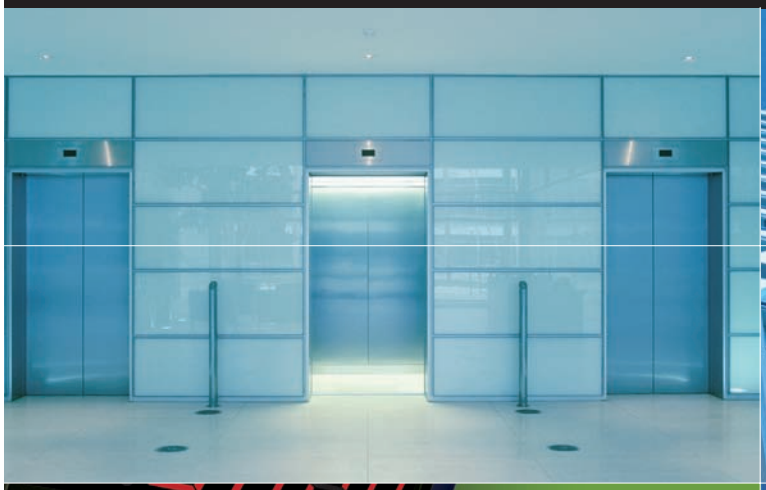
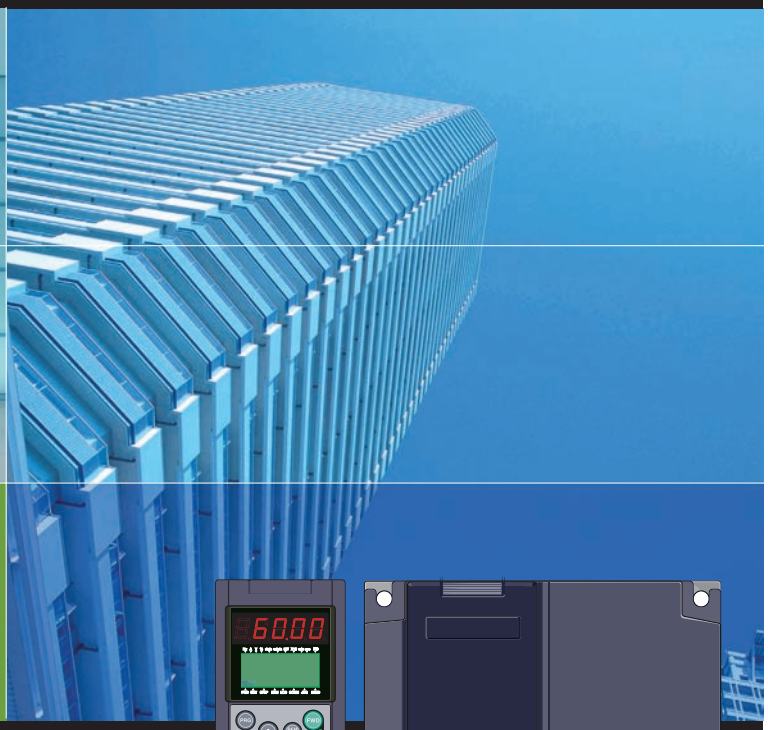
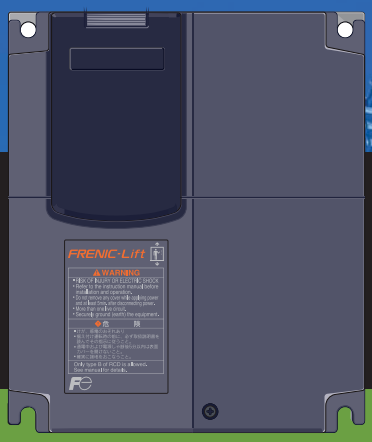
e-Front runners

Elevator Inverter FRENIC-Lift

FRENIC Lift







FUJI INVERTERS

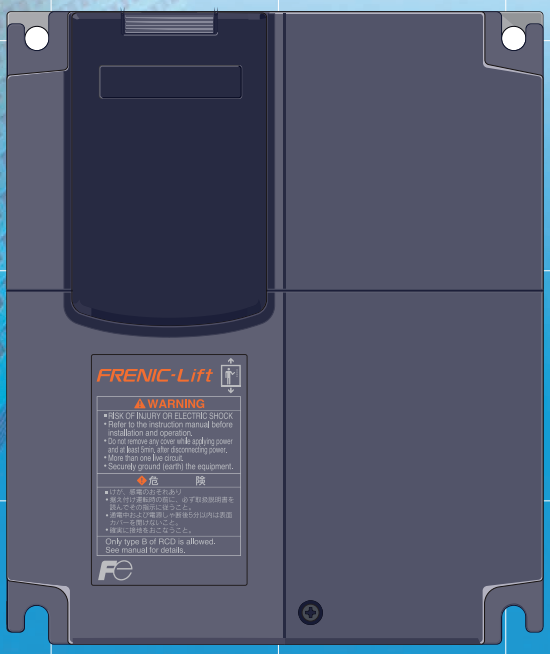
GREAT PERFORMANCE THROUGH DEDICATED DESIGNS

WELCOME TO THE NEW GENERATION OF ELEVATOR INVERTER

MEH426s

FRENIC-Lift Elevator Inverter

The FRENIC-Lift Series of exclusive inverters for operation of elevators are specially designed to have a number of improved features over previous elevator inverters, such as vastly lower torque ripple. We have incorporated the functions that customers find most necessary in elevator controls to provide an inverter that delivers performance that fits your elevator system.



FUJI INVERTERS
Great Performance through Dedicated Designs
Welcome to The New Generation of ELEVATOR Inverter

Optimum Exclusive Design for Passenger Elevators

- A braking circuit is built in the inverters of all the capacities.
- Built-in PG feedback circuit is standard equipment.
- An optional keypad is available.

Higher Performance

- Overload capacity: 200% for 10s
- Current response: 5 times greater than previous models (compared with the G11UD series)
- Reduction of torque ripple realizes low vibration.
- Reduced roll-back during starting up.

Motor capacity (kW)	4.0	5.5	7.5	11	15	18.5	22	30	37	45
Three-phase 400V	●	●	●	●	●	●	●	●	●	●
Three-phase 200V	N.A.	●	●	●	●	●	●	N.A.		

High performance vector control

- Current response (ACR): 500Hz
- Speed control accuracy: ±0.01%

High overload capacity

- 200% of rated current for 10s
  (Overload begins from 80% continuous operation with a carrier frequency of 10kHz.)

IM/PMSM common drive

- A single inverter can control an induction motor (open/closed loop control) and a synchronous motor (the optional PG interface card is required).

Model variations

- FRENIC-Lift inverters are available in a series with capacities ranging from 4.0 to 45kW for three-phase 400V model, 5.5 to 22kW for three-phase 200V model.

Applicable to the feedbacks from various pulse generators

- Applicable to the inputs by open collector/complementary output as a standard specification (Encoder power supply is switchable between +12V and +15V.)
- Applicable to the inputs from the 5V line driver as an option
- Applicable to serial encoders (HEIDENHAIN EnDat 2.1) and parallel encoders (4-bit gray code, UVW 3-bit code) as options

Maintenance functions/ Long life design

- DC bus capacitor life: 7 years
- Electrolytic capacitor life on the printed circuit boards: 7 years
- Cooling fan life: 5 years
- Life warning signal
- Recording and display of cumulative operating time
- Recording and display of cumulative operations

Globalization

- EC Directives
  (CE Marking) (EN61800-3, EN50178)
- Safety standards (EN954-1)
- Sink/source switchable
- RS-485 communications (Modbus RTU) is adopted as standard equipment.
- CAN Bus is adopted as standard equipment.

Peripheral support tools (Option)

- Inverter support loader software is provided.
- A multi-function keypad (with backlit LCD) makes it possible to copy or edit the function code data.

Specifications

Standard specifications for three-phase 200V series

Item				Specifications						
Model (FRN□□□LM1S-2□■) (*9)				5.5	7.5	11	15	18.5	22
Applicable motor rating [kW] (*1)				5.5	7.5	11	15	18.5	22
Output rating	Rated capacity [kVA] (*2)			10.2	14	18	24	29	34
	Voltage [V] (*3)			Three-phase, 200 to 240V, 50/60Hz					
	Rated current [A] (*4)			27.0	37.0	49.0	63.0	74.0	90.0
	Overload current rating [A] (10 sec)			54.0	74.0	98.0	126.0	148.0	180.0 (5s)
	Rated frequency [Hz]			50, 60Hz					
Input power supply	Normal operation	Main power: phases, voltage, frequency		Three-phase, 200 to 240V, 50/60Hz					
		Auxiliary control power input: Phases, voltage, frequency		Single-phase, 200 to 240V, 50/60Hz					
		Permissible voltage and frequency fluctuation (*8)		Voltage: +10 to -15% (Voltage imbalance within 2% *5), frequency: +5 to -5%					
		Rated input current [A] (*6)	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 capacity [kVA] (*7)		7.4	10	15	20	25	30
	Battery operation	Main power		24VDC or higher					
		Auxiliary control power input	Phases, voltage, frequency	Single-phase, 200 to 240V, 50/60Hz					
			Permissible Voltage and Frequency Fluctuations	Voltage: +10 to -15%, Frequency: +5 to -5%					
Braking	Braking time [s]			30					
	Duty cycle (%ED) [%]			50					
	Minimum connectable resistance value [Ω]			15	10	7.5	6	4	3.5
DC REACTOR (DCR)				Option					
Applicable Safety Standard				EN50178: 1997, EN954-1					
Protective enclosure (IEC60529)				IP20					
Cooling system				Fan cooling					
Weight [kg]				5.6	5.7	7.5	11.1	11.2	11.7

(*1) Fuji Electric's 4-pole standard motor is used as an example of a applicable motor rating.
(*2) The rated capacity shows the case where the output voltage is 220V.
(*3) Voltages exceeding the power supply voltage cannot be output.
(*4) The rated current shows the case where the carrier frequency is 10kHz, ambient temperature is 45°C or under, and the root mean squared current in cycle operation is 80% of the inverter's rated current.
(*5) Voltage imbalance [%] = (Max. voltage [V] – Min. voltage [V]) / 3-phase average voltage [V] x 67 (See IEC61800-3).
(*6) Calculations were made based on a power supply capacity of 500 kVA (if the inverter capacity exceeds 50 kVA, the power supply capacity is 10 times the inverter capacity) and a connected power supply %X = 5%.
(*7) The inverter is equipped with a DC reactor (DCR).
(*8) These permissible fluctuations are for the main power and the auxiliary control power input.
(*9) A box (□) in the above table replaces C, E, A or J depending on the shipping destination.
A box (■) in the above table replaces A for the inverter without a CAN port

Standard specifications for three-phase 400V series

Item				Specifications									
Model (FRN□□□LM1S-4□■) (*9)				4.0	5.5	7.5	11	15	18.5	22	30	37	45
Applicable motor rating [kW] (*1)				3.7	5.5	7.5	11	15	18.5	22	30	37	45
Output rating	Rated capacity [kVA] (*2)			6.8	10.2	14	18	24	29	34	45	57	69
	Voltage [V] (*3)			Three-phase, 380 to 480V, 50/60Hz							Three-phase, 380 to 460V, 50/60Hz		
	Rated current [A] (*4)			9.0	13.5	18.5	24.5	32.0	39.0	45.0	60	75	91
	Overload current rating [A] (10 sec)			18.0 (3s)	27.0	37.0	49.0	64.0	78.0	90.0	108 (5s)	135 (5s)	163 (5s)
	Rated frequency [Hz]			50, 60Hz									
Input power supply	Normal operation	Main power: phases, voltage, frequency		Three-phase, 380 to 480V, 50/60Hz									
		Auxiliary control power input: Phases, voltage, frequency		Single-phase, 200 to 480V, 50/60Hz									Single-phase, 380 to 460V, 50/60Hz*10
		Permissible voltage and frequency fluctuation (*8)		Voltage: +10 to -15% (Voltage imbalance within 2% *5), frequency: +5 to -5%									
		Rated input current [A] (*6)	With DCR	7.5	10.6	14.4	21.1	28.8	35.5	42.2	57.0	68.5	83.2
			Without DCR	13	17.3	23.2	33.0	43.8	52.3	60.6	77.9	94.3	114
		Required power capacity [kVA] (*7)		5.2	7.4	10	15	20	25	30	40	48	58
	Battery operation	Main power		48VDC or higher									
		Auxiliary control power input	Phases, voltage, frequency	Single-phase, 200 to 480V, 50/60Hz									Single-phase, 380 to 460V, 50/60Hz*10
			Permissible Voltage and Frequency Fluctuations	Voltage: +10 to -15%, Frequency: +5 to -5%									
Braking	Braking time [s]			30									
	Duty cycle (%ED) [%]			50									
	Minimum connectable resistance value [Ω]			96	64	48	24	24	16	16	10	10	8
DC REACTOR (DCR)				Option									
Applicable Safety Standard				EN50178: 1997, EN954-1							EN50178: 1997		
Protective enclosure (IEC60529)				IP20							IP00		
Cooling system				Fan cooling									
Weight [kg]				3.0	5.6	5.7	7.5	11.1	11.2	11.7	24	33	34

(*1) Fuji Electric's 4-pole standard motor is used as an example of a applicable motor rating.
(*2) The rated capacity shows the case where the output voltage is 440V.
(*3) Voltages exceeding the power supply voltage cannot be output.
(*4) The rated current shows the case where the carrier frequency is 10kHz, ambient temperature is 45°C or under, and the root mean squared current in cycle operation is 80% of the inverter's rated current.
(*5) Voltage imbalance [%] = (Max. voltage [V] – Min. voltage [V]) / 3-phase average voltage [V] x 67 (See IEC61800-3).
(*6) Calculations were made based on a power supply capacity of 500 kVA (if the inverter capacity exceeds 50 kVA, the power supply capacity is 10 times the inverter capacity) and a connected power supply %X = 5%.
(*7) The inverter is equipped with a DC reactor (DCR).
(*8) These permissible fluctuations are for the main power and the auxiliary control power input.
(*9) A box (□) in the above table replaces C, E, A or J depending on the shipping destination.
A box (■) in the above table replaces A for the inverter without a CAN port
(*10) 37kW or more. It is necessary to change the power supply switching the connector on the power supply printed board according to the power supply voltage. The same AC power as the main suuply power input is needed for the auxilliary control power input for the control circuit, the fan and the contactor. The inverter will not operate if the power supply is not input to the auxilliary control power input.

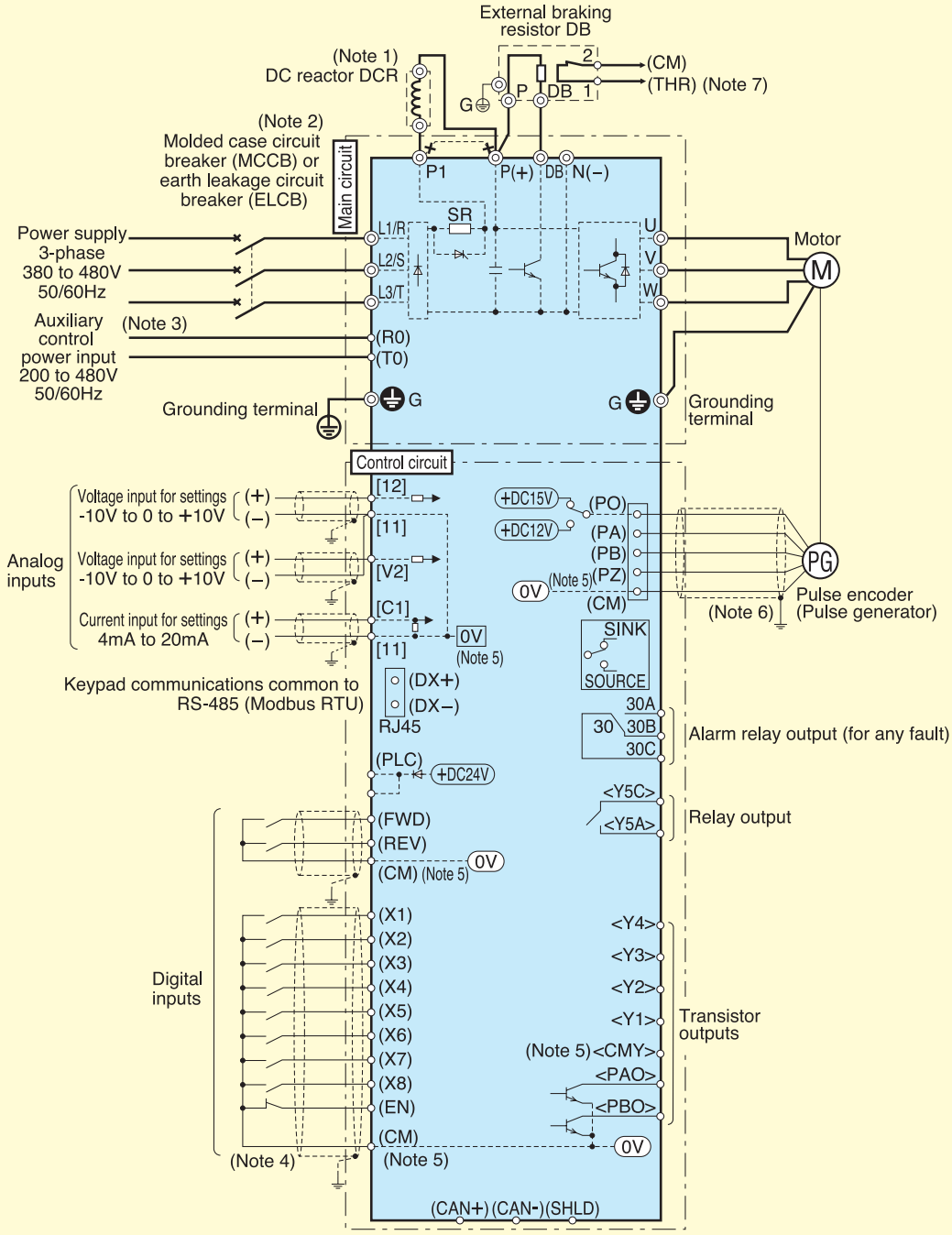
Specifications

Common Specifications

Item			Detailed Specifications
Control method			Vector control with PG (Controlled motor type: Induction motor (IM) Vector control with PG (Controlled motor type: synchronous motor with permanent magnet) Torque vector control (open loop control for Induction Motor) (*1)
Adjustment	Carrier frequency		Set value: Variable from 5 to 15kHz (4.0 to 45kW) Note) To protect the inverter, the carrier frequency may be reduced automatically in accordance with ambient temperature and output current conditions. (An auto reduction stop function is included.)
Speed control	Maximum speed		Converted into inverter output frequency, 120Hz (2-pole: 7,200r/min, 4-pole: 3,600r/min, 6-pole: 2,400r/min) PG frequency: 100kHz or lower
	Control range		Converted into inverter output frequency, 0 to 120 Hz (4-pole: 0 to 3,600 r/min)
	Control response		100Hz(Max)
	Control accuracy		Analog setting: ±0.2% or less of the max. speed (25 ± 10°C) Multi-step speed setting/Communications setting: ±0.01% or less of the max. speed (-10 to +45°C)
	Setting resolution		Analog setting: 1/1,000 of the max. speed Multi-step speed setting (Converted into inverter output frequency): 0.01 Hz (99.99 Hz or lower), 0.1Hz (100.0 to 120.0Hz) Communications: 1/20,000 of the maximum speed or in inverter output frequency conversion, 0.01Hz (fixed)
Control Functions	Start/stop		External signals (digital input): FWD/STOP commands, REV/STOP commands, Coast-to-stop command, External alarm, Error reset, etc. Keypad operation: Remote/Local switching permits start and stop operation using the FWD and STOP keys (option).
	Speed settings		Multi-step speed command: Through a combination of 3 external signals (digital input) (8 steps) Analog Signal: 0 to ± 10V, 4～20mA Multi-function keypad (option): Remote/Local switching permits setting with the ∧ and ∨ keys. Communications: RS-485, CAN Bus
	S-curve acceleration/ deceleration setting		S-curve acceleration start/end point, s-curve deceleration start/end point and other points are set separately (10 steps). Setting range: 0 to 50%
	Sequence functions		Forced stop, Multi-step speed command (with S-curve acceleration/deceleration), Run command matching timer, Multi-step speed command matching timer, Digital input logical inverse, Digital output logical inverse, Soft start, Stop frequency continuation, Acceleration/deceleration calculation function cancel
	Control functions		Torque control, Speed adjuster feed forward compensation, Vibration suppression observer, Speed adjuster parameter switching, Digital torque bias, Analog torque bias, Motor parameter tuning, Magnetic position tuning, etc.
	Exclusive functions		Password, unbalanced load compensation, creepless running, battery operation
	PMSM function		Magnet pole position offset tuning
Environment	Installation location		Indoors. Free from corrosive or flammable gases, dust or oil mist. (Pollution degree 2 (IEC60664-1)). No exposure to direct sunlight.
	Ambient temperature		Open: -10 to +45°C
	Ambient humidity		5 to 95% RH (No condensation)
	Altitude		1,000 m or lower
	Vibration		55kW or lower 3mm: 2 to less than 9Hz 9.8 m/s^2: 9 to less than 20Hz 2 m/s^2: 20 to less than 55Hz 1 m/s^2: 55 to less than 200Hz
	Storage	Ambient Temperature	-25 to +65°C
		Ambient humidity	5 to 95% RH (No condensation)

(*1) Torque vector control is available from 4.0kW to 22kW of 400V series. Please do not use it with other products.

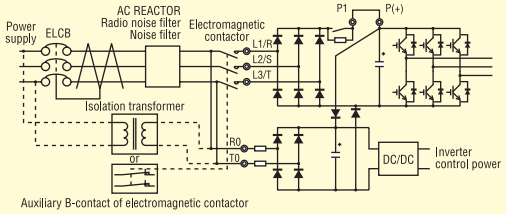
Basic Connection Diagram



(Note 1) Before connecting a DC REACTOR (DCR) (option), remove the jumper bar between terminal [PI] and terminal [P+].

(Note 2) To protect the circuit from overcurrent, install the recommended molded-case circuit breaker (MCCB) or earth leakage circuit breaker (ELCB) (equipped with overcurrent protection function) on the inverter's input side (primary circuit). Do not use a circuit breaker that exceeds the recommended capacity.

(Note 3) Connect to the auxiliary control power input if you want to activate only the control circuit and establish the inverter stand-by state with the main circuit open. The inverter can be operated by wiring to the main circuit without wiring to this terminal.
When connecting an earth leakage circuit breaker (ELCB) to this terminal, connect the terminals R0 and T0 to the ELCB output side. If they are connected to the ELCB input side, the ELCB will malfunction. This is because the inverter input terminal is for three-phase but the terminals R0 and T0 are for single-phase. If connecting the ELCB input side to the terminals R0 and T0, be sure to connect an isolation transformer or an auxiliary B-contact of the electromagnetic contactor in the position indicated in the diagram below.



(Note 4) Use shielded or twisted cables as the control signal wires, and ground the shielded cables. To prevent malfunction due to noise, keep control signal wires away from the main circuit wires as far as possible (at least 10 cm) and never run them in the same duct together. If they need to cross with each other, lay them at right angles.

(Note 5) The common terminals [11], (CM) and (CMY) in the control circuit are independent of each other (isolated).

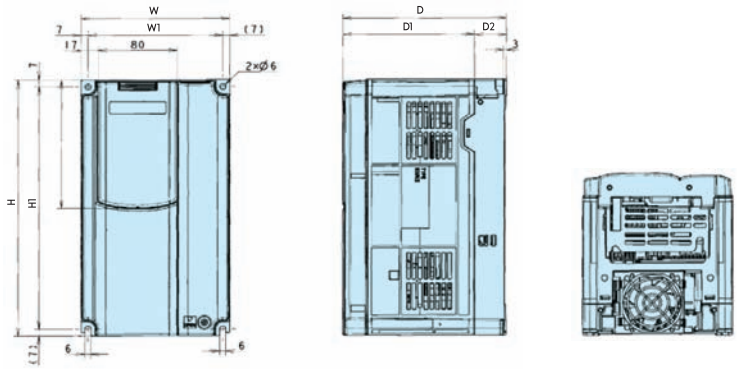
(Note 6) Use shielded cables for wiring. Treat the shielded wire sheath according to the pulse encoder specifications and the connecting conditions with the host controller. The figure shows the shielded cable sheath connected with the motor's grounding cable and the inverter side in open state. Malfunction due to noise, if any, may be improved by connecting the inverter side to (CM). When the wiring between encoder and inverter is long, the signal from the encoder may malfunction and cause irregular noises and torque ripple due to interference between the A-phase and B-phase. In this case, take measures such as shortening the wiring, using cables with small capacitance, etc.

(Note 7) When using the (THR) function, assign the external alarm function (E01 to 08) to any of the terminals (X1) to (X8).

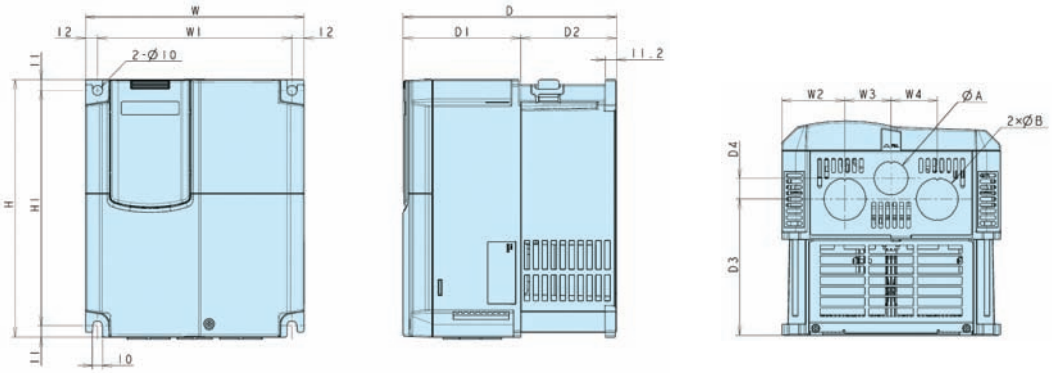
Specifications

External Dimensions

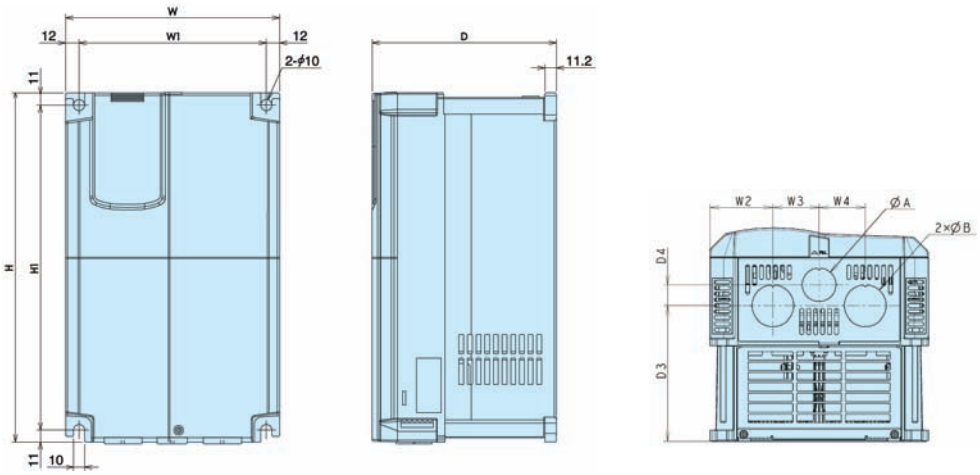
4.0kW



5.5 to 11kW

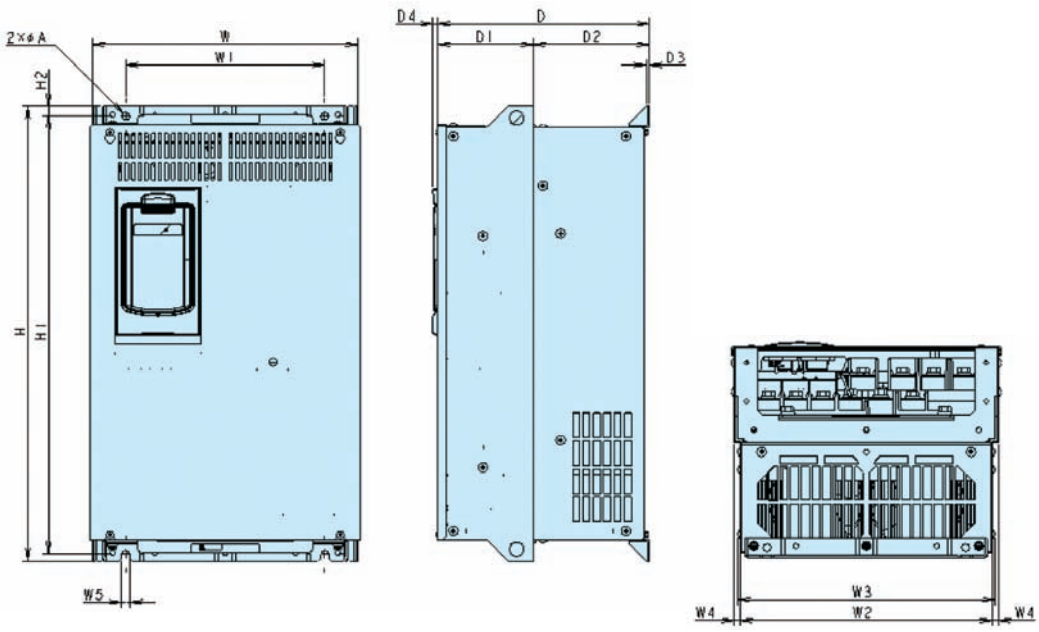


15 to 22kW



30 to 45kW

[Unit: mm]



Power supply voltage	Type	Dimensions (mm)														
		W	W1	W2	W3	W4	W5	H	H1	H2	D	D1	D2	D3	D4	∅A	∅B
Three-phase 200V	FRN5.5LM1S-2□■	220	196	63.5	46.5	46.5		260	238		215	118.5	96.5	136.7	21	34	42
	FRN7.5LM1S-2□■																
	FRN11LM1S-2□■																
	FRN15LM1S-2□■	250	226	67	58	58		400	378			85	130	166.2	2		
	FRN18.5LM1S-2□■																
	FRN22LM1S-2□■																
Three-phase 400V	FRN4.0LM1S-4□■	150	136	–	–	–	–	260	246	–	165	133	32	–	–	–	–
	FRN5.5LM1S-4□■	220	196	63.5	46.5	46.5		260	238		215	118.5	96.5	136.7	21	34	42
	FRN7.5LM1S-4□■																
	FRN11LM1S-4□■																
	FRN15LM1S-4□■	250	226	67	58	58		400	378			85	130	166.2	2		
	FRN18.5LM1S-4□■																
	FRN22LM1S-4□■																
	FRN30LM1S-4□■	320	240	304	310.2	8	10	550	530	12	255	115	140	4	6	10	–
	FRN37LM1S-4□■	355	275	339	345.2						270		155				
	FRN45LM1S-4□■							615	595								

Note: A box (□) in the above table replaces C, E, A or J depending on the shipping destination. A box (■) in the above table replaces A for the inverter without a CAN port

Options

Option card List

Option Type	Specifications	Outline	Motor
OPC-LM1-PP 	Incremental signal: A-phase, B-phase (5V line driver) Absolute position signal: Max. 4 bit PG power output: 5V ± 5% Max. wiring length: 20m Max. input frequency: 100kHz	A card for encoder specifications Parallel interface 3bit or 4 bit absolute position detection (UVW or 4bit gray code)	PMSM
OPC-LM1-PS 	Incremental signal: A-phase, B-phase (sine wave, 1Vpp) Absolute position signal: Serial interface EnDat 2.1 PG power output: 5V ± 5% 300mA(Max.) Applicable PG: HEIDENHAIN ECN1313 Max. wiring length: 20m Max. input frequency: 50kHz	A card for encoder type ECN1313	PMSM
OPC-LM1-PS1 	Incremental signal: A-phase, B-phase (sine wave, 1Vpp) Absolute position signal: Serial interface EnDat 2.1 PG power output: 5V ± 5% 300mA(Max.) Max. wiring length: 20m Max. input frequency: 50kHz	A card for encoder type ECN1313 High resolution for high performance of unbalanced load compensation	PMSM
OPC-LM1-PR 	Incremental signal: A-phase, B-phase (sine wave, 1Vpp) Absolute position signal: SIN/COS PG power output: 5V ± 5% 300mA(Max.) Max. wiring length: 20m Max. input frequency: 50kHz	A card for encoder type ECN1387 High resolution for high performance of unbalanced load compensation	PMSM
OPC-LM1-IL 	Incremental signal: A-phase, B-phase (Line driver RS422) Absolute position signal: SIN/COS PG power output: 5V ± 5% 300mA(Max.) Max. wiring length: 20m Max. input frequency: 100kHz	A card for Line driver input	IM
OPC-LM1-ID 	Frequency Divider Output Circuit: Open Collector (Max.50mA) Ratio: 1, 2, 4, 8, 16, 32, 64 Max. wiring length: 5m	A card for dividing feedback pulse from encoder	IM

Inverter Support Loader

Functionality: Operation monitoring, test operation, tracing (real-time and historical), function code editing, etc.

Supported operating systems: Windows 2000, Windows XP

Note: An RS232C/RS485 adapter or USB/RS485 adapter is required to connect the inverter to your computer.

Keypad (TP-G1-CLS)

Appearance	Specifications	
	Communications	Communications protocol: Modbus-RTU Connection terminal: RJ-45 connector
	Display	Data display: 7-segment LED, 5 digits, LCD display Keypad operation keys: PRG, SHIFT, RESET, ▲, ▼, REM/LOC, FUNC/DATA Motor operation keys: FWD, REV, STOP LED display: For Run (FWD, REV) 1 LED LCD display: <Indicator display> Hz, A, V, %, r/min, m/min, kW, x10, min, sec, PID, FWD, REV, STOP, REM, LOC, COMM, JOG, HAND <Display languages (compatible with 3 languages)>• Chinese, Japanese, English

DC Reactor

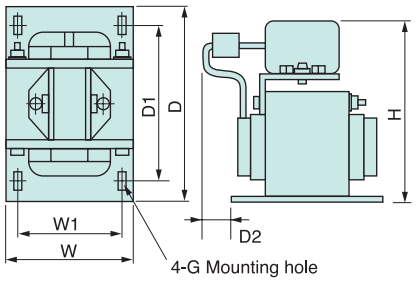


Fig1

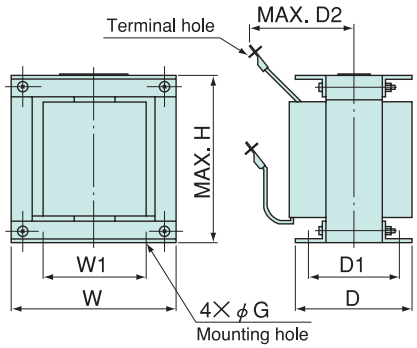


Fig2

Power supply voltage	Nominal applied motor (kW)	Inverter Type	Reactor Type	Dimensions (mm)								Mass (kg)	Fig
				W	W1	D	D1	D2	H	Mounting hole	Terminal screw		
Three-phase 200V	5.5	FRN5.5LM1S-2□■	DCR2-5.5	111	95	100	80	20	130	7 x 11	M5	3.6	1
	7.5	FRN7.5LM1S-2□■	DCR2-7.5	111	95	100	80	23	130	7 x 11	M5	3.8	1
	11	FRN11LM1S-2□■	DCR2-11	111	95	100	80	24	137	7 x 11	M6	4.3	1
	15	FRN15LM1S-2□■	DCR2-15	146	124	120	96	15	171	7 x 11	M6	5.9	1
	18.5	FRN18.5LM1S-2□■	DCR2-18.5	146	124	120	96	25	180	7 x 11	M8	7.4	1
	22	FRN22LM1S-2□■	DCR2-22A	146	124	120	96	25	180	7 x 11	M8	7.5	1
Three-phase 400V	4.0	FRN4.0LM1S-4□■	DCR4-3.7	86	71	100	80	20	110	6 x 9	M4	2.6	1
	5.5	FRN5.5LM1S-4□■	DCR4-5.5	86	71	100	80	20	110	6 x 9	M4	2.6	1
	7.5	FRN7.5LM1S-4□■	DCR4-7.5	111	95	100	80	24	130	7 x 11	M5	4.2	1
	11	FRN11LM1S-4□■	DCR4-11	111	95	100	80	24	130	7 x 11	M5	4.3	1
	15	FRN15LM1S-4□■	DCR4-15	146	124	120	96	15	171	7 x 11	M5	5.9	1
	18.5	FRN18.5LM1S-4□■	DCR4-18.5	146	124	120	96	25	171	7 x 11	M6	7.2	1
	22	FRN22LM1S-4□■	DCR4-22A	146	124	120	96	25	171	7 x 11	M6	7.2	1
	30	FRN30LM1S-4□■	DCR4-30B	152	90	157	115	100	130	8	M8	13	2
	37	FRN37LM1S-4□■	DCR4-37B	171	110	150	110	100	150	8	M8	15	2
	45	FRN45LM1S-4□■	DCR4-45B	171	110	165	125	110	150	8	M8	18	2

Note: A box (□) in the above table replaces C, E, A or J depending on the shipping destination. A box (■) in the above table replaces A for the inverter without a CAN port

Fuji Electric Asia Pacific Pte Ltd

171 Chin Swee Road #12-01, San Centre, Singapore 169877
Tel: +65-6533 0014 Fax: 65-6533 0021
Email: Drive@fujielectric.com.sg Website: www.fujielectric.com.sg

Printed in Singapore 2009-4 (C06b/E05) CM 00 FIS