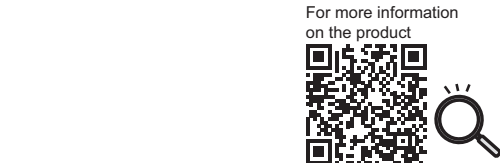


INVERTER

E800-HVC

INVERTER SAFETY GUIDELINE

FR-E820-0011(0.2K) to 0978(30K)-HVC
FR-E840-0018(0.75K) to 0510(30K)-HVC
FR-E820S-0011(0.2K) to 0082(2.2K)-HVC



IB-0600944ENG-C(2405)MEE
Specifications subject to change without notice.

MITSUBISHI ELECTRIC CORPORATION
HEAD OFFICE: TOKYO BUILDING 2-7-3, MARUNOUCHI, CHYODA-KU, TOKYO 100-8310, JAPAN

Manual name	Manual number	Model code	Details
FR-E800-HVC Instruction Manual (Connection)	IB-0600950ENG	—	Manuals describing installation, wiring, specifications, outline dimensions, standards, and how to connect options.
FR-E800 Instruction Manual (Function)	IB-0600868ENG	1A1045	Manual describing details of the functions.
FR-E800 Instruction Manual (Communication)	IB-0600871ENG	1A1051	Manual describing details of the communications.
FR-E800 Instruction Manual (Maintenance)	IB-0600874ENG	1A1054	Manual describing how to identify causes of faults and warnings.
PLC Function Programming Manual	IB-0600482ENG	—	Manual describing details of the PLC function.

Safety information

Do not attempt to install, operate, maintain or inspect this product until you have read through this Safety Guideline and supplementary documents carefully to use the equipment correctly. Do not use the product until you have full knowledge of the product mechanism, safety information and instructions. Installation, operation, maintenance and inspection must be performed by qualified personnel. Here, qualified personnel means a person who meets all the following conditions:

- A person who possesses a certification in regard with electric appliance handling, or person took a proper engineering training. Such training may be available at your local Mitsubishi Electric office. Contact your local sales office for schedules and locations.
- A person who can access operating manuals for the protective devices (for example, light curtain) connected to the safety control system, or a person who has read these manuals thoroughly and familiarized themselves with the protective devices.

In this Safety Guideline, the safety instruction levels are classified into "WARNING" and "CAUTION".

WARNING

Incorrect handling may cause hazardous conditions, resulting in death or severe injury.

CAUTION

Incorrect handling may cause hazardous conditions, resulting in medium or slight injury, or may cause only material damage.

Note that even the **CAUTION** level may lead to a serious consequence depending on conditions. Be sure to follow the instructions of both levels as they are critical to personnel safety.

Read this Guideline before use. In addition, scan the 2D code below to download the FR-E800-HVC Instruction Manual (Connection) and read "Safety Instructions". The PDF manual can also be downloaded from the Mitsubishi Electric FA Global Website.

1 INVERTER INSTALLATION AND PRECAUTIONS

When installing the inverter on the enclosure surface, remove the front cover and wiring cover to fix the inverter.

- Install the inverter on a strong surface securely with screws.
- Leave enough clearances and take cooling measures.
- Avoid places where the inverter is subjected to direct sunlight, high temperature and high humidity.
- Install the inverter on a nonflammable wall surface.
- When tightening screws into the upper mounting holes, tilt the screwdriver seven to ten degrees (FR-E820-0051(1.1K) or lower, FR-E820S-0017(0.4K) or lower).

Allow clearance

10 cm or more

1 cm or more

1 cm or more

1 cm or more

1 cm or more

2 INSTALLATION AND WIRING

2.1 Removal and reinstallation of covers

- ◆ Removal of the wiring cover 1 (FR-E820-0051(1.1K) or lower and FR-E820S-0017(0.4K) or lower)
- ◆ Reinstallation of the wiring cover 1 (FR-E820-0051(1.1K) or lower and FR-E820S-0017(0.4K) or lower)

(a) Loosen the mounting screws of the wiring cover 1.

(b) Slide up the cover and pull it out.

(c) Loosen the mounting screws of the cover. (Tightening torque: 1.4 to 1.9 N·m)

- ◆ Removal of the wiring cover 1 (FR-E820-0082(2.2K) to 0167(5.5K) and FR-E840-0094(5.5K) or lower and FR-E820S-0030(0.75K) or higher)
- ◆ Reinstallation of the wiring cover 1 (FR-E820-0082(2.2K) to 0167(5.5K) and FR-E840-0094(5.5K) or lower and FR-E820S-0030(0.75K) or higher)

(a) Loosen the mounting screws of the wiring cover 1.

(b) Slide up the cover and pull it out.

(c) Loosen the mounting screws of the cover. (Tightening torque: 1.4 to 1.9 N·m)

- ◆ Removal of the wiring cover 1 (FR-E820-0255(7.5K) or higher and FR-E840-0149(7.5K) or higher)
- ◆ Reinstallation of the wiring cover 1 (FR-E820-0255(7.5K) or higher and FR-E840-0149(7.5K) or higher)

(a) Loosen the mounting screws of the wiring cover 1.

(b) Slide up the cover and pull it out.

(c) Loosen the mounting screws of the cover. (Tightening torque: 1.4 to 1.9 N·m)

- ◆ Removal of the front cover
- ◆ Reinstallation of the front cover

(a) With the wiring cover 1 removed, loosen the mounting screw on the front cover. (The screw cannot be removed.)

(b) Put a finger on the recess for the screw of the cover and pull out the cover using its lower side as a support.

(c) With the cover removed, the control circuit terminals (connector) can be wired.

(a) Place the front cover against the inverter.

(b) Tighten the mounting screw of the front cover. (Tightening torque: 0.6 to 0.8 N·m)

- ◆ Removal of the lower front cover (FR-E820-0255(7.5K) or higher and FR-E840-0298(15K) or higher)
- ◆ Reinstallation of the lower front cover (FR-E820-0255(7.5K) or higher and FR-E840-0298(15K) or higher)

(a) With the wiring cover 1 removed, loosen the mounting screws on the lower front cover. (These screws cannot be removed.)

(b) While holding the areas around the installation hooks on the sides of the lower front cover, pull out the cover using its upper side as a support.

(c) With the cover removed, the control circuit terminals (connector) can be wired.

(a) Install the lower front cover by inserting the upper hooks into the sockets on the inverter.

(b) Tighten the screws on the lower part of the lower front cover. (Tightening torque: 0.6 to 0.8 N·m)

- ◆ Removal of the wiring cover 2 (FR-E820-0476(15K) or lower and FR-E840-0196(11K) or lower and FR-E820S-0082(2.2K) or lower)
- ◆ Reinstallation of the wiring cover 2 (FR-E820-0476(15K) or lower and FR-E840-0196(11K) or lower and FR-E820S-0082(2.2K) or lower)

(a) After removing the wiring cover 1 and the front cover (FR-E820-0167(5.5K) or lower and FR-E840-0196(11K) or lower) or the lower front cover (FR-E820-0255(7.5K) or higher), remove the mounting screws of the wiring cover 2.

(b) Tighten the mounting screws of the wiring cover 2.

Inverter	Tightening torque
FR-E820-0167(5.5K) or lower FR-E840-0094(5.5K) or lower FR-E820S-0082(2.2K) or lower	0.9 to 1.3 N·m
FR-E820-0167(5.5K) FR-E840-0196(11K) FR-E820-0255(7.5K) FR-E820-0340(11K)	1.4 to 1.9 N·m
FR-E820-0255(7.5K) FR-E820-0340(11K)	2.8 to 3.6 N·m

- ◆ Removal of the wiring cover 2 (FR-E820-0476(15K) or higher and FR-E840-0298(15K) or higher)
- ◆ Reinstallation of the wiring cover 2 (FR-E820-0476(15K) or higher and FR-E840-0298(15K) or higher)

(a) After removing the wiring cover 1 and the lower front cover, remove the mounting screws of the wiring cover 2.

(b) With the wiring cover 2 removed, the main circuit can be wired.

(a) Tighten the mounting screws of the wiring cover 2.

Inverter	Tightening torque
FR-E840-0298(15K)	1.4 to 1.9 N·m
FR-E820-0476(15K) FR-E820-0587(18.5K)	2.8 to 3.6 N·m
FR-E840-0340(18.5K) FR-E820-0748(22K) or higher FR-E840-0383(22K) or higher	4.7 to 6.4 N·m

- ◆ Connection of conduits

(1) To punch out the knockout holes in the wiring cover 2, put a screwdriver against the knockout's edge and firmly tap it with a hammer or other object.

(2) Pass conduits through the round knockout holes. Fix the conduits with locknuts both inside and outside the cover. Then tighten bushings to fix the conduits to the wiring cover 2.

The line voltage drop can be calculated by the following formula:

Line voltage drop [V] = $\sqrt{3} \times \text{wire resistance} [\text{m}\Omega/\text{m}] \times \text{wiring distance} [\text{m}] \times \text{current} [\text{A}] / 1000$

Use a larger diameter cable when the wiring distance is long or when the voltage drop (torque reduction) in the low speed range needs to be reduced.

- ◆ Three-phase 200/400 V class

- ◆ Single-phase 200 V class

- Make sure the power cables are connected to terminals R/L1, S/L2, and T/L3 (the phases need not be matched). Never connect the power cable to terminals U, V, or W of the inverter. Doing so will damage the inverter.
- Connect the motor to terminals U, V, and W. The motor rotates counterclockwise when viewed from the motor load side when the forward rotation switch [signal] turns ON.

2.3 Recommended cables and wiring length

Select cables of recommended gauge size to ensure that the voltage drop will be 2% or less. If the wiring distance is long between the inverter and motor, the voltage drop in the main circuit will cause the motor torque to decrease especially at a low speed. The following table shows the recommended cable size for cables that are 20 m in length.

Applicable inverter model	Terminal screw size *4	Tightening torque N·m	Crimp terminal R/L1, S/L2, T/L3 *5	HIV cables, etc. (mm ²) *1			AWG *2			PVC cables, etc. (mm ²) *3			
				R/L1, S/L2, T/L3 *5	U, V, W	P/+	R/L1, S/L2, T/L3 *5	U, V, W	P/+	R/L1, S/L2, T/L3 *5	U, V, W	P/+	
FR-E820-0011(0.2K) to 0051(1.1K)	M3.5	1.2	2-3.5	2	2	2	2	2	14	14	2.5	2.5	
FR-E820-0082(2.2K)	M4 (M3.5)	1.5	2-4	2-4	2	2	2	2	14	14	2.5	2.5	
FR-E820-0102(3.0K)	M4 (M3.5)	1.5	5-5.4	5-5.4	3.5	3.5	3.5	3.5	12	12	4	4	
FR-E820-0167(5.5K)	M4 (M3.5)	1.5	5-5.4	5-5.4	5.5	5.5	5.5	5.5	10	10	6	6	
FR-E820-0255(7.5K)	M5	2.5	14-5	5-5.5	14	5.5	14	5.5	6	10	16	6	
FR-E820-0340(11K)	M5	2.5	14-5	14-5	14	14	14	8	6	16	16	10	
FR-E820-0476(15K)	M5	2.5	22-5	22-5	22	22	22	14	4	25	25	16	
FR-E820-0587(18.5K)	M4(M5)	4.4	38-6	22-6	38	22	38	14	2	35	25	25	
FR-E820-0748(22K)	M3(M5)	7.0	60-8	38-8	38	38	38	22	2	35	35	25	
FR-E820-0978(30K)	M3(M5)	7.0	60-8	60-8	60	60	60	22	10	50	60	35	
FR-E840-0018(0.75K) to 0059(3.0K)	M4 (M3.5)	1.5	2-4	2-4	2	2	2	2	14	14	2.5	2.5	
FR-E840-0094(5.5K)	M4 (M3.5)	1.5	2-4	2-4	2	2	3.5	2	12	14	2.5	2.5	
FR-E840-0149(7.5K)	M4	1.5	5-5.4	5-5.4	3.5	3.5	3.5	3.5	12	12	4	4	
FR-E840-0196(11K)	M4	1.5	5-5.4	5-5.4	5.5	5.5	5.5	5.5	10	10	6	6	
FR-E840-0298(15K)	M4	1.5	8-4	5-5.4	8	5.5	8	5.5	8	10	10	6	
FR-E840-0349(18.5K)	M5	2.5	14-5	8-5	14	8	14	8	6	16	10	16	
FR-E840-0383(22K)	M6	4.4	14-6	14-6	14	14	22	14	6	16	16	16	
FR-E840-0510(30K)	M6	4.4	22-6	22-6	22	22	22	14	4	25	25	16	
FR-E820S-0011(0.2K), 0017(0.4K)	M3.5	1.2	2-3.5	2-3.5	2	2	2	2	14	14	2.5	2.5	
FR-E820S-0030(0.75K), 0051(1.1K)	M4(M3.5)	1.5	2-4	2-4	2	2	2	2	14	14	2.5	2.5	
FR-E820S-0082(2.2K)	M4(M3.5)	1.5	5-5.4	2-4	3.5	2	2	2	12	14	4	2.5	2.5

- *1 The cable size is that of the HIV cable (800 V grade heat-resistant PVC insulated wire) etc. with continuous maximum permissible temperature of 75°C. It assumes a surrounding air temperature of 40°C or lower and the wiring distance of 20 m or longer. (For use in the USA, refer to the section 8.2 "Precautions for UL and UL-2.")
- *2 The cable size is that of the PVC cable with continuous maximum permissible temperature of 70°C. It assumes a surrounding air temperature of 40°C or lower and the wiring distance of 20 m or longer. (Selection example: refer to the section 8.2 "Precautions for UL and UL-2.")
- *3 The screw size for terminals R/L1, S/L2, T/L3, U, V, W, P/+, N/-, and the earthing (grounding) terminal is shown. For the single-phase 200 V power input models, the screw size for terminals R/L1, S/L2, U, V, W, P/+, N/-, and the earthing (grounding) terminal is shown. The screw size for earthing (grounding) the FR-E820-0082(2.2K) to 0167(5.5K) is indicated in parentheses.
- *4 When using a single-phase power input model, terminals are R/L1 and S/L2.

The line voltage drop can be calculated by the following formula:

Line voltage drop [V] = $\sqrt{3} \times \text{wire resistance} [\text{m}\Omega/\text{m}] \times \text{wiring distance} [\text{m}] \times \text{current} [\text{A}] / 1000$

Use a larger diameter cable when the wiring distance is long or when the voltage drop (torque reduction) in the low speed range needs to be reduced.

- ◆ Total wiring length

Cable type	Pr.72 setting (carrier frequency)	Voltage class	Applicable inverter model: FR-E820-T-HVC							
			0011 (0.2K)	0017 (0.4K)	0030 (0.75K)	0051 (1.1K)	0082 (2.2K)	0102 (3.0K)	0167 (5.5K) or higher	
Shielded cable-1	1 (1 kHz) or lower 2 (2 kHz) or higher	200 V	50m(200m) 10m(30m)	50m(200m) 50m(200m)	75m(300m) 75m(300m)	100m(500m) 100m(500m)	100 m (500 m) 100 m (500 m)	100 m (500 m) 100 m (500 m)		

Cable type	Pr.72 setting (carrier frequency)	Voltage class	Applicable inverter model: FR-E840-T-HVC				
			0018 (0.75K)	0030 (1.5K)	0047 (2.2K)	0059 (3.0K)	0094 (5.5K) or higher
Shielded cable-1	1 (1 kHz) or lower 2 (2 kHz) or higher	400 V	50 m (200 m) 10 m (30 m)	50 m (200 m) 25 m (100 m)	75 m (300 m) 50 m (200 m)	100 m (500 m) 75 m (300 m)	100 m (500 m) 100 m (500 m)

*1 The value in the parentheses is the total wiring length when unshielded cables are used.

When driving a 400 V class motor by the inverter, surge voltages attributable to the wiring constants may occur at the motor terminals, deteriorating the insulation of the motor. In this case, use a "400 V class inverter-driven insulation-enhanced motor" and set **Pr.72 PWM frequency selection** according to the wiring length: "14.5 kHz or less" when the wiring length is 50 m or shorter, "8 kHz or less" when the wiring length is from 50 m to 100 m, or "2 kHz or less" when the wiring length is longer than 100 m.

2.4 Terminal connection diagram

2.5 Details on the main circuit terminals and the control circuit terminals

Type	Terminal symbol	Common	Terminal name	Terminal function description
Main circuit	R/L1, S/L2, T/L3*1	—	AC power input	Connected to the commercial power supply. Do not connect anything to these terminals when using the high power factor converter (FR-HC2) or the multifunction regeneration converter (FR-XC) in common bus
	U, V, W	—	Inverter output	Connected to a three-phase squirrel cage motor or a PM motor.
	P/+, P1	—	DC reactor connection	Remove the jumper across terminals P/+ and P1, and connect a DC reactor. When a DC reactor is not connected, the jumper across terminals P/+ and P1 should not be removed.
	⏏	—	Earth (ground)	For earthing (grounding) the inverter chassis. Be sure to earth (ground) the inverter.
Control input	STF*2	SD (sink (negative common))	Forward rotation start	Turn ON the STF signal to start forward rotation and turn it OFF to stop.
	STR*2	PC (source (positive common))	Reverse rotation start	Turn ON the STR signal to start reverse rotation and turn it OFF to stop.
	RH, RM, RL*2	—	Multi-speed selection	Multi-speed can be selected according to the combination of RH, RM and RL signals.
	10	5	Power supply for a frequency setting potentiometer	Used as the power supply for an external frequency setting (speed setting) potentiometer.
Frequency setting	2	5	Frequency setting (voltage)	Inputting 0 to 5 VDC (or 0 to 10 VDC) provides the maximum output frequency at 5 (or 10 V) and makes input and output proportional. Use Pr.73 to switch among input 0 to 5 VDC (initial setting), 0 to 10 VDC, and 0 to 20 mA. Set the voltage/current input switch to the "I" position to select current input (0 to 20 mA).
				For voltage input, input resistance: 10 to 11 kΩ For current input, input resistance: 245 ±5 Ω Permissible maximum current: 30 mA
				For voltage input, input resistance: 10 to 11 kΩ For current input, input resistance: 245 ±5 Ω Permissible maximum current: 30 mA
				For voltage input, input resistance: 10 to 11 kΩ For current input, input resistance: 245 ±5 Ω Permissible maximum current: 30 mA
Relay	A, B, C	—	Relay output (fault output)	1 changeover contact output indicates that the inverter protective function has activated and the outputs are stopped. Fault: discontinuity across B and C (continuity across A and C). Normal: continuity across B and C (discontinuity across A and C)
				30 VDC 1 A
				Permissible load: 24 VDC (27 VDC at maximum) 0.1 A (The voltage drop is 3.4 V at maximum while the signal is ON.)
				Output signal: 0 to ±10 VDC Permissible load current: 1 mA (load impedance 10 kΩ or more) Resolution: 12 bits
Open collector	RUN	SE	Inverter running	The output is in LOW state when the inverter output frequency is equal to or higher than the starting frequency (initial value: 0.5 Hz). The output is in HIGH state during stop of DC injection brake operation.*3
				Permissible load current: 1 mA (load impedance 10 kΩ or more) Resolution: 12 bits
				Output signal: 0 to ±10 VDC Permissible load current: 1 mA (load impedance 10 kΩ or more) Resolution: 12 bits
				Output signal: 0 to ±10 VDC Permissible load current: 1 mA (load impedance 10 kΩ or more) Resolution: 12 bits
Analog	AM	5	Analog voltage output	Among several monitor items such as output frequency, select one to output it via this terminals. (The signal is not output during an inverter reset.) The size of output signal is proportional to the magnitude of the corresponding monitor item.
				Output item: Output frequency (initial setting)
				Output signal: 0 to ±10 VDC Permissible load current: 1 mA (load impedance 10 kΩ or more) Resolution: 12 bits
				Output signal: 0 to ±10 VDC Permissible load current: 1 mA (load impedance 10 kΩ or more) Resolution: 12 bits
Common terminal	SD	—	Contact input common (sink (negative common))	Common terminal for the contact input terminal (sink logic).
	SE	—	External transistor common (source (positive common))	Connect this terminal to the power supply common terminal of a transistor output (open collector output) device, such as a programmable controller, in the source logic to avoid malfunction by undesirable current.
	PC	—	24 VDC power supply common	Common output terminal for 24 VDC 0.1 A power supply (terminal PC). Isolated from terminals 5 and SE.
	SD	—	External transistor common (sink (negative common))	Connect this terminal to the power supply common terminal of a transistor output (open collector output) device, such as a programmable controller, in the sink logic to avoid malfunction by undesirable current.
Communication	SDA	—	Inverter transmission terminal	RS-485 communication can be made through the RS-485 terminals.
	SDB	—	Inverter reception terminal	Conforming standard: EIA-485 (RS-485)
	RDA	—	Inverter reception terminal	Transmission format: Multidrop link
	RDB	—	Inverter reception terminal	Communication speed: 300 to 115200 bps
USB	SG	—	Earthing (grounding)	Wiring length: 500 m
				Use the USB connector to communicate with a personal computer.
				- Interface: conforms to USB 1.1 - Transmission speed: 12 Mbps
				- Connector: USB mini B connector (receptacle mini B type)

- *1 Terminal T/L3 is not available for the single-phase power input models.
- *2 Terminal functions can be selected using **Pr.78 to Pr.182 (Input terminal function selection)**. (Refer to the FR-E800 Instruction Manual (Function).)
- *3 When the open collector transistor is ON (conductive) in LOW state, the transistor is OFF (not conductive) in HIGH state.
- *4 USB bus power connection is available. The maximum I/O is 500 mA.

