



Energy Measuring Unit Insulation Monitoring Model

MODEL

# EMU4-LG1-MB

User's Manual (Details)

- Before operating the instrument, you should first read thoroughly this operation manual for safe operation and optimized performance of the product.  
Deliver this user's manual to the end user.





## Safety precautions

Thank you for purchasing the Energy Measuring Unit (EcoMonitorPlus).

- This manual describes setup and usage for the Energy Measuring Unit. Before using the product, please read this manual carefully to ensure correct use. Especially, in the case of where this unit is to be installed, please read “1. Precautions for Use” to ensure correct use.
- Make sure that the end users read this manual and then keep the manual in a safe place for future reference.
- Make sure to deliver this manual to the end-user.
- 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. (For details, please see at the end of this manual.)

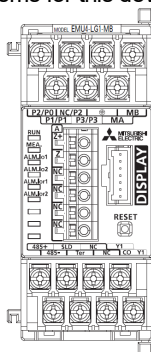
### ■ Notations in this manual

Use the following marks in this manual.

Mark	Meaning of the icons
 <b>Danger</b>	Indicates that incorrect handling may result in death or severe injury, ignoring this marking.
 <b>Caution</b>	Indicates that incorrect handling may result in injury or property damage, ignoring this marking.
 <b>Supplement</b>	Indicates that precautions to avoid a malfunction and to work the unit properly.
	Indicates that the pages described that related matters.

### ■ Checking package contents

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



Energy Measuring Unit x1



User's Manual (Digest) x1

This unit cannot be used for deal and proof of electric energy measurement stipulated in the measurement law. Please use the certified watt-hour meter to be used for deal and proof of electric energy measurement stipulated.

### ■ Related materials

Material name	Ref. No.
Energy Measuring Unit Programming Manual (CC-Link) For ver.1 remote device station	LEN160305
Energy Measuring Unit Programming Manual (CC-Link) For ver.2 remote device station	LNE160316
Energy Measuring Unit Programming Manual (CC-Link IE Field Network Basic) (SLMP)	LEN180123
MITSUBISHI Energy Measuring Unit EcoMonitorLight/EcoMonitorPlus Series MODBUS I/F Specification	LSPY-9025

### ■ Trademark

- MODBUS is a trademark of Schneider Electric USA Inc.
- Other company and product names herein are trademarks or registered trademarks of their respective owners.
- In the text, trademark symbols such as “TM” and “®” may not be written.

## Feature

- This unit can measure the leak current (Io) and leak current for resistance (Ior) for insulation monitoring to keep safety.
- You can construct flexible monitoring system because you can introduce individual products and expansion energy measuring unit and communication unit is easily.
- Leak current Io and leak current for resistance Ior can be monitored 2 steps monitoring. You can use alarm as attention alarm and hazard alarm.
- To Storage the count of Io1-alarm, Io2-alarm, Ior1-alarm and Ior2-alarm and monitoring upper limit of alarm count is used as monitoring application based on frequency occurrence.
- 3 phase-4wire can be measured. (Io only)
- Leak current for resistance can be measured switching High SENS mode by 0.01mA steps.
- The measured data can be sent to the high-end device, such as a monitoring device by MODBUS RTU communication function.

<b>Safety precautions .....</b>	<b>1</b>
<b>Feature.....</b>	<b>1</b>
<b>Table of Content.....</b>	<b>2</b>
<b>1. Precautions for Use.....</b>	<b>3</b>
1.1 Precautions for Operating Environment and Conditions.....	3
1.2 Precautions for Use .....	3
1.3 Installation and connection .....	3
1.4 Usage notes .....	4
1.5 Maintenance Precautions.....	5
1.6 Storage Precautions .....	5
1.7 Disposal Precautions .....	5
1.8 About packaging materials and this manual .....	5
<b>2. Disclaimer.....</b>	<b>6</b>
<b>3. Name and function of each part.....</b>	<b>6</b>
3.1 Name of each part.....	6
3.2 Indication and function of LEDs .....	7
<b>4. Attaching and removing the unit.....</b>	<b>8</b>
4.1 Mounting on IEC rail .....	8
4.2 Mounting on JIS agreement type attachment.....	8
<b>5. Procedure for wiring.....</b>	<b>9</b>
5.1 Wiring for EMU4-BM1-MB .....	9
5.2 Precautions for the connection wire.....	11
<b>6. Setting.....</b>	<b>14</b>
6.1 Setting data .....	14
6.2 Initialization of related items by change of setting .....	16
<b>7. Operation.....</b>	<b>17</b>
7.1 Measurement.....	17
7.2 Leak current monitoring function .....	19
<b>8. Device operation .....</b>	<b>21</b>
8.1 Resolution of measuring data .....	21
8.2 Restrictions of measured data.....	21
<b>9. Reference .....</b>	<b>22</b>
9.1 Trouble shooting.....	22
9.2 After-sales service .....	22
9.3 Q&A.....	23
<b>10. Requirement for the compliance with EMC Directives EMC.....</b>	<b>25</b>
<b>11. Specifications .....</b>	<b>26</b>
11.1 Common specifications .....	26
11.2 Specifications of MODBUS communications.....	28
<b>12. Option devices .....</b>	<b>29</b>
12.1 About option devices .....	29
12.2 Specifications of option devices.....	30
12.3 External dimensions of option devices.....	32
<b>13. External dimensions .....</b>	<b>38</b>
<b>14. Index.....</b>	<b>39</b>

# 1. Precautions for Use

## 1.1 Precautions for Operating Environment and Conditions

This equipment, based on the assumption that it is used in the pollution degree 2 (Note 1) environment. If it is used in other degree of contamination, please do the protection on the device side to be incorporated. Measurement categories for measuring circuit for this equipment is CAT III (Note 1). The overvoltage category of the auxiliary power supply circuit (MA, MB) is CAT III (Note 1). Do not use the unit in any of the following places. Doing so may cause malfunction or reduction in service life.

- Place where the ambient temperature exceeds the working temperature range(-5°C to +55°C)
- Place where the humidity exceeds the humidity range (30% to 85%RH) or condensation occurs
- Place with much dust, corrosive gas, salt or oily smoke
- Place where the unit may be exposed to rain or drops of water
- Place where metallic particles or inductive substances are dispersed
- Place where the daily mean temperature exceeds 35°C
- Place with much vibration or impact
- Place exposed to direct sunlight
- Place with strong electromagnetic field or much foreign noise
- Place where the altitude is over 2000m


This equipment is the open type equipment. (Electric shock protection of the instrument was designed to perform housed in another apparatus equipment). Please use are housed in a control panel etc. Always. For notes on when to adapt the equipment that you have configured in this equipment to the EMC Directive, please refer to 10. Requirement for the compliance with EMC Directives EMC.


Note 1 : For a definition of pollution degree and the measurement categories, please refer to the EN61010-1 / 2010.

## 1.2 Precautions for 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.

## 1.3 Installation and connection

 <b>Danger</b>	<ul style="list-style-type: none"><li>• <b>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.</b></li><li>• <b>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.</b></li></ul>
---	--

 <b>Caution</b>						
<p>&lt;Precautions for Electric work&gt;</p> <ul style="list-style-type: none"><li>• Any person who is involved in the installation and the wiring of this unit should be fully competent to do this work.</li><li>• Secure spatial distance more than 100 mm in all directions (other than back)</li><li>• When tapping or wiring, take care not to entering any foreign objects such as chips and wire pieces into this unit.</li><li>• Check the connection diagram when wiring. Wrong wiring may cause failure of the unit, a fire or electric shock.</li><li>• For protection against noise, <b>transmission lines and input/output lines shall not be placed close to or bound together with the power lines and high-voltage lines.</b></li><li>• 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.</li><li>• If transmission lines and input/output lines are placed close to or bound together with the power lines and high-voltage lines, keep distance as below between them.(Except for the input side of terminal block)</li></ul> <p>If there is concern about the effects of noise even if the distances shown in the table below are increased, it is recommended to use shielded wires.</p> <table border="1"><thead><tr><th>Condition</th><th>Distance</th></tr></thead><tbody><tr><td>Power line 600V or less</td><td>300mm or longer</td></tr><tr><td>Other power line</td><td>600mm or longer</td></tr></tbody></table> <p>&lt;Connection of terminal block&gt;</p> <ul style="list-style-type: none"><li>• Strip the wires with proper length. Overlong stripping length may cause short to next wire. Shorter stripping length may cause contact failure.</li><li>• Take care not to short to next terminal by a filament. (Do not plate the wires with solder.)</li><li>• Do not connect three or more wires to one terminal of a terminal block for preventing loose contact and wires dropout.</li><li>• Use appropriate size of electric wires. If inappropriate size of electric wire is used, it may cause a fire due to generated heat.</li><li>• 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.</li><li>• 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.</li><li>• Be sure to attach the terminal cover to prevent electric shock.</li><li>• 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.</li><li>• Frame GND terminal must be grounded according to the D-type ground (ground resistance is not exceed 100Ω).</li><li>• Do not directly touch any conductive part of the unit. Doing so can cause electric shock, failure or malfunction of the unit. Try touch any conductive part of the unit. Doing so can cause electric shock, failure or malfunction of the unit.</li><li>• Do not input voltage and current at NC terminals. Doing so can cause failure or malfunction of the unit.</li></ul>	Condition	Distance	Power line 600V or less	300mm or longer	Other power line	600mm or longer
Condition	Distance					
Power line 600V or less	300mm or longer					
Other power line	600mm or longer					

<Connection to Zero phase current transformer>

- When using this product, make sure to use it in combination with zero phase current transformer. Do not change input of zero phase current transfer higher than rated value. For further details, please refer to current sensor manual to maintain the functionality and accuracy of this product.
- Zero phase current transformer 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.
- The dedicated current sensor has a polarity (directionality). Be careful about it when installing the unit.
- Zero phase current transformer (CZ, ZT series) is affected by the external magnetic field generated by current when ZCT is installed in the vicinity of the trunk line where large current flows as a result, an error occurs in the measured value. Please install the distance as shown in the below table with the trunk line.

Split type zero-phase current transformer

		CZ-22S	CZ-30S	CZ-55S	CZ-77S	CZ - 112 S
Current flowing in trunk line near ZCT	100A	100mm	100mm	150mm	100mm	100mm
	300A	150mm	250mm			
	500A					
	700A			250mm		
	1000A					
	2000A	250mm	450mm	450mm		

Through type zero-phase current transformer

		ZT15B	ZT30B	ZT40B	ZT60B	ZT80B	ZT100B
Current flowing in trunk line near ZCT	100A	100mm					
	300A						
	500A						
	700A						
	1000A						
	2000A						

<Connection of frame GND terminal>

- Do not exceed the specified voltage when doing an insulation resistance test and a commercial frequency withstand voltage test. Do not connect to frame GND terminal during the insulation resistance test and pressure test.
- Frame GND terminal must be grounded according to the D-type ground (ground resistance is not exceed 100Ω).
- 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. (Required protection code is higher than IP2X.)

**1.4 Usage notes**

- **This unit cannot be used for deal and proof of electric energy measurement stipulated in the measurement law.**
- Before operating the product, check that active bare wire and so on does not exist around the product. If any bare wire exists, stop the operation immediately, and take an appropriate action such as isolation protection.
- In the event of a power outage during the setting by Display unit / Communication line, the Energy Measuring unit is not set correctly. Please set again after power recovery.

**⚠Caution**

- Do not disassemble or modify this unit. It may cause failure, malfunction, injury or fire.
- 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 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.
- Push the RESET switch with an appropriate force (1.6N). The addition of force than necessary, it may cause a malfunction or failure of the Unit.

### 1.5 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 indicators
    - (c) No abnormal noise, smell or heat
  - (2) Periodical maintenance (Once every 6 months to 1 year)
    - No looseness with installation and wire connection

<b>⚠Caution</b>	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.
-----------------	--

### 1.6 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 - +60°C.
  - Places the Relative humidity exceeds the range 30-85% or places with dewfall.
  - Dust, corrosive gas, saline and oil smoke exist.
  - Places exposed to rain, water drop or direct sunlight.
  - Places the average daily temperature exceeds 35°C.
  - Vibration and impact exceed the specifications.
  - Places metal fragments or conductive substance are flying.

### 1.7 Disposal Precautions

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

### 1.8 About packaging materials and this manual

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

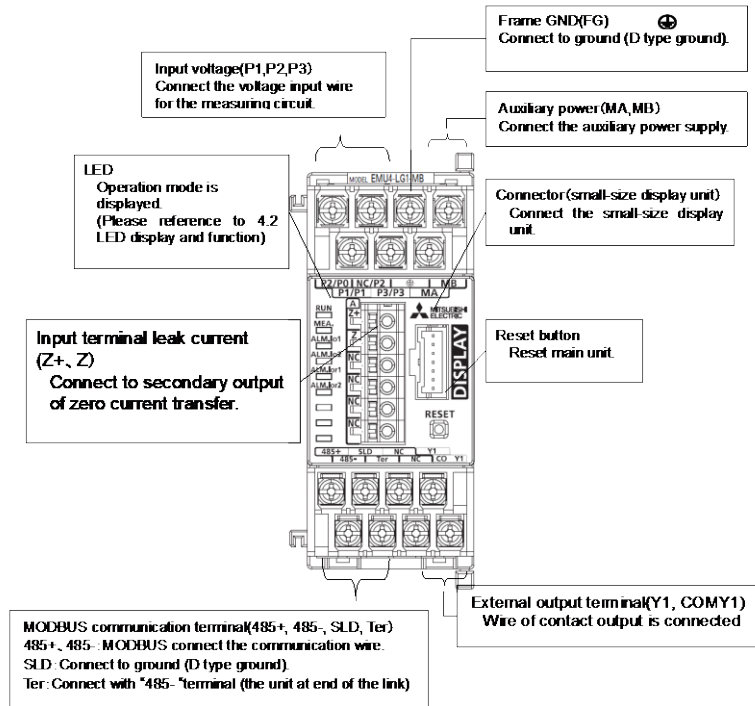
## 2. Disclaimer

- It is prohibited to reprint or copy all contents of this document in any form without our permission.
- The contents of this document will be updated to follow revisions to software and hardware, however under unavoidable circumstances it may not be synchronized.

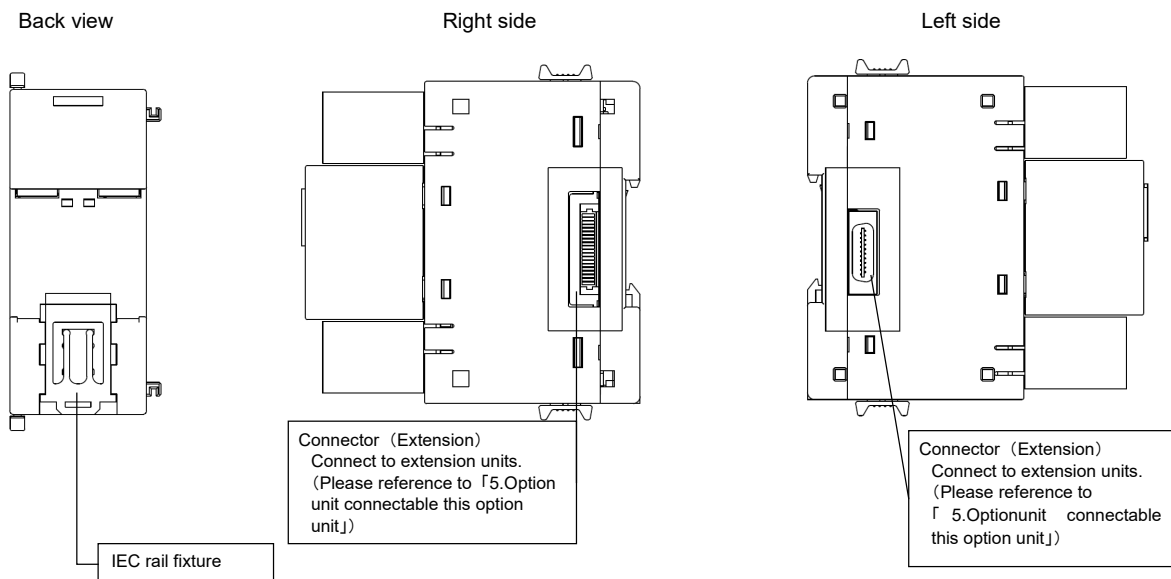
## 3. Name and function of each part

### 3.1 Name of each part

(1) EMU4-LG1-MB




(3) Back view and side view



### 3.2 Indication and function 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 operation OFF: Power off or hardware failure. (Note1)
MEA. LED	Red	Indicate operating status of this unit.	ON: In the middle of measuring lo OFF: Halting measurement
AL.lo1 LED	Red	Indicate lo1-Alarm status of this unit.	On: An error occurs <sup>※1</sup> Slow blink <sup>※2</sup> : lo1-Alarm is issued. Fast blink <sup>※3</sup> : lo1-Alarm count is issued. OFF: lo1_Alarm is not alert.
AL.lo2 LED	Red	Indicate lo2-Alarm status of this unit.	On: An error occurs <sup>※1</sup> Slow blink <sup>※2</sup> : lo2-Alarm is issued. Fast blink <sup>※3</sup> : lo2-Alarm count is issued. OFF: lo2_Alarm is not alert.
AL.lor1 LED	Red	Indicate lor1-Alarm status of this unit.	On: An error occurs <sup>※1</sup> Slow blink <sup>※2</sup> : lor1-Alarm is issued. Fast blink <sup>※3</sup> : lor1-Alarm count is issued. OFF: lor1_Alarm is not alert.
AL.lor2 LED	Red	Indicate lor2-Alarm status of this unit.	On: An error occurs <sup>※1</sup> Slow blink <sup>※2</sup> : lor1-Alarm is issued. Fast blink <sup>※3</sup> : lor1-Alarm count is issued. OFF: lor2_Alarm is not alert.

※1: Please reference to  9.1 In case you think the unit is in failure.

※2: Repeat 500msec lighting and 500msec extinction. LED is the status of upper alarm count when upper alarm count is issued at the same time.

※3: Repeat 100msec lighting and 100msec extinction.



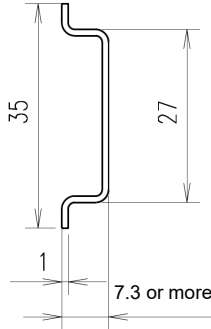
## 4. Attaching and removing the unit

### ⚠ Caution

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

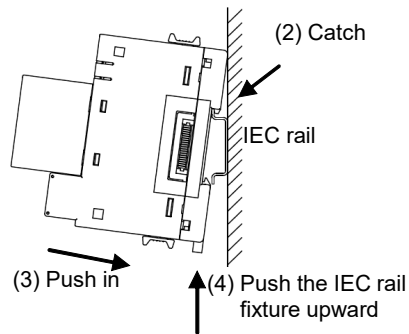
#### 4.1 Mounting on IEC rail

- Applicable IEC rail (35mm)

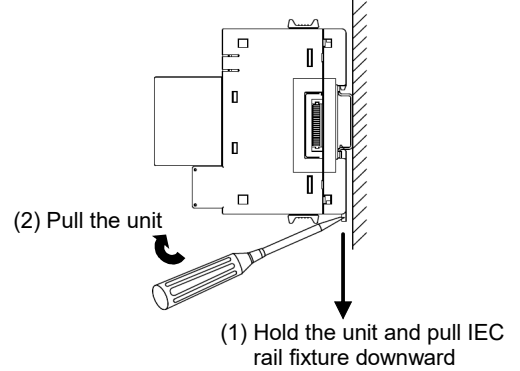


- Mounting

(1) Pull IEC rail fixture downward

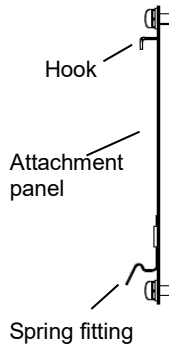


- Removing



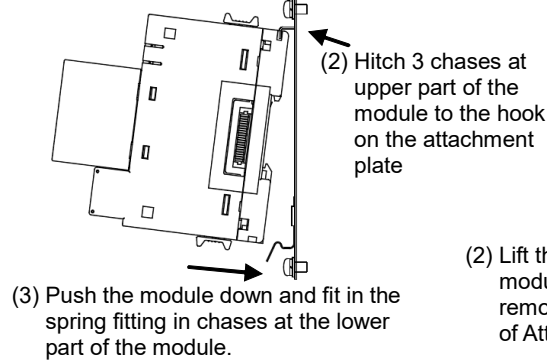
#### 4.2 Mounting on JIS agreement type attachment

- JIS agreement type attachment

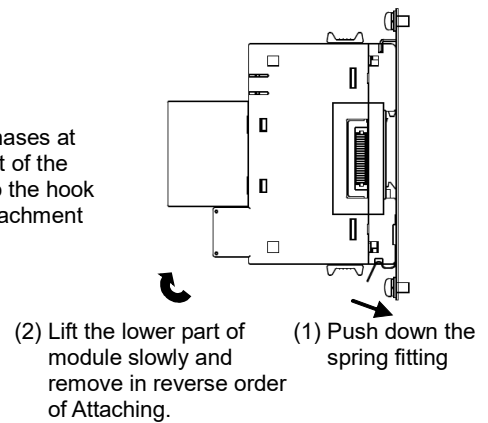


- Mounting

(1) Push the stopper of the IEC rail above



- Removing

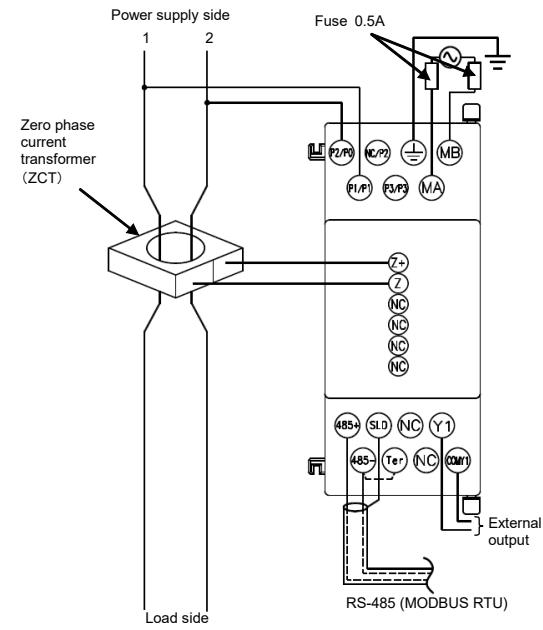


## 5. Procedure for wiring

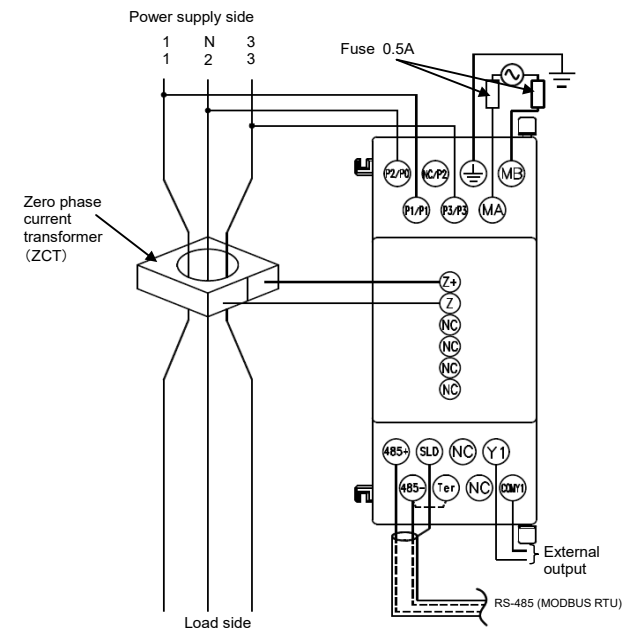
Follow the wiring diagram for wiring of circuit and circuit voltage.  
Please use our zero-phase current transfer (CZ, ZT series) to connection of circuits.

### 5.1 Wiring for EMU4-BM1-MB

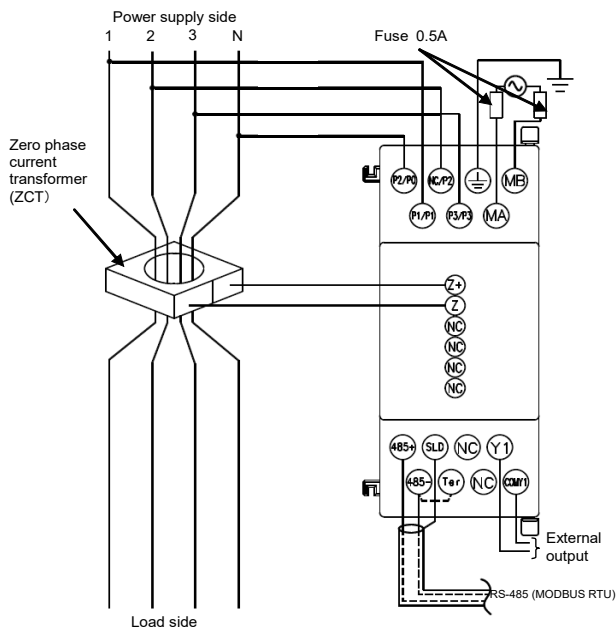
1P2W



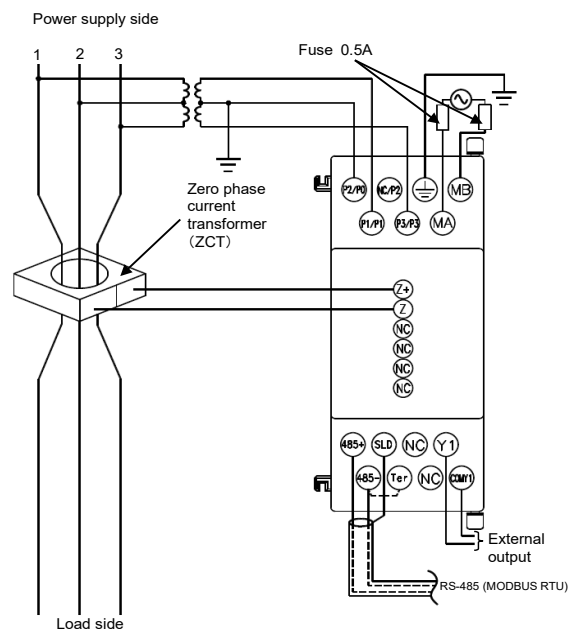
1P3W/3P3W



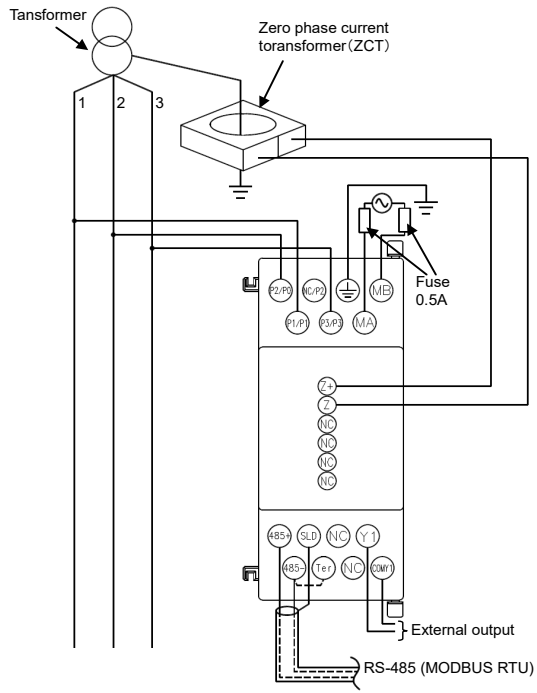
3P4W



3P3W (with voltage transformer)



# Insulation monitoring of ground wire of transformer secondary side



## 5.2 Precautions for the connection wire

<b>⚠Caution</b>	<ul style="list-style-type: none"> <li>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)</li> <li>If there is concern about the effects of noise even if the distances shown in the table below are increased, it is recommended to use shielded wires.</li> </ul>	
	Condition	Distance
	High-voltage line 600V or less	300mm or more
	Other high-voltage line	600mm or more
<ul style="list-style-type: none"> <li>For the actual usage, connect the FG terminal to ground. (D-type ground: Type 3) Connect it directly to the ground terminal.</li> <li>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.</li> </ul>		

- Maximum voltage of the circuit connected to EMU4-VA2 is 277 / 480V.
- Max extendable of wiring is up to 50m from zero-phase current transfer to this unit.
- Leak current for resistance can be measured only 1P2W, 1P3W, 3P3W-deruta circuit. You can measure only leak current in the 3P3W star circuit, high resistance installation circuit, capacitor installation circuit, 3P4W circuit.
- Zero-phase current transfer: CZ, ZT series don't have a secondary polarity.
- Please twist ZCT wire from Z+ and Z terminal in 40 times/m.
- Please connect voltage input terminal. You can't measure accurate measurement without voltage input.

### 5.2.1 How to connect wire

<Voltage input terminals, MODBUS communication terminal, 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: AWG22-16 (0.3 - 1.3mm <sup>2</sup> ) Single wire: AWG22-16 (0.65 - 1.25mm)	0.8 - 1.0N·m	For M3.5 screw of external diameter below 7.1mm
MODBUS communication terminals	SPEV (SB) — MPC—0.2×1P equivalent	0.5 - 0.6 N·m	For M3screw of external diameter below 6.1mm
External input/output terminals	Stranded wire: AWG22-16 (0.3 - 1.3mm <sup>2</sup> ) Single wire: AWG22-16 (0.65 - 1.25mm)	0.5 - 0.6N·m	For M3 screw of external diameter below 6.1mm

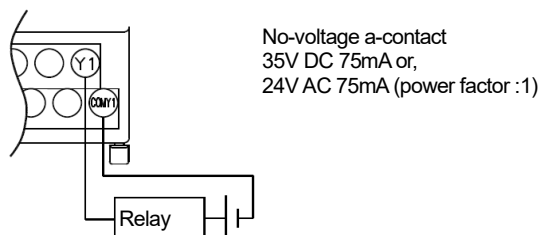
<Leak current input terminal>

- 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: AWG20-16 (0.5 - 1.3mm <sup>2</sup> ) Single wire: AWG24-17 (0.5 - 1.2mm)	TGV TC-1.25-11T (by NICHIFU) equivalent

### 5.2.2 Connection of external input / external output

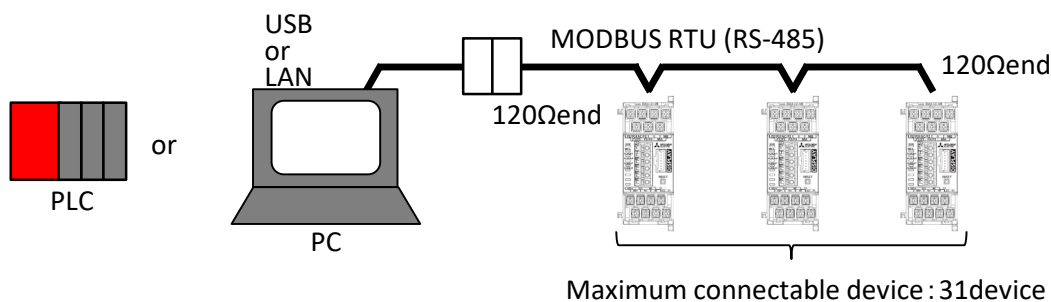
In case using external input and/or external output, refer to the following. External output is contact output.



The wiring lengths in the table below are approximate values. Please use it as a reference when wiring.

Wire diameter [mm]	Resistivity [ $\Omega$ /km]	Wiring length [m]
0.5	94	250
0.65	56.8	400
0.9	29.2	750
1.2	16.5	1000

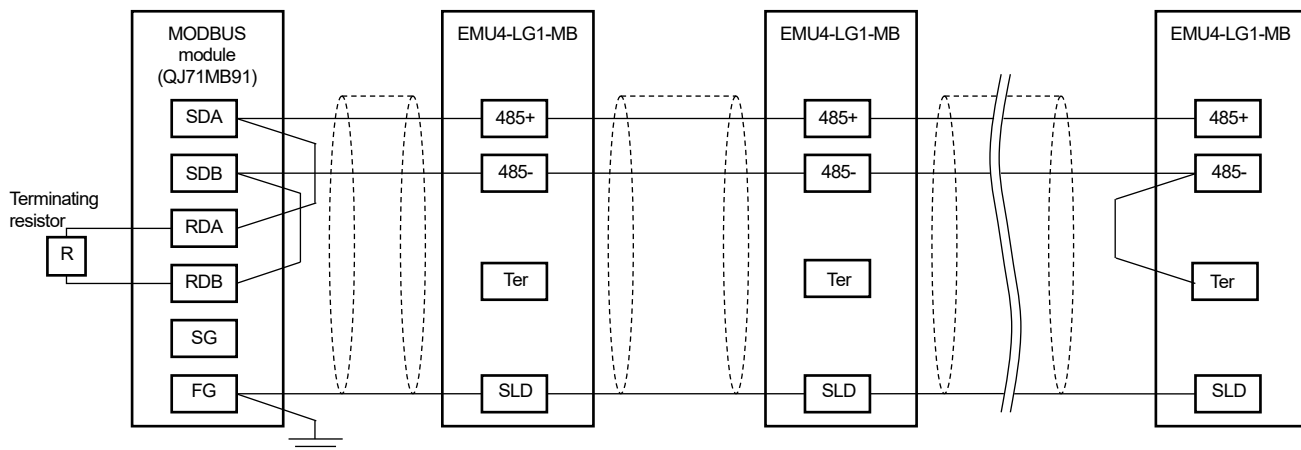
### 5.2.3 System configuration example of MODBUS communication



● Connection of MODBUS communication terminals:

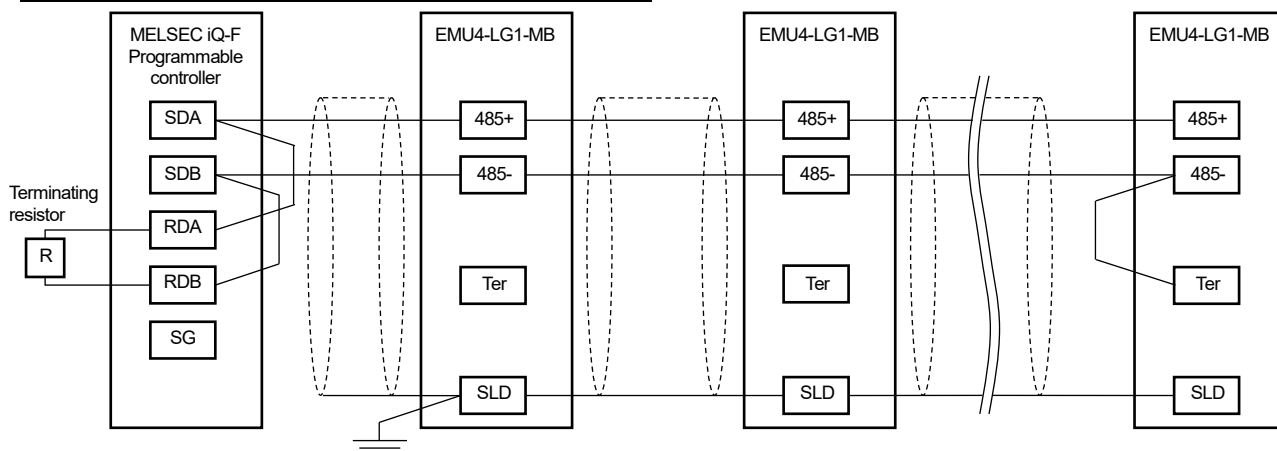
1. Use the twisted shielded pair cable for transmission lines. (Recommended cable page 28)
2. Connect the termination resistances (120Ω) to both ends of the devices connected the MODBUS transmission line.  
Termination resistances of 120Ω can be used by short-circuiting “485-” and “Ter” terminals.
3. Connect to ground by using thick wires to decrease impedance.
4. MODBUS transmission lines shall not be placed close to or bound together with the high-voltage lines.
5. Ground the “SLD” terminal at one end.

Connection with MELSEC Q series MODBUS module (QJ71MB91, QJ71C24N)



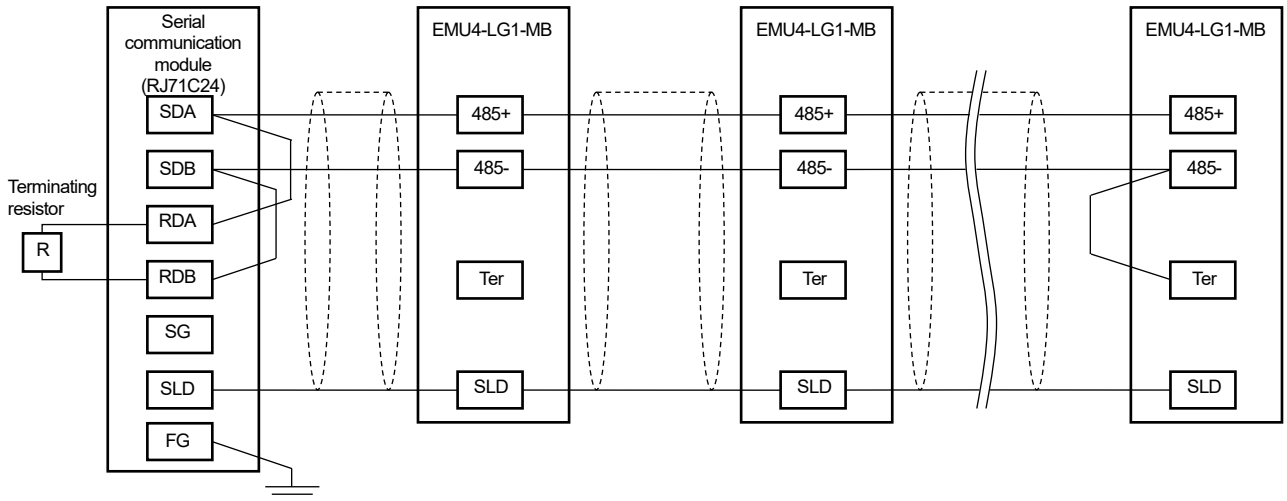
Note: Connect 110 ohm termination resistors on the MODBUS module (QJ71MB91, QJ71C24N) side.  
For details, refer to [MODBUS Interface Module User's Manual] (Ref. No. SH-080578ENG) and [Q Corresponding Serial Communication Module User's Manual (Basic)] (Ref. No. SH-080006).

Connection with MELSEC iQ-F series programmable controller



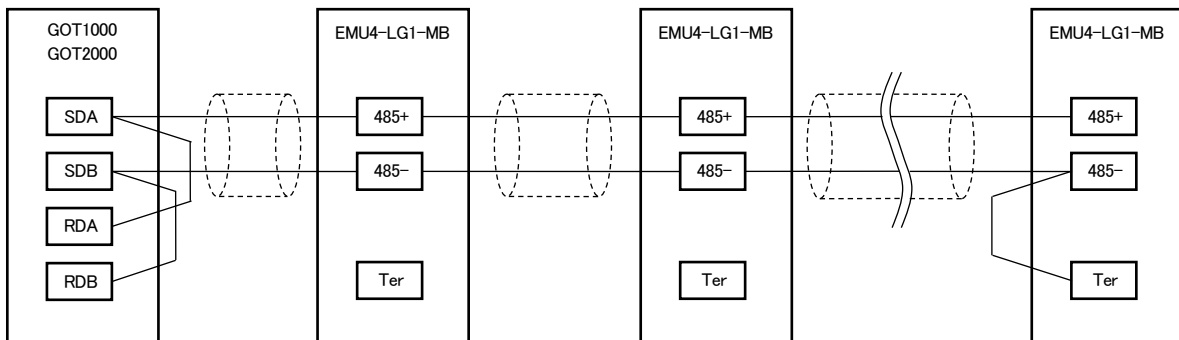
Note: Connect 110 ohm termination resistors on the MELSEC iQ-F programmable controller side.  
For details, refer to [MELSEC iQ-F FX5 User's Manual (MODBUS Communication)] (Ref. No. JY997D56101).

Connection with MELSEC iQ-R Serial Communication Module (RJ71C24, RJ71C24-R4, RJ71C24-R4)



Note: Connect 110 ohm termination resistors on the MELSEC iQ-R programmable controller side.  
For details, refer to Before Using the Product for RJ71C24, RJ71C24-R4 and RJ71C24-R4 (Ref.NO. BCN-P5999-0075).

Connection with GOT (GOT1000, GOT2000)



Note: Set the termination resistor of the GOT (GOT1000, GOT2000) side to 110 ohm.  
For details, refer to [GOT1000 Series Connection Manual (Microcomputers, MODBUS Products, Peripherals) for GT Works3] (Ref.NO. SH-080871ENG) and [GOT2000 Series Connection Manual (Microcomputers, MODBUS/Fieldbus Products, Peripherals) For GT Works3 Version1] (Ref.NO. SH-081200ENG).

## 6. Setting

### 6.1 Setting data

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.

The data can be setup is showed below.

#### 6.1.1 Phase wire system

Setting value is below.

Model	Setting value
Wiring type	1P2W, 1P3W, <b>3P3W</b> , 3P4W

#### 6.1.2 Measurement mode

Setup the measurement mode for I<sub>o</sub> and I<sub>or</sub>. Setting value and details of Measurement mode is below

Setup items	Setting value	Note
Measurement mode	<b>High SENS mode.</b> Low SENS mode	Low SENS...0~1000mA 1mA step High SENS.....0.00~100mA 0.01mA step

#### 6.1.3 Demand time

Setup demand time for calculating demand leak current for resistance and demand leak current.

Setting value is below

Setting item	Setting value
Demand time	0sec, <b>5min</b> , 6min, 7min, 8min, 9min, 10min, 11min, 12min, 13min, 14min, 15min, 20min, 25min, 30min

#### 6.1.4 Differential conversion

Setup the whether to calculate I<sub>or</sub> differential conversion. I<sub>or</sub> differential conversion is calculated below equation.

I<sub>or</sub> differential conversion = I<sub>or</sub> - I<sub>or</sub> differential conversion value

Setting value is below

Setup items	Setting value	Note
I <sub>or</sub> differential conversion	<b>OFF</b> , ON	I <sub>or</sub> differential conversion...Amount of change from I <sub>or</sub> differential conversion value.
I <sub>or</sub> differential conversion value	High SENS mode: <b>0.00</b> ~100.00mA Low SENS mode: <b>0</b> ~1000mA	

#### 6.1.5 Communication setting

Setup the below items for MODBUS communication. Setting items and value is below

Setting item	Setting value
Address	<b>001</b> to 255
Baud rate	2400, 4800, 9600, <b>19200</b> , 38400
Parity	Non, <b>Even</b> , Odd
Stop bit	<b>1</b> , 2

### 6.1.6 The leak current alarm

Setup the whether to monitoring leak current. Please refer to 7.2 Leak current monitoring function for more details.

Setting value is below

Setup items	Setting value
lo monitoring elements	<b>Present value</b> , Demand value
lo1- alarm	High SENS mode: <b>0.00</b> ~100.00mA
lo2-alarm	Low SENS mode: <b>0</b> ~1000mA
lo1-alarm count	<b>0</b> ~999999
lo2-alarm count	
lor monitoring elements	<b>Present value</b> , Demand value, Differential conversion value
lor1-alarm	High SENS mode: <b>0.00</b> ~100.00mA
lor2-alarm	Low SENS mode: <b>0</b> ~1000mA
lor1-alarm count	<b>0</b> ~999999
lor2-alarm count	
Target output of alarm	OFF, lo1-alarm, lo2-alarm, lor1-alarm, lor2-alarm, upper limit of lo1-alarm count, upper limit of lo2-alarm count, upper limit of lor1-alarm count, upper limit of lor2-alarm count
Alarm mask	<b>0sec</b> , 5sec, 10sec, 20sec, 30sec, 40sec, 50sec, 1min, 2min, 3min, 4min, 5min
Reset mode	<b>Auto</b> , Hold



## 6.2 Initialization of related items by change of setting

If setting value is changed, setting value and measured data is initialized in below table 6.2.1 and 6.2.2. Please setup again.

Table 6.2.1 The list of initialization when setup is changed. (Setting value)

Setup items	Setup value to be changed																								
	Measure mode	Wiring type	Demand leak current alarm	Differential conversion ON/OFF setting	Differential conversion value	lo alarm element	lor alarm element	Alarm value (lo1-alarm)	Alarm value (lo2-alarm)	Alarm value (lor1-alarm)	Alarm value (lor2-alarm)	Alarm value (Number of lo1-alarm occurrence)	Alarm value (Number of lo2-alarm occurrence)	Alarm value (Number of lor1-alarm occurrence)	Alarm value (Number of lor2-alarm occurrence)	Alarm of external output circuit	Alarm mask	Alarm reset mode	Modbus address	Modbus baurate	Modbus parity	Modbus stop bit	Logging ID	Logging data clear confirmation	
Measure mode																									
Wiring type																									
Demand leak current alarm																									
Differential conversion ON/OFF setting	<input type="radio"/>	<input type="radio"/>																							
Differential conversion value	<input type="radio"/>	<input type="radio"/>		<input checked="" type="radio"/>																					
lo alarm element	<input type="radio"/>	<input type="radio"/>																							
lor alarm element	<input type="radio"/>	<input type="radio"/>			<input type="checkbox"/>																				
Alarm value (lo1-alarm)	<input type="radio"/>	<input type="radio"/>																							
Alarm value (lo2-alarm)	<input type="radio"/>	<input type="radio"/>																							
Alarm value (lor1-alarm)	<input type="radio"/>	<input type="radio"/>				<input type="checkbox"/>																			
Alarm value (lor2-alarm)	<input type="radio"/>	<input type="radio"/>				<input type="checkbox"/>																			
Alarm value (Number of lo1-alarm occurrence)	<input type="radio"/>	<input type="radio"/>																							
Alarm value (Number of lo2-alarm occurrence)	<input type="radio"/>	<input type="radio"/>																							
Alarm value (Number of lor1-alarm occurrence)	<input type="radio"/>	<input type="radio"/>					<input type="checkbox"/>																		
Alarm value (Number of lor2-alarm occurrence)	<input type="radio"/>	<input type="radio"/>					<input type="checkbox"/>																		
Alarm of external output circuit																									
Alarm mask																									
Alarm reset mode																									
Modbus address																									
Modbus baurate																									
Modbus parity																									
Modbus stop bit																									
Logging ID																									
Logging data clear confirmation																									

Mark	Contents
<input type="radio"/>	Initialized.
<input checked="" type="radio"/>	Initialize when changed from On to OFF.
<input type="checkbox"/>	Initialize when lor alarm element is setup lor differential conversion.

Table 6.2.2 The list of initialization when setup is changed. (Measured value)

Measuring value (initialized)	Setup items	Setup value to be changed																							
		Measure mode	Wiring type	Demand leak current alarm	Differential conversion ON/OFF setting	Differential conversion value	lo alarm element	lor alarm element	Alarm value (lo1-alarm)	Alarm value (lo2-alarm)	Alarm value (lor1-alarm)	Alarm value (lor2-alarm)	Alarm value (Number of lo1-alarm occurrence)	Alarm value (Number of lo2-alarm occurrence)	Alarm value (Number of lor1-alarm occurrence)	Alarm value (Number of lor2-alarm occurrence)	Alarm of external output circuit	Alarm mask	Alarm reset mode	Modbus address	Modbus baurate	Modbus parity	Modbus stop bit	Logging ID	Logging data clear confirmation
Max	Present lo value	<input type="radio"/>	<input type="radio"/>																						
	Demand lo value	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>																					
	Present lor value	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>																					
	Demand lor value	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>																				
	lor differential conversion value	<input type="radio"/>	<input type="radio"/>		<input type="radio"/>	<input type="radio"/>																			
Alarm count	lo1-alarm	<input type="radio"/>	<input type="radio"/>				<input type="radio"/>		<input type="radio"/>																
	lo2-alarm	<input type="radio"/>	<input type="radio"/>				<input type="radio"/>		<input type="radio"/>																
	lor1-alarm	<input type="radio"/>	<input type="radio"/>			<input type="checkbox"/>	<input type="checkbox"/>		<input type="radio"/>																
	lor2-alarm	<input type="radio"/>	<input type="radio"/>			<input type="checkbox"/>	<input type="checkbox"/>		<input type="radio"/>																

Mark	Contents
<input type="radio"/>	Initialized.
<input type="checkbox"/>	Initialize when lor alarm element is setup lor differential conversion.

## 7. Operation

### 7.1 Measurement

Measurement elements are showed below table.

In the case displaying in Display unit

Monitoring or displaying item		High SENS/Low SENS	
		1P2W /1P3W /3P3W	3P4W
Leak current	Present value	●	●
	Maximum value	●	●
Demand leak current	Present value	●	●
	Maximum value	●	●
Leak current for resistance	Present value	●	—
	Maximum value	●	—
Demand leak current for resistance	Present value	●	—
	Maximum value	●	—
Differential conversion of leak current for resistance	Present value	● *1	—
	Maximum value	● *1	—
Time	Present Value	● *2	● *2
Error	—	●	●

● ... Measuring data  
— ... Not measuring data

\*1: Measured value is displayed differential conversion setting is ON.

\*2: Present time is only displayed when connected EMU4-LM.

Details of measurement elements showed below.

Measurement elements	Details
Demand leak current	Calculate demand of leak current. *: Please refer to 6.1.3 demand time for more details.
Demand leak current for resistance	Calculate demand of leak current for resistance *: Please refer to 6.1.3 demand time for more details.
Differential conversion of leak current for resistance	Calculate below equation. Differential conversion of leak current for resistance = Demand leak current for resistance - differential conversion value *: Displayed only when lor differential conversion is ON

**In the case monitoring with various communications**

The supported communications are as follows.

- CC-Link communication
- CC-Link IE Field Basic communication
- SLMP communication
- MODBUS communication

Monitoring or displaying item		High SENS/Low SENS	
		1P2W /1P3W /3P3W	3P4W
Leak current	Present value	●	●
	Maximum value	○	○
Demand leak current	Present value	●	●
	Maximum value	○	○
Leak current for resistance	Present value	●	—
	Maximum value	○	—
Demand leak current for resistance	Present value	●	—
	Maximum value	○	—
Differential conversion of leak current for resistance	Present value	●*1	—
	Maximum value	○	—
Time	Present Value	—	—
Error	—	●	●

- ... Data can monitoring
- ... Data can monitoring only by MODBUS communication
- ... Not measuring data

**In the case logging using EMU4-LM**

Monitoring or displaying item		High SENS/Low SENS	
		1P2W /1P3W /3P3W	3P4W
Leak current	Present value	●	●
	Maximum value	—	—
Demand leak current	Present value	●	●
	Maximum value	—	—
Leak current for resistance	Present value	●	—
	Maximum value	—	—
Demand leak current for resistance	Present value	●	—
	Maximum value	—	—
Differential conversion of leak current for resistance	Present value	●	—
	Maximum value	—	—
Time	Present Value	—	—
Error	—	—	—

- ... Data can logging
- ... Data cannot logging

## 7.2 Leak current monitoring function

### 7.2.1 About monitoring elements

Monitoring elements in each setting value are showed in below table.



Alarm items	High SENS/Low SENS	
	1P2W /1P3W /3P3W	3P4W
lo1-alarm	●	●
lo2-alarm	●	●
lo1-alarm count	●	●
lo2-alarm count	●	●
lor1-alarm	●	—
lor2-alarm	●	—
lor1-alarm count	●	—
lor2-alarm count	●	—

- ... Can monitor data
- ... Can't monitoring data



### 7.2.2 How to use leak current alarm monitoring function

This device can set the leak current alarm and monitor the circuit.

< Alarm setting >

- Leak current alarm value.....Set the upper limit of measured value. For setting value and setting range,  P.15
- Alarm delay time.....Set the value in case you want to remove the inrush current of the load.  
If it exceeds the upper limit alarm value or if it goes below the lower limit alarm value, and the situation continues for the period of the alarm delay time, then it is considered as an alarm occurrence.  
For setting value and setting range,  P.15
- Alarm reset method....Alarm recovery operation is different according to the alarm reset method.

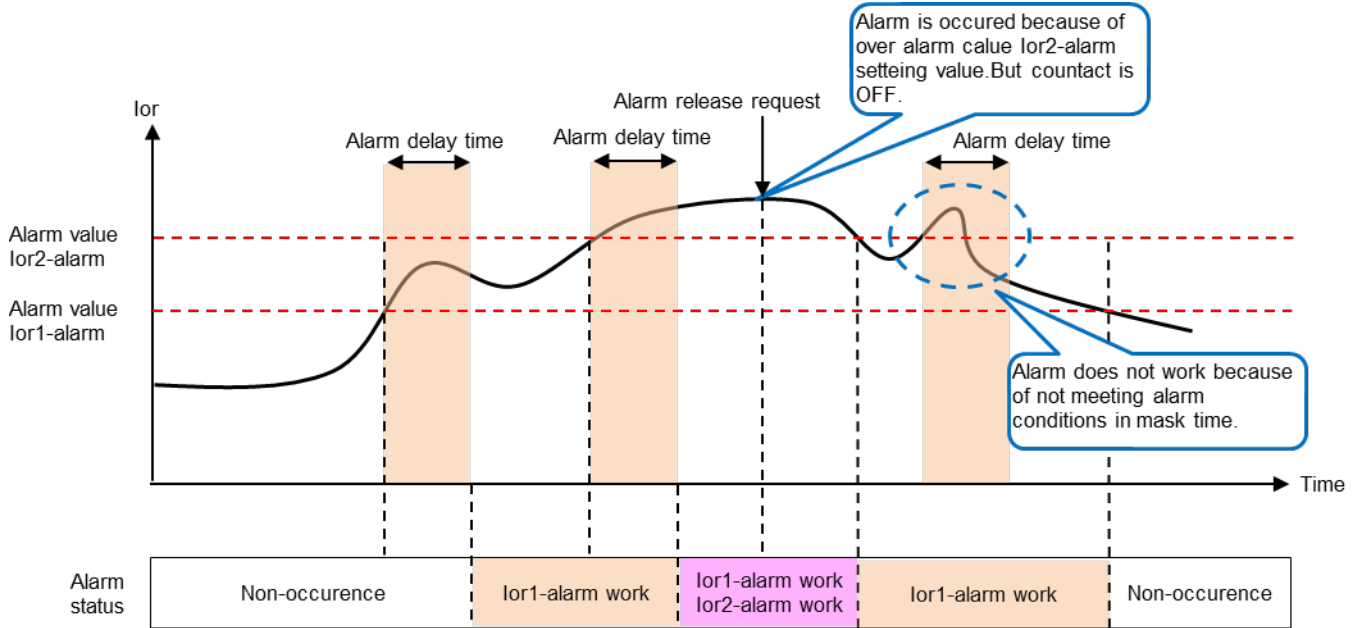
Reset method	Alarm recovery operation
Auto-reset (Auto)	Reset the alarm automatically if the measured value goes below the upper limit or goes over the lower limit.
Self-retention (Hold)	The alarm is held after the measured value goes below the upper limit or goes over the lower limit. Alarm is cleared by alarm reset.

For setting  P.15 For alarm reset operation,  P.15

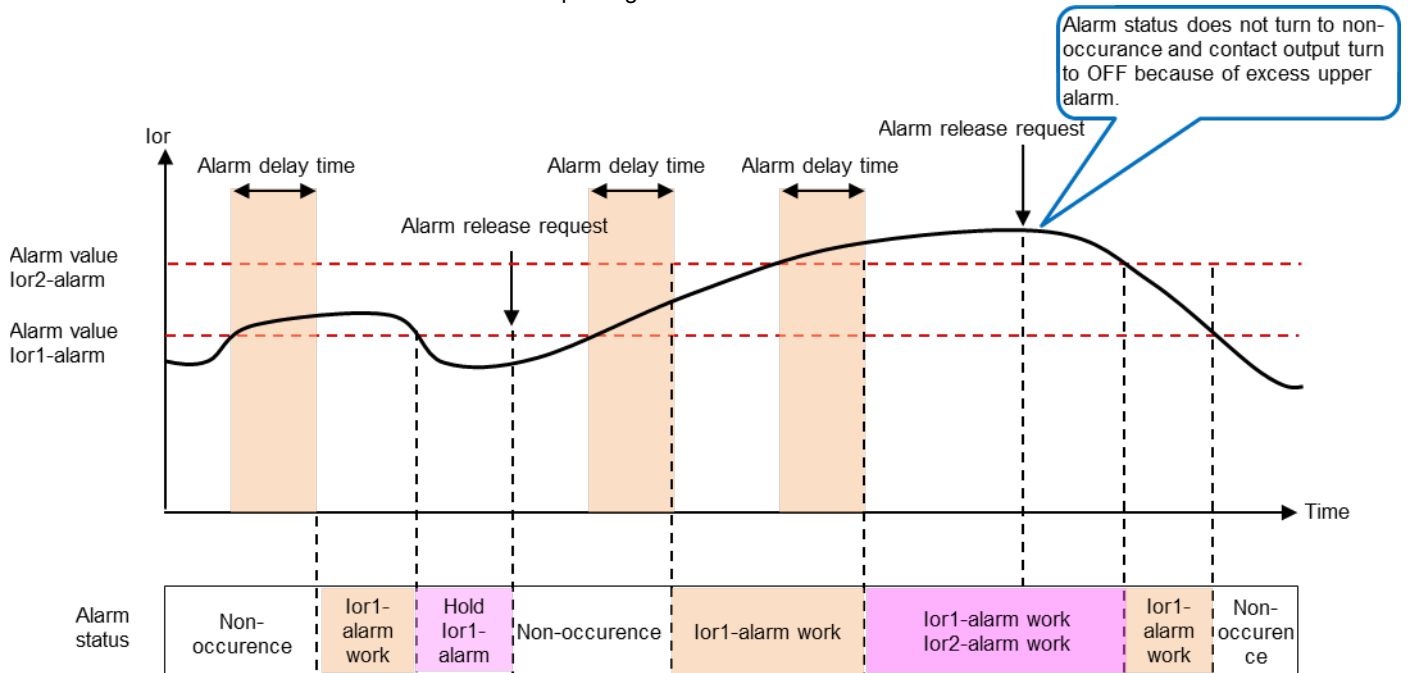
< Alarm occurrence / recovery condition >

Alarm item	Alarm reset method	Alarm status	Alarm occurrence / recovery condition
lo1-alarm lo2-alarm lo1-alarm count lo2-alarm count	Auto-reset (Auto)	Occurrence	Measured value > configured upper limit (Alarm delay time is available)
		Recovery	Measured value < configured upper limit
	Self-retention (Hold)	Recovery	Measured value > configured upper limit (Alarm delay time is available)
		Occurrence	Measured value < configured upper limit AND Alarm reset
lo r1-alarm lo r2-alarm lo r1-alarm count lo r2-alarm count	Auto-reset (Auto)	Occurrence	Measured value ≥ configured upper limit
		Recovery	Measured value < configured upper limit
	Self-retention (Hold)	Occurrence	Measured value ≥ configured upper limit
		Recovery	Measured value < configured upper limit

(1) Alarm reset mode = Auto



(2) Alarm reset mode = Hold and external output target is lor2-alarm.



## 8. Device operation

### 8.1 Resolution of measuring data

The resolution of measuring data is determined as follows according to the settings (High SENS or Low SENS).

■ Leak current (Io), leak current for resistance (Ior)

Setup of measure mode	Resolution	Unit
High SENS mode	2 decimal places	mA
Low SENS mode	Intenger	mA

### 8.2 Restrictions of measured data

Measurement and communication do not performed in a few seconds (about 10seconds) after the power loading to this device. Measurement and communication do not performed in a few seconds after the configuration or the change of the rating to it. Behaviors during operation are as follows.

Measured item	Behaviors of this unit and Indication of Small-size Display Unit
Leak current	Voltage condition: Indicate "0V" if RMS value of voltage V12 (voltage V1N for Three-phase 4-wire) is under 11V. *1 ----- Frequency condition: Indicate "0mA" if frequency is under 44.5Hz. Indicate "0mA" if frequency is over 66.5Hz.
Demand leak current	Indicate "0mA" if leak current is 0mA.
Leak current for resistance	Indicate "0mA" if leak current is 0mA.
Demand leak current for resistance	Indicate "0mA" if leak current is 0mA.
Differential conversion of leak current for resistance	Indicate "0mA" if leak current is 0mA.

\*1: In single-phase three-wire system, indicate "0V" if RMS value is under 22V.

#### ✓ Supplement

- This unit takes a few seconds after change rating setup and the setup. While time measuring operation can't conduct. ( MEA\*\* . LED is turned off)

## 9. Reference

This chapter explains the ways of dealing when you think the unit is in failure, Q&A, etc.

### 9.1 Trouble shooting

If an abnormal sound, bad-smelling smoke, fever break out from this unit, switch it off promptly and don't use it. If you think the unit is in failure, check the following before sending for repair.

---

---

#### Obtained values are different from other measuring instruments.

---

Check the settings of phase wire system.

Check that the measuring instrument used for comparison indicates a correct RMS value. This unit indicates an RMS value.

If the measuring instrument used for comparison measures an average value instead of RMS value, distortion caused by harmonic etc. in the current of the circuit to be measured causes a significant difference of values.

Please confirm that secondary terminal is short circuit of ZCT or not.

Please confirm that secondary terminal is release of ZCT or not.

ZCT connectable to the unit is the dedicated ZCT only. Check that the proper ZCT is connected or not.

---

---

#### Extinction RUN LED

---

Please turn OFF/ON the measuring unit. Unit may be in failure if RUN LED extinction happens again.

---

---

#### Lighting ALM lo1, ALM lo2, ALM lor1, ALM lor2

---

Error is occurred. Please check the error number in display unit.

---

---

### 9.2 After-sales service

If you have any questions or the product is broken down, contact our sales representative near you. (For details, refer to the end of this manual.)

- Gratis warranty is effective until the earlier of 1 year after the date of your purchase or 18 months after manufacturing.
- The gratis warranty shall apply if the product fails even though it is being used properly in the conditions, with the methods and under the environments in accordance with the terms and precautions described in the catalogs, the instruction manual, caution label on the product, etc.
- Repair shall be charged for the following cases even during the gratis warranty period.
  - Failures occurring due to your improper storage or handling, carelessness or fault.
  - Failures due to faulty workmanship
  - Failures due to faults in use and undue modification
  - Failures due to accidental force such as a fire, abnormal voltage, etc. and force majeure such as an earthquake, wind, flood, etc.
  - Failures due to matters unpredictable based on the level of science technology at the time of product.
- 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

### ■ General

<b>Q</b>	<b>To what degree is the unit durable against overvoltage and over current?</b>
<b>A</b>	Durability is as follows: Momentary*: Up to 20 times as high as rated current and 2 times as high as rated voltage. *Momentary means: Energizing 9 times for 0.5 seconds at 1-minute intervals, and then 1 time for 5 seconds. Continuous: Up to 1.1 times as high as rated voltage and rated current.
<b>Q</b>	<b>Is it OK to release (open) the secondary side of ZCT?</b>
<b>A</b>	Do not open the secondary output terminals (k, l) of ZCT. Opening the secondary output terminals may affect characteristics of ZCT. In addition, do not short-circuit or ground the test terminals (kt, lt) of ZCT. Otherwise, the leak current may not be detected correctly.
<b>Q</b>	<b>Is measurement of inverter circuit possible?</b>
<b>A</b>	Measuring the secondary side of the inverter is impossible due to the large fluctuation of frequency. Make measurement on the primary side of the inverter. However, since a current waveform on the primary side of the inverter has a distortion containing the harmonic components, a slight error occurs.
<b>Q</b>	<b>Obtained values may be different from other measuring instruments. Why is it so?</b>
<b>A</b>	There are various possible causes. Check the following first, please: (1) Check for wiring errors. (2) Check the short circuit on the secondary side of ZCT. (3) ZCT connectable to the unit is the dedicated current sensor only. (4) On the split-type ZCT, check for the poor engagement or separation of fitting surfaces. (5) On the split-type ZCT check for pinching of foreign object between fitting surfaces. (6) Check that the measuring instrument used for comparison indicates a correct RMS value.  This unit indicates an RMS value. If the measuring instrument used for comparison measures an average value instead of RMS value, distortion caused by harmonic etc. in the current of the circuit to be measured causes a significant difference of values.

### ■ Q&A about specifications

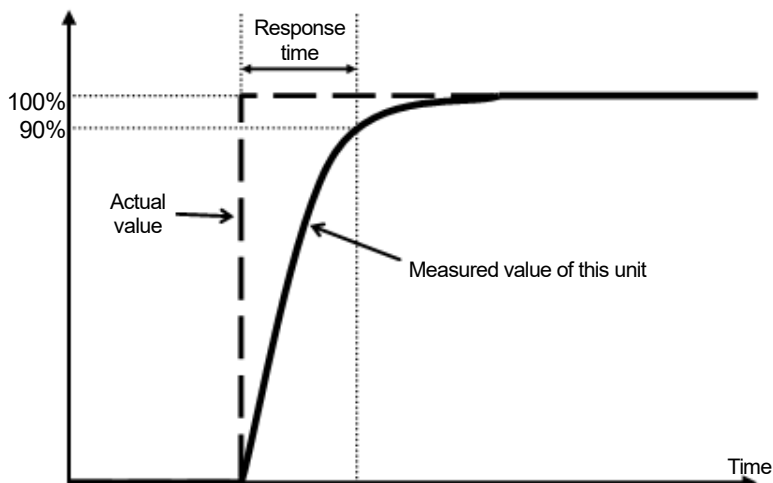
<b>Q</b>	<b>What does “the module tolerance” against?</b>
<b>A</b>	It means a range of tolerances input leak current. 25% of input leak current is allowable tolerance in the range that input leak current is 100~1000mA because rated leak current and leak current for resistance is 1000mA in low SENS mode. When input leak current is less than 100mA, $\pm 2.5\text{mA}$ is the allowable tolerance. When rated leak current is 100mA, $\pm 2.5\text{mA}$ is the allowable tolerance.
<b>Q</b>	<b>Is accuracy of a ZCT included?</b>
<b>A</b>	Accuracy of a ZCT is not included in accuracy of the unit. A maximum value of tolerance is obtained by summing tolerance of the unit and that of a ZCT.
<b>Q</b>	<b>To what degree an area of micro current is measured?</b>
<b>A</b>	Leak current value is measured from the area exceeding 0.01mA in high SENS mode and 1mA in low SENS mode. Measured leak current value is 0 when measured value is less than 0.01mA in high SENS mode or 1mA in low SENS mode.
<b>Q</b>	<b>Leak current <math>I_{lo}</math> and leak current for resistance <math>I_{or}</math> can be measured without voltage applied.</b>
<b>A</b>	Please connecting voltage sure, because $I_{lo}$ and $I_{or}$ are not measured without voltage applied. Measured leak current is 0mA when frequency error because $I_{lo}$ can't be measured when frequency is less than 44.5Hz or more than 66.5Hz.
<b>Q</b>	<b>Is measurement of inverter circuit possible?</b>
<b>A</b>	Measuring the secondary side of the inverter is impossible due to the large fluctuation of frequency. Make measurement on the primary side of the inverter. However, since a current waveform on the primary side of the inverter has a distortion containing the harmonic components, a slight error occurs.



**Q** What does “Response time” mean?


It means time that from input of voltage or current is changed rapidly to output follow within 10%.

**A**



■Q&A about installation

**Q** What is the radius of voltage line that can penetrate to ZCT?

**A** Please reference to  「12.2 Specification of option devices」

■Q&A about connection

**Q** Does connection ZCT and energy measuring unit have polarity?

**A** No, it doesn't.

**Q** Are there any key points in avoiding errors in wiring?

**A** Check that voltage inputs for voltage transform unit are connected correctly among P1, P2, P3, and P0.

■Q&A about setting

**Q** Is the setting required?

**A** At least, settings of phase wires, primary current and primary voltage are required. Specify settings in accordance with a circuit to be connected. To set this unit, dedicated small-size display unit (EMU4-D65) is necessary.

## 10. Requirement for the compliance with EMC Directives EMC

EMC Directives prescribe both "Emission (electromagnetic interference): Do not radiate strong electromagnetic waves outside" and "Immunity (electromagnetic susceptibility): Do not be influenced by electromagnetic waves from outside".

This section compiles the precautions for the compliance of the system incorporating the energy measuring unit (target model: EMU4-BM1-MB and EMU4-HM1-MB) with the EMC Directives. The following description is based on the requirement of the regulations and the standards we understand, but we do not guarantee to comply with the directives above for the whole system built in accordance with this description. The manufacturer of the system finally needs to evaluate the way of the compliance with EMC Directives and whether the system complies with them or not.

- (1) Harmonized standard for EMC Directives: EN61326-1:2013
  - (a) Compatibility condition for harmonized standard

The energy measuring unit is the open type device (i.e. the device incorporated in other device), and needs to be installed in the conductive control panel. The unit is tested with installed in the control panel for the emission and the immunity out of the test items for the standard.
  - (2) Recommended condition for installation in the control panel
    - (a) Control panel
      - Control panel needs to have conducting property.
      - When bolting the top panel, bottom panel etc. of the control panel, mask the grounding part of the panel so as not to be painted.
      - In inner panel, keep the conductivity in as large area as possible by masking the bolting part to the main panel to keep the electric contact to main panel.
      - Ground the main panel by the thick wire so as to keep high impedance even for high-frequency wave.
    - (b) Installation of power line and ground line
      - Set up the ground point to the control panel near the energy measuring unit, and ground the frame GND terminal of the unit to the ground terminal of the control panel (PE) by as thick and short wires as possible. (wire length is 300mm or shorter)
- (3) Cable
  - (a) Auxiliary power, Input voltage, CC-Link cable, MODBUS cable, Small display unit cable

When it is necessary to comply with the EMC Directive (EN-61326-1), attach ferrite cores to each cable. Ferrite cores used in our testing is below.

    - Auxiliary power  
KITAGAWA INDUSTRIES CO.,LTD., RFC-H13  
KITAGAWA INDUSTRIES CO.,LTD., TRM-31-20-15E-WE
    - Input voltage  
KITAGAWA INDUSTRIES CO., LTD., RFC-H13
    - CC-Link cable, MODBUS cable  
KITAGAWA INDUSTRIES CO., LTD., RFC-20
    - Small display unit cable  
KITAGAWA INDUSTRIES CO.,LTD., RFC-H13
  - (b) External input signal line, External output signal line

Wiring of each connection wire should satisfy the following conditions.

    - For wiring inside buildings, the wiring length should not exceed 30 m.
    - Do not route wiring from the inside of the building to the outside of the building.

## 11. Specifications

### 11.1 Common specifications

Item		Specifications	
Model		EMU4-LG1-MB	
Phase-wire system		Single-phase 2-wire / Single-phase 3-wire / Three-phase 3-wire / Three-phase 4-wire(Change of setting)	
Rating	Voltage circuit	Single-phase 2-wire / Three-phase 3-wire	AC110V, 220V, 440V <sup>※1</sup>
		Single-phase 3-wire	110V AC (b/w 1- and 2-phase, 2- and 3-phase), 220V AC (b/w 1- and 3-phase) 220V AC(b/w 1- and 2-phase, 2- and 3-phase), 440V AC (b/w 1- and 3-phase)
		Three-phase 4-wire	Min: 63.5V/110V AC, Max: 277V/480V AC <sup>※2</sup>
	Leak current circuit		AC1A (Using dedicated zero phase current transfer (CZ, ZT series). Show the primary current value of ZCT.)
	Frequency		50Hz / 60Hz (Auto-detect)
Auxiliary power supply rating		AC100V-240V(+10%,-15%) 50Hz/60Hz 10VA Transient voltage 4000V	
Measurable circuit count		1 circuit	
Consumption VA	Voltage circuit	Each phase 0.1VA (at 110V AC), 0.2VA (at 220V AC), 0.4VA (at 440V AC)	
	Auxiliary power supply circuit	At 110V AC : 2.0VA At 220V AC : 3.0VA	
Allowable tolerance <sup>※3</sup>	Leak current I <sub>o</sub>	Low SENS mode	:±2.5%(To 10~100% of rating)
		High SENS mode	:±2.5mA
	Leak current for resistance I <sub>or</sub>	Low SENS mode	:±2.5%(To 10~100% of rating)
		High SENS mode	:±2.5mA
Data update interval	Leak current I <sub>o</sub>	2sec	
	Leak current for resistance I <sub>or</sub>	2sec	
Response time	Leak current I <sub>o</sub>	2sec	
	Leak current for resistance I <sub>or</sub>	2sec	
Range of demand time setting		0, 5~15min (1min intervals), 20min, 25min, 30min	
External output	Input signal	Non-voltage Form A contact, 1 output (choose the function from below)	
	Function	Io1-alarm Io2-alarm Io1-alarm upper limit count Io2-alarm upper limit count Ior1-alarm Ior2-alarm Ior1-alarm upper count Ior2-alarm upper limit count	Auto/ Hold
	Isolation	By semiconductor relay	
	Rated input voltage and current	DC35V, 75mA AC24V, 75mA(power factor = 1)	
Compensation for power failure	Stored items	Setup value, Max, Min (stored in the nonvolatile memory)	

Item		Specifications
Model		EMU4-LG1-MB
Standard		CE Marking (EMC: EN-61326-1: 2013, Safety: EN-61010-1: 2010) UL:UL61010-1※4※5
Usage environment	Operating temperature	-5 - +55°C (Daily average temperature is 35°C or lower)
	Operating humidity	30 - 85%RH (No condensation)
	Storage temperature	-10°C~ +60°C
	Operating altitude	2000m or below
Commercial frequency withstand voltage		B/w all terminals (except for communication circuit and frame GND terminal) and casing: 2000V AC, 1min
		B/w all terminals of leak current input, voltage input / auxiliary power : 2000V AC, 1min
		B/w all terminals of leak current input, voltage input, auxiliary power and all terminals of digital / pulse input, pulse / alarm output, communication: 2000V AC, 1min
Insulation resistance		10MΩ or more at the same part above (500V DC)
Appropriate wire	Terminals of auxiliary power circuit and voltage input	AWG22-16(single/stranded) (Single: φ0.65-φ1.25mm, stranded: 0.3-1.3mm <sup>2</sup> )
	Terminals of MODBUS communication	SPEV (SB) – MPC – 0.2 × 1P equivalent
	Terminals of External output	AWG22-16(single/stranded) (Single: φ0.65-φ1.25mm, stranded: 0.3-1.3mm <sup>2</sup> )
	Terminals of leak current input	Stranded: AWG20-16 (Stranded wires: 0.5-1.3mm <sup>2</sup> ) Single: AWG24-17 (Single line: φ0.5-φ1.2mm)
Tightening torque	Screws for terminals of auxiliary power circuit and voltage input	0.8~1.0N·m
	Screws for terminals of MODBUS communication and External input/output	0.5~0.6N·m
Mass		0.2kg
External dimensions (unit: mm)		37.5(W)×90(H)×94(D) (expect for the protruding portions) (Maximum dimension including the protruding portions: 41.5(W)×99(H)×94(D))

※1: 110V, 220V, 440V AC can connected to this unit directly. For the circuit over this voltage (maximum: 600V AC), transformer (VT) is necessary.

※2: 63.5/110V - 277/480V AC can connected to this unit directly. For the circuit over this voltage (maximum: 600V AC), transformer (VT) is necessary.

※3: Allowable tolerance is not included fudge factor.

※4: When combine it with a B/NET Communication Unit (Model: EMU4-CM-B), it becomes out of a conformity standard.

When combine it with a ZCT (Model: ZT60B, ZT80B, ZT100B), it confirms UL standard.

※5: CC-Link Communication Unit produced after December, 2015 confirms UL in combination with EcoMonitorPlus.

## 11.2 Specifications of MODBUS communications

Item	Specifications
Physical interface	RS-485 2wires half duplex
Protocol	MODBUS RTU mode
Transmission method	Asynchronous
Transmission wiring type	Multi-point bus (either directly on the trunk cable, forming a daisy-chain)
Baud rate	2400, 4800, 9600, 19200, 38400bps (default: 19200bps)
Data bit	8
Stop bit	1, 2 (default: 1)
Parity	ODD,EVEN,NONE (default: EVEN)
Slave address	1~255 (FFh) (default: 1) 0: Broadcast
Response time	1s or shorter from completion of receiving query data to response transmission
Transmission distance	1200m
Maximum connectable devices	31 devices
Termination resistor	120Ω 1/2W
Recommended cable	SPEV(SB)-MPC-0.2 × 1P (Fujikura Dia Cable)

## 12. Option devices

### 12.1 About option devices

Option devices of this unit are showed below. Please reference to manual of option devices.

Product name	Model	Note	
Extention unit	Energy Measuring Unit Expansion product for electric energy monitoring in same voltage system	EMU4-A2	You can monitor Multi-circuit in same voltage system to extension main unit
	Energy Measuring Unit Expansion product for electric energy monitoring in different voltage system	EMU4-VA2	You can monitor Multi-circuit in different voltage system to extension main unit
	Energy Measuring Unit Energy Measuring Extension Model for Pulse Input	EMU4-PX4	You can monitor at most 4 circuits of pulse/a contact input system to extension main unit. When data exceeded the established upper limit value, indication of LEDs and contact output are performed.
	Energy Measuring Unit Energy Measuring Extension Model for Analog Input	EMU4-AX4	You can monitor at most 4 circuits of analog input (0-+5V/0-+20mA) system to extension main unit. When data exceeded the set upper limit value, indication of LEDs and contact output are performed.
Option unit	CC-Link Communication Unit for Energy Measuring Unit	EMU4-CM-C	You can use CC-Link communication by connecting main unit.
	Logging Unit for Energy Measuring Unit	EMU4-LM	You can log the measured data by connecting main unit.
	CC-Link IE Field Network Basic Communication Unit for Energy Measuring Unit	EMU4-CM-CIFB	You can use CC-Link IE Field Basic communication by connecting main unit.
	Small-size Display Unit for Energy Measuring Unit	EMU4-D65	You can display the measured data and use for setup.
Peripheral equipment	Split type zero phase current transformer (ZCT)	CZ-22S	Hole diameter is 22mm.
		CZ-30S	Hole diameter is 30mm.
		CZ-55S	Hole diameter is 55mm.
		CZ-77S	Hole diameter is 77mm.
		CZ-112S	Hole diameter is 112mm.
	Through type zero phase current transformer (ZCT)	ZT15B	Hole diameter is 15mm.
		ZT30B	Hole diameter is 30mm.
		ZT40B	Hole diameter is 40mm.
		ZT60B	Hole diameter is 60mm.
		ZT80B	Hole diameter is 80mm.
ZT100B	Hole diameter is 100mm.		

## 12.2 Specifications of option devices

### (1) Split type zero phase current transfer (ZCT)

Item	Specifications				
Model	CZ-22S	CZ-30S	CZ-55S	CZ-77S	CZ-112S
Hole diameter(mm)	φ22	φ30	φ55	φ77	φ112
Maximum operating voltage	AC 600V				
Rated frequency	50/60Hz				
Rated current in short time (Peak value)	50kA (100kA)				
Category of measuring	CAT III				
Pollution degree	II				
Regulatory Compliance	EN61010-2-032				
Combined equipment	Using with fit EMU4-LG1-MB				
Mass	0.5kg	0.6kg	1.8kg	2.8kg	6.0kg

### ■Hole diameter of split type zero phase current transfer (ZCT) and Maximum wire radius penetrable and allowable current

Wiring method			Maximum wire radius penetrable(mm <sup>2</sup> ) (Allowable current(A))				
Wiring	Wire number	Type of wire	CZ-22S	CZ-30S	CZ-55S	CZ-77S	CZ-112S
Single-phase 2-wire	2	600V vinyl wire (IV wire)	22 (115)	60 (217)	250 (556)	500 (842)	—*1
		600Vcross polyethylene Isolation wire (CV wire)	22 (130)	38 (190)	200 (545)	500 (920)	1000 (1465)
Single-phase 3-wire Three-phase 3-wire	3	600V vinyl wire (IV wire)	22 (115)	38 (162)	200 (496)	500 (842)	—*1
		600Vcross polyethylene Isolation wire (CV wire)	14 (100)	22 (135)	150 (455)	325 (760)	800 (1285)
Three-phase 4-wire	4	600V vinyl wire (IV wire)	14 (88)	38 (162)	150 (395)	325 (650)	—*1
		600Vcross polyethylene Isolation wire (CV wire)	8 (72)	22 (130)	150 (455)	325 (725)	600 (1005)

#### Note

(1)The thickness of the wire is different from maker.

(2)IV wire shows that an insulator.

(3) CV line is showed as airborne culvert laying and compressed stranded wire.  
(more than 600mm<sup>2</sup> cable is showed as reference value.)

\*1: Please use after confirming that it satisfies the followings.

•The using wire can penetrate the ZCT.

•Measuring part satisfies the allowable current of the wire.

## (2) Penetration type zero phase current transfer (ZCT)

Item	Specifications					
Model	ZT15B	ZT30B	ZT40B	ZT60B	ZT80B	ZT100B
Hole diameter(mm)	φ15	φ30	φ40	φ60	φ80	φ100
Maximum operating voltage	AC 600V					
Rated frequency	50/60Hz					
Rated current in short time	50kA (100kA)					
Mass	0.2kg	0.4kg	0.6kg	2.0kg	2.6kg	3.3kg

■ Hole diameter of through type zero phase current transfer (ZCT) and Maximum wire radius penetrations and allowable current

Wiring method			Maximum wire radius penetrable (mm <sup>2</sup> ) (Allowable current(A))					
Wiring	Wire number	Type of wire	ZT15B	ZT30B	ZT40B	ZT60B	ZT80B	ZT100B
Single-phase 2-wire	2	600V vinyl wire (IV wire)	14 (88)	60 (217)	150 (395)	325 (650)	600 (992)	800 (1185)
		600V cross polyethylene Isolation wire (CV wire)	2 (33)	38 (190)	60 (260)	250 (655)	400 (870)	600 (1140)
Single-phase 3-wire Three-phase 3-wire	3	600V vinyl wire (IV wire)	8 (61)	38 (162)	100 (298)	250 (556)	500 (842)	725 (1095)
		600V cross polyethylene Isolation wire (CV wire)	2 (33)	22 (135)	60 (260)	200 (560)	325 (760)	600 (1140)
Three-phase 4-wire	4	600V vinyl wire (IV wire)	8 (61)	38 (162)	100 (298)	150 (395)	325 (650)	600 (992)
		600V cross polyethylene Isolation wire (CV wire)	—	14 (105)	38 (190)	100 (365)	250 (655)	400 (870)

## Note

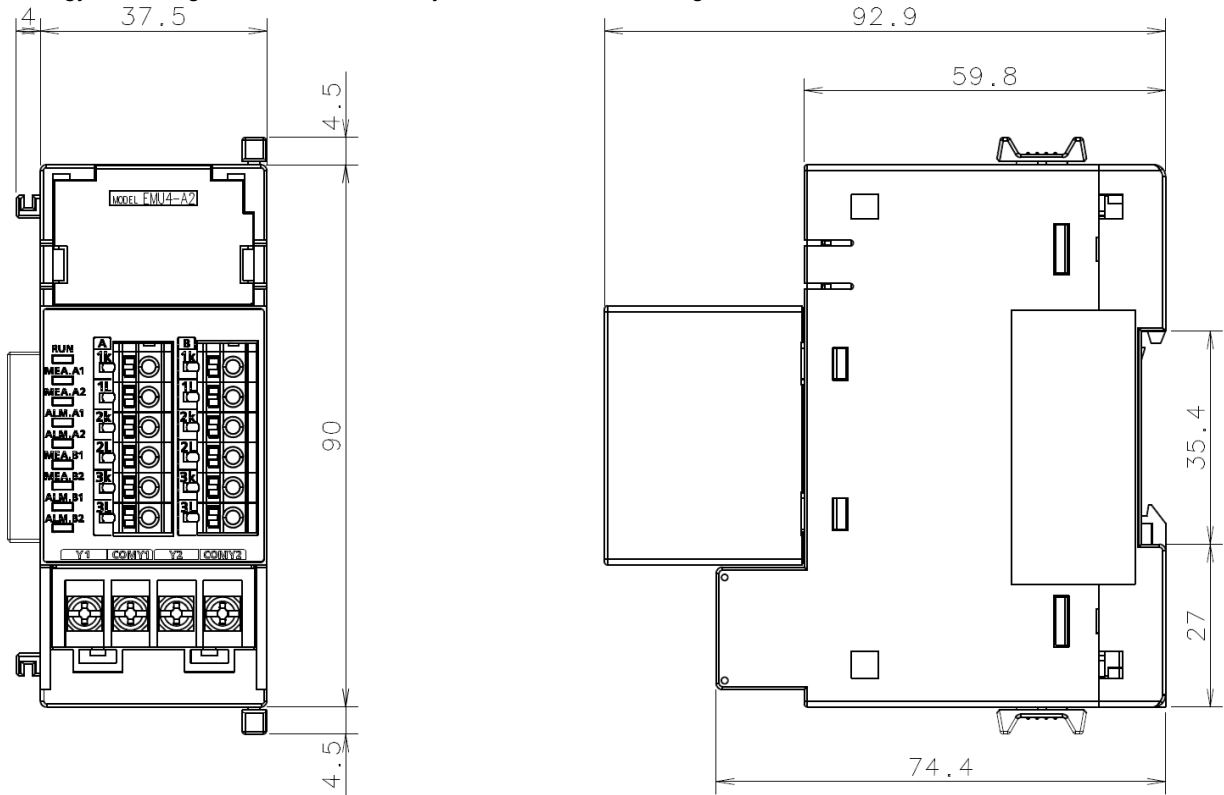
- (1) The thickness of the wire is different from maker.
- (2) IV wire shows that an insulator.
- (3) CV line is showed as airborne culvert laying and compressed stranded wire.  
(more than 600mm<sup>2</sup> cable is showed as reference value.)



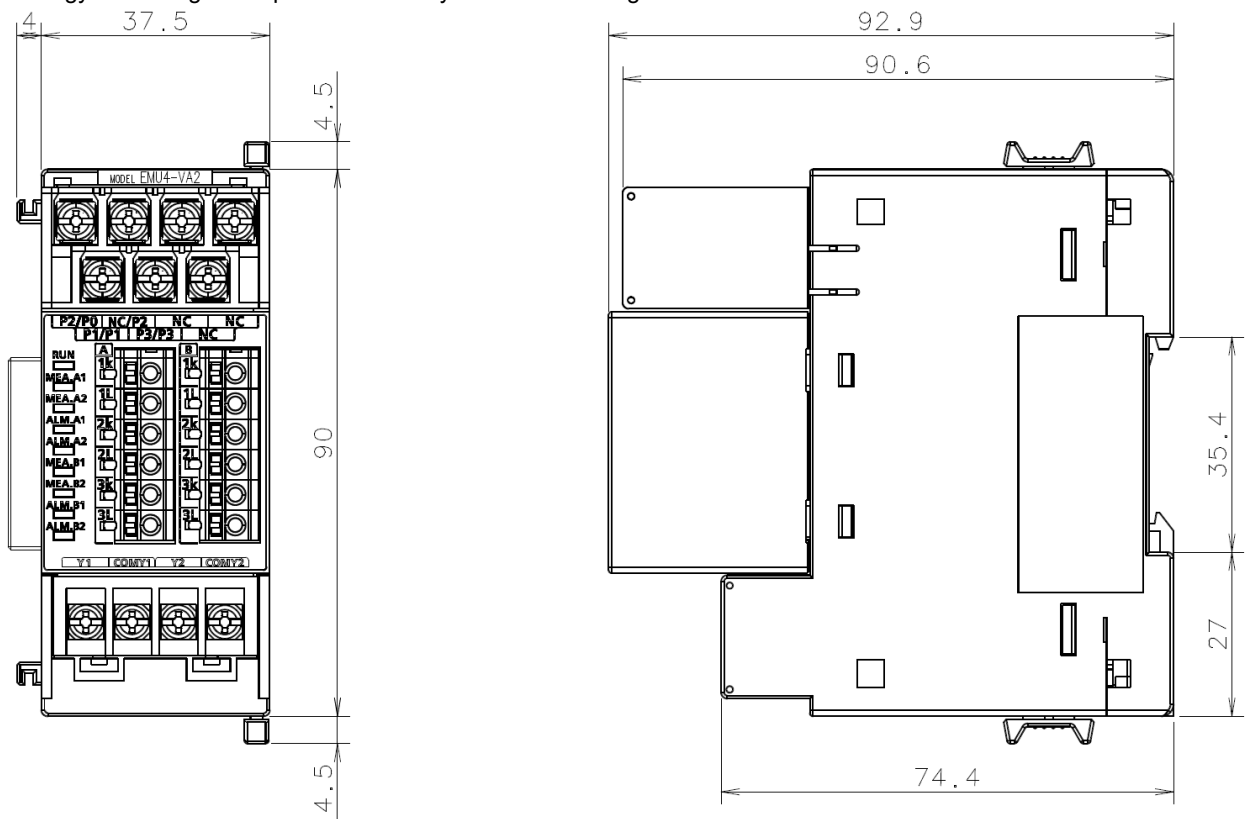
### 12.3 External dimensions of option devices

Unit: mm

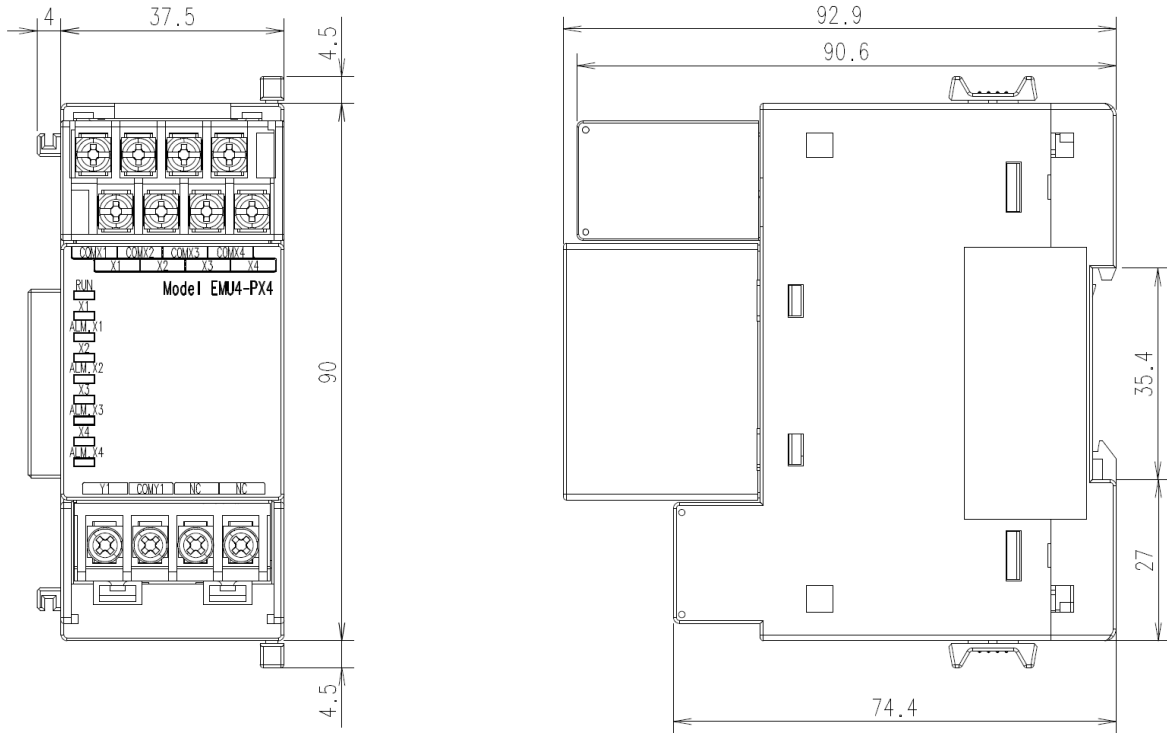
#### ■ Energy measuring unit extension for the system with the same voltage (EMU4-A2)



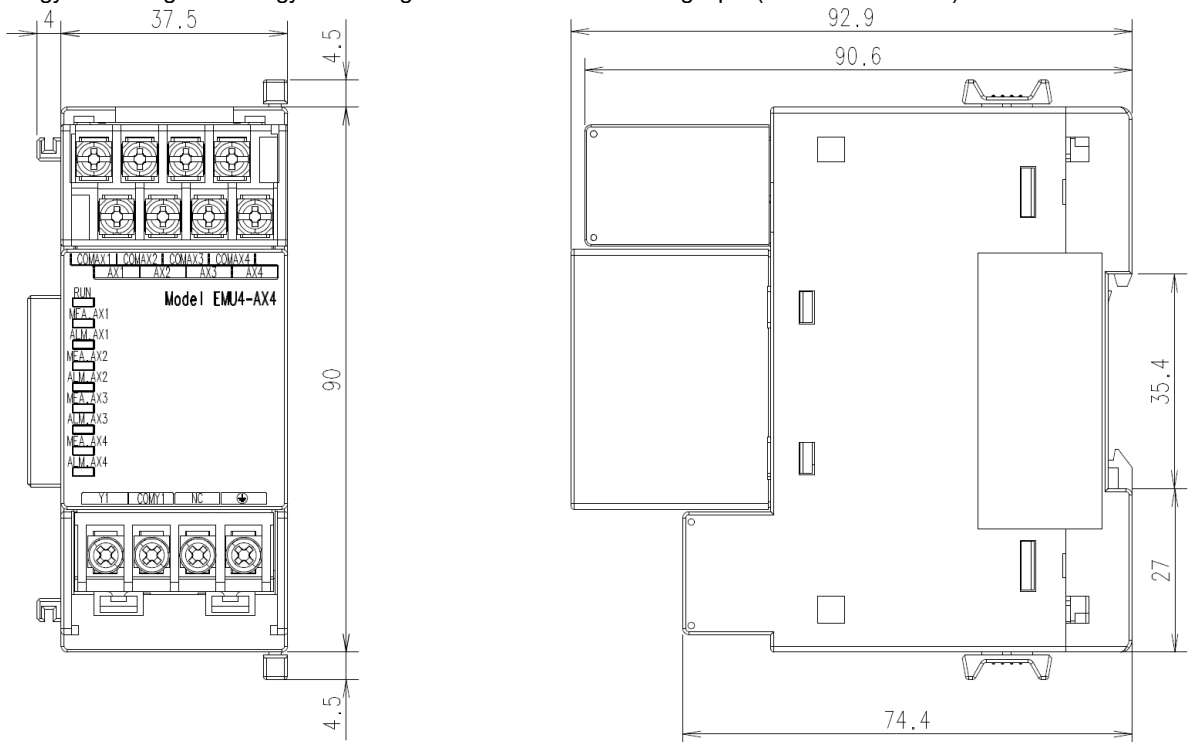
#### ■ Energy measuring unit expansion for the systems same voltage. (EMU4-VA2)



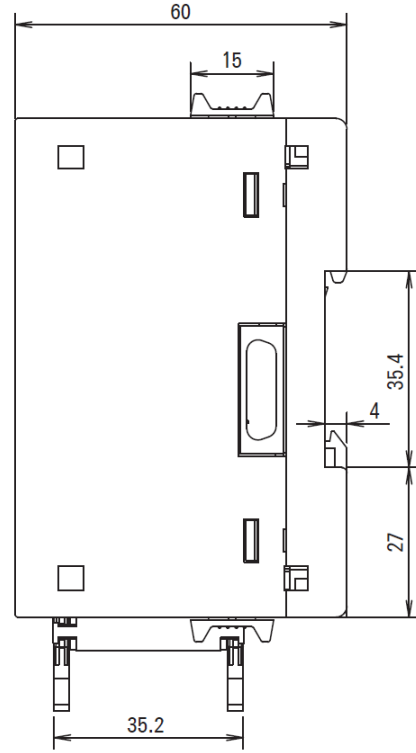
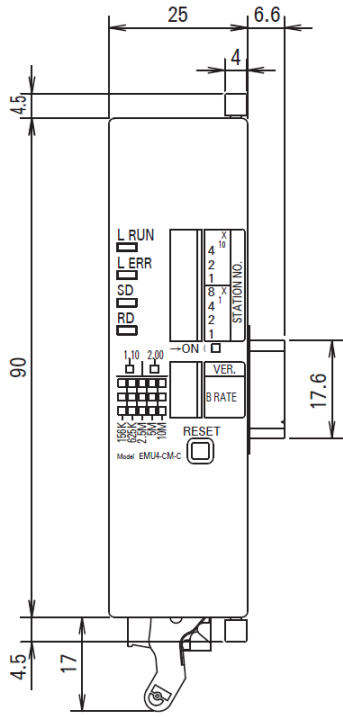
■ Energy Measuring Unit Energy Measuring Extension Model for Pulse Input (Model: EMU4-PX4)



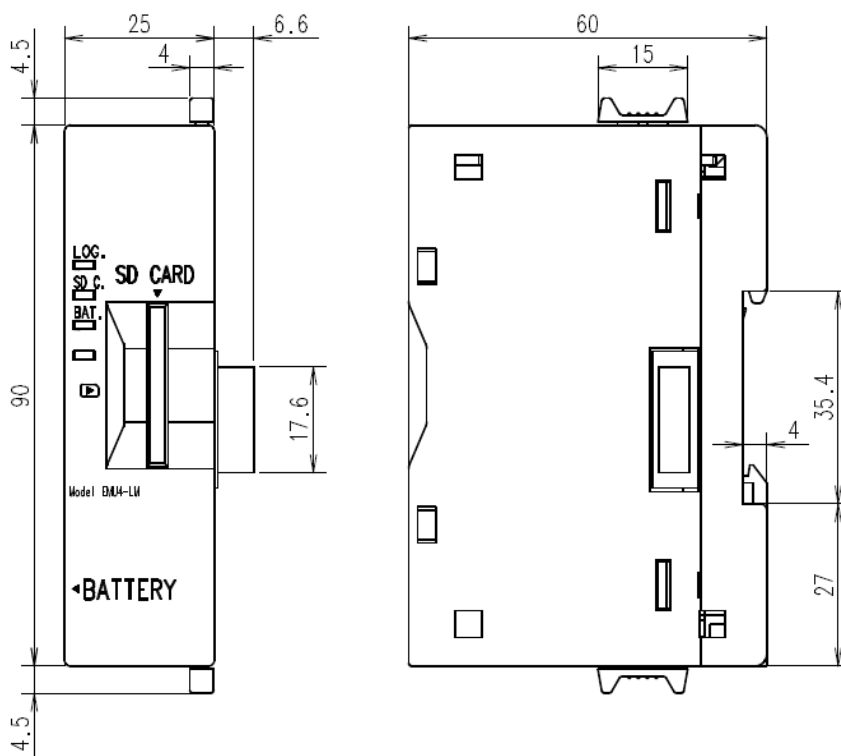
■ Energy Measuring Unit Energy Measuring Extension Model for Analog Input (Model: EMU4-AX4)



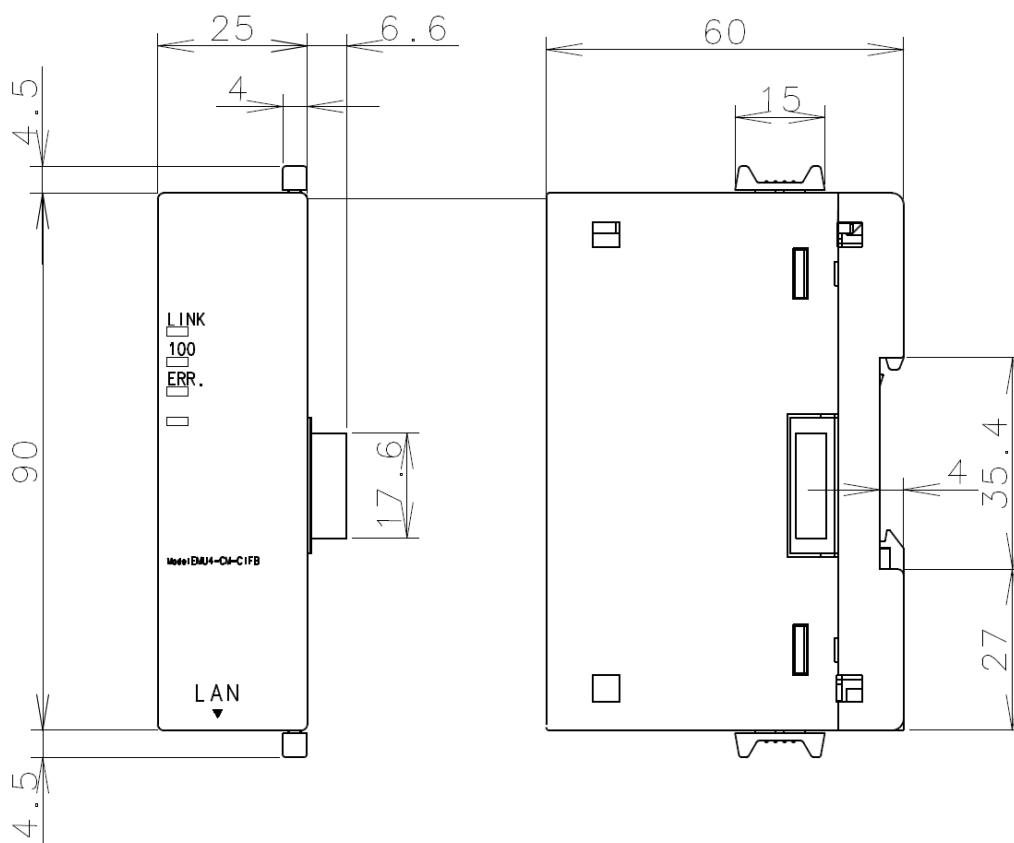
- CC-Link Communication unit (Model: EMU4-CM-C) for energy measuring unit.



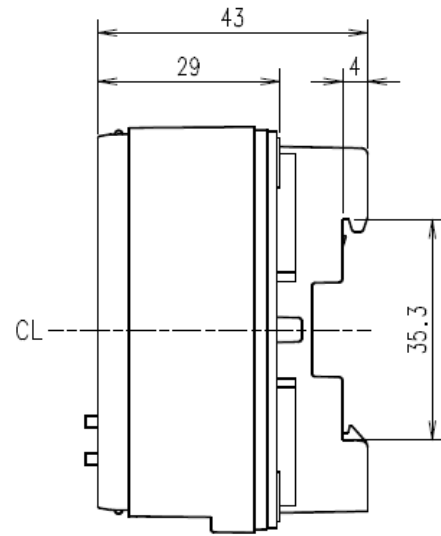
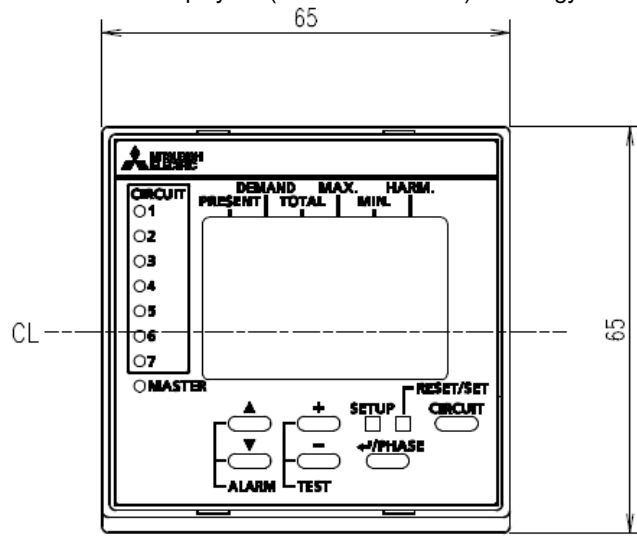
■ Logging Unit(Model: EMU4-LM) for energy measuring unit.



■ CC-Link IE Field Network Basic Communication unit (EMU4-CM-CIFB)

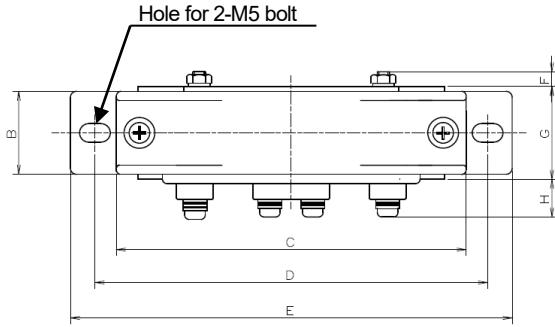


■ Small-size display unit(Model: EMU4-D65) for energy measuring unit.



■ Split type zero phase current sensor (CZ series)

CZ-22S/30S/55S/77S



CZ-112S

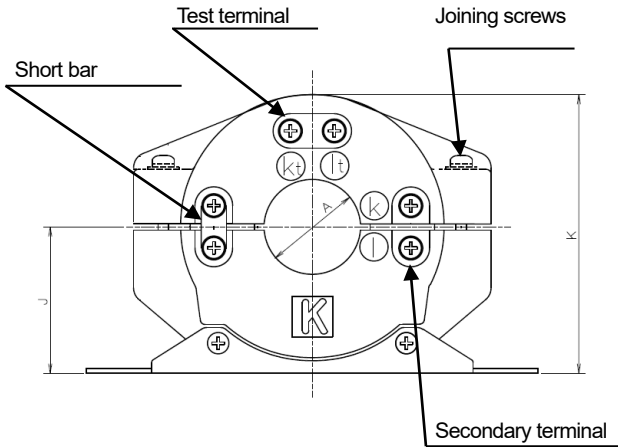
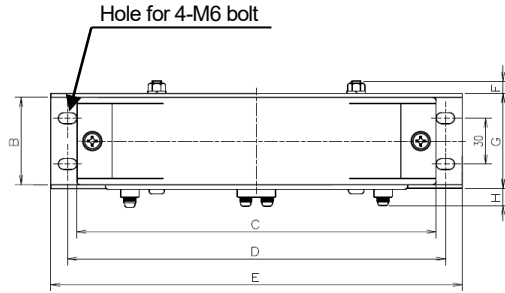


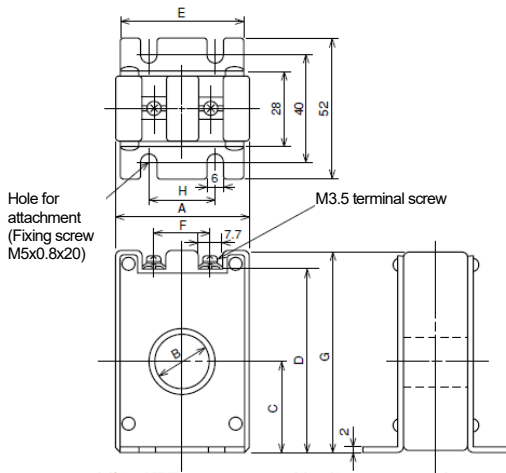
Table of dimension change

Unit (mm)

	CZ-22S	CZ-30S	CZ-55S	CZ-77S	CZ-112S
A	φ22	φ30	φ55	φ77	φ112
B	27	27	32	41	57
C	100	114	148	198	234
D	112	130	160	210	246
E	128	144	177	232	268
F	5	5	7	10	8
G	30	30	36	45	62
H	12	12	12	12	12
J	41	47	66	90	109
K	77	89	124	171	207

■ Through type zero phase current transfer (ZT series)

ZT15B, 30B, 40B models



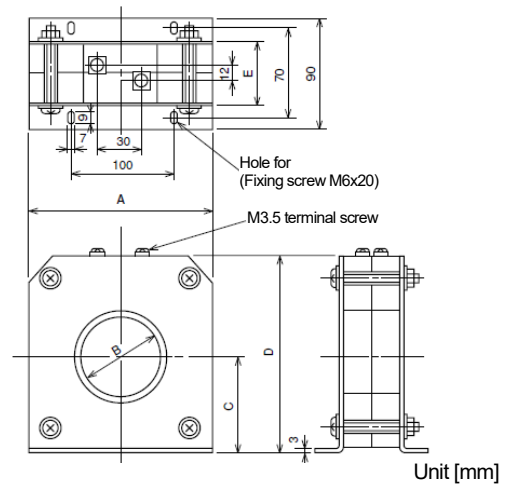
Dimension table for ZT15B, 30B, 40B models

	ZT15B	ZT30B	ZT40B
A	48	68	85
B	15	30	40
C	29	37	43
D	62	82	92
E	46	66	81
F	15	30	40
G	70	90	100
H	25	50	50

Dimension table for ZT60B, 80B, 100B models

	ZT60B	ZT80B	ZT100B
A	140	160	185
B	60	80	100
C	73	82	93
D	150	169	190
E	46	48	50

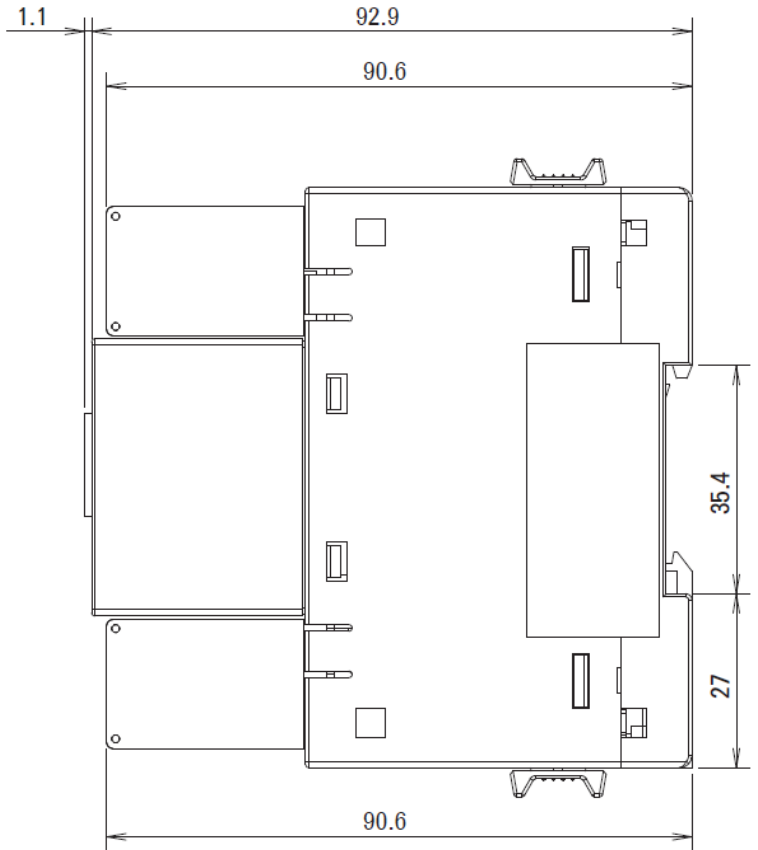
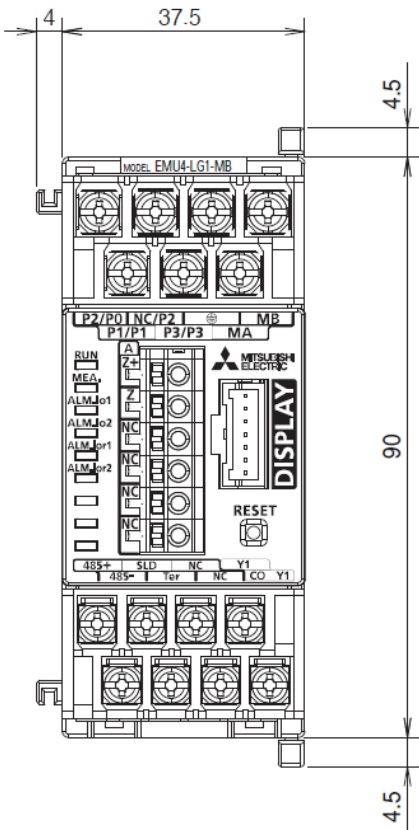
ZT60B, 80B, 100B models



### 13. External dimensions

Unit: mm

■Model : EMU4-LG1-MB



## 14. Index

<b>[A]</b>			
After-sales service .....	22		
Attaching .....	8		
<b>[C]</b>			
Connection of terminal block .....	3		
<b>[D]</b>			
Demand time .....	14		
Device operation .....	21		
Disclaimer .....	6		
Disposal precautions .....	5		
<b>[E]</b>			
Extension unit .....	29		
External dimensions .....	38		
<b>[I]</b>			
IEC rail .....	8		
Initialization .....	16		
Indication and function of LEDs .....	7		
<b>[L]</b>			
Leak current (Io) .....	17		
Leak current for resistance (Ior) .....	17		
<b>[M]</b>			
Maintenance Precautions .....	5		
Measurement .....	17		
MODBUS communication connection .....	12		
Monitoring function .....	19		
<b>[N]</b>			
Name and function of each part .....	6		
<b>[P]</b>			
Peripheral equipment .....	29		
Precautions for Operating Environment and Conditions .....	3		
Precautions for the connection wire .....	11		
Precautions for Use .....	3		
<b>[Q]</b>			
Q&A .....	23		
<b>[R]</b>			
Reference .....	22		
Reset mode .....	15,20		
Resolution of measured data .....	21		
Response time .....	24,26		
Restriction of measured data .....	21		
<b>[S]</b>			
Setting .....	14		
Storage Precautions .....	5		
Specification .....	26		
Common specification .....	26		
MODBUS communication .....	28		
Specification of option devices .....	30		
<b>[T]</b>			
Trouble shooting .....	22		
<b>[W]</b>			
Wiring .....	9		
Wiring type .....	14		
<b>[Z]</b>			
Zero phase current transformer (ZCT) .....	4,37		



# Energy Measuring Unit Insulation Monitoring Model

## Service Network

Country/Region	Corporation Name	Address	Telephone
Australia	Mitsubishi Electric Australia Pty. Ltd.	348 Victoria Road, Rydalmere, N.S.W. 2116, Australia	+61-2-9684-7777
Algeria	Mec Casa	Rue I N 125 Hay-Es-Salem, 02000, W-Chief, Algeria	+213-27798069
Bangladesh	PROGRESSIVE TRADING CORPORATION	HAQUE TOWER,2ND FLOOR,610/11,JUBILEE ROAD, CHITTAGONG, BANGLADESH	+880-31-624307
	ELECTRO MECH AUTOMATION& ENGINEERING LTD.	SHATABDI CENTER, 12TH FLOOR, SUITES : 12-B, 292, INNER CIRCULAR ROAD, FAKIRA POOL, MOTIJHEEL, DHAKA-1000, BANGLADESH	+88-02-7192826
Belarus	Tehnikon	Oktyabrskaya 19, Off. 705, BY-220030 Minsk, Belarus	+375 (0)17 / 210 46 26
Belgium	Koning & Hartman B.V.	Woluwelaan 31, BE-1800 Vilvoorde, Belgium	+32 (0)2 / 2570240
Brazil	Mitsubishi Electric do Brasil Comércio e Serviços Ltda.	Avenida Adelino Cardana, 293 – 21º Andar, Bethaville, Barueri, SP, Brasil, CEP 06401-147	+55-11-4689-3000
Cambodia	DHINIMEX CO.,LTD	#245, St. Tep Phan, Phnom Penh, Cambodia	+855-23-997-725
Central America	Automation International LLC	7050 W. Palmetto Park Road Suite #15 PMB #555, Boca Raton, FL 33433	+1-561-237-5228
Chile	Rhona S.A. (Main office)	Vte. Agua Santa 4211 Casilla 30-D (P.O. Box) Vina del Mar, Chile	+56-32-2-320-600
China	Mitsubishi Electric Automation (China) Ltd.	Mitsubishi Electric Automation Building, No.1386 Hongqiao Road, Shanghai, China 200336	+86-21-2322-3030
	Mitsubishi Electric Automation (China) Ltd. BeiJing	5/F,ONE INDIGO,20 JiuXianQiao Road Chaoyang District,Beijing, China 100016	+86-10-6518-8830
	Mitsubishi Electric Automation (China) Ltd. ShenZhen	Level 8, Galaxy World Tower B, 1 Yabao Road, Longgang District, Shenzhen, China 518129	+86-755-2399-8272
	Mitsubishi Electric Automation (China) Ltd. GuangZhou	Rm.1006, A1 Times E-Park, No.276-282, Hanxi Road East, Zhongcun Street, Panyu Distric, Guangzhou, China 510030	+86-20-8923-6730
	Mitsubishi Electric Automation (China) Ltd. ChengDu	1501-1503,15F, Guang-hua Centre Building-C, No.98 North Guang Hua 3th Rd Chengdu, China 610000	+86-28-8446-8030
Mitsubishi Electric Automation (Hong Kong) Ltd.	20/F., Cityplaza One, 1111 King's Road, Taikoo shing, Hong Kong	+852-2510-0555	
Colombia	Proelectrico Representaciones S.A.	Carrera 42 No 75 – 367 Bodega 109, Itagüí, Medellín, Antioquia, Colombia	+57-4-4441284
Czech Republic	AUTOCONT CONTROL SYSTEMS S.R.O	Technologická 374/6, CZ-708 00 Ostrava - Pustkovec	+420 595 691 150
Denmark	BEIJER ELECTRONICS A/S	LYKKEGÅRDSVEJ 17, DK-4000 ROSKILDE, Denmark	+45 (0)46 75 76 66
Egypt	Cairo Electrical Group	9, Rostom St. Garden City P.O. Box 165-11516 Maglis El-Shaab,Cairo - Egypt	+20-2-27961337
France	Mitsubishi Electric Europe B.V. French Branch	FR-92741 Nanterre Cedex	+33 (0)1 55 68 57 01
Germany	Mitsubishi Electric Europe B.V.	Mitsubishi-Electric-Platz 1, 40882 Ratingen, Germany	+49 (0) 2102 4860
Greece	KALAMARAKIS - SAPOUNAS S.A.	IONIAS & NEROMILOU STR., CHAMOMILOS ACHARNES, ATHENS, 13678 Greece	+30-2102 406000
	UTECO	5, MAVROGENOUS STR., 18542 PIRAEUS, Greece	+30-211-1206-900
Hungary	Meltrade Ltd.	Fertő utca 14. HU-1107 Budapest, Hungary	+36 (0)1-431-9726
India	Mitsubishi Electric India Private Limited	2nd Floor, Tower A&B, Cyber Greens, DLF Cyber City, DLF Phase-III, Gurgaon - 122 022 Haryana, India	+91-124-4630300
	Mitsubishi Electric India Private Limited Pune Sales Office	ICC-Devi Gaurav Technology Park, Unit no. 402, Fourth Floor, Survey no. 191-192 (P), Opp. Vallabh Nagar Bus Depot, Pune – 411018, Maharashtra, India	+91-20-68192100
	Mitsubishi Electric India Private Limited FA Center	204-209, 2nd Floor, 31FIVE, Corporate Road, Prahladnagar, Ahmedabad 380015,Gujarat, India	+91-79677-77888
Indonesia	PT.Mitsubishi Electric Indonesia	Gedung Jaya 8th floor, J.L.MH. Thamrin No.12 Jakarta Pusat 10340, Indonesia	+62-21-3192-6461
	P.T. Sahabat Indonesia	P.O.Box 5045 Kawasan Industri Perjudangan, Jakarta, Indonesia	+62-(0)21-6610651-9
Ireland	Mitsubishi Electric Europe B.V.	Westgate Business Park, Ballymount, IRL-Dublin 24, Ireland	+353 (0)1-4198800
Israel	Gino Industries Ltd.	26, Ophir Street IL-32235 Haifa, Israel	+972 (0)4-867-0656
Italy	Mitsubishi Electric Europe B.V.	Viale Colleoni 7, I-20041 Agrate Brianza (MI), Italy	+39 039-60531
Kazakhstan	Kazpromavtomatika	Ul. Zhambyla 28, KAZ - 100017 Karaganda	+7-7212-501000
Korea	Mitsubishi Electric Automation Korea Co., Ltd	9F Gangseo Hangang xi-tower A, 401 Yangcheon-ro, Gangseo-gu, Seoul 07528 Korea	+82-2-3660-9573
Laos	AROUNKIT CORPORATION IMPORT-EXPORT SOLE CO.,LTD	SAPHANMO VILLAGE. SAYSETHA DISTRICT, VIENTIANE CAPITAL, LAOS	+856-20-415899
Lebanon	Comptoir d'Electricite Generale-Liban	Cebaco Center - Block A Autostrade Dora, P.O. Box 11-2597 Beirut - Lebanon	+961-1-240445
Lithuania	Rifas UAB	Tinklu 29A, LT-5300 Panevezys, Lithuania	+370 (0)45-582-728
Malaysia	Mitrich Sdn Bhd	No. 5 Jalan Pemberita U1/49, Temasya Industrial Park, Glenmarie 40150 Shah Alam,Selangor, Malaysia	+603-5569-3748
	Flexible Automation System Sdn Bhd	60, Jalan USJ 10/1B,UEP Subang Jaya,47620 Selangor Darul Ehsan,Malaysia	+603-5633-1280
Malta	ALFATRADE LTD	99 PAOLA HILL, PAOLA PLA 1702, Malta	+356 (0)21-697-816
Marocco	SCHIELE MAROC	KM 7.2 NOUVELLE ROUTE DE RABAT AIN SEBAA, 20600 Casablanca, Marocco	+212 661 45 15 96
Myanmar	Peace Myanmar Electric Co.,Ltd.	NO137/139 Botahtaung Pagoda Road, Botahtaung Town Ship 11161,Yangon,Myanmar	+95-(0)1-202589
Nepal	Watt&Volt House	KHA 2-65, Volt House Dillibazar Post Box:2108,Kathmandu,Nepal	+977-1-4411330
Netherlands	Imtech Marine & Offshore B.V.	Sluisjesdijk 155, NL-3087 AG Rotterdam, Netherlands	+31 (0)10-487-19 11
North America	Mitsubishi Electric Automation, Inc.	500 Corporate Woods Parkway, Vernon Hills, IL 60061 USA	+847-478-2100
Norway	Scanelec AS	Leirvikasen 43B, NO-5179 Godvik, Norway	+47 (0)55-506000
Mexico	Mitsubishi Electric Automation, Inc. Mexico Branch	Blvd. Miguel de Cervantes Saavedra 301, Torre Norte Piso 5, Col. Ampliación Granada, Miguel Hidalgo, Ciudad de México, CP 11520, México	+52-55-3067-7511
Middle East Arab Countries & Cyprus	Comptoir d'Electricite Generale-International-S.A.L.	Cebaco Center - Block A Autostrade Dora P.O. Box 11-1314 Beirut - Lebanon	+961-1-240430
Pakistan	Prince Electric Co.	2-P GULBERG II, LAHORE, 54600, PAKISTAN	+92-42-575232, 5753373
Peru	Rhona S.A. (Branch office)	Avenida Argentina 2201, Cercado de Lima	+51-1-464-4459
Philippines	MELCO Factory Automation Philippines Inc.	128, Lopez Rizal St., Brgy. Highway Hills, Mandaluyong City, Metro Manila, Philippines	+63-(0)2-256-8042
	Edison Electric Integrated, Inc.	24th Fl. Galleria Corporate Center, Edsa Cr. Ortigas Ave., Quezon City Metro Manila, Philippines	+63-(0)2-634-8691
Poland	Mitsubishi Electric Europe B.V. Polish Branch	Krakowska 48, 32-083 Balice, Poland	+48 12 347 65 00
Republic of Moldova	Intehsis SRL	bld. Traian 23/1, MD-2060 Kishinev, Moldova	+373 (0)22-66-4242
Romania	Sirius Trading & Services SRL	RO-060841 Bucuresti, Sector 6 Aleea Lacul Morii Nr. 3	+40-(0)21-430-40-06
Russia	Mitsubishi Electric (Russia) LLC	2 bld.1, Letnikovskaya street, Moscow, 115114, Russia	+7 495 721-2070
Saudi Arabia	Center of Electrical Goods	Al-Shuwayer St. Side way of Salahuddin Al-Ayoubi St. P.O. Box 15955 Riyadh 11454 - Saudi Arabia	+966-1-4770149
Singapore	Mitsubishi Electric Asia Pte. Ltd.	307 Alexandra Road, Mitsubishi Electric Building, Singapore 159943	+65-6473 2308
Slovakia	PROCONT, Presov	Kupelna 17, SK - 08001 Presov, Slovakia	+421 (0)51 - 7580 611
	SIMAP	Jana Derku 1671, SK - 91101 Trenčín, Slovakia	+421 (0)32 743 04 72
Slovenia	Inea RBT d.o.o.	Stegne 11, SI-1000 Ljubljana, Slovenia	+386 (0)1-513-8116
South Africa	CBI-electric: low voltage	Private Bag 2016, ZA-1600 Isando Gauteng, South Africa	+27-(0)11-9282000
Spain	Mitsubishi Electric Europe B.V. Spanish Branch	Carretera de Rubi 76-80, E-08190 Sant Cugat del Vallés (Barcelona), Spain	+34 (0)93-565-3131
Sweden	Mitsubishi Electric Europe B.V. (Scandinavia)	Hedvig Möllers gata 6, 223 55 Lund, Sweden	+46 (0)8-625-10-00
	Euro Energy Components AB	Järnvägsgatan 36, S-434 24 Kungälv, Sweden	+46 (0)300-690040
Switzerland	TriElec AG	Muehlentalstrasse 136, CH-8201 Schaffhausen, Switzerland	+41-(0)52-6258425
Taiwan	Setsumo Enterprise Co., Ltd	5th Fl., No.105, Wu Kung 3rd, Wu-Ku Hsiang, Taipei, Taiwan, R.O.C.	+886-(0)2-2298-8889
	United Trading & Import Co., Ltd.	77/12 Bamrungmuang Road.Klong Mahanak Pomprab Bangkok Thailand	+66-223-4220-3
Thailand	MITSUBISHI ELECTRIC FACTORY AUTOMATION (THAILAND) CO.,LTD	101, True Digital Park Office, 5th Floor, Sukhumvit Road, Bangchak, Phara Khanong, Bangkok, 10260 Thailand	+662-092-8600
Tunisia	MOTRA Electric	3, Résidence Imen, Avenue des Martyrs Mourouj III, 2074 - El Mourouj III Ben Arous, Tunisia	+216-71 474 599
Turkey	Mitsubishi Electric Turkey A.Ş.	Şerifali Mahallesi Kale Sokak No: 41, 34775 Ümraniye, Istanbul, Turkey	+90-216-969-2666
United Kingdom	Mitsubishi Electric Europe B.V.	Travellers Lane, UK-Hatfield, Herts. AL10 8XB, United Kingdom	+44 (0)1707-276100
Uruguay	Fierro Vignoli S.A.	Avda. Uruguay 1274 Montevideo Uruguay	+598-2-902-0808
Vietnam	Mitsubishi Electric Vietnam Co.,Ltd. Head Office	11th & 12th Floor, Viettel Tower B, 285 Cach Mang Thang 8 Street, Ward 12, District 10, Ho Chi Minh City, Vietnam	+84-28-3910-5945
	Mitsubishi Electric Vietnam Co.,Ltd. Hanoi Branch	24th Floor, Handico Tower, Pham Hung Road, khu do thi moi Me Tri Ha, Nam Tu Liem District, Hanoi City, Vietnam	+84-24-3937-8075

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