

Thank you for purchasing Fuji Electric's FRENIC-Lift Series. This instruction manual contains the minimum information required for product wiring and operation. Please read the User's Manual carefully, and ensure an understanding of the safety-related content prior to use.
[Related documents] User's Manual 2447-E-0179; RS-485 Communication User's Manual 2447-E-0082;
Refer to the Fuji Electric website for details on the above documents.



https://www.fuji-electric.com/products/drives_inverters/ac_drives_lvproduct_series/frnnc-ifrm3_download_pr.html

CAUTION
Thank you for purchasing Fuji Electric's FRENIC-Lift Series of high-performance, multi-function inverters. This product is designed to drive three-phase induction motors and synchronous motors under variable speed control. Please read this instruction manual beforehand to gain an understanding of how to handle the product and ensure correct use.

WARNING
FRENIC-Lift is a piece of equipment used to run three-phase induction motors and synchronous motors. It cannot be used for single-phase motors or other applications.
Failure to observe this could result in fire or an accident.
FRENIC-Lift cannot be used as is for applications which may have a direct effect on the human body such as life support machines.
Strict quality control has been observed in the manufacturing of this product, however, safety devices should be installed when the product is used for equipment which may result in a serious accident or loss in the event of failure.
Failure to observe this could result in an accident.

Installation
• Install on noncombustibles such as metal.
• Do not install near combustibles.
Failure to observe this could result in fire.
If using an optional DC reactor, there is a possibility of users coming into contact with main circuit terminal block parts (live parts). In such cases, take measures such as installing the product in a location where it will not easily come into contact with people.
Failure to observe this could result in electric shock or injury.

Wiring
If no device for detecting zero-phase current (earth leakage current) such as a ground-fault relay is installed in the upstream power supply line in order to avoid the entire power supply system's shutdown undesirable, install a residual-current-operated protective device (RCO) with leakage circuit breaker (ELCB) individually to inverters to break the individual inverter power supply lines only.
Connect to the power supply via a molded case circuit breaker (MCCB) or earth leakage circuit breaker (ELCB) (with overcurrent protection function) for each inverter. Use the recommended molded case circuit breaker or earth leakage circuit breaker, and do not use devices that exceed the recommended capacity.
Be sure to use the specified wire size.
Tighten terminals with the prescribed tightening torque.
If there are multiple inverter and motor combinations, do not use multi-core cables for the purpose of bundling and storing wiring for multiple combinations.
Do not install a surge suppressor at the inverter output side (secondary side).
Be sure to connect an optional DC reactor (DCR) when the capacity of the power supply transformer exceeds 500 kVA, and is at least 10 times the inverter rated capacity.
Failure to observe this could result in fire.

Operation
Be sure to attach the inverter terminal cover and front cover before turning the power ON. Do not remove the terminal cover or front cover while the power is ON.
Do not operate the product with wet hands.
Failure to observe this could result in electric shock.
If the product stops after being tripped when the relay function is selected, depending on the cause of the trip, the product will restart automatically, and the motor will rotate. Design machines in such a way as to ensure the safety of the human body and surrounding area even when rotation is resumed.
There may be times when the stall prevention function (current limiting) causes the product to run at an acceleration/deceleration time or speed different from the set values. Design machines in such a way that safety is ensured even at such times.
Failure to observe this could result in an accident.
After eliminating the cause of the protective function being triggered, ensure that operation command is OFF before canceling the alarm. Canceling the alarm with the operation command ON may result in power being supplied to the motor by the inverter, causing the motor to rotate, and is therefore dangerous.
Failure to observe this could result in an accident.
Set function codes after ensuring a sufficient understanding of this instruction manual. If operation is performed after redlessly changing function code data, the motor may rotate at a torque and speed at which the machine is unable to tolerate.
If the product is run with the encoder miswired, the motor may rotate unintentionally, and therefore due care should be taken when wiring.
When auto tuning is started, the motor rotates. Conduct a sufficient check to ensure that there is no danger even when the motor rotates.
Failure to observe this could result in an accident or injury.
Even if the inverter cuts off the supply of power to the motor, if voltage is still being applied to main power supply input terminals [L1], [L2], and [L3] (three-phase) voltage may be output to the [U], [V], and [W] terminals.
Even if the motor is stopped by DC braking, voltage will be output to the inverter output [U], [V] and [W] terminals.
Failure to observe this could result in electric shock.
Inverter high-speed operations can be specified easily. If settings are changed, use the product after sufficiently checking the motor and machine specifications.
Failure to observe this could result in injury.

Maintenance and inspection, part replacement
Carry out inspection after waiting 5 minutes or longer for units FRN011LM3S-7, FRN0090M3S-2 and FRN0045LM3S-4 or below, or 10 minutes or longer for units FRN0060LM3S-4 or above after turning OFF the power. Furthermore, ensure that charge lamp A is OFF on units FRN011LM3S-7, FRN0090M3S-2 and FRN0045LM3S-4 or below, and that charge lamp A and charge lamp B are OFF on units FRN0060LM3S-4 or above, and use a device such as a tester to ensure that the DC intermediate circuit voltage across main circuit terminals [P+] and [N-] has dropped to a safe level (+25 VDC or less).
Failure to observe this could result in electric shock.
Be sure to perform the daily inspection and periodic inspection described in the instruction manual. Depending on the product without inspection could result in inverter failure and damage, or accident and fire.
A periodic inspection cycle of 1 to 2 years is recommended, however, the cycle may be shortened depending on the usage conditions.
It is recommended that parts for periodic replacement be replaced after the standard number of years indicated in the instruction manual. Lengthy use of the product without replacing parts could result in inverter failure and damage, or accident and fire.
Contact outputs [30A/B/C] and [Y5A/C] use relays, and may remain ON or OFF, or in an indefinite state when the life is reached. In the interests of safety, equip the product with an external protection function.
Failure to observe this could result in fire or an accident.
Maintenance and inspection, and part replacement should only be carried out by the specified individuals.
Remove all metal objects (wrenches, rags, etc.) before beginning work.
Be sure to use insulated tools.
Never modify the product.
Failure to observe this could result in electric shock or injury.

CAUTION
Do not hold the front cover when transporting the product.
Failure to observe this could result in injury if the product is dropped.
Take measures to prevent foreign material such as lint, wastepaper, wood shavings, dust, or metal scraps getting into the inverter, or adhering to the cooling fan.
Use the specified screws for changing the mounting base.
Failure to observe this could result in fire or an accident.
Do not install or run inverters with damaged external or internal parts.
Failure to observe this could result in fire, an accident, or injury.

Wiring
The inverter, motor and wiring generate electric noise, which may cause nearby sensors and devices to malfunction. Employ noise countermasures to prevent malfunction.
Failure to observe this could result in an accident.
Operation
The cooling fans and braking resistors become very hot. Do not touch.
Failure to observe this could result in burns.
Mechanical holding is not possible with the inverter brake function.
The digital input terminals are equipped with a function used to start and stop operation or change the speed command with the "FWD" operation command or "REV" (reverse command). Depending on the digital input terminal status, operation may start suddenly, or the speed may change significantly simply by changing the function code settings. Make changes to function code settings after sufficiently ensuring safety.
With digital input, functions "SS1, SS2, SS4", "LE", etc. used to change the operation procedure for run commands or command procedures for speed commands can be assigned. Depending on the conditions, changes to these signals may result in operation being started suddenly or the speed changing suddenly.
Failure to observe this could result in an accident or injury.

Disposal
If disposing of FRENIC-Lift, handle as industrial waste.
Failure to observe this could result in injury.

Chapter 1 BEFORE USE
1.1 Acceptance Inspection (Rating Plate and Inverter Type)

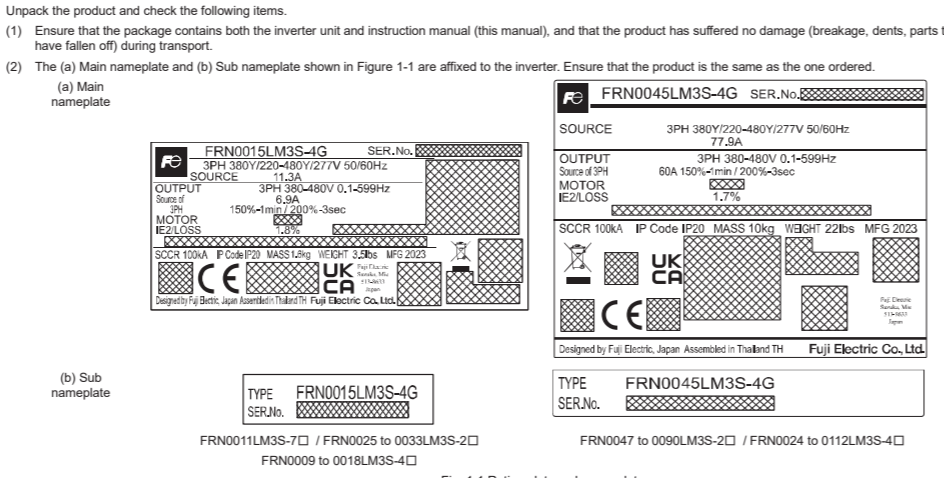


Fig. 1-1 Rating plate, sub nameplate

TYPE: Inverter type

Code	Destination/Manual
G1	Cable/English
A1	India/English
Code	Input power supply
2	Three-phase 200V
4	Three-phase 400V
Code	Construction
S	Standard (P20P100)
Code	Development series
3	3

Serial number: 2X A 1 2 3 A 0 0 1 A A

Production year and week: 21 (Year), 01 (Week)

If there is anything about the product of which you are unsure, please contact your dealer or nearest Fuji Electric sales office.

Chapter 2 INSTALLATION AND WIRING
2.1 Operating Environment

Install FRENIC-Lift in an operating environment that satisfies the conditions listed in Table 2-1 Operating environment.

Table 2-1 Operating environment

Item	Specifications
Location	Indoors
Ambient temperature	FRN00LM3S (standard model): +10 to +55 °C (Current derating necessary in +50 to +55 °C range.) When installed closely side-by-side (Note 3): +10 to +40 °C (It is possible only on units FRN0025 to 0090LM3S-2/C, FRN0009 to 0045LM3S-4/C, and FRN011LM3S-7/C to install closely side-by-side.)
Ambient humidity	5 to 95% RH (there should be no condensation)
Atmosphere	The inverter must not be exposed to dust, direct sunlight, corrosive gases, flammable gases, oil mist, vapor or water droplets. (Pollution degree 2 (IEC60664-1)) (Note 1). The atmosphere can contain a small amount of salt (0.01 mg/m ³ /year or less). There should be no condensation as a result of sudden temperature changes.
Altitude	1,000 m (3,300 ft) max. (Note 2)
Atmospheric pressure	98 to 106 kPa
Vibration	Capacity (voltage series) FRN0025 to 0090LM3S-2/C, FRN0009 to 0045LM3S-4/C, FRN011LM3S-7/C: 3mm (max. amplitude), 9.8 m/s ² , 5.9 m/s ² , 1 m/s ² FRN0060 to 012LM3S-4/C: 2 m/s ²

(Note 1) Do not install the inverter in an environment where lint or most dust, etc. may adhere to the cooling fins. If the inverter is to be used in such an environment, install it in a cabinet to prevent lint, etc. getting in.
(Note 2) If you use the inverter in an altitude above 1,000 m (3,300 ft), you should apply an output current derating factor as listed in Table 2-2. Fuji Electric strongly recommends installing inverters in a panel for safety reasons, in particular, when installing the ones whose enclosure rating is IP00. When installing the inverter in a place out of the specified environmental requirements, it is necessary to derate the inverter or consider the panel engineering design suitable for the special environment of the panel installation location.
(Note 3) If installing inverters closely side-by-side, they may bump against one another due to vibrations or impact. They should therefore be installed taking mounting tolerance into consideration.

2.2 INSTALLATION
2.2.1 Installation Surface

Please install the inverter on noncombustibles such as metal. Also, do not mount it upside down or horizontally.

2.2.2 Surrounding Space

Secure the surrounding space shown in Fig. 2-1 and Table 2-3. Enclosing the inverter in a cabinet and so on, be sure to provide adequate ventilation to the cabinet, as the ambient temperature may rise. Do not contain it in small enclosures with low heat dissipation capacity.

Table 2-3 Surrounding space (mm)

Applicable capacity	A	B	C
FRN0025 to 0090LM3S-2/C, FRN0009 to 0045LM3S-4/C, FRN011LM3S-7/C	10	100	0
FRN0060 to 012LM3S-4/C	50		100

C: Space in front of inverter unit
If connecting a USB device, ensure sufficient space for the cable.

Installation with external cooling

The external cooling installation reduces the generated heat inside the panel by dissipating approximately 70% of the total heat generated (total heat loss) by mounting the cooling fins protruding outside the equipment or cabinet. Installation with external cooling is possible with the addition of an external cooling attachment (option). (Refer to the User's Manual (2447-E-0179)-; for details on external cooling attachments (option).) Take measures to prevent foreign material such as lint, wastepaper, wood shavings, dust, or metal scraps getting into the inverter, or adhering to the cooling fan.

2.2.3 Removal and attachment of the front cover/terminal cover and wiring guide

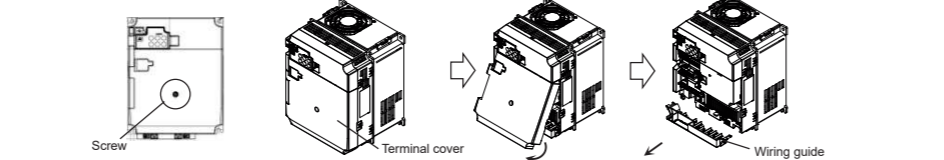
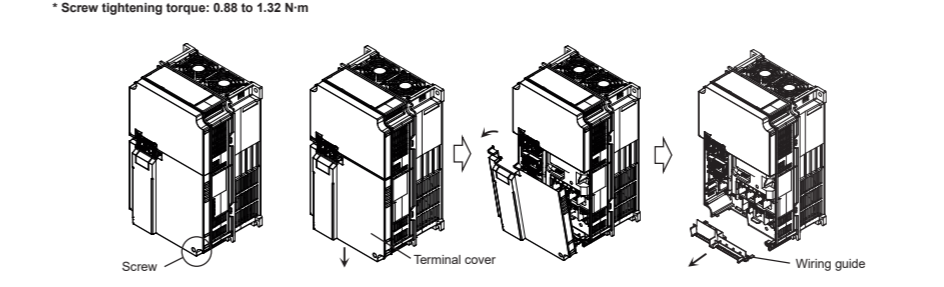


Fig. 2-3 Front cover and wiring guide removal (FRN001LM3S-4G)

- Loosen the terminal cover screws, pull the terminal cover down, and then pull it down toward you.
- Slide the wiring guide upward to remove.
- After routing the wires, attach the wiring guide and the terminal cover reversing the steps above.
 - * Screw tightening torque: 0.88 to 1.32 N·m



- Loosen the screws of the front cover. Hold both sides of the front cover by hand, and slide the cover upward to remove.
- After carrying out wiring work, align the top of the front cover with the hole on the cover, and reattach using the opposite procedure to that in Fig. 2-5.
 - * Screw tightening torque: 1.59 to 2.01 N·m

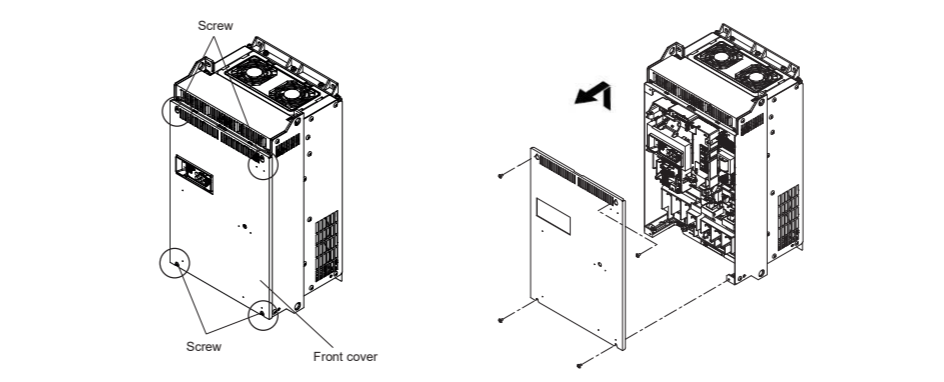


Fig. 2-5 Front cover and wiring guide removal (FRN0060LM3S-4G)

2.2.4 Terminal Layout and Screw Specifications
2.2.4.1 Screw Specifications and Tightening Torque (Main Circuit Terminals)

The specifications for the screws used in the main circuit wiring and the wire sizes are shown below. Exercise caution as the terminal position varies depending on inverter capacity. There is no difference between the input side (primary side) and output side (secondary side) for the two ground terminals (⊕ G). Also, use crimped terminals with insulating sleeves compatible for main circuit or terminals with insulating tubes.

Table 2-4 Screw specifications

Inverter type	Main circuit	Screw specification		
		Grounding	Control power auxiliary input [R], [T]	
Three-phase 200 V	Three-phase 200 V	Screw size (driver size)	Tightening torque (N·m)	
	M5 (No.2)	3.0	M5 (No.2)	3.0
	M5 (No.2)	3.0	M5 (No.2)	3.0
Three-phase 400 V	Three-phase 400 V	Screw size (driver size)	Tightening torque (N·m)	
	M5 (No.2)	3.0	M5 (No.2)	3.0
	M6 (No.3)	3.0	M6 (No.3)	3.0
	M6 (No.3)	3.0	M6 (No.3)	3.0
	M6 (No.3)	5.8	M6 (No.3)	5.8
	M6 (No.3)	5.8	M6 (No.3)	5.8
Single-phase 200 V	Single-phase 200 V	Screw size (driver size)	Tightening torque (N·m)	
	M8	13.5	M8	13.5

2.2.4.2 Terminal Layout Drawing
Refer to the User's Manual (2447-E-0179)-; for the main circuit terminal layout. The following terminals will have high voltage when power is ON. Risk of electric shock
Main circuit: [L1], [L2], [L3], [P1], [P+], [N-], [N], [DB], [U], [V], [W], [R], [T]
Insulation level: Main circuit - casing; Main circuit - control circuit; Contact output: AUX contact ([30A], [30B], [30C], [30A], [Y5C])
Basic insulation (overvoltage category III, pollution degree 2)
Reinforced insulation (overvoltage category III, pollution degree 2)
Reinforced insulation (overvoltage category III, pollution degree 2)

2.2.5 Recommended Wire Size

Table 2-5 shows recommended wire sizes. The examples of recommended wire sizes for main circuit terminals are based on the use of single HV wires at ambient temperature of 50 °C. Refer to the User's Manual (2447-E-0179)-; for conditions other than these.

Table 2-5 Recommended wire sizes (ambient temperature inside panel: 50 °C or less, wire type: 75 °C wire)

Power system	Standard motor kW	Inverter type	Recommended wire size (mm ²)					
			Main power supply input [L1/R], [L2/S], [L3/T]		For DC reactor connection [P1], [P+]		For inverter grounding [⊕ G]	
			With DC reactor (DCR)	Without DC reactor (DCR)	For DC reactor connection [P1], [P+]	For braking resistor connection [P-], [DB]	For inverter grounding [⊕ G]	Inverter output [U], [V], [W]
Three-phase 200 V	5.5	FRN0025LM3S-2/C	2	3.5	3.5	2	3.5	3.5
	7.5	FRN0033LM3S-2/C	3.5	5.5	5.5	2	3.5	3.5
	11	FRN0047LM3S-2/C	5.5	14	8	2	8	8
	18.5	FRN0076LM3S-2/C	14	22	22	5.5	14	14
	22	FRN0090LM3S-2/C	22	38 ¹⁾	22	5.5	22	22
	40	FRN015LM3S-4/C	2	2	2	2	2	2
Three-phase 400 V	11	FRN0033LM3S-2/C	2	3.5 ²⁾	3.5 ²⁾	2	3.5 ²⁾	2
	18.5	FRN0047LM3S-2/C	3.5 ²⁾	5.5	5.5	2	5.5	3.5 ²⁾
	15	FRN0025LM3S-4/C	5.5	8 ¹⁾	5.5	2	5.5	8 ¹⁾
	22	FRN0033LM3S-4/C	5.5	14	8 ¹⁾	2	8	14
	37	FRN0045LM3S-4/C	14	22	22	5.5	8	14
	45	FRN0060LM3S-4/C	22	38	38	22	5.5	8
Single-phase 200 V	55	FRN011LM3S-7/C	22	38	22	8	14	38

- For compatible crimped terminals, please use model BLS-6 by JST Mfg. Co., Ltd. or equivalent.
- *2 to *5 are not applicable.
- For compatible crimped terminals, please use model RS-5.6 by JST Mfg. Co., Ltd. or equivalent.
- For compatible crimped terminals, please use model SR-8 by JST Mfg. Co., Ltd. or equivalent.

2.2.5.1 Screw Specifications and Recommended Wire Size (Control Circuit Terminals)

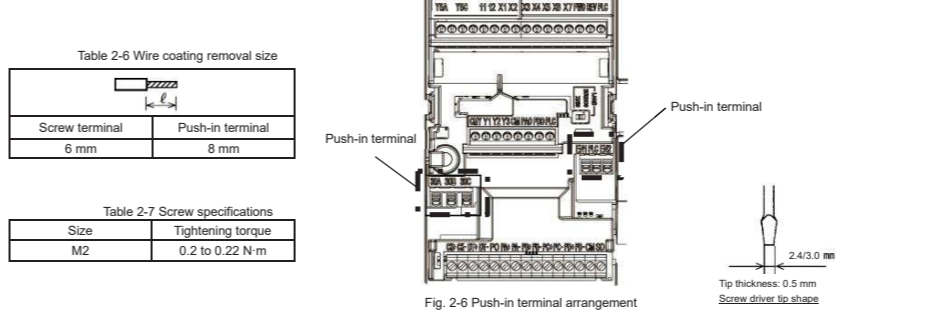


Fig. 2-6 Push-in terminal arrangement

The common specifications for push-in and screw control circuit terminals are as follows.

Table 2-8 Recommended wire sizes, terminal types, and screw driver

Terminal name	Permissible wire size (mm ²) (AWG)	Recommended wire size (mm ²) (AWG)	Wire size (mm ²) (AWG)	Type	Screw driver (shape of tip)
Control circuit terminal (Screw)	0.25 to 1.5 (24 to 18)	0.25 to 0.5 (24 to 20)	0.25 (24)	AI 0.25-8-YE	Minus (0.5 mm x 2.4 mm)
			0.34 (22)	AI 0.34-8-TQ	
Control circuit terminal (Spring)	0.25 to 1.5 (24 to 18)	0.25 to 0.75 (24 to 18)	0.5 (20)	AI 0.5-8-WH	Minus (0.5 mm x 3.0 mm)
			0.75 (18)	AI 0.75-8-GY	

- Recommended terminal: Phoenix Contact
- *2: Use Phoenix Contact CRIMPFOX 6 crimping pliers.
- (Note 1) Depending on the wire type, coil diameter, and number of wires, the inverter terminal cover may rise up. If this happens, it will be necessary to change the wire type or coil diameter, etc.
- (Note 2) Using other than the recommended ferrules may prevent the ferrule from being removed from the terminal block or may damage the terminal block. Unsuitable terminals: Ferrule terminals with different thread lengths, two-way TWIN ferrule terminals, bar crimp terminals

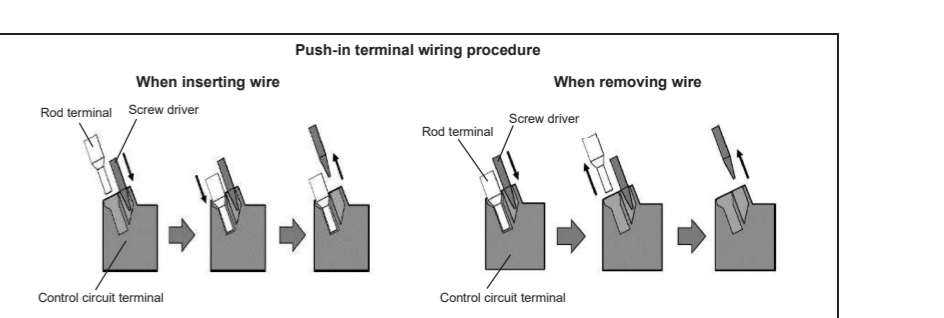
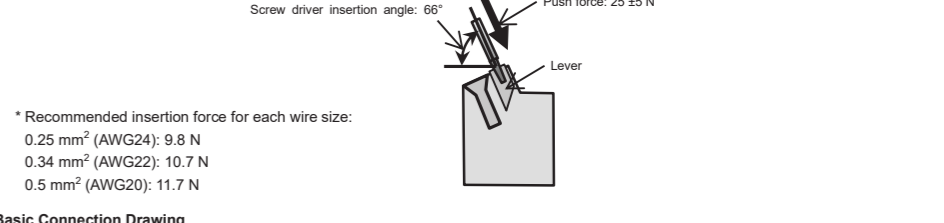


Fig. 2-7 Push-in terminal wiring procedure

When pushing in the lever when inserting or pulling out rod terminals, pay attention to the angle in the following diagram, and try not to push in the lever suddenly or use excessive force.



* Recommended insertion force for each wire size:
0.25 mm² (AWG24): 9.8 N
0.34 mm² (AWG22): 10.7 N
0.5 mm² (AWG20): 11.7 N

2.2.6 Basic Connection Drawing

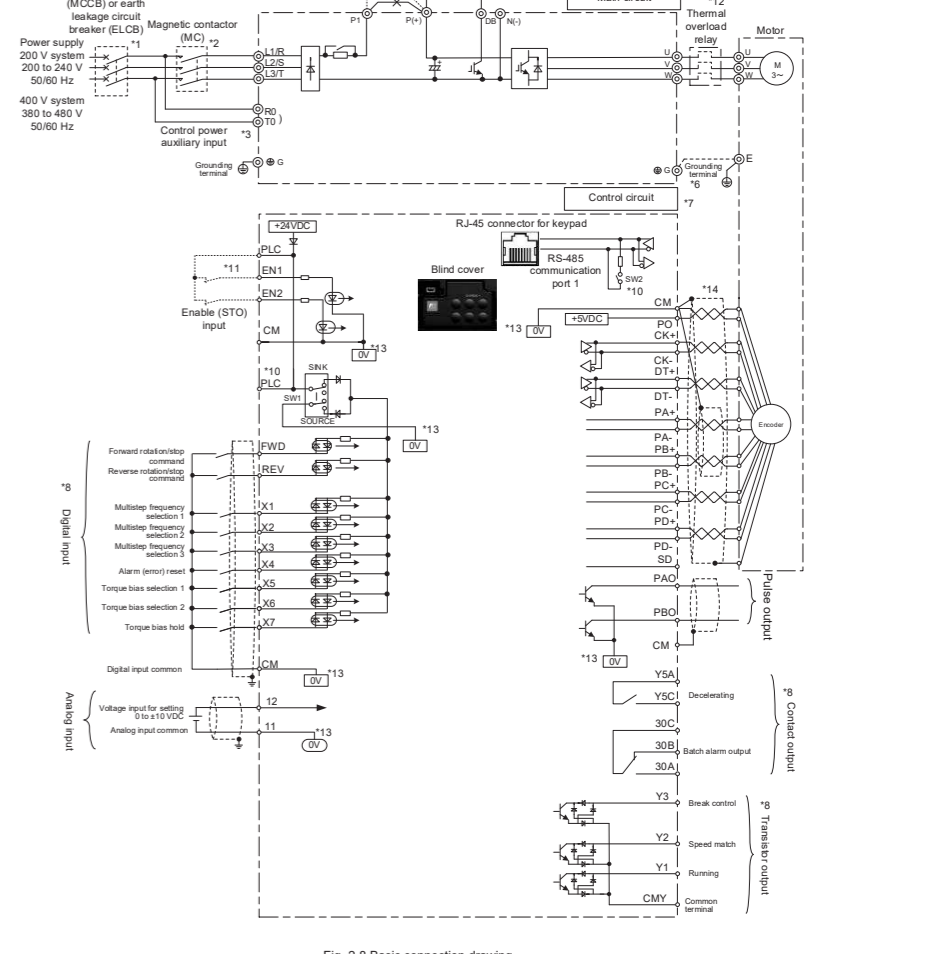


Fig. 2-8 Basic connection drawing

- Install the molded case circuit breaker (MCCB) or earth leakage circuit breaker (ELCB) (with overcurrent protection function) recommended for each inverter on the inverter input side (primary side) to protect wiring. Do not use a circuit breaker that exceeds the recommended rated current.
- An MCCB or ELCB is also used if isolating the motor from the power supply, and therefore the magnetic contactor (MC) recommended for each inverter should be installed if required. Please note that if installing a coil such as an MC or solenoid near the inverter, connect a surge absorber in parallel.
- If wishing to retain the integrated alarm signal issued if the protective function is triggered even when the inverter main power supply is cut off, or to constantly display the keypad(option), connect these terminals to the power supply. The inverter can be run even without inputting power to these terminals (on FRN076LM3S-2, FRN0090LM3S-4 or above).
- Remove the shoring bar between the inverter main circuit terminals [P+] and [P+] before connecting the direct current reactor (DCR) (option). Use a DC reactor (DCR) when the capacity of the power supply transformer is 500 kVA or more and is 10 times or more the inverter rated capacity, or when there are "hysteresis-driver" loads.
- FRENIC-Lift series inverters are equipped with built-in braking transistors, allowing direct connection of braking resistors between [P+] and [DB].
- This terminal is used for grounding the motor. Connect if grounding the motor. Grounding the motor using this terminal is recommended in order to suppress inverter noise. Use twisted wire or shielded wire for control signal lines. Shielded wires are generally grounded, however, if subject to significant induction noise from outside, it may be possible to suppress the effect of the noise by connecting wires to [CM]. Isolate control signal lines from the main circuit wiring as best as possible, and do not run inside the same duct (if diameter of 10 cm or greater is recommended). If lines intersect, ensure that they do so almost perpendicularly to the main circuit wiring.
- Each of the functions described for terminals [FWD] and [REV], terminals [X1] to [X7] (digital input), terminals [Y1], [Y2], and [Y3] (transistor output), and terminals [Y5A/C] and [30A/B/C] (contact output) indicate functions assigned by factory default.
- Set the "External alarm" TRIP function for any of the inverter terminals [X1] to [X7] and connect.
- These are the switches on control PCBs, and are used to change terminating resistor. Refer to the User's Manual (2447-E-0179)-; for details.
- Safety function terminals [EN1] and [EN2] are enabled by factory default. Short terminal [PLC] if not using this terminal function. (Connect short circuit wire across terminal [EN1], [EN2], and [PLC].)
- Use a thermal overload relay if necessary. Make the circuit breakers (MCCB) or the magnetic contactors (MC) trip by the thermal relay auxiliary contacts (main circuit).
- [REV] and [PLC] are isolated and insulated.
- The recommended cable and shield connection method will differ depending on the applicable encoder. Refer to Table 2-9 for details.

Table 2-9 Recommended cable and shield connection method by encoder

Recommended encoder	Recommended wiring	Recommended connection method (shield)
HEIDENHAIN ECN11313 or equivalent part	Double shielded wire	Inverter side: Connect both shields to [CM]. Motor side: Ground outer shield only (Leaves inner shield open.)
Hohner SMRS64 or equivalent part	Single shielded wire	Connect shield to [CM]. Ground
HEIDENHAIN ERN11387 or equivalent part	Single shielded wire	Connect shield to [CM]. Ground

2.2.7 Terminal Function Description
2.2.7.1 Main Circuit Terminals

Table 2-10 Description of main circuit terminal functions

Classification	Terminal symbol	Terminal name	Detailed specifications
Main circuit	[L1/R], [L2/S], [L3/T]	Main power supply input	Connect a three-phase power supply. (Three-phase models only)
	[U], [V], [W]	Inverter output	Connect single-phase models to [L1/R] and [L3/T]. Terminals to connect three-phase motors
	[P+], [P-]	For DC reactor connection	Connect a DC reactor (DCR) (option).
	[P+], [N-]	For direct current bus connection	Used for connection to direct current intermediate circuits of other inverters and PWM converters.
	[P+], [DB]	For braking resistor connection	Connect the braking resistor (option) [P+] and [DB] terminals. (Wiring distance: 5 m or less)
	[⊕ G]	For inverter chassis (case) grounding	Grounding terminal for inverter chassis (case) and motor
	[R], [T]	Control power auxiliary input	If wishing to retain the integrated alarm signal issued if the protective function is triggered even when the inverter main power supply is cut off, or to constantly display the keypad (option), connect this terminal to the power supply. (FRN076LM3S-2, FRN0090LM3S-4 or above)

2.2.7.2 Control Circuit Terminals

A description of control circuit terminal functions is shown in Table 2-11. The control circuit terminal connection method differs based on function code settings to suit the purpose for which the inverter is used. Wire appropriately to minimize the effect of noise from main circuit wiring.

Table 2-11 Description of control circuit terminal functions

Classification	Terminal symbol	Terminal name	Function description
Analog input	[I2]	Analog setting voltage input	(1) Frequency is set up according to the external analog voltage input command value. • +10 to ±10 VDC (0 to ±100%) (normal operation) • +10 to ±5 VDC (0 to ±100%) (reverse operation) (2) Settings other than the speed setting can be used by assigning them to the torque current command value and torque bias command with analog input. (3) Hardware specifications • Input impedance: 22 kΩ • Up to ±15 VDC can be input. However, input exceeding ±10 VDC will be recognized as ±10 VDC.
	[I1]	Analog common	This is the common terminal for analog input signals [terminal I2]. This terminal is insulated from terminals [CM] and [CMY].
Digital input	[X1] [X2] [X3] [X4] [X5] [X6] [X7]	Digital input 1 to 7	(1) Various signals (coast to a stop command, external alarm, multi-speed selection, etc.) set up by function codes E01 to E07, E58, E59 can be set. Refer to the User's Manual (2447-E-0179) for details. (2) The input mode and SINK/SOURCE can be switched using SW1. (3) The operating mode between each digital input terminal and terminal [CM] can be switched to "ON when shorted (active ON)" or "OFF when shorted (active OFF)". Maximum wire length: 20 m Refer to the User's Manual (2447-E-0179) for details on function code settings. Function codes list can be viewed and downloaded by accessing the QR Code below.
	[FWD]	Forward rotation runstop command input	Refer to the User's Manual (2447-E-0179) for digital input circuit specifications.
	[REV]	Reverse rotation runstop command input	
	[EN1] [EN2]	Enable input	(1) When terminals [EN1]/[PLC] or terminals [EN2]/[PLC] are OFF, the inverter output transistors stop switching (safe torque off: STO). Be sure to operate terminals [EN1] and [EN2] simultaneously; otherwise an \overline{E} F alarm is issued and inverter operation is disabled. (2) The input mode for terminals [EN1] and [EN2] is fixed to SOURCE. The mode cannot be changed to SINK. (3) Short across [EN1], [EN2], and [PLC] if not using this function.
	[PLC]	Programmable logic controller signal power supply	(1) Connect the output signal power supply for the programmable controller. (Rated voltage +24 VDC power supply voltage fluctuation range: +20.4 to +27 VDC), maximum 100 mA) (2) The terminal can also be used as the power supply for loads connected to transistor outputs. Refer to the "Transistor output" section for details.
[CM] [Y1] [Y2] [Y3] [CMY]	Digital common	This is a common terminal for digital input signals. (1) Various signals (running signal, frequency reached signal, etc.) set with function codes E20, E21, and E22 can be output. Refer to the User's Manual (2447-E-0179) for details. (2) The operating mode between terminal outputs [Y1] and [Y3] and terminal CMY can be changed to "ON when signal output (active ON)" or "OFF when signal output (active OFF)". Maximum voltage for pull-up power supply: 48 V, maximum load current when ON: 50 mA	
[YSA] [YSC]	Transistor output common	This is a common terminal for transistor output signals. The terminal is insulated from terminals [CM], [I1].	
[YSA] [YSC]	General-purpose relay output	(1) The same signals as those of terminals [Y1] to [Y3] can be selected and output as multi-purpose relay outputs. Contact capacity: 250 VAC 0.3A cosφ = 0.3, 48 VDC 0.5A (2) The same signals as those of terminals [Y1] to [Y3] can be selected and output. (3) It is possible to switch between a "short circuit between terminals [YSA] and [YSC] when an ON signal is output (excitation: active ON)" or an "open circuit between terminals [YSA] and [YSC] when an ON signal is output (non-excitation: active OFF)". Do not connect the PC LAN ports, Ethernet hubs, or telephone lines to the RJ-45 connector. The inverter and the connected device may be damaged.	
[30A] [30B] [30C]	Contact output	(1) When the inverter stops with an alarm, an integrated alarm is output at the relay contact (1C). Contact capacity: 250 VAC 0.3A cosφ = 0.3, 48 VDC 0.5A (2) The same signals as those of terminals [Y1] to [Y3] can be selected and output. (3) It is possible to switch between a "short circuit between terminals [30A] and [30C] when an ON signal is output (excitation: active ON)" or an "open circuit between terminals [30A] and [30C] when an ON signal is output (non-excitation: active OFF)". By removing the blind cover and attaching the keypad relay adapter (RS4D-CF) (optional), it can be used as RS-485 communication port 1 for the following purposes. (1) This is used as a connector for connecting the keypad. The keypad power is supplied from the inverter via an extension cable and RS-485 communication cable. Turn ON the SW2 terminating resistor. (2) This is used to connect a computer or programmable controller, etc. by RS-485 communication after disconnecting the keypad. (Refer to the User's Manual (2447-E-0179) for details on terminating resistance.) Pins 1, 2, 7, and 8 are assigned as the power supply source for the keypad. When connecting this RJ-45 connector to other devices, do not use these pins. Do not connect the PC LAN ports, Ethernet hubs, or telephone lines to the RJ-45 connector. The inverter and the connected device may be damaged.	
[RS]	For keypad connection RJ-45 connector	RS-485 connector port 1	By removing the blind cover and attaching the keypad relay adapter (RS4D-CF) (optional), it can be used as RS-485 communication port 1 for the following purposes. (1) This is used as a connector for connecting the keypad. The keypad power is supplied from the inverter via an extension cable and RS-485 communication cable. Turn ON the SW2 terminating resistor. (2) This is used to connect a computer or programmable controller, etc. by RS-485 communication after disconnecting the keypad. (Refer to the User's Manual (2447-E-0179) for details on terminating resistance.) Pins 1, 2, 7, and 8 are assigned as the power supply source for the keypad. When connecting this RJ-45 connector to other devices, do not use these pins. Do not connect the PC LAN ports, Ethernet hubs, or telephone lines to the RJ-45 connector. The inverter and the connected device may be damaged.
[USB]	USB connector	USB port	This is a USB connector (model specification) for connecting to a computer. Function codes can be edited, transferred, and verified, an inverter test run can be performed, and all states can be monitored using the inverter support loader (FRENC Loader). Refer to the User's Manual (2447-E-0179) for details.
[PC]	Encoder power supply	Encoder power supply	This is the encoder power supply terminal. • Specification voltage: 5 VDC ±10%
[CM]	Digital Common for sequence I/O	Digital Common for sequence I/O	This is the encoder power supply common terminal. The terminal is insulated from terminals [I1], [CMY].
[PA+] [PA-]	A-phase input	A-phase input	This is the A-phase input terminal. The frequency changes based on the motor speed. • Input frequency: Max 50 Hz • Differential input signal V _{p-p} : 0.6 to 1.2 V
[PB+] [PB-]	B phase input	B phase input	This is the B-phase input terminal. The frequency changes based on the motor speed. • Input frequency: Max 50 Hz • Differential input signal V _{p-p} : 0.6 to 1.2 V
[PC+] [PC-]	C-phase input	C-phase input	This is the C-phase input terminal. The frequency changes based on the motor speed. • Input frequency: Max 14 kHz • Differential input signal V _{p-p} : 0.6 to 1.2 V
[PD+] [PD-]	D-phase input	D-phase input	This is the D-phase input terminal. The frequency changes based on the motor speed. • Input frequency: Max 14 kHz • Differential input signal V _{p-p} : 0.6 to 1.2 V
[CK+] [CK-]	Encoder communication clock	Encoder communication clock	Communication data input/output terminal compatible with EnDat2.0, BiSS protocols
[DT+] [DT-]	Encoder communication data	Encoder communication data	Do not connect the shield part of the encoder cable.
[SD]	Do not connect the shield part of the encoder cable		This terminal outputs the same frequency pulse as AB-phase input signals. • Maximum voltage for pull-up power supply: 27 V, maximum load current when ON: 50 mA, Output method: Open collector, max. output frequency: 50 kHz.
[PA0] [PB0]	AB-phase pulse output	AB-phase pulse output	This is a common terminal for pulse output. The terminal is insulated from terminals [I1], [CMY].
[CM]	Digital common	Digital common	The terminal is insulated from terminals [I1], [CMY].

2.2.7.3 Short circuit wiring procedure for EN terminals (In case not use EN terminals)

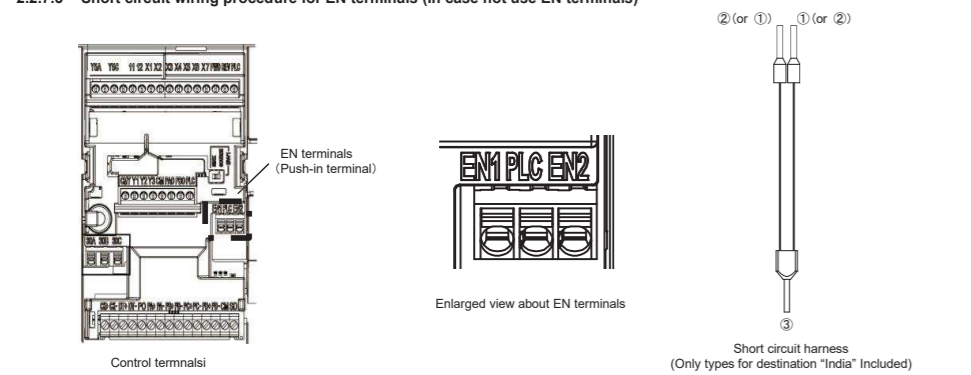


Fig.2-9 EN terminals and short circuit harness

- 1) Wiring terminal ① of short circuit harness to EN2 terminal.
- 2) About terminal ① and ② of short circuit harness, there are no difference.
- 3) Wiring terminal ② of short circuit harness to PLC terminal.
- 4) Wiring terminal ③ of short circuit harness to EN1 terminal.

When wiring to EN1 terminal, direction of terminal ③ should follow arrow view diagram of Fig.2-10.
① Pay attention to avoid other wiring wires being with covers or other parts.
② Following the opposite procedure to that in Fig. 2-10.

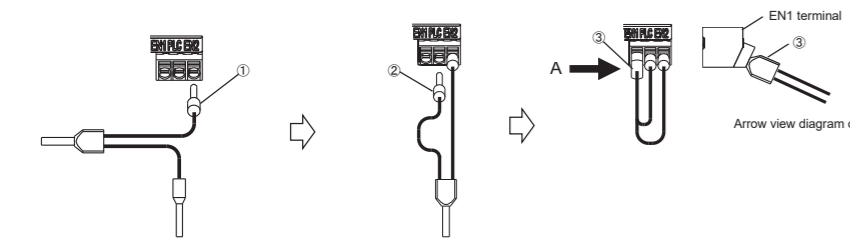


Fig.2-10 Wiring short circuit harness

Chapter 3 OPERATION USING THE KEYPAD

TP-M3 (option) is required for operation from the keypad. Refer to the User's Manual for details.

3.1 Blind Cover and Name of Each Part

※Mounted the blind cover in factory shipping condition is only types for destination "Global".

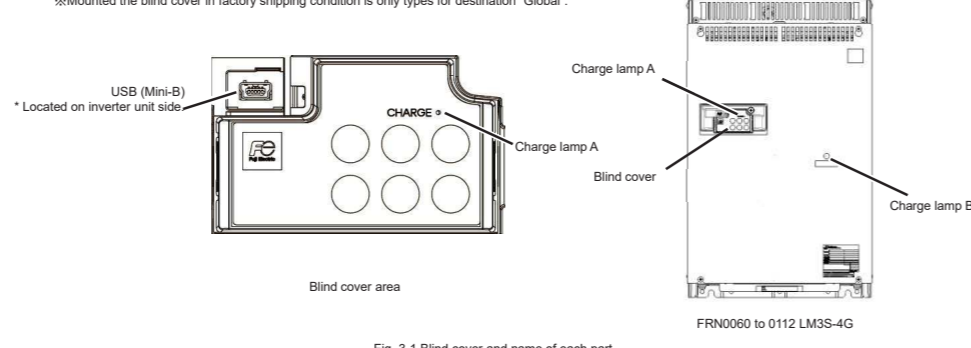


Fig. 3-1 Blind cover and name of each part

Item	Display and keys	Function overview
Charge lamp A		This lamp lights up while the control circuit is running. FRN0025 to 0090 LMS-2-C (Use as the indication for internal voltage). FRN0099 to 0045 LMS-4-C FRN0111 LMS-7-C FRN0060 to 0112 LMS-4-C. Use with front cover charge lamp B for checking internal voltage.
Charge lamp B		This lamp lights up while power is being supplied from the terminal block (main circuit terminals and auxiliary power terminals). (FRN0060 to 0112 LMS-4-C) only
USB port		The inverter and PC can be connected with a USB cable. The connector shape at the inverter side is a mini-B type. Use a USB cable with thickness of 12 mm or less by 8.2 mm or less.

Table 3-1 Overview of blind cover and USB names and functions

Chapter 4 Function code

To check the function code with only the inverter, a keypad (optional) is required.

The alarm display list can be viewed and downloaded by accessing the QR Code below.

Function code list QR Code



https://www.fujielectric.com/products/drives_inverter/a/c_drives/_inproduct_series/frenc-ifrm3_download_pr1.html

Chapter 5 ALARM DISPLAY

To display alarms with only the inverter, a keypad (optional) is required.
The alarm display list can be viewed and downloaded by accessing the QR Code below.

Alarm display list QR Code



https://www.fujielectric.com/products/drives_inverter/siac_drives/_inproduct_series/frenc-ifrm3_download_pr2.html

Table 4-1 Function codes (excerpt)

Function code	Name	Data setting range
F01	Speed setting	0: Multi-step speed with S-curve acceleration/deceleration (Select motor characteristics) 1: Analog command (reversible operation not possible) 2: Analog command (reversible operation possible)
F03	Max. speed	150.0 to 3600 r/min *1
F04	Rated speed	150.0 to 3600 r/min *1
F05	Rated voltage	80 to 240 V (200V series) 160 to 500 V (400V series)
F07, etc.	Acceleration/deceleration time	0.00 to 99.9 s
F26	Motor sound (Carrier frequency)	2 to 16 kHz
F42	Drive control selection	0: Vector control with PG (induction motors) 1: Vector control with PG (synchronous motors) 2: Torque vector control (induction motors) 3: V/f control *2
CO4, etc.	Multi-stage speed setting (zero speed, etc.)	150.0 to 3600 r/min *1
H57, etc.	S-curve setting	0 to 50%
L01	Encoder (Function selection)	0: ABS: No (1215 V complementary / open collector) 1: ABS: Yes (1215 V complementary / open collector / 2-phase only) 4: Serial (EnDat + SinCos - ECHN13) or equivalent *3 5: SinCos - ERN1387 or equivalent *3 6: Serial (BiSS) + SinCos *3
L02	Encoder (pulse count)	360 to 60000 pulses/round
L03	Magnetic pole position offset (tuning)	4: Enable (Clock tuning) 5: Enable (Rotation tuning)
L04	Magnetic pole position offset (offset value)	0.00 to 360.00 deg.
L106	Function code operation selection SW4	bit 1 absolute position reverse rotation 0: No reverse rotation, 1: Reverse rotation When using a Serial encoder (L01 setting value: 4, 6) or SinCos encoder (L01 setting value: 5), this is used to match the relationship between encoder incremental signals and absolute position signals. Refer to the User's Manual for details.

*1: For 4 poles Setting is possible in the 5 to 120 Hz range by converting the inverter output frequency.
*2: V/f control is used only for test operation, and must be selected for elevator control.
*3: These selections are only compatible with a pulse count of 2ⁿ (1024, 2048, etc.).

Chapter 6 MAINTENANCE AND INSPECTION

6.1 Product Inquiries and Warranty

6.1.1 Inquiry Request

If necessary to make an inquiry relating to such aspects as product failure or damage, or anything that is in doubt, please notify Fuji Electric of the following.

- 1) Inverter type. Refer to Chapter 1 "1.1 Acceptance Inspection (Nameplates and Inverter Type)".
- 2) SER No. (serial number of equipment). Refer to Chapter 1 "1.1 Acceptance Inspection (Nameplates and Inverter Type)".
- 3) Any function code data that has been changed from the factory default values (See User's Manual (2447-E-0179)-1).
- 4) ROM version (See User's Manual (2447-E-0179)-1).
- 5) Date of purchase
- 6) Inquiries (for example, point and extent of breakage, uncertainties, failure phenomena, and other circumstances)

6.1.2 Product Warranty

To all our customers who purchase Fuji Electric products included in this documentation:

Please take the following into consideration when placing your order.

When requesting an estimate and placing your orders for the products included in these materials, please be aware that any items such as specifications which are not specifically mentioned in the contract, catalog, specifications or other materials will be as mentioned below.
In addition, the products included in these materials are limited in the use they are put to and the place where they can be used, etc., and may require periodic inspection. Please confirm these points with your sales representative or directly with this company.
Furthermore, regarding purchased products and delivered products, we request that you take adequate consideration of the necessity of rapid receiving inspections and of product management and maintenance even before receiving your products.

6.1.2.1 Free of Charge Warranty Period and Warranty Scope

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

- (1) In the event that breakdown occurs during the product's warranty period which is the responsibility of Fuji Electric, Fuji Electric will replace or repair the part of the product that has broken down free of charge at the place where the product was purchased or where it was delivered. However, if the following cases are applicable, the terms of this warranty may not apply.
(1) The failure was caused by inappropriate conditions, environment, handling or usage methods, etc., which are not specified in the catalog, instruction manual, specifications, or other relevant documents.
(2) The failure was caused by some reason other than the purchased or delivered Fuji Electric product.
(3) The failure was unrelated to a Fuji Electric product, such as a problem with the design of the customer's equipment or software.
(4) The failure was caused by running a program other than that supplied by Fuji Electric for a programmable Fuji Electric product, or as a result of using such a program.
(5) The failure was caused by disassembly, modifications, or repairs carried out by a party other than Fuji Electric.
(6) The failure was caused by a failure to properly maintain or replace the consumable parts, etc. specified in the User's Manual.
(7) The failure was caused by a scientific or technical problem that was not foreseen when making practical application of the product at the time it was purchased or delivered.
(8) The product was not used in the manner in which it was originally intended to be used.
(9) The failure was caused by a reason for which Fuji Electric holds no responsibility, such as natural or other disaster.
(10) Furthermore, the warranty specified herein shall be limited solely to the purchased or delivered product.
(11) The upper limit for the warranty scope shall be as specified in item (1) above, and any damages (damage to or loss of machinery or equipment, or lost profits from the same, etc.) consequent to or resulting from a failure of the purchased or delivered product shall be excluded from coverage by this warranty.
- (2) Trouble diagnosis
As a rule, the customer is requested to carry out a preliminary trouble diagnosis. However, at the customer's request, Fuji Electric or its service network can perform the trouble diagnosis for a fee. In this case, the customer is asked to assume the burden for charges levied in accordance with Fuji Electric's fee regulations.

6.1.2.2 Exclusion of Liability for Loss of Opportunity, etc.

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

6.1.2.3 Repair period after production stoppage, spare parts supply period (maintenance period)

With regards to models (products) which have gone out of production, Fuji Electric shall carry out repairs for a period of 7 years following production stoppage, from the month and year when the production stoppage occurs. In addition, Fuji Electric shall continue to supply the spare parts required for repairs for a period of 7 years, from the month and year when the production stoppage occurs. However, if it is estimated that the life cycle of certain electronic and other parts is short and it will be difficult to procure or produce those parts, there may be cases where it is difficult to provide repairs or supply spare parts even within the 7-year period. For details, please confirm with the Fuji Electric business office or our service office.

6.1.2.4 Delivery conditions

The product delivered and handed over to the customer shall be the standard product for which no settings have been specified, or adjustments made with an application, and Fuji Electric accepts no responsibility for any on-site adjustments or test operation.

6.1.2.5 Service description

The price of the purchased or delivered product does not include service costs such as those required for dispatching technicians and so on. Fuji Electric will be more than happy to discuss this further upon request.

6.1.2.6 Applicable scope of service

The above content applies to transactions and use within Japan. Please consult your dealer or Fuji Electric regarding transactions or use outside Japan.

Chapter 7 STANDARDS COMPLIANCE

7.1 European Standards Compatibility

The CE marking on Fuji products indicates that they comply with the essential requirements of the Electromagnetic Compatibility (EMC) Directive issued by the Council of the European Communities, the Low Voltage Directive, Machine Directives, and LRT Directive.

Note: Keep the ambient temperature at 50 °C or less to comply with European standards. This does not apply to products with no standard indication.

Table 7-1 Compliance standards

EMC Directive	EN12015, EN12016, EN61800-3 Immunity, Second environment (industrial)	Emission: Category C2 (Applicable only when an optional EMC-compliant filter is attached.)
Low Voltage Directive	Adjustable speed electrical power drive systems, Part 5-1: Safety requirements, Electrical, thermal and energy EN61800-5-1	
Machine Directives	ENISO 13849-1: Cat.3 / PL-e EN 60204-1: Stop Category 0 EN 61800-2: SIL 3 (Functional Safety: STO)	
LRT Directive	EN 81-20 (in extract)	

Note 1: Complies with the EMC Directive by combining it with an external filter dedicated to Fuji.

Note 3: Compatibility with revised EMC Directive and Low Voltage Directive

It has a risk about other equipment malfunction or breakdown by radiated electric field strength out of frequency range that is defined

EN 61800-3: 2004 + A1: 2012 2nd Environment and ENIEC 61800-3: 2018 2nd Environment.

Note 2: Refer to the User's Manual (2447-E-0179) for details on Machine Directives.

Note 3: Compatibility with revised EMC Directive and Low Voltage Directive (2014/53/EU). It is necessary to clearly state the name and the address of manufacturers and importers to enhance traceability. Importers shall be indicated as follows when exporting products from Fuji Electric to Europe.

Manufacturer: Fuji Electric Europe GmbH, Goeberring 58, 63067 Offenbach am Main, Germany
Importer in Europe: Fuji Electric Europe GmbH, Goeberring 58, 63067 Offenbach am Main, Germany
*Caution when exporting to Europe:
• Not all Fuji Electric products in Europe are necessarily imported by the above importer. If any Fuji Electric products are exported to Europe via another importer, please ensure that the importer is clearly stated by the customer.

7.2 Compliance with UL Standards and Canadian Standards (cUL Certification) Types for destination "India" are not applicable.

UL Standards (Underwriters Laboratories Inc. standards) are North American safety standards used to prevent fire and other such accidents, and offer protection to users, service technicians, and the general public.

cUL indicates that products which comply with CSA standards are certified by UL. cUL certified products are as effective as those certified as complying with CSA standards.

7.2.1 UL Standards and Canadian Standards (cUL Certification) Compatibility

Compatibility with UL Standards (UL61800-1) and Canadian Standards (cUL certification: C22.2 No.274-17, B44.1/ANSI/ASME A17.5) is ensured by installing inverters with UL / cUL marking in accordance with the following.

UL Standards and Canadian Standards (cUL Certification) Compatibility

Product	UL Standard	UL Marking	UL Marking	UL Marking	UL Marking	UL Marking	UL Marking	UL Marking	UL Marking
FRN0025LMS-2-C	60	80	27 (3.0)	27 (3.0)	10 (5.8)	10 (5.8)	10 (5.8)	10 (5.8)	10 (5.8)
FRN0031LMS-4-C	60	80	27 (3.0)	27 (3.0)	10 (5.8)	10 (5.8)	10 (5.8)	10 (5.8)	10 (5.8)

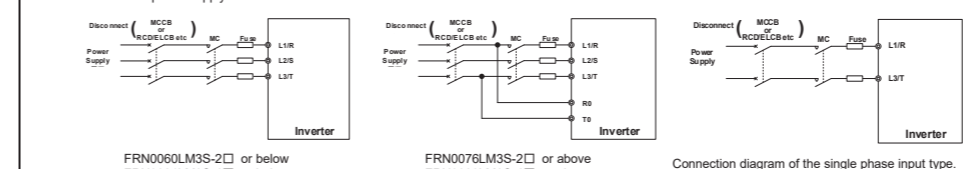
Note) Control circuit terminal lightning torque: 1.8 lbf-in (0.21 N·m), recommended wire size: AWG20 (0.5 mm)
*1: No terminal and treatment is required for connection.
*2: Use 75 °C (167 °F) Cu wire only.
*3: The wire size of UL Open Type and Enclosed Type are common. Please contact us if UL Open Type exclusive wire is necessary.
*4: If using semiconductor fuses, refer to the User's Manual "APPENDIX G" and the additional material "NRM-SH47-2587-1".

CAUTION

1. Solid state motor overload protection (motor protection by electronic thermal overload relay) is provided in each model.
Use function codes F10 to F12 to set the protection level, refer to the description below.

F10	Electronic thermal overload protection for motor 1 (Select motor characteristics) 1: Enable (for general-purpose motors with self-cooling fan) 2: Enable (for inverter-driven motors with separately powered cooling fan)
F11	(Overload detection level) 0.00 (disable) 0.01 to 1.00 (select value of 1 to 135% of inverter rated current) (Thermal time constant)
F12	0.5 to 75.0 min. Refer to the graph right figure.

1. No terminal and treatment is required for connection.
2. Use Cu wire only.
3. Use R/C Appliance Wiring Material (AVLV2B), rated min. 105 °C/60 V for control circuit if the control circuit wiring can touch to the main circuit part.
4. Short circuit current rating
200 volts class models are suitable for use on a circuit of delivering not more than 100,000 rms symmetrical amperes, 240 volts maximum when protected by appropriate protection device (refer to the below tables of 9) having the short circuit current rating (SCCR) not less than 100,000 rms symmetrical amperes, 240 volts maximum.
400 volts class models are suitable for use on a circuit of delivering not more than 100,000 rms symmetrical amperes, 480 volts maximum when protected by appropriate protection device (refer to the below tables of 9) having the short circuit current rating (SCCR) not less than 100,000 rms symmetrical amperes, 480 volts maximum.
5. Field wiring connections must be made by a UL Listed and CSA Certified closed-loop terminal connector sized for the wire gauge involved. Connector must be fixed using the crimp tool specified by the connector manufacturer.
6. All circuits with terminals [L/R], [L2/S], [L3/T], [R], [T] must have a common disconnect and be connected to the same pole of the disconnect if the terminals are connected to the power supply.



7. Environmental Requirements
• Surrounding ambient temperature Maximum Surrounding Air Temperature 50 °C
• Atmosphere For use in pollution degree 2 environments. (for Open-Type models)

8. Storage and Transport Environments

Item	Specifications
Storage temperature	During transport: -25 to +70 °C (-13 to +158 °F) During storage: -25 to +65 °C (-13 to +153 °F)
Relative humidity	5 to 95% RH *1 Places not subjected to abrupt temperature changes or condensation or freezing
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/m ³ or less per year)
Atmospheric pressure	86 to 106 kPa (during storage) 70 to 106 kPa (during transportation)

*1: 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 or freezing.