

6 SPECIFICATIONS

6.1 Inverter rating

◆ Three-phase 575 V power supply

Model FR-E860-1		0017	0027	0040	0061	0090	0120		
		0.75K	1.5K	2.2K	3.7K	5.5K	7.5K		
Applicable motor capacity (kW) *1	LD	1.5	2.2	3.7	5.5	7.5	11.0		
	ND	1.9	2.2	3.7	5.5	7.5			
Rated capacity (kVA) *2	LD	2.5	3.6	5.6	8.2	11.0	15.9		
	ND	1.7	2.7	4.0	6.1	9.0	12.0		
Rated current (A) *7	LD	2.5	3.6	5.6	8.2	11.0	16.0		
	ND	1.7	(3.0)	(4.8)	(7.0)	(9.0)	(13.6)		
Output	LD	2.2	3.7	6.0	8.1	9.0	12.0		
	ND	120% 60 s, 150% 3 s (inverse-time characteristics) at surrounding air temperature of 50°C							
Overload current rating *3	LD	150% 60 s, 200% 3 s (inverse-time characteristics) at surrounding air temperature of 50°C							
	ND								
Voltage *4		Three-phase 525 to 800 V							
Regenerative braking	Brake transistor	Built-in							
	Maximum brake torque (ND reference) %	100%	50%	20%					
Rated input AC voltage/frequency		Three-phase 575 V 60 Hz							
Permissible AC voltage fluctuation		490 to 632 V 50 Hz							
Permissible frequency fluctuation		±5%							
Power supply	Rated input current (A) *8	Without DC reactor	LD	4.3	5.9	8.9	12.4	15.9	22.4
		ND	4.0	4.6	6.6	9.5	13.3	17.4	
	With DC reactor	LD	2.5	3.6	5.6	8.2	11.0	16.0	
		ND	1.7	2.7	4.0	6.1	9.0	12.0	
	Power supply capacity (kVA) *6	Without DC reactor	LD	4.3	5.9	8.9	12.3	16.0	23.0
		ND	4.0	4.6	6.6	9.5	14.0	18.0	
	With DC reactor	LD	2.5	3.6	5.6	8.2	11.0	16.0	
		ND	1.7	2.7	4.0	6.1	9.0	12.0	
	Protective structure		Open type (IP20 for IEC 60529 only)						
	Cooling system		Natural		Forced air				
Approx. mass (kg)		1.9	1.9	1.9	2.4	2.4	2.4		

- *1 The motor capacity indicates the maximum capacity of a 4-pole standard motor driven by all of the inverters in parallel connection.
*2 The rated output capacity assumes that the output voltage is 575 V.
*3 The percentage of the overload current 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 temperatures under 100% load.
*4 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 output side of the inverter is approximately the power supply voltage multiplied by √2.
*5 The amount of braking torque is the average short-term torque (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 torque. 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.
*6 The power supply capacity varies with the value of the power supply side impedance (including those of the input reactor and cables).
*7 The value in parentheses is the rated output current when the low acoustic noise operation is performed with the surrounding air temperature exceeding 40°C while 2 kHz or higher value is selected in **Pr.7.2 PWH frequency selection**.
*8 The rated input current is the value when at the rated output current. The impedance at the power supply side (including those of the input reactor and cables) affects the rated input current.

6.2 Inverter installation environment

Item	Description	Enclosure
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.)	
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)	
Storage temperature	-40°C to +70°C	
Atmosphere	Indoors (free from corrosive gas, flammable gas, oil mist, dust and dirt)	
Altitude/vibration	Maximum 2000 m, 5.9 m/s² or less (For installation at an altitude above 1000 m, consider a 3% reduction in the rated current per 500 m increase in altitude.)	

*1 Surrounding air temperature is a temperature measured at a measurement position in an enclosure. Ambient temperature is a temperature outside an enclosure.

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 measures and ensure the conformity of the inverter used in the residential area.
- Radio frequency interference is expected if used on such a network.

- Notes**
 - Set the EMC Directive compliant EMC filter to the inverter. Insert line noise filters and ferrite cores as required.
 - Connect the inverter to an earthed power supply.
 - 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

◆ Outline of instructions

- 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) securely.
- 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 (AC/DC detection compatible).
- Use the inverter under the conditions of overvoltage category III 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 inverter.



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)	170M1403, 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-E860 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 également 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 and any applicable local codes.

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 any applicable local codes.

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/e800.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).

◆ AVERTISSEMENT:

Si le fusible fond ou si le disjoncteur se déclenche du côté entrée de ce produit, vérifiez 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, vérifiez 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

◆ Wiring to the power supply and the motor

- 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 crimp terminals. Crimp the terminals with the crimping tool recommended by the terminal manufacturer.

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.

Applicable inverter model	Terminal screw size *1	Tightening torque (N·m)	Crimp terminal				Cable gauge			
			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, R/P1, N/, and P1, and the earthing (grounding) terminal is shown.

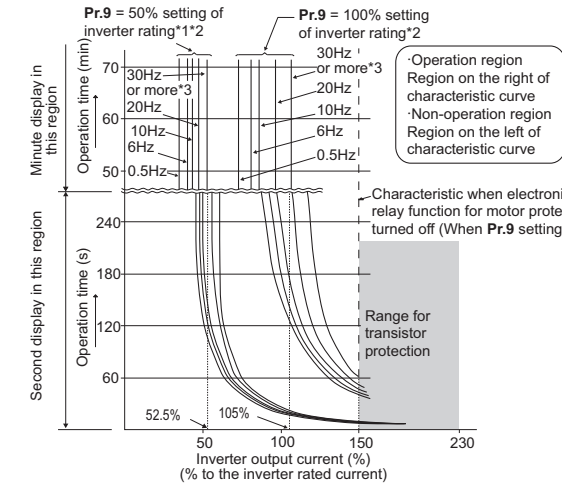
◆ Short circuit ratings

- 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**.

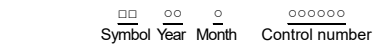
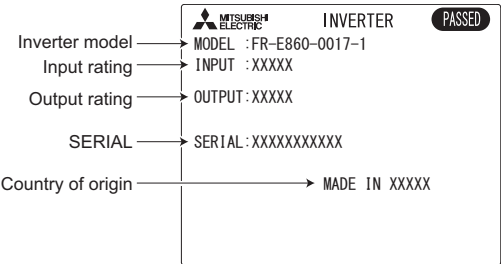


- The internal accumulated heat value of the electronic thermal O/L relay is reset to the initial value by the inverter's power reset or reset signal input. Avoid unnecessary reset and power-OFF.
- Install an external thermal relay (OCR) between the inverter and motors to operate several motors, a multi-pole 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 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 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.
- 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.

7.3 SERIAL number check

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

Rating plate example



The SERIAL consists of two symbol, three characters indicating the production year and month, and six characters indicating the control number. The last two digits of the production year are indicated as the Year, and the Month is indicated by 1 to 9, X (October), Y (November), or Z (December).

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 following:

- Country of origin indication**
 - Check the rating plate of the product.
 - Example: MADE IN JAPAN
- Production year and month**
 - 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: Serfil Mahallesi Kale Sokak. No:41 34775 Umraniye, Istanbul, Turkey

Phone: +90-216-969-25-00

Fax: +90-216-461-44-47

7.5 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 EU on January 31, 2020.

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
FR-E860-0017(0.75K)	2.5 / 1.7	5.7 / 5.7	1.7 / 1.7	1.7 / 2	1.7 / 2	1.2 / 1.4	1.2 / 1.4	1.2 / 1.4	1.0 / 1.2	1.0 / 1.2	IE2
FR-E860-0027(1.5K)	3.6 / 2.7	9.8 / 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
FR-E860-0040(2.2K)	5.6 / 4	9.8 / 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
FR-E860-0061(3.7K)	8.2 / 6.1	14.5 / 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
FR-E860-0090(5.5K)	11 / 9	14.5 / 14.5	1.2 / 1.2	1.2 / 1.2	1.2 / 1.2	0.7 / 0.8	0.7 / 0.8	0.7 / 0.8	0.6 / 0.6	0.6 / 0.6	IE2
FR-E860-0120(7.5K)	16 / 12	14.5 / 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

7.7 Restricted Use of Hazardous Substances in Electronic and Electrical Products

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

部件名称 *2	有害物质 *1					
	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	×	○	×	○	○	○
金属壳体、金属部件	×	○	○	○	○	○
树脂壳体、树脂部件	○	○	○	○	○	○
螺丝、电线	○	○	○	○	○	○

上表依据 SJ/T11364 的规定编制。

○: 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。

*1 新物质中心认为: ×, 表示产品含有, 但可能含有有害物质的含量为限制值以下的物质。

*2 根据产品类型, 一部分部件可能不包含在产品中。

7.8 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.