



E860-SCE

INVERTER SAFETY GUIDELINE

FR-E860-0017(0.75K) to 0120(7.5K)SCE



IB-0600924ENG-E(2312)MEE

MITSUBISHI ELECTRIC CORPORATION

Related manuals

| Manual name | Manual number | Details |
|--|----------------|---|
| FR-E860 Instruction Manual (Connection) | IB-0600906ENG | Manuals describing installation, wiring, specifications, outline dimensions, standards, and how to connect options. |
| FR-E800 Instruction Manual (Function) | IB-0600868ENG | Manual describing details of the functions. |
| FR-E800 Instruction Manual (Communication) | IB-0600871ENG | Manual describing details of the communications. |
| FR-E800 Instruction Manual (Maintenance) | IB-0600874ENG | Manual describing how to identify causes of faults and warnings. |
| FR-E800 Instruction Manual (Functional Safety) | BCN-A23488-000 | Manual describing the functional safety. |
| FR Configurator2 Instruction Manual | IB-0600516ENG | Manual describing details of the software used to set inverter parameters using a personal computer. |
| PLC Function Programming Manual | IB-0600492ENG | Manual describing details of the PLC function. |
| | | |

↑ CAUTION

o not attempt to install, operate, maintain or inspect this product until u have read through this Safety Guldeline and supplementary cuments carefully to use the equipment correctly. Do not use the oduct until you have full knowledge of the product mechanism, safety formation and instructions.

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.

n this Safety Guideline, the safety instruction levels are classified int "WARNING" and "CAUTION".

⚠CAUTION

lote that even the <u>CAUTION</u> level may lead to a serious sequence depending on conditions. Be sure to follow the ructions of both levels as they are critical to personnel safety

Electric shock prevention

leader in some of the product is unaged. Doing so may cause all electric shock or inspection, check that the display of the operation panel is OFF. Any person who is involved in wiring or inspection shall wait for 10 minutes or longer after power OFF and check that there are no residual voltage using a digital multimeter or the like. The capacitor is charged with high voltage for some time after power OFF and it is dangerous. This must be earthed (grounded), Earthing (grounding) must conform to the requirements of national and local safety regulations and electrical code (NEC section 250, 61140 class 1 and other applicable standard). Any person who is involved in wiring or inspection of this product shall be fully competent to do the work.

ny person who is involved in wiring or inspection of this product shall be fully ompetent to do the work. Ise crimp terminals with insulation sleeves to wire the power supply and the

roduct body must be installed before wiring. Otherwise you may get an

This product body must be installed before wining. Otherwise you may get an electric shock or be injured. Do not touch the keys with wet hands. Doing so may cause an electric shock. Do not subject the cables to scratches, excessive stress, heavy loads or pinching. Doing so may cause an electric shock. Do not change the cooling fan while power is ON as it is dangerous to change the cooling fan while power is ON as it is dangerous to change the cooling fan while power is ON as it is dangerous to change the cooling fan while power is ON as it is dangerous to change the cooling fan while power is ON. The cooling so may cause an electric shock is applied to the motor for 1 see, etc. right after powering OFF as the DC voltage is applied to the motor for 1 second at powering OFF if the main circuit capacitor capacity is measured. Doing so may cause an electric shock.

↑ CAUTION

This product must be installed on a nonflammable wall without holes in it so that its components cannot be touched from behind. Installing it on or near flammable

its components cannot be doubled non before. In the service of the

Do not connect a resisfor directly to the DC terminals P/+ and N/-. Doing so could cause a fire.

Across terminals P/+ and PR, connect only an external brake resistor.

Be sure to perform dally and periodic inspections as specified in the Instruction Manual (Maintenance). There is a possibility of explosion, damage, or fire if this product is used without inspection.

↑ CAUTION

Additional instructions The following instructions must be also followed. If the product is handled in the product is handled in the product is handled in the product in the product is shock.

The voltage applied to each terminal must be as specified in the Instruction Manual (Connection). Otherwise an explosion or damage may occur. The cables must be connected to the correct terminals. Otherwise an explosion

↑ CAUTION

Transportation and installation

Use proper lifting techniques or a trolley when carrying products. Failure to do so may lead to injuries.

Do not stack the boxes containing inverters higher than the number

Italy lead to injuries.

Do not stack the boxes containing inverters higher than the number recommended is be installed in a position where it withstands the weight of the Theodoccus to be installed in a position where it withstands the weight of the Individual of Individual One Indivi

transportation time) must be between -40°C and +70°C. Otherwise this product may be damaged.

This product must be used indoors (without corrosive gas, flammable gas, oil mist, dust and dirt). Otherwise the product may be damaged.

Do not use this product at an altitude above 2000 m. Vibration should not excee 5.9 m/s² at 10 to 55 Hz in X, Y, and Z directions. Otherwise the product may be

damaged.
If halogens (including fluorine, chlorine, bromine, and iodine) contained in fumigants for wood packages enter this product, the product may be damaged. Prevent the entry of fumigant residuals or use an alternative method such as hea disinfection. Note that sterilization or disinfection of wood packages should be performed before packing the product.

performed before packing the product.

Wiring

Do not install a power factor correction capacitor, surge absorber, or radio noise filter on the output side of this product. These devices may overheat or burn out.

The output terminals (terminals U, V, and W) must be connected to a motor correctly, Otherwise the motor will rotate inversely.

Even with the power OFT might voltage is still applied to the terminals U, V and W output on the product of the terminals U, V and W output on the product of the terminals U, V and W output on the product of the terminals U, V and W output of the product of the terminal C, V, W of the product of the terminal C, V, W of V and V or the product of the pr

Test operation

Before starting the operation, confirm or adjust the parameter settings. Failure to do so may cause some machines to make unexpected motions.

Thank you for choosing Mitsubishi Electric inverter. This Inverter INVERTER INSTALLATION AND PRECAUTIONS Safety Guideline provides handling information and precautions for use of this product. Do not use this product until you have full

knowledge of the product mechanism, safety information and

Usage

Stay away from the equipment after using the retry function in this product as the equipment will restart suddenly after the output shutoff of this product.

Access to the motor is allowed only after it is fully confirmed that the motor does

Access to the motor is allowed only after it is fully confirmed that the motor does not start nunning.

Depending on the function settings of this product, the product does not stop its output even when the STOP/RESET key on the operation panel is pressed. To prepare for it, provide a separate circuit and switch (to turn OFF the power of this product, or apply a mechanical brake, etc.) for an emergency stop, product, or apply a mechanical brake, etc.) for an emergency stop, and the fold that it is not out to will restart the motor suddenly after a fault is cleared. Do not use a PM motor for an application that the motor may be driven by the load and run at a speed higher than the maximum motor speed. Use only a three-phase squirrel cage motor or PM motor as a load on this product. Connection of any other electrical equipment to the output of this product may damage the equipment. Signal and X13 signal under torque control may start the motor running at a low speed even when the start signal (STF or STR) is not input. This product with the start command ON may also rotate the motor at a low speed when the speed limit value is set to zero. Confirm that the motor running does not cause any safety problems before performing pre-excitation. Do not modify this product.

en installing the MC on the output side of the inverter, turn it ON/OFF while he the inverter and motor are at a stop.

It is electronic thermal O/L relay function may not be enough for protection of a tor from overheading. It is recommended to install an external thermal relay or TC thermistor for overhead protection.

To the mistor for overhead protection. To the product of th

shaft, which may cause electrical corrosion of the bearing. Take measures such as decreasing the carrier frequency. As all parameters return to their initial values after Parameter clear or All parameter clear is performed, the parameters must be set again as required before the operation is started. This product can be easily set for high-speed operation. Therefore, consider all things related to the operation such as the performance of a motor and equipment in a system before the setting change. If the machine must not be restarted when power is restored after a power failure, provide an MC on the input side of the inverter and also make up a sequence which will not switch ON the start signal. When performing an inverter operation with frequent starts/stops, rise/fall in the temperature of the transistor element of the inverter will repeat due to a repeated flow of large current, shortening the life. Perform an inspection and test operation of this product if it has been stored for a long period of time.

erform an inspection and test operation of this product if it has been stored for a no period of time.
a void damage to this product due to static electricity, static electricity in your
dry must be discharged before you touch this product.
In you have the statement of the product of the

Emergency stop

A safety backup such as an emergency brake must be provided for devices or equipment in a system to prevent hazardous conditions in case of failure of this

For clarity, illustrations in this Safety Guideline may be drawn with covers or safety guards removed. Ensure all covers and safety guards are properly instal as described in the Instruction Manual (Connection) prior to starting operation.
 For details on the PM motor, refer to the Instruction Manual of the PM motor.

♦ Application of caution labels Caution labels are used to ensure safety during use of Mitsubishi Electric Caution labels are used to ensure safety during use of Mitsubishi Electric inverters.

Make copies of the following labels and apply them to the inverter if the "retry function" and/or "automatic restart after instantaneous power failure" have been enabled.

> CAUTION (Retry Function Has) Been Selected

Stay away from the motor and machine They will start suddenly (after given

CAUTION Automatic Restart after Instantaneous Power Failure Has Been Selected Stay away from the motor and machine They will start suddenly (after reset

instantaneous power failure occurs.

time has elapsed) when

time has elapsed) when alarm occurs.

For automatic restart after instantaneous power failure

For the retry function

The district of the control of the c

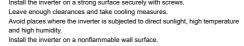
Dos: A denial-of-service (Dos) attack disrupts services by overloading systems or exploiting vulnerabilities, resulting in a denial-of-service (Dos) state

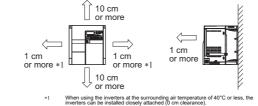
Please forward this Safety Guideline to the end user.

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.





(a) Check the position of the hooks on the rear of the cove

♦ FR-E860-0040(2.2K) or lower

◆ FR-E860-0061(3.7K) or higher

Fit the cover to the inverter along the guides

(b) Insert the hooks of the cover into the sockets of the wiring cover, and reinstall the

(c) Tighten the mounting screws of the front cover. (Tightening torque: 0.6 to 0.8

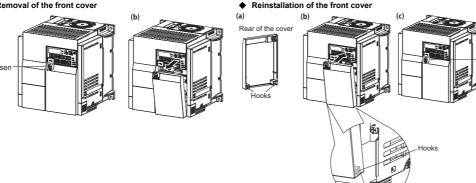
Fit the cover to the inverter along the guides, and push the hook into the socket

Allow clearance

INSTALLATION AND WIRING

Removal and reinstallation of covers

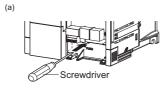
Removal of the front cover

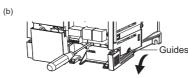


(a) Loosen the mounting screws of the cover. (These screws cannot be

(b) Pull out the cover using its lower side as a support. With the cover removed, the control circuit terminals can be wired and the plug-in option can be installed.

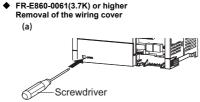
♦ FR-E860-0040(2.2K) or lower Removal of the wiring cov

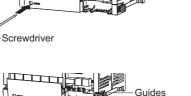


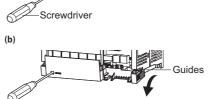


(a) Insert a tool such as a flathead screwdriver into the half-hole above the "PUSH" mark on the wiring cover to push the cover behind the wiring

(b) Pull out the cover along the guides in the direction shown by the arrow in the figure above.



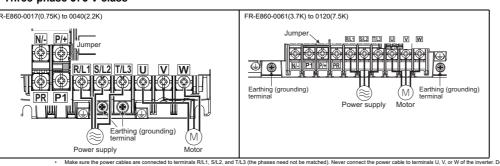




"PUSH" mark on the wiring cover to push the cover behind the wiring

(b) Pull out the cover along the guides in the direction shown by the arrow in the figure above.

2.2 Main circuit terminal layout and wiring to power supply and motor ◆ Three-phase 575 V class



Applicable 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 a selection example for the wiring length of 20 m at the ND rating. When using the inverter with the LD rating, refer to the FR-E860 Instruction

| | | | | | | Cable g | gauge *1 | |
|---------------------|------------------|---------------|------------------------|----------|------------------------|----------------------------|------------------------|---------|
| Applicable Inverter | Terminal | Tightening | Crimp | terminal | HIV cables, | etc. (mm ²) *1 | AWG *2 | |
| model | screw size *3 | torque N·m | R/L1, S/L2, T/L3 | U, V, W | R/L1, S/L2, T/L3 | U, V, W | R/L1, S/L2, T/L3 | U, V, W |
| FR-E860-0017(0.75K) | M4 | 1 | 2-4 | 2-4 | 2 | 2 | 14 | 14 |
| FR-E860-0027(1.5K) | M4 | 1 | 2-4 | 2-4 | 2 | 2 | 14 | 14 |
| FR-E860-0040(2.2K) | M4 | 1 | 2-4 | 2-4 | 2 | 2 | 14 | 14 |
| FR-E860-0061(3.7K) | M4 | 1 | 2-4 | 2-4 | 2 | 2 | 14 | 14 |
| FR-E860-0090(5.5K) | M4 | 1 | 2-4 | 2-4 | 2 | 2 | 14 | 14 |
| FR-E860-0120(7.5K) | M4 | 1 | 5.5-4 | 2-4 | 3.5 | 2 | 12 | 14 |

HIV cable (600 V grade heat-resistant PVC insulated wire) with a continuous maximum permissible temperature of 75°C. It is assumed that the cables will be used in a surrounding air temperature of 50°C or less and the wiring distance of 20 m or shorter.

21 THHW cable with a continuous maximum permissible temperature of 75°C. It is assumed that the cables will be used in a surrounding air temperature of 40°C or less and the wiring distance of 20 m or shorter. (For use in the United States or Canada, refer to the section 7.2 "Instructions for UL and cUL".)

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

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

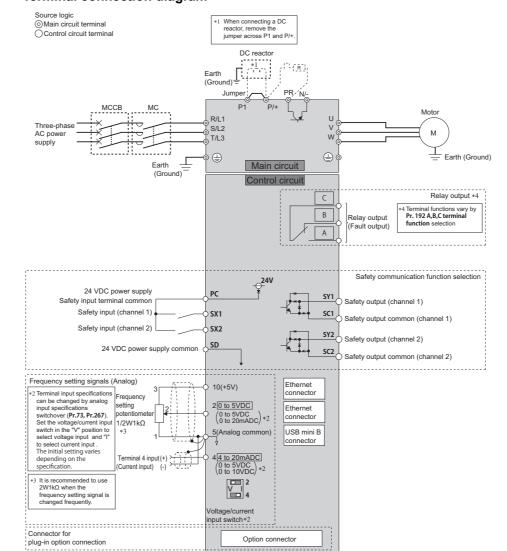
Use a larger diameter cable when the wiring distance is long or when it is desired to decrease the voltage drop (torque reduction) in the low speed range

♦ Total wiring length
Connect one or more motors within the total wiring length (sum of the wiring lengths of the motor and the inverter) shown in the following table.

| | Cable type | (carrier frequency) | class | 0.75K | 1.5K | 2.2K | 3.7K | 5.5K | 7.5K |
|--|------------|---------------------|-------|-------|------|------|------|------|------|
| | Unshielded | 1 (1 kHz) or lower | 575 V | 100m | 100m | 100m | 200m | 400m | 500m |
| | | 2 (2 kHz) or higher | | 100m | 100m | 100m | 200m | 300m | 400m |

Use a "600 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.

Terminal connection diagram



Details on the main circuit terminals and the control circuit terminals

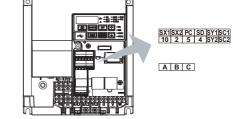
Terminal function description

| | | T/L3 | 1 | AC power input | Connected to the confinercial power suppry. | | | |
|----------------------------|-------------------|---|---|--|--|--|--|--|
| | | U, V, W | _ | Inverter output | Connected to a three-phase squirrel cage motor or a PM motor. | | | |
| Moio cic | ino. | P/+, PR | - | Brake resistor connection | Connect an optional brake resistor across terminals P/+ and PR. | | | |
| 2 | 5 | P/+, N/- | I – | Brake unit connection | Connect the brake unit. | | | |
| Z | Z | P/+, P1 | _ | DC reactor connection | Remove the jumper across terminals P/+ and P1, and connect a DC reac connected, the jumper across terminals P/+ and P1 should not be remov | | | |
| | | | _ | Earth (ground) | For earthing (grounding) the inverter chassis. Be sure to earth (ground) t | he inverter. | | |
| | | 10 | 5 | Power supply for a frequency setting potentiometer | Used as the power supply for an external frequency setting (speed setting) potentiometer. | 5 ±0.5 VDC, Permissible load current: 10 mA | | |
| ignal | Frequency setting | 2 | 5 | Frequency setting (voltage) | Inputting 0 to 5 VDC (or 0 to 10 VDC) provides the maximum output frequency at 5 V (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. * The initial setting varies depending on the specification. 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 | | |
| Input signal | | 4 5 Frequency setting (current) | | | Inputting 4 to 20 mADC (or 0 to 5 VDC, 0 to 10 VDC) provides the maximum output frequency at 20 mA and makes input and output proportional. This input signal is valid only when the AU signal is ON (terminal 2 input is invalid). To use the terminal 4 (current input at initial setting), assign "4" to Pr.178 to Pr.189 (Input terminal function selection) before turning ON the AU signal. "The initial setting varies depending on the specification. Use Pr.267 to switch among input 4 to 20 mA (initial setting), 0 to 5 VDC, and 0 to 10 VDC. Set the voltage/current input switch in the "V" position to select voltage input (0 to 5 V / 0 to 10 V). | Maximum permissible voltage: 20 VDC For current input, Input resistance: 245 ±5 Ω Permissible maximum current: 30 mA | | |
| Output signal | 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) | Contact capacity: 240 VAC 2 A (power factor = 0.4) or 30 VDC 1 A | | |
| 目 | | SX1 | PC | Safety input (channel 1) | | Input resistance: 4.7 kΩ, | | |
| Safety input/output signal | Contact input | potentiometer 2 5 Frequency setting (voltage) 4 5 Frequency setting (current) 5 Relay output (fault output) SX1 PC Safety input (channel 1) SX2 PC Safety input (channel 2) SY1 SC1 Safety output (channel 1) | Terminal functions can be selected using Pr.S051 SX1/SX2 terminal function selection. For details, refer to the FR-E800-SCE Instruction Manual (Functional Safety). woltage when con open: 21 to 26 VDC, current when con short-circuited: 4 to 6 mADC | | | | | |
| put | , | SY1 | SC1 | Safety output (channel 1) | | Deminsible leads 24 V/DC | | |
| Safety in | Open collector | SY2 | SC2 | Safety output (channel 2) | Terminal functions can be selected using Pr.S055 SY1/SY2 terminal function selection. For details, refer to the FR-E800-SCE Instruction Manual (Functional Safety). | 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.) | | |

| Туре | Terminal symbol | Common | Terminal name | Terminal function description | | | | | |
|-----------------|---|---|---|--|---|--|--|--|--|
| | | _ | 24 VDC power supply common | | | | | | |
| | SD | _ | External transistor common (source (positive common)) | Common output terminal for 24 VDC 0.1A power supply (terminal PC). Isolated from terminal | | | | | |
| rminal | PC Safety input terminal common SD 24 VDC power supply Safety output common | | | Common terminal for terminals SX1 and SX2. | Power supply voltage range: | | | | |
| Common terminal | | | 24 VDC power supply | Can be used as a 24 VDC 0.1 A power supply. | 22 to 26.5 VDC Permissible load current: 100 mA | | | | |
| Co | SC1 | = | Safety output common (channel 1) | Common terminal for terminals SY1 and SY2. For details, refer to the FR- | E800-SCE Instruction | | | | |
| | SC2 | (channel 1) Safety output common (channel 2) | | Manual (Functional Safety). | | | | | |
| | 5 | _ | Frequency setting common | Common terminal for the frequency setting signal (terminal 2 or 4). Do not earth (ground). | | | | | |
| Communication | _ | _ | Ethernet connector (2 ports) *2 | Communication can be made via Ethernet - Category: 100BASE-TX/10BASE-T-Transmission method: Baseband Data transmission speed: 100 Mbps (100BASE-TX) / 10 Mbps (10BASE - Maximum segment length: 100 m between the hub and the inverter Inte - Number of cascade connection stages: Up to 2 (100BASE-TX) / up to 4 - Number of interfaces available: 1: IP version: IPv4 | erface: RJ-45 | | | | |
| Comr | USB connector *3 | | | Use the USB connector to communicate with a personal computer. Setting and monitoring of the inverter is enabled using FR Configurator2. Interface: conforms to USB 1.1 Transmission speed: 12 Mbps Connector: USB mini B connector (receptacle mini B type) | | | | | |

*1 Do not connect the parameter unit. The inverter may be damaged.
*3 USB bus power connection is available. The maximum SCCR is 500 mA.

Control circuit terminal layout



BASIC OPERATION

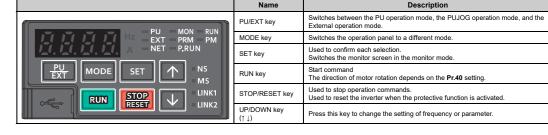
Use crimp terminals and stripped wire for the control circuit wiring. If only a single wire is used, the wire can be stripped and used without a ferrule.

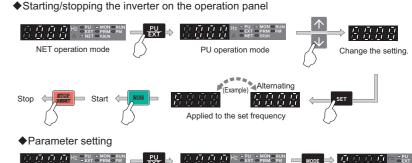
Connect the end of wires (crimp terminal or stranded wire) to the terminal block.

Crimp terminals commercially available (as of April 2023.) Phoenix Contact Co., Ltd.

| | Ferrule pa | rt No. | Crimping tool | |
|-------------------------------|------------------------|------------------------------|---------------|--|
| Wire gauge (mm ²) | With insulation sleeve | Without insulation sleeve | model No. | |
| 0.3 | AI 0,34-10TQ | _ | | |
| 0.5 | AI 0,5-10WH | _ | | |
| 0.75 | AI 0,75-10GY | A 0,75-10 | CRIMPFOX 6 | |
| 1 | AI 1-10RD | A 1-10 | CKIMPPOX | |
| 1.25, 1.5 | AI 1,5-10BK | A 1,5-10 | 1 | |
| 0.75 (for 2 wires) | AI-TWIN 2×0,75-10GY | _ | 1 | |

Components of the operation panel





PU ⇒ HZ - PRU - MON - RUN A NET - PRUM - PM MODE MODE TITILITY HZ - PRU - MON - RUN A NET - PRUM - PM A NET - PRUM Change the setting.

4 PARAMETERS

For details, refer to the FR-E800 Instruction Manual (Function). For details, refer to the FR-E800 Instruction Manual (Maintenance) The PDF manual can also be downloaded from the Mitsubishi Electric FA Global The PDF manual can also be downloaded from the Mitsubishi Electric FA Globa





5 LIST OF FAULT DISPLAYS

SPECIFICATIONS

6.1 Inverter rating

♦ Three-phase 575 V power supply

| | | | | 0017 | 0027 | 0040 | 0061 | 0090 | 0120 | | |
|---------|----------------------------|----------------------|--------------------------|-------------------------|-------------------------|--------------|--------------|---------------|----------------|--|--|
| | Model FR- | E860-[] | | 0.75K | 1.5K | 2.2K | 3.7K | 5.5K | 7.5K | | |
| Annline | bla matar sana | aits (IANA) *4 | LD | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11.0 | | |
| Applica | able motor capa | city (KVV) "I | ND | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | | |
| | Rated capac | itu (k\/A\ *2 | LD | 2.5 | 3.6 | 5.6 | 8.2 | 11.0 | 15.9 | | |
| | Kateu capac | ity (KVA) Z | ND | 1.7 | 2.7 | 4.0 | 6.1 | 9.0 | 12.0 | | |
| | Rated curr | ent (A) *7 | LD | 2.5 (2.1) | 3.6 (3.0) | 5.6 (4.8) | 8.2 (7.0) | 11.0 (9.0) | 16.0 (13.6) | | |
| | | | ND | 1.7 | 2.7 | 4.0 | 6.1 | 9.0 | 12.0 | | |
| Output | Overload current rating *3 | | | surroundi | s, 150% 3 ng air tem | perature of | 50°C | | | | |
| | | ND | surroundi | s, 200% 3 ng air tem | perature of | | icteristics) | at | | | |
| | V | oltage *4 | Three-phase 525 to 600 V | | | | | | | | |
| | | Brake tran | | Built-in | | | | | | | |
| | Regenerative braking | brake ND e) *5 | 100% | 50% | 20% | | | | | | |
| | Rated input A | C voltage/fred | uency | Three-ph | ase 575 V | 60 Hz | | | | | |
| | Permissible A | C voltage fluc | tuation | 490 to 632 V, 60 Hz | | | | | | | |
| | Permissible f | requency fluct | tuation | ±5% | | | | | | | |
| | | Without DC | LD | 4.3 | 5.9 | 8.9 | 12.4 | 15.9 | 22.4 | | |
| Power | Rated input | reactor | ND | 3.0 | 4.6 | 6.6 | 9.5 | 13.3 | 17.4 | | |
| supply | current (A) *8 | With DC | LD | 2.5 | 3.6 | 5.6 | 8.2 | 11.0 | 16.0 | | |
| Supply | | reactor | ND | 1.7 | 2.7 | 4.0 | 6.1 | 9.0 | 12.0 | | |
| | Dawer aummbe | Without DC | LD | 4.3 | 5.9 | 8.9 | 12.3 | 16.0 | 23.0 | | |
| | Power supply capacity | reactor | ND | 3.0 | 4.6 | 6.6 | 9.5 | 14.0 | 18.0 | | |
| | (kVA) *6 | With DC | LD | 2.5 | 3.6 | 5.6 | 8.2 | 11.0 | 16.0 | | |
| | , , | reactor | ND | 1.7 | 2.7 | 4.0 | 6.1 | 9.0 | 12.0 | | |
| P | rotective structu | ire (IEC 60529) |) | Open typ | e (IP20) | | | | | | |
| | Cooling s | ystem | | Natural | Forced a | | | | | | |
| | Approx. m | ass (kg) | | 1.9 | 1.9 | 1.9 | 2.4 | 2.4 | 2.4 | | |

- maximum capacity of a 4-pole standard motor driven by all of the inverters in parallel connection. is that the output voltage is 575 V. urrent rating is the ratio of the overload current to the inverter's rated output current. For repeated duty, allow time for the inverter and motor to return to or below the
- The motor capturing management of the output voltage is 575 V. The percentage of the overload current rating is the ratio of the overload current to the inverter's rated output current. For repeated outry, allow united to the output voltage is 575 V. The percentage of the overload current rating is the ratio of the overload current to the inverter's rated output current. For repeated outry, allow united to the output voltage and output voltage and output current. For repeated outry, allow united to the output voltage waveform at the temperatures under 100% load. The maximum output voltage does not exceed the power supply voltage. The maximum output voltage can be changed within the setting range. The maximum point of the voltage waveform at the maximum output voltage does not exceed the power supply voltage. The maximum output voltage does not exceed the power supply voltage multiplied by √2.
- output side of the invertor is approximately the power supply voltage multiplied by x². The amount of braking broque is the average short-term foruce (which varies depending on motor loss) that is generated when a motor decelerates in the shortest time by itself from 60 Hz. It is not continuous regenerative lorque. The average deceleration torque becomes lower when a motor decelerates from a frequency higher than the base frequency. The inverter is not equipped with a built-in brake resistor. Use a brake resistor for an operation with large regenerative power. A brake unit can be also used.

 The power supply capacity varies with the value of the power supply side impedance (including those of the input reactor and cables).

 The power supply capacity varies with the value of the power supply side impedance (including those of the input reactor and cables).

 The power supply capacity varies with the value of the power supply side impedance (including those of the input reactor and cables).

 The power supply capacity varies with the value of the power supply side impedance (including those of the input reactor and cables). A selection.
 It is a continuous the rated output current. The impedance at the power supply side (including those of the input reactor and cables) affects the rated input current.

Inverter installation environment

| Item | Description | |
|-----------------------------------|---|--|
| Surrounding air temperature *1 | -10°C to +60°C (The rated current must be reduced at a temperature above 50°C. For details, refer to the FR-E860 Instruction Manual (Connection). To meet the UL/EN standards, use the product at temperatures from -10°C to 50°C.) | Enclosure Inverter Measurement |
| Ambient humidity | 95% RH or less (non-condensing) (With circuit board coating (IEC 60721-3-3:1994 3C2 compatible)) 90% RH or less (non-condensing) (Without circuit board coating) | position 5 cm 5 cm 5 cm |
| Storage temperature | -40°C to +70°C | Measurement 5 cm |
| Atmosphere | Indoors (free from corrosive gas, flammable gas, oil mist, dust and dirt) | |
| Altitude/vibration | Maximum 2000 m, 5.9m/s^2 or less (For installation at an altitude above 1000 m, consider a 3% reduction altitude.) | in the rated current per 500 m increase in |

7 APPENDIX

7.1 Instructions for compliance with the EU Directives

- · The authorized representative in the EU
- The authorized representative in the EU is shown below Name: Mitsubishi Electric Europe B.V.
- Address: Mitsubishi-Electric-Platz 1, 40882 Ratingen, Germany

EMC Directive

- We declare that this inverter conforms with the EMC Directive and affix the CE marking on the inverter.
- EMC Directive: 2014/30/EU Standard: IEC 61800-3 (Category "C3" / Second environment)
- This inverter is not intended to be used on a low-voltage public network which supplies domestic premises. When using the inverter in a residential area, take appropriate meand ensure the conformity of the inverter used in the residential area.
- Radio frequency interference is expected if used on such a network

- Set the EMC Directive compliant EMC filter to the inverter. Insert line noise filters and ferrite cores to the power and control cables as required.
- Set the EMC Directive compliant EMC niter to the inverter. Insert line noise internal and territe cores to the power and control values as required.
 Install the motor and controller cable found in the EMC Installation Guidelines (BCN-A21041-204) and Technical News (MF-S-177) according to the instructions. (Contact your sales representative for the manual.)
 To make full use of the EMC Directive compliant noise filter, motor cable lengths should not exceed 20 m.
 Ensure that the finalized system which includes an inverter complies with the EMC Directive.

♦ Low Voltage Directive We have self-confirmed our inverters as products compliant to the Low Voltage Directive and affix the CE marking on the inverters. Low Voltage Directive: 2014/35/EU

Standard: EN 61800-5-1

- Do not use an earth leakage circuit breaker as an electric shock protector without connecting the equipment to the earth. Connect the equipment to the earth (ground)
- Wire the earth terminal independently. (Do not connect two or more cables to one terminal.) Select appropriate wire according to EN 60204-1 or IEC 60364-5-52. (Refer to the selection examples of cable sizes in 2.3 Applicable cables and wiring length.
- Use a tinned (plating should not include zinc) crimping terminal to connect the earth (ground) cable. When tightening the screw, be careful not to damage the threads. For use as a product compliant with the Low Voltage Directive, use PVC cables.
- Use PVC cables for I/O wiring.
- Use the molded case circuit breaker and magnetic contactor which conform to the EN or IEC Standard
- If an earth leakage circuit breaker is required, use a type-B earth leakage circuit breaker (ACIDC detection compatible).

 Use the inverter under the conditions of overvoltage category Ill specified in IEC 60664.

 To use the inverter under the conditions of overvoltage actegory Ill specified in IEC 60664.

 To use the inverter under the conditions of pollution degree 3, install it in the enclosure of IP54 or higher for protection against electric shock and fire.

Attach the fan cover to the fan with the fan cover fixing screw enclosed with the inverte FR-E860-0017(0.75K) or higher





If the cover is not fixed, the inverter protective structure is regarded as IP00.

Fuse selection for branch circuit protection Use the following semiconductor fuses for branch circuit protection

| Inverter model | Cat. No | Manufacturer | Rating | Inverter model | Cat. No | Manufacturer | Rating |
|---------------------|-----------------------------------|--------------|-------------|--------------------|-----------------------------------|--------------|-------------|
| FR-E860-0017(0.75K) | 170M1409, 170M1309 or 170M1359 | Bussmann | 700 V, 16 A | FR-E860-0061(3.7K) | 170M1413, 170M1313 or 170M1363 | Bussmann | 700 V, 40 A |
| FR-E860-0027(1.5K) | 170M1410, 170M1310 or 170M1360 | Bussmann | 700 V, 20 A | FR-E860-0090(5.5K) | 170M1414, 170M1314 or 170M1364 | Bussmann | 700 V, 50 A |
| FR-E860-0040(2.2K) | 170M1312, 170M1362 or 170M1412 | Bussmann | 700 V, 32 A | FR-E860-0120(7.5K) | 170M1415, 170M1315 or 170M1365 | Bussmann | 700 V, 63 A |

♦ Motor overload protection For details, refer to 7.2 Instructions for UL and cUL: Motor overload protection

♦ EU RoHS Directive

We have declared that our inverters are compliant to the EU RoHS Directive and affix the CE marking on the inverters.

For other information, refer to the FR-F860 Instruction Manual (Connection)

7.2 Instructions for UL and cUL

(Standard to comply with: UL 61800-5-1, CSA C22.2 No. 274)

♦ Product handling information / Informations sur la manipulation du produit
-WARNING- Operation of this product requires detailed installation and operation instructions provided in this Safety Guideline and the Instruction Manual (Connection) intended for use with this product. Please forward relevant manuals to the end user. The manuals can also be downloaded in PDF form from the Mitsubishi Electric FA Global Website. To order manuals, please contact your sales representative.

-AVERTISSEMENT-

L'utilisation de ce produit nécessite des instructions détaillées d'installation et d'utilisation fournies dans le présent document de la Directive de sécurité et le Manuel d'instructions (Connexion) destiné à être utilisé avec ce produit. Veuillez transmettre les manuels correspondants à l'utilisateur final. Les manuels peuvent éga être téléchargés au format PDF sur Mitsubishi Electric FA Global Website. Pour commander des manuels, veuillez contacter votre représentant commercial.

♦ Branch circuit protection
For installation in the United States, use the branch circuit protection equipment specified in Technical News MF-S-187, in accordance with the National Electrical Code

For installation in Canada, use the branch circuit protection equipment specified in Technical News MF-S-187, in accordance with the Canadian Electrical Code and

Short circuit protection of the inverter cannot be used as branch circuit protection. Integral solid state short circuit protection does not provide branch circuit protection Branch circuit protection must be provided in accordance with the National Electrical Code and any additional local codes. The installation/operation manual is available via the internet at https://www.mitsubishielectric.com/fa/products/drv/inv/support/e800/e800sce.html

A hard copy of this information may be ordered at +1 (847) 478-2100 (Mitsubishi Electric Automation, Inc. in USA).

Precautions for opening the branch-circuit protective device /
 Précautions pour ouvrir le dispositif de protection du circuit de dérivation
-WARNING-If the fuse melts down or the breaker trips on the input side of this product, check for wiring faults (such as short circuits). Identify and remove the cause of melting down or the trip before replacing the fuse or resetting the tripped breaker (or before applying the power to the inverter again).

Si le fusible fond ou si le disjoncteur se déclenche du côté entrée de ce produit, vérifier les défauts de câblage (tels que les courts-circuits). Identifier et éliminer la cause de la fonte ou du déclenchement avant de remplacer le fusible ou de réinitialiser le disjoncteur déclenché (ou avant de remettre sous tension l'onduleur).

♦ Capacitor discharge time / Temps de décharge du condensateur CAUTION - Risk of Electric Shock -

Before wiring or inspection, check that the LED display of the operation panel is OFF. Any person who is involved in wiring or inspection shall wait for 10 minutes or longer after power OFF, and check that there are no residual voltage using a digital multimeter or the like. The capacitor is charged with high voltage for some time after power OFF, and it is dangerous.

ATTENTION - Risque de choc électrique Avant le câblage ou l'inspection, vérifier que le témoin LED s'éteint. Toute personne impliquée dans le câblage ou l'inspection doit attendre 10 minutes ou plus après la mise hors tension et vérifier l'absence de tension résiduelle à l'aide d'un multimètre numérique ou similaire. Le condensateur est chargé avec une haute tension

pendant un certain temps après la mise hors tension, ce qui est dangereux. Précautions pour ouvrir le dispositif de protection du circuit de dérivation

Refer to the National Electrical Code (Article 310) regarding the allowable current of the cable. Select the cable size for 125% of the rated current according to the National Electrical Code (Article 430). For wiring the input (R/L1, S/L2, T/L3) and output (U, V, W) terminals of the inverter, use the UL listed copper, stranded wires (rated at 75°C) and round

The following table shows examples when the inverter rating is the LD rating, when the cable is the THHW cable with continuous maximum permissible temperature of 75°C, when the surrounding air temperature is 30°C or less, and the wiring length is 20 m or shorter.

| | | | Crimp termi | nal | Cable gauge AWG | | |
|-----------------------------------|---------------------|----------------------------|------------------|---------|--------------------|---------|--|
| Applicable inverter model | Terminal screw size | Tightening torque (N·m) | Crimp termi | IIai | | | |
| | | (, | R/L1, S/L2, T/L3 | U, V, W | R/L1, S/L2, T/L3 | U, V, W | |
| FR-E860-0017(0.75K) to 0040(2.2K) | M4 | 1.5 | 2-4 | 2-4 | 14 | 14 | |
| FR-E860-0061(3.7K), 0090(5.5K) | M4 | 1.5 | 3.5-4 | 2-4 | 12 | 14 | |
| FR-E860-0120(7.5K) | M4 | 1.5 | 5.5-4 | 3.5-4 | 10 | 12 | |

*1 The screw size for terminals R/L1, S/L2, T/L3, U, V, W, PR, P/+, N/-, and P1, and the earthing (grounding) terminal is shown.

Short circuit ratings 600 V class: Suitable for use in a circuit capable of delivering not more than 100 kA rms symmetrical amperes, 575 V maximum.

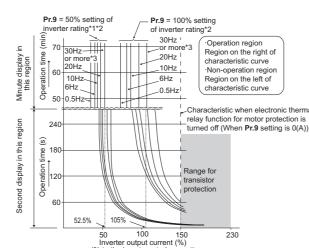
♦ Motor overload protection
The following explains the details of the motor overload protection.
When using the electronic thermal relay function as motor overload protection, set the rated motor current in Pr.9 Electronic thermal O/L relay.

 The internal accumulated heat value of the electronic thermal O/L relay is reset to the initial value by the inverter's power reset or reset signal input. Avoid unnecessary reset and Install an external thermal relay (OCR) between the inverter and motors to operate several motors, a multi-pole motor or a dedicated motor with one inverter. When configuring an external thermal relay, note that the current indicated on the motor rating plate is affected by the line-to-line leakage current. (Refer to the Instruction Manual (Function).) The

the set value is small, the protective characteristics of the electronic thermal relay function will be deteriorated. Use an external thermal relay in such cases. The cooling effect of the motor drops during low-speed operation. Use a motor with built-in thermal protector.

A dedicated motor cannot be protected by the electronic thermal relay. Use an external thermal relay.

cooling effect of the motor drops during low-speed operation. Use a motor with built-in thermal protector. When the difference between the inverter and motor capacities is large and



Motor over temperature sensing is not provided by the drive.
 The electronic thermal memory retention function is not provided by the drive.
 The electronic thermal relay function is not a speed sensing function.

This function detects the overload (overheat) of the motor and shut off the inverter output by stopping the operation of the transistor at the inverter output side. (The operation characteristic is shown on the left.)

- When using the constant-torque motor

 Set one of "10, 13, 15, 16" in **Pr.71**. (This setting enables the 100% constant-torque characteristic in the low-speed range.) Set the rated motor current in Pr.9.

When setting Pr.9 to a value (current value) of 50% of the inverter rated output current. The % value denotes the percentage to the inverter rated output current. It is not the percentage to the rated motor current. When the electronic thermal relay function declared to the constant-torque motor is set, this characteristic curve applies to operation at 6 Hz or higher. Restricted Use of Hazardous Substances in Electronic and Electrical

The mark of restricted use of hazardous substances in electronic and electrical products is applied to the product as follows based on the "Management Methods for the Restriction of the Use of Hazardous Substances in Electrical and Electronic Products" of the People's Republic of China. 电器电子产品有害物质限制使用标识要求



本产品中所含有的有害物质的名称、含量、含有部件如下表所示。

产品中所含有害物质的名称及含量

| | | 有害物质 *1 | | | | | | | | | | |
|---|-----------|-----------|-----------|------------------|---------------|-----------------|--|--|--|--|--|--|
| 部件名称 *2 | 铅 (Pb) | 汞 (Hg) | 镉 (Cd) | 六价铬 (Cr (VI)) | 多溴联苯 (PBB) | 多溴二苯醚 (PBDE) | | | | | | |
| 电路板组件 (包括印刷电路板及其构成的零部件,如电阻、电容、集成电路、连接器等)、电子部件 | × | 0 | × | 0 | 0 | 0 | | | | | | |
| 金属壳体、金属部件 | X | 0 | 0 | 0 | 0 | 0 | | | | | | |
| 树脂壳体、树脂部件 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | | |
| 螺丝、电线 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | | |
| - 表依据ST/T11364的押定编制。 | | | | - | | | | | | | | |

- 〇:表示该有害物质在该部件所有均质材料中的含量均在GB/T26572规定的限量要求以下。
- 表示该有害物质在该部件的至少一种均质材料中的含量超出GB/T26572规定的限量要求。 即使表中记载为 × ,根据产品型号,也可能会有有害物质的含量为限制值以下的情态 根据产品型号,一部分部件可能不包含在产品中。

Referenced Standard (Requirement of Chinese standardized law)

This Product is designed and manufactured accordance with following Chinese standards Machinery safety: GB/T 16855.1

GB/T 12668.502 GB 28526 GB/T 12668.3

Electrical safety: GB/T 12668.501 EMC: GB/T 12668.3

8 WARRANTY

Exclusion of loss in opportunity and secondary loss from warranty liability Regardless of the gratis warranty term, Mitsubishi Electric shall not be liable for compensation to

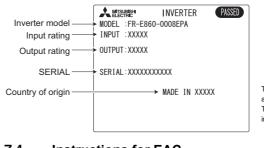
(1) Damages caused by any cause found not to be the responsibility of Mitsubishi Electric. (2) Loss in opportunity, lost profits incurred to the user by Failures of Mitsubishi Electric products.

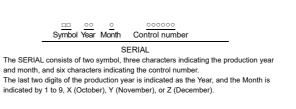
(3) Special damages and secondary damages whether foreseeable or not, compensation for accidents, and compensation for damages to products other than

(4) Replacement by the user, maintenance of on-site equipment, start-up test run and other tasks.

7.3 SERIAL number check

The SERIAL number can be checked on the inverter rating plate or package Rating plate example





7.4 Instructions for EAC

The product certified in compliance with the Eurasian Conformity has the EAC marking.

Note: EAC marking

In 2010, three countries (Russia, Belarus, and Kazakhstan) established a Customs Union for the purposes of revitalizing the economy by forming a large economic bloc by abolishing or reducing tariffs and unifying regulatory procedures for the handling of articles. Products to be distributed over these three countries of the Customs Union must comply with the Customs Union Technical Regulations (CU-TR), and the EAC marking must be affixed to the products.

For information on the country of origin, manufacture year and month, and authorized sales representative (importer) in the CU area of this product, refer to the

· Country of origin indication

- Check the rating plate of the product. Example: MADE IN JAPAN
- Check the SERIAL number indicated on the rating plate of the product
- Authorized sales representative (importer) in the CU area
- The authorized sales representative (importer) in the CU area is shown below. Name: Mitsubishi Electric Turkey A.S. Head Office
- Address: Serifali Mahallesi Kale Sokak. No:41 34775 Umraniye, Istanbul, Turkey Phone: +90-216-969-25-00 ax: +90-216-661-44-47

Compliance with the UK certification scheme

We declare that this product conforms with the related technical requirements under UK legislation, and affix the UKCA (UK Conformity Assessed) marking on the product.

Approval conditions are the same as those for the EU Directives. Refer to the "7.1 Instructions for compliance with the EU Directives" in the Instruction Manual



UKCA marking:
The UKCA marking is used for products sold in the markets of Great Britain (England, Wales, and Scotland) from January 1, 2021 after the departure of the UK from the

7.6 EU ErP Directive (Ecodesign Directive)

The following table shows the power loss data according to Ecodesign Directive. The regulation covers 3-phase variable speed drives from 0.12 kW ≤ Pn ≤ 1 000 kW. (LD rated / ND rated)

| Model name | Rated Apparent power | Stand by loss | load point 1 (90;100) (%) | load point 2 (50;100) (%) | load point 3 (0;100) (%) | load point 4 (90;50) (%) | load point 5 (50;50) (%) | load point 6 (0;50) (%) | load point 7 (50;25) (%) | load point 8 (0;25) (%) | IE class |
|--------------------|----------------------------|---------------------|---------------------------------|---------------------------------|--------------------------------|--------------------------------|--------------------------------|-------------------------------|--------------------------------|-------------------------------|-------------|
| R-E860-0017(0.75K) | 2.5 / 1.7 | 5.7 | 1.7 / 1.7 | 1.7 / 2.0 | 1.7 / 2.0 | 1.2 / 1.4 | 1.2 / 1.4 | 1.2 / 1.4 | 1.0 / 1.2 | 1.0 / 1.2 | IE2 |
| R-E860-0027(1.5K) | 3.6 / 2.7 | 9.8 | 1.4 / 1.5 | 1.4 / 1.5 | 1.4 / 1.5 | 1.1 / 1.2 | 1.1 / 1.2 | 1.1 / 1.2 | 0.9 / 1.1 | 0.9 / 1.1 | IE2 |
| R-E860-0040(2.2K) | 5.6 / 4 | 9.8 | 1.3 / 1.4 | 1.3 / 1.4 | 1.3 / 1.4 | 1.0 / 1.0 | 1.0 / 1.0 | 1.0 / 1.0 | 0.8 / 0.9 | 0.8 / 0.9 | IE2 |
| R-E860-0061(3.7K) | 8.2 / 6.1 | 14.5 | 1.3 / 1.3 | 1.3 / 1.3 | 1.3 / 1.3 | 0.9 / 1.0 | 0.9 / 1.0 | 0.9 / 1.0 | 0.8 / 0.9 | 0.8 / 0.9 | IE2 |
| R-E860-0090(5.5K) | 11 / 9 | 14.5 | 1.2 / 1.2 | 1.2 / 1.2 | 1.2 / 1.2 | 0.7 / 0.8 | 0.7 / 0.7 | 0.7 / 0.7 | 0.6 / 0.6 | 0.6 / 0.6 | IE2 |
| R-E860-0120(7.5K) | 16 / 12 | 14.5 | 1.2 / 1.1 | 1.1 / 1.1 | 1.1 / 1.1 | 0.7 / 0.7 | 0.7 / 0.7 | 0.7 / 0.7 | 0.5 / 0.5 | 0.5 / 0.5 | IE2 |