

Energy Measuring Unit with Insulation Monitoring

Model EMU4-LG1-MB
User's Manual (Digest)

If you are considering using this unit for special purpose such as nuclear power plants, aerospace, medical care or passenger vehicles please refer to our sales representative.

- Before using this unit, please read both this manual and Details carefully and pay attention to safety to handle this unit correctly.
- Make sure that the end users read this manual and then keep the manual in a safe place for future reference.

ABOUT MANUALS

You can download User's manual (Details) of this unit from the following site.
http://www.mitsubishielectric.com/fa/worldwide/index.html

1. Features

- You can measure leak current I_o for safety measures (electric shock prevention), and resistive leak current I_{or} for the measurement and the insulation monitoring of the equipment.
- This unit can be used alone, and can also add the Energy Measuring Unit and the communication unit. Therefore you can build the measuring system flexibly.
- Two-step alert monitor is available for leak current I_o and resistive leak current I_{or} . Two-step alert can be used as the caution alert and danger alert, for example.
- This unit can memorize the frequency of I_o first alert, I_o second alert, I_{or} first alert and I_{or} second alert, and can monitor the upper limit alert of the alert frequency. Therefore you can use this unit for monitoring the system by alert frequency.
- You can monitor three-phase 4-wire system. (Limited to the measurement of I_o)
- You can measure the leak current in increments of 0.01mA in high sensitivity mode.
- The measurement data can also be transmitted to superior monitoring systems through MODBUS RTU communication. MODBUS is a registered trademark of SCHNEIDER ELECTRIC USA, INC in the United States.

2. Checking package contents

The following items for this device are included in package. Check that no items are missing.

- (1) Energy Measuring unit x1 (2) User's Manual (Digest) x1 (3) User's Manual (zero-phase current transformer) x1

3. Safety Precautions

3.1 Precautions for Operating Environment and Conditions

This unit is premised on being used in pollution degree 2 (Note) environment. When used in higher pollution degree, protect this unit from pollution on another device side to be incorporated.

Over voltage category of measuring circuit in this unit is CAT III (Note), and that of auxiliary power circuit (MA, MB) is CAT III (Note).

Do not use this product in the places listed below. Failure to follow the instruction may cause malfunctions and a life decrease of product.

- Places the Ambient temperature exceeds the range -5 to +55°C.
- Places the average daily temperature exceeds +35°C.
- Altitude exceeds 2000m.
- Dust, corrosive gas, saline and oil smoke exist.
- Places in strong electromagnetic field or places large amounts of external noise exist.
- Vibration and impact exceed the specifications.
- Places exposed to direct sunlight.
- Places metal fragments or conductive substance are flying.
- Places exposed to rain or water drop.
- Places the Relative humidity exceeds the range 30 to 85% or places with dewfall.

This unit is the open type device, which are designed to be housed within another device for prevention of electric shock. House this unit within the device such as the control panel before use. (Indoor use)

For the precautions for the compliance of the system incorporating this unit with the EMC Directives, refer to the User's Manual (Details).

(Note) For the definition of the pollution degree and the over voltage category, refer to EN61010-1/2010.

3.2 Matters concerning the precaution before use

- Use the unit in the specified usage environment and conditions.
- To set this unit, dedicated small-size display unit (EMU4-D65) is necessary. For the setting method, refer to User's manual (Details) of the display unit.

3.3 Installation and Wiring Precautions

⚠ Danger	<ul style="list-style-type: none"> • Shut off the external power supply for the unit in all phases before installing or wiring. Failure to do so may cause an electric shock or damage of this unit. • Work under the electric outage condition when installing and wiring. Failure to do so may cause electric shock, a failure of the unit, a fire etc.
⚠ Caution	<ul style="list-style-type: none"> • Any person who is involved in the installation and the wiring of this unit should be fully competent to do this work. • When tapping or wiring, take care not to enter any foreign objects such as chips and wire pieces into this unit. • Secure spatial distance more than 100 mm in all directions (other than back) • Check the connection diagram when wiring. Wrong wiring may cause failure of the unit, a fire or electric shock. • For protection against noise, transmission lines and input/output lines shall not be placed close to or bound together with the power lines and high-voltage lines. • Strip the wires with proper length. Overlong stripping length may cause short to next wire and electric shock. Shorter stripping length may cause contact failure. • Take care not to short to next terminal by a filament. (Do not plate the wires with solder.) • Do not connect more than two wires to one terminal of a terminal block for preventing loose contact and wires dropout. • Use appropriate size of electric wires. If inappropriate size of electric wire is used, it may cause a fire due to generated heat. • Tighten the screw within the specified torque. Under tightening can cause drop of the screw, short circuit or malfunction. Over tightening can damage the screw and/or unit, resulting in drop, short circuit or malfunction. • After tightening the screws, be sure to check all the screws tightened. Loose screw may cause malfunction of the unit, a fire or electric shock. • Be sure to attach the terminal cover to prevent electric shock. • Use the crimp-type terminal appropriated for the size of electric wires. If inappropriate crimp-type terminal is used, a wire breakage or a contact failure may occur, which may cause a device malfunction, a failure, a burnout or a fire. • FG terminal must be grounded according to the D-type ground (ground resistance is not exceed 100Ω). • Do not directly touch any conductive part of the unit. Doing so can cause electric shock, failure or malfunction of the unit. • When using this product, make sure to use it in combination with the zero-phase current transformer (MITSUBISHI CZ, ZT series). Please not to exceed the rating of this product for input of the zero-phase current transformer. For further details, please refer to the manual for the zero-phase current transformer to maintain the functionality and the accuracy of this product. • The zero-phase current transformer (MITSUBISHI CZ and ZT series) is used only for low voltage circuit. It cannot be used for a high voltage circuit. If it is connected with a high-voltage circuit by mistake, it may cause a burnout of the device and a fire. It is critically dangerous. • The zero-phase current transformer (MITSUBISHI CZ and ZT series) does not have a polarity (directionality). • The wires to be connected to this unit shall be placed in a duct or fixed together by cramping. If the electric wires are not placed in the duct or cramped together, loosen wires or their movement or careless stretch may cause a breakage of the unit or wire or a malfunction due to poor contact of electric wires. • If the wires connected to this unit are strongly pulled off, it may cause a malfunction or a breakage to the unit or the wire. • Do not exceed the specified voltage when doing an insulation resistance test and a commercial frequency withstand voltage test. • To prevent persons with little knowledge about electric equipment from electric shock, panel must be taken either following measure. Lock the panel so that only those who get an education about electric equipment and have sufficient knowledge can unlock, or shut off power supply automatically by opening the panel. Cover the dangerous part of this unit.

3.4 Precautions for Use

- **This unit cannot be used for deal and proof of electric energy measurement stipulated in Measurement Act.**

⚠ Caution	<ul style="list-style-type: none"> • Use this unit within the ratings specified in this manual. If it is used outside the ratings, it may cause not only malfunction or failure but also fire burnout. • Do not disassemble or modify this unit. It may cause failure, malfunction, injury or fire. • For protection against electric shock, use a insulation precision screwdriver when push a reset button. • Do not touch the live part such as connection terminal. It may cause electric shock, electric burn injury or burnout of the device. If any exposed conductor is found, stop the operation immediately, and take an appropriate action such as isolation protection.
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3.5 Maintenance Precautions

- Use a soft dry cloth to clean off dirt of the unit surface. Do not let a chemical cloth remain on the surface for an extended period of time nor wipe the surface with thinner or benzene.
- Check for the following items to use this unit properly for long time.
 - (1) Daily maintenance
 - (a) No damage on this unit
 - (b) No abnormality with LED
 - (c) No abnormal noise, smell or heat
 - (2) Periodical maintenance (Once every 6 months to 1 year)
 - No looseness with installation and wire connection

⚠ Caution	Do periodical maintenance under the electric outage condition. Failure to do so may cause electric shock, failure of the unit or a fire. Tighten the terminal regularly to prevent a fire. In case a display unit is attached to a sensor unit, get off the display unit during maintaining or tightening terminals.
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3.6 Storage Precautions

To store this unit, turn off the power and remove wires, and put it in a plastic bag.

For long-time storage, avoid the following places. Failure to follow the instruction may cause a failure and reduced life of the unit.

- Places the Ambient temperature exceeds the range -10 to +60°C.
- Places the Relative humidity exceeds the range 30 to 85% or places with dewfall.
- Dust, corrosive gas, saline and oil smoke exist.
- Places the average daily temperature exceeds +35°C.
- Vibration and impact exceed the specifications.
- Places exposed to rain, water drop or direct sunlight.
- Places metal fragments or conductive substance are flying.

3.7 Disposal Precautions

When disposing of this unit, treat it as industrial waste.

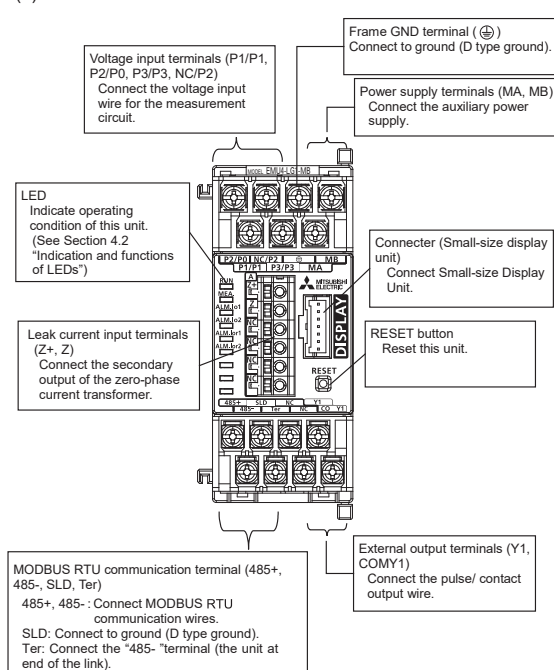
3.8 About packaging materials and this manual

For reduction of environment load, packaging materials are produced with cardboard.

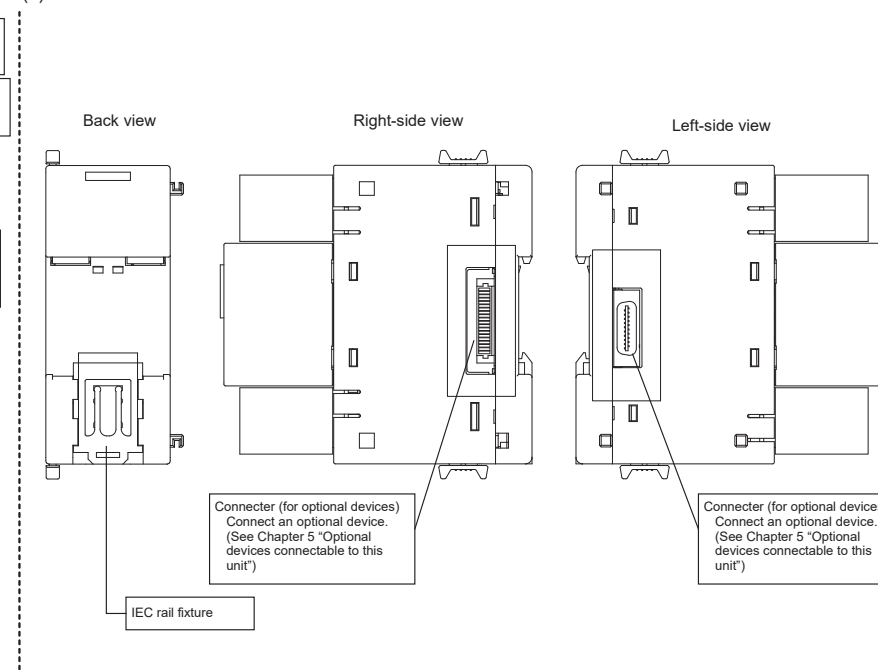
4. Name and function of each part

4.1 Name of each part

(1) Front view



(2) Back view and side view



4.2 Indication and functions of LEDs

The names and operations of LEDs are as follows.

Name	Color	Function	Status
RUN LED	Red	Indicate operating status of this unit.	ON: Normal condition OFF: Power off or hardware failure (Note 1)
MEA. LED	Red	Indicate measuring status of this unit	ON: In the middle of measuring I_o OFF: Halting measurement
AL. I_o1 LED	Red	Indicate occurrence status of I_o first alert of this unit	ON: An error occurs (Note 2) Brink slowly (Note 3): I_o first alert is issued Brink rapidly (Note 4): Upper limit alert of the frequency of I_o first alert is issued OFF: I_o first alert is not issued
AL. I_o2 LED	Red	Indicate occurrence status of I_o second alert of this unit	ON: An error occurs (Note 2) Brink slowly (Note 3): I_o second alert is issued Brink rapidly (Note 4): Upper limit alert of the frequency of I_o second alert is issued OFF: I_o second alert is not issued
AL. I_{or1} LED	Red	Indicate occurrence status of I_{or} first alert of this unit	ON: An error occurs (Note 2) Brink slowly (Note 3): I_{or} first alert is issued Brink rapidly (Note 4): Upper limit alert of the frequency of I_{or} first alert is issued OFF: I_{or} first alert is not issued
AL. I_{or2} LED	Red	Indicate occurrence status of I_{or} second alert of this unit	ON: An error occurs (Note 2) Brink slowly (Note 3): I_{or} second alert is issued Brink rapidly (Note 4): Upper limit alert of the frequency of I_{or} second alert is issued OFF: I_{or} second alert is not issued

- (Note 1) For details, refer to Chapter 14 "Error codes" of "User's Manual (Details)".
 (Note 2) When an error occurs, AL. I_o1 , AL. I_o2 , all of the AL. I_{or1} and AL. I_{or2} turn on.
 (Note 3) 500msec ON and 500msec OFF are repeated.
 (Note 4) 100msec ON and 100msec OFF are repeated.

5. Optional devices connectable to this unit

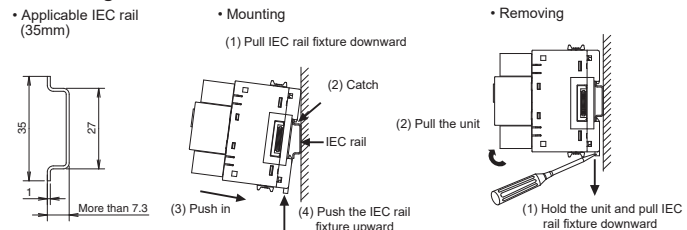
Optional devices connectable to this unit are as follows.

Device	Model	Connection terminal
Extension unit	Energy Measuring Unit Extension for the system with the same voltage	EMU4-A2
	Energy Measuring Unit Extension for the system with the different voltage	EMU4-VA2
	Energy Measuring Unit Pulse Input Unit	EMU4-PX4
	Energy Measuring Unit Analog Input Unit	EMU4-AX4
Optional Unit	B/NET Communication Unit for Energy Measuring Unit	EMU4-CM-B
	CC-Link Communication Unit for Energy Measuring Unit	EMU4-CM-C
	CC-Link IE Field Network Basic Communication Unit for Energy Measuring Unit	EMU4-CM-CIFB
	Logging Unit for Energy Measuring Unit	EMU4-LM
	Small-size Display Unit for Energy Measuring Unit	EMU4-D65

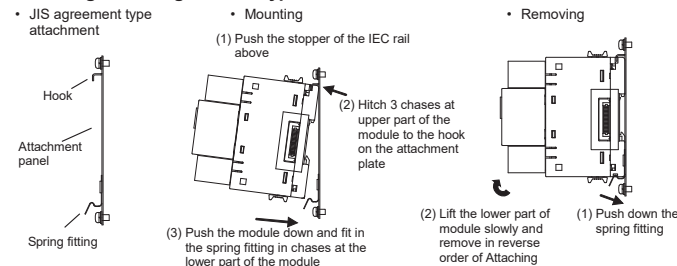
For the details of each device and the way to connect, refer to the manual of the device.

6. Attaching and removing the unit

6.1 Mounting on IEC rail



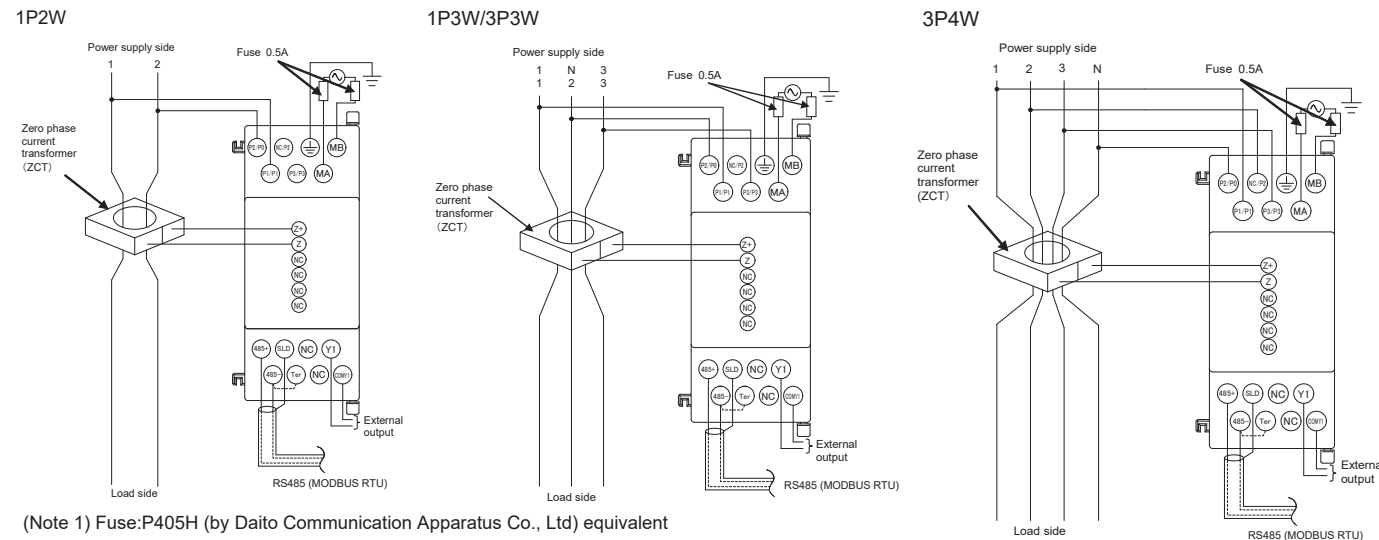
6.2 Mounting on JIS agreement type attachment



7. How to wire

7.1 Wiring

Follow the wiring diagram for external connections of this unit. When using this unit, make sure to use it in combination with the zero-phase current transformer (MITSUBISHI CZ and ZT series).



(Note 1) Fuse:P405H (by Daito Communication Apparatus Co., Ltd) equivalent

Caution

- For protection against noise, transmission lines and input/output lines shall not be placed close to or bound together with the power lines and high-voltage lines. Keep distance as below between them. (except for the terminal block)
- If there is concern about the influence of noise even if the distance is as follows, we recommend using a shielded cable.

Condition	Distance
High-voltage line 600V or less	300mm or more
Other high-voltage line	600mm or more

- For the actual usage, connect the FG terminal to ground. (D-type ground: Type 3) Connect it directly to the ground terminal.
- Do not connect to FG terminal during the insulation resistance test and pressure test. Refer to "User's manual (Details)" Chapter 12 "Specifications" for the applying place.

- Maximum voltage of the circuit connected to this unit directly is 277 / 480V.
- For MODBUS RTU communication wiring, recommended to have the extra length wires about 200mm (When extended to B / NET transmission from MODBUS RTU communication, use of MODBUS RTU communication wiring is possible).
- Maximum wiring length between the zero-phase current transformer and this unit is 50m.
- Measurement of resistive leak current (Ior) is available for the single-phase 2-wire system, the single-phase 3-wire system and the delta connection of three-phase 3-wire system. For the star connection of the three-phase 3-wire system, the special grounded circuit such as the high-resistance grounded circuit and capacitor grounded circuit, and the three-phase 4-wire system, measurement of leak current (Io) is only available.
- The secondary output of the MITSUBISHI zero-phase current transformer CZ and ZT series does not have a polarity.
- For the output wires of ZCT connected to Z+ and Z terminal, twist them about 40 times per meter.
- Be sure to connect the voltage input to the terminal. Otherwise, this unit cannot measure correctly.

7.2 How to connect wires

<Power supply terminals, Voltage input terminals, MODBUS RTU communication terminals, External input/output terminals>

- Use appropriate crimp-type terminal. Applicable crimp-type terminal is shown in the tables below.
- Use electric wires as below, and tighten the terminal screws by the torque as below.

	Applicable wire	Tightening torque	Applicable crimp-type terminal
Power supply terminals, Voltage input terminals	Stranded wire:AWG22 to16 (0.3 to 1.3mm ²) Single wire:AWG22 to16 (φ0.65 to 1.25mm)	0.8 to 1.0N·m	For M3.5 screw of external diameter below 7.1mm
MODBUS RTU communication terminals	SPEV(SB) — MPC — 0.2×1P	0.5 to 0.6N·m	For M3 screw of external diameter below 6.1mm
External input/output terminals	Stranded wire:AWG22 to16 (0.3 to 1.3mm ²) Single wire:AWG22 to16 (φ0.65 to 1.25mm)	0.5 to 0.6N·m	For M3 screw of external diameter below 6.1mm

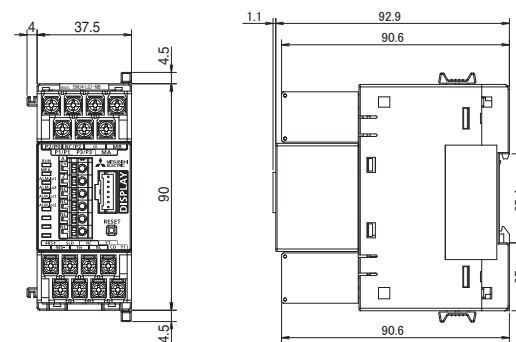
<Leak current input terminals>

- Stripping length of the used wire in use has to be 10 to 11mm.
- In case using stranded wire, take measures so that the filament should not vary by using a bar terminal or by processing the point twisted.
- When attaching and detaching cables to/from the terminal, use the push button. Check that the wire is securely inserted.
- Insert a wire to the terminal all the way until it touches the end.
- Use appropriate electric wires as shown below.

Applicable wire	Applicable crimp-type terminal
Stranded wire: AWG20 to16 (0.5 to 1.3mm ²) Single wire: AWG24 to17 (φ0.5 to 1.2mm)	TGV TC-1.25-11T (by NICHIFU) equivalent

8. Dimensions

Unit:mm

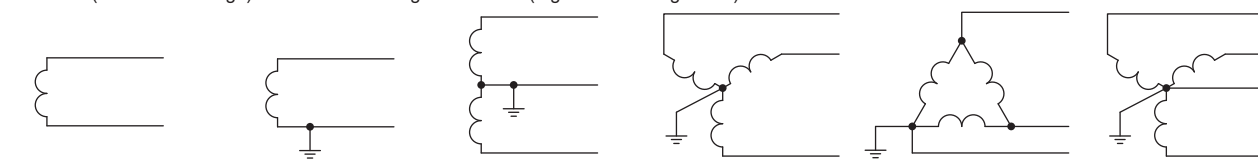


9. Specifications

Item	Specifications		
Model	EMU4-LG1-MB		
Phase-wire system	Single-phase 2-wire, single-phase 3-wire, three-phase 3-wire, and three-phase 4-wire (common use)		
Measurement item	Leak current (Io), Resistive leak current (Ior), Io demand, Ior demand, Io difference converted value, Ior difference converted value		
Rating	Voltage Circuit	Single-phase 2-wire, Three-phase 3-wire	110V, 220V, 440V AC (Note2)
	(Note1)	Single-phase 3-wire	110V AC (between 1-and 2-side, 2- and 3-side), 220V AC (between 1- and 3-side) 220V AC (between 1-and 2-phase, 2- and 3-phase), 440V AC (between 1- and 3-phase)
		Three-phase 4-wire	Min: 63.5V / 110V AC, Max: 277V / 480V AC
	Leak current circuit	1A AC (The zero-phase current transformer (MITSUBISHI CZ and ZT series) is used. Primary current value of the transformer is indicated.)	
Frequency	50/60Hz (Auto detect)		
Auxiliary power supply rating	100-240V AC (+10%, -15%), 50/60Hz, Transient overvoltage 4,000V		
Consumption VA	unit	3.0VA (110V AC:2.0VA, 220V AC:3.0VA)	
	largest component (Note3)	13VA (110V AC:11VA, 220V AC:13VA)	
Transient overvoltage	Measuring circuit: CATIII, Auxiliary power supply: CAT III.		
Measurable circuit count	1 circuit		
External output	Output signal type	No voltage a-contact 1 output	
	Rated open/close voltage/current	35V DC 75mA or 24V AC 75mA (Power factor = 1)	
Operating Environment	Operating temperature	-5 to +55°C (Under the conditions indicated in section 3.1)	
	Operating humidity	30 to 85% RH (No condensation)	
	Storage temperature	-10 to +60°C	
	Operating altitude	2000m or below	
Standard (Note 4)	CE marking (EMC: EN61326-1: 2013, Safety: EN-61010-1: 2010) UL: UL61010-1		

(Note 1) Each of voltage circuit is as follows.

(Note 2) In case of a circuit which is wired from the delta connection of a three-phase 3-wire type or a circuit of a transformer of a single-phase 2-wire type, (line to neutral voltage) the maximum rating is 110V AC and 220V AC. (Figure9.2 and Figure9.5)
In case of a circuit which is wired from a 3-phase 4-wire type, the star connection of a three-phase 3-wire type or a single-phase 3-wire type, (line to line voltage) the maximum rating is 440V AC. (Figure9.4 and Figure9.6)



(Note 3) When the model is combined with three Pulse Input Units (Model : EMU4-PX4), CC-Link Communication Unit (Model: EMU4-CM-C), and Small-size Display Unit (Model: EMU4-D65), it becomes the largest component.

(Note 4) When the model is combined with a B/NET Communication Unit (Model : EMU4-CM-B), it becomes out of a conformity standard. When the model is combined with a ZCT (Model: ZT60B,ZT80B,ZT100B), it becomes UL standard.

10. Contained harmful substances

(1) 电器电子产品有害物质限制使用标识

根据《电器电子产品有害物质限制使用管理办法》，该标识适用于在中国销售的电器电子产品，其中的数字为产品的环保使用期限。只要遵守本产品在安全和使用方面的注意事项，从生产日期起的环保使用期限内不会造成环境污染或对人体、财产产生深刻的影响。
注) 产品正常使用废弃后，应按照国家 and 地方的法律法规完成该电器电子产品回收和再利用。

(2) 产品中有害物质的名称及含量
本产品中所含有的 6 种有害物质的名称、含有信息及含有部件如下表所示。

部件名称	有害物质					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr(VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
基板	×	○	○	○	○	○
箱子	○	○	○	○	○	○
端子盖	○	○	○	○	○	○
螺钉	○	○	○	○	○	○
铭牌	○	○	○	○	○	○
接线	○	○	○	○	○	○
接线皮	○	○	○	○	○	○

本表格依据 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/T 26572 规定的限量要求以下。

×: 表示该有害物质至少在该部件的某一均质材料中的含量超出 GB/T26572 规定的限量要求。

且虽然目前业界没有成熟的替代方案，但是符合欧盟 RoHS 指令要求。

11. Warranty

• The warranty is effective until the earlier of 1 year after the date of your purchase or 18 months after manufacturing. Repair shall be charged for the case failures occur due to your intent or fault even during the warranty period.

• Please check ALM A1 LED and ALM A2 LED turn off the light. (ALM A1 LED and ALM A2 LED lighting show errors occur)

• If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

• Our company shall not be liable to compensate for any loss arising from events not attributable to our company, opportunity loss and lost earning of the customer due to failure of the product, and loss, secondary loss, accident compensation, damage to other products besides our products and other operations caused by a special reason regardless of our company's predictability.

Caution If an abnormal sound, bad-smelling smoke, fever break out from this unit, switch it off promptly and don't use it.

12. Customer Service

MITSUBISHI ELECTRIC CORPORATION
HEAD OFFICE: TOKYO BUILDING, 2-7-3, MARUNOUCHI, CHIYODA-KU, TOKYO 100-8310, Japan
Please refer to "catalog" or "user's manual (Details)" for more details.