31→Other function codes

Note: The setting ranges and units of the function codes in this manual are mentioned, based on the factory defaults of C21 and P01, that is, C21 = 0 (r/min) and P01 = 4 (4 poles).

F codes: Fundamental Functions

Code	Name	Data setting range	Increment	Unit	Change when running	Data copying	Default setting	Torque Contro
F00	Data Protection	0000 _H : Disable data protection (Function code data can be edited) 001 _H : Enable data protection Note: This setting is effective f H99 = 0000 _H .		-	Y	N	0000н	Y
	(Password entry)	0001 _H to FFFF _H Note: This setting is effective if H99 = other than 0000 _H . Data of H99 is your password						
F01	Speed Command	Multistep speed command (SS1, SS2, SS4) Analog speed command (Not reversible) Analog speed command (Reversible)			N	Y	0	N
F03	Maximum Speed	150.0 to 3600 ¹¹	Variable	r/min	N	Y	1800 12	Y
F04	Rated Speed	150.0 to 3600 "1	Variable	*3	N	Y	1500	Y
F05	Rated Voltage	80 to 240 (200V series) 160 to 500 (400V series)	1	٧	N	Y2	190 380	Υ
F05	Rated Voltage	160 to 500 V	1	>	N	Y2	380	Υ
F07	Acceleration/Deceleration Time 1	0.00 to 99.9 Note: Acceleration/Deceleration time is ignored at 0.00.	Variable	s	Υ	Υ	6.00	N
F08	Acceleration/Deceleration Time 2		Variable	ø	Υ	Υ	6.00	N
F09	Torque boost	0.0 to 5.0	0.1	٠	Y	Y	0.0	N
F10	Electronic Thermal Overload Protection for Motor (Select motor characteristics)	For general-purpose motors with built-in sef-cooling fan For inverter-driven motors or high-speed motors with force-d-ventilation fan	-	-	Y	Υ	2	Y
F11	(Overload detection le vel)		Variable	Α	Y	Y1 Y2	Refer to default table	Υ
F12	(Thermal time constant)	0.5 to 75.0	0.1	min	Y	Y	5.0 (22kW or below) 10.0 (30kW or above)	Y
F20	DC Braking			*3				
	(Starting Speed)		Variable		N	Y	0.0	N
F21	(Braking Level)		1	%	N	Y	0	N
F22	(Braking Time)	0.01 to 30.00	0.01	s	N	Υ	0.00	N
F23	Starting Speed	0.00 to 150.0 ^{*1}	Variable	*3	N	Y	6.00	N
F24	(Holding time)		0.01	S	N	Y	0.00	N
F25 F26	Stop Speed Motor Sound (Carrier frequency)	0.00 to 150.0 *1	Variable 1	*3 kHz	N N	Y	3.00	N Y
F30	Reserved '4	3 10 10		N-1Z	Y	Y		<u> </u>
F42	Control Mode	Vector control with PG for asynchronous motor Vector control with PG for synchronous motor Torque vector control	-	-	N N	Y	0	Y
F44	Current Limiter	100 to 230 (Percentage to the rated current of the inverter) 999: The maximum current of each inverter automatically applies.	1	%	Υ	Υ	999	N

⁽Level 1999. The maximum current of each inv
11 The data setting range is variable. Refer to 6.5-3.
22 The factory default setting varies depending on the shipping destination.
33 The unit changes depending on the setting of C21.
44 Reserved for particular manufacturens. Do not access this function code.

E codes: Extension Terminal Functions

Codo	Nama	Pata astrina mass	Increment	Unit	Change	Data	Default	Torque
Code	Name	Data setting range		Unit	when running	copying	setting	Control
E01	Command Assignment to:	Selecting function code data assigns the corresponding function to						
	[X1]	terminals [X1] to [X8] as listed below.	-		N	Y	0	-
E02		Setting the value of 1000s in parentheses() shown below assigns	-	-	N	Y	1	-
E03		a negative logic input to a terminal.	-	÷	N N	Y	2 8	-
E05	[X4] [X5]			-	N N	Y	60	-
E06	[X6]		⊢ `	_	N N	Y	61	i i
E07	[X0] [X7]			-	N N	Y Y	62	-
E08	[X8]			Ė	N	Y	63	_
E00	[^0]	0 (1000): Select multistep speed 1 SS1			IN		- 03	N.
		1 (1001): Select multistep speed 2 SS2						N
		2 (1002): Select multistep speed 4 SS4						N
		7 (1007): Enable coast-to-stop BX						Υ
		8 (1008): Reset alarm RST						Y
		9 (1009): Enable external alarm trip THR						Υ
		10 (1010): Enable jogging operation JOG						N
		24 (1024): Enable communications link via LE						Υ
		RS485 or CAN						
		25 (1025): Universal DI U-DI						Υ
		27 (1027): Enable PG vector control PG/Hz						N
		60 (1060): Select torque bias 1 TB1						Y
		61 (1061): Select torque bias 2 7B2						Y
		62 (1062): Hold torque bias H-TB						Y
		63 (1063): Enable battery operation BATRY						
		64 (1064): Start creepless operation CRPLS 65 (1065): Check brake control						N N
		66 (1066): Force to decelerate DRS						Y
		67 (1067): Start unbalance load compensation UNBL						Ϋ́
		68 (1068): Reserved for particular manufacturers DBTrBR						
		69 : Start magnetic pole position of fset tunir PPT						Y
		101 (1101): Enable external alarm trip 2 THR2						Ý
		102 (1102): Start reference torque decreasing RTDEC						Y
		103 (1103): Check status MC control CS-MC						Y
		108 (1108): CAN Enable CAN_EN						Υ
		Note: In the case of THR, DRS, THR2, data (1009), (1066),						
		(1101) are for normal logic, and "9", "66", "101" are for negative						
		logic, respectively.						
E10	Acceleration/Deceleration	0.00 to 99.9	Variable	s	Y	Y	6.00	N
	Time 3	Acceleration/Deceleration time is ignored at 0.00.						
E11	Acceleration/Deceleration Time 4		Variable	s	Υ	Υ	6.00	N
E12	Acceleration/Deceleration		Variable	s	Υ	Υ	6.00	N
	Time 5		—	_	-			ļ
E13	Acceleration/Deceleration		Variable	s	Υ	Y	6.00	N
	Time 6	ł		.	<u> </u>			
E14	Acceleration/Deceleration		Variable	s	Y	Y	6.00	N
F45	Time 7	 	Madabi			· ·	0.00	
E15	Acceleration/Deceleration Time 8		Variable	s	Y	Y	6.00	N
E16	Acceleration/Deceleration	†	Variable	s	Y	Y	6.00	N
	Time 9			1	l '	'		l
E17	Acceleration/Deceleration	Ť	Variable	s	Y	Y	6.00	N
	Time 10							<u> </u>
E18	Run Command/		-	-	N	Y	2	
	Multistep (Mode)	0: None						Υ
	Speed	1: FWD, REV						Y
	Command Assignment to:	2: SS1, SS2, SS4						N
	Agreement	3: FWD, REV SS1, SS2, SS4						Y
E19	Timer (Time)	0.000 to 0.100	0.001	S	N	Y	0.005	Υ

(E code continued)

					Change	Data	Default	Torque
Code	Name	Data setting range	Increment	Unit	when running	copying	setting	Control
E 20	Signal Assignment to:	Selecting function code data assigns the corresponding function to)					
	(Transistor signal)	terminals [Y1] to [Y4], [Y5A/C], and [30A/B/C] as listed below.						
	D		-		N	Y	0	-
E21	D	2) a negative logic output to a terminal.	-	٠	N	Y	71	
E22	D	3]	-	٠	N	Y	57	-
E23	D	4]	-	٠	N	Y	73	-
E24	(Relay contact signal)							
	[Y5A		-	-	N	Y	74	-
E27	[30A/B	21			N	Y	99	-
		0 (1000): Inverter running RUN						Y
		1 (1001): Speed arrival FAR						N
		2 (1002): Speed detected FDT						Y
		3 (1003): Undervoltage detected LU						Y
		(Inverter stopped)						
		10 (1010): Inverter ready to run RDY						Y
		12 (1012): MC control SW52-2						Ÿ
		25 (1025): Cooling fan in operation FAN						Ϋ́
								Y
		26 (1026): Auto-resetting TRY						Y
		27 (1027): Universal DO U-DO						
		28 (1028): Overheat early warning OH						Y
		30 (1030): Service life alarm LIFE						Y
		35 (1035): Inverter output on RUN2						Y
		37 (1037): Current detected ID						Y
		38 (1038): Current detected 2 ID2						Y
		55 (1055): Run command activated AX2						Y
		56 (1056): Motor overheat detected (PTC) THM						Y
		57 (1057): Brake control BRKS						N
		70 (1070): Speed existence DNZS						Y
		71 (1071): Speed agreement DSAG						N
		72 (1072): Speed arrival 3 FAR3						N
		73 (1073): During acceleration DACC						N
		74 (1074): During deceleration DDEC						N
		75 (1075): During zero speed DZR						N
		76 (1076): PG abnormal PG-ABN						N
		78 (1078): Door control DOPEN						N
		99 (1099): Alarm output (for any alarm) ALM						Y
		101 (1101): EN detection circuit fault DECF						Y
		102 (1102): EN terminal off ENOFF						Y
		103 (1103): Reserved for particular manufacturers ISW						-
		104 (1104): Low voltage detected LVD						Y
		105 (1105): Electrical angle cycle EAC						Y
		106 (1106): Reserved for particular manufacturers DTBW						-
		107 (1107): During magnetic pole position DTUNE offset tuning						Y
		108 (1108): Reserved for particular manufacturers RRD-D						-
		109 (1109): Recommended running direction RRD						N
		110 (1110): Drive continuance alarm output ALM2						Υ
		111 (1111): Shutdown confirmation SD						Y
		112 (1112): Input power limitation IPL						Y
		114 (1114) AX2 OR SW52-2 SW52-3						Y
		115 (1115) Pole tuning done PTD						Y
		116 (1116) Detected speed direction DSD						Y
E30	Speed Arrival (FAR)							
		s) 0.00 to 3600 ¹¹	Variable	*3	Y	Y	10	N
E31	Speed Detection (FDT)							
	(Detection lev	al) 0.00 to 3600 ^{*1}	Variable	*3	Y	Y	1800 "2	Y
E32	(Hysteres		Variable	*3	Y	Y	20	Ÿ
E34	Current Detection 1 (ID)	When you set 1 to L98:bit0,	valiable				Refer to	
E 34	Current Detection 1 (ID)	when you set 1 to £98:bitu, E34 and E35 are effective over torque current alarm (\mathcal{L}).					default	l
	,, .		14-7			,,,		.,
	(Level		Variable	Α	Y	Y1	table	Y
		Current value of 1 to 200% of the inverter rated current		_		Y2		<u> </u>
E35	(Tin	0.01 to 600.00	0.01	s	Y	Y	10.00	Y
E37	Current Detection 2 (ID2)						Refer to	l
	(Level	2) 0.00: (Disable)	Variable	Α	Y	Y1	default	Y
		Current value of 1 to 200% of the inverter rated current				Y2	table	<u></u>
E39	Recommended running							
	direction (RRD)							l
	(Detection lev	el) 0 to 100	1	%	N	Y	0	N

^{*1} The data setting range is variable. Refer to p. 5-3.

*2 The factory default setting varies depending on the shipping destination.

*3 The unit changes depending on the setting of C21.

(E code continued)

Code	Name	Data setting range	Increment	Unit	Change when running	Data copying	Default setting	Torque Control
E43	LED Monitor	0: Speed monitor (Select by E48)	-	-	Υ	Υ	0	Υ
		3: Output current						
		4: Output voltage 8: Calculated torque						
		9: Input power						
		18: Reference torque						
		19: Torque bias balance adjustment (Offset) (BTBB)						
E45	LCD Monitor	20: Torque bias gain adjustment (BTBG)						
	(Display mode)	0: Running status, rotational direction and operation guide	-	-	Υ	Y	0	Y
		Bar charts for reference speed(final), output current and						
E46	(Language selection)	reference torque 0: Chinese	-	-	Y	Y	1 *2	Y
	(. 55 ,	1: English						
		2: Japanese						
		3: German 4: French						
		5: Spanish						
		6: Italian						
		7: Russian						
		8: Greek 9: Czech						
		10: Polish						
		11: Turkish						
		Note: When the connected multi-function keypad (option) doesn't						
E47	(Contrast control)	support the selected language, it is displayed in English. 0 (Low) to 10 (High)	1	-	Y*	Y	5	Y
	LED Monitor		·		Y	Υ	0	·
	(Speed monitor item)	0: Reference speed (final)						N
		2: Reference speed (pre-ramp) 3: Motorspeed						Y
		5: Elevator speed						Y
E61	Analog Input for:	Selecting function code data assigns the corresponding function to						
	(Extension function	terminals [12], [C1] and [V2] as listed below.						
	selection) [12]				N	~	0	
E62	[C1]		-	-	N	Y	0	-
E63	[V2]		-		N	Υ	0	-
		0: None 1: Speed command						Y N
		(Not reversible operation with polarity)						IN
		2: Speed command						N
		(Reversible operation with polarity)						
		(Nothing for [C1]) 3: Torque current command						Y
		4: Torque bias command						Ý
E98	Command Assignment to:	Selecting function code data assigns the corresponding function to	2					
	[FWD]	terminals [FWD] and [REV] as listed below.			N	Y	98	
E99		Setting the value of 1000s in parentheses () shown below assigns a negative logic input to a terminal.	-	-	N N	Y	99	-
	, ,	0 (1000): Select multistep speed 1 SS1						N
		1 (1001): Select multistep speed 2 SS2						N
		2 (1002): Select multistep speed 4 SS4 7 (1007): Enable coast-to-stop BX						N Y
		8 (1008): Reset alarm RST						Y
		9 (1009): Enable external alarm trip THR						Y
		10 (1010): Enable jogging operation JOG						N Y
		24 (1024): Enable communications link via RS485 or CAN						Y
		25 (1025): Universal DI U-DI						Υ
		27 (1027): Enable PG vector control PG/Hz						N
		60 (1060): Select torque bias 1 TB1 61 (1061): Select torque bias 2 TB2						Y
		62 (1061): Select forque bias 2 62 (1062): Hold torque bias H-TB						Y
		63 (1063): Enable battery operation BATRY						Υ
		64 (1064): Start creepless operation CRPLS 65 (1065): Check brake control BRKE						N N
		65 (1065): Check brake control BRKE 66 (1066): Force to decelerate DRS						N Y
		67 (1067): Start unbalance load compensation UNBL						Y
		68 (1068): Reserved for particular manufacturers DBTrBR						
		69 : Start magnetic pole position offset tunir PPT 98 : Run forward FWD						Y
		98 : Run forward FWD 99 : Run reverse REV						Y
		101 (1101): Enable external alarm trip 2 THR2						Y
		102 (1102): Start reference torque decreasing RTDEC						Y
		102 (1102). Start felerence torque decreasing XIDLO						
		103 (1103): Check status MC control CS-MC						Y
		103 (1103): Check status MC control 108 (1108): CAN Enable CAN_EN Note: In the case of THR, DRS, THR2, data (1009), (1066).						Y
		103 (1103): Check status MC control CS-MC 108 (1108): CAN Enable CAN_EN						

^{*2} The factory default setting varies depending on the shipping destination.

C codes: Control Functions

Code	Name	Data setting range	Increment	Unit	Change when running	Data copying	Default setting	Torque Control
C01	Battery Operation							
	(Torque limit level	0 to 100	1	%	Y	Y	999	Y
	for drive side)							
		999: Torque limit level is F44.						
C02	(Torque limit time)	0.0: C01 is effective during battery operation.	0.1	s	Y	Υ	0.0	Υ
		0.1 to 30.0						
C03	Battery Operation Speed	0.00 to 3600 ¹¹	Variable	*3	Υ	Υ	0.00	N
C04	Multistep Speed							
	Zero Speed	0.00 to 3600 ^{*1}	Variable	*3	Y	Y	0.00	N
C05	Manual Speed (Middle)		Variable	*3	Υ	Υ	0.00	N
C06	Maintenance Speed		Variable	*3	Y	Υ	0.00	N
C07	Creep Speed		Variable	*3	Y	Υ	0.00	N
C08	Manual Speed (Low)		Variable	*3	Y	Υ	0.00	N
C09	Low Speed		Variable	*3	Y	Υ	0.00	N
C10	Middle Speed		Variable	*3	Y	Υ	0.00	N
C11	High Speed		Variable	*3	Y	Υ	0.00	N
C20	Jogging Operation Speed	0.00 to 3600 ¹¹	Variable	*3	Y	Υ	150.0	N
C21	Speed Command Unit	0: r/min	-		Y	Υ	0	Y
		1: m/min						
		2: Hz						
C31	Analog Input Adjustment for							
	[12]							
	(Offset)	-100.0 to +100.0	0.1	%	Y*	Y	0.0	Y
C32	(Gain)	0.00 to 200.00	0.01	%	Y*	Υ	100.00	Υ
C33	(Filter time constant)		0.001	s	Y	Υ	0.050	Y
	Analog Input Adjustment for							
	[C1]							
		-100.0 to +100.0	0.1	%	Y*	Y	0.0	Y
C37		0.00 to 200.00	0.01	%	Y*	Υ	100.00	Y
C38	(Filter time constant)		0.001	s	Y	Y	0.050	Y
	Analog Input Adjustment for		0.001				2.300	
	[V2]	l						I
		-100.0 to +100.0	0.1	%	Y*	Y	0.0	Υ
	(Offset)							
C42		0.00 to 200.00	0.01	%	Y*	Y	100.00	Ÿ

^{*1} The data setting range is variable. Refer to p. 5-3.
*3 The unit changes depending on the setting of C21.

P codes: Motor Parameters

Code	Name	Data setting range	Increment	Unit	Change when running	Data copying	Default setting	Torque Control
P01	Motor (No. of poles)		2	Poles	N	Y1 Y2	4	Υ
P02	(Rated capacity)	0.01 to 55.00	0.01	kW	N	Y1 Y2	Refer to default table	Y
P03	(Rated current)	0.00 to 500.0	Variable	Α	N	Y1 Y2	Refer to default table	Y
P04	(Auto-tuning)	Disable United the motor is stopped.) Chable (Tune %R1 and %X while the motor is stopped.) Chable (Tune %R1, %X, no-bad current, and rated slip while the motor is stopped.) Chable (Tune %R1, %X and rated slip while the motor is stopped.) Chable (Tune %R1, %X and rated slip while the motor constant)		1	N	N	0	Y
P06	(No-load current)	0.00 to 500.0	Variable	Α	N	Y1 Y2	Refer to default table	Y
P07	(%R1)	0.00 to 50.00	0.01	%	Y	Y1 Y2	Refer to default table	Y
P08	(%X)	0.00 to 50.00	0.01	%	Y	Y1 Y2	Refer to default table	Y
P09	(Slip comp. driving gain)	0.0 to 200.0	0.1	%	Y	Υ	100.0	Y
P10	(Slip comp. braking gain)		0.1	%	Υ	Υ	100.0	Υ
P11	(Slip comp. response time)		0.01	s	Υ	Υ	1.00 5	Y
P12	(Rated slip)	0.00: Rated slip of Fuji standard motor 0.01 to 15.00	0.01	Hz	Υ	Y1 Y2	0.00	Y

^{*5} The default setting is different in inverter ROM version.

H codes: High Performance Functions

	_							
Code	Name	Data setting range	Increment	Unit	Change when running	Data copying	Default setting	Torque Control
H03	Data Initialization	0: Disable initialization	-	-	N	N	0	Y
H04	Auto-resetting	Initialize all function code data to the factory defaults Disable	1	Times	Y	Υ	0	Υ
H05	(Times) (Reset interval)		0.1	s	Y	Y	2.0	Y
H06	Cooling Fan Control	0.0: Automatic ON/OFF depending upon temperature 0.5 to 10.0 min: OFF by timer	0.1	min	Y	Y	999	Y
H18	Torque Control	999: Disable (Always ON) 0: Disable (Speed control)	-	-	N	Υ	0	Υ
H26	PTC Thermistor	1: Enable (Torque control) 0: Disable	-	-	Y	Y	0	Y
	(Mode)	trips and stops with \$\mathcal{D}^{47}\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \						
H27	(Level) Communications Link		0.01	V	Y	Y	1.60	Y
H30	Communications Link Operation	Speed command Run command Torque bias command	-	-	Y	Y	0	Y
		0: F01 Terminal L54	1					
		1: RS485 Teminal L54	1					
		2: F01 RS485 L54						
		3: RS485 RS485 L54 4: CAN Terminal L54	1					
		5: F01 CAN L54	1					
		6: CAN CAN L54						
		7: F01 Teminal RS485 8: RS485 Teminal RS485						
		9: F01 RS485 RS485	1					
		10: RS485 RS485 RS485	1					
		11: F01 Teminal CAN						
		12: CAN Terminal CAN 13: F01 CAN CAN						
		14: CAN CAN CAN	1					
		Note: 4, 5, 6, 11, 12, 13, and 14 can set only the version equipped	i					
		with CAN.						
H42	Considerate of DO Link Dun	(for models of FRN_LM1S-2C, -2E, -2J, -2A, -4C, -4E, -4J, -4A)			N	N		Y
H43	Capacitance of DC Link Bus Capacitor Cumulative Run Time of	0 to 65535: Indication for replacing DC link bus capacitor 0 to 65535: Indication of cumulative run time of cooling fan for		_	N N	N N		Y
1143	Cooling Fan	replacement	-			14		
H47	Initial Capacitance of DC Link Bus Capacitor	0 to 65535: Indication for replacing DC link bus capacitor	-	-	N	N	Set at factory shipping	Y
H48	Cumulative Run Time of Capacitors on Printed Circuit Board	0 to 65535: Indication for replacing capacitors on printed dircuit boards		-	N	N	-	Y
H54	Acceleration Time (Jogging)	0.00 to 99.9	Variable	s	Y	Υ	6.00	N
H55	Deceleration Time (Jogging)	0.00 to 99.9	Variable	s	Y	Υ	6.00	N
H56	Deceleration Time for Forced to Decelerate	0.00 to 99.9	Variable	s	Y	Υ	6.00	N
H57	S-curve Setting 11	0 to 50% of max. speed	1	%	Y	Y	0	N N
H58 H59	S-curve Setting 12 S-curve Setting 13	<u> </u>	1	%	Y	Y	0	N
H60	S-curve Setting 14		1	%	Y	Y	0	N
H64	Zero Speed Holding Time	0.00 to 10.00	0.01	s	N	Y	0.00	N
H65	Starting Speed (Soft start time)	0.0 to 60.0	0.1	s	N	Y	0.0	N
H66	Stop Speed	0: Use detected speed	-	-	N	Y	0	N
H67	(Detection method) (Holding time)	1: Use reference speed (final) 0.00 to 10.00	0.01	s	N	Y	0.00	N
H74	Speed Agreement		5.01		-		5.00	<u> </u>
	(Hysteresis)	0.00 to 3600 ¹	Variable	*3	Y	Y	10.00	N
H75	(OFF delay time)	0.00 to 1.00	0.01	S o/	Y	Y	0.20	N N
H76	PG Error Detection for Mode 3 (Detection level)	0 to 50	1	%	Y	Y	10	N
H77	(Detection time)	0.0to 10.0	0.1	s	Υ	Υ	0.5	N
H80	Exciting current damping gain	0.00 to 0.40	0.01		Y	Υ	0.20	N
H94	Cumulative Run Time of Motor Clear Alarm Data	0 to 65535: Change or reset the cumulative data If H97= 1, its data returns to zero after clearing alarm data.	<u> </u>	H	N Y	N N	0	Y
H97	Protection/Maintenance	00000000 _b to 11111111 _b (Displayed on the keypad's LCD in		-	Y	Y	81	-
	Function	decimal format. In each bit, "0" for disabled, "1" for enabled.)						
		Bit 0: Lower the carrier frequency automatically						Y
		Bit 1: Detect input phase loss Bit 2: Detect output phase loss						- Y
		Bit 3: Select deput phase loss Bit 3: Select life judgment criteria of DC link bus capacitor						Y
		Bit 4: Judge the life of DC link bus capacitor						Y
		Bit 5: Detect DC fan lock						Y
		Bit 6: Detect a short-circuit at startup Bit 7: Detect thermistor disconnect for heat sink						Y
		Note: Bit 5 and Bit 7 are effective only for models of 30kW or above (200V series) or 37kW or above (400V series).						Ė
H99	Password Protection	0000 _H to FFFF _H	- 1	-	Υ	N	0000 _H	Y
_		0000 _H : Disable password protection		L	L			Ĺ
*1	The data setting range is variable						_	

^{*1} The data setting range is variable. Refer to p. 5-3.
*3 The unit changes depending on the setting of C21.

y codes: Link Functions

Code	Name	Data setting range	Increment	Unit	Change when running	Data copying	Default setting	Torque Control
y01	RS485 Communication							
y02	(Station address) (Communications error	1 to 255 0: Immediately trip with alarm Fr8	1	_	N Y	Y	0	Y
y02	(Communications error processing)	 Immediately up with alarm E-P3 Trip with alarm E-P3 after running for the period specified by timer y03 Retry during the period specified by timer y03. If retry fails, trip with alarm E-P3. If it succeeds, continue to run. Continue to run 	-	-	ľ	Ť	U	r
y03	(Error processing time)		0.1	s	Y	Y	2.0	Y
y04	(Baud rate)	0: 2400 bps 1: 4800 bps 2: 9600 bps 3: 19200 bps 4: 38400 bps	-	-	Y	Y	3	Y
y05	(Data length)	0: 8 bits 1: 7 bits	-	-	Υ	Y	0	Y
y06	(Parity check)	0: None (Stop bit 2) 1: Even parity 2: Odd parity 3: None (Stop bit 1)	-	-	Y	Y	0	Y
y07	(Stop bits)	0: 2 bits 1: 1 bit	-	,	Υ	Υ	0	Y
y08	(No-response error	0: (No detection)	1	s	Y	Y	0	Y
	detection time)							
y09	(Response latency time)	0.00 to 1.00	0.01	S	Y	Y	0.01	Y
y10	(Protocol selection)	Modbus RTU protocol SX protocol (FRENIC Loader protocol) Reserved for particular manufacturers	-	-	Y	Y	1	Y
y21	CAN Communication *6							
	(Station address)		1	-	N	Y	1	Y
y24	(Baud rate)	0: 10 ktps 1: 20 ktps 2: 50 ktps 3: 125 ktps 4: 250 ktps	-	-	N	Y	3	Y
y25	(User-defined I/O parameter 1)	0000 _H to FFFF _H	-	-	N	Y	0000 _H	Y
y26	(User-defined I/O parameter 2)		-	-	N N	Y	0000 _H	Y
y27 y28	(User-defined I/O parameter 3) (User-defined I/O parameter 4)		_	Ė	N N	Y	0000 _H	Y
y28 y29	(User-defined I/O parameter 4) (User-defined I/O parameter 5)		-	-	N N	Y	0000 _H	Y
v30	(User-defined I/O parameter 6)			-	N	Y	0000 _H	Y
y31	(User-defined I/O parameter 7)			-	N	Ý	0000	Ÿ
y32	(User-defined I/O parameter 8)				N	Y	0000 _H	Y
y33	(Operation)	0: Disable 1: Enable	-		N	Υ	0	Y
y41	Reserved '4	-	-	-	N	Y	0	N
y99	Loader Link Function (Mode)	Control command Run command	-	-	Y	N	0	Y

^{*4} Reserved for particular manufacturers. Do not access this function code.
*6 These are able to set only the version equipment with CAN ifor models of FRN. IM1S-2C. 2F. 2.I.-2A. -4C. -4F. -4.I. -4A)

L codes: Lift Functions

Code	Name		Data	setting range	Increment	Unit	Change when	Data copying	Default setting	Torque Control
		Ь.					runnina		_	
L01	Pulse Encoder (Selection)			ABS signal	-	-	N	Y	0	-
		0:	12/15 V	None						Y
			- Complementary - Open collector							
			5 V Line driver							
			12/15 V	Z						
		'-	- Complementary	[l '
			- Open collector							
			5 V Line driver							
		2:	5 V Line driver	3-bit code						Y
		3:	5 V Line driver	4-bit gray code						Y
		4:	Sinusoidal differential	EnDat 2.1 (ECN1313 compatible)						Y
			voltage (1 V p-p)							
			Sinusoidal differential	SIN/COS (ERN1387 compatible)						Υ
			voltage (1 V p-p)							
L02	(Resolution)	360 t	o 60000		1	P/R	N	Y N	1024	Y
L03	Magnetic Pole Position Offset	H			-		N	N	0	-
	(Tuning)		Disable							Y
			Enable	a detection)						Y
			Enable (with miss wirin Enable (with checking							Ÿ
			Enable (for SPM)	uww.uby)						Y
			Enable (motorrotated)							N N
			This setting is effective	e if F42 = 1.						<u> </u>
				condition that the brake is a dose.						I
		5 : It	is necessary condition	that the brake is a release and						
			ut load.							
L04	(Offset angle)		to 360.00 (Return value		0.01	deg	N	Υ	0.00	Υ
		Note:	This setting is effective	e if F42 = 1.						
L05	Reserved ^{'4}	-			-		Y	Y	1.5 *5	Υ
L06	Reserved '4	Ŀ			-		Υ	Y	0.80	Y
L07	Auto magnetic Pole Position	_	B: 11		-	-	N	N	0	- V
	tuning mode select		Disable							
			Enable Enable (with miss wirin	a detection)						Y
										· ·
			Enable (with checking a Enable (for SPM)	accuracy)						, T
			This setting is effective	# F42 = 1						<u> </u>
				condition that the brake is a dose.						
L08	Divide frequency ratio		1/1		-	-	N	Υ	0	Υ
			1/2							
		2:	1/4							
			1/8							
			1/16							
			1/32							
			1/64							
L09	Filter Time Constant for	0.000	0 to 0.100		0.001	s	Y	Υ	0.000	N
	Reference Speed (Final)									
L10	Filter Time Constant for	0.000) to 0.100		0.001	s	Y	Υ	0.005	Υ
	Detected Speed	\vdash				\vdash				
L11	Multistep Speed Command									
	Combination	0000	0000 +- 00000144 /0	to 7)			N	_	0	N
J 12	Zero Speed	0000 Note:	0000₀ to 00000111₀ (0	to 7)	1		N N	Y	0	N N
L12	Zero Speed Manual Speed (Middle)	Note:	If a binary value within	the range from 00000000 _b to	1 1		N N	Y Y	1	N
L13	Zero Speed Manual Speed (Middle) Maintenance Speed	Note:	If a binary value within	to 7) the range from $00000000_{\rm b}$ to ed, the inverter trips with alarm \mathcal{E} - \mathcal{E} .			N	_	1 2	N N
L13 L14	Zero Speed Manual Speed (Middle) Maintenance Speed Creep Speed	Note:	If a binary value within	the range from 00000000 _b to	1		N N N	Y	1	N N N
L13	Zero Speed Manual Speed (Middle) Maintenance Speed Creep Speed Manual Speed (Low)	Note:	If a binary value within	the range from 00000000 _b to	1		N N	Y	1 2 3	N N
L13 L14 L15 L16	Zero Speed Manual Speed (Middle) Maintenance Speed Creep Speed Manual Speed (Low) Low Speed	Note:	If a binary value within	the range from 00000000 _b to	1 1 1		N N N N	Y Y Y	1 2 3 4	N N N
L13 L14 L15	Zero Speed Manual Speed (Middle) Maintenance Speed Creep Speed Manual Speed (Low) Low Speed Middle Speed	Note:	If a binary value within	the range from 00000000 _b to	1 1 1		N N N	Y Y Y	1 2 3 4 5	N N N N
L13 L14 L15 L16 L17	Zero Speed Manual Speed (Middle) Maintenance Speed Creep Speed Manual Speed (Low) Low Speed	Note: 0000	If a binary value within	the range from 00000000 _b to	1 1 1 1	- - - - - - -	N N N N	Y Y Y Y	1 2 3 4 5	N N N N
L13 L14 L15 L16 L17 L18	Zero Speed Manual Speed (Midde) Mainten ance Speed Creep Speed Manual Speed (Low) Low Speed Midde Speed High Speed S-curve Setting 1	Note: 0000	: If a binary value within 0 111₀ is double-assign	the range from 00000000 _b to	1 1 1 1 1	- - - - - - - - - - - - - - - - - - -	N N N N N N N N N N N N N N N N N N N	Y Y Y Y Y	1 2 3 4 5 6 7	N N N N N
L13 L14 L15 L16 L17 L18 L19	Zero Speed Manual Speed (Midde) Maintenance Speed Creep Speed Manual Speed (Low) Low Speed Middle Speed High Speed	Note: 0000	: If a binary value within 0 111₀ is double-assign	the range from 00000000 _b to	1 1 1 1 1 1		N N N N N N	Y Y Y Y Y	1 2 3 4 5 6 7	N N N N N N
L13 L14 L15 L16 L17 L18 L19 L20	Zero Speed Manual Speed (Midde) Mainten ance Speed Creep Speed Manual Speed (Low) Low Speed Middle Speed High Speed Scurve Setting 1 Scurve Setting 2	Note: 0000	: If a binary value within 0 111₀ is double-assign	the range from 00000000 _b to	1 1 1 1 1 1	% %	N N N N N N N N Y Y	Y Y Y Y Y Y Y	1 2 3 4 5 6 7 0	N N N N N N N
L13 L14 L15 L16 L17 L18 L19 L20 L21 L22 L23	Zero Speed Manual Speed (Mdde) Mairtenance Speed Creep Speed Manual Speed (Low) Low Speed Mdde Speed High Speed Seure Setting 1 Scurve Setting 2 Scurve Setting 3 Scurve Setting 4 Scurve Setting 5 Scurve Setting 5	Note: 0000	: If a binary value within 0 111₀ is double-assign	the range from 00000000 _b to	1 1 1 1 1 1 1 1 1 1 1	% % %	N N N N N N N N N N N N N N N N N N N	Y Y Y Y Y Y Y	1 2 3 4 5 6 7 0 0 0	N N N N N N N N N N
L13 L14 L15 L16 L17 L18 L19 L20 L21 L22 L23 L24	Zero Speed Manual Speed (Mdde) Maintenance Speed Creep Speed Manual Speed (Low) Low Speed Mdde Speed — High Speed Scurve Setting 1 Scurve Setting 3 Scurve Setting 4 Scurve Setting 4 Scurve Setting 5 Scurve Setting 5 Scurve Setting 6	Note: 0000	: If a binary value within 0 111₀ is double-assign	the range from 00000000 _b to	1 1 1 1 1 1 1 1 1 1 1	% % %	N N N N N N N N Y Y Y Y Y Y	Y Y Y Y Y Y Y Y	1 2 3 4 5 6 7 0 0 0 0	N N N N N N N N N N N N N N N N N N N
L13 L14 L15 L16 L17 L18 L19 L20 L21 L22 L23 L24 L25	Zero Speed Manual Speed (Mdde) Maintenance Speed Creep Speed Manual Speed (Low) Low Speed Midde Speed High Speed Scure Setting 1 Scure Setting 2 Scure Setting 4 Scure Setting 4 Scure Setting 5 Scure Setting 5 Scure Setting 5 Scure Setting 6 Scure Setting 7	Note: 0000	: If a binary value within 0 111₀ is double-assign	the range from 00000000 _b to	1 1 1 1 1 1 1 1 1 1 1 1 1	% % % %	N N N N N N N N Y Y Y Y Y Y Y	Y Y Y Y Y Y Y Y	1 2 3 4 5 6 7 0 0 0 0	N N N N N N N N N N N N N N N N N N N
L13 L14 L15 L16 L17 L18 L19 L20 L21 L22 L23 L24 L25 L26	Zero Speed Manual Speed (Mdde) Maintenance Speed Creep Speed Manual Speed (Low) Low Speed Mdde Speed High Speed Scurve Setting 2 Scurve Setting 3 Scurve Setting 4 Scurve Setting 5 Scurve Setting 7 Scurve Setting 8	Note: 0000	: If a binary value within 0 111₀ is double-assign	the range from 00000000 _b to	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	% % % % %	N N N N N N N N Y Y Y Y Y Y Y Y	Y Y Y Y Y Y Y Y Y	1 2 3 4 5 6 7 0 0 0 0 0	N N N N N N N N N N N N N N N N N N N
L13 L14 L15 L16 L17 L18 L19 L20 L21 L22 L23 L24 L25 L26 L27	Zero Speed Manual Speed (Mdde) Maintenance Speed Creep Speed Manual Speed (Low) Low Speed High Speed High Speed Scurve Settling 1 Scurve Settling 2 Scurve Settling 3 Scurve Settling 4 Scurve Settling 5 Scurve Settling 7 Scurve Settling 7 Scurve Settling 7 Scurve Settling 8	Note: 0000	: If a binary value within 0 111₀ is double-assign	the range from 00000000 _b to	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	% % % % %	N N N N N N N N Y Y Y Y Y Y Y Y Y Y Y Y	Y Y Y Y Y Y Y Y Y Y Y	1 2 3 4 5 6 7 0 0 0 0 0	N N N N N N N N N N N N N N N N N N N
L13 L14 L15 L16 L17 L18 L19 L20 L21 L22 L23 L24 L25 L26 L27 L28	Zero Speed Manual Speed (Middle) Maintenance Speed Creep Speed Manual Speed (Low) Low Speed Middle Speed High Speed Scurve Setting 2 Scurve Setting 2 Scurve Setting 4 Scurve Setting 5 Scurve Setting 9 Scurve Setting 9 Scurve Setting 9 Scurve Setting 10	Note: 0000	: If a binary value within 0 111₀ is double-assign	the range from 00000000 _b to	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	% % % % %	N N N N N N N N Y Y Y Y Y Y Y Y	Y Y Y Y Y Y Y Y Y	1 2 3 4 5 6 7 0 0 0 0 0	N N N N N N N N N N N N N N N N N N N
L13 L14 L15 L16 L17 L18 L19 L20 L21 L22 L23 L24 L25 L26 L27	Zero Speed Manual Speed (Mdde) Maintenance Speed Creep Speed Manual Speed (Low) Low Speed Midde Speed High Speed High Speed Scurve Setting 1 Scurve Setting 2 Scurve Setting 3 Scurve Setting 5 Scurve Setting 5 Scurve Setting 6 Scurve Setting 6 Scurve Setting 6 Scurve Setting 6 Scurve Setting 8 Scurve Setting 8 Scurve Setting 9 Scurve Setting 9 Scurve Setting 9 Scurve Setting 10	00000000000000000000000000000000000000	. If a binary value within 0111 ₁₀ is double-assign 0111 ₁₀ to doubl	the range from 00000000 _b to	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	% % % % %	N N N N N N N N N Y Y Y Y Y Y Y Y Y Y Y	Y Y Y Y Y Y Y Y Y Y Y	1 2 3 4 5 6 7 0 0 0 0 0 0	N N N N N N N N N N N N N N N N N N N
L13 L14 L15 L16 L17 L18 L19 L20 L21 L22 L23 L24 L25 L26 L27 L28 L29	Zero Speed Manual Speed (Mdde) Maintenance Speed Creep Speed Manual Speed (Low) Low Speed Midde Speed High Speed Server Scure Setting 1 Scure Setting 2 Scure Setting 3 Scure Setting 4 Scure Setting 5 Scure Setting 7 Scure Setting 9 Scure Setting 10 Short Foor Operation (Holding time)	0 to 5	. If a binary value within 0111 _b is double-assign 0111 _b is double-assign 50% of max. speed	the range from 00000000 _b to	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	% % % % % %	N N N N N N N N N N N N N N N N N N N	Y Y Y Y Y Y Y Y Y Y Y Y Y Y Y Y Y Y Y	1 2 3 4 5 6 7 0 0 0 0 0 0 0 0	N N N N N N N N N N N N N N N N N N N
L13 L14 L15 L16 L17 L18 L19 L20 L21 L22 L23 L24 L25 L26 L27 L28 L29	Zero Speed Manual Speed (Mdde) Maintenance Speed Creep Speed Manual Speed (Low) Low Speed Mdde Speed (Low) Low Speed High Speed High Speed Scurve Setting 1 Scurve Setting 2 Scurve Setting 3 Scurve Setting 3 Scurve Setting 5 Scurve Setting 6 Scurve Setting 6 Scurve Setting 7 Scurve Setting 7 Scurve Setting 8 Scurve Setting 1	0 to 5	. If a binary value within 0111 ₁₀ is double-assign 0111 ₁₀ to doubl	the range from 00000000 _b to	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	% % % % %	N N N N N N N N N Y Y Y Y Y Y Y Y Y Y Y	Y Y Y Y Y Y Y Y Y Y Y	1 2 3 4 5 6 7 0 0 0 0 0 0	N N N N N N N N N N N N N N N N N N N
L13 L14 L15 L16 L17 L18 L19 L20 L21 L22 L23 L24 L25 L26 L27 L28 L29	Zero Speed Manual Speed (Mdde) Maintenance Speed Creep Speed Manual Speed (Low) Low Speed Mdde Speed High Speed Scurve Setting 1 Scurve Setting 2 Scurve Setting 3 Scurve Setting 4 Scurve Setting 4 Scurve Setting 5 Scurve Setting 7 Scurve Setting 7 Scurve Setting 9 Scurve Settin	0 to 5	. If a binary value within 0111 _b is double-assign 0111 _b is double-assign 50% of max. speed to 10.00	the range from 00000000, to etd, the inverter trips with alarm \mathcal{E} - \mathcal{E} .	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	% % % % % % %	N N N N N N N N N N N N N N N N N N N	Y Y Y Y Y Y Y Y Y Y Y Y Y Y Y Y Y Y Y	1 2 3 4 5 6 7 0 0 0 0 0 0 0 0 0 0 0	N N N N N N N N N N N N N N N N N N N
L13 L14 L15 L16 L17 L18 L19 L20 L21 L22 L23 L24 L25 L26 L27 L28 L29 L30 L31	Zero Speed Manual Speed (Mdde) Maintenance Speed Creep Speed Manual Speed (Low) Low Speed Mdde Speed (Low) Low Speed High Speed Scurve Setting 1 Scurve Setting 3 Scurve Setting 3 Scurve Setting 5 Scurve Setting 5 Scurve Setting 6 Scurve Setting 6 Scurve Setting 8 Scurve Setting 9 Scurve Setting 1 Scurve Setting 6 Scurve Setting 7 Scurve Setting 7 Scurve Setting 7 Scurve Setting 8 Scurve Setting 9 Scurve Setting 9 Scurve Setting 9 Scurve Setting 10 Shot Fbor Operation (Notable Speed)	0 to 5	If a binary value within 0111 _b is double-assign 0111 _b is double-assign 50% of max. speed to 10.00 to 10.00 to 10.00 to 20.00 (Elevator speed to 240.00 (Elevator speed to 240.00 (Elevator speed to 240.00 (Elevator spe	the range from 00000000 _b to	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	% % % % % % % % % % m/min	N N N N N N N N N N N N N N N N N N N	Y Y Y Y Y Y Y Y Y Y Y Y Y Y Y Y Y Y Y	1 2 3 4 5 6 7 0 0 0 0 0 0 0 0 0 0 0	N N N N N N N N N N N N N N N N N N N
L13 L14 L15 L16 L17 L18 L19 L20 L21 L22 L23 L24 L25 L26 L27 L28 L29	Zero Speed Manual Speed (Mdde) Maintenance Speed Creep Speed Manual Speed (Low) Low Speed Mdde Speed High Speed Scurve Setting 1 Scurve Setting 2 Scurve Setting 3 Scurve Setting 4 Scurve Setting 4 Scurve Setting 5 Scurve Setting 7 Scurve Setting 7 Scurve Setting 9 Scurve Settin	0 to 5	If a binary value within 0111 _b is double-assign 0111 _b is double-assign 50% of max. speed to 10.00 to 10.00 to 10.00 to 20.00 (Elevator speed to 240.00 (Elevator speed to 240.00 (Elevator speed to 240.00 (Elevator spe	the range from 00000000, to etd, the inverter trips with alarm \mathcal{E} - \mathcal{E} .	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	% % % % % % %	N N N N N N N N N N N N N N N N N N N	Y Y Y Y Y Y Y Y Y Y Y Y Y Y Y Y Y Y Y	1 2 3 4 5 6 7 0 0 0 0 0 0 0 0 0 0 0	N N N N N N N N N N N N N N N N N N N

In create sesting range is variable. Refer to p.5.3.
 The data setting range is variable. Refer to p.5.3.
 The unit changes depending on the setting of C21.
 Reserved for particular manufacturers. Do not access this function code 15 The default setting is different in inverter ROM version.

(L code continued)

Code	Name	Data setting range	Increment	Unit	Change when running	Data copying	Default setting	Torque Control
L36	ASR							
	(P constant at high speed)	0.01 to 200.00	0.01	-	Y	Υ	40.00	N
L37	(I constant at high speed)		0.001	s	Y	Υ	0.100	N
L38	(P constant at low speed)	0.01 to 200.00	0.01		Y	Υ	40.00	N
L39	(I constant at low speed)	0.001 to 1.000	0.001	s	Y	Υ	0.100	N
L40	(Switching speed 1)		Variable	*3	Y	Υ	150.0	N
L41	(Switching speed 2)		Variable	*3	Y	Υ	300.0	N
L42	(Feed forward gain)		0.001	s	Y	Υ	0.000	N
L43	Reserved *4		-	-	Y	Υ	10	Υ
L44	Reserved *4		-	-	Y	Υ	0	Y
L45	Reserved "4		-		Y	Υ	10	Υ
L46	Reserved ^{'4}		-	-	Y	Y	0	Y
L47	Reserved '4		-		Y	Υ	10	Υ
L48	Reserved '4			-	Y	Υ	0	Y
L49	Vibration Suppression							
	Observer							
		0.00: Disable	0.01	-	Y	Υ	0.00	Υ
	()	0.01 to 1.00						· ·
L50	(Integral time)	0.005 to 1.000	0.001	s	Y	Y	0.100	Υ
L51	(Load inertia)	0.01 to 655.35	0.01	kam²	Y	Y	0.01	Y
	Start Control Mode	0: Enable speed start mode	1	KUIII	Y	Ϋ́	0.01	N.
LJZ	Start Control Wode	Enable speed start mode Enable torque start mode	l '	-	,	'	U	14
		Note: This setting is effective if H18 = 0.						
1.54	Torque Bias (Mode)	Note: This setting is effective if H18 = 0.	-	-	N	Y	0	Υ
L34	roique bias (wode)	0: Analog						
		1: Digital						
		2: Pl control						
		3: DCP						
L55	(Startup time)		0.01	s	Y	Y	0.20	Y
L56	(Reference torque end time)	0.00: Disable	0.01	S	Y	Y	0.20	Ÿ
L30	(Reference torque end time)	0.01 to 20.00	0.01	S	Y	Y	0.00	,
L57	a i		1	%	Y	Y	400	Υ
L58	(Limiter)	0.01 to 10.00	0.01	- 76	Y	Y	1.00	Y
			0.01		Y	Y		Y
L59 L60	(Integral time)		0.01	S 0/	Y Y*	Y	1.00	Y
L60	(Driving gain)			%	Y*	Y	100.0	Y
		-1000.0 to 1000.0	0.1	_				
L62	(Digital 1)	-200 to 200	1	%	Y	Y	0	Y
L63	(Digital 2)		1	%	Y	Y	0	_
L64	(Digital 3)	-200 to 200	1	%	Y	Υ	0	Υ
L65	Unbalanced Load							
	Compensation	0.00				.,		.,
	(Operation)	0: Disable	-	-	N	Υ	0	Υ
		1: Enable						
L66	(Activation time)	0.00 to 2.00	0.01	s	N	Y	0.50	Υ
L67	(Holding time)		0.01	s	N	Y	0.50	Y
L68	(ASR P constant)	0.00 to 200.00	0.01	_	Y	Y	40.00	Υ
L69		0.001 to 1.000	0.001	s	Y	Y	0.100	Υ
L73	(APR P constant)		0.01	-	Y	Υ	0.00	Y
L74	(APR D gein)		0.1	-	Y	Υ	0.0	Υ
L75	(Filter Time Constant	0.000 to 0.100	0.001	s	Y	Υ	0.000	Υ
	for Detected Speed)							
L76	(ACR P constant	0.0 to 10.0	0.1		Υ	Υ	0.0	Υ

^{*1} The data setting range is variable. Refer to p. 5-3.
*3 The unit changes depending on the setting of C21.
*4 Reserved for narticular manufacturers. Do not access this function code.

(L code continued)

Code	Name	Data setting range	Increment	Unit	Change when running	Data copying	Default setting	Torque Control
L80	Brake Control (Mode)	Brake control by time Brake control by output current	-		N	Υ	1	N
L81	(Operation level)		1	%	N	Y	100	N
L82	(ON delay time)		0.01	s	N	Y	0.00	N
L83	(OFF delay time)		0.01	s	N	Y	0.00	N
L84	(Brake check time)	0.00 to 10.00	0.01	S	N	Y	0.00	N
L85	MC Control							
	(Startup delay time)		0.01	S	N	Y	0.00	Y
L86	(MC OFF delay time)	0.00 to 10.00	0.01	S	N	Y	0.00	Υ
L87	Door Control			*3				
	(Door open starting speed)		Variable	_	N	Y	100.0	N
L88	(Door open delay time)		0.1	S	N	Y	1.0	N
L89	(Door open period)	0.1 to 30.0	0.1	s	N	Y	5.0	N
L90	PG Error Detection		-	-	N	Y	1	-
		0: Continue to run						N
	(Mode)	1: Trip at alarm mode 1 with a larm E-E						N
		2: Trip at alarm mode 2 with a larm Ε-Ε						N
		 Trip at alarm mode 3 with a larm ErE 						N
L91	(Detection level)		1	%	Y	Y	10	N
L92	(Detection time)	0.0 to 10.0	0.1	S	Y	Y	0.5	N
L93	Overheat Early Warning Level	1 to 20	1	deg	Υ	Y	5	Υ
	Reserved '4	-	-		N	Y	999	Υ
	Reserved "4	-	-		N	Y	30	Υ
L97	Reserved ^{'4}	-	-		N	Y	20	Y
L98	Protection2	00000000 _b to 00000011 _b	-	-	N	Y	0	-
		(In each bit, "0" for disabled, "1" for enabled.)						
		Bit0: Over torque alarm (⊕E)						Υ
		Bit1: Drive continuance mode when specific alarm						Y
		Bit2: Reserved						-
		Bit3: Reserve d						-
		Bit4: Reserved						-
		Bit5: Reserved for particular manufacturers						Y
L99	Control Switch	00000000₀ to 000111111ь	-	-	N	Y	0	-
		(In each bit, "0" for disabled, "1" for enabled.)						
		Bit0: Current confirmation when starting (for synchronous motor)						Y
		Bit1: Rewrite magnetic pole position offset angle (tuning by PPT)						Y
		Bit2: Torque bias operation with offset						N
		Bit3: Select short floor operation mode						N
		Bit4:Reserved						N
		Bit5:Reserved						N
		Bit6:DOPEN function change						Y
		Note: Bit 1 is effective only for tuning by PPT.						

Appendix: Factory Defaults

Туре	P02	F11,E34,E37,P03	P06	P07	P08
FRN5.5LM1S-2	5.50[kW]	27.00[A]	16.80[A]	4.05[%]	11.72[%]
FRN7.5LM1S-2	7.50[kW]	37.00[A]	19.70[A]	4.23[%]	13.01[%]
FRN11LM1S-2	11.00[kW]	49.00[A]	27.70[A]	3.22[%]	12.27[%]
FRN15LM1S-2	15.00[kW]	63.00[A]	35.80[A]	2.55[%]	11.47[%]
FRN18.5LM1S-2	18.50[kW]	74.00[A]	32.50[A]	1.98[%]	11.97[%]
FRN22LM1S-2	22.00[kW]	90.00[A]	38.10[A]	2.11[%]	12.35[%]
FRN4.0LM1S-4	3.70[kW]	9.00[A]	5.70[A]	5.54[%]	8.33[%]
FRN5.5LM1S-4	5.50[kW]	13.50[A]	8.40[A]	4.05[%]	11.72[%]
FRN7.5LM1S-4	7.50[kW]	18.50[A]	9.80[A]	4.23[%]	13.01[%]
FRN11LM1S-4	11.00[kW]	24.50[A]	13.90[A]	3.22[%]	12.27[%]
FRN15LM1S-4	15.00[kW]	32.00[A]	17.90[A]	2.55[%]	11.47[%]
FRN18.5LM1S-4	18.50[kW]	37.00[A]	16.20[A]	1.98[%]	11.97[%]
FRN22LM1S-4	22.00[kW]	45.00[A]	19.00[A]	2.11[%]	12.35[%]
FRN30LM1S-4	30.00[kW]	58.00[A]	21.40[A]	2.14[%]	14.62[%]
FRN37LM1S-4	37.00[kW]	72.00[A]	30.80[A]	1.86[%]	11.99[%]
FR N45LM1S-4	45.00[kW]	85.00[A]	31.10[A]	1.96[%]	13.40[%]
FRN2.2LM1S-7	2.20[kW]	11.00[A]	7.20[A]	6.82[%]	9.91[%]

^{*1} The data setting range is variable. Refer to p. 5-3.
*3 The unit changes depending on the setting of C21.
*4 Reserved for particular manufacturers. Do not access this function code.

Chapter 6 TROUBLESHOOTING

6.1 Before Proceeding with Troubleshooting

↑ WARNING

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, reset the alarm. Note that if the alarm is reset while any run commands are set to on, the inverter may supply the power to the motor which may cause the motor to rotate.

Injury may occur.

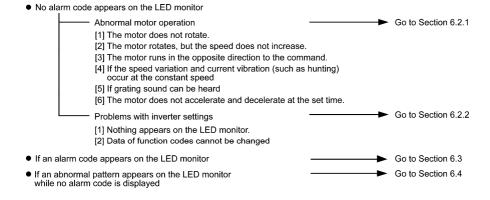
- Even though the inverter has interrupted power to the motor, if the voltage is applied to the main circuit power input terminals L1/R, L2/S and L3/T, voltage may be output to inverter output terminals U, V, and W.
- Before setting up any internal control switches, turn the power OFF. For the inverters with a capacity of 22 kW or below, wait at least 5 minutes; for those with a capacity of 30 kW or above, wait at least 10 minutes. Further, check that the charge lamp is unlit and make sure that the DC link bus voltage between the terminals P (+) and N (-) has dropped below the safe voltage level (25 VDC) using a multimeter or a similar instrument.

Electric shock may occur.

wait more than five minutes for models of 30 kW or below, or ten minutes for models of 37 kW or above.

Follow the procedure below to solve problems.

- (1) First, check that the inverter is correctly wired, referring to Chapter 2, Section 2.3.6 "Wiring for main circuit terminals and grounding terminals."
- (2) Check whether an alarm code is displayed on the LED monitor.



If any problems persist after the above recovery procedure, contact your Fuji Electric representative.

6.2 If No Alarm Code Appears on the LED Monitor

6.2.1 Motor is running abnormally

[1] The motor does not rotate.

Possible Causes		What to Check and Suggested Measures
(1)	No power supplied to the	Check the input voltage, output voltage and interphase voltage unbalance.
	inverter.	→ Turn ON a molded case circuit breaker, an earth leakage circuit breaker (with overcurrent protection) or a magnetic contactor.
		→ Check for voltage drop, phase loss, poor connections, or poor contacts, and fix them if necessary.
		→ If only auxiliary control power is supplied, turn ON the main power.
(2)	Neither forward run command nor reverse run	Check the input status of the control circuit terminals [FWD] and [REV] with Menu 4 "I/O Checking" using the keypad.
	command were inputted, or both run commands	→ Input a run command.
	were inputted	→ Set either <i>FWD</i> or <i>REV</i> to off if both run commands are being inputted.
	simultaneously (external signal operation).	→ Correct the assignment of commands <i>FWD</i> and <i>REV</i> to function codes E98 and E99.
		→ Connect the external circuit wires to control circuit terminals [FWD] and [REV] correctly.
		→ Make sure that the sink/source slide switch on the printed circuit board is properly configured.
(3)	A run command with higher priority than the one	Check the higher priority run command with Menu 2 "Data Checking" and Menu 4 "I/O Checking" using the keypad.
	attempted was active, and the run command was stopped.	→ Correct any incorrect function code data settings in H30 or cancel the higher priority run command.
(4)	The reference speed (pre-ramp) was set below the starting speed or stop speed.	Check that a reference speed (pre-ramp) has been entered, with Menu 4 "I/O Checking" using the keypad.
		→ Set the value of the reference speed (pre-ramp) to the same or higher than that of F23 (Starting Speed) or F25 (Stop Speed).
		→ Reconsider F23 (Starting Speed) or F25 (Stop Speed), and if necessary, change them to lower values.
		→ Inspect the speed command sources, speed controller, signal converters, switches, or relay contacts. Replace any ones that are faulty.
		→ Connect the external circuit wires correctly to terminals [12], [11], [C1], and [V2] (analog speed command operation).
(5)	A reference speed command with higher priority than the one	Check the higher priority reference speed command setting with Menu 2 "Data Checking" and Menu 4 "I/O Checking" using the keypad, referring to the block diagram of the reference speed command generator*.
	attempted was active.	*Refer to the FRENIC-Lift Reference Manual (INR-SI47-1068-E), Chapter 1.
		→ Correct any incorrect function code data settings (e.g. cancel the higher priority reference speed command).
(6)	The enable coast-to-stop command was effective.	Check the data of function codes E01, E02, E03, E04, E05, E06, E07, E08, E98 and E99 and the input signal status with Menu 4 "I/O Checking" using the keypad.
		→ Release the enable coast-to-stop command setting.
(7)	EN terminal circuit opens.	Check the EN terminal state with I/O check menu using the keypad.
	·	→ Close the EN terminal circuit.
(8)	Broken wire, incorrect	Check the cabling and wiring (Measure the output current).
	connection or poor contact with the motor.	→ Repair the wires to the motor or replace them.

Possible Causes	What to Check and Suggested Measures
(9) Overload	Measure the output current.
	→ Lighten the load or change the inverter for an upper size.
	Check that a mechanical brake is in effect.
	→ Release the mechanical brake.
(10) Torque generated by the	Check the data of function codes F04, F05, and P01 to P12.
motor was insufficient.	→ Change the function code data to match the motor's characteristics.
(11) Miss-/weak-connection of	Check the wiring connection.
the DC reactor (DCR)	→ Connect the DC reactor correctly. Repair or replace wires for the DC reactor.

[2] The motor rotates, but the speed does not increase.

Possible Causes		What to Check and Suggested Measures		
(1)	The maximum speed was set to too low a value.	Check the data of function code F03 (Maximum Speed).		
		→ Readjust the data of F03 (Maximum Speed).		
(2)	The reference speed (pre-ramp) command was	Check the signals for the reference speed (pre-ramp) command from the control circuit terminals with Menu 4 "I/O Checking" using the keypad.		
	set to too low a value.	→ Increase the reference speed (pre-ramp).		
		→ If an external potentiometer for speed command source, signal converter switches, or relay contacts are malfunctioning, replace them.		
		→ Connect the external circuit wires to terminals [12], [11], [C1], and [V2 correctly.		
(3)	A reference speed command with higher priority than the one attempted was active and	Check the settings (data) of the relevant function codes and what speed commands are being received, through Menu 1 "Data Setting," Menu 2 "Data Checking" and Menu 4 "I/O Checking," using the keypad and referring to the block diagram of the speed command source.		
	the reference speed was set to too low a value.	*Refer to the FRENIC-Lift Reference Manual (INR-SI47-1068-E), Chapter 1.		
		→ Correct any incorrect function code data settings (e.g. cancel highe priority speed commands, etc.).		
(4)	The acceleration time was too long or too short.	Check acceleration time-related data of function codes.		
		→ Change the acceleration/deceleration time to match the load.		
(5)	Overload	Measure the output current.		
		→ Lighten the load or change the inverter for an upper size.		
		Check if mechanical brake is working.		
		→ Release the mechanical brake.		
(6)	Mismatch with the characteristics of the motor	Check whether P01, P02, P03, P06, P07, P08, P09, P10, and P12 agree with the parameters of the motor.		
		→ Set P02 and P03 properly and auto-tune the inverter for the moto according to P04 data.		
(7)	The output speed did not	Check data of F44 (current limiter (operation level)).		
	increase due to the current limiting operation.	→ Set data of F44 correctly, or set 999 to F44 if no current limit is needed.		
		Check the data of function codes F04, F05, P01, and P12 to ensure that the V/f pattern is right.		
		 → Match the V/f pattern values with the motor ratings. → Set P02 and P03 properly and auto-tune the inverter for the motor according to P04 data. 		
(8)	Offset and grain data was	Check the data of function codes C31, C32, C36, C37, C41, and C42.		
	set incorrectly.	→ Readjust the offset and gain to appropriate values.		
(9)	Miss-connection of the pulse encoder	Check the wiring.		
		→ Rewire to [P0], [PA], [PB], [PZ] and [CM] terminals.		

Possible Causes	What to Check and Suggested Measures
(10) Miss-setting of pulse count of the encoder	Check the magnet pole angle detection data of L02 (Pulse Encoder (Resolution)).
	→ Set up L02 for correct data.

[3] The motor runs in the opposite direction to the command.

Possible Causes		What to Check and Suggested Measures		
(1)	Wiring has been connected to the motor incorrectly.	Check the wiring to the motor.		
		→ Connect terminals U, V, and W of the inverter to the respective U, V, and W terminals of the motor.		
(2)	Incorrect connection and settings for run commands and rotation direction command <i>FWD</i> and <i>REV</i>	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)	Miss-connection of the	Check the wiring.		
	pulse encoder	→ Rewire to [P0], [PA], [PB], [PZ] and [CM] terminals.		
		Check whether the feedback signal from the pulse encoder is satisfies following requirements.		
		 When the inverter runs with FWD command, a rising edge of [PA] is in the time fame while [PB] is kept in the high level. 		
		 When the inverter runs with REV command, a rising edge of [PA] is in the time frame while [PB] is kept in the low level. 		
		→ If not, interchange the signal wires between [PA] and [PB].		

[4] If the speed variation and current vibration (such as hunting) occur at the constant speed

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Pos	ssible Causes	What to Check and Suggested Measures
(1)	The reference speed (pre-ramp) fluctuated.	Check the signals for the speed command with Menu 4 "I/O Checking" using the keypad.
		→ Increase C33, C38, and C43 (Analog Input Adjustment for Terminal [12], [C1] and [V2] (Filter time constant)) for the speed command.
(2)	The external speed	Check that there is no noise in the control signal wires from external sources.
	command source device was used.	→ Isolate the control signal wires from the main circuit wires as far as possible.
		→ Use shielded or twisted wires for the control signal.
		Check whether the speed command source has not failed because of noise from the inverter.
		→ Connect a capacitor to the output terminals of the speed command source or pass the signal wire through a ferrite core. (Refer to Chapter 2 Section 2.3.7 "Wiring for control circuit terminals.")
(3)	Speed switching or multistep speed command was enabled.	Check whether the relay signal for switching the speed command is chattering.
		→ If any weak contact is in the relay, replace the relay.
		→ Reconfigure function codes E18 (Operation Command and Multistep Speed Agreement Timer (Mode)) and E19 (Timer).
(4)	Signal cable from the pulse encoder picks noises up.	Check the termination of shielded sheath of the pulse encoder cable.
		→ Ground the shielded sheath at the motor side.
		→ Connect it to the inverter's [CM] terminal.
		→ Raise L10 (Filter Time Constant for Speed Detection).

Possible Causes	What to Check and Suggested Measures
5) The machinery having low stiffness in a load causes hunting, or the output current is oscillatory due to irregular motor parameters.	Check data of function codes auto speed regulator (ASR). → Decrease L36 (ASR (P constant at high speed)) and L38 (ASR (P constant at low speed)). → Increase L37 (ASR (I constant at high speed)) and L39 ASR ((I constant at low speed)).
	Check that the motor vibration is suppressed if you decrease level of F26 (Motor Sound (Carrier frequency)). → Decrease level of F26 (Motor Sound (Carrier frequency)).

[5] If grating sound can be heard from the motor

Possible Causes		What to Check and Suggested Measures		
(1)	The carrier frequency was set too low.	Check the data of function codes F26 (Motor Sound (Carrier frequency)). → Increase F26 (Motor Sound (Carrier frequency)).		
(2)	The ambient temperature of the inverter was too high (when automatic lowering of the carrier frequency was enabled by H98).	Measure the temperature inside the enclosure of the inverter. → If it is over 40°C, lower it by improving the ventilation. → Lower the temperature of the inverter by reducing the load. Note) If you set H98 (bit 0 = 0), an ②H / ②H3 or ③LU alarm may occur.		
(3) Resonance with the load		Check the precision of the mounting of the load or check whether there is resonance with the enclosure or likes. Disconnect the motor and run it without the inverter, and determine where the resonance comes from. Upon locating the cause, improve the characteristics of the source of the resonance.		

[6] The motor does not accelerate and decelerate at the set time.

Pos	ssible Causes	What to Check and Suggested Measures		
(1)	Selected S-curve accel./decel. pattern miss-matches with the mutistep speed command.	Check the related function code data and the issuing timing of the multistep speed command.		
		→ Check and correct F07, F08, and E10 to E17 (Acceleration/Deceleration Time), L11 to L18 (Multistep Speed Command Combination), and L19 to L28 (S-curve Setting).		
(2)	The speed was controlled,	Check that the setting of F44 (Current limiter (Level)) is reasonable.		
	because the current limit operated.	→ Readjust the setting of F44 to appropriate value.		
	operated.	→ Increase the acceleration/deceleration time.		
		→ Correct P12 (Motor (Rated slip)).		
(3)	Overload	Measure the output current.		
		→ Lighten the load or change the inverter for an upper size.		
(4)	Torque generated by the motor was insufficient.	Check the data of motor parameters.		
		→ Match data of F04, F05, and P01 to P12 with data on the motor rating plate.		
(5)	An external speed command source is being used.	Check that there is no noise superimposed on the external signal wires.		
		→ Isolate the control signal wires from the main circuit wires as far as possible.		
		→ Use shielded wire or twisted wire for the control signal wires.		
		→ Connect a capacitor to the output terminals of the speed command source or pass the signal wire through a ferrite core. (Refer to Chapter 2 Section 2.3.7 "Wiring for control circuit terminals.")		
		→ Check and correct the filter time constant.		
		→ Check and correct F07 and F08 (Acceleration/Deceleration Time).		

Possible Causes	What to Check and Suggested Measures
(6) The V2/PTC switch was turned to PTC (when [V2] was being used).	Check whether control terminal [V2] is not set to the PTC thermistor input mode. Confirm SW4. (Refer to Chapter 2 Section 2.3.8 "Setting up slide switches.")
	→ Turn the V2/PTC switch on the printed circuit board to V2.

6.2.2 Problems with inverter settings

[1] Nothing appears on the multi-function keypad.

Possible Causes		What to Check and Suggested Measures
(1)	No power supplied to the inverter (main circuit power, auxiliary power for control circuit).	Check the power supply and measure the input voltage. → Turn on the molded case circuit breaker, earth leakage circuit breaker (with overcurrent protection) or magnetic contactor on the primary circuit. → Check for voltage drop, phase loss, weak connections, or weak contacts, and fix them if necessary.
(2)	The power for the control circuit did not reach a high enough level.	Check if the short bar has been removed between terminals [P1] and [P (+)] or if there is poor contact between the short bar and the terminals. Connect the short bar or DC reactor between terminals [P1] and [P (+)] or retighten the screws.
(3)	The keypad was not properly connected to the inverter.	Check whether the keypad is properly connected to the inverter. → Remove the keypad, put it back, and see whether the problem persists. → Replace the keypad with another one and check whether the problem persists.
		When running the inverter at a remote site, ensure that the extension cable is securely connected both to the keypad and to the inverter. → Disconnect the cable, reconnect it, and see whether the problem persists. → Replace the keypad with another one and check whether the problem persists.

[2] 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.	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. Stop the motor then change the data of the function codes.	
(2)	The data of the function codes is protected or in the password-protected state.	Check the data of function code F00 (Data Protection). → Change the data of F00 from "1" to "0." → If the inverter is in password-protected state, set the password up into F00.	
(3)	The key was not pressed.	Check whether you have pressed the key after changing the function code data. → Press the key after changing the function code data.	

6.3 If an Alarm Code Appears on the LED Monitor

■ Quick reference table of alarm codes

Alarm code	Name	Refer to	Alarm code	Name	Refer to
OE /			Er /	Memory error	6-12
OC2	Overcurrent	6-7	E-2	Keypad communications error	6-12
OC3			E-3	CPU error	6-12
OU /			E-4	Option communications error	6-13
OU2	Overvoltage	6-8	E-5	Option error	6-13
OU3			E-5	Operation error	6-13
LU	Undervoltage	6-8	Er- 7	Tuning error	6-13
<i>'</i>	Input phase loss	6-9	E-8	RS485 communications error	6-14
	Heat sink overheat	6-9	E-H	Hardware error (option detection)	6-15
	External alarm	6-10	ECF	EN circuit fault	6-15
OH3	Internal air overheat	6-10	PG	Broken wiring in the PG	6-16
	Motor protection (PTC thermistor)	6-10	Ert	CAN bus communications error	6-16
OL /	Motor overload	6-11	<i>0</i> 5	Over speed error	6-16
OLU	Inverter overload	6-11	E-E	Speed mismatching (Out of speed control)	6-17
PbF	Charger circuit fault	6-18	ΩĿ	Over torque current	6-18

[1] $D \subseteq n$ Overcurrent

Problem The inverter momentary output current exceeded the overcorrect level.

OC1 Overcurrent occurred during acceleration.

OC2 Overcurrent occurred during deceleration.

OC3 Overcorrect occurred when running at a constant speed.

Possible Causes	What to Check and Suggested Measures	
(1) The inverter output terminals were short-circuited.	Remove the wires connected to the inverter output terminals (U, V, and W) and measure the interphase resistance of the wires. Check if the resistance is too low.	
	→ Remove the part that short-circuited (including replacement of the wires, relay terminals and motor).	
(2) Ground faults occurred a the inverter output	Remove the wires connected to the inverter output terminals (U, V, and W) and perform a Megger test.	
terminals.	→ Remove the part that short-circuited (including replacement of the wires, relay terminals and motor).	
(3) Loads were too heavy.	Measure the motor current with a measuring device, and to trace the current trend. Therefore, use this information to judge if the trend is over the calculated load value for your system design.	
	→ If the load is too heavy, change the inverter for an upper size.	
	Trace the current trend and check if there are any sudden changes in the current.	
	→ Change the inverter for an upper size.	

Possible Causes		What to Check and Suggested Measures		
(4)	The acceleration/ deceleration time was too short.	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.		
		 → Increase F07, F08, and E10 to E17 (Acceleration/Deceleration Time). → Change the inverter for an upper size. 		
(5) A high intensity noise was given to the inverter.		Check if noise control measures are appropriate (e.g., correct grounding and routing of control and main circuit wires).		
		→ Take the countermeasure to noises.		
		→ Insert a surge absorber into a noise source such as an activation coil of MC or electro-magnetic solenoids.		
(6)	Invalid motor parameters set.	Check the motor parameters (P codes).		
		→ Correct the motor parameters by replacing with printed ones on the motor nameplate		

[2] ## Overvoltage

Problem The DC link bus voltage was over the detection level of overvoltage.

OU1 Overvoltage occurs during the acceleration.

OU2 Overvoltage occurs during the deceleration.

OU3 Overvoltage occurs during running at constant speed.

Possible Causes		What to Check and Suggested Measures
(1)	The power supply voltage was over the range of the inverter's specifications.	Measure the input voltage.
		→ Decrease the voltage to within that of the specifications.
(2)	A surge current entered the input power source.	If within the same power source a phase-advancing capacitor is turned ON or OFF or a thyristor converter is activated, a surge (temporary precipitous rise in voltage or current) may be caused in the input power.
		→ Install a DC reactor.
(3)	The deceleration time was too short compared with the inertia of the load.	Calculate the deceleration time from the inertia of the load and the braking torque again.
		→ Increase the deceleration time.
(4)	Braking load was too heavy.	Compare the braking torque of the load with that of the inverter.
		→ Select a minimum resistance braking resistor connectable to the inverter.
		→ Change the inverter for an upper size.
(5)	A high intensity noise was given to the inverter.	Check if noise control measures are appropriate (e.g., correct grounding and routing of control and main circuit wires).
		→ Take the countermeasure to noises.
		→ Insert a surge absorber into a noise source such as an activation coil of MC or electro-magnetic solenoids.
(6)	No connected braking resistor	Check whether the braking resistor is connected to the inverter correctly.
		→ Check the braking resistor is connected to terminals P (+) and DB correctly. Or, retighten screws/nuts.
		→ Check whether any terminal bites the wire sheath. If so correct it.

[3] LL/ Undervoltage

Problem DC link bus voltage was below the undervoltage detection level.

Possible Causes	What to Check and Suggested Measures
(1) A momentary power failure occurred.	→ Reset the alarm.

Possible Causes		What to Check and Suggested Measures
(2)	The power supply voltage did not reach the range of the inverter's specifications.	Measure the input voltage. → Increase the voltage to within that of the specifications.
(3)	Peripheral equipment for the power circuit malfunctioned, or the connection was incorrect.	To locate the peripheral equipment malfunctioned or incorrect connection, measure the input voltage. → Replace any faulty peripheral equipment or correct any incorrect connections.
(4)	Other loads were connected to the same power source and required a large current to start running to the extent that it caused a temporary voltage drop on the supply side.	Measure the input voltage and check the voltage variation. → Reconsider the power system configuration.
(5)	Inverter's inrush current caused the power voltage drop because power transformer capacity was insufficient.	Check if the alarm occurs when you switch on a molded case circuit breaker, an earth leakage circuit breaker (with overcurrent protection) or a magnetic contactor. Reconsider the capacity of the power source transformer.

[4] L n Input phase loss

Problem Input phase loss occurred, or interphase voltage unbalance rate was large.

Possible Causes		What to Check and Suggested Measures
(1)	Main circuit power input wires broken.	Measure the input voltage.
		→ Repair or replace the wires.
(2)	The terminal screws for the main circuit power input of the inverter were not tight enough.	Check if the screws on the inverter input terminals have become loose.
		→ Tighten the terminal screws to the recommended torque.
(3) Interphase unbalance rate	Measure the input voltage.	
	of three-phase voltage was too large.	→ Change the inverter for an upper size.
(4)	Overload cyclically occurred.	Measure ripple wave of DC link circuit voltage.
		→ If the ripple is large, raise the inverter capacity.

Note You can disable input phase loss protection using the function code H98.

[5] $\square H$ / Cooling fin overheat

Problem Temperature around heat sink rose.

Possible Causes	What to Check and Suggested Measures	
(1) Temperature around the inverter exceeded that of	Measure the temperature around the inverter.	
inverter specifications.	→ Lower the temperature around the inverter (e.g., ventilate the enclosure well).	
(2) Air vent is blocked.	Check if there is sufficient clearance around the inverter.	
	→ Increase the clearance.	
	Check if the heat sink is not clogged.	
	→ Clean the heat sink.	

Possible Causes	What to Check and Suggested Measures
(3) Cumulative running time of the cooling fan exceeded the standard	Check the cumulative running time of the cooling fan. → Replace the cooling fan.
period for replacement, or the cooling fan malfunctioned.	Visually check whether the cooling fan rotates abnormally. → Replace the cooling fan.
(4) Load was too heavy.	Measure the output current. → Decease F26 (Motor Sound (Carrier frequency)).

[6] ## External alarm

Problem External alarm was inputted *THR*.

(in case external alarm *THR* is assigned to one of digital input terminals [X1] through [X8], [FWD], or [REV])

Possible Causes		What to Check and Suggested Measures
(1)	An alarm function of the external equipment was activated.	Inspect external equipment operation. → Remove the cause of the alarm that occurred.
(2)	Incorrect connection.	Check if the wire for the external alarm signal is correctly connected to the terminal to which the "Trip command (External failure)" has been assigned (Any of E01, E02, E03, E04, E05, E06, E07, E08, E98, and E99 is set to "9.").
		→ Connect the wire for the alarm signal correctly.
(3)	Incorrect settings.	Check whether the "Trip command (External failure)" has not been connected to an unassigned terminal (None of E01, E02, E03, E04, E05, E06, E07, E08, E98, and E99).
		→ Correct the assignment.
		Check whether the logic assignment (normal/negative) of the external signal agrees with that of thermal command <i>THR</i> assigned by any of E01, E02, E03, E04, E05, E06, E07, E08, E98, and E99.
		→ Ensure that logic agrees each other.

[7] DH3 Inverter inside overheat

Problem The temperature inside the inverter exceeded the allowable limit.

Possible Causes	What to Check and Suggested Measures
(1) The ambient temperature exceeded the allowable limit specified for the inverter.	Measure the ambient temperature. → Lower the ambient temperature by improving the ventilation of the system enclosure or the like.

[8] ## Motor protection (PTC thermistor)

Problem Temperature of the motor rose abnormally.

Possible Causes		What to Check and Suggested Measures
(1)	Temperature around the	Measure the temperature around the motor.
	motor exceeded that of motor specifications.	→ Lower the temperature.
(2)	Cooling system for the	Check if the cooling system of the motor is operating normally.
	motor malfunctioned.	→ Repair or replace the cooling system of the motor.

Pos	ssible Causes	What to Check and Suggested Measures
(3)	Load was too heavy.	Measure the output current. → Lower the temperature around the motor. → Increase F26 (Motor Sound (Carrier frequency)).
(4)	The set operation level (H27) of the PTC thermistor for overheat protection was inadequate.	Check the thermistor specifications and recalculate the detection voltage. → Reconsider the data of function code H27 (PTC Thermistor Input (Level)).
(5)	A PTC thermistor and pull-up resistor were connected incorrectly or the resistance was inadequate.	Check the connection and the resistance of the pull-up resistor. → Correct the connections and replace the resistor with one with an appropriate resistance.
(6)	The V/f pattern did not match the motor.	Check whether data of function codes F04, F05, and P01 to P12 match the values on the nameplate on the motor. → Match the function code data to the values on the nameplate of the motor. → After the setup of P02 and P03 auto-tune the inverter for the motor by P04.
(7)	Wrong settings	Although no PTC thermistor is used, the V2/PTC switch is turned to PTC, which means that the thermistor input is active on the PTC (H26). → Set H26 (PTC Thermistor Input (Mode)) to "0" (Disable).

[9] ## / Motor overload

Problem Electronic thermal function for motor overload detection was activated.

Possible Causes	What to Check and Suggested Measures
The characteristics of electronic thermal motor protection did not match those of the motor overload.	Check the motor characteristics. → Reconsider the data of function codes F10 and F12. → Use an external thermal relay.
(2) Activation level for the electronic thermal motor protection was inadequate.	Check the continuous allowable current of the motor. → Reconsider and change the data of function code F11.
(3) Load was too heavy.	Measure the output current. → Review characteristics or properties of the machinery.

[10] 🕮 Inverter overload

Problem Temperature inside inverter rose abnormally.

Possible Causes	What to Check and Suggested Measures
(1) Temperature around the inverter exceeded that of inverter specifications.	Measure the temperature around the inverter. → Lower the temperature (e.g., ventilate the enclosure well).
(2) Load was too heavy.	Measure the output current. → Decrease F26 (Motor Sound (Carrier frequency)).
(3) Air vent is blocked.	Check if there is sufficient clearance around the inverter. → Increase the clearance.
	Check if the heat sink is not clogged. → Clean the heat sink.

Possible Causes	What to Check and Suggested Measures
(4) The service life of the cooling fan has expired or the cooling fan	Check the cumulative running time of cooling fan. → Replace the cooling fan.
malfunctioned.	Visually check that the cooling fan rotates normally.
	→ Replace the cooling fan.

[11] *Er* / Memory error

Problem Error occurred in writing the data to the memory in the inverter.

Possible Causes		What to Check and Suggested Measures
(1)	While the inverter was writing data (especially initializing data or copying data), power supply was turned OFF and the voltage for the control circuit dropped.	Check whether pressing the (RESET) key can reset the alarm after the function code data are initialized by setting the data of H03 to 1. → Return the initialized function code data to their previous settings, and restart the operation.
(2)	A high intensity noise was given to the inverter while data (especially initializing data) was being written.	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. → Improve the countermeasure to noises. Alternatively, return the initialized function code data to their previous settings, and restart the operation.
(3)	The control circuit failed.	Initialize the function code data by setting H03 to 1, and reset the alarm by pressing the (NEST) key and check that the alarm goes on. → This problem was caused by a failure of the printed circuit board (PCB) (on which the CPU is mounted). Contact your Fuji Electric representative.

[12] Err2 Keypad communications error

Problem A communications error occurred between the keypad and the inverter.

(When the inverter is running in the local mode.)

Possible Causes	What to Check and Suggested Measures
(1) Break in the communications cable or poor contact.	Check continuity of the cable, contacts and connections. → Re-insert the connector firmly. → Replace the cable.
(2) A high intensity noise was given to the inverter.	Check if appropriate noise control measures have been implemented (e.g., correct grounding and routing of control and main circuit wires). Improve the countermeasure to noises.
(3) The keypad malfunctioned.	Check that alarm Er⊇ does not occur if you connect another keypad to the inverter. → Replace the keypad.

[13] *Er-3* CPU error

Problem A CPU error (e.g. erratic CPU operation) occurred.

Possible Causes	What to Check and Suggested Measures
(1) A high intensity noise was given to the inverter.	Check if appropriate noise control measures have been implemented (e.g., correct grounding and routing of control and main circuit wires).
	→ Improve the countermeasure to noises.

[14] 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 bus option card and the inverter.	Check whether the connector on the bus option card is properly mating with the connector of the inverter. Reload the bus option card into the inverter.	
(2)	There was a high intensity noise from outside.	Check whether appropriate noise control measures have been implemented (e.g. correct grounding and routing of control and main circuit wires and communications cable). Improve the countermeasure to noises.	
(3)	Any faults is in the wiring connection between the pulse encoder and the option card.	Check whether the pulse encoder and the option card are wired each other correctly. → Wire them correctly.	

[15] Er-5 Option error

Problem Option card-related error occurs.

Possible Causes		What to Check and Suggested Measures
(1) The pulse broken.	encoder is	→ Replace the pulse encoder for new one.
(2) Wrong pul connected	se encoder is	Check whether the pulse encoding is specified within encoder specifications described in the option card instruction manual. → Replace the pulse encoder for a correct one.
connection	is in the wiring n between the oder and the d.	Check whether the pulse encoder and the option card are wired each other correctly. → Wire them correctly.

[16] ErB Run operation error

Problem You incorrectly operated the inverter.

Possible Causes	What to Check and Suggested Measures
(1) Wrong setup of multistep speed commands	Check whether all function codes of L11 to L18 (Multistep Speed Command Combination) are configured with different data each other. → Reconfigure the commands.
(2) The brake does not follow the brake command.	Check whether the brake status signal <i>BRKE</i> input agrees with the brake command <i>BRKS</i> . → Reconfigure L84 (Brake Control (Brake check time)).

[17] *Er*- 7 Tuning error

Problem Auto-tuning failed.

Pos	ssible 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. → If any contactor is inserted between the inverter and motor, turn the contactor on anytime while tuning.
(2)	V/f or the rated current of the motor was not properly set.	Check whether the data of function codes F04, F05, P02, and P03 agrees with the specifications of the motor.
motor	The rated capacity of the motor was significantly different from that of the	Check whether the rated capacity of the motor is smaller than that of the inverter by three or more orders of class or larger by two or more sizes in capacity.
	inverter.	→ Review the inverter capacity.→ Set motor parameters (P06, P07, P08, and P12) up manually.
(4)	The motor was a special type.	→ Set motor parameters (P06, P07, P08, and P12) up manually.
(5)	Wrong sequence operation.	 → Do not turn the [EN] terminal OFF while tuning. → Do not turn the run command OFF while tuning. → Do not press the weekey ON the keypad while tuning. → Do not turn the enable coast-to-stop command BX ON while tuning. → Do not turn the force to decelerate command DRS OFF while tuning.
(6)	Excessive overcurrent is flown.	Check whether any wires between the inverter and the motor is short-circuited or ground-faulted. → Remove the fault factor/s. Check whether data of function codes (F04, F05, P02, and P03) agrees with motor specifications. → Correct the mismatch data.

For details of tuning errors, refer to "Errors during Tuning" in Chapter 4, Section 4.1.3 "Preparation before running the motor for a test – Setting function code data."

[18] $\mathit{Er-B}$ RS485 communications error

Problem A communications error occurred during RS485 communications.

Pos	ssible Causes	What to Check and Suggested Measures
(1)	Conditions for communications differ between the inverter and host equipment.	Compare the settings of the y codes (y01 to y10) with those of the host equipment. Correct any settings that differ.
(2)	Even though y08 (no response error detection time) has been set, communications is not performed within the specified cycle.	Check the host equipment. → Change the settings of the host equipment software, or make the no response error detection time be ignored (y08=0).
(3)	Host equipment (e.g., PLCs and personal computers) did not operate due to incorrect settings and/or defective software/hardware.	Check the host equipment. → Remove the cause of the equipment error.
(4)	Converters (e.g., RS485 converter) did not operate due to incorrect connections and settings, or defective hardware.	Check the RS485 converter (e.g., check for poor contact). → Change the various RS485 converter settings, reconnect the wires, or replace hardware (such as recommended devices) as appropriate.
(5)	Broken communications cable or poor contact.	Check continuity of the cable, contacts and connections. → Replace the cable.
(6)	A high intensity noise was given to the inverter.	Check if appropriate noise control measures have been implemented (e.g., correct grounding and routing of control and main circuit wires). → Improve the countermeasure to noises. → Improve the countermeasure to noises on the host side. → Replace the RS485 level converter with a recommended insulated converter.

[19] ErH Hardware error (option detection)

Problem The inverter does not detect an option card.

Possible Causes	What to Check and Suggested Measures
(1) The option card is broken.	You need to replace the option card.
	→ Consult your Fuji Electric representative.

[20] ELF EN terminal circuit failure

Problem The detection circuit for EN terminal signal is broken.

Possible Causes	What to Check and Suggested Measures
(1) The circuit is broken.	You need to replace the control printed circuit board (CPCB.)
	→ Consult your Fuji Electric representative.

[21] PL PG disconnection error

Problem Any pulse encoder signal wires is broken.

Possible Causes	What to Check and Suggested Measures
(1) Any wire between the	Check whether the pulse coder is correctly connected to the option card.
pulse encoder and the option card is broken.	 → Check that the pulse encoder signals are wired to the option card's terminals specified by the instruction manual. If so, retighten the fixing screws. → Check that any terminal bites the wire sheath. If so correct it.
(2) A high intensity noise was	Check if appropriate noise control measures have been implemented (e.g.,
given to the inverter.	correct grounding and routing of control and main circuit wires).
	 → Improve the countermeasure to noises. → Separate the control wires as far from the main power wires as possible.

[22] Er-E CAN bus communications error

Problem A communications error occurred during CAN bus communication.

Possible Causes	What to Check and Suggested Measures
(1) Wrong transmission speed	Check the transmission speed consistency between the inverter (y24) and host equipment.
	→ Correct the mismatch if any.
(2) Host equipment	Review the host equipment.
malfunction in hardware, operating system, or their configuration	→ Remove or repair the error factor/s in the host equipment.
(3) Disconnection or weak connection of the	Check that cable conductivity and contact state at the connector in each counterpart.
communications cable	→ Replace the communications cable.
(4) A high intensity noise was given to the inverter.	Check if appropriate noise control measures have been implemented (e.g., correct grounding and routing of control and main circuit wires).
	→ Improve the countermeasure to noises.
	→ Improve the countermeasure to noises on the host side

[23] *0*5 Over speed error

Problem The motor runs in excess-speed (where Motor speed \geq (F03 \times 1.2))

Pos	ssible Causes	What to Check and Suggested Measures
(1)	Wrong configuration	Check relationship between set data for P01 (Motor (number of poles)) and L02 (Pulse Encoder (Resolution)).
		 → Set data of P01 up so as to agree with the motor parameter. → Set data of L02 up so as to agree with the encoder resolution.
		Check data of F03 (Maximum Speed).
		→ Set data of F03 so as to agree with the motor running speed.
	A high intensity noise was given to the inverter.	Check if appropriate noise control measures have been implemented (e.g., correct grounding and routing of control and main circuit wires).
		→ Improve the countermeasure to noises.
(3)	An external speed	Check whether signal cable from the external controller picks noises up.
	controller is used.	 → Separate the control wires as far from the main power wires as possible. → Use a shielded or twisted-pair wire for the control signal wiring connection.
		Check whether noises from the inverter affect the speed controller to malfunction.
		→ Connect a noise suppressor capacitor between the controller output terminals or pass the signal wire through a ferrite core.

[24] ErE Out of control speed

Problem An out of control error (PG failure) occurs between the speed command and the speed feedback.

Possible Causes		What to Check and Suggested Measures
(1) Wro	Wrong configuration	Check data of function code L90, L91, and L92.
		 → If the speed fluctuation is within the allowable range, then set data of L90 (PG Error Detection (Mode)) up to 0. → Widen L91 (PG Error Detection (Detection level)). → Lengthen L92 (PG Error Detection (Detection time)).
		Check relationship between set data for P01 (Motor (number of poles)) and L02 (Pulse Encoder (Resolution)).
		→ Set data of P01 up so as to agree with the motor parameter.
		→ Set data of L02 up so as to agree with the encoder resolution.
(2) Ove	erload	Measure the output current.
		→ Lower the load.
		Check whether the mechanical brake is activated.
		→ Release it.
	tput speed cannot	Check data of F44 (Current Limiter (Level)).
	rease by a reaction of current limiter.	→ Change data of F44 so as to agree with desired operations, or set it up to 999 if no speed limiting is needed.
		Check whether the V/f pattern is correctly profiled in function codes, F04 F05, and P01 to P12.
		 → Make the V/f pattern match the motor rating. → Change the V/f pattern so as to agree with the motor used.
(4) Wro	ong motor parameters	Check data of function codes, P01, P02, P03, P06, P07, P09, P10, and P12 agrees with parameters of the motor.
		→ Set P02 and P03 properly and auto-tune the inverter for the moto according to P04 data.
	s-connection of the	Check the wiring.
puls	se encoder	→ Rewire to [P0], [PA], [PB], [PZ] and [CM] terminals.
		Check whether the feedback signal from the pulse encoder is satisfied following requirements.
		 When the inverter runs with FWD command, a rising edge of [PA] is in the time fame while [PB] is kept in the high level.
		 When the inverter runs with REV command, a rising edge of [PA] is in the time frame while [PB] is kept in the low level.
		→ If not, interchange the signal wires between [PA] and [PB].
	ing has been	Check the wiring to the motor.
	connected to the motor incorrectly.	→ Connect terminals U, V, and W of the inverter to the respective U, V, and W terminals of the motor.
` regu	in of auto speed ulator (ASR) was too or small.	→ Reconfigure L36 to L39 (ASR).

[25] ## Over torque current

Problem Reference torque current became excessive.

Possible Causes		What to Check and Suggested Measures
(1)	The inverter output wiring has been disconnected.	Wiring from the inverter output terminal (U, V, and W) to the motor is confirmed with the tester.
		→ The disconnection part is removed.
		→ Check that any terminal bites the wire sheath. If so correct it.
		The magnetic contactor is set up on the output side of the inverter (the second side). Whether the magnetic contactor is driven while opened is checked.
		→ After the magnetic contactor is short-circuited, the inverter is operated.
(2)	Any wire between the pulse	Check whether the pulse coder is correctly connected to the option card.
	encoder and the option card is broken.	→ Check that the pulse encoder signals are wired to the option card's terminals specified by the instruction manual. If so, retighten the fixing screws.
		→ Check that any terminal bites the wire sheath. If so correct it.
(3)	Loads were too heavy.	Measure the motor current with a measuring device, and to trace the current trend. Therefore, use this information to judge if the trend is over the calculated load value for your system design.
		→If the load is too heavy, change the inverter for an upper size.
		Trace the current trend and check if there are any sudden changes in the current.
		→ Change the inverter for an upper size.
	The acceleration/deceleration time was too short.	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.
		→ The setting of acceleration/deceleration time is changed long.
		→ Change the inverter for an upper size.
(5)	Invalid motor parameters set.	Check the motor parameters (P codes).
		→ Correct the motor parameters by replacing with printed ones on the motor nameplate
(6)	The magnetic pole position is wrong.	→ Tuning the magnetic pole position.(L03)

For the magnetic pole position tuning refer to the instruction manual of the option.

[26] PbF Charger circuit fault (37 kW or above (400 V Series))

Problem The magnetic contactor for short-circuiting the resistor for charging failed to work.

Possible Causes	What to Check and Suggested Measures	
Control power was not supplied to the magnetic contactor intended for short-circuiting the charging resistor.	Whether the power supply is connected with auxiliary power input terminals (R0, T0) is confirmed. → It wires correctly. (Refer to Chapter 2) → Check that any terminal bites the wire sheath. If so correct it.	
	The voltage of the auxiliary power input terminals is measured, and whether power switching connectors [CN UX] is correctly connected is confirmed. (37 kW or above (400V series)) Power switching connectors [CN UX] is correctly connect. (Refer to Chapter 2)	

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

[1] --- (center bar) appears

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

Possible Causes	What to Check and Suggested Measures				
(1) Connection to the keypad was in weak connection.	Prior to proceed, check that pressing the key does not take effect for the LED display. Check connectivity of the extension cable for the keypad used in remote operation. Replace the cable.				

[2] ____ (under bar) appears

Problem	An under bar () appeared on the LED monitor when you pressed the we key or the
	key or entered a run forward command <i>FWD</i> or a run reverse command <i>REV</i> . The motor did not
	start.

Possible Causes	What to Check and Suggested Measures				
(1) The voltage of the DC link bus was low.	Select Menu 5 "Maintenance Information" in Programming mode on the keypad, and check the voltage of the DC link bus, which should be: 400 VDC or below for 3-phase 400V.				
	→ Connect the inverter to a power supply that meets its input specifications.				
(2) The main power is not ON,	Check that the main power is turned ON.				
while the auxiliary input power to the control circuit is supplied.	→ If it is not ON, turn it ON.				

Chapter 7 MAINTENANCE AND INSPECTION

Perform daily and periodic inspection to avoid trouble and keep reliable operation for a long time. Take care of the following items during work.

↑ WARNING

 Before starting inspection, turn the power OFF. For the inverters with a capacity of 22 kW or below, wait at least 5 minutes; for those with a capacity of 30 kW or above, wait at least 10 minutes. Further, check that the charge lamp is unlit and make sure that the DC link bus voltage between the terminals P (+) and N (-) has dropped below the safe voltage level (25 VDC) using a multimeter or a similar instrument.

Electric shock may occur.

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

Electric shock or injuries could occur.

7.1 Daily Inspection

Visually inspect errors in the state of operation from the outside without removing the covers while the inverter operates or while it is turned ON.

- Check if the expected performance (satisfying the standard specification) is obtained.
- Check if the surrounding environment satisfies Chapter 2, Section 2.1 "Operating Environment."
- Check for abnormal noise, odor, or excessive vibration.
- Check for traces of overheating, discoloration and other defects.

7.2 Periodic Inspection

Perform periodic inspection by following the items of the list of periodic inspection in Table 7.1. Before performing periodic inspection, be sure to stop the motor, turn OFF the inverter, and shut down power supply. Then remove the covers of the control and main circuit terminal blocks.

Table 7.1 List of Periodic Inspections

Check part	Check item	How to inspect	Evaluation criteria	
Environment	Check the ambient temperature, humidity, vibration and atmosphere (dust, gas, oil mist, or water drops).	Check visually or measure using apparatus.	The standard specification must be satisfied.	
	 Check if tools or other foreign matter or dangerous objects are left around the equipment. 	Visual inspection	No foreign or dangerous objects are left.	
Voltage	Check if the voltages of the main and control circuit are correct.	Measure the voltages using a multimeter or the like.	The standard specification must be satisfied.	

Table 7.1 Continued

(Check part	Check item	How to inspect	Evaluation criteria	
	icture such irame and er	1) Abnormal noise and excessive vibration 2) Loose screws (tightened parts) 3) Deformation and breakage 4) Discoloration and deformation caused by overheat 5) Check for foulness and dust.	1) Visual or hearing inspection 2) Retighten. 3), 4), 5) Visual inspection	1), 2), 3), 4), 5) No abnormalities	
	Common	1) Check if bolts and screws are tight and not missing. 2) Check the devices and insulators for deformation, cracks, breakage and discoloration caused by overheat and deterioration. 3) Check for foulness and dust.	Retighten. (2), 3) Visual inspection	1), 2), 3) No abnormalities	
	Conductor and wire	Check the conductor for discoloration and distortion caused by overheat. Check the sheath of the cable for cracks and discoloration.	1), 2) Visual inspection	1), 2) No abnormalities	
ircuit	Terminal block	Check that the terminals are not damaged.	Visual inspection	No abnormalities	
Main circuit	Filtering capacitor	1) Check for electrolyte leakage, discoloration, cracks and swelling of the case. 2) Check if the safety valve does not protrude remarkably. 3) Measure the capacitance if necessary.	1),2) Visual inspection 3) Measure discharge time with capacitance probe.	1),2) No abnormalities 3) The discharge time is not shorter than time specified by the replacement manual.	
	Magnetic contactor and relay	Check for chatters during operation. Check for rough contacts.	Hearing inspection Visual inspection	1), 2) No abnormalities	
Control circuit	Printed circuit board	1) Check for loose screws and connectors. 2) Check for odor and discoloration. 3) Check for cracks, breakage, deformation and remarkable rust. 4) Check the capacitors for electrolyte leaks and deformation.	Netighten. Smelling and visual inspection Netight Netight	1), 2), 3), 4) No abnormalities	
Cooling system	Cooling fan	Check for abnormal noise and excessive vibration. Check for loose bolts. Check for discoloration caused by overheat.	Hearing and visual inspection, or turn manually (be sure to turn the power OFF). Retighten. Visual inspection	1) Smooth rotation 2), 3) No abnormalities	
	Ventilation path	Check the heat sink, intake and exhaust ports for clogging and foreign matter.	Visual inspection	No abnormalities	

If the inverter is stained, wipe it off with a chemically neutral cloth to remove dust, use a vacuum cleaner.

7.3 List of Periodical Replacement Parts

Each part of the product has its own service life that will vary according to the environmental and operating conditions. It is recommended that the following parts be replaced as specified below.

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

Table 7.2 Replacement Parts

	Standard replacement intervals			
DC link bus capacitor	7 years			
Electrolytic capacitor or	n the printed circuit board	7 years		
Cooling fan	200V series 22kW or below or 400V series 30kW or below	4.5 years		
	400V series 37kW or above	2.5 years		

(Note) These replacement intervals are based on the estimated service life of the inverter at an ambient temperature of 40°C in 80% of the rated RMS current. In environments with an ambient temperature above 40°C or a large amount of dust or dirt, the replacement intervals may need to be reduced.

7.3.1 Judgment on service life

(1) Viewing data necessary for judging service life; Measurement procedures

Through Menu 5 "Maintenance Information" in Programming mode, you can view on the optional multi-function keypad (option) various data (as a guideline) necessary for judging whether key components such as the DC link bus capacitor, the electrolytic capacitor on the printed circuit board, and the cooling fan are approaching their service life.

①-1 Measuring the capacitance of the DC link bus capacitor (in comparison with that at factory shipment)

Measure the capacitance of the DC link bus capacitor according to the procedure given below. The result will be displayed on the keypad as a ratio (%) to the initial capacitance at the time of factory shipment.

------ Procedure for measuring capacitance ------

- 1) To ensure validity in the comparative measurement, configure the condition of the inverter as follows.
 - 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).
 - If the multi-function keypad is mounted, remove it.
 - Turn OFF all the digital input signals fed to terminals [FWD], [REV], [EN], and [X1] through [X8] of the
 control circuit.
 - If the encoder is wired at terminals (P0, PA, PB, and PZ (if any)), remove it..
 - If an external apparatus is attached to terminal [PLC], disconnect it.
 - Ensure that transistor output signals ([Y1] [Y4]) and relay output signals ([Y5A/C] and [30A/B/C]) will not be turned ON.

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 ambient temperature within 25 ±10°C.
- 2) Switch ON the main circuit power.
- 3) Confirm that the cooling fan is rotating and the inverter is in stopped state.
- 4) Switch OFF the main circuit power.
- 5) Mount the multi-function keypad after five minutes having elapsed, switch ON the main circuit power again.
- 6) Select Menu 5 "Maintenance Information" in Programming mode and note the reading (relative capacitance (%) of the DC link bus capacitor).

1 -2 Measuring the capacitance of the DC link bus capacitor (during power-off time under ordinary operating condition)

In general, the discharging condition of the DC link bus capacitor during a power-off time under the ordinary operating condition at the end user's installation is different from that under which the initial measurement is conducted at the time of factory shipment. As a result, the measured data for the DC link bus capacitor may not be updated. A method is provided, therefore, that allows you to measure the capacitance of the DC link bus capacitor during an ordinary power-off time by taking on (assuming) its discharging condition during a power-off time under the ordinary operation condition at the end user's installation.

Presented below is the procedure for taking on the discharging condition during a power-off time under the ordinary operating condition at the end user's installation.

-----Procedure for setting up measurement condition ------

- 1) Set function code H98 (Maintenance function) to enable the user to specify the judgment criteria for the service life of the DC link bus capacitor (Bit 3) (refer to function code H98).
- 2) Place the inverter in stopped state.
- 3) Place the inverter in the state of power-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) Switch OFF the inverter.
 - Measure the discharging time of the DC link bus capacitor and save the result in function code H47 (Initial Capacitance of DC Link Bus Capacitor).
 - The condition under which the measurement has been conducted will be automatically collected and saved. During the measurement, "...." will appear on the LED monitor.
- 6) Switch 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. Move 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. Check whether there has been any mistake in operation and conduct the measurement again.

To change the settings back to the state at the time of factory shipment, set H47 (Initial Capacitance of DC Link Bus Capacitor) to "0002"; the original values will be restored.

Hereafter, each time the inverter is switched OFF, the discharging time of the DC link bus capacitor is automatically measured if the above condition is met.

Note

The condition given above produces a rather large measurement error. If this mode gives you a lifetime alarm, set H98 (Protection/Maintenance Function) back to the factory defaults (Bit 3 (Select life judgment criteria of DC link bus capacitor) = 0) and conduct the measurement under the condition at the time of factory shipment.

Electrolytic capacitor on the printed circuit board

Move to Menu 5 "Maintenance Information" in Programming mode and check the accumulated run time of the electrolytic capacitor on the printed circuit board. This value is calculated from the cumulative total number of hours a voltage has been applied on the electrolytic capacitor, adjusted with ambient temperature, and is used as the basis for judging whether it has reached its service life. The value is displayed on the LED monitor in units of 1 hour.

3 Cooling fan

Select Menu 5 "Maintenance Information" and check the accumulated run time of the cooling fan. The inverter accumulates hours for which the cooling fan has run. The display is in units of 1 hour. The accumulated time should be used just a guide since the actual service life will be significantly affected by the temperature and operation environment.

(2) Early warning of lifetime alarm

For the components listed in Table 7.3, you can get an early warning of lifetime alarm 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 conditions listed under the "Judgment level" column has been exceeded.

Table 7.3 Criteria for Issuing a Lifetime Alarm

	Parts to be replaced	Judgment level			
DC link bus cap	pacitor	85% or lower of the capacitance than that of the factory setting			
Electrolytic cap	acitor on the printed circuit board	61000 hours or longer as accumulated run time			
Cooling fan	200V series 22kW or below or 400V series 30kW or below	Accumulated run time ≥ 40000 hours*1			
	400V series 37kW or above	Accumulated run time ≥ 22000 hours*1			

^{*1 (}estimated service life at the inverter's ambient temperature of 40°Cin 80% of the rated RMS current)

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) include 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 calculate in the following formula.

■ Three-phase input

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	In	put (primary) sic	de	Outp	DC link bus voltage (P (+)-N (-))		
Waveform	Voltage Current			Voltage Current			
Name of meter	Ammeter AR, As, At			Ammeter Au, Av, Aw	Voltmeter Vu, Vv, Vw	Wattmeter Wu, 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	₩	**	_		_		A



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.

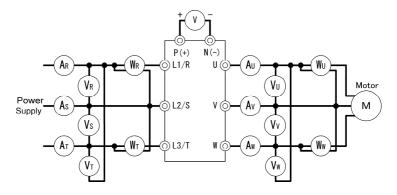


Figure 7.1 Connection of Meters

7.5 Insulation Test

Because an insulation test is made in the factory before shipment, avoid a Megger test.

If a Megger test is unavoidable, follow the procedure below. Because a wrong test procedure will cause breakage of the inverter, take sufficient care.

A dielectric strength test will cause breakage of the inverter similarly to the Megger test if the test procedure is wrong. When the dielectric strength test is necessary, contact 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 during measurement.
- 2) If the test voltage leaks to the control circuit due to the wiring, disconnect all the control wiring.
- 3) Connect the main circuit terminals with a common cable 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 terminal (G).
- 5) 5 MΩ (1 MΩ for the EMC filter built-in type of inverters) or a larger value displayed at the Megger indicates a correct state. (The value is for a discrete inverter.)

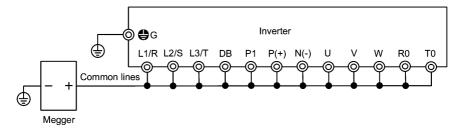


Figure 7.2 Megger Test

(2) Dielectric strength test of control circuit

Do not perform a Megger test or dielectric strength test for the control circuit. Prepare 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. 1 M Ω or a larger measurement indicates a correct state.

(3) Dielectric strength test of external main circuit and sequence control circuit

Disconnect all the inverter terminals so that the test voltage is not applied.

7.6 Inquiries about Product and Guarantee

(1) When making an inquiry

Upon breakage of the product, uncertainties, failure or inquiries, report the following information to your Fuji Electric representative.

- 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) Date of purchase
- Inquiries (for example, point and extent of breakage, uncertainties, failure phenomena, and other circumstances)

(2) Product warranty

The term of product warranty is one year after the purchase or 24 months from the month and year of production specified on the nameplate, whichever comes first. However, the product will not be repaired free of charge in the following cases, even if the warranty term has not expired.

- 1) The cause includes incorrect usage or inappropriate repair or modification.
- 2) The product is used outside the standard specified range.
- 3) The failure is caused by dropping, damage or breakage during transportation after the purchase.
- 4) The cause is earthquake, fire, storm or flood, lightening, excessive voltage, or other types of disaster or secondary disasters.

Chapter 8 SPECIFICATIONS

8.1 Standard Models

8.1.1 Three-phase 200 V class series

Item							Specific	cations		
Type FRNLM1S-2_□■ *10					5.5	7.5	11	15	18.5	22
Nominal applied motor *1 [kW]					5.5	7.5	11	15	18.5	22
2 1 1 2 2 1 1 1 2					10.2	14	18	24	28	34
iji		d voltage *3 [V			Three-pha	se 200V-2	40V,50/60	Hz		
<u> </u>		d current *4 [A]			27.0	37.0	49.0	63.0	74.0	90.0
brt		load capacity			54.0	74.0	98.0	126.0	148.0	180.0
Output ratings		nissible energ			(10s)	(10s)	(10s)	(10s)	(10s)	(5s)
Ľ.	Rate	d frequency [F			50, 60Hz					
	_	Main power Phases, Volt	age,Freque		Three-pha	ase, 200 to	240V, 50/	60Hz		
	ratior	Auxiliary cor Phases,Volt			0 1		240V, 50/			
	Normal operation	Voltage/freq	uency varia	tions*8		·10 to -15% y: +5 to -5%		unbalance	: 2% or les	s *5),
gs	E.	Rated currer	o+ *6 [A]	with DCR	21.1	28.8	42.2	57.6	71.0	84.4
ati I	Nor	Rated curren	iii [A]	without DCR	31.5	42.7	60.7	80.1	97.0	112
Input ratings		Required power supply capacity *7 [kVA]			7.4 10 15 20 25 30					
드		Main power supply			DC 24V or more in the direct current voltage conversion.					
	Ē	Auxiliary control	Phases, \ Frequence		Single-phase, 200 to 240V, 50/60Hz					
	Battery operation	power input *12	Voltage/fr variations	equency	Voltage: +10 to -15%, Frequency: +5 to -5%					
	BB op	Operation tir	me ^{*13} [s]		180					
	Braki	ing time*14 [s]			60					
Бu	Braki	ing duty-cycle	(%ED)*14 [9	%]	50					
Braking		d regenerative	· ·	-	4.4	6.0	8.8	12	14.8	17.6
	Minimum resistance which can be connected $[\Omega]^{-9}$				15	10	7.5	6	4	3.5
DC Re	DC Reactor (DCR)					•			•	
Applicable safety standard					EN61800-	5-1:2003,	EN954-1 C	Category3 *	15	
Enclosure (IEC60529)					IP20	<u> </u>		<u> </u>		
	Cooling method					ng				
	t/Mass				5.7	5.9	7.4	11.0	11.3	11.8
		tandard motor								

1) Fuji's 4-pole standard motor

- *2) Rated capacity is calculated by regarding the output rated voltage as 220V for three-phase 200V series.

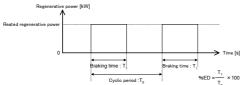
 3) Output voltage cannot exceed the power supply voltage.

 4) It is a value in the condition of the career frequency 10kHz and the ambient temperature 45°C. Select the inverter capacity such that the square average current in cycle operation is 80% or less of the rated current of an inverter.
- *5) Voltage unbalance [%] = (Max. voltage [V] Min. voltage [V])/ Three-phase average voltage [V] x 67 (IEC61800-3)
- *6) The power supply capacity is 500kVA (ten times the inverter capacity when the inverter capacity exceeds 50kVA), and the calculation value when connecting with the power supply of %X=5%.
- *7) Obtained when a DC Reactor is used.
- *8) An acceptable variation of the main power supply and the control power supply assistance input.
- *9) The admissible error of minimum resistance is ±5%
- *10) Type List

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

A box () in the above table replaces A for the inverter without a CAN port

- *12) The same AC power as the main power supply input is connected for the backup of the control circuit power source.
- *13) It is a value in the condition of the career frequency 10kHz and the ambient temperature 45°C. Use the inverter such that the square average current in battery operation is 80% or less of the rated current of an inverter.
- *14) Braking time and duty cycle (%ED) are defined by cycle operation at the rated regenerative power as shown in the figure below.



^{*15)} The inverter that last 2 digits of a software version are from 50 to 99 corresponds to this standard.

8.1.2 Three-phase 400 V class series

Item									Specif	ications				
Type FRNLM1S-4_□■ 10					4.0	5.5	7.5	11	15	18.5	22	30	37	45
Nominal applied motor [kW]					3.7 6.8	5.5	7.5	11	15	18.5	22	30	37	45
S		Rated capacity *2 [kVA]				10.2	14	18	24	29	34	45	. 57	69
Output ratings	Rat	ed voltage *	³ [V]		Three-	phase 38	80V-480V	, 50/60H	z			Three-p 380V-4	phase 60V, 50	/60Hz
± .	Rat	ed current [*]	¹ [A]		9.0	13.5	18.5	24.5	32.0	39.0	45.0	60.0	75	91
효		rload capad			18.0	27.0	37.0	49.0	64.0	78.0	90.0	108	135	163
Ō		rmissible er		ime)	(3s)	(10s)	(10s)	(10s)	(10s)	(10s)	(10s)	(5s)	(5s)	(5s)
	Rat	ed frequence Main pow			50, 60H	1Z								-
		Phases,V		equency	Three-	phase, 3	80 to 480	V, 50/60	Hz					
	Normal operation	Auxiliary control power input *12 Phases, Voltage, Frequency					00 to 480						Single- 380 to 50/60H	
	Voltage/frequency variations *8				Freque	ncy: +5 t		ŭ		2% or le	,-			
Sc	Ĕ	Rated cur	rent *6	with DCR	7.5	10.6	14.4	21.1	28.8	35.5	42.2	57.0	68.5	83.2
ratin	Š	[A]		without DCR	13	17.3	23.2	33	43.8	52.3	60.6	77.9	94.3	114
Input ratings		Required power supply capacity ₇ [kVA]			5.2	7.4	10	15	20	25	30	40	48	58
-		Main pow	er supply		DC 48\	or more	e in the d	irect curr	ent volta	ge conve	rsion.			
	uc	Auxiliar y	Phases uency	,Voltage,Freq	Single-phase, 200 to 480V, 50/60Hz						Single- 380 to 50/60H	480V,		
	Battery operation	power input*12	Voltage variation	/frequency	Voltage	e: +10 to	-15%, Fr	equency	+5 to -5	%				
	g g	Operation	time*13 [s	1					1	80				
	Bra	king time ^{*14}		-					6	30				
<u>6</u>		king duty-cy)*14 [%]					ţ	50				
Braking	Rat	ed regenera	ative power	er ^{*14} [kW]	3.2	4.4	6.0	8.8	12	14.8	17.6	24	29.6	36
ш		imum resist nected $[\Omega]$		ch can be	96	64	48	24	24	16	16	10	10	8
DC F	DC Reactor (DCR)			Option										
Appli	Applicable safety standard			EN61800-5-1:2003, EN954-1 Category3 *15					EN618 1:2003					
Enclo	osure	(IEC60529)			IP20 IP00									
Cooli	ing me	ethod			Fan co	oling						•		
Weig	ht/Ma	ss [kg]			3.0	5.6	5.7	7.5	11.1	11.2	11.7	24	33	34

*1) Fuji's 4-pole standard motor

*2) Rated capacity is calculated by regarding the output rated voltage as 440V for three-phase 400V series.
*3) Output voltage cannot exceed the power supply voltage.

*4) It is a value in the condition of the career frequency 10kHz and the ambient temperature 45°C. Select the inverter capacity such that the square average current in cycle operation is 80% or less of the rated current of an inverter.

*5) Voltage unbalance [%] = (Max. voltage [V] - Min. voltage [V])/ Three-phase average voltage [V] x 67 (IEC61800-3)

*6) The power supply capacity is 500kVA (ten times the inverter capacity when the inverter capacity exceeds 50kVA), and the calculation value when connecting with the power supply of %X=5%.

*7) Obtained when a DC Reactor is used.
*8) An acceptable variation of the main power supply and the control power supply assistance input.
*9) The admissible error of minimum resistance is ±5%.

*10) Type List A box () in the above table replaces C, E, A or J depending on the shipping destination.

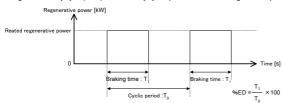
A box () in the above table replaces A for the inverter without a CAN port

*11) It is necessary to change the power-supply voltage change connector on the power supply printed wiring board depend on the power-supply voltage. *12) 30kW or less

The same AC power as the main power supply input is connected for the backup of the control circuit power source. 37kW or more

The same AC power as the main power supply input is connected for the control circuit, the fan, and the contactor. The inverter doesn't operate if the power supply is not input to the auxiliary control power input. Please supply power.

- *13) It is a value in the condition of the career frequency 10kHz and the ambient temperature 45°C. Use the inverter such that the square average current in battery operation is 80% or less of the rated current of an inverter.
- *14) Braking time and duty cycle (%ED) are defined by cycle operation at the rated regenerative power as shown in the figure below.



^{*15)} The inverter that last 2 digits of a software version are from 50 to 99 corresponds to this standard

8.1.3 Single-phase 200 V class series

Item			em		Specifications
	Type FRNLM1S-7□■ *9				2.2
Non	Nominal applied motor *1 [kW]				2.2
2 1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2					4.1
ij		ed voltage *3			Three -phase 200V-220V, 50/60Hz
t a		ed current *4			11
Output ratings		rload capaci		\	22
Ö		missible ene		ie)	(3s) 50, 60Hz
-	Nate	Main powe	• •		50, 00112
	<u>_</u>	Phases,Vo		quency	Single -phase, 200 to 240V, 50/60Hz
	eratic	Auxiliary c Phases,Vo			Single-phase, 200 to 240V, 50/60Hz
	ф	Voltage/fre	equency va		Voltage: +10 to -15% ,Frequency: +5 to -5%
တ္သ	nal	Phases, Voltage, Frequency Auxiliary control power input Phases, Voltage, Frequency Voltage, Frequency **The state of the			17.5
ij	Norr				24
nput ratings		Required power supply capacity -6 [kVA]		ply capacity _{*6}	3.5
Ξ		Main powe			DC 24V or more in the direct current voltage conversion.
	uo	Auxiliary control	Phases, ency	Voltage,Frequ	Single-phase, 200 to 240V, 50/60Hz
	Battery operation	power input *10	Voltage/ variation	frequency is	Voltage: +10 to -15%, Frequency: +5 to -5%
	МБ	Operation	time*11 [s]		180
	Brak	ing time ^{*12} [s]		60
Б	Brak	ing duty-cyc	cle (%ED)	¹² [%]	50
Braking	Rate	ed regenerat	ive power	¹² [kW]	1.76
В	Minimum resistance which can be connected [Ω] *8		can be	33	
DC R	DC Reactor (DCR)			Option	
Appli	Applicable safety standard			EN61800-5-1:2003, EN954-1 Category3	
Enclo	Enclosure (IEC60529)				IP20
Cooli	ng me	thod			Fan cooling
Weig	ht/Mas	ss [kg]			3.0
*4\ F	1) Fuji's 4-nole standard motor				

*1) Fuji's 4-pole standard motor

*2) Rated capacity is calculated by regarding the output rated voltage as 220V.

*3) Output voltage cannot exceed the power supply voltage.

*4) It is a value in the condition of the career frequency 10kHz and the ambient temperature 45°C. Select the inverter capacity such that the square average current in cycle operation is 80% or less of the rated current of an inverter.

*5) The power supply capacity is 500kVA (ten times the inverter capacity when the inverter capacity exceeds 50kVA), and the calculation value when connecting with the power supply of %X=5%.

*6) Obtained when a DC Reactor is used.

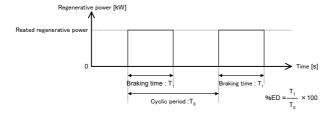
*7) An acceptable variation of the main power supply and the control power supply assistance input.

*8) The admissible error of minimum resistance is ±5%.

*9) Type List A box (□) in the above table replaces C, E, A or J depending on the shipping destination.

A box (■) in the above table replaces A for the inverter without a CAN port

- *10) The same AC power as the main power supply input is connected for the backup of the control circuit power source.
- *11) It is a value in the condition of the career frequency 10kHz and the ambient temperature 45°C. Use the inverter such that the square average current in battery operation is 80% or less of the rated current of an inverter.
- *12) Braking time and duty cycle (%ED) are defined by cycle operation at the rated regenerative power as shown in the figure below.



8.2 Common Specifications

	Item			Description		Remarks			
Cor	ntrol system	Vector control with PG Vector control with PG Torque vector control ((for a sy		otor)	*1)			
	Max. speed	120 Hz (3600 r/min for 4-pole motor) in the equivalent frequency Pulse encoder frequency: 100 kHz max. 15 kHz or more recommended at the maximum speed							
lo	Controllable range	0 to 120 Hz (0 to 3600	r/min fo	r 4 pole motor) in the equivalent fi	requency				
Speed control	Control accuracy	Multistep speed comma	and/via-	. speed (ambient temp. within 25 communications command: x. speed (ambient temp. within -1	,				
S	Setting resolution	Analog setting: Multistep speed comm Via-communications co		1/1000 of max. speed 0.01 Hz in the equivalent invert (99.99 Hz or less), 0.1 Hz (100. 1/20000 at the max. speed or 0 the equivalent inverter output fr	0 to 120.0 Hz) .01 Hz (fixed) in				
		Terminal command: Rualarm, etc.	ın forwa	rd/reverse, coast-to-stop, externa	l alarm, reset				
	Start/stop	Link operation: Operati	on by R	S485 or CAN bus communication	s link				
	Statustop	Note Before to procee	Key operation: Start and stop with (ww) / (REV) / (STOP) keys. Note Before to proceed to running with these keys switch the mode from Remote to Local using the multi-function keypad.						
	Carrier frequency	Data: Variable within 5 to 16 kHz Note The carrier frequency may drop automatically according to the ambient temperature or output current to protect the inverter. This protective operation can be canceled by function code H98.							
		Multistep speed command source: Combination of 3 terminal command (8 steps)							
ty	Speed	Can be set with external voltage/current input. • 0 to ±10 VDC/0 to ±100% (terminal [12], [V2]) • 4 to 20 mA DC/0 to 100% (terminal [C1])							
facili	command	Link operation: Available for RS485 and CAN bus communications link.							
Control facility		Key operation: Can be Note Before to procee to Local using the	d to runr	ning with these keys switch the m	ode from Remote				
		Operation		Customizing feature	Miscellaneo	us			
	Features and commands	Force to stop, Soft start Concurrent application of S-curved accel./decel. pattern + Accel./decel. time + Multistep frequency commands Continue-to-run at the stop frequency Torque control Creep-less operation Buttery drivable Unbalance load		Run command/detected speed assented timer Multistep speed command/detected speed assented timer Digital input/output logic inversion Disable accel./decel. Processing function Command source format switching of the speed controller Digital/analog torque biasing	Feed-forward com of the speed contr Oscillation suppre observer Motor parameter t Magnet pole angle tuning Password protecti etc.	oller ssion uning e offset			
Environ- ment	Environment.		rage Er	nvironment" and Chapter 2, Sec					

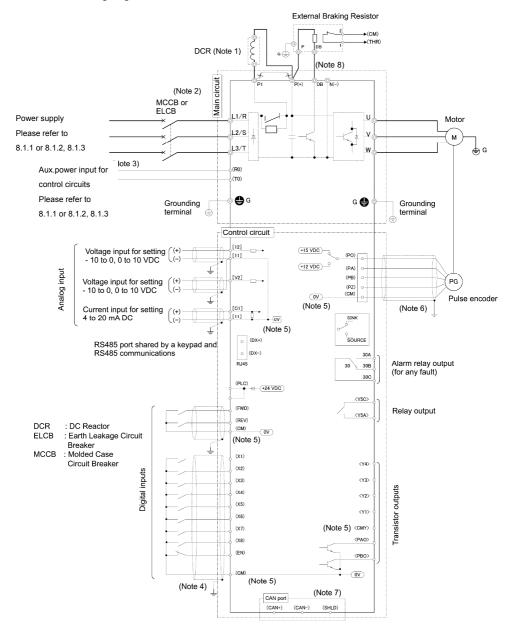
^{*1)} Torque vector control is available from 4.0kW to 22kW of 400 V series. Please don't use it with other products.

8.3 Terminal Specifications

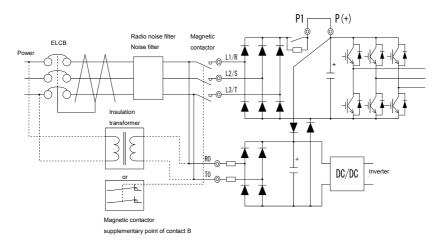
8.3.1 Terminal functions

For details about the main and control circuit terminals, refer to Chapter 2, Sections 2.3.6 and 2.3.7 (Table 2.12), respectively.

8.3.2 Basic wiring diagram



- (Note 1) When connecting a DC reactor (DCR), first remove the short bar between terminals P1 and P(+),
- (Note 2) To protect wiring, insert a molded case circuit breaker (MCCB) or an earth leakage circuit breaker (ELCB) (with overcurrent protection) of the type recommended for the inverter between the commercial power supply and the inverter. Do not use a circuit breaker with a capacity exceeding the recommended capacity.
- (Note 3) Connect this pair of wires to terminals [R0] and [T0] if you want the inverter to stay in standby state, with only its control circuit being active, when the main circuit power supply is open (cut off). Without this pair of wires connected to these terminals, you can still run the inverter as long as the main wires of the commercial power supply to the main circuit are properly connected. Connect terminal [R0] and [T0] with the output side on earth leakage circuit breaker when you connect earth leakage circuit breaker. When you connect terminal [R0] and [T0] with the input side of on earth leakage circuit breaker, an earth leakage circuit breaker malfunctions. Connect insulation transformer or supplementary point of contact B with the position shown in the figure below whenever you connect [R0] and [T0] with the input side of an earth leakage circuit breaker.



- (Note 4) For the wiring of the control circuit, use shielded or twisted wires. When using shielded wires, connect the shields to earth. To prevent malfunction due to noise, keep the control circuit wires as far away as possible from the main circuit wires (recommended distance: 10 cm or longer), and never put them in the same wire duct. Where a control circuit wire needs to cross a main circuit wire, route them so that they meet at right angles.
- (Note 5) Common terminals [11], [CM] and [CMY] for the control input/output circuits are insulated each other.
- (Note 6) Use a shielded sheath cable to wire the control signals. Process and terminate correctly the shielded sheath ends according to wiring state and specifications of the pulse encoder or host equipment. The figure in this section illustrates an example for the cable's shielded sheath grounding where the shielded sheath end is connected to the grounding wire of the motor and another end is opened at the inverter side. If the inverter malfunctions due to noises p i c k e d up by the signal cable, connecting the inverter end of the shielded sheath to the inverter's [CM] terminal may reduce the noise affection. When the wiring between the encoder and the inverter is long, the allophone and the torque ripple might be generated because the signal from the encoder malfunctions by interfering with A phase and B phase. In this case, please execute measures such as; wiring shorter cable, cable of smaller electrostatic capacity, etc.
- (Note 7) A CAN port is provided on the FRN□□□LM1S-□C, -□E, -□A and -□J, not on the FRN□□□LM1S-□EA, -□AA or -□JA.
- (Note 8) Please connect it according to the drawing when you wire for the braking resistance. There is a possibility that charge resistance and an inverter internal parts are damaged when miss wiring.

ACAUTION

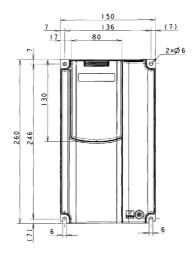
· Please connect it according to the drawing when you wire for the braking resistance.

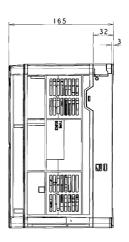
Fire or accident could occur.

8.4 External Dimensions

8.4.1 Standard models

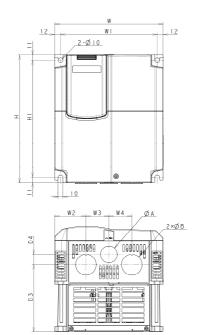
Unit: mm

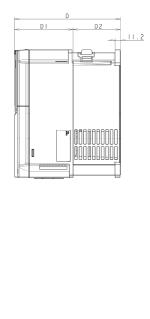






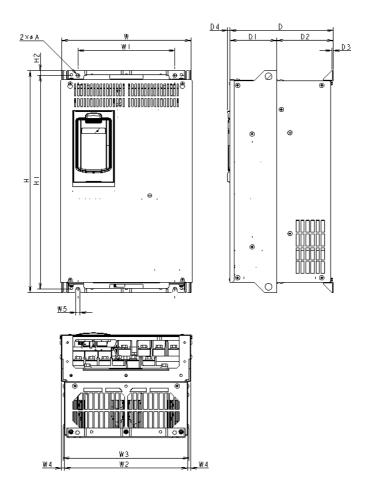
FRN2.2LM1S-7□ FRN4.0LM1S-4□





Power	_						Dir	mensio	ns (mr	n)					
supply voltage	Туре	W	W1	W2	W3	W4	Н	H1	D	D1	D2	D3	D4	φА	φВ
	FRN5.5LM1S-2□				46.5	46.5 26		238					21	0.4	
Three-	FRN7.5LM1S-2□	220	196	63.5			260			118.5	96.5	136.7			
	FRN11LM1S-2□								215						42
phase 200 V	FRN15LM1S-2□								215					34	42
	FRN18.5LM1S-2□	250	226	67	58	58	400 378	378		85 1	130	166.2	2		
	FRN22LM1S-2□														
	FRN5.5LM1S-4□														
	FRN7.5LM1S-4□	220	196	63.5	46.5	46.5	260	238		118.5	96.5	136.7	21		
Three- phase 400 V	FRN11LM1S-4□								045					34	42
	FRN15LM1S-4□		226 67		58	58	400	378	215					34	42
	FRN18.5LM1S-4□	250		67						85	130	166.2	2		
	FRN22LM1S-4□														

Note: A box (\square) in the above table replaces C (China), E (EU), A (Asia) or J (Japan) depending on the shipping destination.



Power	Time	Dimensions (mm)														
supply Type voltage		W	W1	W2	W3	W4	W5	H1	H1	H2	D	D1	D2	D3	D4	φА
Three-	FRN30LM1S-4□	320	240	304	310.2			550	500		255		140			
phase	FRN37LM1S-4□	255	075	220	245.2	8	10	550	530	12	070	115	455	4	6	10
400 V	FRN45LM1S-4□	355	275	339	345.2			615	595		270		155			

Note: A box (\Box) in the above table replaces C (China), E (EU), A (Asia) or J (Japan) depending on the shipping destination.

8.5 Protection Features

Name	Description		LED monitor displays *1	Alarm output [30A/B/C]
Overcurrent protection	The inverter is stopped for protection against overcurrent caused by an overload.	OC /	Yes	
Short circuit protection	The inverter is stopped for protection against overcurrent caused by a short circuit in the output circuit.			
		During deceleration	OC2	
Grounding fault protection	The inverter is stopped for protection against overcurrent caused by a grounding fault in the output circuit. If the power supply is turned on with the grounding fault, the protection may be invalidated.	During running at constant speed	<i>0</i> C3	
Overvoltage protection	An excessive voltage (400 VDC for the 200 V class series, 800 VDC for the 400 V class series) in the DC link circuit is	During acceleration	OU I	Yes
	detected and the inverter is stopped. If a remarkably large voltage is applied by mistake, the protection cannot be made.	During deceleration	OU2	
		During running at constant speed (Stopped)	OU3	
Undervoltage protection	Stops the inverter output when the DC link bus voltage undervoltage level (200 VDC for the 200 V class series, 400 class series).		LU	Yes*2
	When the inverter is driven by a battery power, however, undervoltage alarm detection and is to output no alarm signal.	er, it disables an		
Input phase loss protection	Detects input phase loss, stopping the inverter output. This func inverter from undergoing heavy stress that may be caused by in inter-phase voltage unbalance and may damage the inverter. If connected load is light or a DC reactor is connected to the in will not detect input phase loss if any.	put phase loss or	در ک	Yes*2
Overheating protection	,			Yes
	The temperature inside the inverter unit in the event of cooli overload is detected to stop the inverter.	ng fan trouble and	OH3	Yes
External alarm input	With the digital input signal <i>THR</i> , the inverter is stopped as for		Yes	
Abnormal condition in charger circuit	Upon detection of an abnormal condition in the charger circuit this function stops the inverter output. (Applicable to 37 kW 400 V))	<i>P</i>	Yes	
Overload protection	The temperature inside the IGBT is calculated from the current and internal temperature, to shut off the inverter output.	•	OLU	Yes

^{*1} When the inverter is equipped with the multi-function keypad, it displays the alarm letters on the LED indicator of the keypad.

^{*2} This alarm [30A/B/C] may not be output depending upon the data setting of the function code.

Name		Description	LED monitor displays *1	Alarm output [30A/B/C]			
Motor protection	Electronic thermal	OL I	Yes				
	PTC thermistor	A PTC thermistor input stops the inverter to protect the motor. The PTC thermistor is connected between terminals V2 and 11 to set switch on the control PC board and function codes.		Yes			
Alarm relay output (for any alarm)	- The inversard stops < Alarm F The alarm keypad (6)	_	Yes				
Memory error	Data is chec to stop the in	Er- /	Yes				
Keypad communication error	Multi-function the keypad inverter if ar	E2	Yes				
CPU error	Detect a CP	Er-3	Yes				
Option communication error	When PG option card is used, a fault of communication with the inverter main body is detected to stop the inverter. $ \mathcal{E}^{-\mathcal{Y}} $						
Option error	When each inverter.	<i>E-5</i>	Yes				
Operation error	Brake status error	If the braked status input BRKE does not follow the brake command BRKS , the inverter stops.	E5	Yes			
	Speed command error	Attempting to drive the inverter with the same speed data being set up in any of multistep speed commands (L11 to L18) stops the inverter.					
	MC status error	If the MC status input CS-MC does not follow the MC command SW52-2 , the inverter stops.					
Tuning error	When tuning failure, interruption, or any fault as a result of tuning is detected while tuning the motor constant, the inverter is stopped. \mathcal{E}						
RS485 communication error	When the connection port of the keypad is connected via RS485 communication to the network to detect a communication error, the inverter is stopped to display the error. Yes						
Hardware error (option detection)	When using the option card upon an error in the option or due to a loose mounting of the card being detected the inverter stops itself.						
EN terminal circuit error		detects an error on the EN terminal circuit, and stops itself. ue to the internal circuit error, the reset feature of inverter itself cannot rm	ECF	Yes			

[&]quot;-": Not applicable.

^{*1} When the inverter is equipped with the multi-function keypad, it displays the alarm letters on the LED indicator of the keypad.

Name	Description	LED monitor displays *1	Alarm output [30A/B/C]
Broken wiring in the PG	The inverter detects a broken wiring connection in the pulse encoder and stops itself. This feature takes effect for some models of the PG interface card.	PG	Yes
CAN bus communication error	An abnormal communication with the main body of the inverter is detected when the CAN bus is used, and the inverter is stopped.	Er-t-	Yes
Overspeed prevention	If the motor has run at 120% or more of the maximum rated speed, the inverter stops.	<i>05</i>	Yes
Speed mismatching (Out of speed control)	If difference between the reference speed and motor speed (ASR feedback) increases too much large to keep control, and this situation continues for the specified time, then the inverter stops.	ErE	Yes
Over torque current	The inverter is stop when reference torque current of the inverter exceeds the over torque current detection level and the reference torque current continues longer than the period specified by over torque current detection time.	ΩE	Yes
Retry	When the motor is tripped and stopped, this function automatically resets the tripping state and restarts operation.	_	_
	(The number of retries and the length wait before resetting can be set.)		
Failsafe feature	Whenever the EN terminal circuit that should be assigned to any digital inputs (X1 to X8) turns off, the inverter shuts down its main power circuit to secure to stop the output.		_
Alarm relay output (for any fault)	The inverter outputs a relay contact signal when the inverter issues an alarm and stops the inverter output. The alarm stop state is reset by the digital input signal <i>RST</i> .	l	Yes
Surge protection	The inverter is protected against surge voltage intruding between the main circuit power line and ground.		
Momentary power failure protection	A protective function (inverter stoppage) is activated upon a momentary power failure for 15 ms or longer.	_	_

[&]quot;—": Not applicable.

^{*1} When the inverter is equipped with the multi-function keypad, it displays the alarm letters on the LED indicator of the keypad.

Chapter 9 LIST OF PERIPHERAL EQUIPMENT AND OPTIONS

The table below lists the main peripheral equipment and options that are connected to the FRENIC-Lift. Use them in accordance with your system requirements.

	Name of peripheral equipment	Function and application								
	Molded case circuit breaker (MCCB) Earth leakage circuit breaker	MCCBs are designed to protect the power circuits between the power control board and inverter's main terminals (L1/R, L2/S and L3/T) from overload or short-circuit which in turn prevents secondary disasters caused by the inverter malfunctioning. RCDs/ELCBs function in the same way as MCCBs. Use the MCCBs and RCDs/ELCBs that satisfy the recommended rated current listed below.								
	(ELCB)* * with overcurrent	Input	Nominal applied motor Inverter type			current of d ELCB (A)				
	protection	power source	(kW)		w/ DCR	w/o DCR				
			5.5	FRN5.5LM1S-2□	30	50				
			7.5	FRN7.5LM1S-2□	40	75				
		Three-phase	11	FRN11LM1S-2□	50	100				
		200 V	15	FRN15LM1S-2□	75	125				
			18.5	FRN18.5LM1S-2□	400	150				
	oment .		22	FRN22LM1S-2□	100	175				
			3.7	FRN4.0LM1S-4□	10	20				
Ħ			5.5 FRN5.5LM1S-4□		15	30				
Jue			7.5	FRN7.5LM1S-4□	20	40				
qui			11 FRN11LM1S-4□		30	50				
al e	Main peripheral equipment	Three-phase	15	FRN15LM1S-4□	40	60				
her		400 V	18.5	FRN18.5LM1S-4□	40	75				
erip			22	FRN22LM1S-4□	50	100				
in			30	FRN30LM1S-4□	75	405				
Ĕ			37	FRN37LM1S-4□	100	125				
			45	FRN45LM1S-4□	100	150				
		Single-phase 200 V	2.2	FRN2.2LM1S-7□	20	30				
		depending Select the MCCI supply capacity. When connect circuit breaker	on the shipping des or RCD/ELCB with the inverter to the and earth leakage of the the rated current cent protection	e replaces C (China), E stination. In appropriate breaking cape VARNING The power supply, add a refircuit breaker* in the path court of the recommenced ra	acity according	g to the power				

	Name of option	Function and application
	Magnetic	Insert an MC in the power source side of the inverter in order to:
	contactor (MC)	 Forcibly cut off the inverter from the power source (generally, commercial/factory power lines) with the protection function built into the inverter, or with the terminal signal line.
		 Stop the inverter operation in an emergency when the inverter cannot interpret the stop command due to internal/external circuit failures.
		3) Cut off the inverter from the power source when the MCCB inserted in the power source side cannot cut it off for maintenance or inspection purpose. If you are to use the MC for this purpose only, it is recommended that you use an MC capable of turning the MC ON/OFF manually.
		Note 1: When your system requires the motor(s) driven by the inverter to be started/stopped with the MC, the frequency of the starting/stopping operation should be once or less per hour. The more frequent the operation, the shorter operation life of the MC and capacitor/s used in the DC link bus due to thermal fatigue caused by the frequent charging of the current flow. If this is not necessary, start/stop the motor with the terminal commands FWD and REV , or with the keypad.
		Note 2: Install an MC in compliance with regulations that apply to the system.
	DC reactors (DCL)	A DCL is mainly used for co-operative power supply and for supplied power-factor correction (for reducing harmonic components).
_		For co-operative power supply
Main option		 Use a DCR when the capacity of a power supply transformer exceeds 500 kVA and is 10 times or more than the rated inverter capacity. In this case, the percentage-reactance of the power source decreases, and harmonic components and their peak levels increase. These factors may break rectifiers or capacitors in the DC link bus of inverter, or decrease the capacitance of the capacitor (which can shorten the inverter's service life).
		 Also use a DCR when there are thyristor-driven loads or when phase-advancing capacitors are being turned ON/OFF.
		For supplied power-factor correction (harmonic component reduction)
		Generally a capacitor is used to correct the power factor of the load, however, it cannot be used in a system that includes an inverter. 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 inverter. Using a DCR corrects the input power factor to approximately 86 to 90%.
		$\label{eq:Note: Note: At the time of shipping, a short bar is connected across the terminals P1 and P (+) on the terminal block. Remove the short bar when connecting a DCR.}$
	Ferrite ring	An ACL is used to reduce radio noise emitted by the inverter.
	reactors for reducing radio frequency noise	An ACL suppresses the outflow of high frequency harmonics caused by switching operation inside the inverter for the power supply (primary) lines. Pass the power supply lines together through the ACL for 4 turns (coiled 3 times).
	(ACL)	If wiring length between the inverter and motor is less than 20 m, insert an ACL to the power supply (primary) lines; if it is more than 20 m, insert it to the power output (secondary) lines of the inverter.

	Name of option	Function and application
	Multi-function keypad	Multi-function keypad (option) allows you to monitor the status of the inverter including voltage, current, and input power, as well as to set various function code data in a conversational mode. Equipped with a liquid crystal display (LCD).
Suc		Also this allows you to copy function code data from one FRENIC-Lift inverter to another.
mmunicatic	Extension cable for remote keypad operation	The extension cable connects the RS485 communications port (standard) with a keypad or an RS485-USB converter. Three lengths are available: 5 m, 3 m and 1 m.
Options for Operation and Communications	PG option card for driving of a synchronous motor with the parallel encoder	The card helps the inverter drive a synchronous motor equipped with absolute positioning type encoder that outputs magnet pole angle in a 4 bits gray code or 3 bits code (for U, V, and W phases) format.
Options for Op	PG option card for driving of a synchronous motor with the EnDat-compatible serial encoder	The card helps the inverter drive a synchronous motor equipped with absolute positioning type encoder that outputs mechanical angle in the serial interface compatible to EnDat 2.1.
	Inverter support loader software	Inverter support loader software, Windows GUI (Graphics User Interface) based, that makes setting up of function codes easy.
quipment	Surge absorbers	A surge absorber suppresses surge currents and noise from the power lines to ensure effective protection of your power system from the malfunctioning of the magnetic contactors, mini-relays and timers.
Other peripheral equipment	Surge killers	A surge killer eliminates surge currents induced by lightening and noise from the power supply lines. Use of a surge killer is effective in preventing the electronic equipment, including inverters, from damage or malfunctioning caused by such surges and/or noise.
Other pe	Arresters	An arrester suppresses surge currents and noise invaded from the power supply lines. Use of an arrester is effective in preventing electronic equipment, including inverters, from damage or malfunctioning caused by such surges and/or noise.
Other options	Mounting adapters	FRENIC-Lift series of inverters can be installed to your system enclosure or equipment using mounting adapters that utilize the mounting holes used for conventional inverters of FRENIC5000G11 (11 kW) series.
Other	Attachment for external cooling	This adapter allows you to mount your FRENIC-Lift series of inverters on the panel in such a way that the heat sink assembly may be exposed to the outside. Using this adapter greatly reduces heat radiated or spread inside your enclosure.

Designed for Elevating Machinery

FRENIC-Lift

Instruction Manual

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The purpose of this instruction manual is to provide accurate information in handling, setting up and operating of the FRENIC-Lift 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.

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