



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.

User's Manual (Digest)

- 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.co.jp/haisei/lvs/downloads/handling.htm>

1. Features

- (1) This Energy Measuring unit can measure various types of electric quantity such as voltage, current, electric power and electric energy using a generalized current transformer.
- (2) The measurement data can also be transmitted to superior monitoring systems through MODBUS RTU communication.
- (3) In addition to the provision for measuring the quantity of electricity, the unit has two external input ports supporting both pulse input and contact input by way of switching. With pulse input set, you can measure the production volume or the utility other than electricity, such as water, gas and air. With contact input set, you can monitor status or alarm and measure the operating time of facility or the operating power. MODBUS is a registered trademark of SCHNEIDER ELECTRIC USA, INC in the United States.

2. Checking package contents

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

- (1) Energy Measuring unit x1
- (2) User's Manual (Digest) x1

3. Safety Precautions

3.1 Precautions for Operating Environment and Conditions

- This unit is premised on being used in pollution degree 2* 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*, and that of auxiliary power circuit (MA, MB) is CAT III*.
- 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.
 - Places in strong electromagnetic field or places large amounts of external noise exist.
 - Places exposed to direct sunlight.
 - Places exposed to rain or water drop.
 - Places the Relative humidity exceeds the range 30 to 85% or places with dewfall.
 - Dust, corrosive gas, saline and oil smoke exist.
 - Vibration and impact exceed the specifications.
 - Places metal fragments or conductive substance are flying.
 - 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).

*: 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.
- The setting of this unit (phase system, primary voltage and primary current) is necessary before use it. Please refer to User's Manual (Details) about each setting method.

3.3 Installation and Wiring Precautions

Any person who is involved in the installation and the wiring of this unit should be fully competent to do this work.

⚠ Danger	• 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.
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⚠ Caution	<ul style="list-style-type: none"> • 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. • When tapping or wiring, take care not to entering any foreign objects such as chips and wire pieces into this unit. • 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. 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). • High-voltage protective element is mounted between MA and FG, MB and FG. When applied high voltage, for example during a commercial frequency withstand voltage test, protective element works to short between MA and FG, MB and FG. • 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 a current transformer whose secondary current is 5A or 1A (max 30V AC). • A current transformer has a polarity. Be careful about it when installing the unit. • 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.
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3.4 Precautions for Use

⚠ 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. • 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 LCD
 - (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

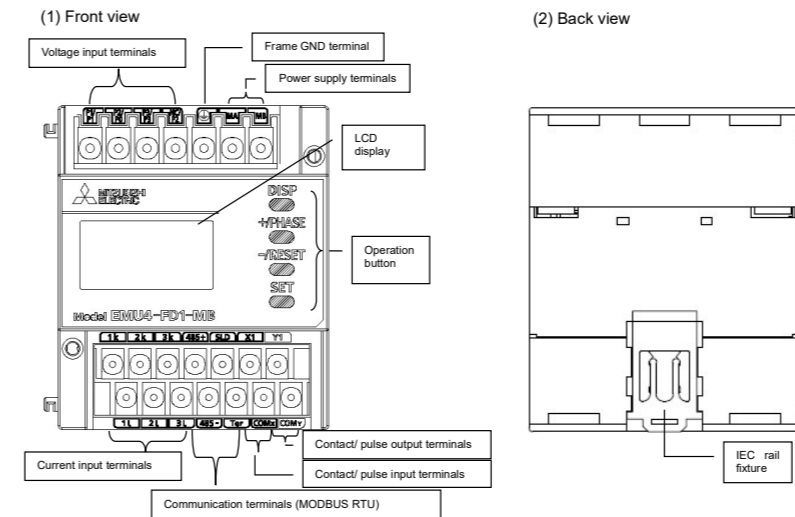
When disposing of this unit, treat it as industrial waste.

3.8 About packaging materials and this manual

For reduction of environment load, packaging materials are produced with cardboard, and this manual is printed on recycled paper.

4. Name and function of each part

4.1 Name of each part



Names of signals of terminal block

Terminal symbol	Function	Description
P1/P2/P3, P3/P3.NC/P2	Input voltage	Connect the voltage input wire for the measurement circuit.
⊕	Frame GND(FG)	Connect to ground (D type ground). (Protective earthing *1)
MA, MB	Auxiliary power	Connect the auxiliary power supply.
1k, 1L, 2k, 2L, 3k, 3L	Input current	Connect the secondary output of the current transformer (CT) connected to the measurement circuit's current wire.
485+, 485-	MODBUS RTU communication	Connect the communication wire (MODBUS RTU).
SLD		Connect to ground (D type ground).
Ter		Connect the *485- terminal (the unit at end of the link).
X1, COMx	Pulse input/ Contact input	Connect the contact/ pulse input wire.
Y1, COMy	Pulse output/ Contact output	Connect the contact/ pulse output wire.

*1 It is being bonded to the conductive part of the product for safety reasons and being connected to the terminal which is connected the outside protection grounding system.

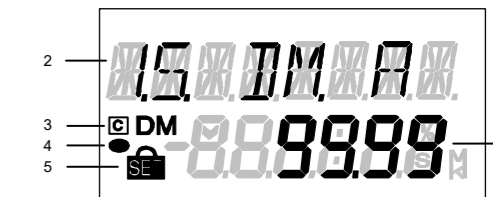
4.2 Functions of operation buttons

Control buttons have many functions as below.

Meaning of symbol: ○ (Press), □ (Press more than 1 sec), ⊙ (Press more than 2 sec), — (Press both at the same time)

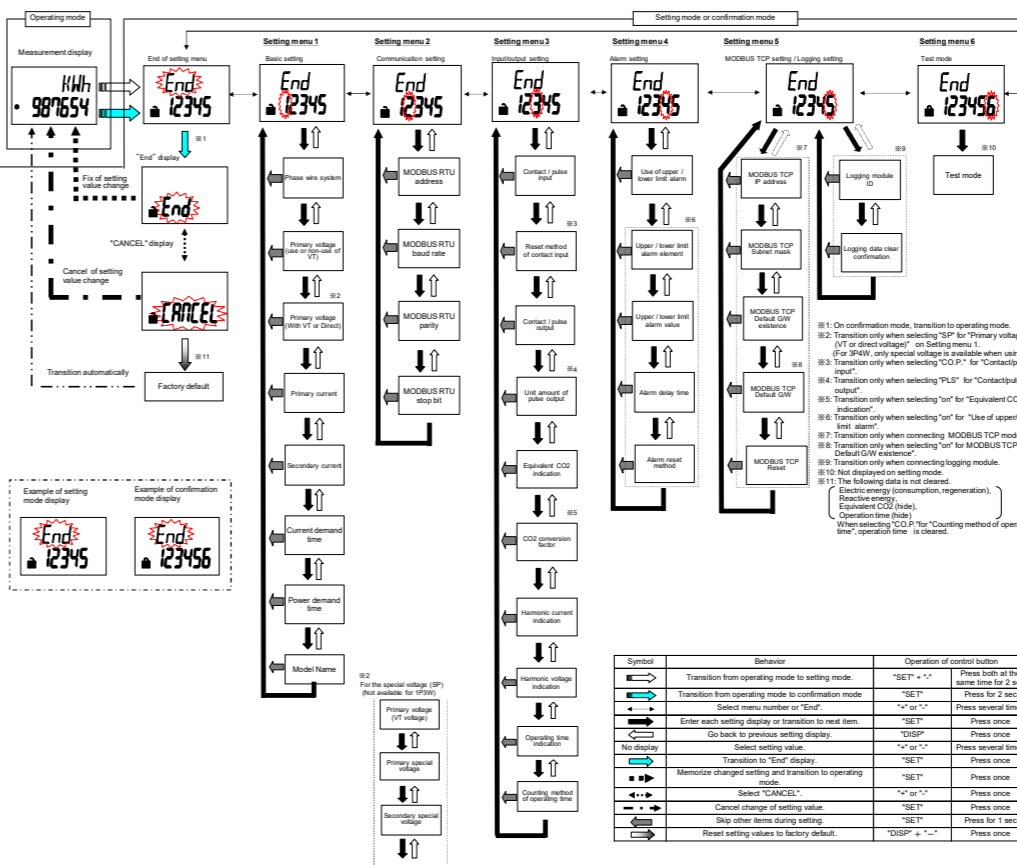
Mode	Operation	Name of Button	Event
Operating Mode	Contact display Integrated value display	SET	Change measured items
		-/RESET	Change phase
		+PHASE	Change harmonic order (at harmonic display)
		-/RESET	Clear alarm (at alarm keeping)
		SET	Transition to confirmation mode
		SET	Transition to setting mode
		SET	Clear contact latch
		SET	Transition to preset display
		SET	Transition to reset display of all data
		SET	Enter setting menu
Setting mode / Confirmation mode	Menu display Setting mode / Setting display Confirmation mode / Setting display Confirmation display of setting reflection	○ (□)	Moving up or down of menu number (Move at fast speed when pressing more than 1sec)
		○ (□)	Transition to setting menu number (at final setting item)
		○ (□)	Moving up or down of setting value (Move at fast speed when pressing more than 1sec)
		○	Change setting items (backward)
		○	Transition to setting menu number (at beginning setting item)
		□	Go back to setting menu
		○	Change setting items (forward)
		○	Transition to setting menu number (at final setting item)
		○	Change setting items (backward)
		○	Transition to setting menu number (at beginning setting item)
○	Transition to setting menu		
○	At "END" display, memorize changed setting and transition to operating mode		
○	At "CANCEL" display, annual changed setting and transition to operating mode		
○	Moving up or down of setting value		
○	Reset setting values to factory default (only effective at CANCEL display)		

4.3 Functions of LCD



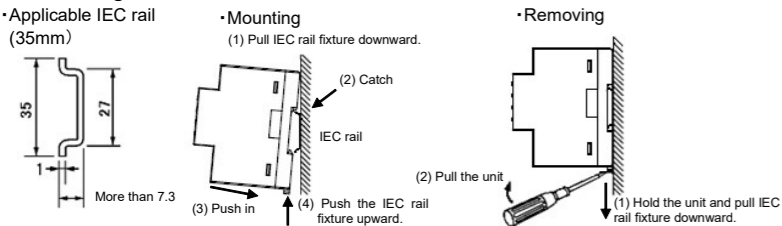
No.	Indicator	Description
1	Measured value	Display measured value digitally.
2	Measured item	Display measured item displayed on indicator No. 1.
3	Communication	Light when connecting communication unit.
4	Energy Measurement	Light when measuring electric energy (consumption).
5	Setting	Indicator lights on setting mode. Indicator lights on confirmation mode.

5. Procedures for setting



6. Attaching and removing the unit

6.1 Mounting on IEC rail



*When showing the display part by cutting the panel face in mounting the IEC rail, cut the panel at where it is more than 50mm away from the fulcrum of the open / close of the door.

6.2 Mounting on the panel

Dimensions of hole panel(76×44.5)

The panel hole dimensions are as shown below. And it can be attached to a panel of thickness 1.6 to 4.0mm.

Mounting

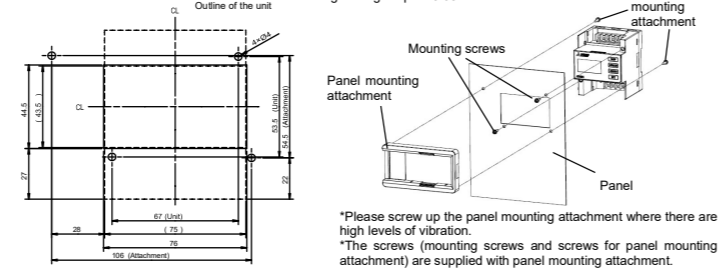
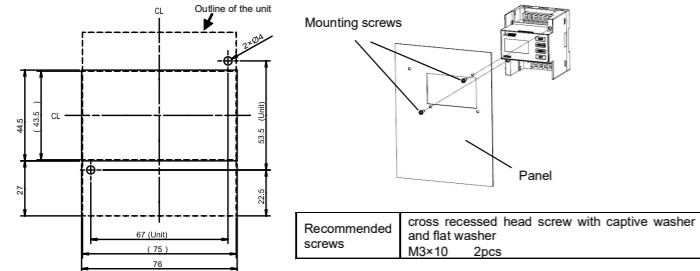
Attached to the panel with screws (2 pcs). Tightening torque : 0.63N · m

Dimensions of hole panel(76×44.5)

The panel hole dimensions are as shown below. And it can be attached to a panel of thickness 1.6 to 4.0mm.

Mounting

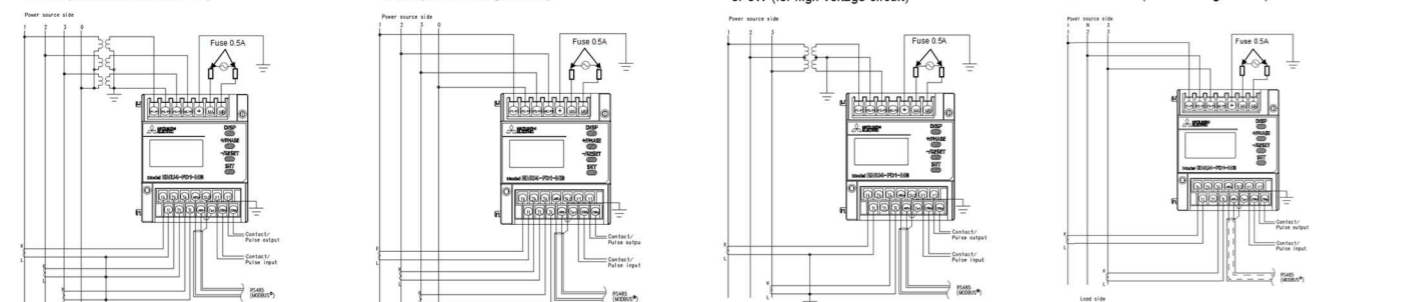
Mount the unit to mounting plate by mounting screws (M3×10), then mount the panel mounting attachment. Tightening torque : 0.63N · m



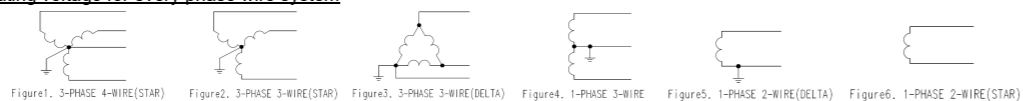
7. How to wire

7.1 Wiring

Follow the wiring diagram for external connections of this unit.
3P4W (in combination with VT)
3P4W (for low voltage circuit)
3P3W (for high voltage circuit)
1P3W/3P3W (for low voltage circuit)



Rating voltage for every phase wire system



Phase wire type	Type	Rating voltage	Figure
3-phase 4-wire type	STAR	max 277V AC(L-N) / 480V AC(L-L)	Figure 1
	DELTA	max 220V AC(L-L)	Figure 2
3-phase 3-wire type	STAR	max 440V AC(L-L)	Figure 3
	DELTA	max 220V AC(L-N) / 440V AC(L-L)	Figure 4
1-phase 3-wire type	DELTA	max 220V AC(L-L)	Figure 5
1-phase 2-wire type (Note)	STAR	max 440V AC(L-L)	Figure 6
	DELTA	max 220V AC(L-L)	Figure 6

Note. In case of a circuit which is wired from the delta connection of a 3-phase 3-wire type or a circuit of a transformer of a 1-phase 2-wire type, the maximum rating is "220V AC".
In case of a circuit which is wired from a 3-phase 4-wire type, the star connection of a 3-phase 3-wire type or a 1-phase 3-wire type, the maximum rating is "440V AC".

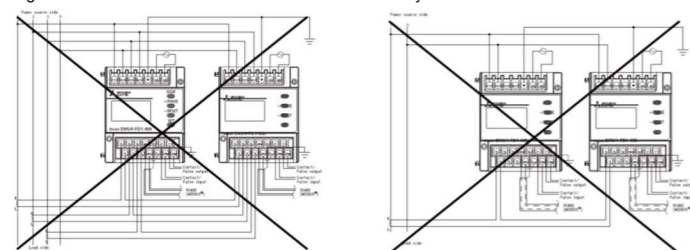
*Consider the insulation with MAINS circuit in Current transformer

- *1 For low voltage circuits, do not connect to grounding the secondary side of VT and CT.
- *2 When this unit is used at a high voltage circuit, the terminal P0(P2) must be connected to ground.
- *3 When grounding a CT line, please make the L side of the CT a common line and connect 1L, 2L, 3L terminal for the unit side by the shortest course.
- *4 When connecting the L side of the CT by a common line, please connect 1L, 2L, 3L terminal for the unit side by the shortest course.
- * 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)

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. This is being bonded to the conductive part of the product for safety reasons and being connected to the terminal which is connected the outside protection grounding system.
- *Do not connect to FG terminal during the insulation resistance test and pressure test.
- *Do not connect together more than one EMU4-FD1-MB on the secondary side of a current transformer.
- *Do not connect together other units and EMU4-FD1-MB on the secondary side of a current transformer.

Caution



7.2 How to connect wires

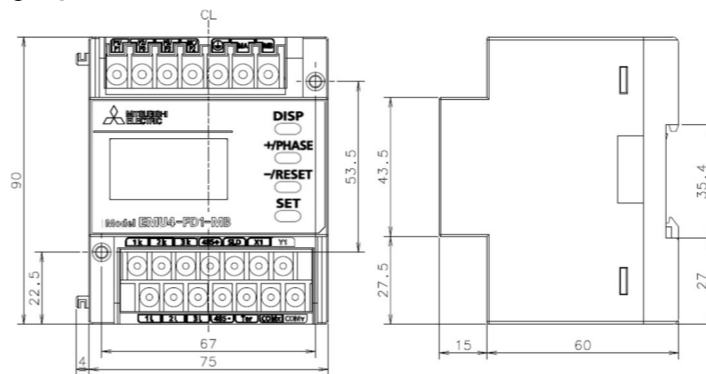
- Use appropriate crimp-type terminal.
- Use electric wires as below, and tighten the terminal screws by the torque as below.

	Applicable wire (single wire / stranded wire)	Tightening torque	Recommended crimp-type terminal
Power supply terminals, voltage input terminals	AWG26 to 14 (φ0.41 to 1.62mm / 0.13 to 2.0mm ²)	0.8 to 1.0 N · m	For M3.5 screw of external diameter below 5.6mm
Current input terminals, input/output terminals	AWG22 to 14 (φ0.65 to 1.62mm / 0.33 to 2.0mm ²)	0.5 to 0.6 N · m	For M3 screw of external diameter below 5.6mm

- Maximum voltage of the circuit connected to this unit directly is 277 / 480V for EMU4-FD1-MB. For the circuit over this voltage, use the transformer. Using the transformer, primary voltage is configurable up to 6600V. secondary voltage is fixed to 110V. (special Primary voltage of VT can be set up to 220V in any, and special secondary voltage of VT can be set up to 220V in any.)
- When screwing the terminals at both ends of the terminal block, be careful not to touch the projection of the terminal block cover.
- For MODBUS communication wiring, recommended to have the extra length wires about 200mm (When extended to B / NET transmission from MODBUS communication, use of MODBUS communication wiring is possible).

8. Dimensions

EMU4-FD1-MB



Unit [mm]

9. Specifications

Item	Specifications	
Model	EMU4-FD1-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	Electric energy (consumption, regeneration), Current, Current demand, Voltage, Electric power, Electric power demand, Reactive power, Apparent power, Power factor, Frequency, Harmonic current, Harmonic voltage, Reactive energy, Periodic electric energy, Pulse count value, Operating time, Equivalent CO2	
Rating	Voltage Circuit *1	single-phase 2-wire, three-phase 3-wire: 110V, 220V, 440V AC single-phase 3-wire: 110V AC (between 1- and 2-side, 2- and 3-side), 220V AC (between 1- and 3-side) three-phase 4-wire: Min: 63.5V AC / 110V AC, Max: 277V AC / 480V AC
	Current circuit	5AAC, 1AAC
	Frequency	50Hz / 60Hz
Auxiliary power supply rating	100 to 240V AC (+10%, -15%), 50Hz / 60Hz, 10VA, Transient overvoltage 4,000V	
Transient overvoltage	Measuring circuit: CAT III, Auxiliary power supply: CAT III	
Measurable circuit count	1 circuit	
External input	Input signal type	No voltage a-contact 1 input
	Rated input voltage/current	5V DC 7mA
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 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	EMC: EN61326-1: 2013 UL: UL61010-1 LVD: EN-61010-1: 2010	
Possible combination optional unit for UL	EMU4-LM, EMU4-CM-C, EMU4-CM-MT, EMU4-CM-CIFB *2	
Product life expectancy	10 years (Under the conditions indicated in section 3.1)	
The number of insert and remove between the units	200 times	

*1: Refer to 7.1 section.

*2: EMU4-LM enables to memorize the data of various quantities related to electricity for a certain period. EMU4-CM-C is communication unit for CC-Link. EMU4-CM-MT is communication unit for MODBUS TCP. EMU4-CM-CIFB is communication unit for CC-Link IE Field network Basic.

10. Optional devices connectable to this unit

Optional devices connectable to this unit are as follows.

Device	Model	Connection terminal
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

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

11. 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	○	○	○	○	○	○
端子台	○	○	○	○	○	○
端子盖	○	○	○	○	○	○
螺钉	○	○	○	○	○	○
铭牌	○	○	○	○	○	○
LCD	○	○	○	○	○	○
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。

12. Warranty

The charge-free 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 charge-free warranty period.

- 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.

13. 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.