Fuji Electric

Innovating Energy Technology

AC Drives for Elevator applications

FRENIC-Lift Series

FRENIC-Lift

[OUTPUT : 2.2 - 55kW]

Great performance through dedicated designs
Welcome to the new generation of elevator inverter

CE

UL CERTIFIED E132902
IND.CONT.EQ.
ELEVATOR CONTROL (E538368)
ALSO CERTIFIED TO CSA B44.1, ANSI/ASME A17.5

24A1-E-0181a

AC Drives for Elevator applications Launch of Long-Awaited New Series.

Improved basic performance with the same optimized specifications for elevator applications. The FRENIC-Lift (LM3) Series, which is even easier to use than the FRENIC-Lift (LM1) Series, greatly contributes to comfortable elevator operations by reducing sway and landing position errors.

Optimized for elevator applications

Dedicated design optimized for passenger elevators, featuring built-in full-capacity braking circuit, rescue operation mode, and more

FRENIC-Lift
LM3
SERIES

Improves basic performance

Supports various motor combinations. Contributes to improved elevator ride quality by improving encoder detection accuracy

Improves maintainability

Improves work efficiency with simplified wiring and easy setup. Features safe and reliable preventive and predictive maintenance functions

CONTENTS

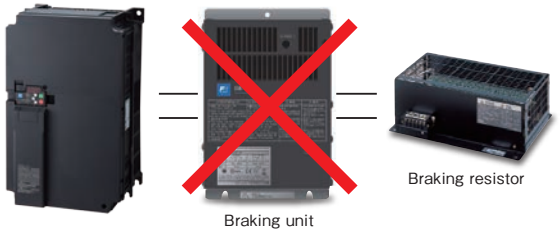
Optimized for elevator applications

Dedicated design optimized for passenger elevators,
featuring built-in full-capacity braking circuit, rescue operation mode, and more

01 Dedicated design optimized for passenger elevators

Built-in full-capacity braking circuit

Comes standard with built-in full-capacity braking circuit that contributes to space and cost savings in the control panel.



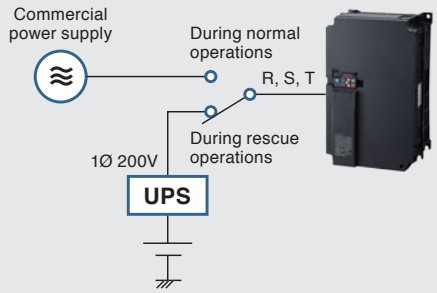
Comes standard with built-in PG feedback circuit

- Standardly supports sine wave encoder (1Vpp) and serial encoder (EnDat2.1, Biss-C).
- Standardly supports pulse output for connection to host controllers.

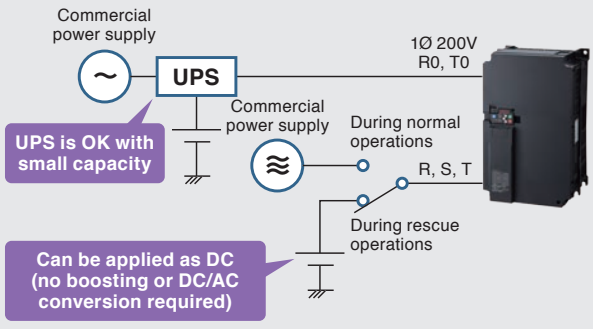
02 Rescue operations

During rescue operations, the AC Drive is operated (for braking) with a single-phase 200 V or battery-powered power supply to enable movement to a door area.

Rescue operations using single-phase 200 V



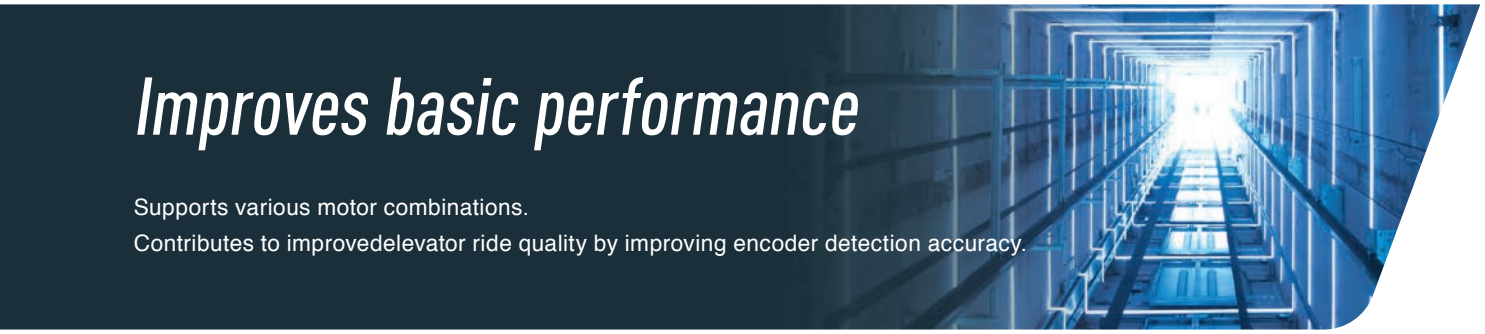
Rescue operations using battery



Required voltage during rescue operations		Synchronous motor	Induction motor
15 kW or less	Single-phase 200 V	**Available**[*1]	**Available**
	24 V DC (200 V series) 48 V DC (400 V series)	×	×
18.5 kW or more	Single-phase 200 V	**Available**[*1]	**Available**
	24 V DC (200 V series) 48 V DC (400 V series)	**Available**[*2]	**Available**[*2]

*1: Magnetic pole position offset tuning may be required before rescue operation.
*2: Requires input of the voltage specified for the control power supply auxiliary input.

* During rescue operations, braking operations are implemented. For details, refer to the User's Manual.

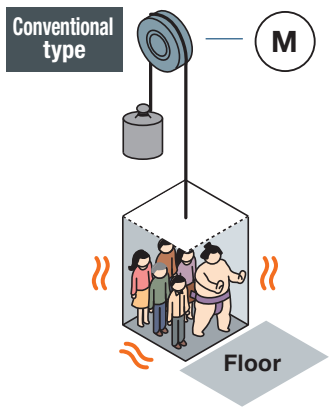


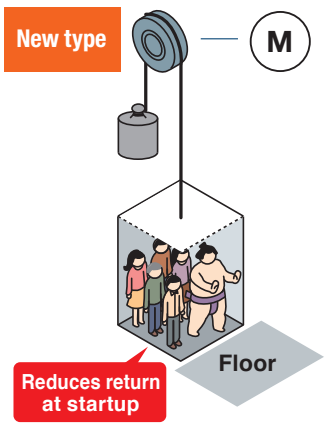
Improves basic performance

Supports various motor combinations.
Contributes to improvedelevator ride quality by improving encoder detection accuracy.

01 Improves AC Drive control performance

The current response (ACR) of the AC Drive is 500 Hz.
Improves detection accuracy at very low speeds with a sine-wave encoder.





Reduces rollback

Reduces rollback via improved performance.
Improves ride comfort.

Improves encoder detection accuracy

Improved encoder detection accuracy* enhances imbalance load compensation performance.
Capable of simplifying load cells.

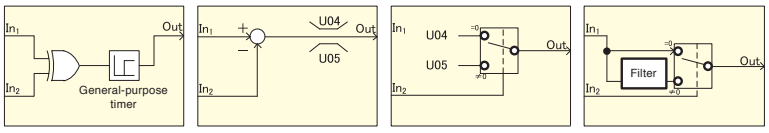
* Only when incremental signal uses a sine wave encoder

02 Customizable logic functions

The FRENIC-Lift (LM3) Series also features the customized logic functions of the FRENIC-Ace (E3)/MEGA (G2) Series.

What are customizable logic functions?

Built-in simple PLC functions that enable programming for the AC Drive.

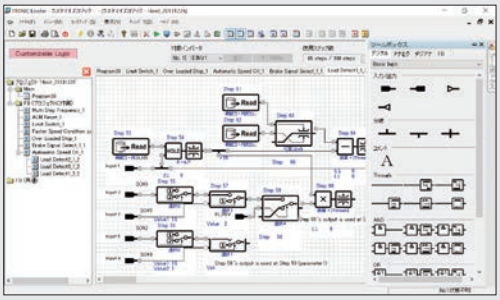


Digital operations | Analog operations | Selector | Filter

Flexible development environment

PC loader

Enables intuitive programming with PC loader support.
Function blocks (FBs) created by users can be exported/imported and shared with other users.
FBs can also be given a control number and can be password locked to conceal their internal logic.

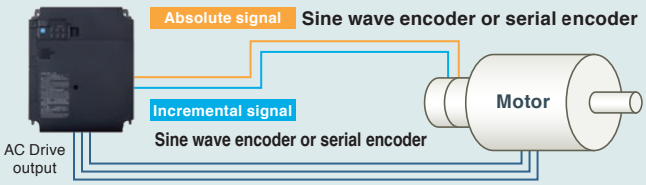


03 Supports various combinations

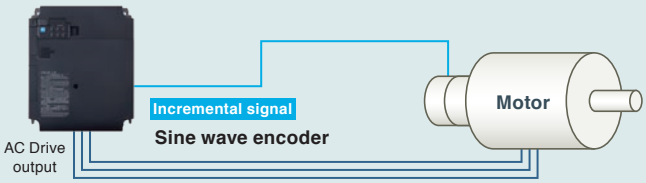
Supports various encoders and motors combinations.
Standardly supports sine wave encoder (1Vpp) and serial encoder (EnDat2.1, Biss-C).

Supported as standard

Synchronous motor
High-speed sensor-equipped vector control



Induction motor
High-speed sensor-equipped vector control



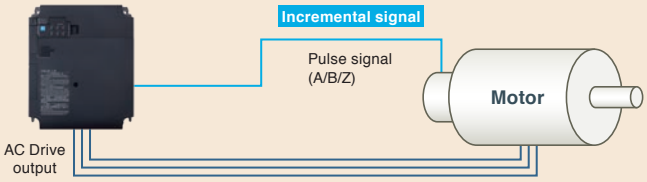
Induction motor
Dynamic torque vector control

* Does not support hole sensor UVW and 4-bit gray code. Does not support high-speed sensorless vector control

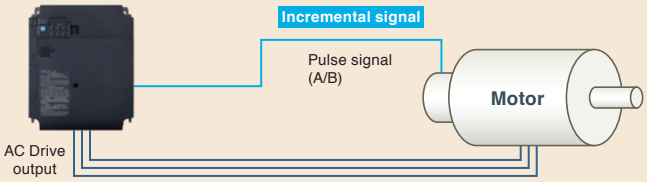
Optional

PG interface card
OPC-LM-PG3

Synchronous motor
High-speed sensor-equipped vector control



Induction motor
High-speed sensor-equipped vector control



04 Password function

Comes with a password function to protect AC Drive parameters.

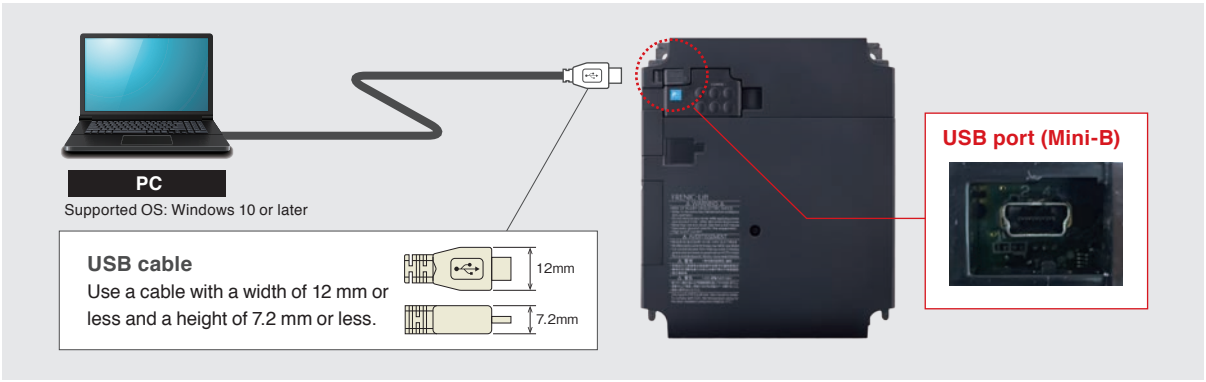
Password function
Locks parameter changes to prevent unintended parameter changes.

Improves maintainability

Improves work efficiency with simplified wiring and easy setup.
Features safe and reliable preventive and predictive maintenance functions

01 Equipped with USB port

Comes standard with USB port (Mini-B) for direct communication between AC Drive and PC. Capable of writing and reading parameters to and from the AC Drive using only bus power.



02 PC loader

Capable of directly connecting to a PC via USB to edit and monitor AC Drive parameters.

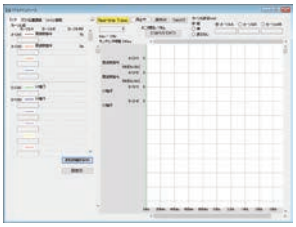
FRENIC-Loader4

Function codes

Easy function code changes

"Edit", "Read", "Transfer", "Compare", "Initialize", and "Store data" for function codes.

Trace



Confirm with waveform

Displays a trace of the present status of current, voltage, and digital terminals as analog and digital waveforms. Capable of saving and loading trace data.

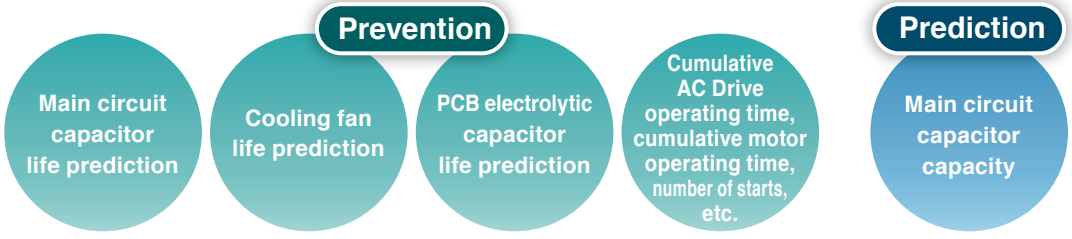
Monitor

What is the present status?

Displays meter values of operating conditions in real time. Capable of displaying trip history, I/O status, and serviceable parts status.

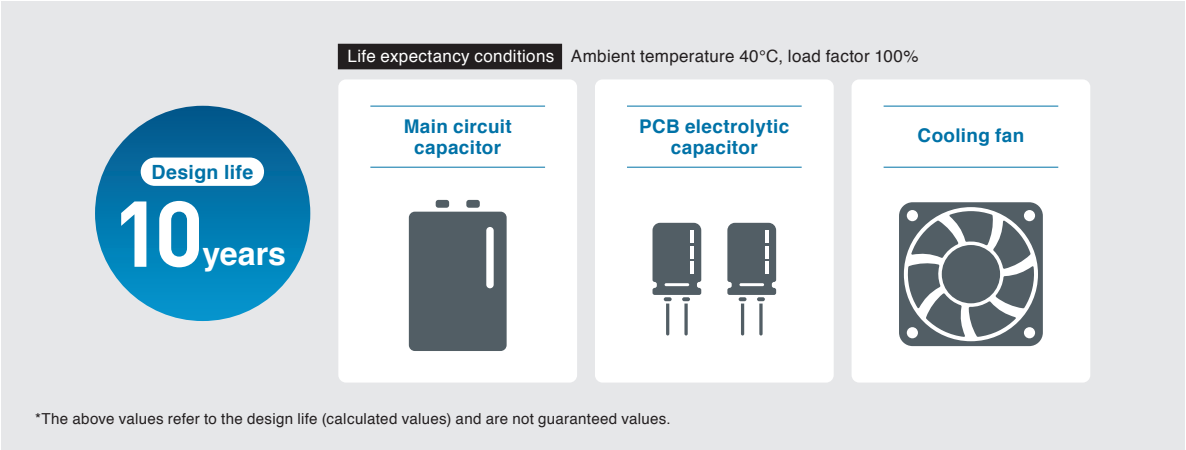
03 Preventive maintenance and predictive maintenance

The keypad and PC loader make it easy to check the status of equipment and detect problems before they occur, helping to reduce production equipment maintenance time and downtime.



04 Long life expectancy (main components)

Many of the serviceable parts inside the AC Drive have been designed to meet customer equipment maintenance cycles.



*The above values refer to the design life (calculated values) and are not guaranteed values.

05 Standards compliance

Compliant with overseas safety standards.

Item		Description	Certification mark
Europe	Low Voltage Directive	EN61800-5-1: Ov3	CE
Europe	EMC Directive	EN12015 EN12016 EN 61800-3 +A1	
United States	UL Standard	UL61800-5-1	cULus E132902
Canada	CSA Standard	C22.2 No. 274-17 B44.1 (ANSI/ASME A17.5)	
Korea	KC Standard		KC

Model Variations

Standard applicable motor kW	3-phase 400 V series	3-phase 200 V series	1-phase 200 V series
2.2			FRN0011LM3S-7☐
4.0	FRN0009LM3S-4☐		
5.5	FRN0015LM3S-4☐	FRN0025LM3S-2☐	
7.5	FRN0018LM3S-4☐	FRN0033LM3S-2☐	
11	FRN0024LM3S-4☐	FRN0047LM3S-2☐	
15	FRN0031LM3S-4☐	FRN0060LM3S-2☐	
18.5	FRN0039LM3S-4☐	FRN0076LM3S-2☐	
22	FRN0045LM3S-4☐	FRN0090LM3S-2☐	
30	FRN0060LM3S-4☐		
37	FRN0075LM3S-4☐		
45	FRN0091LM3S-4☐		
55	FRN0112LM3S-4☐		

How to read the inverter modelerter model

FRN 0025 LM 3 S - 2 G

Code	Series name
FRN	FRENIC series

Code		Applicable motor rating [kW] HHD
Three-phase 200V	0025	5.5
	0033	7.5
	0047	11
	0060	15
	0076	18.5
	0090	22
Three-phase 400V	0009	4.0
	0015	5.5
	0018	7.5
	0024	11
	0031	15
	0039	18.5
	0045	22
	0060	30
	0075	37
	0091	45
	0112	55
Single-phase 200V	0011	2.2

Code	Destination / Manual
G	Global / English
A	India / English

Code	Power supply
2	Three-phase 200V
4	Three-phase 400V
7	Single-phase 200V

Code	Enclosure
S	Standard (Basic type)

Code	Development code
3	3

Code	Applicable area
LM	For Lift

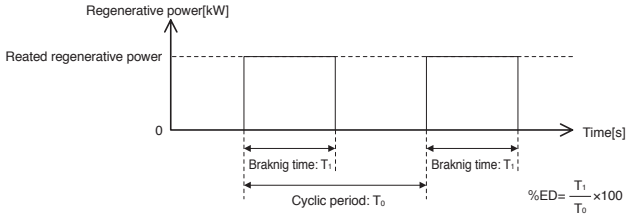
Note) India model(FRN**LM3S-☐A): The keypad is mounted in factory shipping condition.
Global model(FRN**LM3S-☐G): The blind cover is mounted in factory shipping condition.The keypad is an option sold separately.

Standard specifications

Three-phase 200V series

Item				Specifications					
Type (FRN□□□□LM3S-2 □)				**0025**	**0033**	**0047**	**0060**	**0076**	**0090**
Standard-applied motor*1 [kW]				5.5	7.5	11	15	18.5	22
Standard-applied motor*1 [HP]				7.5	10	15	20	25	30
Output rating	Rated capacity*2 [kVA]			9.5	13	18	23	29	34
	Rated voltage*3 [V]			With 3-phase 200～240 V(with AVR function)					
	Rated current*4 [A]			25	33	47	60	76	90
	Overload current rating(Tolerance overload time)			150%-1 min 200%-3 s					
	Ambient temperature			-10 to +55 °C [14 to 131 °F] (current derating necessary in +50 to +55 °C [122 to 131 °F] range)					
	Rated frequency [Hz]			50, 60 Hz					
Input rating	Normal operation	Voltage, frequency		Three-phase 200 to 240 V, 50/60 Hz					
		Voltage and frequency fluctuation		Voltage: +10 to -15% (phase-to-phase unbalance ratio: 2% or less)*7 Frequency: +5 to -5%					
		Rated current*5 [A]	With DCR	21.1	28.8	42.2	57.6	71.0	84.4
			Without DCR	31.5	42.7	60.7	80.1	97.0	112
		Required power supply (with DCR)*6 [kVA]		7.3	10	15	20	25	30
		Control power supply Auxiliary input		–				Single phase 200 to 240V, 50/60 Hz	
	UPS*8 operation	Main power (L1/R,L3/T)		Single phase:200 to 240 V, 50/60 Hz					
		Voltage and frequency fluctuation		Voltage: +10 to -10%, Frequency: +5 to -5%					
		Operation time [s]		180					
	Battery*8 operation	Main power (L1/R,L3/T)		–				DC 24V or higher	
		Control power supply Auxiliary input (R0,T0)	Rating Voltage Frequency	–				Single phase 200 to 240V, 50/60 Hz	
			Voltage• Frequency Variation	–				Voltage: +10 to -15% Frequency: +5 to -5%	
		Operation time [s]						180	
Braking	Braking time*9 [s]			60					
	Braking duty ratio*9 (%ED) [%]			50					
	Rated regenerative power*9 [kW]			4.4	6.0	8.8	12	14.8	17.6
	Minimum connectable resistance*10 [Ω]			15	10	7.5	6	4	3.5
DC reactor (DCR)				Option					
Protective construction (IEC60529)				IP20 enclosed type, UL open type					
Cooling system				Fan cooling					
Mass〔kg(lbs)〕				3.8 (8.4)	4.0 (8.8)	5.3 (12)	5.4 (12)	11 (24)	12 (26)

(*1) Standard applicable motors are for Fuji Electric's 4-pole standard motors.
(*2) The rated capacity is for 200V series: 220V rating.
(*3) A voltage higher than the power supply voltage cannot be output.
(*4) Indicates when the ambient temp. is 50°C 10kHz, the carrier frequency. Select the inverter capacity so that the mean square current in operation is 80% or less of the inverter rated current.
(*5) This is the estimated value when the power supply capacity is 500 kVA and connected to the power supply of %X=5%.
(*6) Indicates the type with a DC reactor (DCR).
(*7) Phase-to-phase imbalance ratio [%] = (Refer to max. voltage [V]-min. voltage [V])/3-phase averaging voltage [V] × 67(IEC/EN 61800-3)
Use an AC reactor (ACR: optional) when using with an unbalance ratio of 2 to 3%.
(*8) In UPS operation or battery operation, use with braking load.
Connect UPS or battery power supply to L1/R,L3/T.
(*9) Braking time and braking duty ratio (%ED) are defined by cycling operation at the rated regenerative power shown in the diagram below.

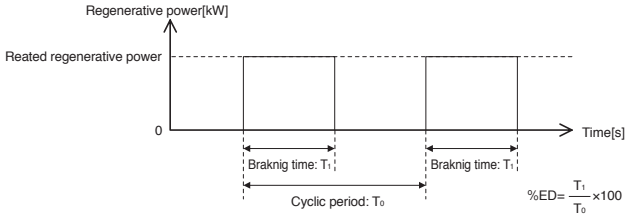


(*10) The allowable error of the minimum connectable resistance value is ±5%.

Three-phase 400V series

Item				Specifications									
Type(FRN□□□□LM3S-4□)				**0009**	**0015**	**0018**	**0024**	**0031**	**0039**	**0045**	**0060**	**0075**	**0091**	**0112**
Standard-applied motor[*1] [kW]				4.0	5.5	7.5	11	15	18.5	22	30	37	45	55
Standard-applied motor[*1] [HP]				5.4	7.5	10	15	20	25	30	40	50	60	75
Output rating	Rated capacity[*2] [kVA]			7.0	11	14	18	24	30	34	45	57	69	85
	Rated voltage[*3] [V]			With 3-phase 380～480 V(with AVR function)										
	Rated current[*4] [A]			9.2	14.8	18	24	31	39	45	60	75	91	112
	Overload current rating(Tolerance overload time)			150%-1 min 200%-3 s										
	Ambient temperature			-10 to +55 °C [14 to 131 °F] (current derating necessary in +50 to +55 °C [122 to 131 °F] range)										
	Rated frequency [Hz]			50, 60 Hz										
Input rating	Normal operation	Voltage, frequency		Three-phase 380 to 480 V, 50/60 Hz										
		Voltage and frequency fluctuation		Voltage: +10 to -15% (phase unbalance ratio: 2% or less) [*7] Frequency: +5 to -5%										
		Rated current[*5] [A]	With DCR	7.7	10.6	14.4	21.1	28.8	35.5	42.2	57.0	68.5	83.2	102
			Without DCR	14.2	17.3	23.2	33	43.8	52.3	60.6	77.9	94.3	114	140
		Required power supply (with DCR)[*6] [kVA]		5.4	7.3	10	15	20	25	29	40	48	58	71
		Control power supply Auxiliary input		–					Single phase 400 to 480 V, 50/60 Hz					
	UPS[*8] operation	Main power (L1/R,L3/T)		Single phase 220 to 480 V, 50/60 Hz										
		Voltage and frequency fluctuation		Voltage: +10 to -10%, Frequency: +5 to -5%										
		Operation time [s]		180										
	Battery[*8] operation	Main power (L1/R,L3/T)		–					DC 48V or higher					
		Control power supply Auxiliary input (R0,T0)	Rating Voltage Frequency	–					Single phase 380 to 480V, 50/60 Hz					
			Voltage・Frequency Variation	–					Voltage: +10 to -15% Frequency: +5 to -5%					
		Operation time [s]							180					
Braking	Braking time[*9] [s]			60										
	Braking duty ratio[*9] (%ED) [%]			50										
	Rated regenerative power[*9] [kW]			3.2	4.4	6.0	8.8	12	14.8	17.6	24	29.6	36	44
	Minimum connectable resistance[*10] [Ω]			96	64	48	24		16		10		8	6.4
DC reactor (DCR)				Option										
Protective construction (IEC60529)				IP20 enclosed type, UL open type							IP00 open UL open type External IP55 for installation of external coolant			
Cooling system				Fan cooling										
Mass〔kg(lbs)〕				3.8 (8.4)	3.8 (8.4)	3.8 (8.4)	5.2 (11)	5.4 (12)	11 (24)	11 (24)	23 (51)	23 (51)	28 (62)	31 (68)

(*1) Standard applicable motors are for Fuji Electric's 4-pole standard motors.
(*2) The rated capacity is for 400V series: 440V rating.
(*3) A voltage higher than the power supply voltage cannot be output.
(*4) Indicates when the ambient temp. is 50°C 10kHz, the carrier frequency. Select the inverter capacity so that the mean square current in operation is 80% or less of the inverter rated current.
(*5) This is the estimated value when the power supply capacity is 500 kVA and connected to the power supply of %X=5%.
(*6) Indicates the type with a DC reactor (DCR).
(*7) Phase-to-phase imbalance ratio [%] = (Refer to max. voltage [V]-min. voltage [V])/3-phase averaging voltage [V] × 67(IEC/EN 61800-3)
Use an AC reactor (ACR: optional) when using with an unbalance ratio of 2 to 3%.
(*8) In UPS operation or battery operation, use with braking load.
Connect UPS or battery power supply to L1/R,L3/T.
(*9) Braking time and braking duty ratio (%ED) are defined by cycling operation at the rated regenerative power shown in the diagram below.



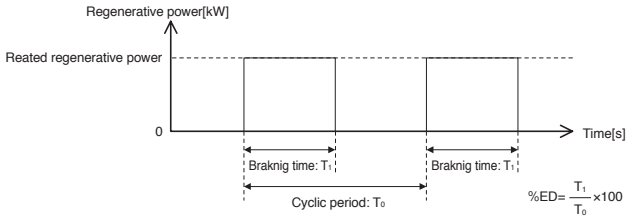
(*10) The allowable error of the minimum connectable resistance value is ±5%.

Standard specifications

Single phase 200V series

Item				Specifications
Type (FRN□□□□LM3S-7□)				**0011**
Standard-applied motor*1 [kW]				2.2
Standard-applied motor*1 [HP]				3
Output rating	Rated capacity*2 [kVA]			4.2
	Rated voltage*3 [V]			With single-phase 200～240 V(with AVR function)
	Rated current*4 [A]			11
	Overload current rating(Tolerance overload time)			150%-1 min 200%-3 s
	Ambient temperature			-10 to +55 °C [14 to 131 °F] (current derating necessary in +50 to +55 °C[122 to 131 °F] range)
	Rated frequency [Hz]			50, 60 Hz
Input rating	Normal operation*7	Voltage, frequency		Single phase 200 to 240 V,50/60Hz
		Voltage and frequency fluctuation		Voltage: +10 to -10%, Frequency: +5 to -5%
		Rated current*5 [A]	With DCR	17.5
			Without DCR	22.0
		Required power supply (with DCR)*6 [kVA]		3.5
		Control power supply Auxiliary input		–
	UPS operation*7	Main power (L1/R,L3/T)		Single phase 200 to 240 V, 50/60 Hz
		Voltage and frequency fluctuation		Voltage: +10 to -10%, Frequency: +5 to -5%
		Operation time [s]		180
Braking	Braking time*8 [s]			60
	Braking duty ratio*8 (%ED) [%]			50
	Rated regenerative power*8 [kW]			1.76
	Minimum connectable resistance*9 [Ω]			33
DC reactor (DCR)				Option
Protective construction (IEC60529)				IIP20 enclosed type, UL open type
Cooling system				Fan cooling
Mass〔kg(lbs)〕				3.8 (8.4)

(*1) Standard applicable motors are for Fuji Electric's 4-pole standard motors.
(*2) The rated capacity is for 200V series: 220V rating.
(*3) A voltage higher than the power supply voltage cannot be output.
(*4) Indicates when the ambient temp. is 50°C 10kHz, the carrier frequency. Select the inverter capacity so that the mean square current in operation is 80% or less of the inverter rated current.
(*5) This is the estimated value when the power supply capacity is 500 kVA and connected to the power supply of %X=5%.
(*6) Indicates the type with a DC reactor (DCR).
(*7) Only braking operation can be used during battery operation. Cannot be used in load operation.
Connect UPS or battery power supply to L1/R,L3/T.
(*8) Braking time and braking duty ratio (%ED) are defined by cycling operation at the rated regenerative power shown in the diagram below.



(*9) The allowable error of the minimum connectable resistance value is ±5%.

MEMO

Common Specifications

Item		Detailed specifications	Remarks
Control method		Vector control with PG (motor to be controlled: induction motor) Vector control with PG (motor to be controlled: permanent-magnet type synchronous motor) Dynamic torque vector control (open loop, controlled motor: induction motor) V/f control*1	
Adjustment	Carrier frequency	Setting: 2 to 16kHz variable Note) The carrier frequency may automatically lower depending upon the ambient temperature or the output current to protect the inverter. (The automatic lowering function can be disabled.)	
Speed control	Maximum speed	5 to 120Hz (4 poles: 150～3600r/min) conveted to inverter output-frequency	
	Control range	0 to 120Hz (4 poles: 0 to 3600r/min) conveted to inverter output-frequency	
	Control response	100Hz(Max)	(For vector control with PG)
	Control accuracy	Analog setting: ±0.2% or less of the max. speed (25±10°C) (77 ±18 °F) Multi-speed setting/communication setting: ±0.01% or less of the maximum speed (-10 to +45°C) (14 to 113 °F)	
	Setting resolution	Analog setting: 1/1000 of the maximum speed Multi-speed setting: 0.01Hz(99.99Hz or less in inverter output-frequency conversion), 0.1Hz(100.0～120.0Hz) Communication : 0.01Hz at 1/20000 of the maximum. speed or inverter output-frequency conversion (fixed)	
Control function	Operation	External signal (digital input): Forward operation/stop command, reverse run/stop command, free run command, external alarm, error reset, etc.	
	Speed setting	Multi-speed reference : Combination of 3 external signals (digital input) (8 stages) Analog signal :0～±10 V Communication: USB*2, RS485	
	S-curve acceleration/ deceleration setting	Individual setting of each point such as start, acceleration completion, deceleration start and stop (10 stages) Setting range :0～50%	
	Sequence Function	Forced stop, S-curve range/acceleration/deceleration time/multi-stage speed command simultaneous setting, operation command match timer, multi-stage speed command match timer, digital input logic inversion, digital output logic inversion, soft start at start, stop frequency continuation, acceleration/deceleration calculation function cancel	
	Control function	Speed controller feedforward compensation, vibration suppression observer, speed controller parameter switching motor constant tuning, customization logic, etc.	
	Torque control	Analog setting :0～±10 V Communication: RS485	
	Torque bias	Analog setting :0～±10 V Digital : Combination of two external signals (digital input) (3 levels)	
	Dedicated function	Password, unbalanced load compensation, creep press operation, battery operation, handshake function	
	Functions for Permanent Magnet Synchronous Motors	Magnetic pole position offset tuning	

*1 For test operation, such as feedback check of the encoder. Do not use with elevator control.
*2 Only during test run via "FRENIC Loader"

Item		Detailed specifications		Symbol*1	Alarm output*2
Protection function	Overcurrent protection	Stops the inverter to protect it from overcurrent caused by an overload.	During acceleration	0C1	○
	Short circuit protection	Stops if the inverter detects an overcurrent due to a short circuit in the output circuit.	During deceleration	0C2	○
	Ground fault protection	Stops if the inverter detects an overcurrent due to a short circuit in the output circuit. It may not be detected at powered if an inverter output is under the ground fault status.	In constant speed	0C3	○
			During acceleration	0U1	○
	Overvoltage protection	Stops the inverter if a DC link bus circuit overvoltage is detected. The inverter cannot be protected if an excessively large voltage is applied by accident.	During deceleration	0U2	○
			In constant speed(Stopped)	0U3	○
	Undervoltage error	Stops the inverter if a drop in DC link bus voltage is detected. However, undervoltage detection is canceled during battery operation (alarm output is not performed).		LU	△
	Input phase loss detection	Stops the inverter if input phase loss or input phase voltage unbalance is detected. The input phase loss protection may not work under light load or with DC reactor. It does not occur in the single-phase input type.		Lin	△
	Output phase loss detection	Stops the inverter if inverter output phase loss is detected during operation.		OPL	○
	Overheat protection	Stops the inverter if a cooling fan fault, or cooling fin overheating when an overload occurs is detected.		OH1	○
		Stops the inverter if a cooling fan fault, or inverter unit internal overheating when an overload occurs is detected.		OH3	○
	External alarm input	Stops the inverter and displays an error if a digital input signal (THR) is input.		OH2	○
	Inverter overload protection	Stops the inverter if overheating is detected by calculating the IGBT internal temperature from the output current and detected internal temperature.		OLU	○
	Electronic thermal	The inverter is stopped by the setting of the electronic thermal function to protect the motor. Protects general-purpose motor and inverter motor in the whole frequency range. Operation level and thermal time constant can be set.		OL1	○
	Memory error	When the power is turned ON, a data check is performed when writing data, and an error is displayed if a memory error is detected.		Er1	○
	CPU error	Stops the inverter and displays an error if a CPU error is detected due to noise.		Er3	○
	Terminal block PCBa Communication error	Detects communication error, etc. with the standard terminal block PCBa and stops the inverter.		Er4	○
	Combination error	Detects inconsistencies between the control method (F42) and encoder selection (L01), etc., and shuts down the drive.		Er5	○
	Operation Error	If the brake check [BRKE] input does not correspond to the brake control [BRKS] state, the inverter is stopped. When the same speed setting is assigned in the speed selection (L11 to L18) of multi-speed, the inverter is stopped.		Er6	○
	Tuning Error	Stops the inverter and displays an error if tuning failure or interruption is detected during motor constant tuning, or if the tuning result is a defect.		Er7	○

*1 These symbols are displayed on keypad LEDs.(Option for global only)
*2 ○ Display is outputted to 30A,B,C. △ may not be displayed depending on the setting of the function cord.

	Item	Detailed specifications	Symbol*1	Alarm output*2
Protection function	RS485 communication error	When the connection port of the touch panel is connected to the network by RS485 communication and a communication error is detected, the inverter is stopped and an error is displayed.	Er8	○
	Data saving error during undervoltage	Stops the inverter and displays an error if unable to successfully save data when undervoltage protection is triggered.	ErF	○
	Hardware error	Stops the inverter and displays an error if an inverter internal hardware fault is detected.	ErH	○
	STO input (EN1, EN2) terminal circuit fault	Stops the inverter and displays an error if the inverter detects an EN1 or EN2 terminal circuit mismatch.	ECF	○
	PG wire break	Disconnection detection*3 of sine wave input of sine wave encoder and serial encoder to stop the inverter.	PG	○
	Over-speed protection	Stops the inverter if the motor speed reaches 120% or more of the maximum speed.	OS	○
	Speed mismatch or excessive speed deviation	Stops the inverter and displays an error if an excessive deviation appears between the reference speed and detected/estimated speed.	ErE	○
	Charging circuit fault	Stops the inverter and displays an error if an inverter charging circuit error is detected.	PbF	○
	Over torque current	Stops the inverter when the torque-current command has exceeded the set-level (E34) and elapsed the set-time (E35).	OT	○
	Braking transistor fault	Stops the inverter and displays an error if a braking transistor error is detected.	dbH	○
	Integrated alarm output	When the inverter stops with an alarm, an integrated alarm is output at the relay contact or transistor output. <Alarm reset> Resets the alarm stop state by a digital input signal (RST) or a command through communication.	–	○
	Retry	Even if a protective function subject to a retry is triggered, an attempt is made to automatically cancel the trip condition up to the number of set times to resume operation without outputting an integrated alarm. (The number of retries and the wait time before resetting can be set.)	–	–
	Surge protection	This function protects the inverter from a surge voltage between main circuit power lines and the ground.	–	–

*1 These symbols are displayed on keypad LEDs.(Option for global only)
*2 ○ Display is outputted to 30A,B,C. △ may not be displayed depending on the setting of the function cord.
*3 PG wire break may not be detected.

	Item	Detailed specifications
Operating environment	Installation location	Indoors
	Ambient temperature	-10 to +55°C [14 to 131 °F] (current derating necessary in +50 to +55 °C [122 to 131 °F] range) Horizontal close mounting (22kW or less):-10 to +40°C [14 to 104 °F]
	Ambient humidity	5 to 95%RH (non-condensing)
	Atmosphere	The inverter must not be exposed to dust, direct sunlight, corrosive or flammable gases, oil mist, vapor, water drops or vibration. (Pollution degree 2 (IEC60664-1)) The atmosphere must contain only a low level of salt. (0.01 mg/cm2 or less per year) There should be no condensation due to sudden temperature changes.
	Altitude	1000 m (3300 ft) or lower If used in a location with altitude of 1000 m (3300 ft) or higher, do so after reducing the output current as shown in the following table.

Altitude	Output current derating factor
1000 m or lower (3300 ft or lower)	1.00
1000 to 1500 m (3300 to 4900 ft)	0.97
1500 to 2000 m (4,900 to 6600 ft)	0.95
2000 to 2500 m (6600 to 8200 ft)	0.91
2500 to 3000 m (8200 to 9800 ft)	0.88

Vibration

Type	2 to less than 9Hz	9 to less than 20Hz	Less than 20 to 55Hz	55 to 200Hz
FRN5.5 to 22LM3S-2J	3mm (maximum amplitude)	9.8m/s²	5.9m/s²	1m/s²
FRN4.0 to 22LM3S-4J				
FRN2.2LM3S-7J				
FRN30 to 55LM3S-4J			2m/s²	

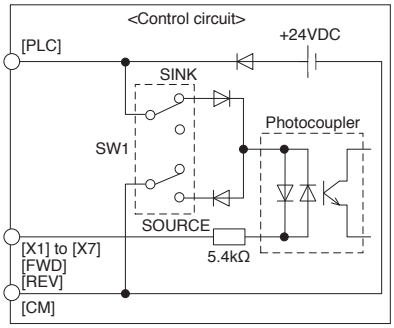
Storage environment	Storage temperature (Note 1)	-25 to +70°C (during transport) (-13 to +158°F)	Places not subjected to condensation or freezing due to sudden temperature changes
		-25 to +65°C (during temporary storage) (-13 to +149°F)	
		-10 to +35°C (during long-term storage) (14 to +95°F)	
	Relative humidity (Note 2)	During temporary storage: 5 to 95% RH (there should no condensation) During long-term storage: 5 to 70% RH	
	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 (during storage) 70 to 106 kPa (during transport)	

(Note 1) Assuming comparatively short time storage, e.g., during transportation.
(Note 2) 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.

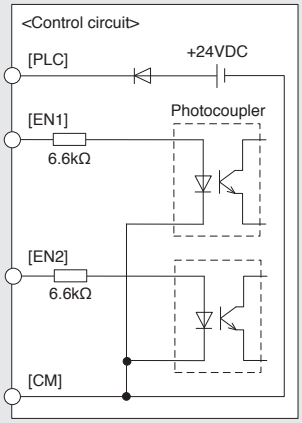
Terminal Specifications

Class	Symbol	Terminal name	Explanation	Remarks
Main circuit	L1/R,L2/S,L3/T	Main power supply input terminals	Connect a three-phase power supply. (3-phase models only)	
			Connect a single-phase power supply. (single-phase models only)	
	R0, T0	Auxiliary control power input terminals	If you wish to retain the batch alarm signal when the protective function is activated even if the main power of the inverter is shut down, if you wish to have the keypad displayed at all times, or if you wish to use rescue operation, connect the control power supply auxiliary input terminals to a commercial power supply or UPS. If connecting a PWM converter, do not connect the power supply directly to the inverter control power auxiliary input terminals (R0, T0).	FRN0076LM3S-2□ FRN0090LM3S-2□ FRN0031LM3S-4□ FRN0039LM3S-4□
	U, V, W	Inverter output terminals	Connect three-phase motor terminals U, V, and W to match the phase sequence.	
	P1, P(+)	DC reactor connection terminals	Connect a DC reactor (DCR) (option) for power-factor improvement.	
	P(+), N(-)	DC link bus connection terminals	Connect braking unit terminals P(+) and N(-). Furthermore, DC link bus circuit of other inverters and PWM converters can be connected.	
	P(+), DB	Braking resistor connection terminals	Connect terminals P(+) and DB of the inverter to braking resistor terminals (option).	
	⏚G	Inverter grounding terminal	This is a grounding terminal for the inverter chassis (case). Be sure to ground grounding terminals to ensure safety, and as a noise countermeasure.	

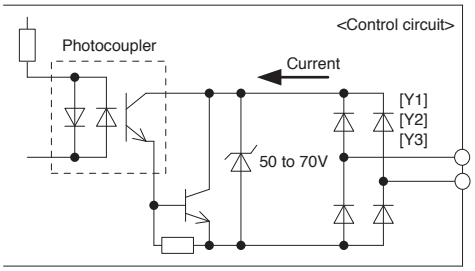
Class	Symbol	Terminal name	Function
Analog input	[12]	Analog Set voltage input	(1) Specify the frequency based on the external voltage input. ・DC 0～±10V/0～±100(%) (2) Torque current command value and torque bias command other than speed setting by analog input It can be assigned and used. (3) Hardware Specifications *Input impedance: 22(kΩ) * The maximum input is ±15 VDC, but is handled as ±10 VDC for voltages greater than ±10 VDC.
	[11]	Analog Common	This is a common terminal of the analog input signal (terminal [12]). This terminal is isolated from terminals [CM] and [CMY].
Digital input	[X1]	Digital Input 1	(1) Various signals (free-run command, external alarm, multi-speed selection, etc.) can be set for terminals E01 to E07,E98,E99 can be set. (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 lengt 20 m <Digital input circuit specifications>
	[X2]	Digital Input 2	
	[X3]	Digital Input 3	
	[X4]	Digital Input 4	
	[X5]	Digital Input 5	
	[X6]	Digital Input 6	
	[X7]	Digital Input 7	
	[FWD]	Forward operation・Stop command Input	
	[REV]	Reverse operation・Stop command Input	
	[EN1] [EN2]	Enable Input	(1) By opening the circuit between terminals [EN1] and [PLC], or between terminals [EN2] and [PLC], inverter output transistor operation is stopped by the IEC/EN 61800-5-2-compliant STO safety stop function. (2) The input mode for terminals [EN1] and [EN2] is fixed at SOURCE mode. (3)When this function is not used, short circuit between terminals [EN1]-[EN2]-[PLC]. <Terminal [EN1], [EN2] Circuit>



Item		Minimum	Maximum
Operation Voltage (SINK)	ON Level	0 V	2 V
	OFF	20 V	27 V
Operation Voltage (SOURCE)	ON Level	20 V	27 V
	OFF	0 V	2 V
Operating current when ON (when input-voltage 0 V)		2.5 mA	5 mA
Permissible leakage current when OFF		—	0.5 mA



Item		Minimum	Maximum
Operating voltage (SOURCE)	ON Level	20 V	27 V
	OFF	0 V	2 V
Operating current when ON (when input voltage 27 V)		—	4.5 mA
Permissible leakage current when OFF		—	0.5 mA

Class	Symbol	Terminal name	Function
Digital input	[PLC]	ProgrammableController Signal power	(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 DC) (2) The terminal can also be used as the power supply for loads connected to transistor outputs.
	[CM]	Digital Common	This is a common terminal for digital input signals. The terminal is insulated from terminals [11] and [CMY].
Transistor output	[Y1]	Transistor output 1	(1) Various signals (running signals, frequency arrival signals, overload early warning signals, etc.) set with function codes E20 to E22 can be output. (2) The operating mode between transistor output terminals [Y1],[Y2],[Y3] and terminal [CMY] can be switched to "ON when signal output (active ON)" or "OFF when signal output (active OFF)". <Transistor output circuit specifications>  Item / Maximum Operating voltage: ON Level 2 V; OFF 48 V Max. current when ON: 50 mA Leakage current when OFF: 0.1 mA
	[Y2]	Transistor output 2	
	[Y3]	Transistor output 3	
	[CMY]	Transistor output common	This is a common terminal for digital input signals. The terminal is insulated from terminals [11] and [CMY].
Contact output	[Y5A] [Y5C]	General contact output	(1) As a general contact output, various types of signals similar to the terminal [Y1] to [Y3] can be selected and output. Contact capacity: 250 VAC 0.3 A cosφ = 0.3, 48 VDC 0.5 A (2) The function code E24 selects and outputs a signal similar to that of the terminal [Y1][Y2][Y3]. (3) It is possible to switch between a "short circuit between terminals [Y5A] and [Y5C] when an ON signal is output (excitation: active ON)" or an "open circuit between terminals [Y5A] and [Y5C] when an ON signal is output (non-excitation: active OFF)".
	[30A] [30B] [30C]	Integrated alarm output	(1) When the inverter stops with an alarm, an integrated alarm is output at the relay contact (1C). Contact capacity: 250 VAC 0.3 A cosφ = 0.3, 48 VDC 0.5 A (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)".
Communication	RJ-45 Connector Keypad (Option only global model)	RS-485 communication Port 1 (Keypad for connection)	(1) This is used as a connector for connecting the keypad(option only global model). The keypad power is supplied from the inverter via an extension cable for remote operation. To connect the keypad remotely, the keypad relay adapter CBAD-CP is required separately. (2) This is used to connect a personal computer or programmable controller, etc. by RS-485 communication after disconnecting the keypad. Protocols can be selected from the following. - Dedicated keypad protocol (automatically selected) - Modbus RTU, dedicated Fuji inverter protocols - Start-stop synchronization, half-duplex method - Max. communication distance: 20 m (when using RS-485 communication: 500 m) - Max. communication speed: 115.2 kbps(*) (*) The communication speed when the engineering PC tool "FRENIC Loader 4" is connected is automatically adjusted.
	USB Connector	USB port	This is a USB connector (miniB specification) for connecting to a personal computer. Function codes can be edited, transferred, or verified, an inverter test run can be carried out, and all states can be monitored using the engineering PC tool "FRENIC Loader 4". It is possible to edit, transfer, and verify the function code of "FRENIC Loader" with USB bus power.
Encoder*1	[PO]	Power supply for encoder	Power supply terminal for the encoder. ・Voltage specification :DC+5 V±10% ・Rated current: max.200mA
	[CM]	Digital Common	Common terminal for encoder power supply. This terminal is isolated from terminals [11] and [CMY].
	[PA+] [PA-]	A phase input	A-phase input terminal for encoder. The frequency changes according to the motor speed. ・Input frequency:max.50 kHz ・Differential input-signal Vp-p:0.6～1.2V
	[PB+] [PB-]	B phase input	B-phase input terminal for encoder. The frequency changes according to the motor speed. ・Input frequency:max.50 kHz ・Differential input-signal Vp-p:0.6～1.2V

*1 Encoder cable shall be max.20m.

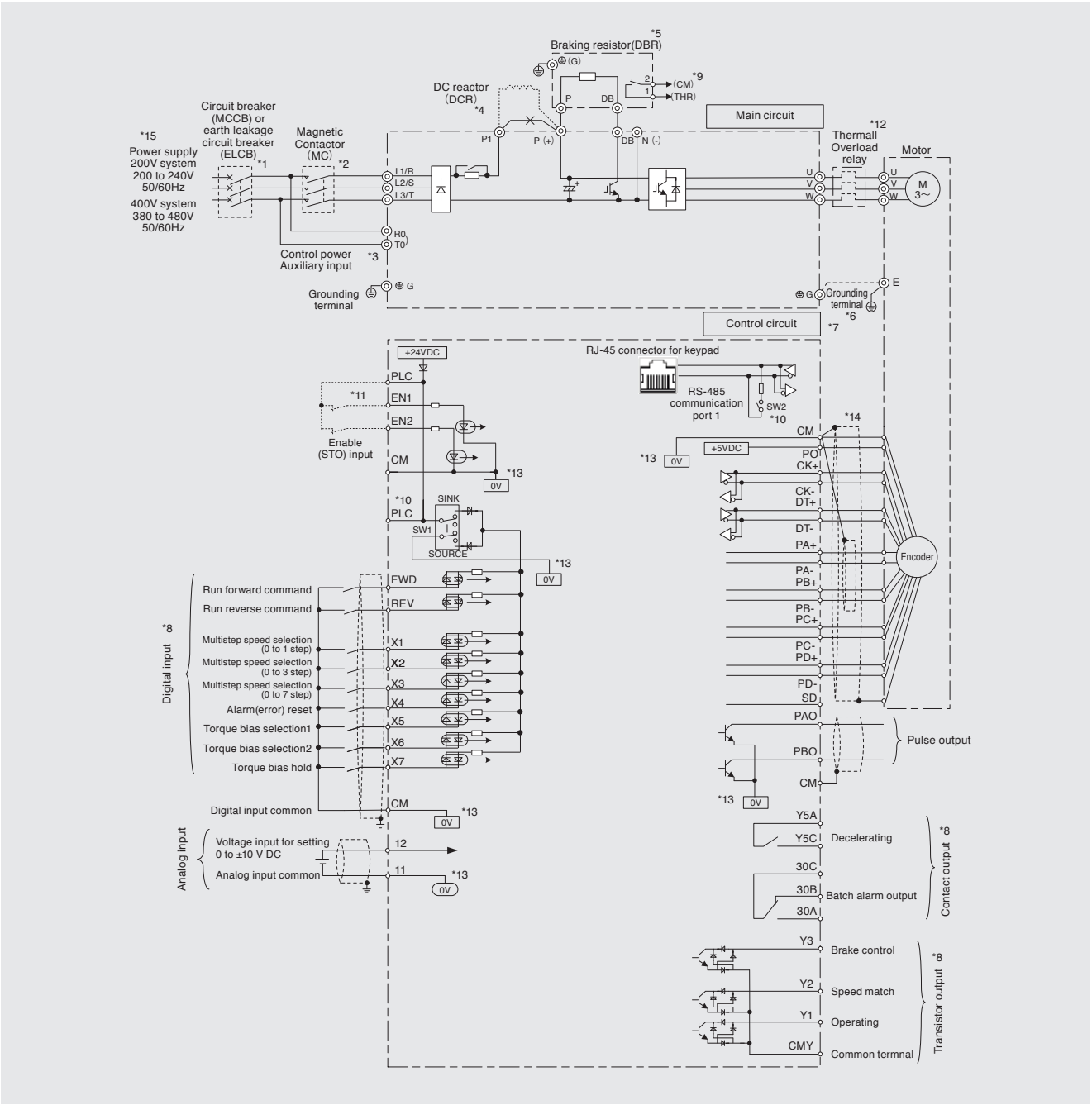
Terminal Specifications

Class	Symbol	Terminal name	Function
Encoder*1	[PB+] [PB-]	B phase input	B-phase input terminal for encoder. The frequency changes according to the motor speed. ・Input frequency:max.50 kHz ・Differential input-signal Vp-p:0.6～1.2V
	[PC+] [PC-]	C phase input	C-phase input terminal for encoder. The frequency changes according to the motor speed. ・Input frequency:max.1 kHz ・Differential input-signal Vp-p:0.6～1.2V
	[PD+] [PD-]	D phase input	D-phase input terminal for encoder. The frequency changes according to the motor speed. ・Input frequency:max.1 kHz ・Differential input-signal Vp-p:0.6～1.2V
	[CK+] [CK-]	Communication clock for encoder	Clock output terminal for EnDat2.1 and BiSS protocol.
	[DT+] [DT-]	Communication data for encoder	Communication data I/O terminal is supported for EnDat2.1 and BiSS protocol.
	[SD]	—	Do not connect to the shield cable of the encoder.
	[PAO] [PBO]	A/B phase Pulse output	These terminals output the same frequency as A/B phase input. ・Output method: Open collector ・Output voltage :max.DC+27 V ・Output current :max.50 mA ・Output frequency: max.50kHz
	[CM]	Digital Common	Common terminal for pulse output. This terminal is isolated from terminals [11] and [CMY].

*1 Encoder cable shall be max.20m.

Basic Wiring Diagram

Wiring of main circuit terminal and grounding terminal



*1 Install a circuit breaker (MCCB) or earth leakage circuit breaker (ELCB) (with overcurrent protection function) recommended for each inverter on the input side (primary side) of the inverter to protect the wiring. Do not use a circuit breaker that exceeds the recommended rated current.

*2 It is used when the inverter is separated from the power supply separately from MCCB or ELCB, so install a recommended magnetic contactor (MC) for every inverter as required. When installing coils such as MC or solenoids close to the inverter, connect surge absorbers in parallel.

*3 When you want to hold the batch alarm signal when the protection function operates even if the main power supply of the inverter is cut off, Connect this terminal to the power supply when you want to display the keypad (option) at all times. (Mounted on FRN0076LM3S-2□/FRN0039LM3S-4□ and above) The inverter can be operated without inputting power to this terminal.

*4 When connecting a DC reactor (DCR) (optional), remove the short-circuit bar across the inverter main circuit terminal P1-P (+) before connecting. Apply a DC reactor when the capacity of the power transformer is equal to or greater than 500 kVA and 10 times the rated capacity of the drive, or when the thyristor is loaded in the same power supply system.

*5 The inverter has a built-in braking transistor that allows direct connection of a braking resistor between P(+) and DB.

*6 Terminal for grounding the motor. It is recommended to ground the motor at this terminal to suppress inverter noise.

*7 Use twisted or shielded wires for the control signal wires. The shielded wire is basically grounded. However, if the wire is subjected to a large amount of external induced noise, it may be possible to suppress the effect of noise by connecting it to the [CM]. Keep it as far away from the main circuit wiring as possible and do not put it in the same duct. (We recommend that you keep a distance of at least 10 cm between them.) If they intersect, they should be almost perpendicular to the main circuit wiring.

*8 The functions described in the terminals [FWD], [REV] and [X1]~[X7] (Digital In), Terminals [Y1], [Y2], [Y3] (transistor output), and Terminals [Y5A/C] [30A/B/C] (contact output) indicate the functions assigned at the factory.

*9 Set the function of "External alarm:THR" to one of the terminals [X1]~[X7] of the inverter before connecting.

*10 Various switching switches on the control printed circuit board to set the inverter operation.

*11 The safety function terminals [EN1] and [EN2] are enabled by default. When this pin function is not used, short-circuit with the terminal [PLC]. (Short-corcuit 3 terminals, between [EN1], [EN2], and [PLC]. /only India model, there is short-circuit harness for this terminal included.*not wired.)

*12 Apply the thermal relay as required. Trip the circuit breaker (MCCB) or the magnetic contactor (MC) using the auxiliary contact (manual return) of the thermal relay.

*13 Isolated from 2X and insulated from 2X.

*14 Recommended wiring and shield connection methods differ depending on the applicable encoder. Refer to the table below for details.

Recommended encoder	Recommended wiring	Recommended connection method (shield part)	
		Inverter side	Motor side
HEIDENHAIN ECN1313 or equivalent	Double shielded cable	Connect both shields to [CM]	Outer shield only grounded (inner shield open)
Hohner SMRS64 or equivalent	Single shielded wire	Connect shields to [CM]	Earth
HEIDENHAIN ERN1387 or equivalent	Single shielded wire	Connect shields to [CM]	Earth

*15 For single-phase 200V inputs. Connect L1/R,L3/T.

External Dimensions

Fig.A [Unit: mm(inch)]

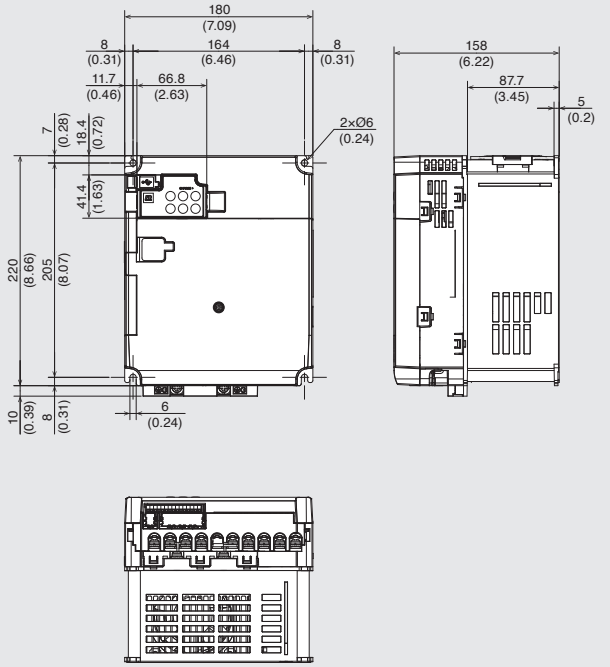


Fig.B [Unit: mm(inch)]

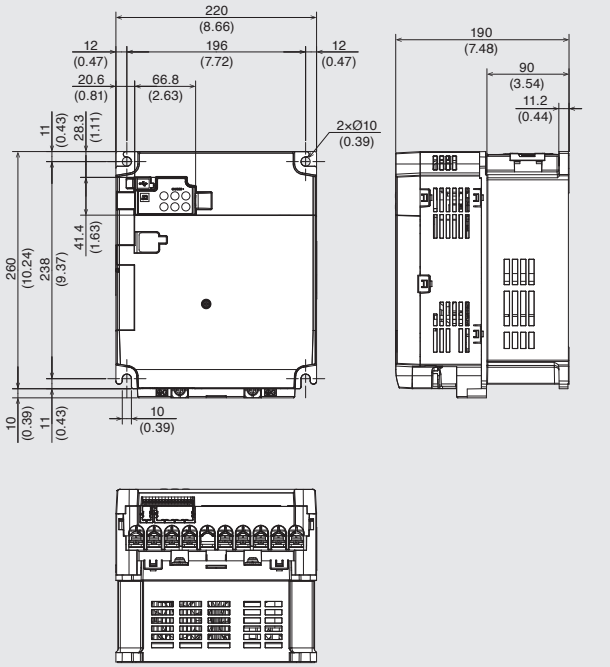


Fig.C [Unit: mm(inch)]

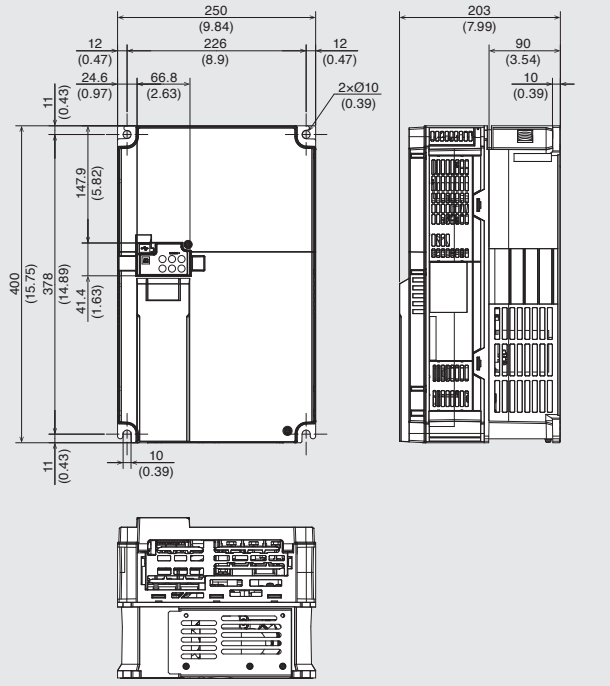
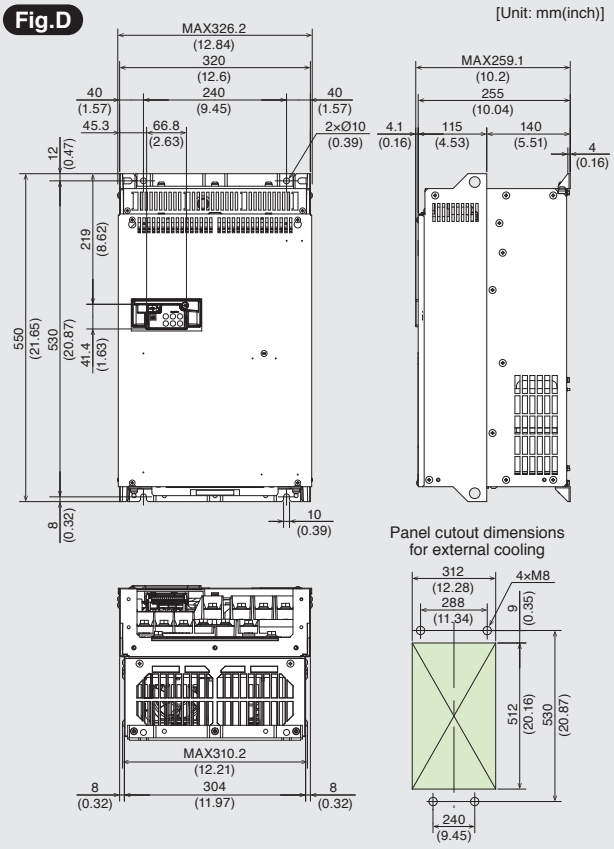
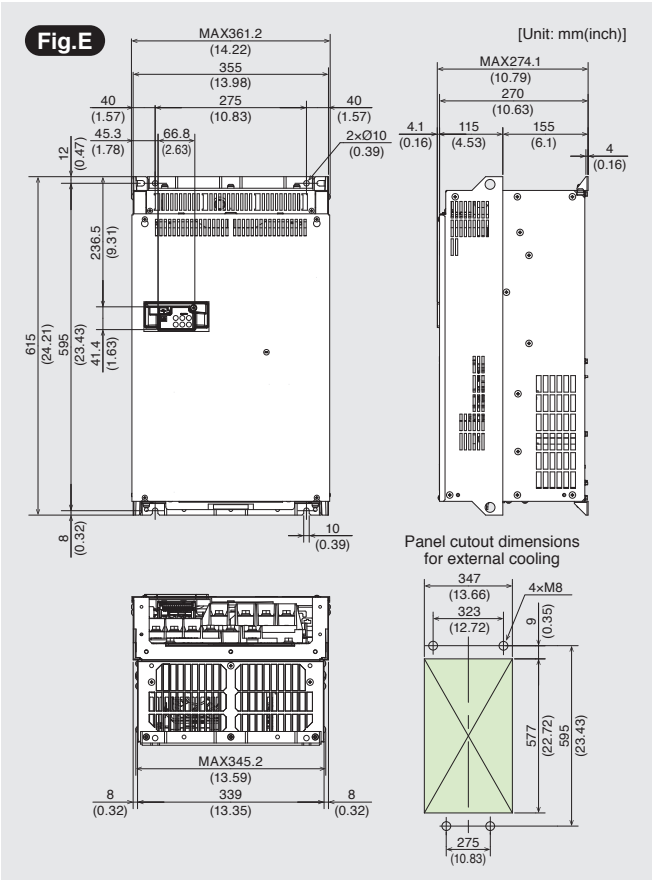
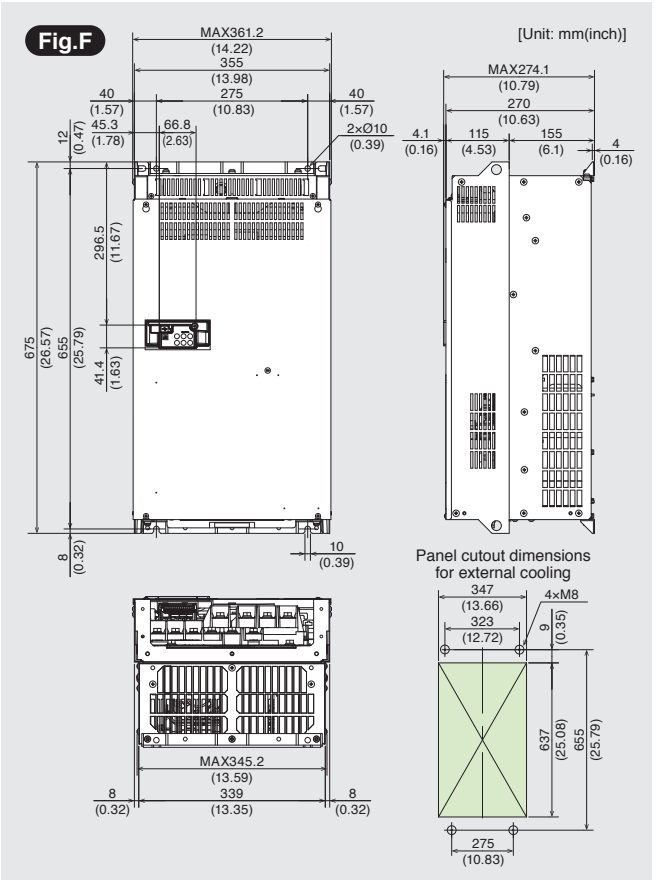


Fig.D [Unit: mm(inch)]







Power supply Series	Inverter type	Figure	External Dimensions [mm(inch)]		
			W	H	D
3-phase 200V	FRN0025LM3S-2□	A	180(7.09)	220(8.66)	158(6.22)
	FRN0033LM3S-2□		180(7.09)	220(8.66)	158(6.22)
	FRN0047LM3S-2□	B	220(8.66)	260(10.24)	190(7.48)
	FRN0060LM3S-2□		220(8.66)	260(10.24)	190(7.48)
	FRN0076LM3S-2□	C	250(9.84)	400(15.75)	203(7.99)
	FRN0090LM3S-2□		250(9.84)	400(15.75)	203(7.99)
3-phase 400V	FRN0009LM3S-4□	A	180(7.09)	220(8.66)	158(6.22)
	FRN0015LM3S-4□		180(7.09)	220(8.66)	158(6.22)
	FRN0018LM3S-4□		180(7.09)	220(8.66)	158(6.22)
	FRN0024LM3S-4□	B	220(8.66)	260(10.24)	190(7.48)
	FRN0031LM3S-4□		220(8.66)	260(10.24)	190(7.48)
	FRN0039LM3S-4□	C	250(9.84)	400(15.75)	203(7.99)
	FRN0045LM3S-4□		250(9.84)	400(15.75)	203(7.99)
	FRN0060LM3S-4□	D	326.2(12.84)	550(21.65)	259.1(10.2)
	FRN0075LM3S-4□		326.2(12.84)	550(21.65)	259.1(10.2)
	FRN0091LM3S-4□	E	361.2(14.22)	615(24.21)	274.1(10.79)
	FRN0112LM3S-4□	F	361.2(14.22)	675(26.57)	274.1(10.79)
Single phase 200V	FRN0011LM3S-7□	A	180(7.09)	220(8.66)	158(6.22)

Note) India model(FRN**LM3S-□A): The keypad is mounted in factory shipping condition.
Global model(FRN**LM3S-□G): The blind cover is mounted in factory shipping condition.The keypad is an option sold separately.

Options

Remote keypad
[TP-M3]

By connecting this keypad to the FRENIC-Lift (LM3) series of inverters, you can display inverter information (various data, I/O checks, maintenance information, alarm information, etc.) and configure function code settings. You can install this keypad directly on the inverter main body, or use it to remotely control the inverter by connecting it via the keypad relay adapter (CBAD-CP) and the extension cable for remote control.

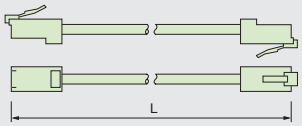
Note) When connecting, first remove the blind cover from the inverter main body.

Item	Specifications	Remarks
Applicable inverter	FRENIC-Lift (LM3) series	
Connection cable	Conforming to ANSI/TIA/EIA568A Category 5 or higher (for 10BASET/100BASE-TX straight connection)	Option type: CB-5S, CB-3S, CB-1S
Cable length	20 m (787 ft) or less	
Protective construction	Panel side: IP20, reverse side: IP20	
Weight	107 g (3.8 oz)	

Extension cable for remote control
[CB-□S]

This straight cable is used to connect the RJ-45 connector of the inverter body to the keypad, USB-RS485 converter, etc.
Available in three lengths (1, 3, 5m).

• Cable



Type	CB-5S	CB-3S	CB-1S
Length [m]	5	3	1

Adapter for Keypad panel
[CBAD-CP]

This is a relay adapter to remotely control the unit with the remote keypad (optional).
This adapter is a bundled product consisting of a relay connector for the inverter and a rear mounting adapter for the panel surface.

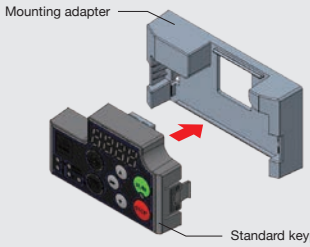
*Cannot be installed in Ethernet built-in type.

■Connection accessories

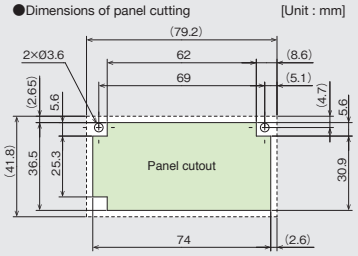
■Mounting adapter

Connection accessories

Mounting adapter



●Dimensions of panel cutting [Unit : mm]



Built-in option card

Option name	Detailed specifications	Remarks
PG interface (12V/15V) Card (OPC-LM-PG3)	Signal-input method: 12V/15V complementary Pulse resolution: 20~3600 P/R, A, B, Z phase (incremental) Pulse frequency: 100kHz max (complementary) Feedback signal can be input from the velocity sensor.	Internal Option

Comparison of new/old types

Classification	Item	FRENIC-Lift (LM1S)	FRENIC-Lift (LM3S)
Appearance			
Capacity	Three-phase 200 V series	5.5 to 22 kW	
	Three-phase 400 V series	4.0 to 45 kW	4.0 to 55 kW
	Single-phase 200 V series	2.2 kW	
Main circuit	Overload capacity	200% (3s to 10s)	200% (3s)
	Auxiliary control power input R0, T0	200 V series: Single-phase 200 V to 240 V 400 V series: Single-phase 200 V to 480 V	200 V/400 V 18.5 kW and above only 200 V series: Single-phase 200 V to 240 V 400 V series: Single-phase 200 V to 480 V
	Braking transistor	Built-in	
	Degree of protection	[22 kW or less]: IP20 [30 kW or more]: IP00	
Control circuit	USB	–	Mini-B
	Digital input	10 points [X1-8], [FWD], [REV]	9 points [X1-7], [FWD], [REV]
	Functional safety	1 point [EN]	2 points [EN1], [EN2]
	Analog input	3 points [12], [C1], [V2]	1 point [12]
	Analog output	–	
	Digital output	4 points [Y1], [Y2], [Y3], [Y4]	3 points [Y1], [Y2], [Y3]
	Relay output	[Y5A/Y5C, 30A/30B/30C]: 250 V AC, 0.3 A/48 V DC, 0.5 A	
	RS-485 communication connector	RJ45 jack	RJ45 plug
	CAN communication	1 point (CAN+, CAN-, SHLD)	–
	Encoder input	A, B, Z phase complementary	Absolute signal: Sine wave encoder (1Vpp) and serial encoder (EnDat2.1, Biss-C)
			Incremental signal: Sine wave encoder Serial encoder
	Pulse output	AB phase pulse output (open collector)	
	Encoder power supply	12/15 V selectable 120 mA	5 V 200 mA
	Keypad	Options (TP-G1-□LS)	Option (TP-M3)
	Terminal block	Screw	Screw, push-in

Table of Option Combinations [Comparison of FRENIC-Lift (LM1S) and FRENIC-Lift (LM3S)]

LM1S				LM3S			
Option combinations	Encoder input		Pulse output	Option combinations	Encoder input		Pulse output
	Incremental position signal	Absolute position signal			Incremental position signal	Absolute position signal	
Inverter only	AB phase open collector	–	Open collector output	**Inverter + OPC-LM-PG3**(Note)	AB phase open collector	–	Open collector output
Inverter + OPC-LM1-IL	ABZ phase line driver	None	Open collector output	**No successor model**			
Inverter + OPC-LM1-ID			FA/FB (divided output) open collector output	**No successor model**			
Inverter + OPC-LM1-PR	AB phase sine wave	Sin/Cos (CD phase) sine wave	Open collector output	**Inverter only**	AB phase sine wave	Sin/Cos (CD phase) sine wave	Open collector output
Inverter + OPC-LM1-PS or OPC-LM1-PS1	AB phase sine wave	EnDat2.1 serial communications	Open collector output	**Inverter only**	AB phase sine wave	EnDat2.1/BiSS-C serial communications	Open collector output
Inverter + OPC-LM1-PP	AB phase line driver	4-bit (UVW/gray code) line driver	Open collector output	**No successor model**			

Note) Since the encoder power supply has been changed from an output of 12 V/15 V to an output of 5 V, please arrange for an appropriate power supply.

Related products

Converters

Energy savings through power regeneration.
Lineup includes three series for different capacities and applications.

Compact PWM Converter

FRENIC-eRHC

- Compact size with regenerative and harmonic suppression functions
- Applicable to small-capacity equipment and single-unit systems

Compact Regenerative Converter

FRENIC-eRHR

- Includes low-cost regenerative function
- Reduces installation space by replacing braking resistor and braking unit
- Applicable to up-down conveyors and drive systems for large-inertia equipment

High-Performance PWM Converter

FRENIC-RHC

- Simplifies system compatibility thanks to its ability to use option cards to connect to a variety of communication I/Fs
- Comes standard with a failure analysis function with traceback capabilities
- Capable of expanding capacity by operating multiple converters in parallel
- Applicable to systems using multiple inverters (plant equipment, etc.), large-capacity cranes, and servo presses

Product Warranty

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

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

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

1. Free of Charge Warranty Period and Warranty Range

1-1 Free of charge warranty period

(1) The product warranty period is "1 year from the date of purchase" or 24 months from the manufacturing date imprinted on the name place, whichever date is earlier.
(2) However, in cases where the operating 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."

1-2 Warranty range

(1) In the event that breakdown occurs during the product's warranty period which is the responsibility of Fuji Electric, Fuji Electric will replace or repair the part of the product that has broken down free of charge at the place where the product was purchased or where it was delivered. However, if the following cases are applicable, the terms of this warranty may not apply.

1) The breakdown was caused by inappropriate conditions, environment, handling or use methods, etc. which are not specified in the catalog, operation manual, specifications or other relevant documents.
2) The breakdown was caused by the product other than the purchased or delivered Fuji's product.
3) The breakdown was caused by the product other than Fuji's product, such as the customer's equipment or software design, etc.
4) Concerning the Fuji's programmable products, the breakdown was caused by a program other than a program supplied by this company, or the results from using such a program.
5) The breakdown was caused by modifications or repairs affected by a party other than Fuji Electric.
6) The breakdown was caused by improper maintenance or replacement using consumables, etc. specified in the operation manual or catalog, etc.
7) The breakdown was caused by a chemical or technical problem that was not foreseen when making practical application of the product at the time it was purchased or delivered.
8) The product was not used in the manner the product was originally intended to be used.
9) The breakdown was caused by a reason which is not this company's responsibility, such as lightning or other disaster.

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

1-3. Trouble diagnosis

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

2. Exclusion of Liability for Loss of Opportunity, etc.

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

3. Repair Period after Production Stop, Spare Parts Supply Period (Holding Period)

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

4. Transfer Rights

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

5. Service Contents

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

6. Applicable Scope of Service

Above contents shall be assumed to apply to transactions and use of the country where you purchased the products. Consult the local supplier or Fuji for the detail separately.

NOTES

When running general-purpose motors

- **Driving a 400V general-purpose motor**
  When driving a 400V general-purpose motor with an inverter using extremely long cables, damage to the insulation of the motor may occur. Use an output circuit filter (OFL) if necessary after checking with the motor manufacturer. Fuji's motors do not require the use of output circuit filters because of their reinforced insulation.
- **Torque characteristics and temperature 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. If constant torque is required in the low-speed range, use a Fuji inverter motor or a motor equipped with an externally powered ventilating fan.
- **Vibration**
  When the motor is mounted to a machine, resonance may be caused by the natural frequencies, including that of the machine. Operation of a 2-pole motor at 60Hz or more may cause abnormal vibration.
  * Study use of tier coupling or dampening rubber.
  * It is also recommended to use the inverter jump frequency control to avoid resonance points.
- **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. High-speed operation at 60Hz or more can also result in more noise.

When running special motors

- **High-speed motors**
  When driving a high-speed motor while setting the frequency higher than 120Hz, test the combination with another motor to confirm the safety of high-speed motors.
- **Explosion-proof motors**
  When driving an explosion-proof motor with an inverter, use a combination of a motor and an inverter that has been approved in advance.
- **Submersible motors and pumps**
  These motors have a larger rated current than general-purpose motors. Select an inverter whose rated output current is greater than that of the motor.
  These motors differ from general-purpose motors in thermal characteristics. Set a low value in the thermal time constant of the motor when setting the electronic thermal function.
- **Brake motors**
  For motors equipped with parallel-connected brakes, their braking power must be supplied from the primary circuit (commercial power supply). If the brake power is connected to the inverter power output circuit (secondary circuit) by mistake, problems may occur.
  Do not use inverters for driving motors equipped with series-connected brakes.
- **Geared motors**
  If the power transmission mechanism uses an oil-lubricated gearbox or speed changer/reducer, then continuous motor operation at low speed may cause poor lubrication. Avoid such operation.
- **Synchronous motors**
  It is necessary to use software suitable for this motor type. Contact Fuji for details.
- **Single-phase motors**
  Single-phase motors are not suitable for inverter-driven variable speed operation. Use three-phase motors.
  * Even if a single-phase power supply is available, use a three-phase motor as the inverter provides three-phase output.

Environmental conditions

- **Installation location**
  Use the inverter in a location with an ambient temperature range of -10 to 50˚C.
  The inverter and braking resistor surfaces become hot under certain operating conditions. Install the inverter on nonflammable material such as metal.
  Ensure that the installation location meets the environmental conditions specified in "Environment" in inverter specifications.

Combination with peripheral devices

- **Installing a molded case circuit breaker (MCCB)**
  Install a recommended molded case circuit breaker (MCCB) or an earth leakage circuit breaker (ELCB) in the primary circuit of each inverter to protect the wiring. Ensure that the circuit breaker capacity is equivalent to or lower than the recommended capacity.
- **Installing a magnetic contactor (MC) in the output (secondary) circuit**
  If a magnetic contactor (MC) is mounted in the inverter's secondary circuit for switching the motor to commercial power or for any other purpose, ensure that both the inverter and the motor are fully stopped before you turn the MC on or off. Remove the surge killer integrated with the MC.
- **Installing a magnetic contactor (MC) in the input (primary) circuit**
  Do not turn the magnetic contactor (MC) in the primary circuit on or off more than once an hour as an inverter fault may result. If frequent starts or stops are required during motor operation, use FWD/REV signals.
- **Protecting the motor**
  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 to protect the motor.
  If you connect the motor thermal relay to the motor with a long cable, 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 or use the output circuit filter (OFL).
- **Regarding power-factor correcting capacitor**
  Do not mount power factor correcting capacitors in the inverter (primary) circuit. Use the DC REACTOR to improve the inverter power factor. Do not use power factor correcting capacitors in the inverter output circuit (secondary). An overcurrent trip will occur, disabling motor operation.
- **Discontinuance of surge killer**
  Do not mount surge killers in the inverter output (secondary) circuit.
- **Reducing noise**
  Use of a filter and shielded wires are typical measures against noise to ensure that EMC Directives are met.
- **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.
  We recommend connecting a DC REACTOR to the inverter.
- **Megger test**
  When checking the insulation resistance of the inverter, use a 500V megger and follow the instructions contained in the Instruction Manual.

Wiring

- **Wiring distance of control circuit**
  When performing remote operation, use twisted shield wire and limit the distance between the inverter and the control box to 20m.
- **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 50m. If this length must be exceeded, lower the carrier frequency or mount an output circuit filter (OFL).
- **Wiring size**
  Select cables with a sufficient capacity by referring to the current value or recommended wire size.
- **Wiring type**
  Do not use multicore cables that are normally used for connecting several inverters and motors.
- **Grounding**
  Securely ground the inverter using the grounding terminal.

Selecting inverter capacity

- **Driving general-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 standard.
- **Driving special motors**
  Select an inverter that meets the following condition: Inverter rated current > Motor rated current.

Transportation and storage

When transporting or storing inverters, follow the procedures and select locations that meet the environmental conditions that agree with the inverter specifications.

Fuji Electric Co., Ltd.

Gate City Ohsaki, East Tower, 11-2,
Osaki 1-chome, Shinagawa-ku,
Tokyo 141-0032, Japan
Phone: +81-3-5435-7066 Fax: +81-3-5435-7475
URL: www.fujielectric.com/

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