MITSUBISHI ELECTRIC

Energy Measuring Unit

MODEL

EMU4-BD1A-MB
EMU4-HD1A-MB

User's Manual

- 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.
This manual describes mounting method and usage for energy measuring unit EcoMonitorLight (Model: EMU4-BD1A-MB, EMU4-HD1A-MB).
Before using the product, please read this manual carefully 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.

Disclaimer	This unit cannot be used for deal and proof of electric energy measurement stipulated in the measurement law.

■Related materials
Related material as follows. Read them together as necessary.

Related materials	Ref. No.	Summary
About this product		
Before using the instrument	IB63G63	Provides a concise explanation of how to handle the product. Included with the instrument.
Abou related option units		
B/NET Communication Unit for Energy Measuring Unit User's Manual	IB63792	Describes how to handle the B/NET communication unit of the energy measuring unit.
CC-Link Communication Unit for Energy Measuring Unit User's Manual	IB63791	Describes how to handle the CC-Link communication unit for the energy measuring unit.
CC-Link IE Field Network Basic Communication Unit for Energy Measuring Unit User's Manual	IB63E27	Describes how to use the CC-Link IE Field Network Basic communication unit for the energy measuring unit.
Logging Unit for Energy Measuring Unit User's Manual	IB63780	Describes in detail how to handle the logging unit for the energy measuring unit.
About a sequencer ladder program		
Energy Measuring Unit Programming Manual (B/NET transmission sequencer I/F unit edition)	LAN030518	Describes the communication specifications and message specifications when using B/NET communication.
Energy Measuring Unit Programming Manual (CC-Link edition) for ver.1 remote device station	LEN160305	Describes the communication specifications and message specifications when using CC-Link Ver.1 communication.
Energy Measuring Unit Programming Manual (CC-Link edition) for ver.2 remote device station	LEN130271	Describes the communication specifications and message specifications when using CC-Link Ver.2 communication.
Energy Measuring Unit Programming Manual (CC-Link IE Field Network Basic edition) (SLMP edition)	LEN180123	Describes the communication specifications and message specifications when using CC-Link IE Field Network Basic communication.
Energy Measuring Unit EcoMonitorLight/EcoMonitorPlus Series MODBUS I/F Specification	LSPY-9025	Describes the communication specifications and message specifications when using MODBUS RTU communication.
About construction		
B/NET Design Construction Manual (Transmission edition)	IB63308	Describes how to install and construct B/NET communication equipment.

■Explanation of terms

This instruction manual uses the following terms.

Terms	Description
CT	Refers to the current transformer. *"CT" is also included in the model's name and phase wire system of split-type current sensors. Please be careful not to make a mistake.
Current sensor	This is a sensor that senses current. You must use a dedicated current sensor.
VT	Refers to the voltage transformer for instrument.
Three-phase 3-wire system	Refers to both three-phase 3-wire system (2CT) and three-phase 3-wire system (3CT).
Three-phase 3-wire system (2CT)	This is a method to measure the circuit by attaching split type current sensors to the 1st and 3rd phases of the three-phase 3-wire system. Find the 2nd phase current with vector math.
Three-phase 3-wire system (3CT)	This method measures the circuit by attaching a split current sensor to each phase of a three-phase, 3-wire system. Measure the 2nd phase current with a split current sensor.
2 circuit measurement	This is a function that can measure two circuits only when used in a single-phase 2-wire system. Single-phase two-wire system between 1-N and single-phase 2-wire system between 3-N branched from single-phase 3-wire system can be measured. (For details, refer to "9.1.3 2-circuit measurement function".)
Simple measurement	This function enables simple power measurement without voltage input. Calculates each measurement element using the fixed values (set values) of voltage and power factor and the input current value. (For details, refer to "9.1.4 Simple measurement function".)
Upper / lower limit alarm	Monitors the upper limit and lower limit of measured values. If the measured value exceeds the upper limit alarm value or falls below the lower limit alarm value, an alarm will be occurred. (For details, refer to "9.3.1 Upper / lower limit alarm function".)
Waveform band monitoring	When measuring the load current of the equipment that repeats the same operation, the load current of each operations a function to detect equipment abnormalities by monitoring the current waveform by using the same value and waveform. (For details, refer to "9.3.2 Waveform band monitoring".)
B/NET	Mitsubishi power distribution control network B/NET is an abbreviation for base network, and is a network developed as a field network for our power distribution control equipment.
CC-Link	This is an FA network that uses dedicated cables. Use a linked device to communicate data regularly (cyclic transmission) between the master station and the slave station.
CC-Link IE Field Network Basic	This is an FA network that utilizes general-purpose Ethernet. Use a linked device to communicate data regularly (cyclic transmission) between the master station and the slave station.

Features

【EMU4-BD1A-MB】

- This energy measuring unit can measure various types of electric quantity such as voltage, current, electric power and electric energy.
- MODBUS RTU communication function (built-in) and various types of communication via an optional unit (sold separately) allow measurement data to be transmitted to a superior monitoring system, etc.
- The measurement setting support function automatically determines the setting value (phase wire system, primary voltage) of this unit from the input voltage, contributing to reduction of setting man-hours and prevention of setting errors.
- The simple measurement function enables simple power measurement without voltage input.

【EMU4-HD1A-MB】

- This energy measuring unit can measure various types of electric quantity such as voltage, current, electric power and electric energy.
- MODBUS RTU communication function (built-in) and various types of communication via an optional unit (sold separately) allow measurement data to be transmitted to a superior monitoring system, etc.
- The measurement setting support function automatically determines the setting value (phase wire system, primary voltage) of this unit from the input voltage, contributing to reduction of setting man-hours and prevention of setting errors.
- The simple measurement function enables simple power measurement without voltage input.
- The unit has one external input and one external output, each of which can be switched between pulse input/output and contact input/output. 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 facilities or the operating power.
- The waveform band monitoring function allows you to monitor the normal/abnormal status of equipment that repeats the same operation.

Table of Content

1. Precautions for Use

In this instruction manual, the following safety alert symbols are used in the following meanings.

Symbol	Content
⚠ DANGER	Indicates that incorrect handling occurs hazardous conditions, resulting in death or severe injury.
⚠ WARNING	Indicates that incorrect handling may cause hazardous conditions, resulting in Severe injury.
⚠ CAUTION	Indicates that incorrect handling may cause in personal injury.
NOTICE	Indicates that incorrect handling may cause in damage machines.

Even the items listed in "⚠ CAUTION" and "NOTICE" may have serious consequences depending on the situation.

1.1 Precautions for Operating Environment and Conditions

- Do not use this product in the places listed below. Failure to follow the instruction may cause malfunctions and a life decreases of product.
  - ・Places the Ambient temperature exceeds the range -5℃ to +55℃.
  - ・Places the average daily temperature exceeds +35℃
  - ・Places the Relative humidity exceeds the range 30% to 85% or places with dewfall.
  - ・Dirt, corrosive gas(Note), saline and oil smoke exist.
    (Note) Gas that attacks metals and plastics (Such as sulfur dioxide, ammonia, hydrogen sulfide).
  - ・Vibration and impact exceed the specifications.
  - ・Places exposed to rain or water drop.
  - ・Places exposed to direct sunlight.
  - ・Place exposed to strong induction noises, electric fields, magnetic fields.
  - ・Places exposed to large amounts of external noise.
  - ・Altitude exceeds 2000 m.
  - ・Places metal fragments or conductive substance are flying.

- Over voltage category of measuring circuit in this unit is CAT III (Note), and that of auxiliary power circuit is overvoltage category III (Note).
- This unit is premised on being used in pollution degree 2 (Note) environment. When used in higher pollution degree, protect this unit from pollution on another device side to be incorporated.
- For notes on when to adapt the equipment that you have configured in this equipment to the EMC Directive, please refer to "11. Requirement for the compliance with EMC Directives".

(Note) For the definition of the pollution degree and the over voltage category, refer to EN 61010-1.

⚠ CAUTION	●Any person who is involved should be fully competent to do this work. ●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) ●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. ・Shut off power supply automatically by opening the panel. ・Use a control panel of IP2X or higher to protect against electric shock.

1.2 Installation and Wiring Precautions

⚠ DANGER	Do not touch the live part such as the connection terminal while it is energized. Failure to do so may cause electric shock, a fire, a failure etc.

⚠ WARNING	●Work under the electric outage condition. Do not do hot-line work. Failure to do so may cause electric shock, a fire, a failure etc. ●Check the Wiring Diagram carefully before making any connections. Failure to do so may cause electric shock, a fire, a failure etc. ●Make sure that the circuit to be connected to this equipment is within the Rating. If used outside the rating, it may cause electric shock, a fire, a failure etc. ●Strip the wires with proper length. Overlong stripping length may cause short to next wire. Shorter stripping length may cause contact failure. ●After wiring, confirm whether there is a wiring forgetting or a faulty wiring. Failure to do so may cause electric shock, a fire, a failure etc. ●Use only wires and solderless terminals that conform to the applicable requirements. Use of inappropriate wires or solderless terminals may cause electric shock, a fire, a malfunction etc. ●Do not use spade solderless terminals. If the screws become loose, they may fall off, and cause electric shock, a fire, a failure etc. ●Tighten the crimp terminal after confirming that there is no dirt, foreign matter, plating peeling, deformation, etc. on the contact surface. It may cause overheating or fire. ●After tightening the screws, be sure to check all the screws tightened. Loose screw may cause electric shock, a fire, a failure etc. ●Be sure to ground the protective conductor terminal to use. The ground resistance is 100 Ω or less. ●Be sure to attach the terminal cover after installation and connection. ●Connect an overcurrent protection device (fuse, circuit breaker, etc.) to the voltage input terminal and auxiliary power supply terminal. ●Do not input voltage and current at NC terminals. Doing so can cause failure or malfunction of the unit. ●This product make sure to use it in combination with the dedicated current sensor. ●This product cannot connect with the secondary side (5 A) of current transformer. ●The dedicated current sensor (EMU-CT***, EMU-CT***-A) is used only for low voltage circuit. If it connects to a high voltage circuit by mistake, it may cause a burnout of the device and a fire. When measuring a high-voltage circuit, connect the EMU2-CT5, EMU2-CT5-4W and EMU-CT5-A to the secondary side (5 A) of the current transformer. ●Do not open the secondary terminals of the split type current sensor.

⚠ CAUTION	●Any person who is involved in the installation and the wiring of this unit should be fully competent to do this work. ●Take care not to entering any foreign objects such as chips and wire pieces into this unit. Failure to do so may cause electric shock, a failure of the unit, a fire etc. ●In order to prevent short circuits and ground faults caused by falling metal pieces, cover exposed charging parts with taping or insulating tubes. ●Do not touch the conductive parts or electronic parts of this unit directly. It may cause an electric shock accident, injury, equipment failure or malfunction. ●Do not pull on the wire while it is connected to this device. It may cause equipment failure or malfunction. Also, if you pull it too hard, it may cause electric shock or fire due to damage to the wire.

<table>
<tr><td>NOTICE</td><td>
●Do not damage the outer circumference of the device. If there is damage on the outer circumference or terminals, the accuracy may be lost, and the life may be shortened due to the influence of dust, etc. Please handle with care.
●Do not apply a strong impact to the liquid crystal display. Doing so may cause damage.
●When using stranded wire, please use it after twisting the tip so that the thin wire does not come apart.
●Do not solder the ends of the wires used. The screws may loosen over time.
●Tighten the screw within the specified torque. Under tightening can cause drop, short circuit or malfunction. Over tightening can damage the screw.
●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.
●Lay the cable to be connected to the instrument indoors. However, some communication standards permit outdoor wiring. In that case, follow the communication standards.
●For protection against noise, all wires shall not be placed close to or bound together with the power lines and high-voltage lines. If there is concern about the influence of noise even if the distance is as follows, we recommend using a shielded cable.
<table>
<tr><th>Condition</th><th>Distance</th></tr>
<tr><td>High-voltage line 600 V or less</td><td>300 mm or more</td></tr>
<tr><td>Other high-voltage line</td><td>600 mm or more</td></tr>
</table>
●The split type current sensor has a polarity (directionality). Be careful about it when installing the unit. (K: power source side, L: load side)
●The maximum wire wiring length for the split type current sensor is as follows. EMU-C***, EMU-CT***-A are extendable up to 50 m. EMU2-CT5, EMU2-CT5-4W are extendable up to 11 m (using together with the extension cable).
●Do not ground the secondary side of the current sensor.
●Up to two wires can be connected to one terminal of the screw terminal block. If three or more are connected, the meshing may become weak and may come off.
●Only one wire should be connected to one terminal of the spring clamp terminal block. If you connect two or more, the engagement may become weak and may come off.
</td></tr>
</table>

1.3 Matters concerning the precaution before use

⚠DANGER	Do not touch the live part such as the connection terminal while it is energized. Failure to do so may cause electric shock, a fire, a failure etc.

⚠WARNING	Make sure that the circuit to be connected to this equipment is within the rating. If used outside the rating, it may cause electric shock, a fire, a failure etc.

⚠CAUTION	●Any person who is involved should be fully competent to do this work. ●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. ●Shut off the external power supply for the unit in all phases before installing and removal. Failure to do so may cause an electric shock or damage of this unit.

NOTICE	●Do not apply a strong impact to the liquid crystal display. Doing so may cause damage. ●The setting of this unit is necessary before use it. If the setting is wrong, it will not work properly. (Note) For the setting method, refer to “8. Setting method” in this manual. ●In the event of a power outage during the setting, the unit is not set correctly. Please set again after power recovery. ●Do not exceed the specified voltage when doing an insulation resistance test and a withstand voltage test.

1.4 Precautions for Use

⚠ DANGER	●Do not disassemble or modify this unit. It may cause electric shock, a fire, a failure, a malfunction etc. ●Do not touch the live part such as the connection terminal while it is energized. It may cause electric shock, a fire, a failure, a malfunction etc. ●If the voltage applied to the instrument drops below approximately 40V, the display will disappear, but do not touch the terminals or circuits as voltage may be applied. It may cause electric shock, a fire, a failure, a malfunction etc.

⚠ WARNING	Make sure that the circuit to be connected to this equipment is within the Rating. If used outside the rating, it may cause electric shock, a fire, a failure etc.

⚠ CAUTION	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.

NOTICE	●Push the switch with an appropriate force. ●Do not apply a strong impact to the liquid crystal display. Doing so may cause damage.

1.5 Precautions for case of failure or abnormality

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.
Please refer to ”16.1 Troubleshooting” for information on how to easily identify failures and how to deal with them yourself.

⚠ DANGER	Do not touch the live part such as the connection terminal while it is energized. It may cause electric shock, a fire, a failure, a malfunction etc.

⚠ WARNING	If an abnormal sound, bad-smelling smoke, fever break out from this unit, switch it off promptly and do not use it.

1.6 Maintenance Precautions

Please refer to “15 Maintenance” for the maintenance details.

⚠ DANGER	Do not touch the live part such as the connection terminal while it is energized. It may cause electric shock, a fire, a failure, a malfunction etc.

⚠ WARNING	Work under the electric outage condition. Do not do hot-line work. Failure to do so may cause electric shock, a fire, a failure etc.

⚠ CAUTION	Any person who is involved should be fully competent to do this work.

1.7 Storage Precautions

●Please refer to "14. Storage" about storage.
●For long-time storage, avoid the following places.
- Places the Ambient temperature exceeds the range -10℃ to +60˚C.
- Places the average daily temperature exceeds +35˚C.
- Places the Relative humidity exceeds the range 30% to 85% or places with dewfall.
- Dirt, corrosive gas (Note), saline and oil smoke exist.
  (Note) Gas that attacks metals and plastics (Such as sulfur dioxide, ammonia, hydrogen sulfide)
- Vibration and impact exceed the specifications.
- Places exposed to rain or water drop.
- Places exposed to direct sunlight.
- Place exposed to strong induction noises, electric fields, magnetic fields.
- Places metal fragments or conductive substance are flying.

⚠ DANGER	●Do not touch the live part such as the connection terminal while it is energized. It may cause electric shock, a fire, a failure, a malfunction etc.

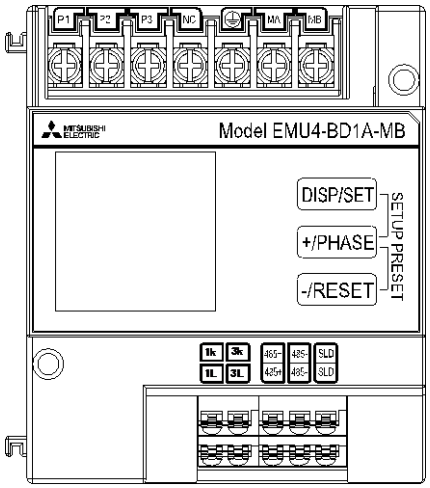
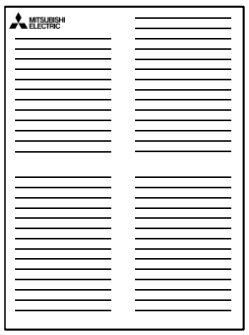
⚠ WARNING	●Work under the electric outage condition. Do not do hot-line work. Failure to do so may cause electric shock, a fire, a failure etc.

1.8 Disposal Precautions

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

2. Name and quantity of package contents

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

Item	Quantity	Specifications
Main unit	1	 This image is EMU4-BD1A-MB.
Before using the instrument	1	

3. Option devices

Option devices of this unit are showed below.

(1) Option unit

Product name	Model	Sales unit	with UL	Note
B/NET Communication Unit for Energy Measuring Unit	EMU4-CM-B	1	–	You can use B/NET communication by connecting main unit.
CC-Link Communication Unit for Energy Measuring Unit	EMU4-CM-C	1	○	You can use CC-Link communication by connecting main unit.
Logging Unit for Energy Measuring Unit	EMU4-LM	1	○	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	1	○	You can use CC-Link IE Field Network Basic communication by connecting main unit.

(2) Option

①Option for Energy Measuring Unit

Product name	Model	Sales unit	with UL	Note
Attachment for panel mounting	EMU4-PAT	1	○	This attachment is used when mounting the instrument on the panel.

②Option for Logging Unit

Product name	Model	Sales unit	with UL	Note
SD Memory Card for Logging Unit	EMU4-SD2GB	1	○	This is an SD memory card used in the logging unit.
Lithium battery for Energy Measuring Unit	EMU4-BT	1	○	By connecting to the logging unit, it will keep timekeeping operation and logging data in case of power failure.。

(3) Accessory
①Split type current sensor

Product name	Model	Sales unit	with UL	Note
Split type current sensor (Connection with general wire type)	EMU-CT5-A	1	–	Connect to this unit for general wire.
	EMU-CT50-A	1	–	
	EMU-CT100-A	1	–	
	EMU-CT250-A	1	–	
	EMU-CT400-A	1	○	
	EMU-CT600-A	1	○	
	EMU-CT50	1	○	
	EMU-CT100	1	○	
	EMU-CT250	1	○	
Split type current sensor (Connection with dedicated cable type)	EMU2-CT5	1	○	Connect to this unit for dedicated cable. Single-phase 2-wire, single-phase 3-wire, three-phase 3-wire(2CT) system only.
	EMU2-CT5-4W	1	○	Connect to this unit for dedicated cable. Three-phase 3-wire(3CT), three-phase 4-wire system only.

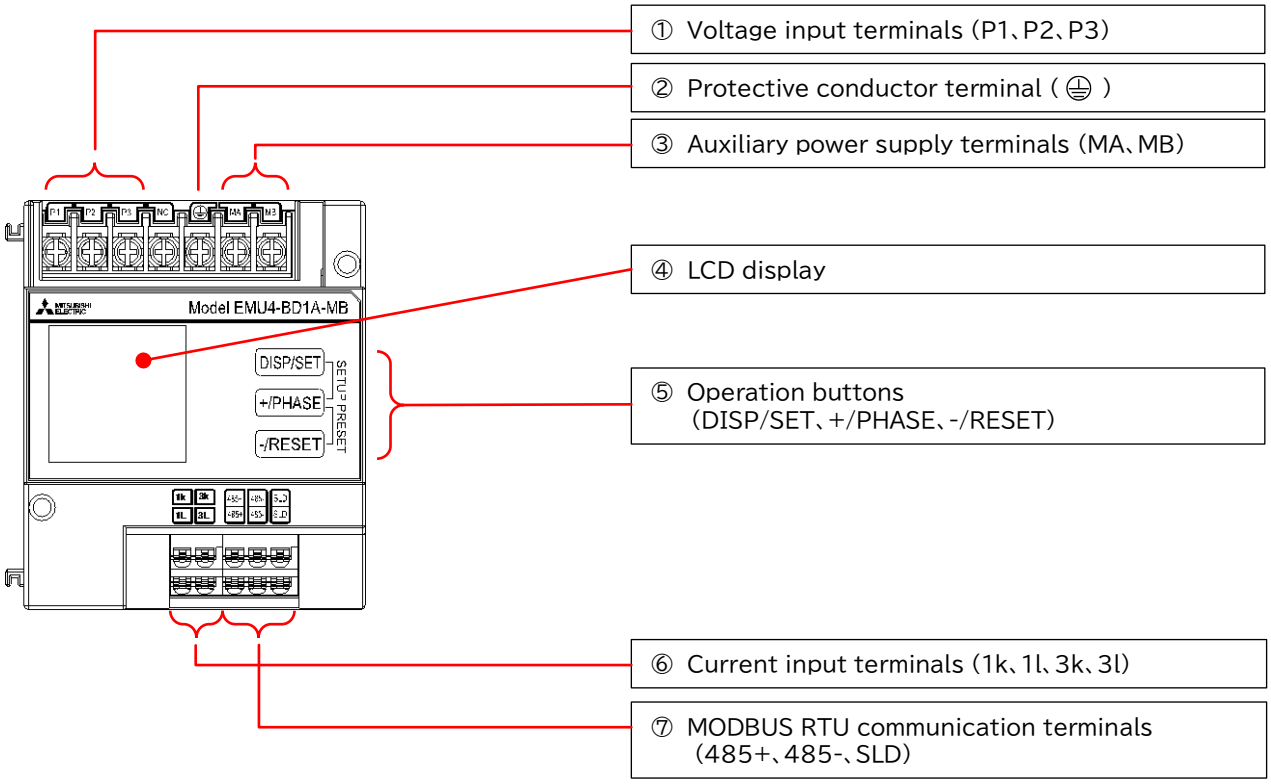
②Dedicated cable
Using together with Split type current sensor (dedicated cable type).

Product name	Model	Sales unit	with UL	Note
Split type 5A current sensor cable	EMU2-CB-Q5A	1	○	Connect the EMU2-CT5 and the current input terminal of the instrument.
	EMU2-CB-Q5A-4W	1	○	Connect the EMU2-CT5-4W and the current input terminal of the instrument.
Extension cable (Standard type)	EMU2-CB-T1M	1	○	Used to extend the connection distance between the split type current sensor (cable type) and this instrument.
	EMU2-CB-T5M	1	○	
	EMU2-CB-T10M	1	○	
Extension cable (Separate type)	EMU2-CB-T1MS	1	○	Used to extend the connection distance between the EMU2-CT5-4W and this instrument.
	EMU2-CB-T5MS	1	○	
	EMU2-CB-T10MS	1	○	

4. Name and function of each part

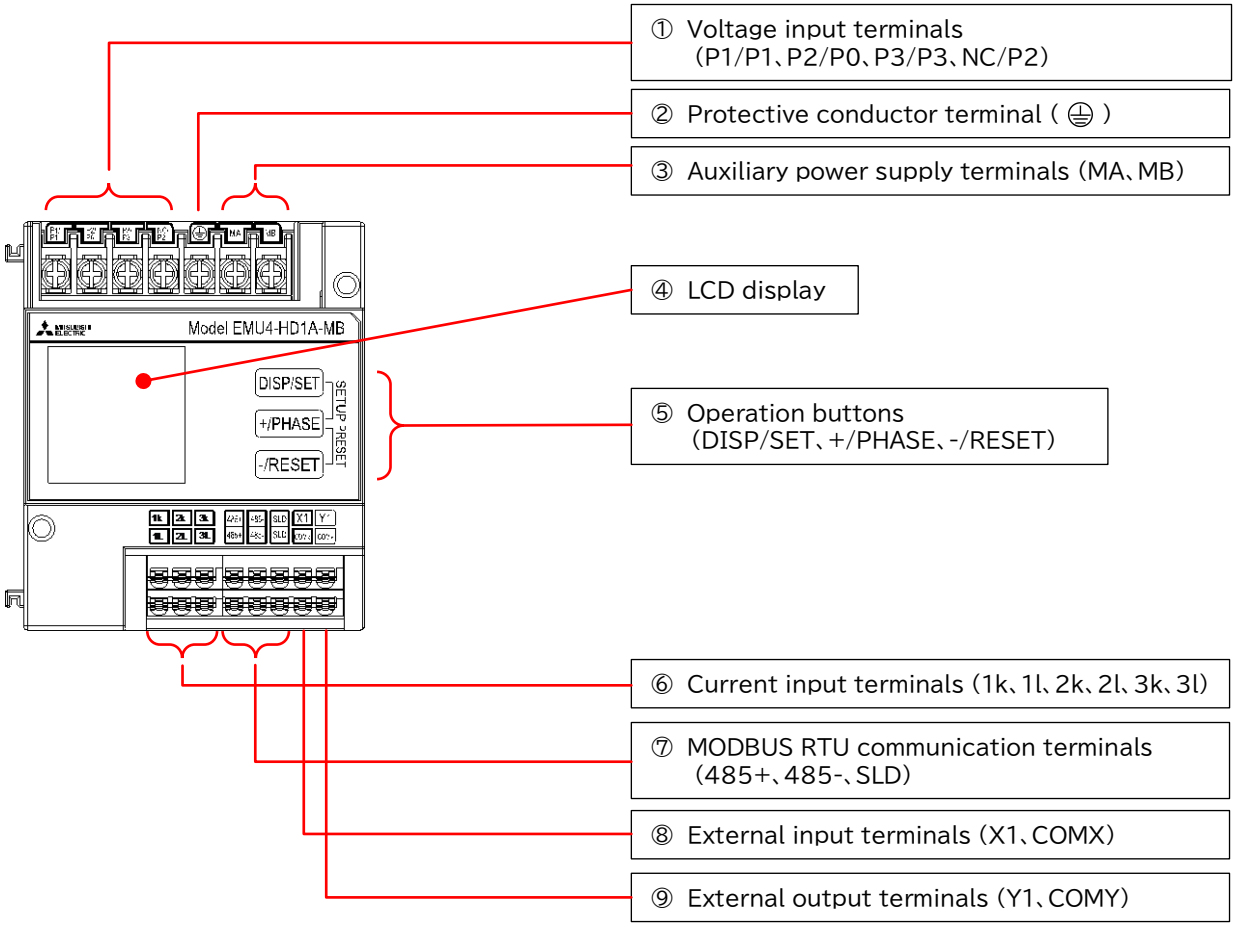
4.1 Name of each part

Front view (Model:EMU4-BD1A-MB)



Name of each part	Function
① Voltage input terminals	Connect the voltage input wire for the measuring circuit.
② Protective conductor terminal	Connect to ground (D type ground).
③ Auxiliary power supply terminals	Connect the power supply voltage line for operating the main unit.
④ LCD display	Displays measured values, element information, and operating status (Communication, weighing, settings). Refer to "4.2 Functions of LCD".
⑤ Operation buttons	Various settings and display switching during operation are performed. Refer to "4.3 Operation buttons".
⑥ Current input terminals	Connect the secondary output of the dedicated current sensor connected to the measurement circuit's current wire.
⑦ MODBUS RTU communication terminals	Connect the communication wire (MODBUS RTU).

Front view (Model:EMU4-HD1A-MB)



Name of each part	Function
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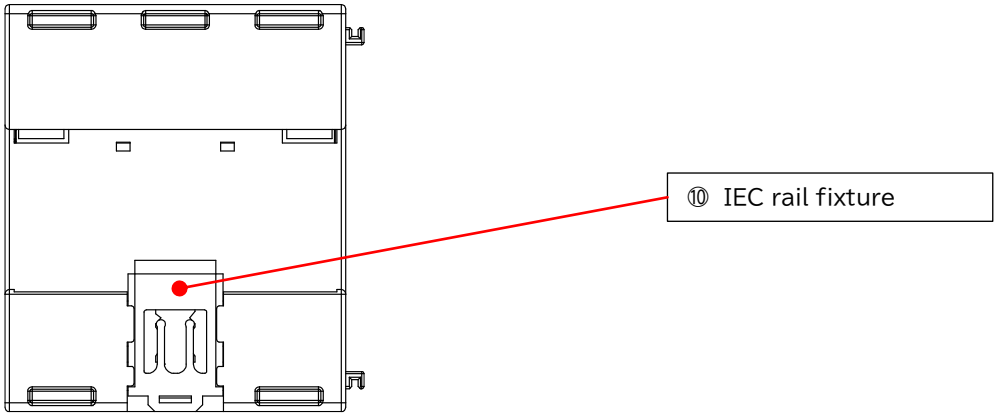
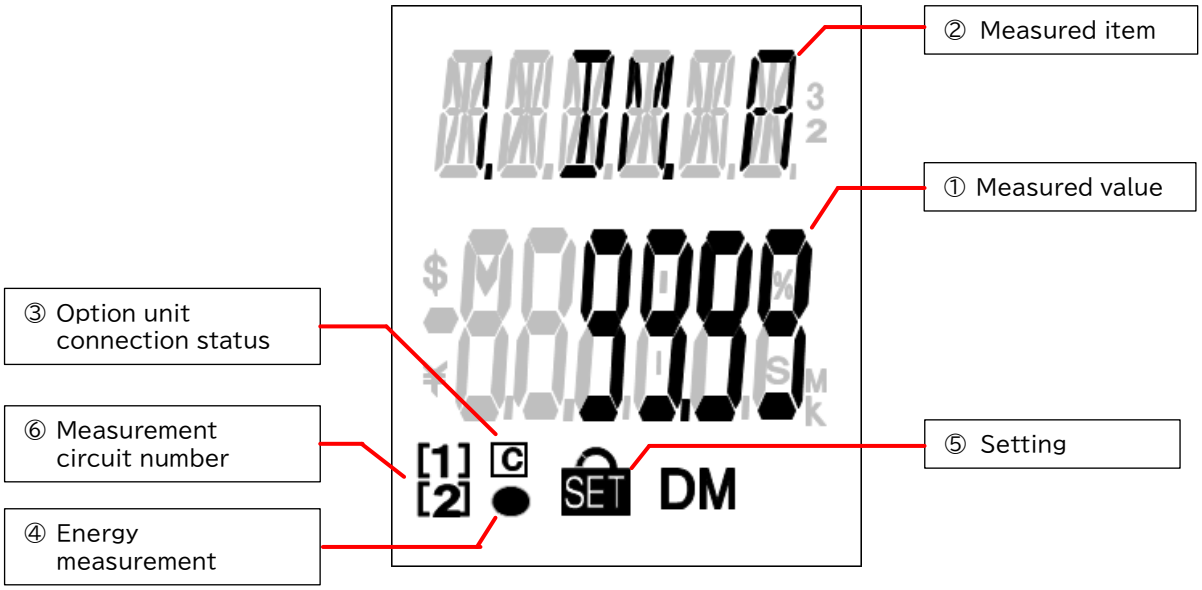
④ LCD display	Displays measured values, element information, and operating status (Communication, weighing, settings). Refer to “4.2 Functions of LCD”.
⑤ Operation buttons	Various settings and display switching during operation are performed. Refer to “4.3 Operation buttons”.
⑥ Current input terminals	Connect the secondary output of the dedicated current sensor connected to the measurement circuit’s current wire.
⑦ MODBUS RTU communication terminals	Connect the communication wire (MODBUS RTU).
⑧ External input terminals	Connect pulse / contact input wires.
⑨ External output terminals	Connect pulse / contact output wires.

Back view (Model：EMU4-BD1A-MB, Model：EMU4-HD1A-MB Common regardless of model.)



Name of each part	Function
⑩ IEC rail fixture	Fixing the device to the IEC rail.

4.2 Functions of LCD



Indicator	Description
① Measured value	Display measured values in digital numbers.
② Measured item	Display measuring elements expressed in digital numbers.
③ Option unit connection status	Light when connecting optional device.
④ Energy Measurement	Light when measuring electric energy (incoming). (Light off: Not measuring, Lighting: Measuring)
⑤ Setting	Indicator SET light up in the setting mode. Indicator SET light up in the confirmation mode.
⑥ Measurement circuit number	Represent circuit number. (Note) Two circuits measuring mode only.

4.3 Operation buttons

Operation buttons have many functions as below.
For details, refer to each chapter.
Meaning of symbols:
○(Press), □(Press more than 1 sec.), ◎(Press more than 2 sec.), —(Press both at the same time)

Mode \ Operation		Name of Button			Event
		DISP/SET	+/PHASE	-/RESET	
Operating mode		○			Switch the measurement screen.
			○		Switch phase screen.
				○	Switch harmonics order. (In the harmonics screen only)
				◎	Clear alarm. (At alarm keeping.)
		◎			Enter the confirmation mode.
		◎	◎		Enter the setting mode.
	Contact display			◎	Clear contact latch. (When the contact input reset status is latched.)
	Integrated value display		◎	◎	Transition to preset display.
		◎		◎	Transition to reset display of all data.
	Date indication		◎		Change of date format.
			◎	◎	Transition to clock setting.
	Band out rate		◎	◎	Move to the reference waveform generation screen for waveform band monitoring. (When on the Band out rate display screen.)
Setting mode ／ Confirmation mode	Menu display	○			Enter the setting menu.
			○ (□)	○ (□)	Moving up or down of menu number. (Move at fast speed when pressing more than 1sec.)
	Setting display	○			Change of setting items. (Forward) Transition to setting menu number. (At final setting item)
			○ (□)	○ (□)	Moving up or down of setting value. (Move at fast speed when pressing more than 1 sec.) (Note)Only effective at setting mode.
		□			Return to the setting menu.
	END display	○			Memorize changed setting and transition to operating mode.
	CANSEL display	○			Annul changed setting and transition to operating mode.
			◎	◎	Reset setting values to factory default.

5. Attaching and removing

Mounting means have "on the IEC rail", "on JIS agreement type attachment" and "on the panel".

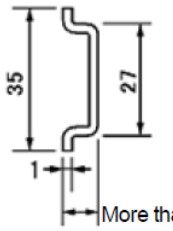
⚠WARNING	●Work under the electric outage condition. Do not do hot-line work. Failure to do so may cause electric shock, a fire, a failure etc. ●Be sure to attach the terminal cover after installation and connections are completed.

⚠CAUTION	●Any person who is involved should be fully competent to do this work. ●Take care not to entering any foreign objects such as chips and wire pieces into this unit. Failure to do so may cause electric shock, a failure of the unit, a fire etc. ●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. ●Shut off the external power supply for the unit in all phases before installing and removal. Failure to do so may cause an electric shock or damage of this unit.

5.1 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 50 mm away from the fulcrum of the open/close of the door.
(Please refer to "5.3 Mounting on panel" for panel cut dimensions.)

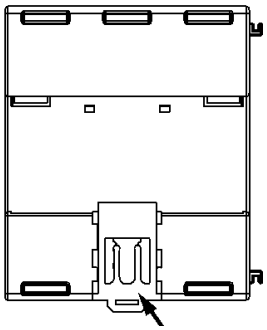
● Applicable IEC rail (35 mm)



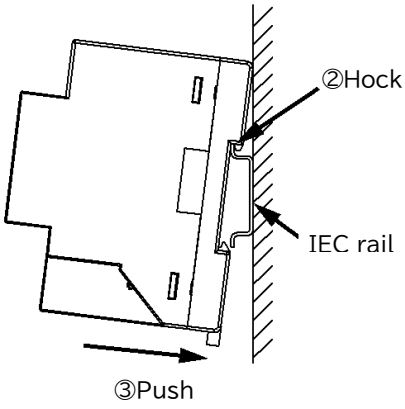
Unit[mm]

● Mounting

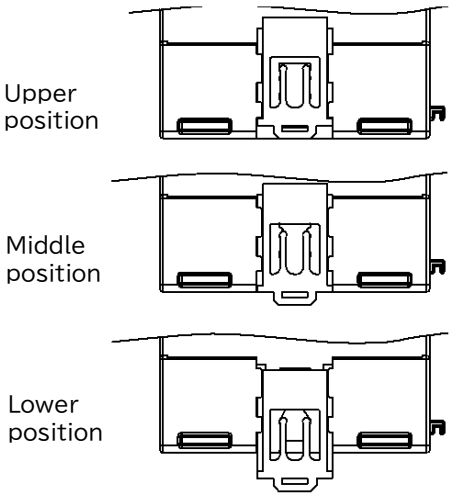
①Slide the IEC rail fixture to the middle position. (Note.1)



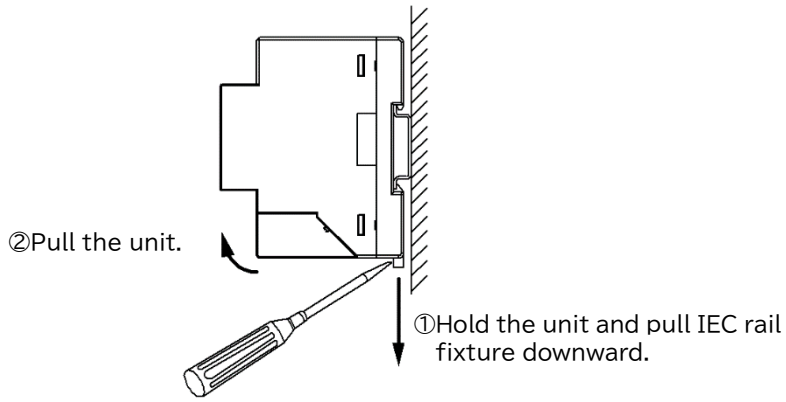
IEC rail fixture



(Note.1) The position of IEC rail fixtures have 3 levels.



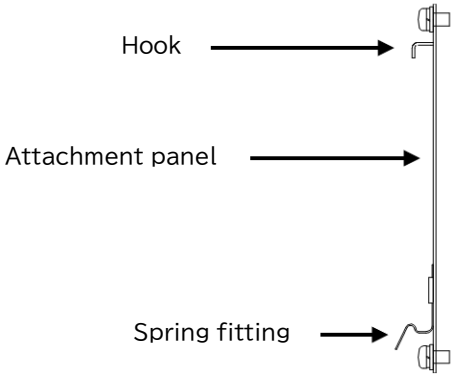
● Removing


②Pull the unit.
①Hold the unit and pull IEC rail fixture downward.

5.2 Mounting on JIS agreement type attachment

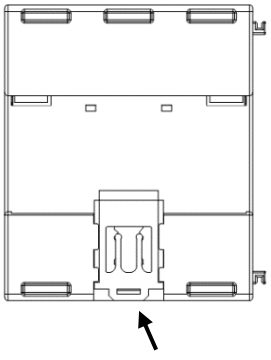
When showing the display part by cutting the panel face in mounting the JIS agreement type attachment, cut the panel at where it is more than 50 mm away from the fulcrum of the open/close of the door.
(Please refer to "5.3 Mounting on panel" for panel cut dimensions.)

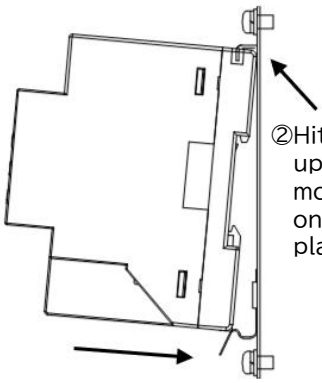
● JIS agreement type attachment



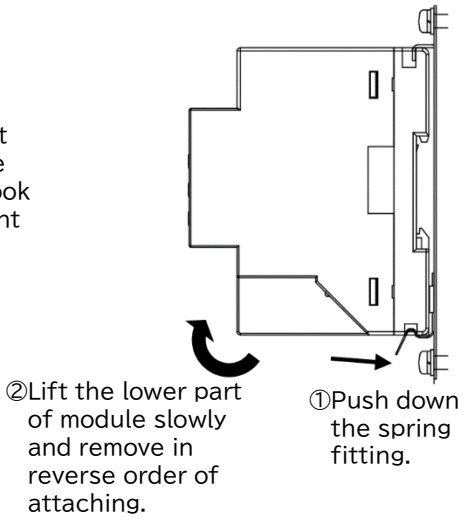
● Mounting

①Push the stopper of the IEC rail this unit, and be housed in a unit.





● Removing

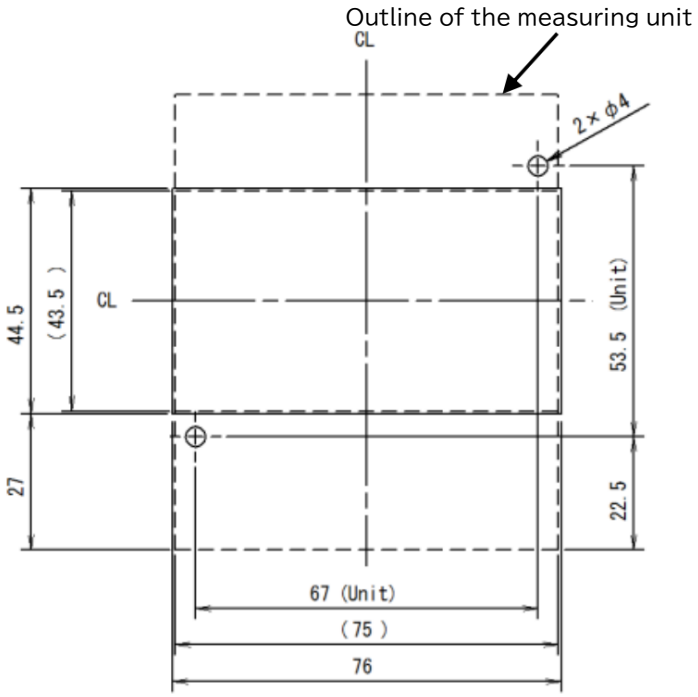


5.3 Mounting on panel

Panel cut dimensions are made larger than the product considering tolerance in panel cut.
If you want to prevent dust and other intrusion the gap of panel cut, cut the panel according to the product to be mounted.

(1) Only this unit

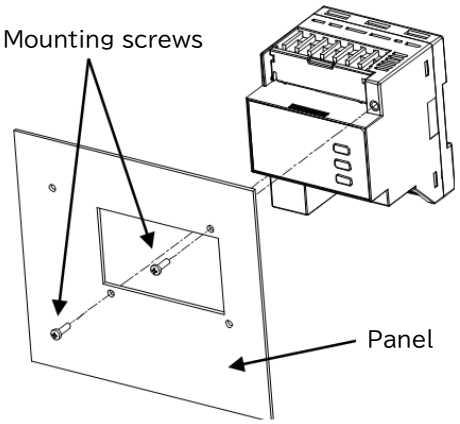
● Dimensions of hole panel (76 mm × 44.5 mm)



Unit[mm]

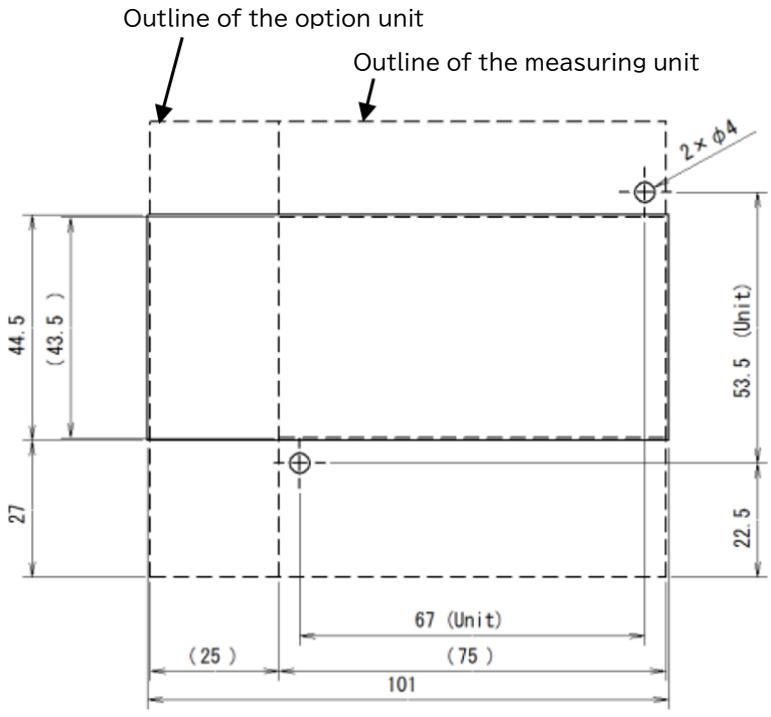
● Mounting

Recommended screws:
*Cross recessed head screw with captive spring washer and flat washer M3 × 10 2pcs.
(Note) Screws are not included.



(2) Measuring unit with optional unit

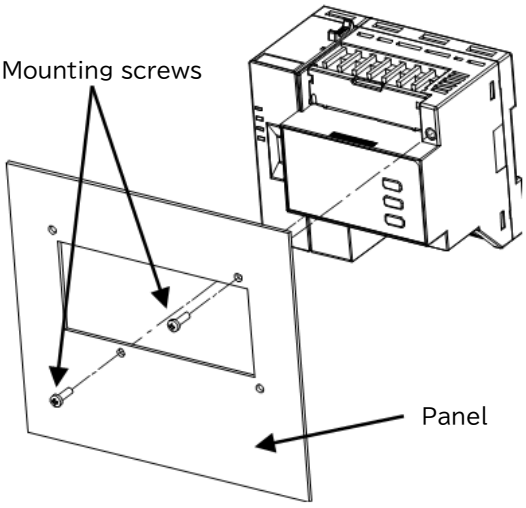
● Dimensions of hole panel (101 mm × 44.5 mm)



Unit[mm]

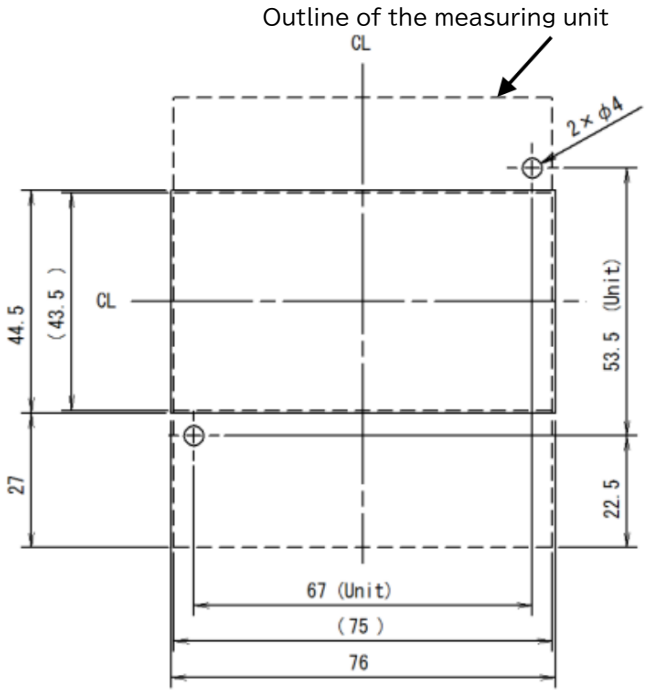
● Mounting

Recommended screws:
*Cross recessed head screw with captive spring washer and flat washer M3 × 10 2pcs.
(Note) Screws are not included.



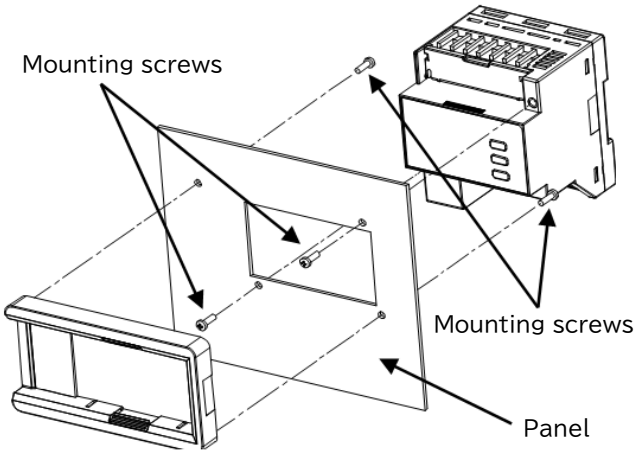
(3) When using the measuring unit and the attachment for panel mounting

● Dimensions of hole panel (76 mm × 44.5 mm)



● Mounting

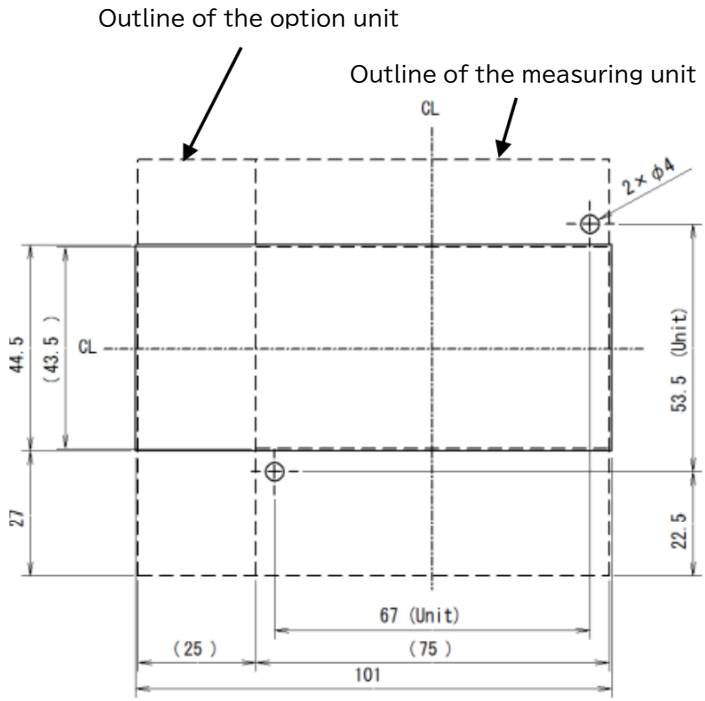
*The screws (mounting screws and screws for panel mounting attachment) are supplied with panel mounting attachment.
*Please screw up the panel mounting attachment where there are high levels of vibration.



Unit[mm]

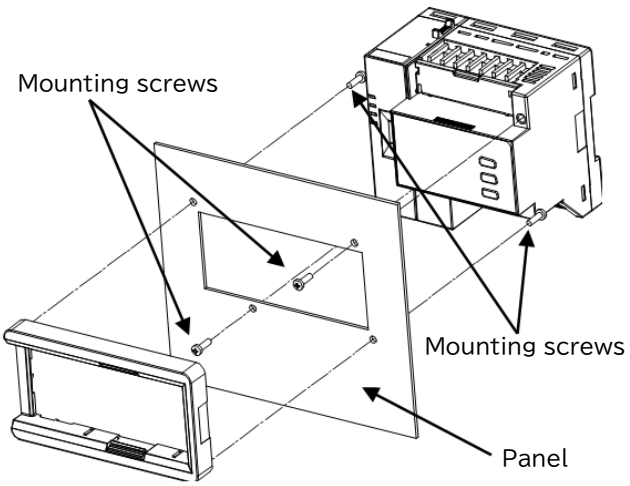
(4) Measuring unit with optional unit, when using the attachment for panel mounting

● Dimensions of hole panel (101 mm × 44.5 mm)



● Mounting

*The screws (mounting screws and screws for panel mounting attachment) are supplied with panel mounting attachment.
*Please screw up the panel mounting attachment where there are high levels of vibration.



Unit[mm]

6. Wiring

⚠DANGER	Do not touch the live part such as the connection terminal while it is energized. It may cause electric shock, a fire, a failure, a malfunction etc.

⚠WARNING	●Work under the electric outage condition. Do not do hot-line work. Failure to do so may cause electric shock, a fire, a failure etc. ●Check the Wiring Diagram carefully before making any connections. Failure to do so may cause electric shock, a fire, a failure etc. ●Make sure that the circuit to be connected to this equipment is within the rating. If used outside the rating, it may cause electric shock, a fire, a failure etc. ●Use only wires and solderless terminals that conform to the applicable requirements. Use of inappropriate wires or solderless terminals may cause electric shock, a fire, a malfunction etc. ●After tightening the screws, be sure to check all the screws tightened. Loose screw may cause electric shock, a fire, a failure etc. ●Be sure to ground the protective conductor terminal to use. The ground resistance is 100 Ω or less. ●Be sure to attach the terminal cover after installation and connections are completed. ●Connect an overcurrent protection device (fuse, circuit breaker, etc.) to the auxiliary power supply terminal. ●Do not input voltage and current at NC terminals. Doing so can cause failure or malfunction of the unit. ●This product make sure to use it in combination with the dedicated current sensor. ●This product cannot connect with the secondary side (5 A) of current transformer. ●The dedicated current sensor (EMU-CT***, EMU-CT***-A) is used only for low voltage circuit. If it connects to a high voltage circuit by mistake, it may cause a burnout of the device and a fire. When measuring a high-voltage circuit, connect the EMU2-CT5, EMU2-CT5-4W and EMU-CT5-A to the secondary side (5 A) of the current transformer.

⚠CAUTION	●Any person who is involved in the installation and the wiring of this unit should be fully competent to do this work. ●Take care not to entering any foreign objects such as chips and wire pieces into this unit. Failure to do so may cause electric shock, a failure of the unit, a fire etc. ●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.

NOTICE	●When using stranded wire, please use it after such as twisting the tip so that the fine wires do not scatter. ●Do not plate the wires with solder. The screws may become loose over time. ●For protection against noise, all wires shall not be placed close to or bound together with the power lines and high-voltage lines. If there is concern about the influence of noise even if the distance is as follows, we recommend using a shielded cable.

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

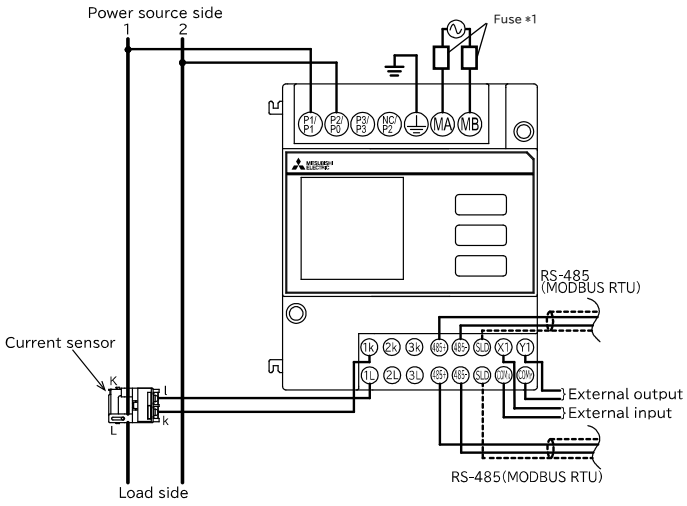
	●The setting of this unit is necessary before use it. If the setting is wrong, it will not work properly. (Note) For the setting method, refer to "8. Setting method" in this manual. ●In the event of a power outage during the setting, the unit is not set correctly. Please set again after power recovery. ●The split type current sensor has a polarity (directionality). Be careful about it when installing the unit. (K: power source side, L: load side) ●The maximum wire wiring length for the split type current sensor is as follows. EMU-C***, EMU-CT***-A are extendable up to 50 m. EMU2-CT5, EMU2-CT5-4W are extendable up to 11 m. (using together with the extension cable) ●Do not ground the secondary side of the current sensor. ●Up to two wires can be connected to one terminal of the screw terminal block. If three or more are connected, the meshing may become weak and may come off. ●Only one wire should be connected to one terminal of the spring clamp terminal block. If you connect two or more, the engagement may become weak and may come off.

DISCLAIMER	●Connect to ground by using thick wires to decrease impedance. ●For the communication signal line, use an appropriate cable according to each communication method and ground it appropriately. Also, be sure to insulate the shield of the communication signal line with insulating tape or the like.

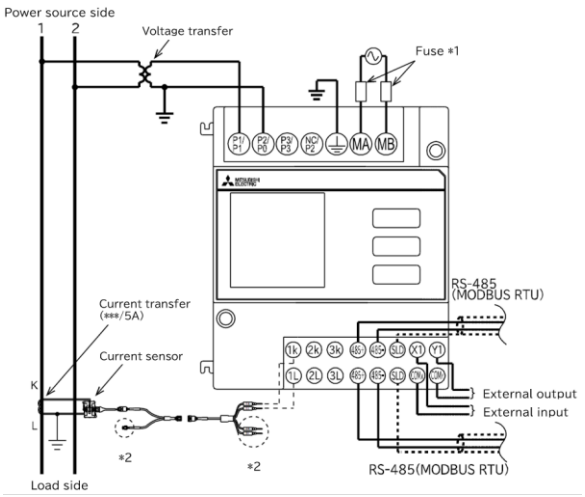
6.1 Example of wiring for measuring circuit

Example of wiring for this instrument is as follows. (EMU4-HD1A-MB is taken as an example.)
For split type current sensors that can be used, refer to “3. Option devices”.
Also, when the simple measurement function is enabled, the circuit voltage is not connected to the instrument.
Read this assuming that no circuit voltage is connected to the instrument.

●1P2W(For low voltage circuit)

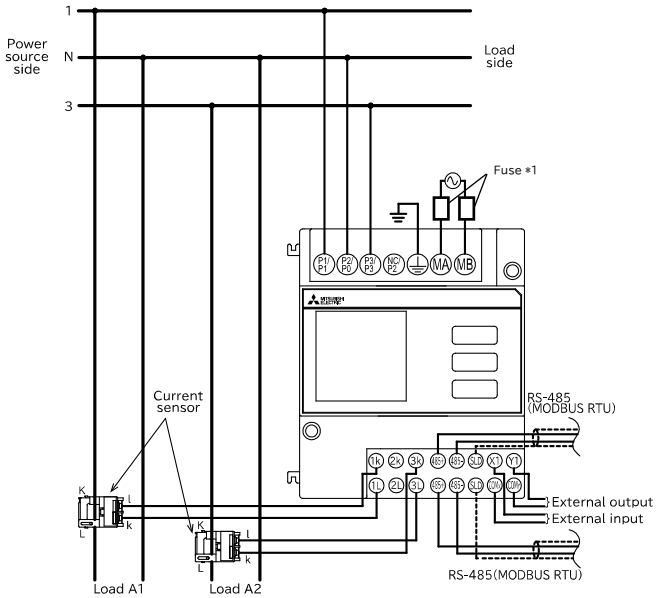


●1P2W(For High voltage circuit)

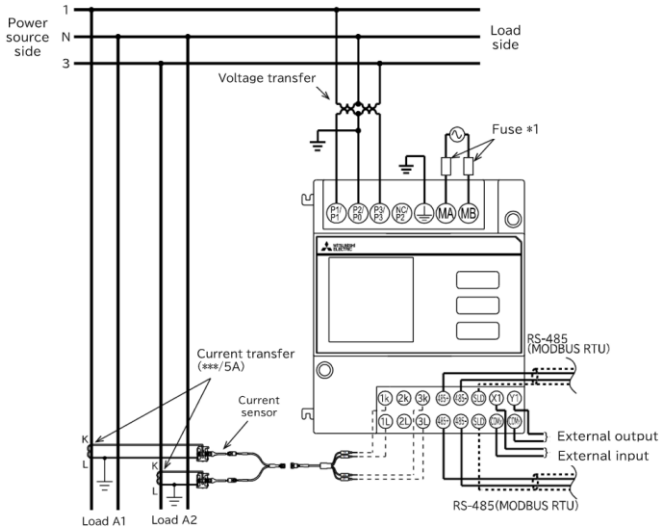


*1: If UL/CE Marking/UKCA Marking compliant, a fuse is required. Below are the recommended fuses.
Rated current: 0.5 A, Rated breaking capacity: 250 V AC 1,500 A / 250 V DC 1,500 A (a UL certified product)
*2: The 3 side of the current sensor cable is not used.
For disposal of unnecessary cables, refer to ”6.1.2 Secondary wiring of split type current sensor”.

●1P2W(2circuit measuring)(For low voltage circuit)

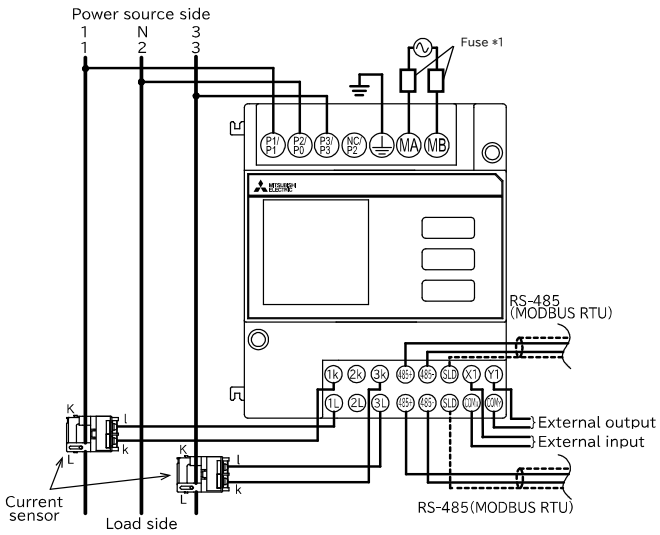


●1P2W(2circuit measuring)(For High voltage circuit)

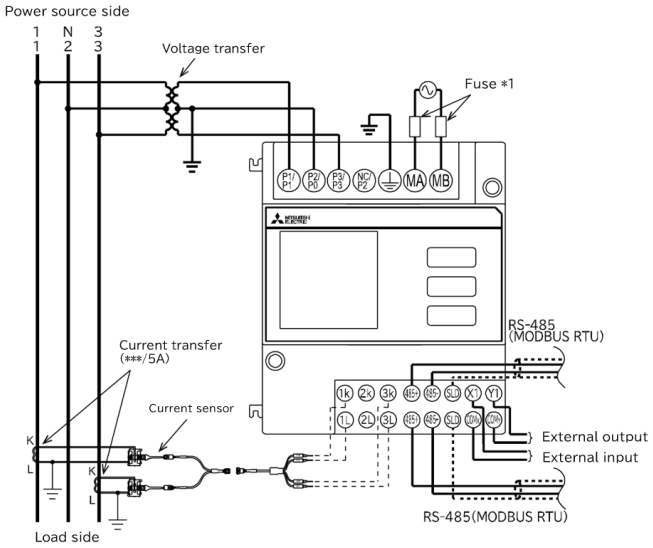


*1: If UL/CE Marking/UKCA Marking compliant, a fuse is required. Below are the recommended fuses.
Rated current: 0.5 A, Rated breaking capacity: 250 V AC 1,500 A / 250 V DC 1,500 A (a UL certified product)

●1P3W/3P3W(2CT)(For low voltage circuit)

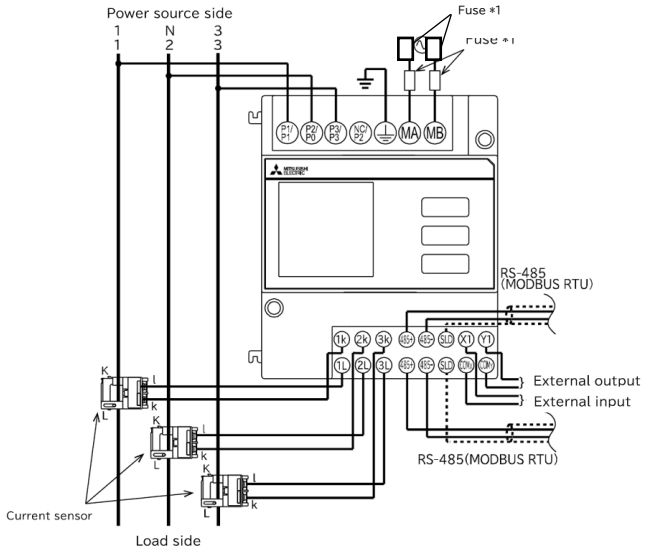


●1P3W/3P3W(2CT)(For High voltage circuit)

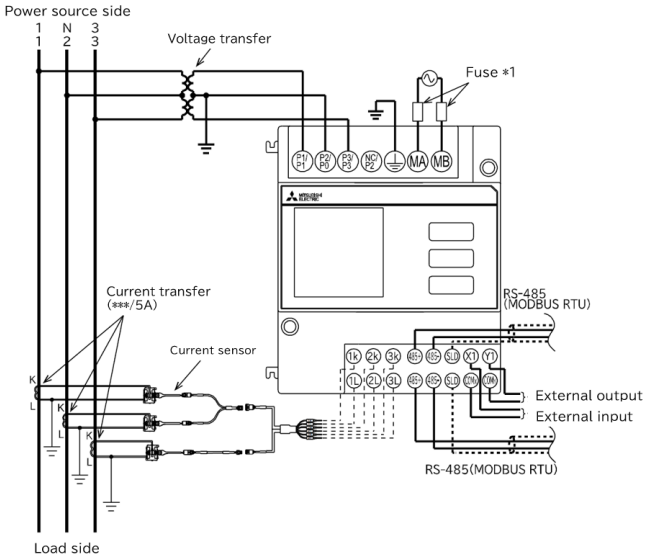


*1: If UL/CE Marking/UKCA Marking compliant, a fuse is required. Below are the recommended fuses.
Rated current: 0.5 A, Rated breaking capacity: 250 V AC 1,500 A / 250 V DC 1,500 A (a UL certified product)

●3P3W(3CT)(For low voltage circuit)

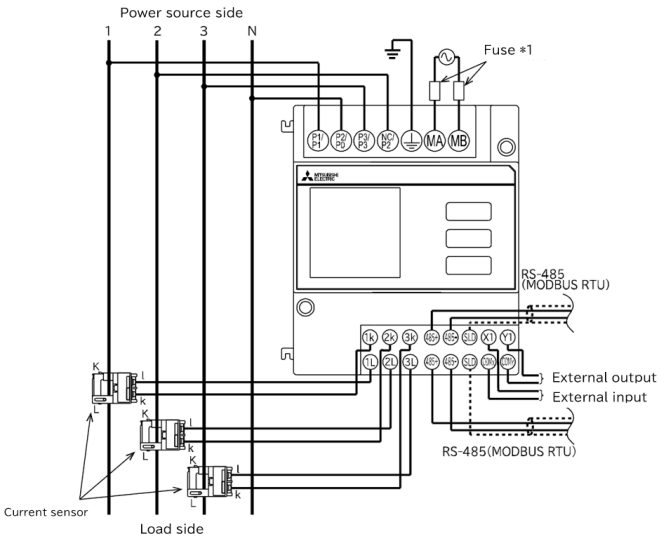


●3P3W(3CT)(For High voltage circuit)

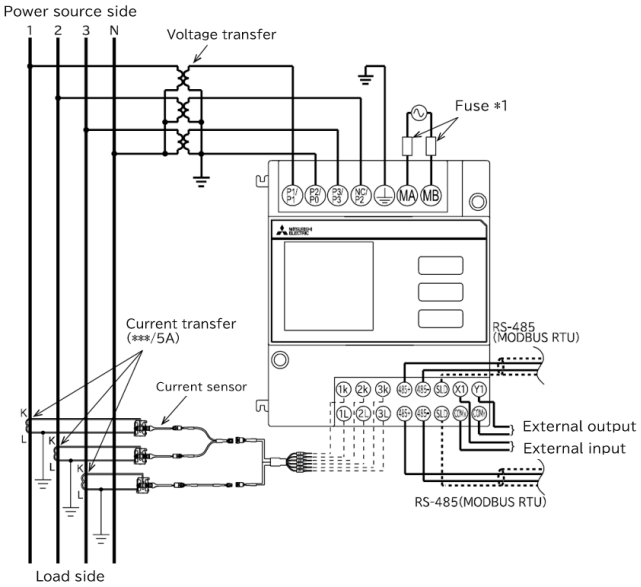


*1: If UL/CE Marking/UKCA Marking compliant, a fuse is required. Below are the recommended fuses.
Rated current: 0.5 A, Rated breaking capacity: 250 V AC 1,500 A / 250 V DC 1,500 A (a UL certified product)

●3P4W(For low voltage circuit)



●3P4W(For High voltage circuit)



*1: If UL/CE Marking/UKCA Marking compliant, a fuse is required. Below are the recommended fuses.
Rated current: 0.5 A, Rated breaking capacity: 250 V AC 1,500 A / 250 V DC 1,500 A (a UL certified product)

6.1.1 Installation of split type current sensor

Install the current sensor to the cable of the circuit to be measured by the following method.

(1) EMU-CT5/CT50/CT100/CT250-A

■Procedure for wiring of current sensor

① Press the locking claw of the moving core, please open the moving core by removing the engagement (Figure 1). Before inserting the cable, check the symbols K and L to fit the current sensor in the correct direction. (The direction from the power supply side to the load side is indicated with → (arrow).) (Figure 3)

② After checking that the core parting faces are free from dirt, close the moving core. Push down the moving core until the stoppers are securely locked. (Locking claw of the moving core is applied to the stopper, you hear click.) (Figure 2)

③ Pass the tying bands into the current sensor locking holes to secure the sensor with the cable. (Figure 3)

④ Cut off the excess length of the bands by nipper or the like.

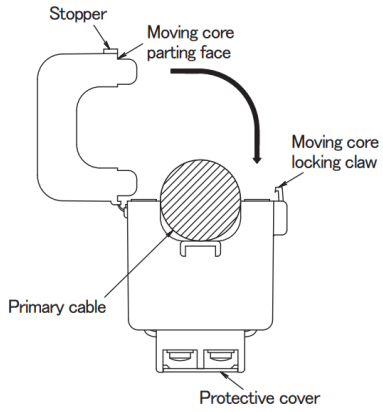


Figure 1

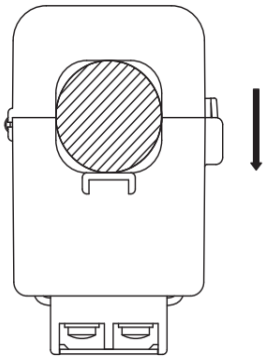
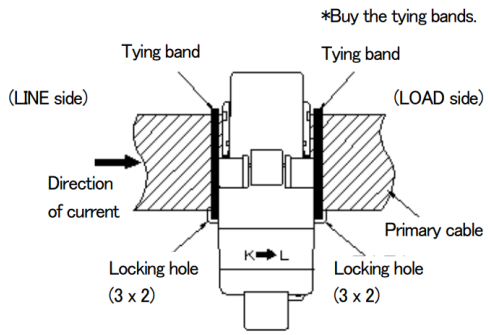


Figure 2



*Recommended tying band: T18I(Hellermann Tyton)
*Please prepare tying band yourself.

Figure 3

NOTICE	●Do not open the moving core more than 90°. The current sensor may be damaged. ●Electric wire size which can be penetrated (reference) should refer to the following table.

		EMU-CT5-A	EMU-CT50-A	EMU-CT100-A	EMU-CT250-A
Usable wires size (reference)	IV cable	38mm²	38mm²	60mm²	200mm²
	CV cable	22mm²	22mm²	60mm²	150mm²

*Size of electric wires conforms to what is described in the catalog of general PVC insulated wires. Thickness of external PVC insulation is different for different wire. Check with the external dimension diagram of this product and make sure the wire can go through the given space.

POINT	<u>The current sensor has a polarity (directionality).</u> Check the direction of the arrow printed on the side of the current sensor and the direction of the primary conductor (power supply side/load side), and be careful not to connect it incorrectly.

■Procedure for connecting of current sensor

① Remove the terminal protective cover on the secondary terminal by lifting the center and connect it to the measurement unit with the appropriate wire/cable.

POINT	<u>The current sensor has a polarity (directionality).</u> Check the terminal symbol printed on the secondary side terminal surface of the current sensor and be careful of incorrect connection.

(2) EMU-CT400/CT600-A

■Procedure for wiring of current sensor

① Press the locking claw of the moving core, please open the moving core by removing the engagement (Figure 1). Before inserting the cable, check the symbols K and L to fit the current sensor in the correct direction. (The direction from the power supply side to the load side is indicated with → (arrow).) (Figure 3)

② After checking that the core parting faces are free from dirt, close the moving core. Push down the moving core until the stoppers are securely locked. (Locking claw of the moving core is applied to the stopper, you hear click.) (Figure 2)

③ Pass the tying bands into the current sensor locking holes to secure the sensor with the cable. (Figure 3)

④ Cut off the excess length of the bands by nipper or the like.

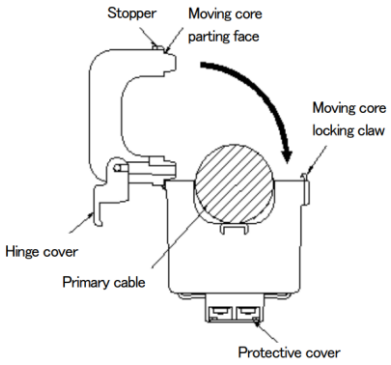


Figure 1

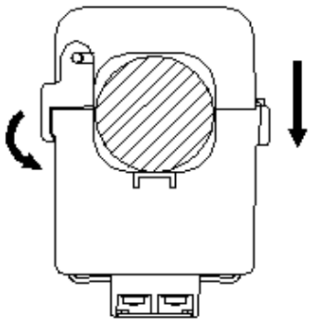
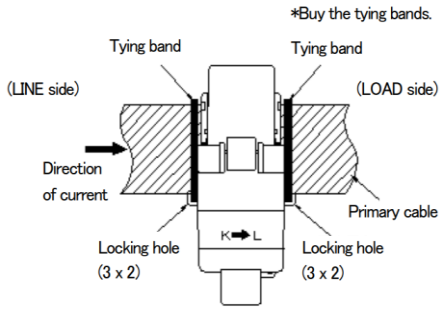


Figure 2



*Recommended tying band: T18I(Hellermann Tyton)
*Please prepare tying band yourself.

Figure 3

NOTICE	●Do not open the moving core more than 90°. The current sensor may be damaged. ●Electric wire size which can be penetrated (reference) should refer to the following table.

		EMU-CT400-A	EMU-CT600-A
Usable wires size (reference)	IV cable	500mm²	500mm²
	CV cable	400mm²	400mm²

*1 Size of electric wires conforms to what is described in the catalog of general PVC insulated wires. Thickness of external PVC insulation is different for different wire. Check with the external dimension diagram of this product and make sure the wire can go through the given space.

*2 When conforming to UL / c-UL standards, use AWM wires that satisfy the following three conditions((a), (b), (c)).

(a)Working voltage (voltage to ground)

150 Vac or less: AWM wire (UL758) with a rated voltage of 150 Vac or more.

150 Vac to 300 Vac: AWM wire with rated voltage of 600 Vac or more and AWG 1 or more (UL758).

(b)Wire diameter:500kcmil(253mmˆ2) or more.

(c)Temperature rating:Temperature rating of 105℃ or higher.

POINT	<u>The current sensor has a polarity (directionality).</u> Check the direction of the arrow printed on the side of the current sensor and the direction of the primary conductor (power supply side/ load side), and be careful not to connect it incorrectly.

■Procedure for connecting of current sensor

① Remove the terminal protective cover on the secondary terminal by lifting the center and connect it to the measurement unit with the appropriate wire/cable.

POINT	<u>The current sensor has a polarity (directionality).</u> Check the terminal symbol printed on the secondary side terminal surface of the current sensor and be careful of incorrect connection.

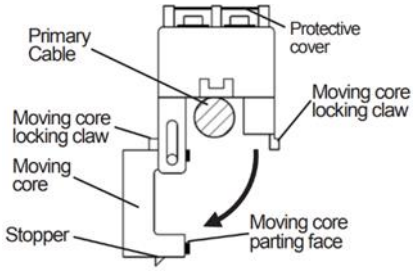
(3) EMU-CT50/CT100/CT250

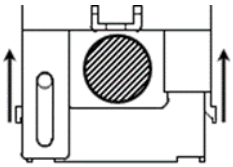
■Procedure for wiring of current sensor

① Open the moving core as shown in the right figure. Slowly lift the moving core locking claws on both sides of the moving core to open and remove them from the stoppers. Be careful not to force it open and break the claws.

② Draw the cable of the circuit to be measured through the center hole of the current sensor. Before drawing the cable through the hole, check the installation direction of the current sensor. There is an arrow indicating K⇨L.

③ To fix the current sensor, draw a and through the locking hole located on both sides of the sensor, and lightly fix them together with the cable.

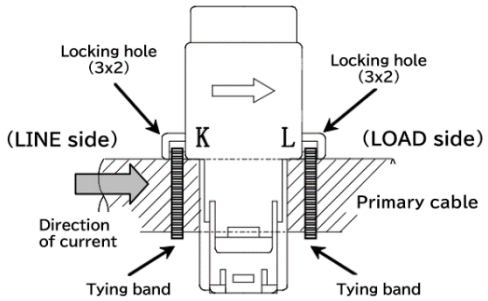




④ Pass the tying band (included with the current sensor) through the current sensor locking hole and fix it to the cable. Be careful not to over-tighten it so that it stops lightly (current sensor locking holes are on both sides of the current sensor).

⑤ Cut off the excess length of the bands by nipper or the like.

⑥ Lift the center of the protective cover of the secondary terminal and remove it, then connect the specified sensor cable.



NOTICE	●Do not open the moving core more than 90°. The current sensor may be damaged. ●Electric wire size which can be penetrated (reference) should refer to the following table.

		EMU-CT50	EMU-CT100	EMU-CT250
Usable wires size (reference)	IV cable	60mm²	60mm²	150mm²
	CV cable	380mm²	38mm²	150mm² ∗1

∗1 100 mm² is recommended

∗2 Size of electric wires conforms to what is described in the catalog of general PVC insulated wires. Thickness of external PVC insulation is different for different wire. Check with the external dimension diagram of this product and make sure the wire can go through the given space.

∗3 When conforming to UL / c-UL standards, use AWM wires that satisfy the following three conditions((a), (b), (c)).

(a) Working voltage (voltage to ground)
150 Vac or less: AWM wire (UL758) with a rated voltage of 150 Vac or more.
150 Vac to 300 Vac: AWM wire with rated voltage of 600 Vac or more and AWG 1 or more (UL758).

(b)Wire diameter of each current sensor
EMU-CT50: AWG10 (5.261 mmˆ2) or more.
EMU-CT100: AWG6 (13.30 mmˆ2) or more.
EMU-CT250: AWG 3/0 (85.03 mmˆ2) or more.

(c)Temperature rating: Temperature rating of 105°C or higher.

POINT	<u>The current sensor has a polarity (directionality).</u> Check the direction of the arrow printed on the side of the current sensor and the direction of the primary conductor (power supply side/load side) and be careful not to connect it incorrectly.

■Procedure for connecting of current sensor

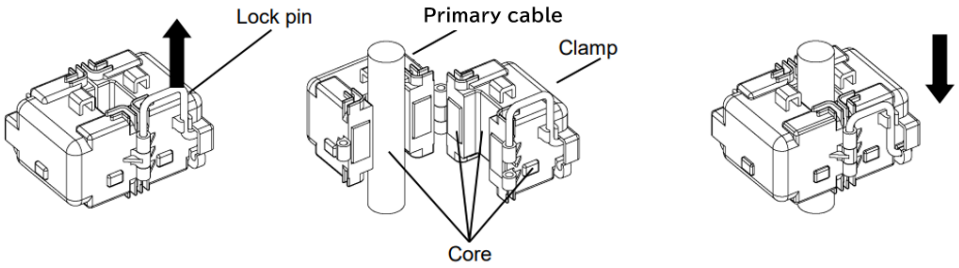
① Remove the terminal protective cover on the secondary terminal by lifting the center and connect it to the measurement unit with the appropriate wire/cable.

POINT	<u>The current sensor has a polarity (directionality).</u> Check the terminal symbol printed on the secondary side terminal surface of the current sensor and be careful of incorrect connection.

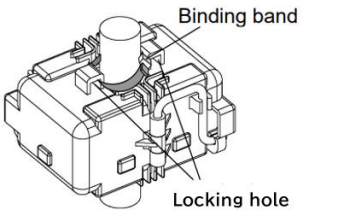
(4) EMU2-CT5/EMU2-CT5-4W

■Procedure for wiring of current sensor

① Please let me slide a lock pin in the direction of an arrow.
② It lets an electric wire pass in a clamp, and close a clamp again.
③ Please hold a clamp in the fully close state with a finger, and push in until a lock pin is locked.



④ Use the tying band, when fixing the penetrating electric wire and the sensor. A thing W= 2.6mm or less should be used for the tying band used when it fixes the electric wire and sensor to penetrate. When it fixes, a tying band is fixed to one place of the hole for current sensor fixation with a through cable. Be careful not to fasten too much by the grade which stops lightly (a total of four hole)
⑤ Cut off the excess length of the bands by nipper or the like.



⚠CAUTION	A lock pin is metal. Keep in mind that the contact to a charge part has failure of an electric shock accident and equipment and fear of a fire.

NOTICE	●If impossible power is applied where a clamp is opened, there is fear of breakage. Normal measurement cannot be performed if a direction is mistaken. ●When conforming to UL/c-UL standards, use AWM wires (UL758) with a rated voltage of 150 Vac or higher and AWG22(0.325mm^2) and or more and temperature rating of 105°C or higher.

POINT	**The current sensor has a polarity (directionality).** Check the direction of the arrow printed on the side of the current sensor and the direction of the primary conductor (power supply side/load side), and be careful not to connect it incorrectly.

■Procedure for connecting of current sensor

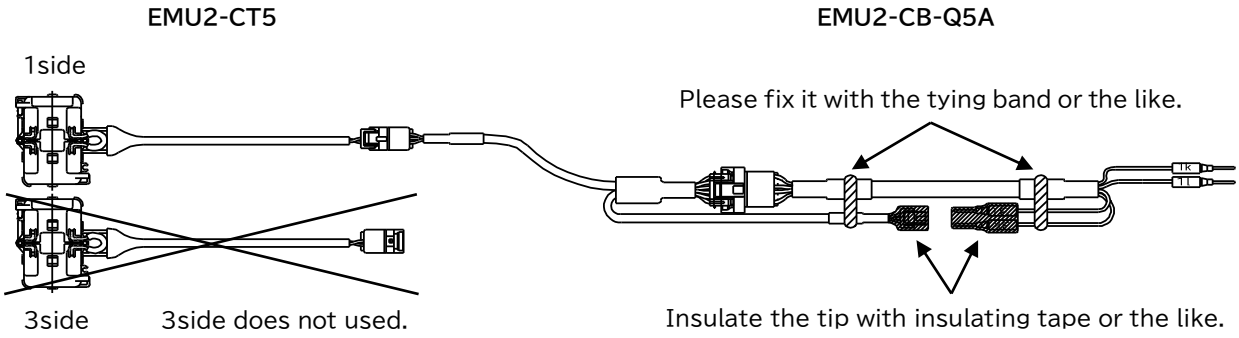
① Combine the cable connected to the current sensor with the dedicated cable (EMU2-CB-Q5A) and connect it to the measurement unit. For details, refer to ”6.1.2 Secondary wiring of split type current sensor”.

POINT	**The current sensor has a polarity (directionality).** Check the terminal symbol on the dedicated cable (EMU2-CB-Q5A/EMU2-CB-Q5A) and be careful not to connect it by mistake.

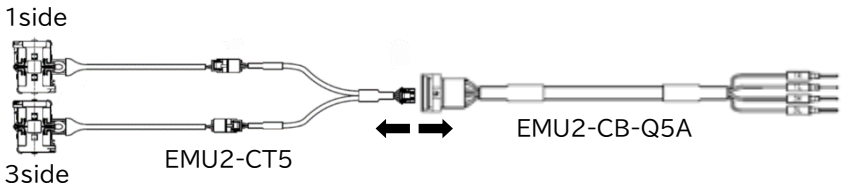
6.1.2 Secondary wiring of split type current sensor

Notes on connection are also described in "1.2 Installation and Wiring Precautions", so please read them as well.

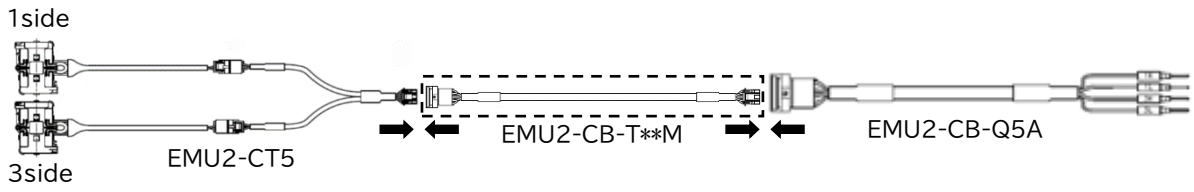
●The split type current sensor (dedicated cable type) has a sensor cable that do not use with the single-phase 2-wire system.
Please wire according to the following procedure.



●Split type current sensor (dedicated cable) is extensible in the following ways.
(1) When extending EMU2-CT5 with a current sensor extension cable (standard type).
① Remove the connector.

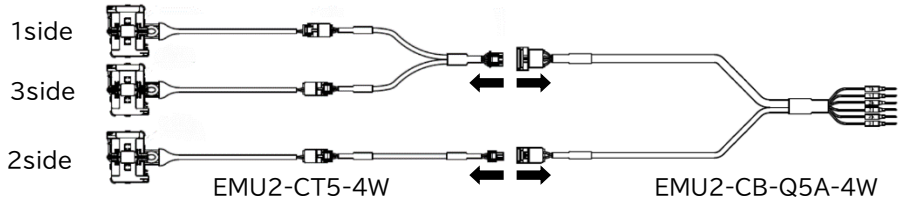


② Connect the current sensor extension cable.

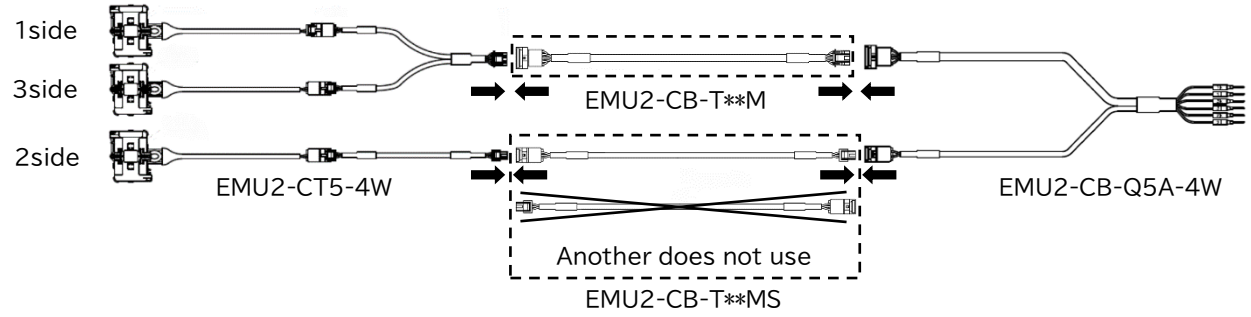


(2) When extending EMU2-CT5-4W with a current sensor extension cable (standard type) and a current sensor extension (separate type).

① Remove the connector.



② Connect the current sensor extension cable.



(3) EMU2-CT5, EMU2-CT5-4W are extendable up to 11 m, using together with the extension cable. To extend the wire further, use the current transformer (CT) for split-type instrument in combination, extending the secondary wiring on current transformer (CT) side.

6.2 Terminal Specifications, Applicable wire

Applicable wire, Applicable solderless terminal and tightening torque is below.

●Screw terminal block

Item	Voltage input terminal Auxiliary power supply terminal
Applicable wire	Stranded wire: AWG26 to 14 (0.13 mm^2 to 2.00 mm^2)
	Single wire: AWG26 to 14 (ϕ0.41 mm to 1.61 mm)
Tightening torque	0.8 N·m to 1.0 N·m
Applicable solderless terminal	For M3.5 screw of external diameter below 5.6 mm

●Spring clamp terminal block

Item	Current input terminal External input terminal ∗1 External output terminal ∗1	MODBUS RTU communication terminal
Applicable wire ∗2	Stranded wire: AWG22 to 16 (0.33 mm^2 to 1.25 mm^2)	SPEV(SB)-MPC-0.2×3P (Produced by Fujikura Dia Cable) or its equivalent
	Single wire: AWG22 to 16 (ϕ0.13 mm to 2.00 mm)	
Tightening torque	–	–
Applicable solderless terminal	TGV TC-1.25-11T (by NICHIFU) equivalent	TGV TC-1.25-11T (by NICHIFU) equivalent

∗1 EMU4-HD1A-MB only. EMU4-BD1A-MB not used.

∗2 Stripping length of the used wire has to be 8 to 9mm.

6.3 Connection of external input / external output

6.3.1 How to connection

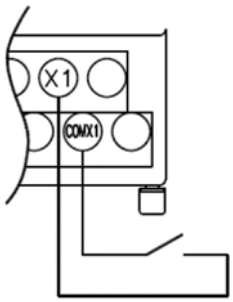
In case using external input and/or external output, refer to the following.

(1) External input

■For the case of contact input

No-voltage a-contact / open collector

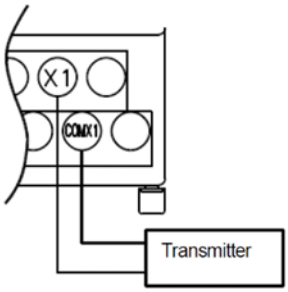
Voltage of the contact is 5 V DC, and current is 7 mA, so use something appropriate for the switching condition.



■For the case of pulse input

No-voltage a-contact / open collector

Voltage of the contact is 5 V DC, and current is 7 mA, so use something appropriate for the switching condition. Please connect GND side to COMX1 when output of transmitter is open collector pulse.

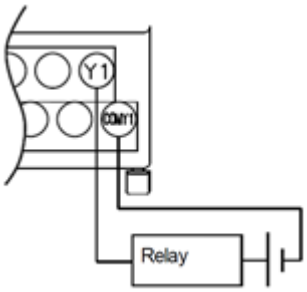


(2) External output

■For the case of alarm output and digital output

No-voltage a-contact

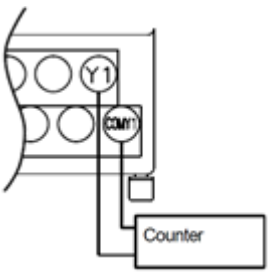
35 V DC 75 mA or 24 V AC 75 mA (power factor: 1)



■For the case of pulse output

No-voltage a-contact

35 V DC 75 mA or 24 V AC 75 mA (power factor: 1)



Describe the pulse wiring length for each wire diameter.

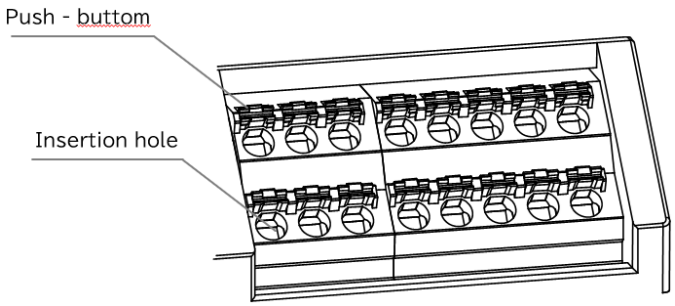
*Polyethylene insulating vinyl sheath cable FCPEV wire.

Wire diameter [mm]	Resistivity[Ω/km]	Wiring length[m]
0.5	94	300
0.65	56.8	400
0.9	29.2	750
1.2	16.5	1000

For notes on when to connect the product, please refer to “1.2 Installation and Wiring Precautions” and “6. Wiring” in this manual. Please refer to “6.2 Terminal Specifications, Applicable wire” in this manual about terminal specifications.

6.3.2 How to use for spring clamp terminal block

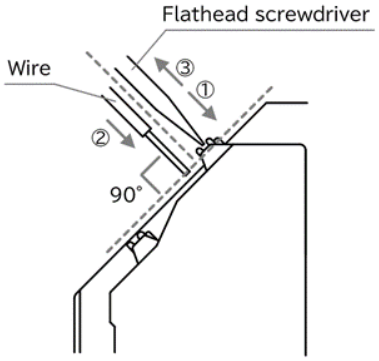
■Name of each part spring clamp terminal block



(1) Connection of wire

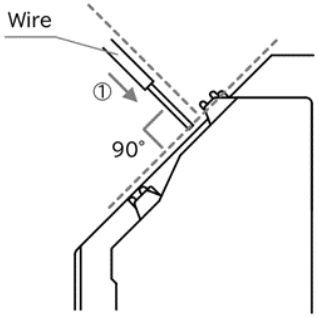
■For stranded wires

①Press the push button with a flathead screwdriver at a 90° angle to the surface of the terminal block.
②Insert the wire into the insertion hole at a 90° angle to the surface of the terminal block.
③Release the flathead screwdriver from the push button.



■For single wire or bar crimp terminals

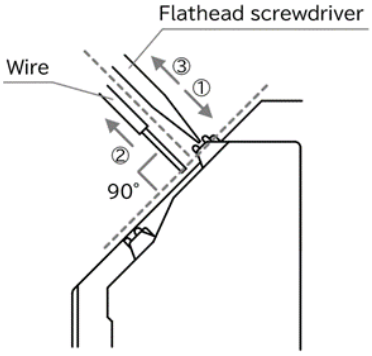
①Insert the wire into the insertion hole at a 90° angle to the surface of the terminal block.



POINT	If it is difficult to insert, please insert while pressing the push button in the same way as ”For stranded wires”.

(2) Disconnection of wire

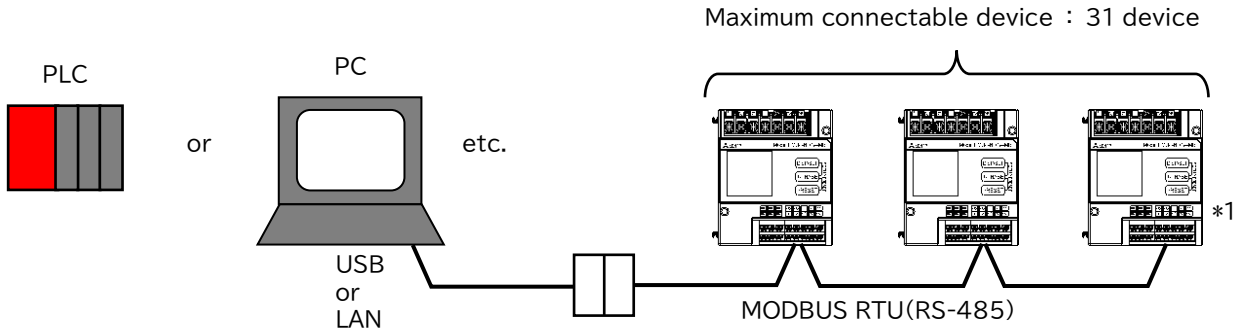
①Press the push button with a flathead screwdriver at a 90° angle to the surface of the terminal block.
②Pull out the wire in a 90° direction to the terminal block surface.
③Release the flathead screwdriver from the push button.



NOTICE	Use a screwdriver with a blade tip thickness of 0.6 mm and a blade width of 3.5 mm.

6.4 Connection of MODBUS RTU communication cable

6.4.1 How to connection



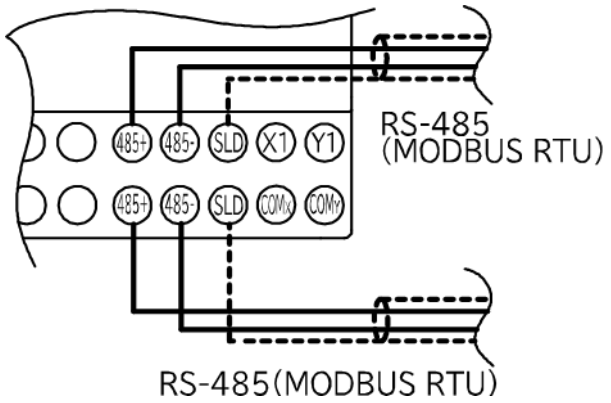
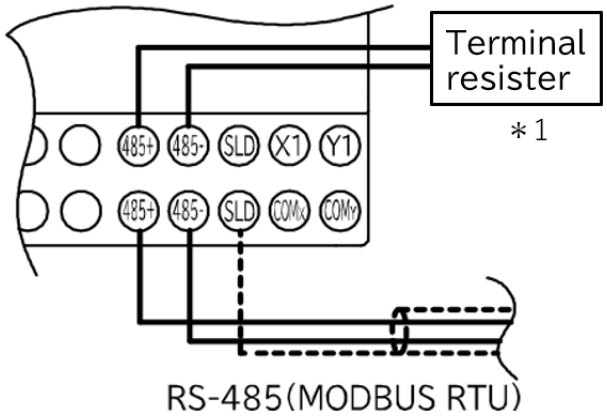
*1 Termination resistances of 120 Ω

Connect the termination resistances (120 Ω) to both ends of the devices connected the MODBUS transmission line.

NOTICE	If you use a termination resistor other than 120 Ω (master station accessories, etc.), be sure to check the reliability of communication, etc.

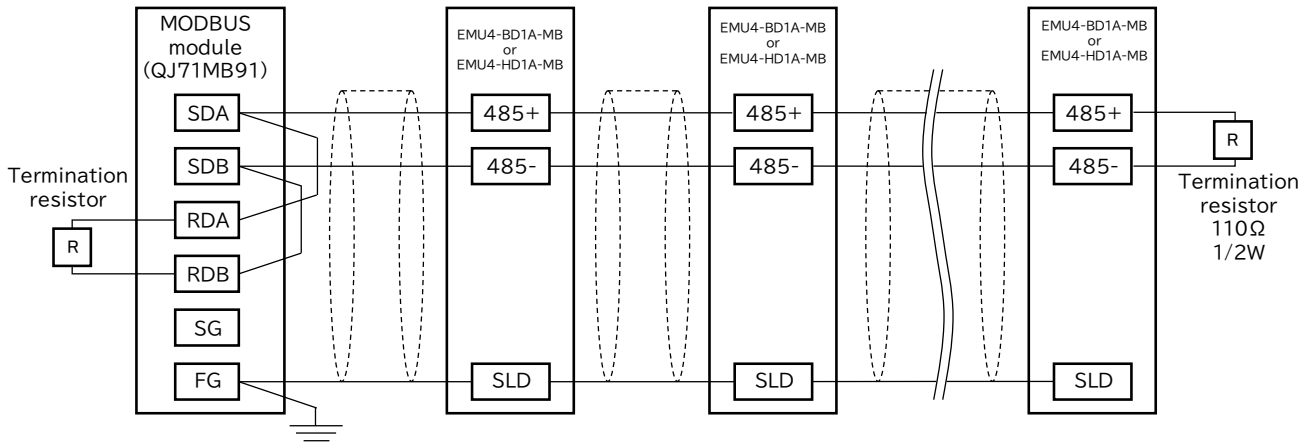
Refer to "6.4.2 Example of wiring" for a typical wiring example with the master station.

6.4.2 Example of wiring

Installation in the middle of the transmission route	Installation at the end of the transmission route
	 *1: This product does not include a termination resistor. Prepare a termination resistor of 120 Ω 1/2 W. If the termination resistance of the master station is other than 120 Ω, prepare a termination resistance that matches the master station.

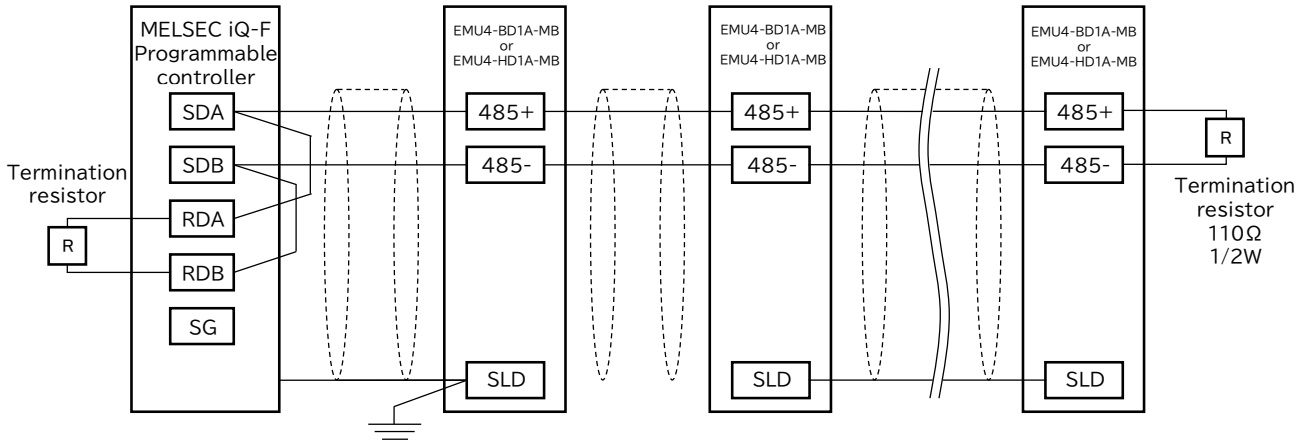
For notes on when to connect the product, please refer to "1.2 Installation and Wiring Precautions" and "6. Wiring" in this manual.
Please refer to "6.2 Terminal Specifications, Applicable wire" in this manual about terminal specifications.
Please refer to "6.3.2 How to use for spring clamp terminal block" in this manual about how to connection for spring clamp terminal block

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



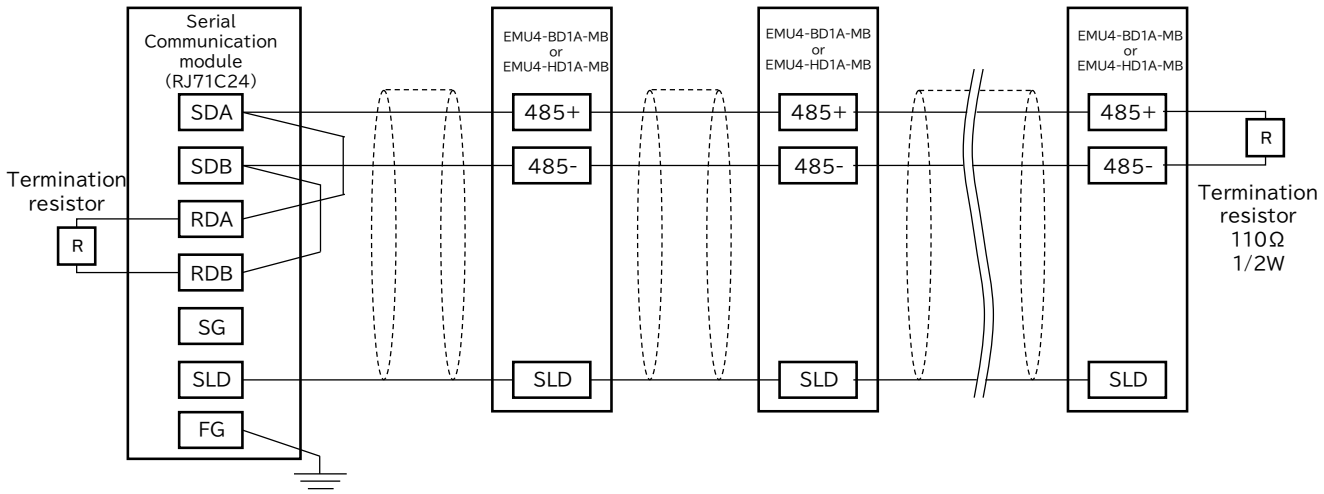
Note: Connect 110 Ω termination resistors on the MODBUS module (QJ71MB91, QJ71C24N) side.
For details, refer to [MODBUS Interface Module User's Manual] (Ref. No. SH-080578ENG) and [Q Corresponding Serial Communication Module User's Manual (Basic)] (Ref. No. SH-080006).

■Connection with MELSEC iQ-F series programmable controller



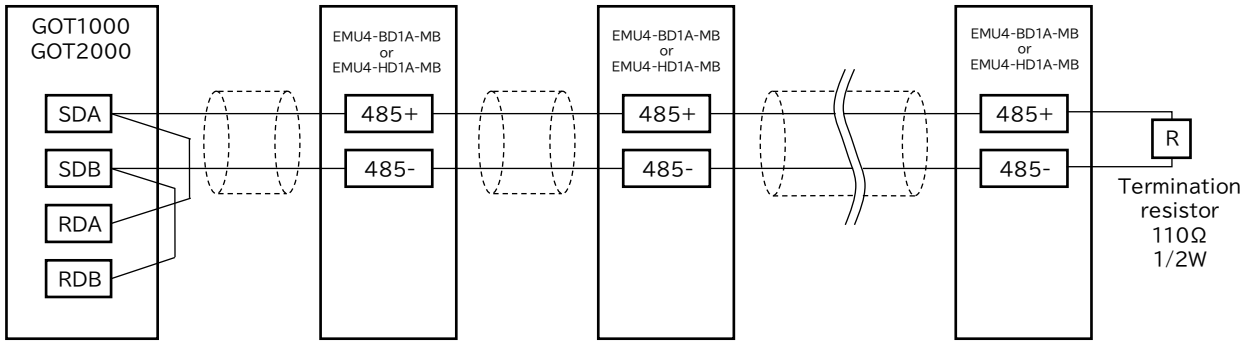
Note: Connect 110 Ω termination resistors on the MELSEC iQ-F programmable controller side.
For details, refer to [MELSEC iQ-F FX5 User's Manual (MODBUS Communication)] (Ref. No. JY997D56101).

■Connection with MELSEC iQ-R Serial Communication Module (RJ71C24, RJ71C24-R2, RJ71C24-R4)



Note: Connect 110 Ω termination resistors on the MELSEC iQ-R programmable controller side.
For details, refer to Before Using the Product for RJ71C24, RJ71C24-R2 and RJ71C24-R4 (Ref.NO. BCN-P5999-0075E).

■Connection with GOT (GOT1000, GOT2000)



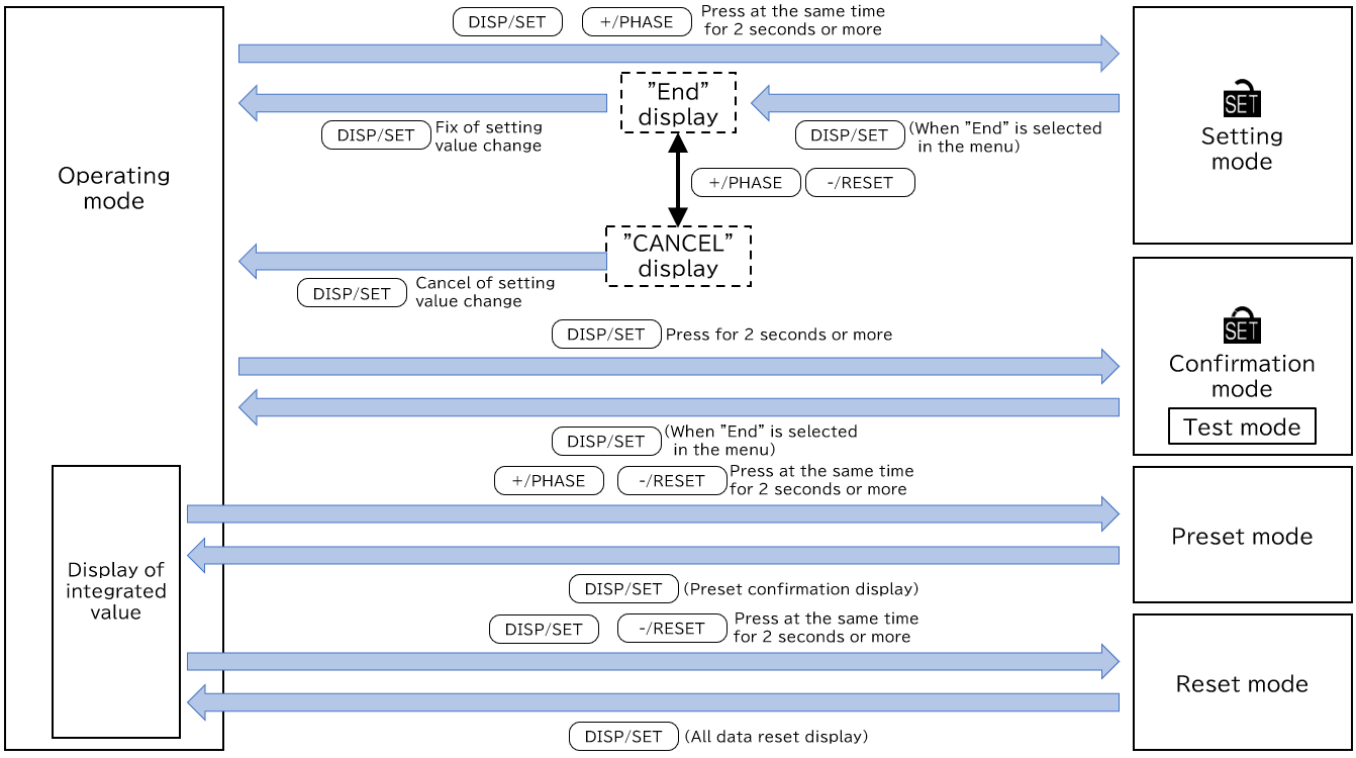
Note: Set the termination resistor of the GOT (GOT1000, GOT2000) side to 110 Ω.
For details, refer to [GOT1000 Series Connection Manual (Microcomputers, MODBUS Products, Peripherals) for GT Works3] (Ref.NO. SH-080871ENG) and [GOT2000 Series Connection Manual (Microcomputers, MODBUS / Fieldbus Products,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

7. Operating mode

This unit has the operating modes. Switch these modes according to the purposes.
The operating mode is displayed immediately after the auxiliary power loading.

Mode	Function	Reference
Operating mode	Display measured value digitally. It can display the condition of contact input (*1) and present time (*2) other than the present value of the measured values.	Chapter 9.2
Setting mode	Make settings related to basic settings (e.g. phase wire system, primary voltage, primary current, sensor type) and alarm monitoring (e.g. waveform band monitoring presence/absence, upper/lower limit alarm presence / absence), etc.	Chapter 8
Confirmation mode (Test mode)	Mode to confirm the setting value for each setting item. (The setting cannot be changed in this mode, so it can be prevented setting change by human error.) In addition, this unit has the test function that can be used for such as set up of an equipment. ●Discrimination support display for incorrect wiring: Display useful to discriminate for incorrect wiring such as phase angle display of voltage, current. ●Pulse, Alarm test: Switch pulse output contact and alarm contact without measurement (voltage and current) input. ●Communication test: Send back fixed numerical data without measurement (voltage and current) input. ●F/W version display: Display the F/W version of this unit.	Chapter 10
Reset mode / Preset mode	Reset: Integrated values (electric energy, operating time, etc.) can be zeroed. Preset: Preset of electric energy and reactive energy.	Chapter 8.8.1

*1: EMU4-HD1-MB only.
*2: Only when connecting logging unit.



8. Setting method

⚠ DANGER	Do not touch the live part such as the connection terminal while it is energized. Failure to do so may cause electric shock, a fire, a failure etc.

⚠ WARNING	If an abnormal sound, bad-smelling smoke, fever break out from this unit, switch it off promptly and do not use it.

NOTICE	●The setting of this unit is necessary before use it. If the setting is wrong, it will not work properly. (Note) For the setting method, refer to "8. Setting method" in this manual. ●In the event of a power outage during the setting, the unit is not set correctly. Please set again after power recovery.

DISCLAIMER	●Setting menu 5 related to the logging unit is shifted to setting mode from operating mode, and please go in a procedure to set only setting menu 5. (Please refer to "8.6.5 Setting related to logging unit" in this manual.) ●If you change setting, related setting items and measured data are initialized. Please check them beforehand. (Please refer to "8.7 Initialization of related items by change of setting.")

8.1 Procedures for setting

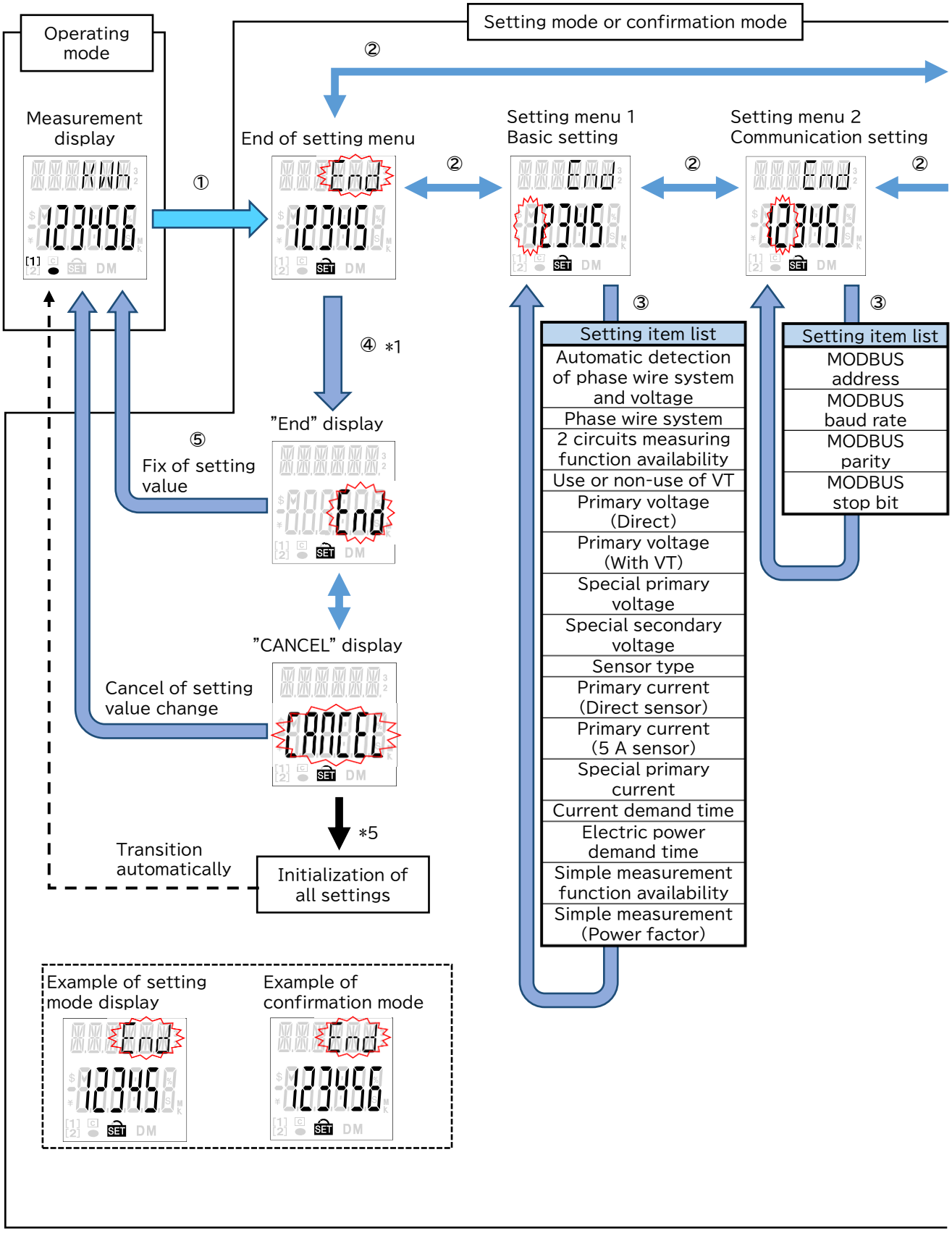
Set items such as phase wire system, primary voltage, and primary current in the setting mode to measure and monitor. Under normal use, it shall be sufficient to set the setting menu 1 (Basic setting) only. For details, refer to after the following page.

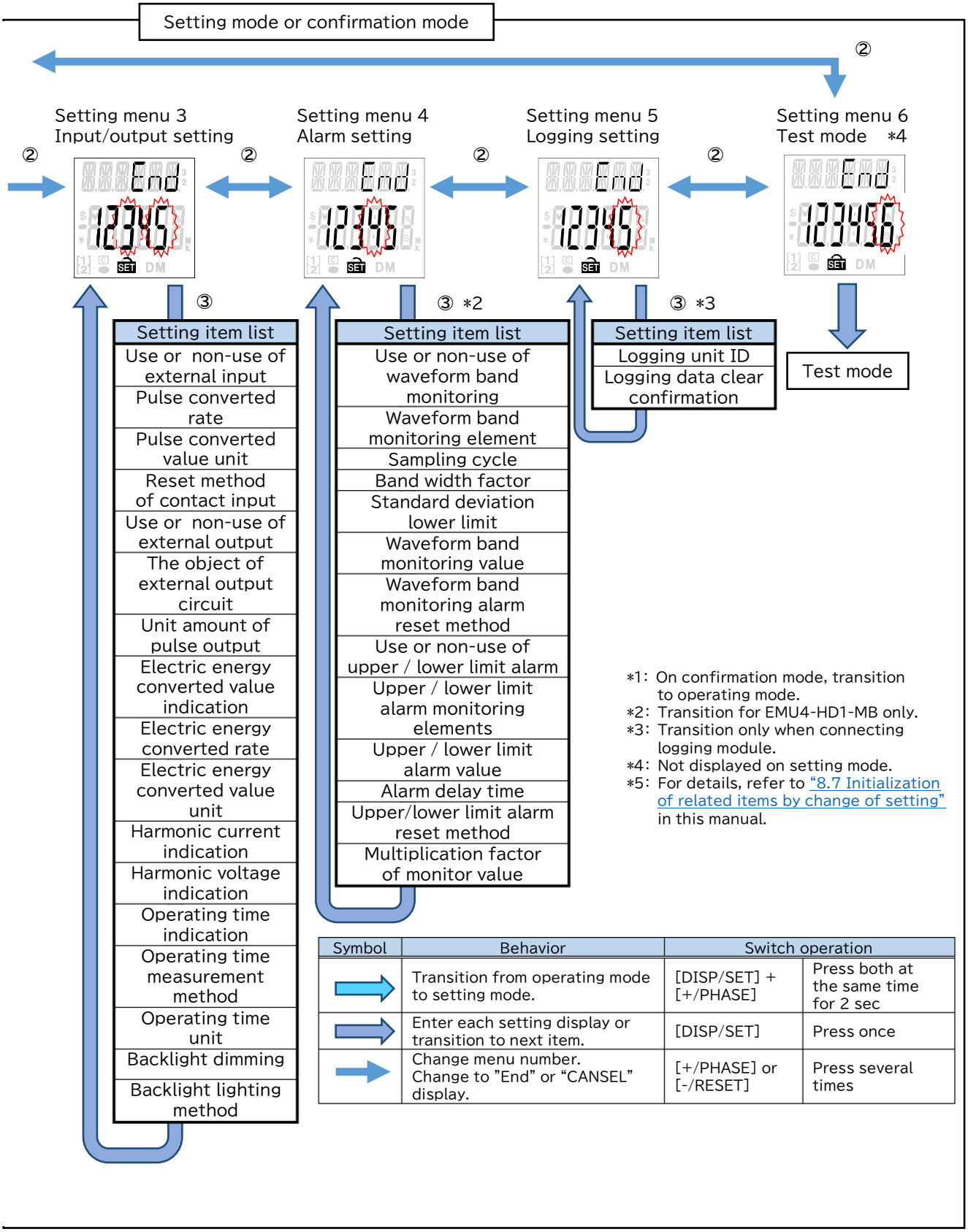
■**How to set**

①Go into the setting mode by pressing both [DISP/SET] and [+/PHASE] at the same time for 2 seconds.
②Select the setting menu number by pressing [+/PHASE] or [-/RESET].
③Determine the setting menu number by pressing [DISP/SET].
④After all setting are done, select “End” on the setting menu and press [DISP/SET].
⑤When prompted for End display, select “End” and press [DISP/SET].

■Operations for each setting item

Function	Operation	Supplement
Choose setting value	Press [+/PHASE] or [-/RESET]	Press for more than one second to fast forward.
Confirm setting value	Press [DISP/SET]	After setting value is confirmed, transition to next item.
Go back to setting menu during setting	Press [DISP/SET] for one second	Setting value of the last item before return is effective.


Operating mode
Measurement display
①
Setting mode or confirmation mode
②
End of setting menu
②
Setting menu 1
Basic setting
②
Setting menu 2
Communication setting
②
③
Setting item list
Automatic detection of phase wire system and voltage
Phase wire system
2 circuits measuring function availability
Use or non-use of VT
Primary voltage (Direct)
Primary voltage (With VT)
Special primary voltage
Special secondary voltage
Sensor type
Primary current (Direct sensor)
Primary current (5 A sensor)
Special primary current
Current demand time
Electric power demand time
Simple measurement function availability
Simple measurement (Power factor)
③
Setting item list
MODBUS address
MODBUS baud rate
MODBUS parity
MODBUS stop bit
④ *1
"End" display
⑤
Fix of setting value
"CANCEL" display
Cancel of setting value change
*5
Transition automatically
Initialization of all settings
Example of setting mode display
Example of confirmation mode



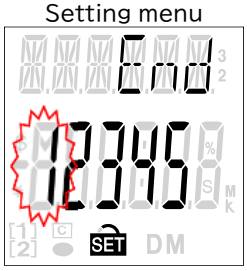
*1: On confirmation mode, transition to operating mode.
*2: Transition for EMU4-HD1-MB only.
*3: Transition only when connecting logging module.
*4: Not displayed on setting mode.
*5: For details, refer to "8.7 Initialization of related items by change of setting" in this manual.

Symbol	Behavior	Switch operation	
→	Transition from operating mode to setting mode.	[DISP/SET] + [+/PHASE]	Press both at the same time for 2 sec
→	Enter each setting display or transition to next item.	[DISP/SET]	Press once
→	Change menu number. Change to "End" or "CANSEL" display.	[+/PHASE] or [-/RESET]	Press several times

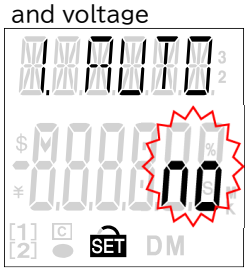
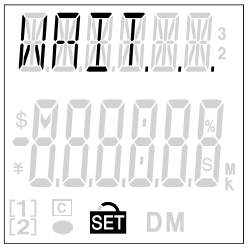
8.2 Setting menu 1 : Phase wire system, primary voltage, sensor type, primary current, demand time, etc.

In this menu, set phase wire system, primary voltage, sensor type, primary current, demand time, etc.
In operating mode, press both [DISP/SET] and [+/PHASE] at the same time for more than two seconds to transition to setting mode and enable the following operations.

The underlined values each setting value are the defaults.

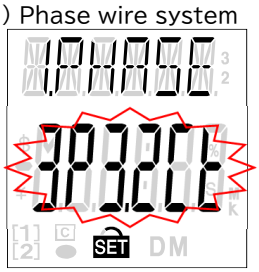
Setting menu 	Choose the setting menu 1.

DISP/SET

(1) Automatic detection of phase wire system and voltage 	Select whether to enable or disable the phase wire system and voltage automatic detection function. *This function determines the voltage for direct measurement (not combined with VT). The voltage when combined with VT cannot be determined.  ●For yES, the phase wire system and voltage of the circuit to be measured are automatically determined (Use the input voltage for discrimination). During the automatic detection, the screen shown in the upper right figure is displayed. Once the determination is complete, move on to the next setting. Check the determined result by “(2) phase and wire system” and “(5) primary voltage (direct)”. If it fails, the screen shown in the lower right figure will be displayed and you will move to the next setting.  ●For no, automatic determination is not performed. <u>no</u> (Do not detect automatically) ⇔ yES (Detect automatically)

DISP/SET

(2) Phase wire system



Set according to the phase wire system for the measured circuit.
If automatic detection is being performed by “(1) automatic detection of phase wire system and voltage”, the set value is displayed.

For EMU4-BD1A-MB

3P3.2Ct:
Three-phase 3-wire (2CT)
1P2: Single-phase 2-wire
1P3: Single-phase 3-wire

For EMU4-HD1A-MB

3P3.2Ct:
Three-phase 3-wire (2CT)
3P3.3Ct:
Three-phase 3-wire (3CT)
3P4: Three-phase 4-wire
1P2: Single-phase 2-wire
1P3: Single-phase 3-wire

●For Single-phase 2-wire: Transition to the setting below.

●For Single-phase 3-wire:
・EMU4-BD1A-MB: Transition to “(9)Sensor type”.
・EMU4-HD1A-MB: Transition to “(5)Primary voltage (Direct)”.

●For other phase wire system: Transition to “(4)Use or non-use of VT”.

*When single-phase three-wire system is selected for EMU4-BD1A-MB, “(4) Use or non-use of VT” is set to no, “(5) Primary voltage (direct)” is set to 110 V/ 220 V.

DISP/SET

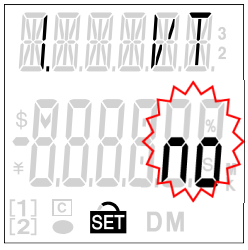
(3) 2 circuits measuring function availability

Set to effective or invalid of 2 circuits measuring function.

no ⇔ yES
(2 circuits measuring invalid) (2 circuits measuring effective)

DISP/SET

(4) Use or non-use of VT



Set to use or non-use of VT.

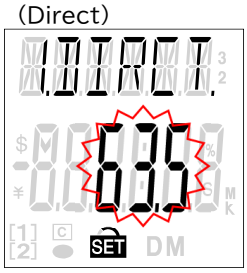
no ⇔ yES

●You measure directly (i.e. without VT):
⇒ Choose “no” and press [DISP/SET] to transition to “(5) Primary voltage (Direct)”.

●You measure with VT:
⇒ Choose “yES” and press [DISP/SET] to transition to “(6) Primary voltage (with VT)”.

DISP/SET

(5) Primary voltage (Direct)



Set the direct voltage according to voltage of the measured circuit.
If automatic detection is being performed by “(1)automatic detection of phase wire system and voltage”, the set value is displayed.

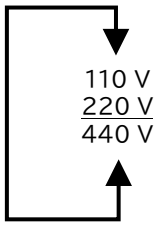
●For EMU4-BD1A-MB: 110 V ⇔ 220 V

●For EMU4-HD1A-MB:
The setting range differs depending on the setting of ”(2) Phase wire system”.
*For setting values with ”/” such as ”110 V/220 V”, the left side of ”/” is displayed on the screen.

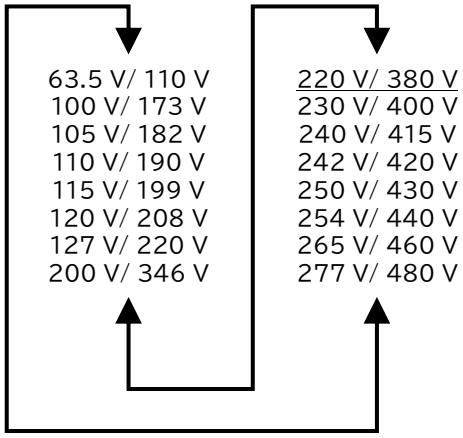
・In case of Single-phase 3-wire:

110 V/ 220 V ⇔ 220 V/ 440 V

・In case of Three-phase 3-wire, Single-phase 2-wire:

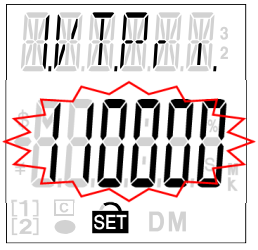


・In case of Three-phase 4-wire:

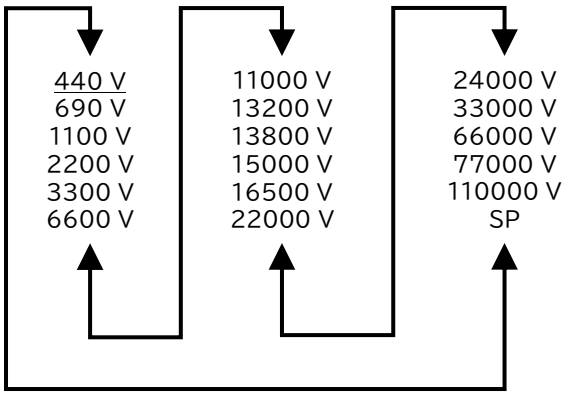


DISP/SET

(6) Primary voltage (With VT)



Set the primary voltage of combined VT.



Set according to the following conditions according to the phase wire system.

・Single-phase 2-wire:
Line voltage
・Single-phase 3-wire:
Line voltage
・Three-phase 3-wire:
Line voltage
・Three-phase 4-wire:
Phase voltage

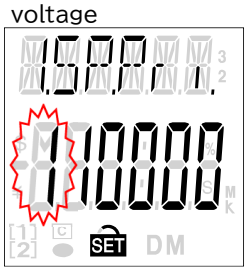
*If there is no values above you want to set to, choose “SP” to enable the special primary voltage and the special secondary voltage.
In case you choose “3P4” (three-phase 4-wire system) in “(2) Phase wire system”, the special voltage is only available.

●If you choose “SP”: Transition to “(7) Special primary voltage”.

●If you choose the value except for “SP”: Transition to “(9) Sensor type”.
(In this case, secondary voltage is fixed to 110 V.)

DISP/SET

(7) Special primary voltage



Setting of special primary voltage

The setting range differs depending on the setting of "(2) Phase wire system".

●In case of Three-phase 3-wire, Single-phase 2-wire:
Setting range: 1 V to 110000 V
(Set the upper three digit of the value)
Default value: 440 V

●In case of Three-phase 4-wire:
Setting range: 1 V to 63500 V
(Set the upper three digit of the value)
Default value: 254 V

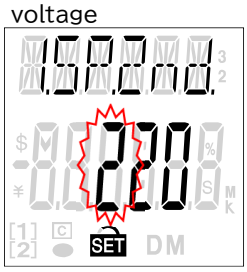
Set according to the following conditions according to the phase wire system.
・Single-phase 2-wire:
Line voltage
・Single-phase 3-wire:
Line voltage
・Three-phase 3-wire:
Line voltage
・Three-phase 4-wire:
Phase voltage

■Setting operation
①Set the value in order from the upper digits (at flashing digits).
Press [+/PHASE] or [-/RESET] to choose the value at flashing digit.
②Press [DISP/SET] for the setting digit (flashing digit) to shift to the next digit.
③Press [DISP/SET] at the lowest digit to transition to "(8) Special secondary voltage".

*The values set the upper fourth digit and lowers to are rounded down. After setting value flashes three times, transition to "(8) Special secondary voltage".
*In case you set the value for out of range, indicate the error (E005).
When indicating the error, press [DISP/SET] to check the setting values and set the new value again.

DISP/SET

(8) Special secondary voltage



Set the special secondary voltage of combined VT.

Setting range: 1 V to 220 V

●For Three-phase 3-wire, Single-phase 2-wire:
Default value: 110 V

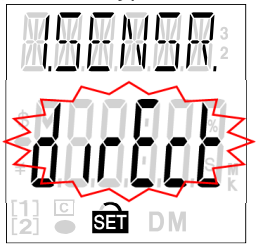
●For Three-phase 4-wire
Default value: 64 V

■Setting operation
①Set the value in order from the upper digits(flashing digits).
Press [+/PHASE] or [-/RESET] to choose the value at flashing digit.
②Press [DISP/SET] for the setting digit (flashing digit) to shift to the next digit.
③Press [DISP/SET] at the lowest digit to transition to "(9) Sensor type".

*In case you set the value for out of range, indicate the error (E005).
When indicating the error, press [DISP/SET] to check the setting values and set the new value again.

DISP/SET

(9) Sensor type



Set the type of combined split type current sensor.

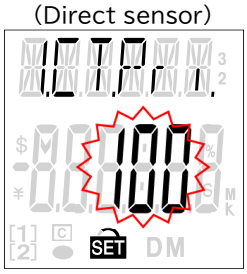
dirEct ⇔ 5 A

●You use split type current sensor (connection with general wire type) (except for EMU-CT5-A):
⇒ Choose "dirEct" and press [DISP/SET] to transition to "(10) Primary current (Direct sensor)".

●You use split type current sensor (connection with dedicated cable type) or EMU-CT5-A:
⇒ Choose "5 A" [DISP/SET] and press to transition to "(11) Primary current (5 A sensor)".

DISP/SET

(10) Primary current (Direct sensor)



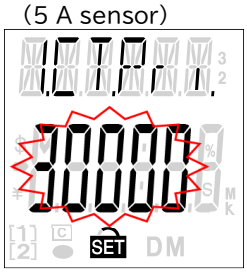
Set the primary current of combined split type current sensor.

50 A ◆◆ <u>100 A</u> ◆◆ 250 A ◆◆ 400 A ◆◆ 600 A

After you choose the value, transition to “(13) Current demand time”.

DISP/SET

(11) Primary current (5 A sensor)



Set the primary current of combined CT (Current transformer).

5 A	30 A	200 A	1200 A	6000 A
6 A	40 A	250 A	1250 A	7500 A
7.5 A	50 A	300 A	1500 A	8000 A
8 A	60 A	400 A	1600 A	10000 A
10 A	75 A	500 A	2000 A	12000 A
12 A	80 A	600 A	2500 A	20000 A
15 A	<u>100 A</u>	750 A	3000 A	25000 A
20 A	120 A	800 A	4000 A	30000 A
25 A	150 A	1000 A	5000 A	SP

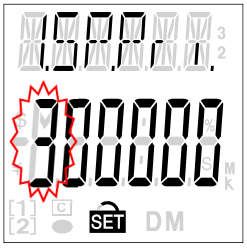
*Supplement: If there is no values above you want to set to, choose “SP” to enable the special primary current.

●You choose “SP”: Transition to “(12) Special primary current”.

●You choose the value except for “SP”: Transition to “(13) Current demand time”.

DISP/SET

(12) Special primary current



Set the special primary current of combined CT (Current transformer).

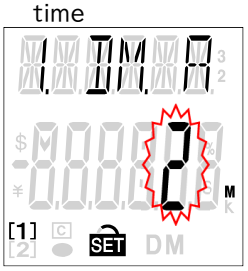
Setting range: 5 A to 30000 A (Default: 100.0 A)
*The value is less than 10 A: You can set upper two digits of it.
The value is 10 A or more: You can set upper three digits of it.

■Setting operation
①Set the value in order from the upper digits(flashing digits).
Press [+/PHASE] or [-/RESET] to choose the value at flashing digit.
②Press [DISP/SET] for the setting digit (flashing digit) to shift to the next digit.
③Press [DISP/SET] at the lowest digit to transition to “(13) Current Demand time”.

*In case you set the value for out of range, indicate the error (E005).
When indicating the error, press [DISP/SET] to check the setting values and set the new value again.

DISP/SET

(13) Current demand time



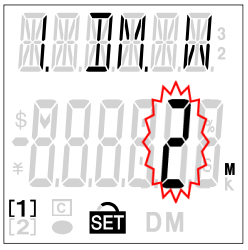
Set the current demand time.
On setting display, “s” means “second” and “M” means “minute”.

0 s → 10 s → 20 s → 30 s → 40 s → 50 s → 1 M → 2 M → 3 M → 4 M → 5 M → 6 M → 7 M → 8 M → 9 M → 10 M → 11 M → 12 M → 13 M → 14 M → 15 M → 20 M → 25 M → 30 M → 0 s

*If “(3) 2 circuits measurement function availability” is set to ”yES”, set each circuit. Set the first circuit ([1] is displayed at the bottom left of the screen) and the second circuit ([2] is displayed at the bottom left of the screen) in order.

DISP/SET

(14) Electric power demand time



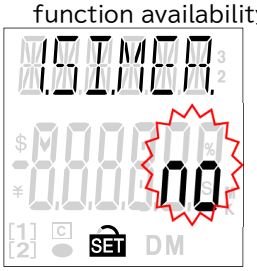
Set the electric power demand time.
On setting display, “s” means “second” and “M” means “minute”.

0 s → 10 s → 20 s → 30 s → 40 s → 50 s → 1 M → 2 M → 3 M → 4 M → 5 M → 6 M → 7 M → 8 M → 9 M → 10 M → 11 M → 12 M → 13 M → 14 M → 15 M → 20 M → 25 M → 30 M → 0 s

*If “(3) 2 circuits measurement function availability” is set to ”yES”, set each circuit. Set the first circuit ([1] is displayed at the bottom left of the screen) and the second circuit ([2] is displayed at the bottom left of the screen) in order.

DISP/SET

(15) Simple measurement function availability



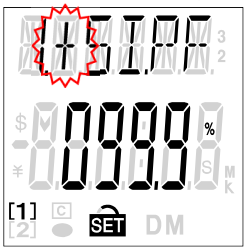
Set to effective or invalid of simple measurement function.

no (Simple measurement invalid) ⇔ yES (Simple measurement effective)

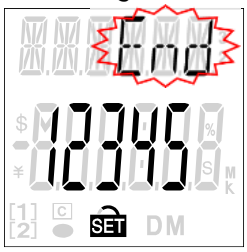
●You choose “no”: Transition to “Setting menu”.

●You choose “yES”: Transition to the setting below.

DISP/SET

(16) Simple measurement (Power factor) 	Set the power factor value in the simple measurement. Setting range: -0.1 to -99.9, 100.0 to 0.0 Default value: 100.0 ■Setting operation ①Set the blinking part in the order of the sign and the numerical value (the numerical value is from the upper digit). Press [+/PHASE] or [-/RESET] to choose the value at flashing digit. ②Press [DISP/SET] for the setting digit (flashing digit) to shift to the next digit. ③Press [DISP/SET] at the lowest digit to transition to “Setting menu”. *In case you set the value for out of range, indicate the error (E005). When indicating the error, press [DISP/SET] to check the setting values and set the new value again. *If “(3) 2 circuits measurement function availability” is set to ”yES”, set each circuit. Set the first circuit ([1] is displayed at the bottom left of the screen) and the second circuit ([2] is displayed at the bottom left of the screen) in order.

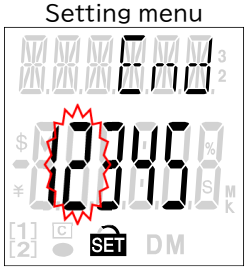
DISP/SET

Setting menu 	Complete the setting or continue in other menu according to procedures for setting. For procedures for setting, refer to “8.1 Procedures for setting”.

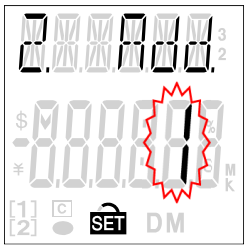
8.3 Setting menu 2 : MODBUS RTU communication

In this menu, set address, baud rate, parity and stop bit for MODBUS RTU communication.
In operating mode, press both [DISP/SET] and [+/PHASE] at the same time for more than two seconds to transition to setting mode and enable the following operations.

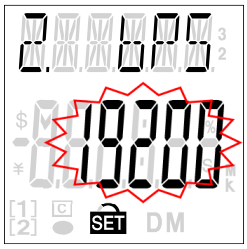
The underlined values each setting value are the defaults.

Setting menu 	Choose the setting menu 2.

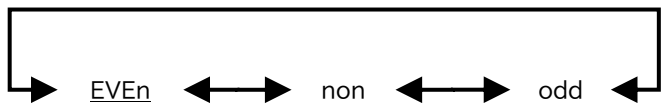
DISP/SET

(1) MODBUS address 	Set the address for MODBUS RTU. Available address: <u>1</u> to 255

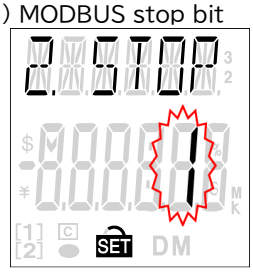
DISP/SET

(2) MODBUS baud rate 	Set the transmission speed for MODBUS RTU. 

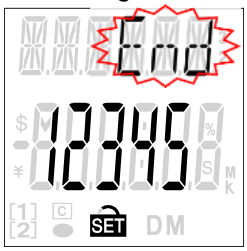
DISP/SET

(3) MODBUS parity 	Set the parity for MODBUS RTU. 

DISP/SET

(4) MODBUS stop bit 	Set the stop bit for MODBUS RTU. 1 ⇔ 2

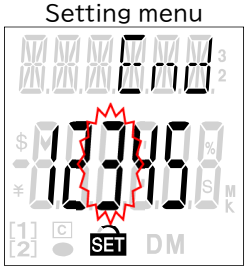
DISP/SET

Setting menu 	Complete the setting or continue in other menu according to procedures for setting. For procedures for setting, refer to “8.1 Procedures for setting”.

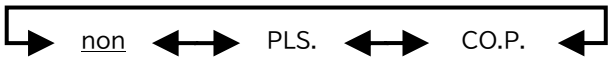
8.4 Setting menu 3 : External input/output, electric energy converted value, harmonic, operating time, etc.

In this menu, set External input/output, electric energy converted value, harmonic, operating time, etc.
In operating mode, press both [DISP/SET] and [+/PHASE] at the same time for more than two seconds to transition to setting mode and enable the following operations.

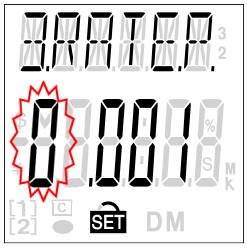
The underlined values each setting value are the defaults.

Setting menu 	Choose the setting menu 3. ●For EMU4-BD1A-MB: ⇒ Choose “3“ and press [DISP/SET] to transition to “(13) Operating time indication”. ●For EMU4-HD1A-MB: ⇒ Choose “3“ and press [DISP/SET] to transition to the setting below.

DISP/SET

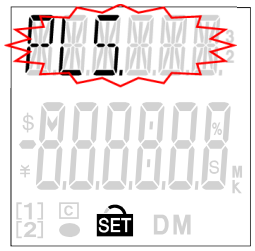
(1) Use or non-use of external input 	Set external input signal.  ●You choose “PLS.”: Transition to “(2) Pulse converted rate”. ●You choose “CO.P.”: Transition to “(4) Reset method of contact input”. ●You choose “non”: Transition to “(5) Use or non-use of external output”.

DISP/SET

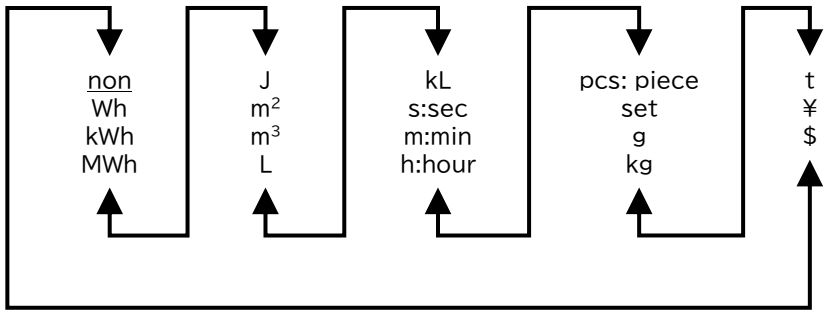
(2) Pulse converted rate 	Sets the pulse multiplication factor of the external input pulse. Multiply the number of weighing pulses by a multiplier to convert to other units. Converted rate is displayed. Setting range: 0.001 to 10000 Default value: 1.000 ■Setting operation ①Set the value in order from the upper digits(flashing digits). Press [+/PHASE] or [-/RESET] to choose the value at flashing digit. ②Press [DISP/SET] for the setting digit (flashing digit) to shift to the next digit. ③Press [DISP/SET] at the lowest digit to transition to the setting below. *In case you set the value for out of range, indicate the error (E005). When indicating the error, press [DISP/SET] to check the setting values and set the new value again.

DISP/SET

(3) Pulse converted value unit



Set the unit amount pulse converted value.



After you choose the value, transition to “(5) Use or non-use of external output”.

DISP/SET

(4) Reset method of contact input

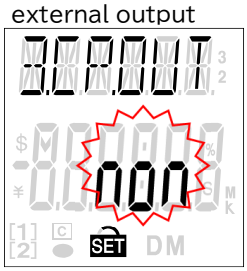
Set the reset method of contact input.

Auto ⇔ HoLd

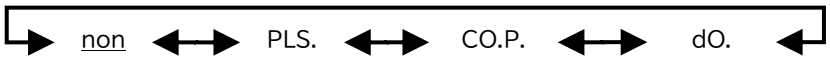
Reset method (Setting value)	Summery
Auto-reset (Auto)	When contact input turns OFF (open), contact input state display also turns OFF (open) automatically.
Self-retention (HoLd)	Once the device detects contact input ON (close), contact input state display keeps ON (close) until retention clear operation even if contact input turns OFF (open).

DISP/SET

(5) Use or non-use of external output



Set External output signal.



Setting value	Summery
PLS.	Outputs the measured electric energy (incoming) in pulses.
CO.P.	Contact output is made when an alarm is generated by the upper/lower limit alarm or waveform band monitoring.
dO.	Performs contact output. ON/OFF can be controlled by communication.
non	No external output.

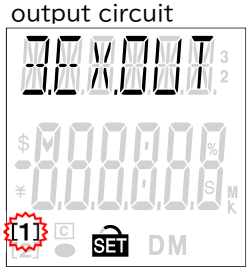
The following screen differs depending on this setting and the setting of setting menu 1 ”(3) 2 circuits measuring function availability ”.

●In case you set 2 circuits measuring effective.
・PLS.: Transition to the setting below.
・CO.P., dO., non : Transition to “(8) Electric energy converted value indication”.

●In case you set 2 circuits measuring invalid.
・PLS.: Transition to “(7) Unit amount of pulse output”.
・CO.P., dO., non: Transition to “(8) Electric energy converted value indication”.

DISP/SET

(6) The object of external output circuit

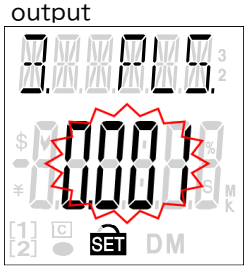


Set when you set 2 circuits measuring effective.
Set the circuit to which the pulse output is performed.

[1]: 1st circuit ⇔ [2]: 2nd circuit

DISP/SET

(7) Unit amount of pulse output



Set the unit amount per pulse of pulse output.
The pulse output unit changes as follows by the full load power.

$$\text{Full load power[kW]} = \frac{\alpha \times (\text{primary voltage}) \times (\text{primary current})}{1000}$$

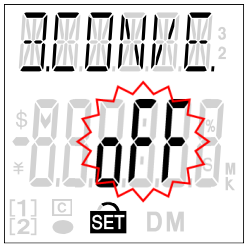
$$\left(\begin{array}{l} \alpha: 1 \text{ Single-phase 2-wire} \\ \quad 2 \text{ Single-phase 3-wire} \\ \sqrt{3} \text{ 3-phase 3-wire} \\ \quad 3 \text{ 3-phase 4-wire} \end{array} \right)$$

*1: The primary voltage is calculated with a setting value either primary voltage(direct) or primary voltage(with VT).
*2: The primary current is calculated with a setting value either primary current(direct) or primary current(5 A sensor).
*3: The primary voltage of the three phase 4-wire system is calculated by the phase voltage.

"Full load power" [kW]	Selectable unit amount per pulse [kWh/pulse]				Default value
less than 12	1	0.1	0.01	0.001	0.001
12 or more and less than 120	10	1	0.1	0.01	0.01
120 or more and less than 1200	100	10	1	0.1	0.1
1200 or more and less than 12000	1000	100	10	1	1
12000 or more and less than 120000	10000	1000	100	10	10
120000 or more	100000	10000	1000	100	100

DISP/SET

(8) Electric energy converted value indication



Set whether the electric energy converted value is indicated or not.
The electric energy conversion value is displayed by multiplying the electric energy (incoming) by the electric energy conversion factor and integrating it.

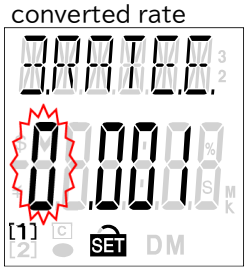
oFF ⇔ on
(Do not indicate) (Indicate)

●You choose “on”: Transition to the setting below.

●You choose “oFF”: Transition to “(11) Harmonic current indication”.

DISP/SET

(9) Electric energy converted rate



Set the electric energy converted rate.

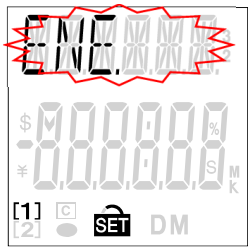
Setting range: 0.001 to 10000
Default value: 1.000

■Setting operation
①Set the value in order from the upper digits(flashing digits).
Press [+/PHASE] or [-/RESET] to choose the value at flashing digit.
②Press [DISP/SET] for the setting digit (flashing digit) to shift to the next digit.
③Press [DISP/SET] at the lowest digit to transition to the setting below.

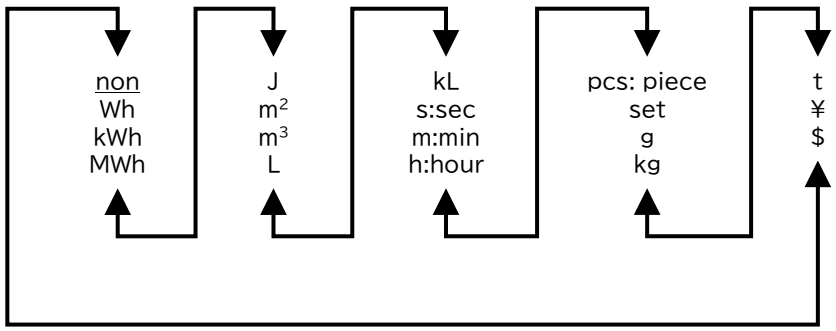
*In case you set the value for out of range, indicate the error (E005).
When indicating the error, press [DISP/SET] to check the setting values and set the new value again.
*If “(3) 2 circuits measurement function availability” is set to “yES”, set each circuit.
Set the first circuit ([1] is displayed at the bottom left of the screen) and the second circuit ([2] is displayed at the bottom left of the screen) in order.

DISP/SET

(10) Electric energy converted value unit



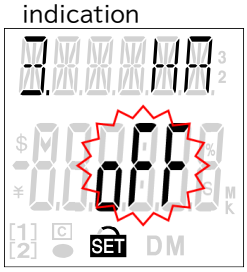
Set the unit amount electric energy converted value.



*If “(3) 2 circuits measurement function availability” is set to “yES”, set each circuit.
Set the first circuit ([1] is displayed at the bottom left of the screen) and the second circuit ([2] is displayed at the bottom left of the screen) in order.

DISP/SET

(11) Harmonic current indication

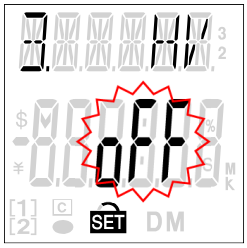


Set whether the harmonic current is indicated or not.

oFF ⇔ on
(Do not indicate) (Indicate)

DISP/SET

(12) Harmonic voltage indication

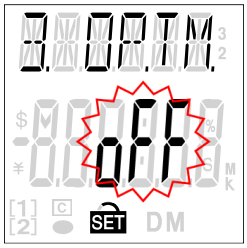


Set whether the harmonic voltage is indicated or not.

oFF ⇔ on
(Do not indicate) (Indicate)

DISP/SET

(13) Operating time indication



Set whether the operating time is indicated or not.

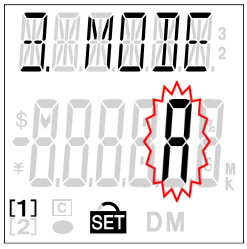
oFF ⇔ on
(Do not indicate) (Indicate)

●For EMU4-BD1A-MB.
・You choose “oFF”: Transition to “(16) Backlight dimming”.
・You choose “on”: Transition to “(15) Operating time”.

●For EMU4-HD1A-MB.
・You choose “oFF”: Transition to “(16) Backlight dimming”.
・You choose “on”: Transition to the setting below.

DISP/SET

(14) Operating time measurement method



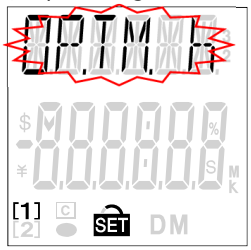
Set the operating time measurement method.
When “A” is selected, operating time is the time integrated while the current measurement. When “CO.P.” is selected, operating time is the time integrated while external input is “ON”.

∗”CO.P.” in this setting can be set when ”CO.P.” is selected in ”(1) Use or non-use of external input”.

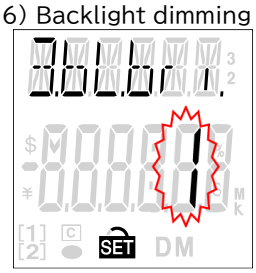
A ⇔ CO.P.
(By current) (By contact input)

∗If “(3) 2 circuits measurement function availability” is set to ”yES”, set each circuit. Set the first circuit ([1] is displayed at the bottom left of the screen) and the second circuit ([2] is displayed at the bottom left of the screen) in order.

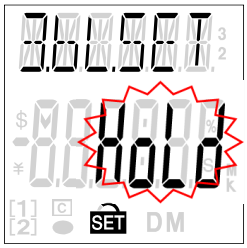
DISP/SET

(15) Operating time unit 	Set the Operating time unit h: hour ⟷ m: min ⟷ s: sec *If “(3) 2 circuits measurement function availability” is set to ”yES”, set each circuit. Set the first circuit ([1] is displayed at the bottom left of the screen) and the second circuit ([2] is displayed at the bottom left of the screen) in order.

DISP/SET

(16) Backlight dimming 	Set the brightness of the backlight. The higher the number, the brighter the backlight. Setting range: 1 to 5 Default value: 3

DISP/SET

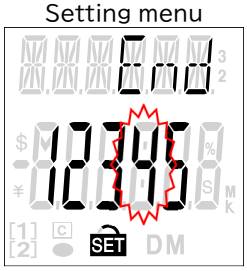
(17) Backlight lighting method 	Set the lighting method of the backlight. When “AUTO” is selected, turn in the backlight only during operation.(If 5 minute has passed since the last key operation, backlight will be OFF.) When “HOLD” is selected, always turn on the backlight. Auto ⇔ HoLd

DISP/SET

Setting menu 	Complete the setting or continue in other menu according to procedures for setting. For procedures for setting, refer to “8.1 Procedures for setting”.

8.5 Setting menu 4 : Waveform band monitoring, upper / lower limit alarm, etc.

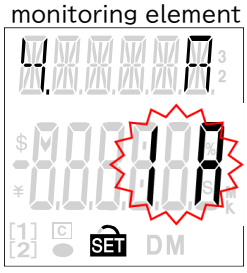
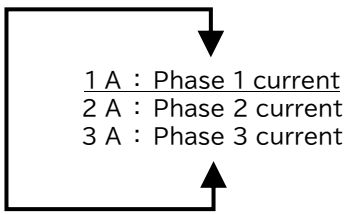
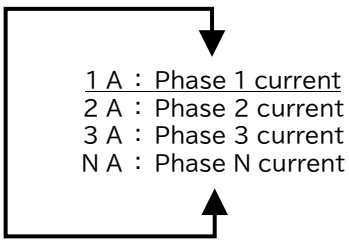
In this menu, configure settings related to waveform band monitoring and upper/lower limit alarms.
In operating mode, press both [DISP/SET] and [+/PHASE] at the same time for more than two seconds to transition to setting mode and enable the following operations.

Setting menu 	Choose the setting menu 4. ●For EMU4-BD1A-MB: Transition to “(8) Use or non-use of upper / lower limit alarm“. ●For EMU4-HD1A-MB: Transition to “(1) Use or non-use of waveform band monitoring“.

DISP/SET

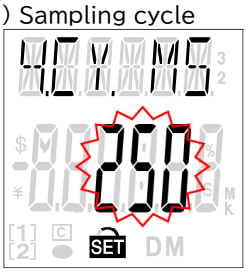
(1) Use or non-use of waveform band monitoring 	Set to effective or invalid of waveform band monitoring. *When waveform band monitoring is enabled, ”(1)Use or non-use of external input” in setting menu 3 is changed to ”CO.P.” (contact input) and ”(5) Use or non-use of external output” in setup menu 3 is changed to ”CO.P.” (alarm output). no ⇔ yES (Do not monitor) (Monitor) ●You choose “no”: Transition to “(8) Use or non-use of upper / lower limit alarm“. ●You choose “yES”: Transition to the setting below.

DISP/SET

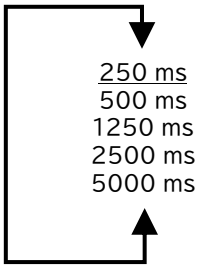
(2) Waveform band monitoring element 	Set the phase current of waveform band monitoring. Setting range is determined by setting for “(2) Phase wire system“ and “(3) 2 circuits measuring function availability” of Setting menu 1. ●For Single-phase 2-wire(1 circuit measuring) 1 A: Phase 1 current ●For Single-phase 2-wire(2 circuits measuring) 1 A: Phase 1 current ⇔ 3 A: Phase 3 current ●For Single-phase 3-wire, Three-phase 3-wire  1 A : Phase 1 current 2 A : Phase 2 current 3 A : Phase 3 current ●For Three-phase 4-wire  1 A : Phase 1 current 2 A : Phase 2 current 3 A : Phase 3 current N A : Phase N current

DISP/SET

(3) Sampling cycle

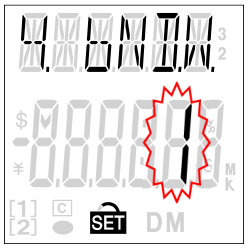


Set the sampling cycle of waveform band monitoring.



DISP/SET

(4) Band width factor

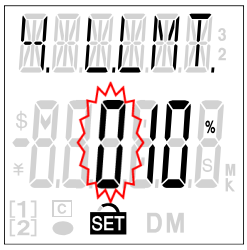


Set the width of the band.
If you choose a large value, the band width will be wider.

Setting range: 1 to 10
Default value: 3

DISP/SET

(5) Standard deviation lower limit



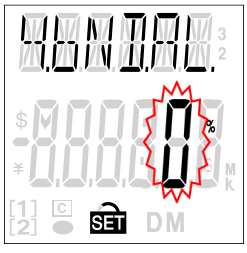
Set the value of standard deviation lower limit. (The standard deviation is used to determine the band width.)
If the standard deviation calculated when generating the reference waveform is less than “primary current x standard deviation lower limit (%)”, the band width is determined by using “primary current x standard deviation lower limit (%)” as the standard deviation.

*The primary current is either “(10) Primary current (Direct sensor)” or “(11) Primary current (5 A sensor)” in the setting menu 1.

Setting range: 1 to 100 (Can be set in increments of 1%.)
Default value: 10

DISP/SET

(6) Band out rate

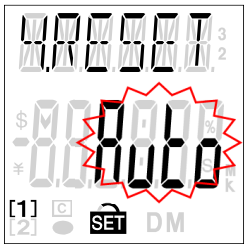


Sets the threshold for waveform band monitoring.
An alarm is output when the Band out rate exceeds the threshold.

Setting range: 0 to 100 (Can be set in increments of 5%.)
Default value: 30

DISP/SET

(7) Waveform band monitoring alarm reset method



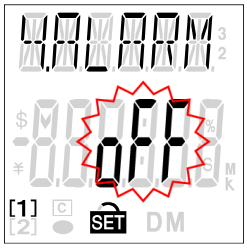
Set the alarm reset method when an alarm occurs with waveform band monitoring.
Auto ⇔ HoLd

Reset method (Setting value)	Summery (For details, refer to "9.3.2".)
Auto-reset (Auto)	Reset the alarm automatically when alarm occurring condition is gone.
Self-retention (HoLd)	The alarm is held even after alarm occurring condition is gone. Button operation is necessary to clear the alarm.

After you choose the value, go back to "Setting menu".

DISP/SET

(8) Use or non-use of upper / lower limit alarm



Set the use or non-use of upper / lower limit alarm.
oFF ⇔ on
(Do not use alarm) (Use alarm)

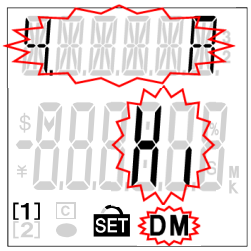
●You choose "oFF": Transition to "Setting menu".

●You choose "on": Transition to the setting below.

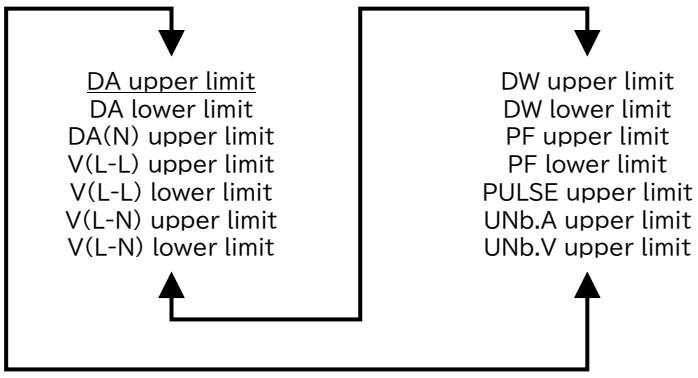
*If "(3) 2 circuits measurement function availability" is set to "yES", set each circuit. Set the first circuit ([1] is displayed at the bottom left of the screen) and the second circuit ([2] is displayed at the bottom left of the screen) in order.

DISP/SET

(9) Upper / lower limit alarm monitoring elements



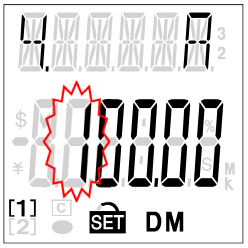
Set the measured element applying upper / lower limit alarm to.
Upper / lower limit alarm of measured value is available by setting this item.



*1: DA: Current demand, DA(N): N-phase Current demand, DW: Electric power demand, V(L-L): Line voltage, V(L-N): Phase voltage, PULSE: Pulse converted value, UNb.A: Current unbalance rate, UNb.V: Voltage unbalance rate
*2: "DA(N)" and "V(L-N)" are selectable in three-phase 4-wire system
*3: "PULSE" is only selectable when you choose "Pulse (PLS.)" on "(1) Use or non-use of external input" of setting menu No.3.
*4: "UNb.A" and "UNb.V" can only be selected when other than "1P2" is selected in setting menu 1 "(2) phase wire system".
*5: If "(3) 2 circuits measurement function availability" is set to "yES", set each circuit. Set the first circuit ([1] is displayed at the bottom left of the screen) and the second circuit ([2] is displayed at the bottom left of the screen) in order.

DISP/SET

(10) Upper / lower limit alarm value



(Example:
DA upper limit)

Set the upper / lower limit alarm values.
Setting range is as follows:

Measurement element	Setting range	Threshold	Unit
DA upper limit DA(N) upper limit	0% to 100%	Primary current × Setting value	A
DA lower limit	0% to 100%		
V(L-L) upper limit V(L-N) upper limit	0% to 136% (Default value is 110)	Primary voltage × Setting value	V
V(L-L) lower limit V(L-N) lower limit	0% to 136%		
DW upper limit	-100% to 0% to 100%	Full load power × Setting value	kW
DW lower limit	-100% to 0% to 100%		
PF upper limit	-5% to 100% to 5% (Default value is -50)	Setting value	%
PF lower limit	-5% to 100% to 5% (Default value is 50)		
PULSE upper limit	1 to 999999 (Default value is 100000)	Setting value	
UNb.A upper limit	0.01 to 999.99 (Default value is 30.00)	Setting value	%
UNb.V upper limit	0.01 to 999.99 (Default value is 3.00)		

■Setting operation
①Set the value in order from the upper digits(flashing digits).
Press [+/PHASE] or [-/RESET] to choose the value at flashing digit.
②Press [DISP/SET] for the setting digit (flashing digit) to shift to the next digit.
③Press [DISP/SET] at the lowest digit to transition to “(11) Alarm delay time”.

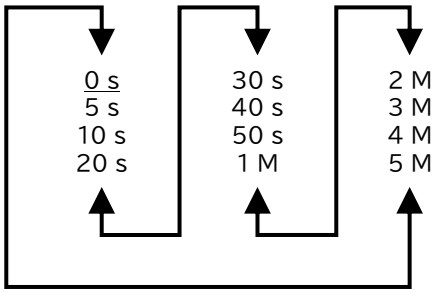
*In case you set the value for out of range, indicate the error (E005).
When indicating the error, press [DISP/SET] to check the setting values and set the new value again.
*If “(3) 2 circuits measurement function availability” is set to ”yES”, set each circuit.
Set the first circuit ([1] is displayed at the bottom left of the screen) and the second circuit ([2] is displayed at the bottom left of the screen) in order.

↓ DISP/SET

(11) Alarm delay time

Set the delay time from fulfilling the upper / lower limit alarm occurring condition.
In setting display, “s” means “second” and “M” means “minute”.

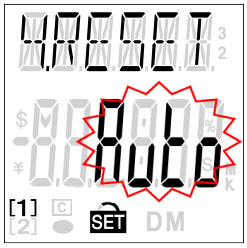
*Set the alarm delay time if you want to avoid the alarm caused by such as instant overload and noise.
Once setting, the alarm does not occur unless the time of exceeding the upper / lower limit alarm value is over the specified delay time.



*If “(3) 2 circuits measurement function availability” is set to ”yES”, set each circuit. Set the first circuit ([1] is displayed at the bottom left of the screen) and the second circuit ([2] is displayed at the bottom left of the screen) in order.

DISP/SET

(12) Upper/lower limit alarm reset method



Set the alarm reset method in the upper / lower limit alarm occurrence.

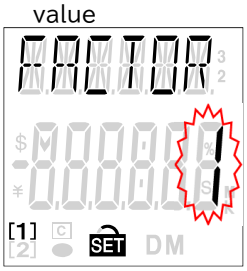
Auto ⇔ HoLd

Reset method (Setting value)	Summery (For details, refer to “9.3.1”.)
Auto-reset (Auto)	Reset the alarm automatically when alarm occurring condition is gone.
Self-retention (HoLd)	The alarm is held even after alarm occurring condition is gone. Button operation is necessary to clear the alarm.

*If “(3) 2 circuits measurement function availability” is set to ”yES”, set each circuit. Set the first circuit ([1] is displayed at the bottom left of the screen) and the second circuit ([2] is displayed at the bottom left of the screen) in order.

DISP/SET

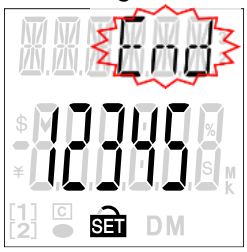
(13) Multiplication factor of monitor value



Set the multiplier when displaying the alarm cumulative time.
When the alarm cumulative time is displayed on the LCD of this unit, the value multiplied by the set value is displayed by the alarm cumulative time.

*If “(3) 2 circuits measurement function availability” is set to ”yES”, set each circuit. Set the first circuit ([1] is displayed at the bottom left of the screen) and the second circuit ([2] is displayed at the bottom left of the screen) in order.

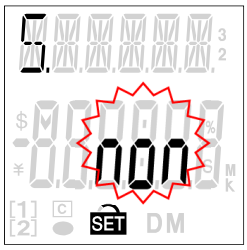
DISP/SET

Setting menu 	Complete the setting or continue in other menu according to procedures for setting. For procedures for setting, refer to “8.1 Procedures for setting”.

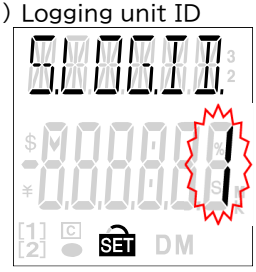
8.6 Setting menu 5: Setting related to logging unit

In this menu, set the logging unit ID or logging data clear.
In operating mode, press both [DISP/SET] and [+/PHASE] at the same time for more than two seconds to transition to setting mode and enable the following operations.

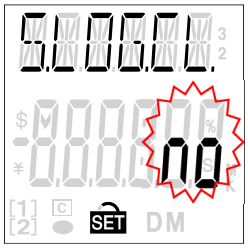
DISCLAIMER	When set Setting menu 1 to 4, perform the end (choose ”End” twice and shift to operating mode) of setting mode once, and please go to setting mode in a procedure to set Setting menu 5 after a shift again. (Set point of Setting menu 5 cannot cool reflection definitely when do not set Setting menu 5 in individual treatment.)

Setting menu 	Choose the setting menu 5. *When the logging unit (module : EMU4-LM) is not connected, the display indicates “non” (as shown in the right figure) and go back to setting menu. 

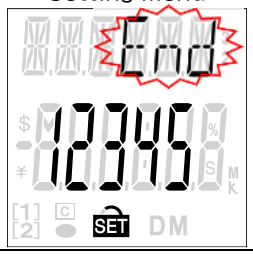
DISP/SET

(1) Logging unit ID 	Set the ID number of logging unit. Available ID: 1 to 255

DISP/SET

(2) Logging data clear confirmation 	Clear the logging data. no ⇔ yES (Do not clear data) (Clear data)

DISP/SET

Setting menu 	Complete the setting according to procedures for setting. For procedures for setting, refer to “8.1 Procedures for setting”.

8.7 Initialization of related items by change of setting

The following operation will change the corresponding settings, the accumulated values, maximum values and minimum values to the default values.

■To be changed the setting values and the reference waveform.

Setting item			Changed setting value																								
			Menu 1											Menu 3					Menu 4								
			Phase wire system	Use or non-use of VT	2 circuits measuring function availability	Primary voltage(Direct)	Primary voltage(With VT)	Special primary voltage	Special secondary voltage	Sensor type	Primary current(Direct sensor)	Primary current(5 A sensor)	Special primary current	Use or non-use of external input	Pulse converted rate	Reset method of contact input	Use or non-use of external output	The object of external output circuit	Use or non-use of waveform band monitoring	Waveform band monitoring element	Sampling cycle	Upper / lower limit alarm monitoring elements	Upper / lower limit alarm value	Upper / lower limit alarm monitoring elements(CH2)	Upper / lower limit alarm value(CH2)
Setting value to be changed	Menu 1	Use or non-use of VT	●	■	●																						
		2 circuits measuring function availability	●		■																						
		Primary voltage(Direct)	●		●	■																					
		Primary voltage(With VT)	●		●		■																				
		Special primary voltage	●		●			■																			
		Special secondary voltage	●		●				■																		
		Sensor type	○		○					■																	
		Primary current(Direct sensor)	○		○					○	■																
		Primary current(5A sensor)	○		○					○		■															
		Special primary current	○		○					○			■														
	Menu 3	Use or non-use of external input												■					★								
		Reset method of contact input														■			★								
		Use or non-use of external output															■		★								
		The object of external output circuit	○		○													■	★								
		Unit amount of pulse output	○	○	○	○	○	○	○	○	○	○	○														
	Menu 4	Use or non-use of waveform band monitoring	○		○					○	○	○	○	○		○	○	○	■								
		Waveform band monitoring element	○		○					○	○	○	○							■							
		Sampling cycle	○		○					○	○	○	○								■						
		Band width factor	○		○					○	○	○	○							○	○	■					
		Standard deviation lower limit	○		○					○	○	○	○							○	○		■				
		Waveform band monitoring value	○		○					○	○	○	○							○	○			■			
		Use or non-use of upper / lower limit alarm	○	○	○	○	○	○		○	○	○	○	■	▲			○	○						■		
		Upper / lower limit alarm monitoring elements	○	○	○	○	○	○		○	○	○	○	■	▲			○					■			■	
		Upper / lower limit alarm value	○	○	○	○	○	○		○	○	○	○	■	▲			○					○	■			■
		Multiplication factor of monitor value	○	○	○	○	○	○		○	○	○	○	■	▲			○					○	○	■		
		Use or non-use of upper / lower limit alarm(CH2)	○	○	○	○	○	○		○	○	○	○	■	▲			○	○							■	
		Upper / lower limit alarm monitoring elements(CH2)	○	○	○	○	○	○		○	○	○	○	■	▲			○									■
		Upper / lower limit alarm value(CH2)	○	○	○	○	○	○		○	○	○	○	■	▲			○								○	■
		Multiplication factor of monitor value(CH2)	○	○	○	○	○	○		○	○	○	○	■	▲			○								○	○
	Standard waveform		○		○					○	○	○	○							○	○						
	Standard deviation		○		○					○	○	○	○							○	○						
	Number of standard waveform data		○		○					○	○	○	○							○	○						

symbol	Details
○	It will be changed to the initial value.
●	It will be changed to the initial value corresponding to the phase and wire system.
■	When "pulse conversion value upper limit" is set in the "Upper/lower limit alarm monitoring element" or "Upper/lower limit alarm monitoring element [2]", and "Use or non-use of external input" is changed from "pulse input" to "contact input", it will be changed to the initial value.
▲	If the upper/lower limit alarm monitoring element is set to "pulse conversion value upper limit", it will be changed to the
★	When the waveform band monitoring is changed from "Non-use" to "Use", change the settings as follows. ・Change "Use or non-use of external input" to "contact input". ・Change "Reset method of contact input" to "Auto-reset". ・Change "Use or non-use of external output" to "alarm output". ・Change "The object of external output circuit" to "1".

(CH2) is the setting for the second circuit.
This can be set when the 2-circuits measurement function is enabled.
Settings and measurement items with nothing written on them represent the setting items for the first circuit.

■To be changed the accumulated values, maximum values and minimum values.

Setting item			Changed setting value																																							
			Menu 1																			Menu 3						Menu 4															
			Phase wire system	Use or non-use of VT	2 circuits measuring function availability	Primary voltage(Direct)	Primary voltage(with VT)	Primary special voltage	Secondary special voltage	Sensor type	Primary current(Direct)	Primary current(5A sensor)	Primary special current	Current demand time	Current demand time(CH2)	Power demand time	Power demand time(CH2)	Use or non-use of external input	Reset method of contact input	Use or non-use of external output	The object of external output circuit	Counting method of operating time	Counting method of operating time(CH2)	Use or non-use of waveform band monitoring	Waveform band monitoring element	Sampling cycle	Use or non-use of upper / lower limit alarm	Upper / lower limit alarm monitoring elements	Upper / lower limit alarm value	Alarm delay time	Use or non-use of upper / lower limit alarm(CH2)	Upper / lower limit alarm monitoring elements(CH2)	Upper / lower limit alarm value(CH2)	Alarm delay time(CH2)
Measured value to be the default	Accumulated values	Periodic electric energy																○																							
		Pulse count value																○																							
		Pulse converted value																○																							
		Operating time																				○																			
		Operating time(CH2)																					○																		
		Alarm cumulative time	○	○	○	○	○	○	○	○	○	○	○											○			○	○	○	○										
		Alarm cumulative time(CH2)	○	○	○	○	○	○	○	○	○	○	○											○							○	○	○	○						
		Band alarm count	○		○					○	○	○						○	○	○	○			○	○	○														
		Band cycle count	○		○					○	○	○						○	○	○	○			○	○	○														
	Maximum values	Line voltage	○	○	○	○	○	○	○																															
		Line voltage(CH2)	○	○	○	○	○	○	○																															
		Phase voltage	○	○	○	○	○	○	○																															
		Power factor	○	○	○	○	○	○	○	○	○	○	○																											
		Power factor(CH2)	○	○	○	○	○	○	○	○	○	○	○																											
		Current demand time	○		○					○	○	○	○	○																											
		Current demand time(CH2)	○		○					○	○	○	○		○																										
		Power demand time	○	○	○	○	○	○	○	○	○	○	○			○																								
		Power demand time(CH2)	○	○	○	○	○	○	○	○	○	○	○				○																							
		Current unbalance rate	○		○					○	○	○	○																											
		Voltage unbalance rate	○	○	○	○	○	○	○																															
	Minimum values	Line voltage	○	○	○	○	○	○	○																															
		Line voltage(CH2)	○	○	○	○	○	○	○																															
		Phase voltage	○	○	○	○	○	○	○																															
		Power factor	○	○	○	○	○	○	○	○	○	○	○																											
		Power factor(CH2)	○	○	○	○	○	○	○	○	○	○	○																											
		Current demand time	○		○					○	○	○	○	○																											
		Current demand time(CH2)	○		○					○	○	○	○		○																										
		Power demand time	○	○	○	○	○	○	○	○	○	○	○			○																								
		Power demand time(CH2)	○	○	○	○	○	○	○	○	○	○	○				○																							

symbol	Details
○	It will be initialized (changed to default value).

(CH2) is the setting for the second circuit.
This can be set when the 2-circuit measurement function is enabled.
Settings and measurement items with nothing written on them represent the setting items for the first circuit.

■Initialize all settings.

Enter CANCEL display in setting mode and press both [DISP/SET] and [+/PHASE] at the same time for more than two seconds to initialize all settings. (For entering CANCEL display, refer to “8.1 Procedures for setting”.)

Settings are only initialized. Integrated values (such as electric energy, reactive energy, and operating time) are not changed.

However, if the counting method of operating time is contact input, the operating time will be cleared.

8.8 Other setting

Explain the setting operation other than the setting mode.

8.8.1 Preset and all data reset (Reset/Preset mode)

It is possible to zero clear or preset the integrated value of each measured value (electric energy, operating time, etc.).

■Preset
Preset the following measurement items (integrated values).

Electric energy (incoming), Reactive energy, Electric energy (transmission), periodic electric energy, Electric energy converted value, Pulse converted value, Operation time

Operating mode (Integrated value)  Example : Electric energy(incoming)	Display the screen of the integrated values you want to preset in operation mode.

↓ +/PHASE -/RESET

Press both [+/PHASE] and [-/RESET] at the same time for more than two seconds.

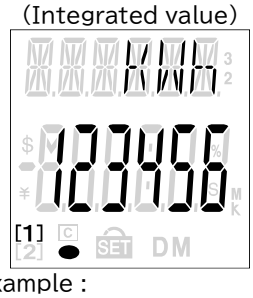
(1) Preset display 	Set the value of preset. ■Setting operation ①Set it in order from the upper digits (at flashing digits). Press [+/PHASE] or [-/RESET] to choose the value at flashing digit. ②Press [DISP/SET] for the setting digit (flashing digit) to shift to the next digit. ③Press [DISP/SET] at the lowest digit to transition to the setting below.

↓ DISP/SET

(2) Preset confirmation display 	Select to execute or cancel the preset. no ⇔ yES (Do not preset) (Preset) ●For preset: ⇒ Choose “yES” and press [DISP/SET]. After you set the preset value, go back to “Operating mode display (Integrated value)”. ●For cancel: ⇒ Choose “no” and press [DISP/SET] to transition to “Operating mode display(Integrated value)”.

■All data reset
Zero clear the following measurement items (integrated value, maximum value, minimum value).

Integrated value	Electric energy (incoming), Reactive energy, Electric energy (transmission), Periodic electric energy, Electric energy converted value, Pulse count value, Pulse converted value, Operation time, Alarm cumulative time, Band alarm count, Band cycle count
Maximum value	Current demand, Voltage, Electric power demand, Power factor, Current unbalance rate, Voltage unbalance rate
Minimum value	Current demand, Voltage, Electric power demand, Power factor

Operating mode (Integrated value)  Example : Electric energy(incoming)	Display the screen of the integrated values in operation mode.

DISP/SET + -/RESET : Press both [DISP/SET] and [-/RESET] at the same time for more than two seconds.

(1) All data reset display (Select the measure target circuit)  	Display when you set 2 circuits measuring effective. (For invalid, transition to the next display.) Select the measure target circuit. no.1: 1st circuit ⇔ no.2: 2nd circuit

DISP/SET

(2) All data reset display  	Select to execute or cancel all data reset. no ⇔ yES (Do not reset) (Reset) ●For reset: ⇒ Choose “yES” and press [DISP/SET].After you set the reset value, go back to “Operating mode display(Integrated value)”. ●For cancel: ⇒ Choose “no” and press [DISP/SET] to transition to “Operating mode display (Integrated value)”.

8.8.2 Clock setting and logging data clear

When connecting logging unit, you can set the clock of it.
On the date indication in operating mode, press both [+/PHASE] and [-/RESET] at the same time for more than two seconds to transition to clock setting and enable the following operations.

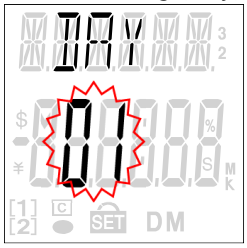
*The date is not indicated in operating mode when the logging unit is not connected.

(1) Clock setting (Year) 	Set “Year” of the year, month and day. Press [+/PHASE] or [-/RESET] to choose the value. Setting range: 2000 to 2099

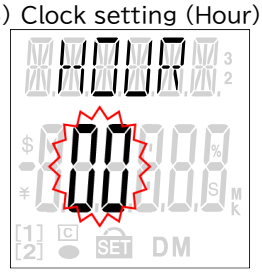
↓ DISP/SET

(2) Clock setting (Month) 	Set “Month” of the year, month and day. Press [+/PHASE] or [-/RESET] to choose the value. Setting range: 01(January) to 12(December)

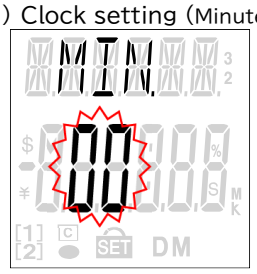
↓ DISP/SET

(3) Clock setting (Day) 	Set “Day” of the year, month and day. Press [+/PHASE] or [-/RESET] to choose the value. Setting range: 01 to 31

↓ DISP/SET

(4) Clock setting (Hour) 	Set “Hour” in the clock. Press [+/PHASE] or [-/RESET] to choose the value. Setting range: 00 to 23

DISP/SET

(5) Clock setting (Minute) 	Set “Minute” in the clock. Press [+/PHASE] or [-/RESET] to choose the value. Setting range: 00 to 59

DISP/SET

(6) Logging data clear confirmation 	Confirm logging data clear. no ⇔ yES (Do not clear data) (Clear data) ●If you do not clear logging data: ⇒ Choose “no” and press [DISP/SET] to enter date indication (operating mode). *If you choose “no” (i.e. do not clear data), the clock setting is not changed. ●If you clear logging data: ⇒ Choose “yES” and press [DISP/SET] to transition to below setting.

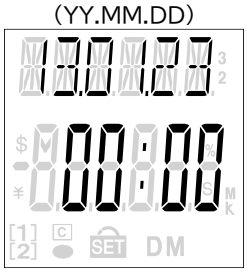
DISP/SET

(7) Final confirmation 	Final confirmation of logging data clear. no ⇔ yES (Do not clear data) (Clear data) ●If you do not clear logging data: ⇒ Choose “no” and press [DISP/SET] to enter date indication (operating mode). ●If you clear logging data: ⇒ Choose “yES” and press [DISP/SET] to enter date indication (operating mode) after clear data. *If you choose “no” (i.e. do not clear data), the clock setting is not changed. *If you choose “yES” (i.e. clear data) here, logging data is cleared, and at the same time, clock setting is changed.

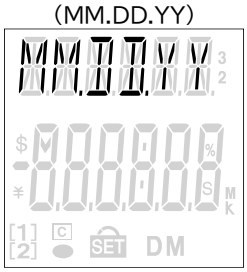
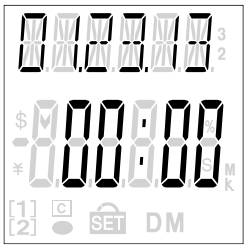
8.8.3 Change of date format

In date format setting, you can choose from “YY.MM.DD”, “MM.DD.YY” or “DD.MM.YY” format.
On the date indication in operating mode, press [+/PHASE] for more than two seconds to transition to date format setting and enable the following operations.

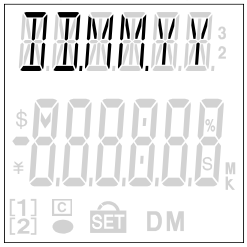
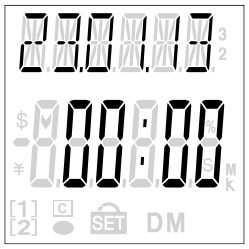
*The date is not indicated in operating mode when the logging unit is not connected.

Date / Time indication (YY.MM.DD) 	Set the date format. 

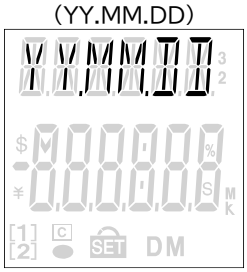
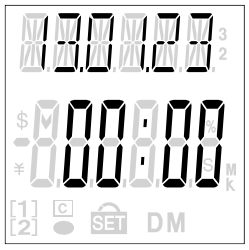
+/PHASE Press “+ / PHASE” for more than two seconds.

Date format setting (MM.DD.YY) 	Set the date format to “MM.DD.YY” format. One second later, it transitions to date indication (as shown in the right figure) automatically. If you want to change to the other format, go back to date indication and then change format. 

+/PHASE Press “+ / PHASE” for more than two seconds.

Date format setting (DD.MM.YY) 	Set the date format to “DD.MM.YY” format. One second later, it transitions to date indication (as shown in the right figure) automatically. If you want to change to the other format, go back to date indication and then change format. 

+/PHASE Press “+ / PHASE” for more than two seconds.

Date format setting (YY.MM.DD) 	Set the date format to “YY.MM.DD” format. One second later, it transitions to date indication (as shown in the right figure) automatically. If you want to change to the other format, go back to date indication and then change format. 

9. Operation

⚠ DANGER	Do not touch the live part such as the connection terminal while it is energized. It may cause electric shock, a fire, a failure, a malfunction etc.

⚠ WARNING	If an abnormal sound, bad-smelling smoke, fever break out from this unit, switch it off promptly and do not use it.

9.1 Measurement functions

9.1.1 Measurement items

The measurement items of this unit are shown in the table below.

Measurement items of circuit	Support range		EMU4-HD1A-MB / EMU4-BD1A-MB 1P2W	1P3W	3P3W	3P4W
Electric energy (incoming)	Present		●	●	●	●
Electric energy (transmission) *1	Present		●	●	●	●
Reactive energy (incoming lag)	Present		● *3	●	●	●
Detailed electric energy (incoming)	Present		●	●	●	●
Detailed electric energy (transmission)	Present		●	●	●	●
Detailed reactive energy (transmission lag)	Present		● *3	●	●	●
Periodic electric energy	Present		◎	◎	◎	◎
Electric energy converted value	Present		◎	◎	◎	◎
Operating time	Present		○	○	○	○
Current	Present	Phase 1	●	●	●	●
		Phase 2	–	●	●	●
		Phase 3	–	●	●	●
		Phase N	–	–	–	●
		Total	●	●	●	●
Current demand	Present	Phase 1	●	●	●	●
		Phase 2	–	●	●	●
		Phase 3	–	●	●	●
		Phase N	–	–	–	●
	Max, Min		●	●	●	●
Voltage *2	Present	1-2 line	●	●	●	●
		2-3 line	–	●	●	●
		3-1 line	–	●	●	●
		1-N phase	–	–	–	●
		2-N phase	–	–	–	●
		3-N phase	–	–	–	●
		Total	●	●	●	●
	Max, Min		●	●	●	●

●: Measured data
○: Measured data by settings
◎: Measured data by settings (Only EMU4-HD1A-MB)
–: Not measured data

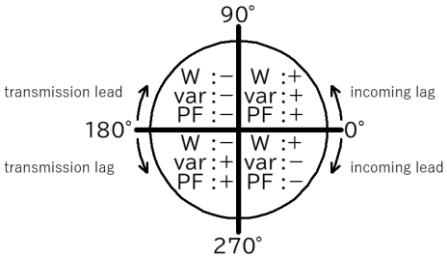
*1: In case you set the simple measurement effective, the setting value will be a fixed value (0).
*2: In case you set the simple measurement effective, the setting value will be a fixed value (Setting value).
*3: In case you set 2 circuits measuring function effective, it will not be measured.
*4: The degree of harmonic is displayed 1st, 3rd, 5th, 7th, 9th, 11th, 13th.
*5: Only displayed in setting 3P3W(3CT).
*6: The number of monitoring circuits for the waveform band monitoring function is only one (only one phase current).
In case you set 2 circuits measuring function effective, it will only monitor the circuit you yet.

Measurement items of circuit	Support range		EMU4-HD1A-MB / EMU4-BD1A-MB 1P2W	1P3W	3P3W	3P4W
Electric power	Present		●	●	●	●
Electric power demand	Present		●	●	●	●
	Max, Min		●	●	●	●
Reactive power	Present		●	●	●	●
Apparent power	Present		–	–	–	●
Power factor *2	Present		●	●	●	●
	Max, Min		●	●	●	●
Frequency *1	Present		●	●	●	●
Harmonics current total RMS value / distortion *1, 4	Present	Phase 1	◎	◎	◎	◎
		Phase 2	–	–	◎ *5	◎
		Phase 3	–	◎	◎	◎
		Phase N	–	–	–	◎
Harmonics voltage total RMS value / distortion *1, 4	Present	1-2 line	◎	◎	◎	◎
		2-3 line	–	◎	◎	◎
		1-N phase	–	–	–	◎
		2-N phase	–	–	–	◎
		3-N phase	–	–	–	◎
1-13N harmonics current RMS value / content rate *1, 4	Present	Phase 1	◎	◎	◎	◎
		Phase 2	–	–	◎ *5	◎
		Phase 3	–	◎	◎	◎
		Phase N	–	–	–	◎
1-13N harmonics voltage RMS value / content rate *1, 4	Present	1-2 line	◎	◎	◎	◎
		2-3 line	–	◎	◎	◎
		1-N phase	–	–	–	◎
		2-N phase	–	–	–	◎
		3-N phase	–	–	–	◎
Current unbalance rate	Present		–	●	●	●
	Max		–	●	●	●
Voltage unbalance rate *1	Present		–	●	●	●
	Max		–	●	●	●
Alarm cumulative time	Present		○	○	○	○
Band out rate	Present		◎ *6	◎	◎	◎
Band alarm count	Present		◎ *6	◎	◎	◎
Band cycle count	Present		◎ *6	◎	◎	◎
Other measurement items						
Pulse count value	Present		◎			
Pulse converted value	Present		◎			
Contact input status	Present		◎			

●: Measured data
○: Measured data by settings
◎: Measured data by settings (Only EMU4-HD1A-MB)
–: Not measured data

*1: In case you set the simple measurement effective, the setting value will be a fixed value (0).
*2: In case you set the simple measurement effective, the setting value will be a fixed value (Setting value).
*3: In case you set 2 circuits measuring function effective, it will not be measured.
*4: The degree of harmonic is displayed 1st, 3rd, 5th, 7th, 9th, 11th, 13th.
*5: Only displayed in setting 3P3W(3CT).
*6: The number of monitoring circuits for the waveform band monitoring function is only one (only one phase current).
In case you set 2 circuits measuring function effective, it will only monitor the circuit you yet.

The details of measurement items showed below table.

<table>
<tr><th>Measurement elements</th><th>Details</th></tr>
<tr><td>Electric power
Reactive power
Power factor</td><td>Details of the sign is showed below figure.
 
</td></tr>
<tr><td>Current total value</td><td>Calculated depending on the phase-wire system.
<table>
<tr><th>Phase-wire system</th><th>Calculating formula</th></tr>
<tr><td>Single-phase 2-wire</td><td>phase 1 current</td></tr>
<tr><td>Single-phase 3-wire,
Three-phase 3-wire(2CT)</td><td>(phase 1 current ＋ phase 3 current) / 2</td></tr>
<tr><td>Three-phase 3-wire(3CT),
Three-phase 4-wire</td><td>(phase 1 current ＋ phase 2 current
＋ phase 3 current) / 3</td></tr>
</table></td></tr>
<tr><td>Voltage total value</td><td>Calculated depending on the phase-wire system.
<table>
<tr><th>Phase-wire system</th><th>Calculating formula</th></tr>
<tr><td>Single-phase 2-wire</td><td>voltage V12</td></tr>
<tr><td>Single-phase 3-wire,
Three-phase 3-wire</td><td>(voltage V12 ＋ voltage V23) / 2</td></tr>
<tr><td>Three-phase 4-wire</td><td>(voltage V12 ＋ voltage V23 ＋ voltage V31) / 3</td></tr>
</table></td></tr>
<tr><td>Pulse count value</td><td>Measure the input pulse. Measure the output pulse of equipment by connecting it.
<table>
<tr><th>Measurement range</th><th>Unit</th></tr>
<tr><td>0 to 999999</td><td>Pulse</td></tr>
</table></td></tr>
<tr><td>Pulse converted value</td><td>It is calculated by multiplying the measured pulse count value by the set pulse converted rate.
Pulse converted value ＝ Pulse count value × Pulse converted rate
*Pulse converted rate: 0.001 to 10000 (Initial value: 1.000)</td></tr>
<tr><td>Contact input state</td><td>Measuring the contact input state. By connecting other equipment, you can capture the contact output as an alarm.
<table>
<tr><th>Contact information</th></tr>
<tr><td>ON、OFF</td></tr>
</table></td></tr>
<tr><td>Operating time</td><td>Measuring the time during contact input is ON or measuring current.
<table>
<tr><th>Measurement range</th><th>Unit</th></tr>
<tr><td>0 to 999999</td><td>hour[hour], minute[min], second[sec]</td></tr>
</table></td></tr>
<tr><td>Electric energy (expansion)
Reactive energy (expansion)</td><td>Extended electric energy is the data of lower three digits more than electric energy data. The number of digits of response data is the same as the amount of electric energy data.

・The image of the electric energy(extended)
In the case measuring device has ”12345.6789” as internal data.

(Please multiply multiplying factor in electric energy for calculate measured value.)

Electric energy data:”123456”
12345.6789
Extended electric energy data:”456789”</td></tr>
<tr><td>Periodic electric energy</td><td>Measuring the electric energy (incoming) during contact input is ON.</td></tr>
<tr><td>Electric energy converted value</td><td>It is calculated by multiplying the measured electric energy (incoming) by the set electric energy conversion rate.
Electric energy converted value =
Electric energy (incoming) × Electric energy converted rate
*Electric energy converted rate: 0.001 to 10000 (Initial value: 1.000)</td></tr>
</table>

<table>
<tr><th>Measurement elements</th><th>Details</th></tr>
<tr><td>Alarm cumulative time</td><td>Measured when the upper/lower limit alarm is enabled.
Measures the time during which the upper/lower limit alarm is occurring.
Integration is performed every measurement cycle (250ms), and 1 count indicates 250ms.
(For details, refer to Chapter 9.3.1 “Measurement of alarm cumulative time”.)
<table><tr><th>Measurement range</th><th>Unit</th></tr><tr><td>0 to 999999999</td><td>none</td></tr></table></td></tr>
<tr><td>Band alarm count</td><td>Measure when the waveform band monitoring is enabled.
Waveform band monitoring is performed, and the number of alarm occurrences is measured (integrated).
<table><tr><th>Measurement range</th><th>Unit</th></tr><tr><td>0 to 999999</td><td>none</td></tr></table></td></tr>
<tr><td>Band cycle count</td><td>Measure when the waveform band monitoring is enabled.
Measures (integrates) the number of waveform data acquired during waveform band monitoring.
<table><tr><th>Measurement range</th><th>Unit</th></tr><tr><td>0 to 999999</td><td>none</td></tr></table>
If it exceeds 999999, it will recount from 0.</td></tr>
</table>

■Measurement items that can be monitored by communication/logging
The measurement items that can be monitored by communication and logging are as follows.
For details on the measurement items that can be monitored, refer to the programming manual for each communication, the MODBUS I/F specifications, and the logging unit instruction manual.

*For CC-Link IE Field Basic communication and SLMP communication, refer to "CC-Link communication" in the table below.

Monitored and displayed items of circuit		B/NET communication	CC-Link communication	MODBUS RTU communication	Logging unit
Electric energy (Incoming)	Present	●	●	●	●
Electric energy (Transmission)	Present	●	●	●	●
Reactive energy (Incoming lag)	Present	●	●	●	●
Detailed electric energy (Incoming)	Present	●	●	●	●
Detailed electric energy (Transmission)	Present	●	●	●	●
Detailed reactive energy (Incoming lag)	Present	●	●	●	●
Periodic electric energy	Present	●	●	●	●
Electric energy converted value	Present	●	●	●	●
Operating time	Present	●	●	●	●
Current	Present	●	●	●	●
Current demand	Present	●	●	●	●
	Max, Min	–	–	●	–
Voltage	Present	●	●	●	●
	Max, Min	–	–	●	–
Electric power	Present	●	●	●	●
Electric power demand	Present	●	●	●	●
	Max, Min	–	–	●	–
Reactive power	Present	●	●	●	●
Apparent power	Present	–	●	●	●
Power factor	Present	●	●	●	●
	Max, Min	–	–	●	–
Frequency	Present	●	●	●	●
Harmonics current total RMS value / distortion *1	Present	●	●	●	●
Harmonics voltage total RMS value / distortion *1	Present	●	●	●	●
1-13N harmonics current RMS value / content rate *1	Present	●	●	●	●
1-13N harmonics voltage RMS value / content rate *1	Present	●	●	●	●
Current unbalance rate	Present	–	●	●	●
	Max	–	–	–	–
Voltage unbalance rate	Present	–	●	●	●
	Max	–	–	–	–
Alarm cumulative time	Present	●	●	●	●
Band out rate	Present	–	–	●	–
Band alarm count	Present	●	●	●	●
Band cycle count	Present	●	●	●	●
Other monitored and displayed items		**B/NET communication**	**CC-Link communication**	**MODBUS RTU communication**	**Logging unit**
Pulse count value	Present	●	●	●	●
Pulse converted value	Present	●	●	●	●
Contact input status	Present	●	●	●	●

●: Monitorable data
–: Not monitorable data

*1: The degree of harmonic is displayed 1st, 3rd, 5th, 7th, 9th, 11th, 13th.

9.1.2 Restrictions of measured data

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

Measurement elements	Behaviors of this unit	
	Display part indication	Communication data
Current	Indicate “0 A” if RMS value is less than 0.1% range of rating.	Same as on the left
Voltage	Indicate “0 V” if RMS value is under 11 V. *1	Same as on the left
Electric power Reactive power Apparent power	Indicate “0 W”, “0 var” or “0 VA” if indicated voltage values of all phases are 0 V or indicated current values of them are 0 A.	Same as on the left
Power factor	Indicate “100.0%” if indicated voltage values of all phases are 0 V or indicated current values of them are 0 A.	Same as on the left
Frequency	Voltage condition: Indicate “----” if voltage V12 (voltage V1N for 3P4W) is 0 V.	0
	Frequency condition: Indicate “----” if frequency is under 44.5 Hz. Indicate “----” if frequency is over 99.9 Hz.	44.5
RMS value of harmonic current	Current condition: Indicate “0 A” at only applicable phase if displayed current is 0 A.	0
	Voltage condition: Indicate “----” at all phases if voltage V12 (voltage V1N for 3P4W) is 0 V	0
	Frequency condition: Indicate “----” at all phases if frequency is under 44.5 Hz.	0
Content rate of harmonic current (Modulation distortion)	Harmonic current condition: Indicate “0%” at only applicable phase if displayed current is 0 A.	0
	Voltage condition: Indicate “0%” at all phases if voltage V12 (voltage V1N for 3P4W) is 0 V.	0
	Frequency condition: Indicate “----” at all phases if frequency is under 44.5 Hz.	0
RMS value of harmonic voltage	Voltage condition: Indicate “0 V” at only applicable phase if displayed voltage is 0 V. Indicate “----” at all phases if voltage V12 (voltage V1N for 3P4W) is 0 V.	0
	Frequency condition: Indicate “----” at all phases if frequency is under 44.5 Hz.	0
Content rate of harmonic voltage (Modulation distortion)	Voltage condition: Indicate “----” at only applicable phase if voltage is 0 V. Indicate “----” at all phases if voltage V12 (voltage V1N for 3P4W) is 0 V.	0
	Frequency condition: Indicate “----” at all phases if frequency is under 44.5 Hz.	0
Electric energy	The electric energy is measured with a load that is about 0.4% or more of full load power. Even if the indicated value is “0”, measurement value will increase.	Same as on the left
Pulse converted value	In case of ”Use or non-use of upper / lower limit alarm” is ”on” and ”Upper / lower limit alarm element” is ”Pulse converted value (upper limit)”. If it exceeds 999999.999, it becomes a fixed value of 999999.999.	Same as on the left
	In case of ”Use or non-use upper / lower limit alarm” is ”off” or ”Upper / lower limit alarm element” is other than ”Pulse conversion value (upper limit value)”. If it exceeds 999999.999, it will start counting again from 0.	Same as on the left
Operating time *2	Indicate “999999 h” if operating time is over 999999 h.	Same as on the left
Current unbalance rate	Indicate “999.99%” if current unbalance rate is over 999.99%.	Same as on the left
Voltage unbalance rate	Indicate “999.99%” if voltage unbalance rate is over 999.99%.	Same as on the left

*1: In single-phase, three-wire system, indicate “0 V” if RMS value is under 22 V.
*2: Operation time is reference value.

9.1.3 2 circuits Measuring function

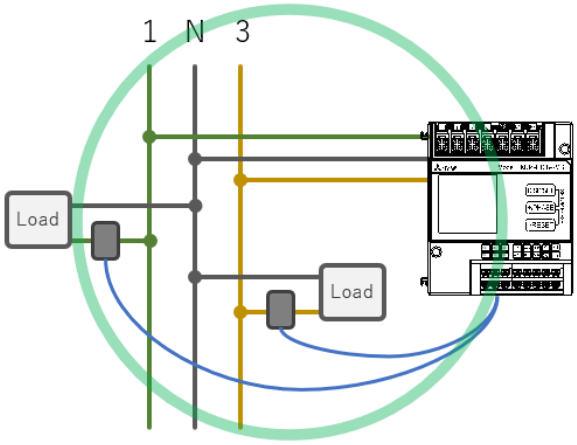
This is a function that can measure only two circuits of the single-phase two-wire system (between 1-N and between 3-N), which are branched from the single-phase three-wire system, together.
To enable this function, set the following values in "8.2 Setting menu 1: Setting of phase wire system, primary voltage, sensor type, primary current, demand time limit, etc."

●(2) Phase wire system ··· 1P2 : Single-phase 2-wire
●(3) 2 circuits measuring function availability ··· yES : 2 circuits measuring effective

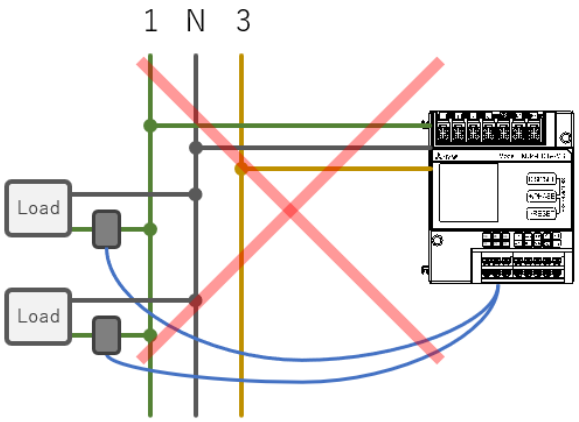
POINT

The applicable power supply system is "between 1-N and between 3-N branched from a single-phase three-wire".

●Can be measured



●Cannot be measured



9.1.4 Simple measurement function

This function enables simple power measurement without voltage input. Each measurement elements calculated by the voltage and power factor and input current.
Measurement resolution is not guarantee. To enable this function, set the following values in "8.2 Setting menu 1: Setting of phase wire system, primary voltage, sensor type, primary current, demand time limit, etc."

●(15) Simple measurement function availability ··· yES: Simple measurement effective.
●(16) Simple measurement (Power factor) ··· Any value.

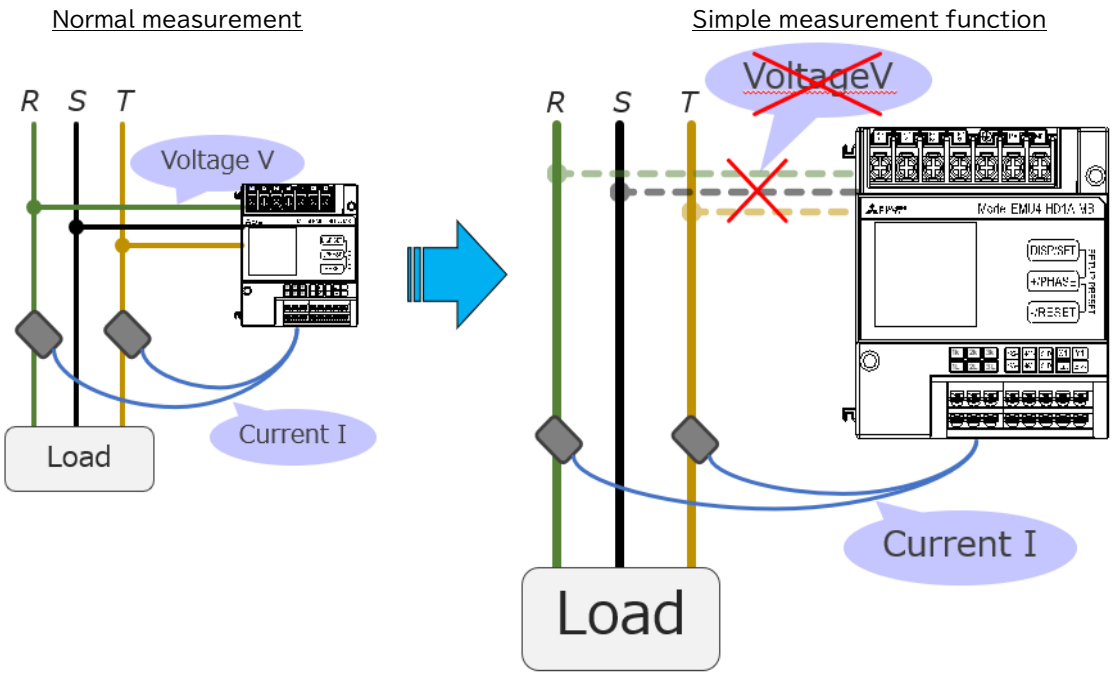
Restrictions on the measurement data when the simple measurement function is enabled are as follows.

Measurement elements	Behaviors of this unit	
	Indication of Display Unit	Communication data
Current	Current is 0A when input current is less than 0.1% range of rating.	Same as on the left
Electric power Reactive power Apparent power	Indicate "0 W", "0 var" or "0 VA" if indicated current values of all phases are 0 A.	Same as on the left
Pulse converted value	When use of upper / lower limit alarm = on and upper / lower limit alarm element = pulse count (upper limit), it is fixed to 999999 when 999999 have been exceeded.	Same as on the left
	When use of upper / lower limit alarm = oFF or upper / lower limit alarm element ≠ pulse count (upper limit), counting restarts from 0 when 999999 have been exceeded.	Same as on the left
Operating time *1	Indicate "999999 h" if operating time is over 999999 h.	Same as on the left
Current unbalance rate	Indicate "999.99%" if current unbalance rate is over 999.99.%	Same as on the left

*1: Operation time is reference value.

POINT

It can be used for measuring places where voltage wiring work is not possible.



9.2 Display function(Operating mode)

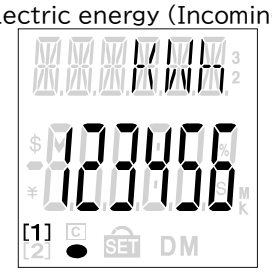
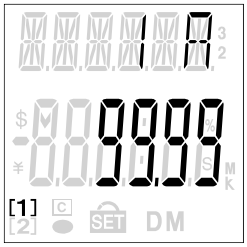
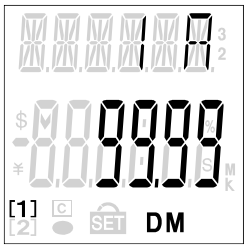
This unit indicates the measured value of each item in operating mode.
(For the measured items which can be indicated, refer to "9.2.1 Change the measured item".)

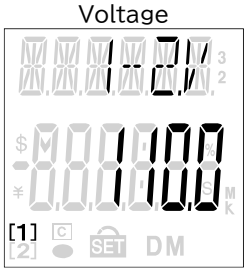
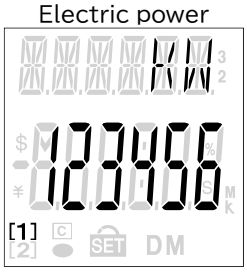
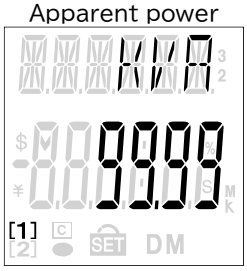
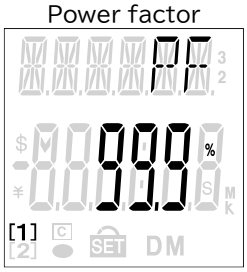
Operation procedure to change the screen indicated is as follows:

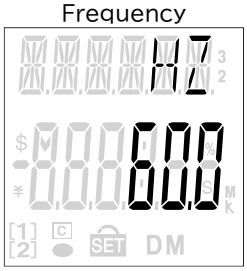
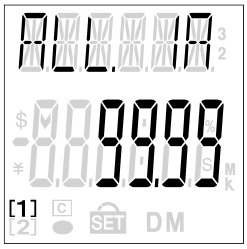
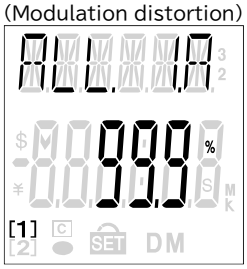
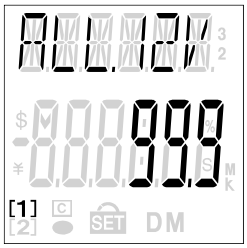
Action	Operation	Details
Change of the measured item	Press [DISP/SET]	Change the measurement items to be displayed. The order of changing, refer to "9.2.1 Change the measured item".
Change of the phase	Press [+/PHASE]	Change the phase to be displayed. The order of changing, refer to "9.2.2 Change phase".
Change of the circuits		In case you set 2 circuits measuring effective, change the circuit to be displayed.
Change of the orders	Press [-/RESET]	In case you indicate the following measured item, change the degree indicated. ・RMS value of harmonic current ・Content rate of harmonic current (modulation distortion) ・RMS value of harmonic voltage ・Content rate of harmonic voltage (modulation distortion)
Display of the measurement items where the alarm occurred	–	Transition to applicable measured item indicated, when alarm status is no alarm; alarm status is occurred at the upper / lower limit alarm function or waveform band monitoring function. If alarm occurs with multiple phases at the upper / lower limit alarm, transition to the display at first alarm occurrence.

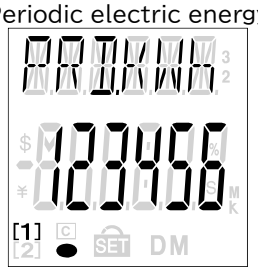
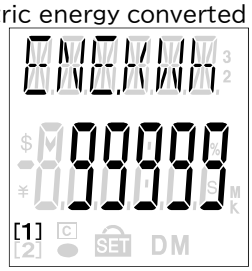
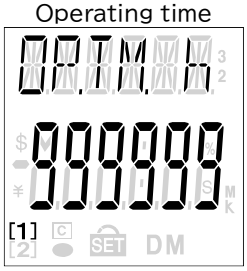
9.2.1 Change the measured item

Measured item with "Enable" can be changed from the phase to be displayed. (Refer to "9.2.2 Change phase".)

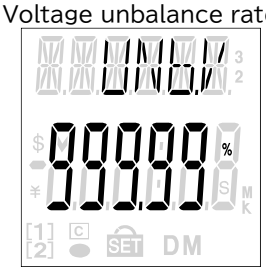
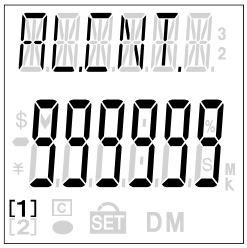
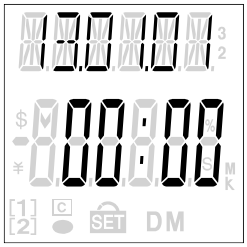
Measured item ／ Example of display	Unit	Change phase	Supplement
Electric energy (Incoming) 	kWh MWh	–	–
Current 	A	Enable	–
Current demand 	A	Enable	–

Measured item ／ Example of display	Unit	Change phase	Supplement
Voltage 	V	Enable	In case you set the simple measurement effective, it will not be displayed.
Electric power 	kW MW	–	–
Electric power demand 	kW MW	Enable	–
Reactive power 	kvar Mvar	–	–
Apparent power 	kVA MVA	–	For EMU4-BD1A-MB, it will not be displayed. If you do not set phase wire system 3P4W, it will not be displayed.
Power factor 	%	Enable	In case you set the simple measurement effective, it will not be displayed.

Measured item ／ Example of display	Unit	Change phase	Supplement
Frequency 	Hz	–	In case you set the simple measurement effective, it will not be displayed.
RMS value of harmonic current 	A	Enable	For EMU4-BD1A-MB, it will not be displayed. In case you set the harmonic current indication invalid, it will not be displayed. In case you set the simple measurement effective, it will not be displayed.
Content rate of harmonic current (Modulation distortion) 	%	Enable	
RMS value of harmonic voltage 	V	Enable	For EMU4-BD1A-MB, it will not be displayed. In case you set the harmonic current indication invalid, it will not be displayed. In case you set the simple measurement effective, it will not be displayed.
Content rate of harmonic voltage (Modulation distortion) 	%	Enable	
Reactive energy (Incoming lag) 	kvarh Mvarh	–	In case you set the 2 circuits measuring function effective, it will not be displayed.

Measured item ／ Example of display	Unit	Change phase	Supplement
Electric energy (Transmission) 	kWh MWh	–	In case you set the simple measurement effective, it will not be displayed.
Periodic electric energy 	kWh MWh	–	For EMU4-BD1A-MB, it will not be displayed. Not displayed if the external input is other than contact input.
Electric energy converted value 	※1	–	For EMU4-BD1A-MB, it will not be displayed. In case you set the electric energy converted value indication invalid, it will not be displayed.
Pulse converted value 	※1	–	For EMU4-BD1A-MB, it will not be displayed. In case you set the pulse input invalid, it will not be displayed.
Contact input status 	–	–	For EMU4-BD1A-MB, it will not be displayed. Not displayed if the external input is other than contact input.
Operating time 	hour min sec	–	In case you set the operating time indication invalid, it will not be displayed.

*1: The unit of electric energy converted value and pulse converted value depends on the setting.
For the setting, refer to "8.4 Setting menu 3: Setting of external input/output, electric energy converted value, harmonic, operating time, etc."

Measured item ／ Example of display	Unit	Change phase	Supplement
Current unbalance rate 	%	Enable	If you set phase wire system 1P2W, it will not be displayed.
Voltage unbalance rate 	%	Enable	If you set phase wire system 1P2W, it will not be displayed. In case you set the simple measurement effective, it will not be displayed.
Alarm cumulative time 	–	–	In case you set the upper / lower limit alarm invalid, it will not be displayed.
Band out rate 	%	Enable	For EMU4-BD1A-MB, it will not be displayed. In case you set the waveform band monitoring invalid, it will not be displayed. In case you set the 2 circuits measuring function effective, it will be displayed the circuit to be monitored. Indicator [1] light up ： Phase 1 current Indicator [2] light up ： Phase 3 current
Date / Time indication 	–	–	In case you do not connect the logging unit, it will not be displayed.

9.2.2 Change phase

Measured items	Display order
Current	For Single-phase 2-wire Phase 1 → Total → ⋯ For Single-phase 3-wire, Three-phase 3-wire Phase 1 → Phase 2 → Phase 3 → Total → ⋯ For Three-phase 4-wire Phase 1 → Phase 2 → Phase 3 → Phase N → Total → ⋯
Current demand	For Single-phase 2-wire No change for phase (only phase 1 displayed.). For Single-phase 3-wire, Three-phase 3-wire Phase 1 → Phase 2 → Phase 3 → ⋯ For Three-phase 4-wire Phase 1 → Phase 2 → Phase 3 → Phase N → ⋯
Voltage	For Single-phase 2-wire Line 1-2 → Total → Max → Min → ⋯ For Single-phase 3-wire, Three-phase 3-wire Line 1-2 → Line 2-3 → Line 3-1 → Total → Max → Min → ⋯ For Three-phase 4-wire Line 1-2 → Line 2-3 → Line 3-1 → Phase 1-N → Phase 2-N → Phase 3-N → Total → Max → Min → ⋯
Electric power demand	Present → Max → Min → ⋯
Power factor	
RMS value of harmonic current	For Single-phase 2-wire No change for phase (only phase 1 displayed.). For Single-phase 3-wire, Three-phase 3-wire (2CT) Phase 1 → Phase 3 → ⋯ Three-phase 3-wire (3CT) Phase 1 → Phase 2 → Phase 3 → ⋯ For Three-phase 4-wire Phase 1 → Phase 2 → Phase 3 → Phase N → ⋯
Content rate of harmonic current (Modulation distortion)	
RMS value of harmonic voltage	For Single-phase 2-wire No change for phase (only Line 1-2 displayed.). For Single-phase 3-wire, Three-phase 3-wire Line 1-2 → Line 2-3 → ⋯ For Three-phase 4-wire Line 1-2 → Line 2-3 → Phase 1-N → Phase 2-N → Phase 3-N → ⋯
Content rate of harmonic voltage (Modulation distortion)	
Current unbalance rate	Present → Max → ⋯
Voltage unbalance rate	
Band out rate	For no alarm and no failure. No change for phase. For alarm occurs. Band out rate → Alarm case → ⋯ For waveform acquisition fails. Band out rate → Check the failure factors → ⋯

For the total current and total voltage, refer to "9.1.1 Measurement items".

9.2.3 Measured item indication in operating mode

■The indication format of electric energy, reactive energy and periodic electric energy.
It is as follows depending on the full load power.

$$\text{Full load power [kW]} = \frac{\alpha \times (\text{Primary voltage}) \times (\text{Primary current})}{1000}$$

α: 1 Single-phase 2-wire
2 Single-phase 3-wire
$\sqrt{3}$ Three-phase 3-wire
3 Three-phase 4-wire

*1: The primary voltage is calculated with a setting value either primary voltage (direct) or primary voltage (with VT).
*2: The primary current is calculated with a setting value either primary current (direct sensor) or primary current (5 A sensor).
*3: The primary voltage of the three phase 4-wire system is calculated by the phase voltage.

Full load power [kW]		Indication format	
		Digital indication	Unit
	less than 12	8888.88	kWh kvarh
12 or more and	less than 120	88888.8	
120 or more and	less than 1200	888888	
1200 or more and	less than 12000	8888.88	MWh Mvarh
12000 or more and	less than 120000	88888.8	
120000 or more		888888	

■The indication format of current and current demand.
It is as follows depending on the primary current.

Primary current [A]		Indication format	
		Digital indication	Unit
	less than 40	888.888	A
40 or more and	less than 400	8888.88	
400 or more and	less than 4000	88888.8	
4000 or more and		888888	

■The indication format of voltage.
It is as follows depending on the primary voltage.
*1: In three-phase 4-wire system, the indication of VT primary voltage and direct voltage depends on the phase voltage.

Primary voltage [V]		Indication format	
		Digital indication	Unit
	less than300	88888.8	V
300 or more and		888888	

■The indication format of electric power, electric power demand, reactive power and apparent power.
It is as follows depending on the full load power.
(For procedures for the full load power, refer to “The indication format of electric energy, reactive energy and periodic electric energy”.)

Full load power [kW]		Indication format	
		Digital indication	Unit
	less than 12	888.888	kW kvar kVA
12 or more and	less than 120	8888.88	
120 or more and	less than 1200	88888.8	
1200 or more and	less than 12000	888888	
12000 or more and	less than 120000	8888.88	MW Mvar MVA
120000 or more		88888.8	

The sign of electric power and reactive power represents the following state.
(For details, refer to “9.1.1 Measurement items”.)

Sign	Electric power	Reactive power
Unsigned	Incoming	Lag
-	Transmission	Lead

■The indication format of power factor.
The sign of electric power factor represents the following state.(For details, refer to “9.1.1 Measurement items”.)

Sign	Power factor
Unsigned	Lag
-	Lead

■The indication format of harmonics current and Harmonics voltage.
It is as follows depending on the full load power. (For procedures for the full load power, refer to “The indication format of electric energy, reactive energy and periodic electric energy.”.)
To indicate harmonic current and harmonic voltage, the indication setting of them is needed in advance.

Measurement elements	Indication format	
	Digital indication	Unit
RMS value of harmonic current	same as current	same as current
Content rate of harmonic current (Modulation distortion)	888.8	%
RMS value of harmonic voltage	same as voltage	same as voltage
Content rate of harmonic voltage (Modulation distortion)	888.8	%

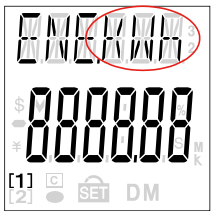
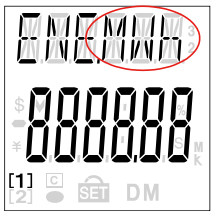
■The indication format of electric energy (converted value).
It is shown in the table below depending on the electric energy converted unit and the full load power.
(For procedures for the full load power, refer to “The indication format of electric energy, reactive energy and periodic electric energy”.)
Significant digits are the lower 6 digits.
To display it, you need to set the electric energy converted value display setting in advance.

①When the unit of electric energy converted value is set to MWh, kl, or t.

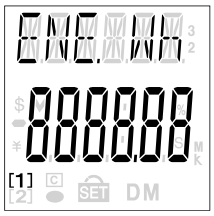
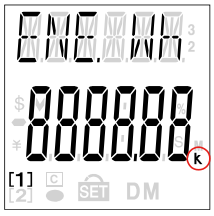
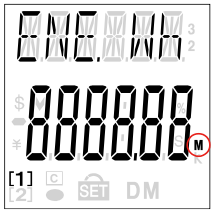
Full load power [kW]	Indication format		Supplement
	Digital indication	Unit	
less than 12	8888.88	MWh kl t	–
12 or more and less than 120	88888.8		
120 or more	888888		

*When monitoring the electric energy converted value by communication, the resolution of the LCD display value may be smaller than the monitor value depending on the size of the full load power.
Example: Full load power: 1200 kW, electric energy conversion value: 5433330
LCD display value: 433330
Monitor value in communication: 5433330 = 543333 (data part) × 10^1 (Multiplication part)

②When the unit of electric energy converted value is set to kWh, l, or kg.

Full load power [kW]		Indication format		Supplement
		Digital indication	Unit	
	less than 12	8888.88	kWh l kg	The set unit of electric energy converted value is displayed. 
12 or more and	less than 120	88888.8		
120 or more and	less than 1200	888888		
1200 or more and	less than 12000	8888.88	MWh kl t	The unit larger than the set electric energy converted value unit is displayed. 
12000 or more and	less than 120000	88888.8		
120000 ore more		888888		

③When the unit of electric energy converted value is set to other units.

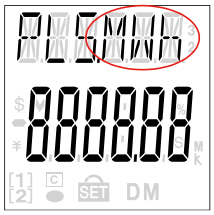
Full load power [kW]		Indication format		Supplement
		Digital indication	Unit	
	less than 12	8888.88	Set unit	
12 or more and	less than 120	88888.8		
120 or more and	less than 1200	888888		
1200 or more and	less than 12000	8888.88		Indicator “K” light up (Multiplier: Represented × 10^3) 
12000 or more and	less than 120000	88888.8		
120000 or more and	less than 1200000	888888		
1200000 or more		8888.88		Indicator “M” light up (Multiplier: Represented × 10^6) 

■The indication format of pulse converted value.
It is as follows depending on the pulse converted unit and the pulse converted rate.
The effective number is the last 6 digits.
To indicate pulse converted value, the indication setting of external pulse input is needed in advance.

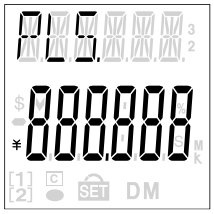
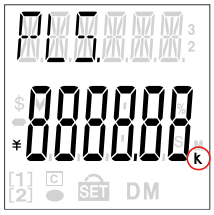
①When the unit of pulse converted value is set to MWh, kl, or t.

Pulse converted rate		Indication format		Supplement
		Digital indication	Unit	
	less than 0.01	888.888	MWh kl t	–
0.01 or more and	less than 0.1	8888.88		
0.1 or more and	less than 1	88888.8		
1 or more		888888		

②When the unit of pulse converted value is set to Wh, kWh, l, g, kg.

Pulse converted rate		Indication format		Supplement
		Digital indication	Unit	
0.001 or more and	less than 0.01	888.888	Wh kWh l g kg	The set unit of pulse converted value is displayed. 
0.01 or more and	less than 0.1	8888.88		
0.1 or more and	less than 1	88888.8		
1 or more and	less than 10	888888		
10 or more and	less than 100	8888.88	kWh MWh kl kg t	The unit larger than the set pulse converted value unit is displayed. 
100 or more and	less than 1000	88888.8		
1000 or more		888888		

③When the unit of pulse converted value is set to other units.

Pulse converted rate		Indication format		Supplement
		Digital indication	Unit	
0.001 or more and	less than 0.01	888.888	Set unit	
0.01 or more and	less than 0.1	8888.88		
0.1 or more and	less than 1	88888.8		
1 or more and	less than 10	888888		
10 or more and	less than 100	8888.88		Indicator “K” light up (Multiplier: Represented × 10^3) 
100 or more and	less than 1000	88888.8		
1000 or more		888888		

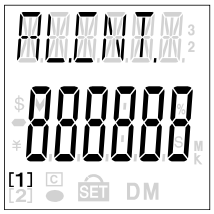
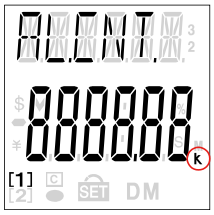
■The indication format of operating time.
To indicate operating time, the indication setting of them is needed in advance.

Indication format	
Digital indication	Unit
8888.88	hour min sec

■The indication format of current unbalance rate and voltage unbalance rate.

Indication format	
Digital indication	Unit
8888.88	%

■The indication format of alarm cumulative time.
It is as follows depending on the monitor multiplier.
To indicate upper / lower limit alarm, the indication setting of them is needed in advance.

Monitor multiplier	Indication format		Supplement
	Digital indication	Unit	
1	888888	–	
10	8888.88		Indicator “K” light up (Multiplier: Represented × 10^3) 
100	88888.8		
1000	888888		

■The indication format of Band out rate.

Indication format	
Digital indication	Unit
888.8	%

9.3 Monitoring function

9.3.1 Upper / lower limit alarm function

Monitor the upper and lower limits of the measured value.
Alarm will occur when the measured value exceeds the upper limit alarm value or below the lower limit alarm value.

■Monitoring elements
This instrument can set the upper/lower limit alarm value for each measured value individually.

Monitoring elements	EMU4-BD1A-MB	EMU4-HD1A-MB
Current demand upper limit alarm	●	●
Current demand lower limit alarm	●	●
Line voltage upper limit alarm	●	●
Line voltage lower limit alarm	●	●
Phase voltage upper limit alarm	–	● *1
Phase voltage lower limit alarm	–	● *1
Electric energy demand upper limit alarm	●	●
Electric energy demand lower limit alarm	●	●
Power factor upper limit alarm	●	●
Power factor lower limit alarm	●	●
Phase N current demand upper limit alarm	–	● *1
Pulse conversion value upper limit alarm	–	●
Current unbalance rate upper limit alarm	● *2	● *2
Voltage unbalance rate upper limit alarm	● *2	● *2

●: Monitorable data
–: Not monitorable data

*1: Only monitored in 3P4W setting.
*2: Only systems other than the single-phase two-wire system can be monitored.

■Upper / lower limit alarm setting
To make the upper / lower limit alarm, you must be set the following items :
For the setting value and setting range of each item, refer to "8.5 Setting menu 4: Waveform band monitoring, upper / lower limit alarm, etc.".

●Upper limit alarm value
Alarm will occur when the measured value exceeds the upper limit alarm value.

●Lower limit alarm value
Alarm will occur when the measured value below the lower limit alarm value.

●Alarm delay time
Set the value in case you want to remove the inrush current of the load, etc. from the objects of monitoring.
Alarm does not occur when the measured value goes below the upper limit or goes over the lower limit within the configured time.

●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 alarm reset operation, refer to "■Alarm reset operation method".

■Alarm occurrence / recovery condition

Measured items	Alarm reset method	Monitoring items	Alarm status	Alarm occurrence / recovery condition
Current demand Phase N current demand Voltage Electric power demand Power factor Current unbalance rate Voltage unbalance rate	Auto-reset (Auto)	Upper limit monitoring	Occurrence	Measured value > Upper limit alarm value (Alarm delay time is available)
			Recovery	Measured value ≦ Upper limit alarm value
		Lower limit monitoring	Occurrence	Measured value < Lower limit alarm value (Alarm delay time is available)
			Recovery	Measured value ≧ Lower limit alarm value
	Self-retention (HoLd)	Upper limit monitoring	Occurrence	Measured value > Upper limit alarm value (Alarm delay time is available)
			Retention	Measured value ≦ Upper limit alarm value
			Recovery	Measured value ≦ Upper limit alarm value and Alarm reset
		Lower limit monitoring	Occurrence	Measured value < Lower limit alarm value (Alarm delay time is available)
			Retention	Measured value ≧ Lower limit alarm value
			Recovery	Measured value ≧ Lower limit alarm value and Alarm reset
Pulse converted value	Auto-reset (Auto)	Upper limit monitoring	Occurrence	Measured value ≧ Upper limit alarm value
			Recovery	Measured value < Upper limit alarm value
	Self-retention (HoLd)	Upper limit monitoring	Occurrence	Measured value ≧ Upper limit alarm value
			Retention	Measured value < Upper limit alarm value
			Recovery	Measured value < Upper limit alarm value

*Since the measured value of pulse conversion value is an integrated value, it does not decrease.
When an alarm occurs, it is necessary to satisfy the recovery condition by one of the following methods.
●Reset pulse conversion value.
●Preset pulse conversion value less than setting value of upper limit alarm value.
●Setup upper limit alarm value more than pulse conversion value.

For pulse conversion value preset operation, refer to "8.8.1 Preset and all data reset (Reset/Preset mode)".

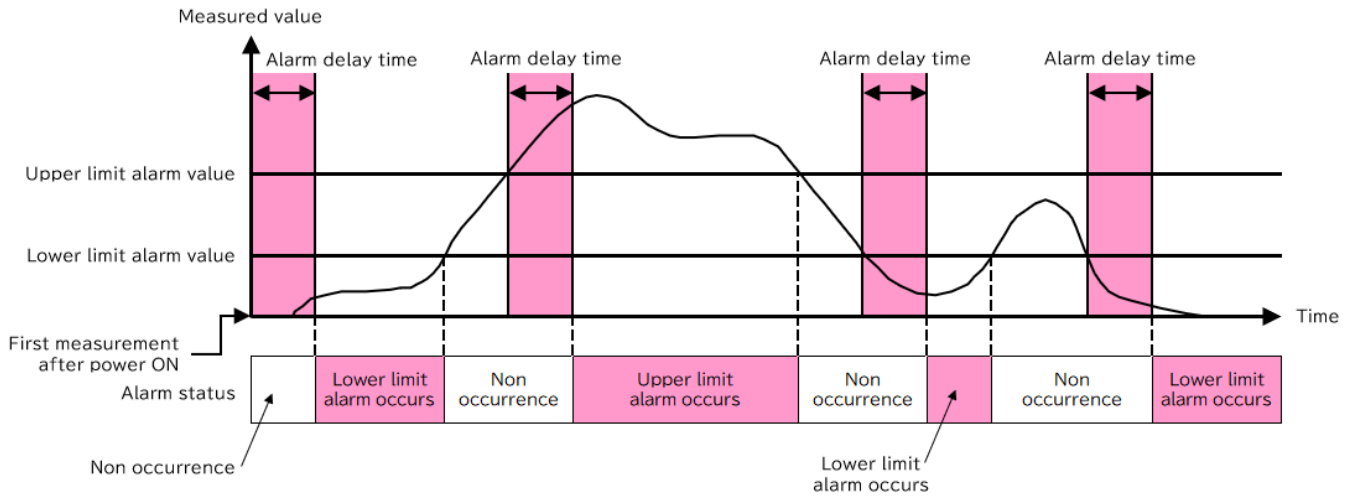
■Indication at alarm status
When an alarm occurs, the display(turn on, flashing) will change.

	No alarm	Alarm occurrence		Alarm retention	
		When indicating the alarm-occurrence phase	When indicating the other phase	When indicating the alarm-occurrence phase	When indicating the other phase
Elements Information indication	●	◎	◎	△	△
Other indication	●	◎	●	△	●

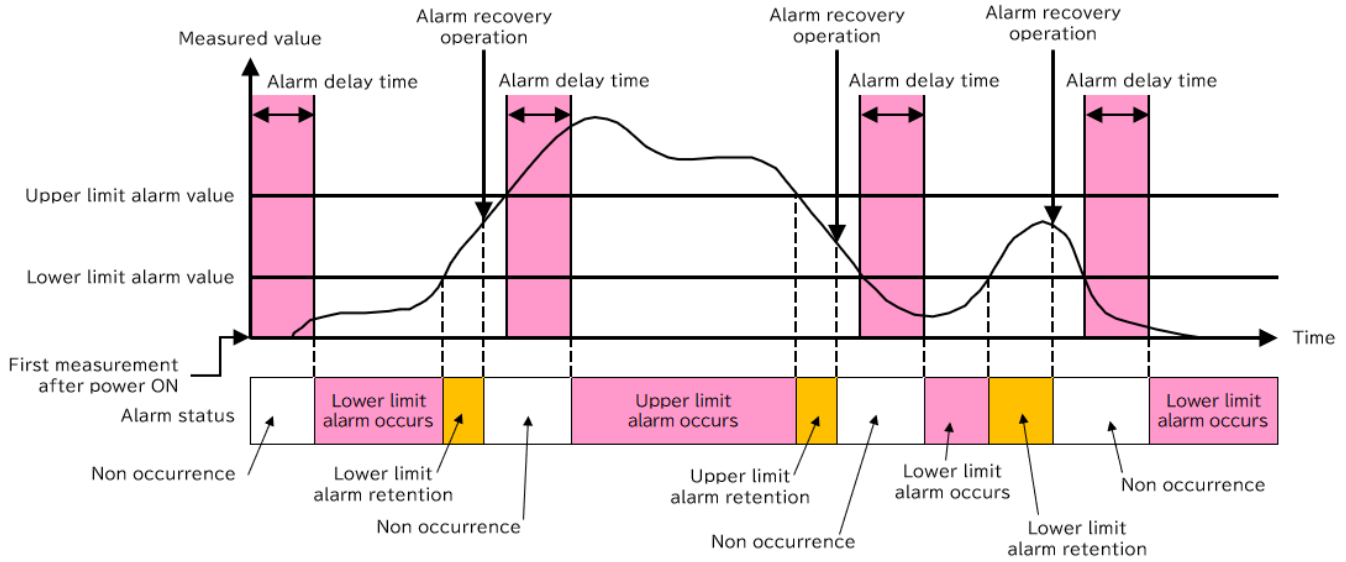
●: Turn on
◎: Flashing(250ms ON/250ms OFF)
△: Flashing(500ms ON/500ms OFF)

■Examples of alarm occurring (except for the upper limit of pulse conversion value)

(1) When the alarm reset method is “Auto-reset (Auto)”.



(2) When the alarm reset method is “Self-retention (HoLd)”.

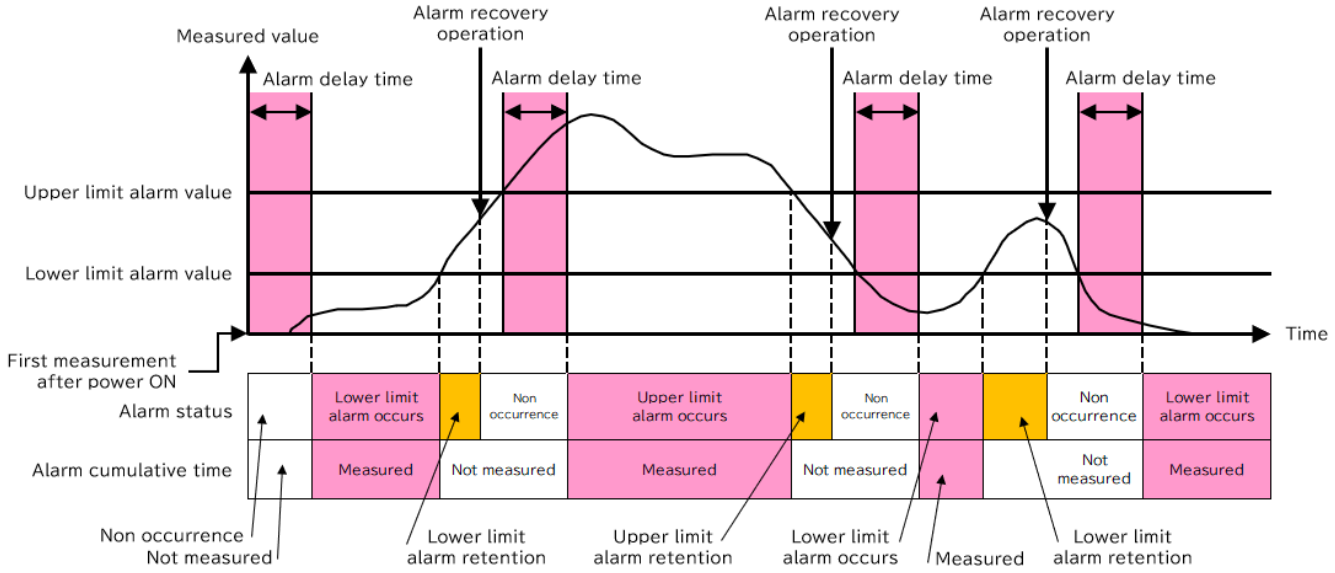


■Alarm reset operation method

The method of resetting the alarm differs depending on the setting of the alarm reset method.

Alarm 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. Clear the alarm as below after the value goes below the upper limit or goes over the lower limit. ・Pressing the [-/RESET] button for two seconds on the current value display screen in the operation mode will reset the alarm. (Alarm clear is effective even in other than the alarm-occurrence phase.)

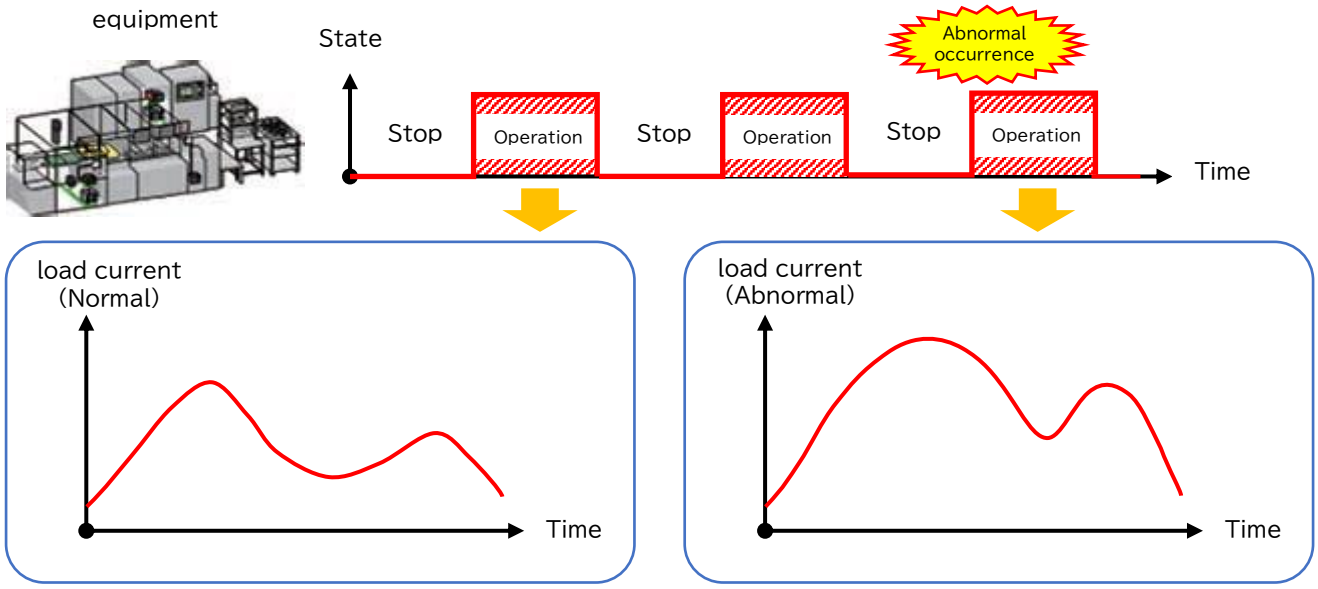
■Measurement of alarm cumulative time
Alarm cumulative time measures the time during alarm occurrence.
It does not count during alarm delay time or self- retention.



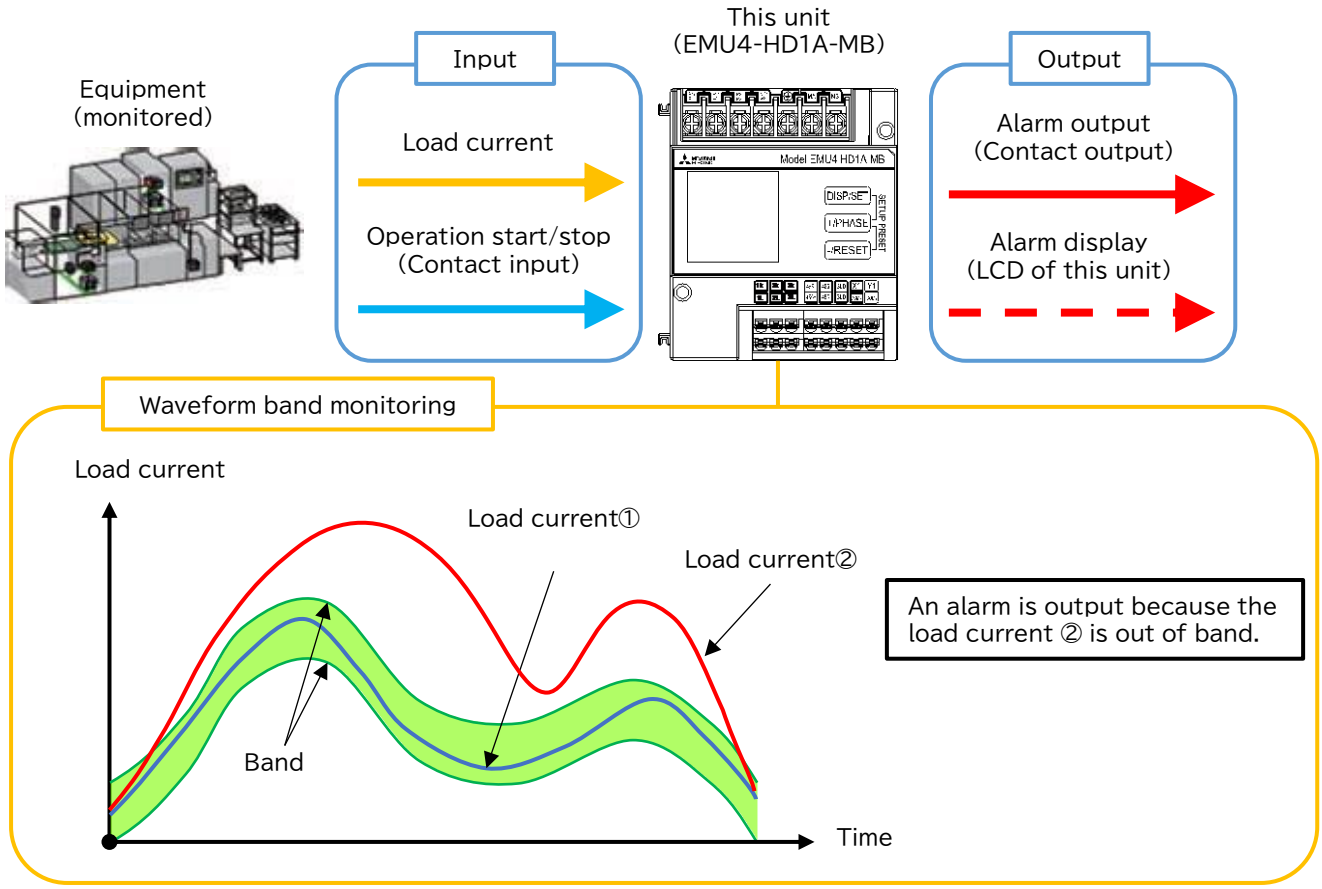
9.3.2 Waveform band monitoring function

*It is a function that can only be used by EMU4-HD1A-MB.

Waveform band monitoring function is a function to monitor the load current of the facilities.
When measuring the load current of "equipment that repeats the same operation" as shown in the figure below, the load current for each operation has the same value and waveform(*).
However, if the equipment continues to operate, the value and waveform of the load current will differ from normal due to equipment wear and abnormalities.
The waveform band monitoring function is a function for "detecting abnormalities in equipment that repeats the same operation."
*It cannot be used with equipment that does not produce the same waveform.

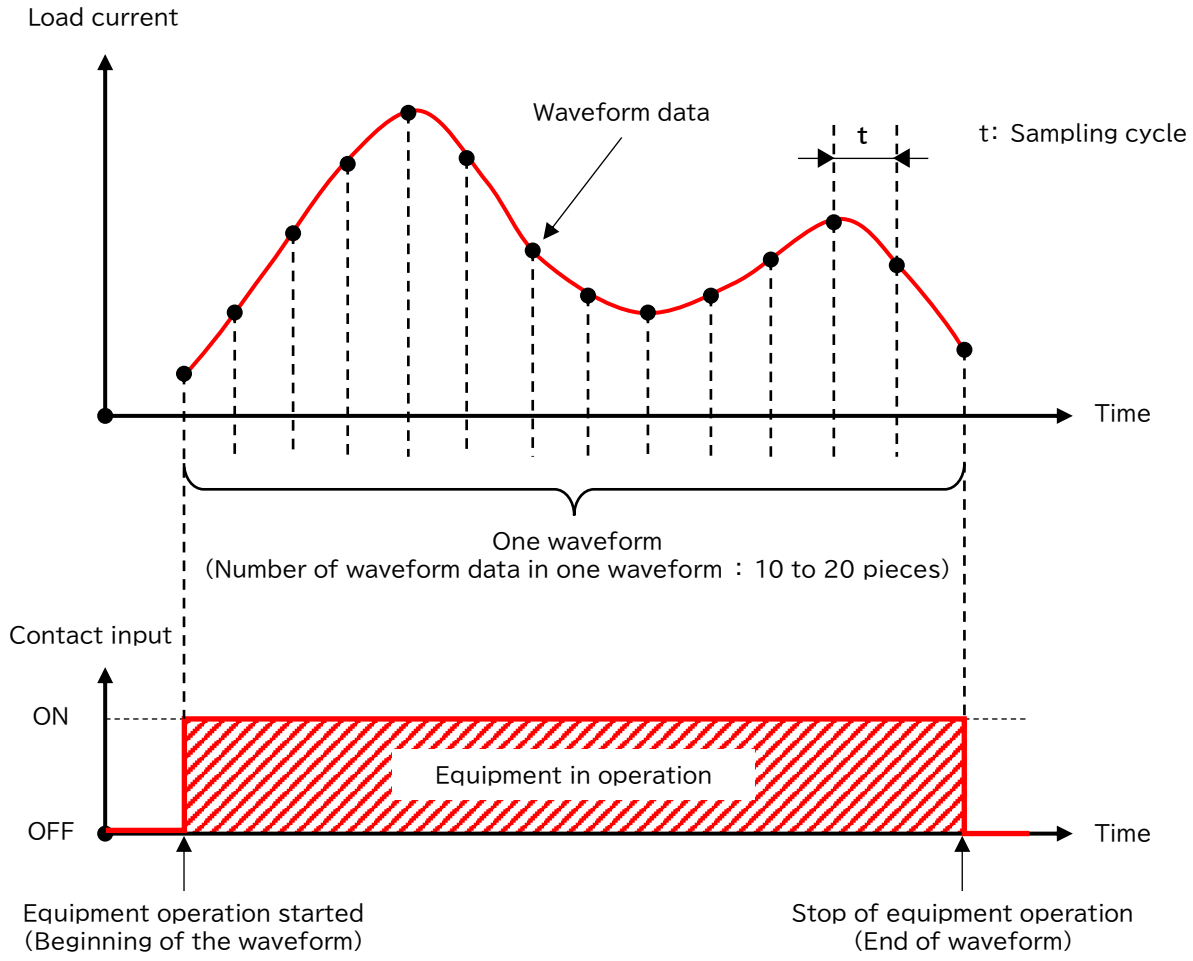


The waveform band monitoring function sets the band (upper and lower thresholds) for the load current waveform.
An alarm is output when a waveform that deviates from the band over a certain percentage is detected.



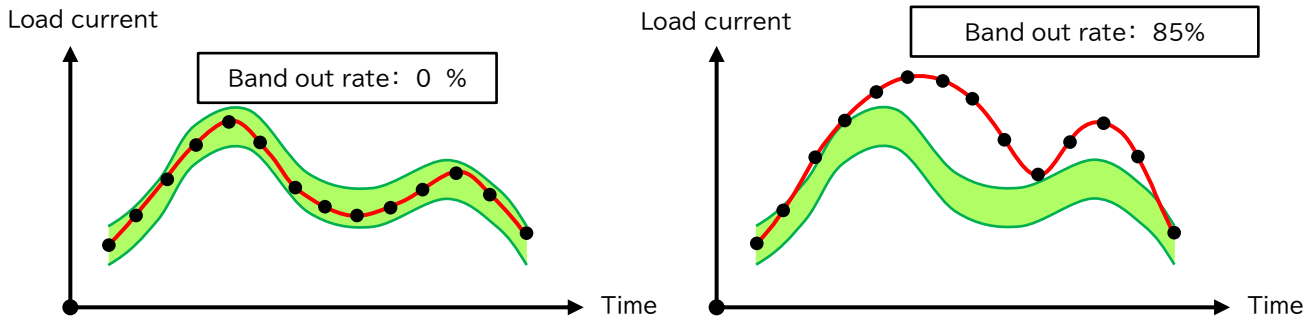
This instrument performs the waveform band monitoring function as follows.

■Waveform measurement method and anomaly detection
This instrument recognizes the waveform from the contact input and waveform data (load current value).
It recognizes the start/stop of equipment operation (beginning/end of waveform) by ON/OFF of contact input.
While the contact input is ON, the waveform data is measured at intervals of the Sampling cycle (set value).



The normality/abnormality of the measured waveform is determined using the Band out rate.
The Band out rate indicates the rate at which the waveform data deviates from the band.

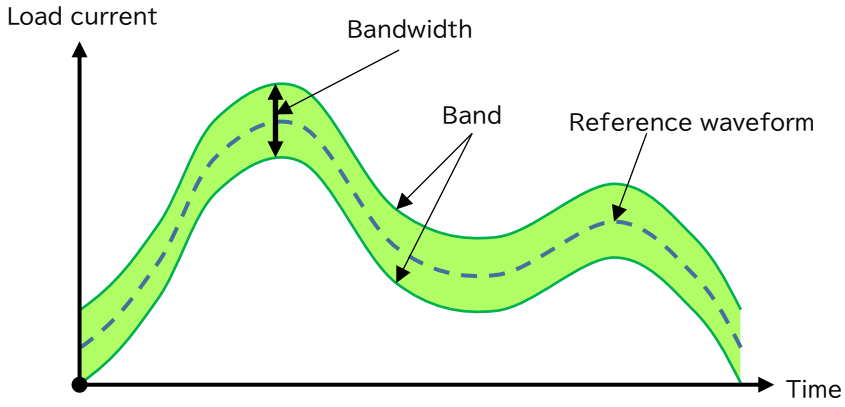
$$\text{Band out rate [\%]} = \frac{\text{Number of waveform data that deviates from the band}}{\text{Number of waveform data for one waveform}} \times 100$$



A threshold can be set for the Band out rate. (Default value : 30%)
When the Band out rate exceeds the threshold, it is determined that an abnormality has occurred and an alarm is output.

■Bandwidth determination method
This instrument determines the band from the reference waveform.
Bands are calculated with the following formula:

Band = Reference waveform ± (Bandwidth factor (setting value) × Standard deviation)



The reference waveform is generated from the waveform of the load current.
Acquire waveforms for 10 cycles, and the average value becomes the reference waveform.
Also, determine the standard deviation from the load current when generating the reference waveform.

Note that, a lower limit can be set for the standard deviation.

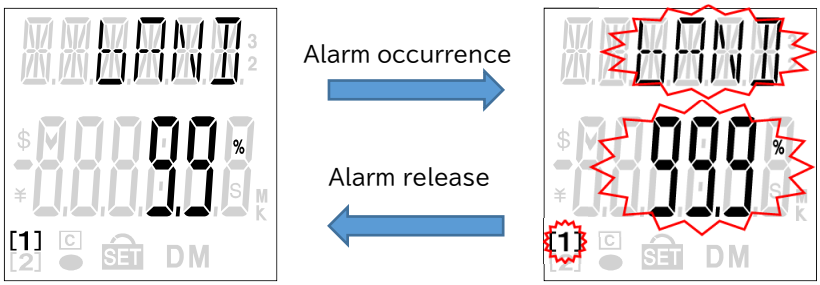
In case of “Standard deviation” < (“Primary current” × “Standard deviation lower limit” [%])
calculated as “Primary current” x “Standard deviation lower limit”.

POINT	**Q. What kind of scene should the standard deviation lower limit level employ you in?** **A. Basically, you can use the default values as they are.** For example, it can be useful in the following cases: If the trend of the load current of the equipment to be measured is very clean, the waveform data for 10 cycles may approximate. The standard deviation at this time is very small, and even a slight disturbance in the waveform may be detected as abnormal. By setting a large lower limit of standard deviation, the bandwidth can be widened so that disturbances in the waveform due to external disturbances, etc., are not detected as abnormalities.

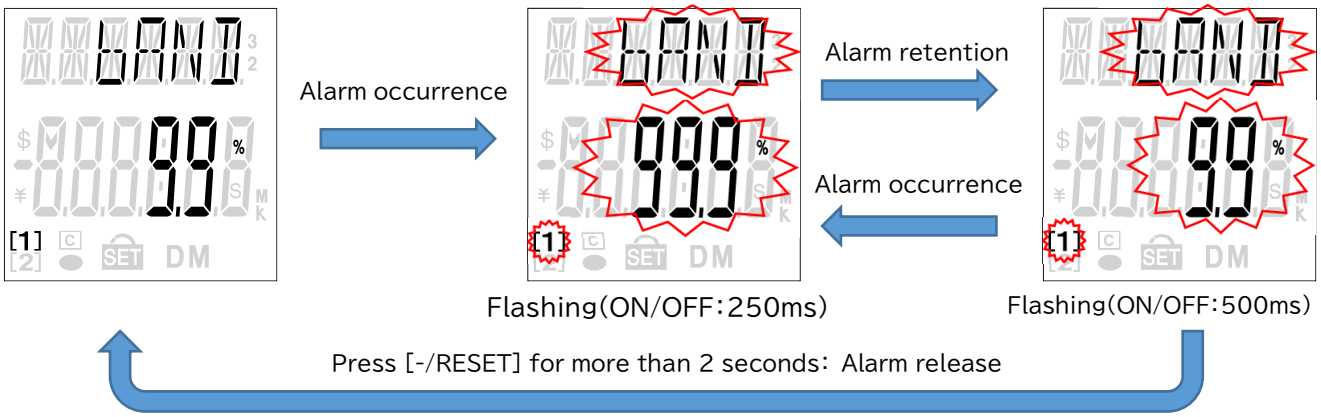
■Alarm reset method and operation method
Depending on the alarm reset method, the screen display and whether or not the alarm reset operation is performed will differ.

Alarm reset method	Alarm recovery operation
Auto-reset (Auto)	The alarm is automatically reset when the Band out rate falls below the threshold.
Self-retention (HoLd)	The alarm is retained even after the Band out rate falls below the threshold. After the Band out rate falls below the threshold, perform the following alarm release operation. ・Pressing the [-/RESET] button for two seconds on the current value display screen in the operation mode will reset the alarm. (Cancellation is also valid for phases other than the alarm generation phase.)

(1) Alarm reset method ＝ In the case of automatic reset (Auto)



(2) Alarm reset method ＝ In the case of self-retention (HoLd)



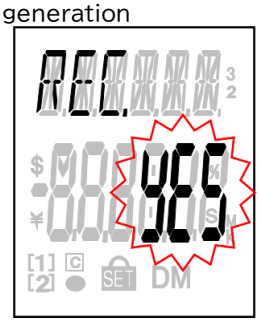
■Waveform band monitoring operation method

(1) Setting the reference waveform and waveform band monitoring
Set the parameters for generating the reference waveform and the items required for monitoring.
For the setting, refer to ”8.5 Setting Menu 4: Setting Waveform band monitoring, upper / lower limit alarm, etc.”.

(2) Generation of reference waveforms
A reference waveform is automatically generated by collecting the load current.
To generate a reference waveform, do the following:

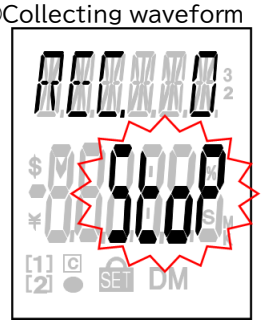
Operating mode (Waveform band monitoring) 	Displays the waveform band monitoring screen in the operation mode. Before the reference waveform is generated, the Band out rateis displayed as ”----”.

+/PHASE + -/RESET: Press both [+/PHASE] and [-/RESET] at the same time for more than two seconds.

①Presence/absence of reference waveform generation 	Generate the reference waveform. When yES is selected, load current is collected and a reference waveform is generated. When no is selected, no reference waveform is generated. yES ⇔ no (Generate) (Do not generate) ●You choose ”yES”: To the next screen. ●You choose ”no”: To operation mode (Waveform band monitoring).

DISP/SET

②Collecting waveform



Collect the load current.
Turn on the external input of this instrument and collect 10 waveforms of load current.

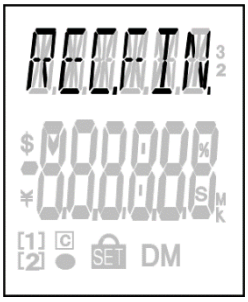
The waveform is determined by the external input status and the number of waveform data.

Beginning of the waveform	When the external input turns from OFF to ON.
End of waveform	When 20 waveform data are collected.
	When the external input turns from ON to OFF. (Regardless of the amount of waveform data collected.)

The number of collected load current waveforms is displayed in the upper right of the screen.
After 10 waveforms are collected, the reference waveform generation starts.

Press [DISP/SET] to stop generating the reference waveform.

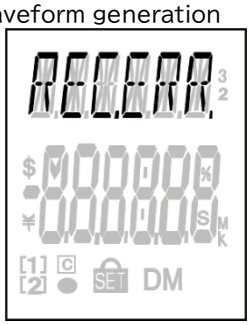
Reference waveform generation



When the reference waveform generation is completed, the screen on the left is displayed.

Press [DISP/SET], [+/PHASE] or [-/RESET] to return to the operating mode(waveform band monitoring).

Aborting reference waveform generation



If the reference waveform could not be generated or if the generation of the reference waveform is stopped, the screen shown on the left is displayed.

If the reference waveform could not be generated, the possible causes are as follows.
●The waveform with 9 or less waveform data exists.
●There is variation in the number of waveform data for each waveform.
●There are waveform data with far different values compared to other waveforms.

Press [DISP/SET], [+/PHASE] or [-/RESET] to return to the operating mode(waveform band monitoring).

(3) Performing waveform band monitoring
Waveform band monitoring is performed during operation mode.
The alarm occurrence status changes as follows according to the monitoring result.

Monitoring result	Alarm occurrence status	Remarks
Normal	Non-occurrence	In this case, the Band out rate is below the threshold.
Alarm occurrence	occurrence	In this case, the Band out rate exceeds the threshold and an alarm is occurred.
Alarm holding status	Retention	In this case, the Band out rate exceeds the threshold and then falls below the threshold.
Waveform acquisition failure	Non-occurrence	This is a case of failure to acquire waveform data, such as when the number of data is small.

It operates as follows according to the alarm occurrence status.

●Contact output
When an alarm occurs, the contact output status changes as follows.

Alarm occurrence status	Contact output	Remarks
Non-occurrence	OFF	The contact output will turn OFF.
Alarm holding status	ON	When the alarm reset operation has not been performed.
	OFF	When the alarm reset operation is performed.
Occurrence	ON	The contact output will turn ON. If the alarm output was ON last time as well, the ON state will be continued.

●Screen display
When an alarm occurs, the screen display changes as follows.

Alarm occurrence status	Display	Displayed content	
		Elements display	Other display
Non-occurrence	Band out rate	●	●
Alarm holding status	Band out rate	○	○
	Alarm case	●	●
Occurrence	Band out rate	◎	◎
	Alarm case	●	●

●: Turn on
◎: Flashing(250ms ON/250ms OFF)
○: Flashing(500ms ON/500ms OFF)

Also, when an alarm occurs, you can transition to the ”alarm case” screen.
The alarm case screen displays the alarm case number according to the alarm occurrence status.

Alarm case No.	Details
1	There is waveform data that exceeds the upper and lower limit value of the band.
2	There is waveform data that exceeds the lower limit value of the band.
3	There is waveform data that exceeds the upper limit value of the band.

●Waveform acquisition failure
If acquisition of waveform data fails, you will be able to transition to the failure factor confirmation screen.
On the failure factor confirmation screen, the failure factor number corresponding to the content of the error is displayed (”----” is displayed for the Band out rate).

Failure reason No.	Details
1	The number of collected load current waveform data is less than 10.
2	The amount of waveform data is larger than that of the reference waveform. (Number of waveform data of reference waveform +3 < Number of waveform data of collected load current)
3	The amount of waveform data is smaller than that of the reference waveform. (Number of waveform data of reference waveform -3 < Number of waveform data of collected load current)

10. Confirmation mode / Test mode

⚠ DANGER	Do not touch the live part such as the connection terminal while it is energized. It may cause electric shock, a fire, a failure, a malfunction etc.

⚠ WARNING	If an abnormal sound, bad-smelling smoke, fever break out from this unit, switch it off promptly and do not use it.

10.1 Confirmation mode: Confirmation of setting values in setting menu 1 to 5

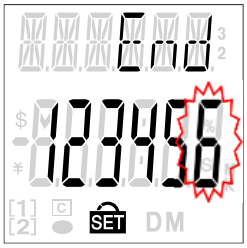
In operating mode, press [DISP/SET] for more than two seconds to transition to confirmation mode and enable operation.
Transition of display and operation of setting menu 1 to 5 is as same as those of setting mode.
For setting menu 1 to 5, refer to “8.2” to “8.6”. (Change of setting is not available in confirmation mode.)

10.2 How to use test mode

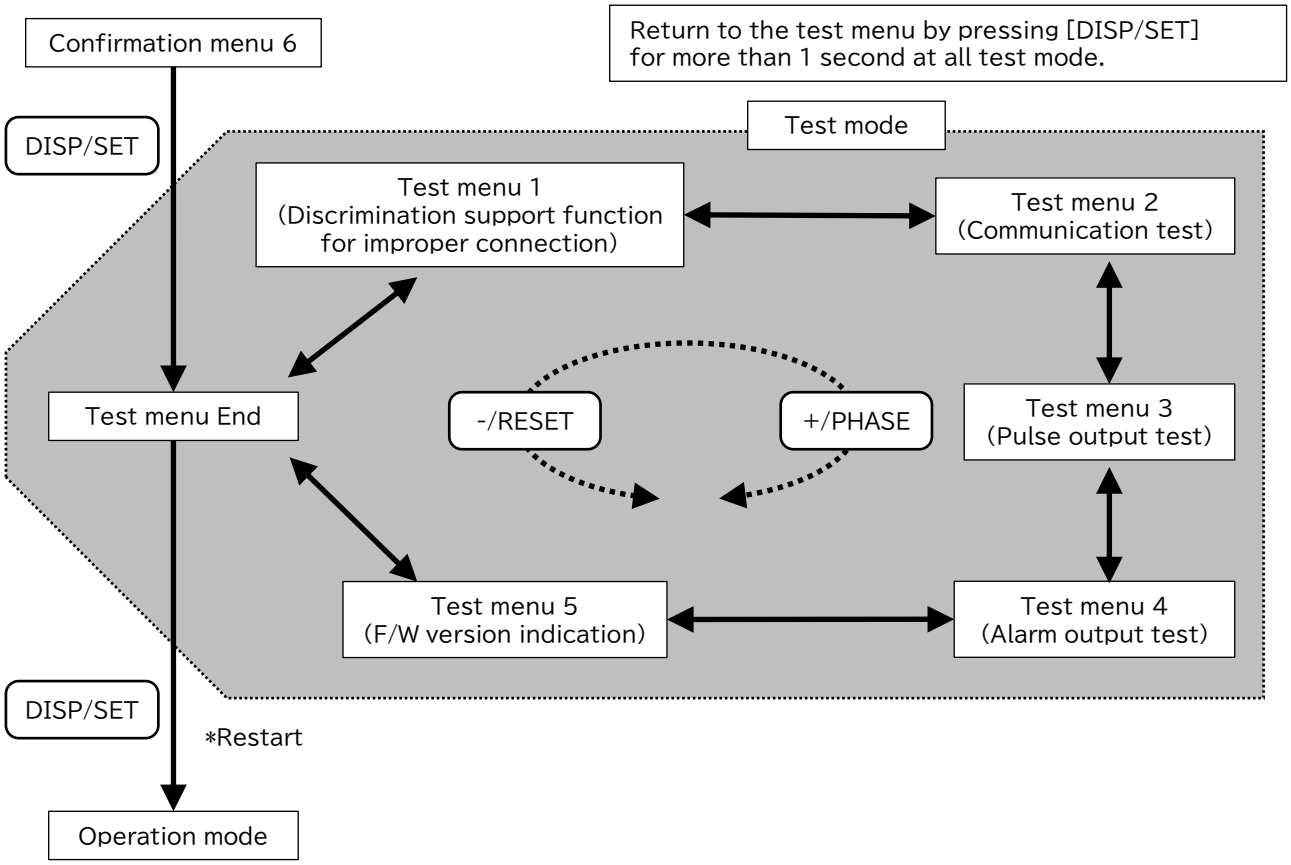
Test mode has the functions which you can utilize in such as the launch of equipment.
The functions in test mode are as follows:

Test menu	Details
1. Discrimination support function for improper connection	Indicate the phase angle of current and voltage, electric power value, voltage value and current value of each phase. By checking each displayed value, it becomes easier to determine whether there is a misconnection in the measurement (voltage/current) input connection.
2. Communication test	For models with communication functions, fixed numerical data can be returned without measurement (voltage/current) input. Please use it for the facing test with the host system.
3. Pulse output test	In case of EMU4-HD1A-MB, you can check the pulse output operation without measurement (voltage/current) input. Use for such as the check of the connection to the receiving device.
4. Alarm output test	In the case of EMU4-HD1A-MB, you can check the alarm output operation without measurement (voltage/current) input. Please use it to check the connection with the receiving device.
5. F/W version indication	Displays the F/W version of the instrument.

■How to test
① Press [DISP/SET] for two seconds to enter confirmation mode.
② Press [+/PHASE] or [-/RESET] to choose confirmation menu 6.
(As shown in the right figure.)
③ Press [DISP/SET] to enter test mode.
④ Test for the each menu.



■Flow of the test function

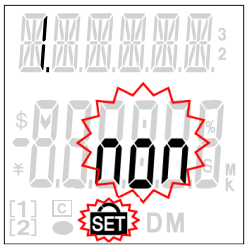


10.3 Test menu 1: Discrimination support function for improper connection

In test mode, the following operations can be possible.

Test menu

Choose the test menu 1.
*In case you set the simple measurement effective, the voltage and phase angle cannot be measured, so “non” will be displayed and it will automatically return to the setting menu.



DISP/SET

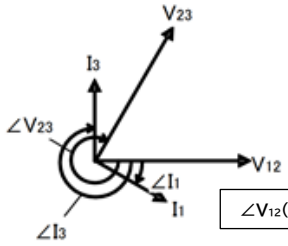
(1) Discrimination support function for improper connection

Phase angle (Voltage, phase 1N)

Indicate the phase angle, electric power, voltage and current.
Refer to the judgment example(“17 Appendix : Display example of discrimination support function for improper connection”) and check the result.
Refer to the next page for operation and transition of display.

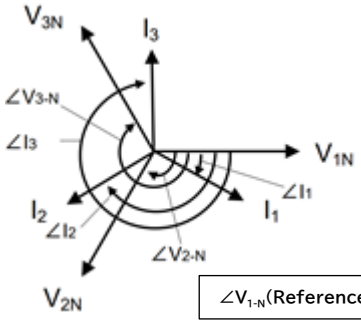
The phase angle is measured as shown below.

●For single-phase 3-wire and three-phase 3-wire.
The phase angle is indicated in a clockwise direction from V_{12}, as baseline (0 degree).



$\angle V_{12}$: Reference angle (=0)
$\angle V_{23}$: Phase angle between V_{23} and V_{12}
$\angle I_1$: Phase angle between I_1 and V_{12}
$\angle I_3$: Phase angle between I_3 and V_{12}

●For three-phase 4-wire.
The phase angle is indicated in a clockwise direction from V_{1N}, as baseline (0 degree).



$\angle V_{1\text{-}N}$: Reference angle (=0)
$\angle V_{2\text{-}N}$: Phase angle between V_{1N} and V_{2N}
$\angle V_{3\text{-}N}$: Phase angle between V_{1N} and V_{3N}
$\angle I_1$: Phase angle between I_1 and V_{1N}
$\angle I_2$: Phase angle between I_2 and V_{1N}
$\angle I_3$: Phase angle between I_3 and V_{1N}

DISP/SET

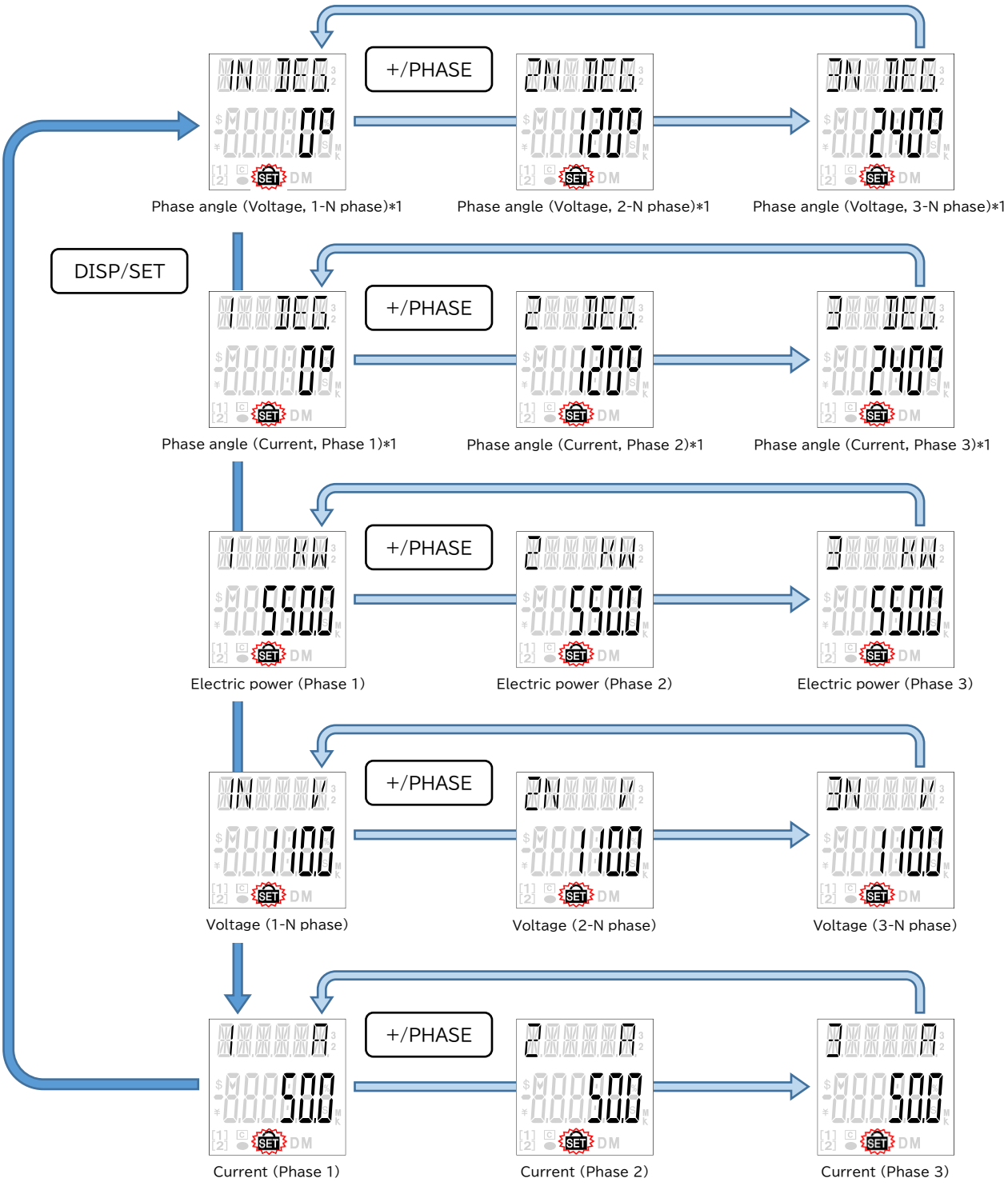
Press [DISP/SET] for more than 1 second.

Test menu

●If you continue other test menu
⇒ Choose other test menu number and press [DISP/SET].

●If you finish the test mode
⇒ Choose “End” and press [DISP/SET] to return to operating mode.

■Operation and transition of display. (Examples of a three-phase 4-wire)



*1: When the voltage value or the current value is 0, indicate "----".

POINT	Refer to the judgment example("17 Appendix : Display example of discrimination support function for improper connection") and check the result.

10.4 Test menu 2: Communication test

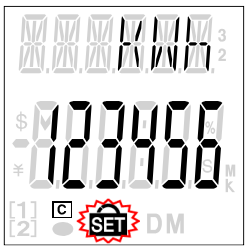
In test mode, the following operations can be possible.

Test menu

Choose the test menu 2.

DISP/SET

(1) Communication test



Test the communication.
(You can monitor non-zero values without voltage or current input.)

■Monitored value in communication
Monitoring the fixed value determined by the set value (phase wire system, primary voltage, primary current) is possible.

■Display
Indication is made according to the setting of indication pattern, etc. as with operating mode.

■Button operation

Operation	Function
Press [DISP/SET]	Change elements
Press [+/PHASE]	Change phase or circuit
Press [-/RESET]	Change degree(indication of harmonic only)
Press [DISP/SET] for more than 1sec	Return to test menu

DISP/SET

Press [DISP/SET] for more than 1 second.

Test menu

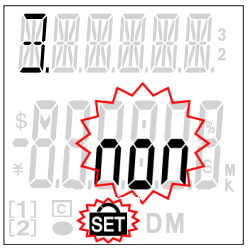
●If you continue other test menu.
⇒ Choose other test menu number and press [DISP/SET].

●If you finish the test mode.
⇒ Choose “End” and press [DISP/SET] to return to operating mode.

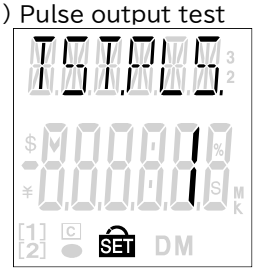
POINT	The fixed value to respond is indicated on the display (LCD). You can confirm normality of the communication by comparing a value displayed by the acquisition, shown data and this apparatus by a higher system and can utilize it for the debugging of the program.

10.5 Test menu 3: Pulse output test

In test mode, the following operations can be possible.

Test menu 	Choose the test menu 3. *For EMU4-BD1A-MB, this unit is not the external output function, so “non” will be displayed and it will automatically return to the setting menu. 

DISP/SET

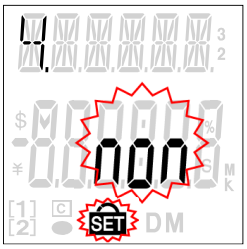
(1) Pulse output test 	Test the pulse output. (Input is unnecessary.) Press [+/PHASE] to output 1 pulse. 1 → 2 → ··· → 49 → 50 [pulse] Display indicates the present output pulse count. If count becomes 50, it is reset to1 at next output.

DISP/SET Press [DISP/SET] for more than 1 second.

Test menu 	●If you continue other test menu. ⇒ Choose other test menu number and press [DISP/SET]. ●If you finish the test mode. ⇒ Choose “End” and press [DISP/SET] to return to operating mode.

10.6 Test menu 4: Alarm output test

In test mode, the following operations can be possible.

Test menu 	Choose the test menu 4. *For EMU4-BD1A-MB, this unit is not the external output function, so “non” will be displayed and it will automatically return to the setting menu. 

↓ DISP/SET

(1) Alarm output test 	Test the alarm output. Switch output status off and on by pressing [+/PHASE]. oFF (Contact is opened) ⇔ on (Contact is closed) *Output should turn “oFF” when returning to test menu.

↓ DISP/SET Press [DISP/SET] for more than 1 second.

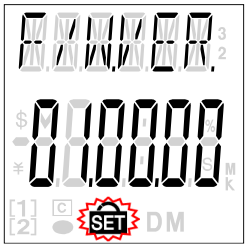
Test menu 	●If you continue other test menu. ⇒ Choose other test menu number and press [DISP/SET]. ●If you finish the test mode. ⇒ Choose “End” and press [DISP/SET] to return to operating mode.

10.7 Test menu 5: F/W version indication

In test mode, the following operations can be possible.

Test menu 	Choose the test menu 5.

DISP/SET

(1) F/W version indication 	Display F/W version of this unit.

DISP/SET Press [DISP/SET] for more than 1second.

Test menu 	●If you continue other test menu. ⇒ Choose other test menu number and press [DISP/SET]. ●If you finish the test mode. ⇒ Choose “End” and press [DISP/SET] to return to operating mode.

11. Requirement for the compliance with EMC Directives

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-BD1A-MB and EMU4-HD1A-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: EN 61326-1
(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 radiated emission and the immunity out of the test items for the standard.

(2) 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 low impedance even for high-frequency wave.

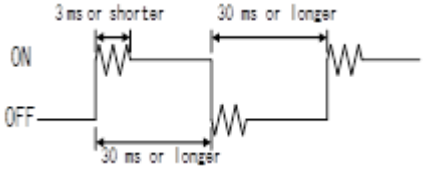
(b) Installation of power line and ground line
- ●Set up the ground point to the control panel near the energy measuring unit, and ground the protective conductor terminal of the unit to the ground terminal of the control panel (PE) by as thick and short wires as possible.(Wire length is 300 mm or shorter.)

(c) Cable
- ●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.

12. Specifications

12.1 Common specifications

Items			Specifications	
Model			EMU4-BD1A-MB	EMU4-HD1A-MB
Phase-wire system (Change of setting)			Single-phase 2-wire/ Single-phase 3-wire/ Three-phase 3-wire	Single-phase 2-wire/ Single-phase 3-wire/ Three-phase 3-wire/ Three-phase 4-wire
Rating	Voltage circuit *1	Single-phase 2-wire Three-phase 3-wire	110 V, 220 V AC common	110 V, 220 V, 440 V AC common (Delta connection:Max 220V, Star connection:Max 440V)
		Single-phase 3-wire	110 V AC (Between 1 and 2 line, 2 and 3 line), 220 V AC (Between 1 and 3 line)	110 V AC (Between 1 and 2 line, 2 and 3 line), 220 V AC (Between 1 and 3 line), 220 V AC (Between 1 and 2 line, 2 and 3 line), 440 V AC (Between 1 and 3 line)
		Three-phase 4-wire	–	Min: 63.5 V/ 110 V AC, Max: 277 V/ 480 V AC
	Current circuit *2		5 A, 50 A, 100 A, 250 A, 400 A, 600 A AC *Each value refers to the split type current at the primary side of the current sensor.	
	Frequency		50 Hz/ 60 Hz (Auto-detect)	
Auxiliary power supply rating			100 V to 240 V AC (+10%, -15%) 50 Hz / 60 Hz 10 VA Transient voltage 4000 V	
Measurable circuit counts			Single-phase 3-wire/ Three-phase 3-wire/ Three-phase 4-wire: 1 circuit Single-phase 2-wire: 2 circuit	
Consumption VA	Voltage circuit		Each phase 0.1 VA (at 110 V AC), 0.2 VA (at 220 V AC), 0.4 VA (at 440 V AC)	
	Current circuit		Each phase 0.1 VA (split type current sensor primary side)	
	Auxiliary power supply circuit		At 110 V AC: 9 VA At 220 V AC: 10 VA	
Allowable tolerance *3, *4			Current, voltage, electric power, reactive power, apparent power, frequency :±1.0% (100% of the rating) Power factor :±3.0% (against the electric angle 90°) Electric energy :±2.0% (5 to 100% range of the rating, power factor=1) Reactive energy :±2.5% (10 to 100% range of the rating, power factor=0) Harmonic current, harmonic voltage :±2.5%	
Data update interval			250 msec	
Range of demand time setting			0, 10 s, 20 s, 30 s, 40 s, 50 s, 1 to 15 min (1 min intervals), 20 min, 25 min, 30 min	
Alarm monitoring	Upper / lower limit alarm	Monitoring element	Current demand upper limit alarm, Current demand lower limit alarm, Line voltage upper limit alarm, Line voltage lower limit alarm, Electric energy demand upper limit alarm, Electric energy demand lower limit alarm, Power factor upper limit alarm, Power factor lower limit alarm, Current unbalance rate upper limit alarm, Voltage unbalance rate upper limit alarm,	Current demand upper limit alarm, Current demand lower limit alarm, Line voltage upper limit alarm, Line voltage lower limit alarm, Electric energy demand upper limit alarm, Electric energy demand lower limit alarm, Power factor upper limit alarm, Power factor lower limit alarm, Pulse conversion value upper limit alarm, Current unbalance rate upper limit alarm, Voltage unbalance rate upper limit alarm,
		Alarm reset method	Choose from auto-reset or self-retention	
	Waveform band monitoring	Monitoring element	–	Band out rate
		Alarm reset method	–	Selectable from either auto-reset or self-retention

Items			仕様 Specifications	
External input	Input signal		–	Non-voltage Form A contact, or open collector 1 input
	Function		–	Pulse count: 0 to 999999 counts Contact monitoring *5
	Isolation		–	By photo coupler
	Rated input voltage and current		–	5 V DC, 7 mA (Supplied by this unit)
	Input condition		–	ON time :30 ms or longer OFF time :30 ms or longer Chattering time :3 ms or shorter 
External output	Output signal		–	Non-voltage Form A contact, 1 output (Choose the function from below)
	Isolation		–	By semiconductor relay
	Rated switching voltage and current		–	35 V DC, 75 mA 24 V AC, 75 mA (Power factor = 1)
	Alarm output		–	Upper / lower limit alarm, Waveform band monitoring
	Pulse output	Output element	–	Electric energy (Incoming)
		Unit of pulse	–	0.001/ 0.01/ 0.1/ 1/ 10/ 100/ 1000/ 10000 (kWh/ pulse)
		Pulse width	–	0.1 to 0.15 s
Compensation for power failure	Stored items		Stored in the nonvolatile memory (Setting values, integrated values, operating time)	
Standard *6			UL:UL61010-1 CE Marking / UKCA Marking (EMC: EN 61326-1, LVD: EN 61010-1)	
Usage environment	Operating temperature		-5℃ to +55℃ (Daily average temperature is +35℃ or lower)	
	Operating humidity		30% to 85%RH(No condensation)	
	Storage temperature		-10℃ to +60℃	
	Operating altitude		2000 m or below	
Commercial frequency withstand voltage			2000 V AC, 1 min	
			・Between all terminals (Except for protective conductor terminal) and casing.	
			・Between all terminals of current input, voltage input and all terminals of auxiliary power.	
			・Between all terminals of current input, voltage input, auxiliary power (Except for protective conductor terminal) and all terminals of communication.	・Between all terminals of current input, voltage input, auxiliary power (Except for protective conductor terminal) and all terminals of external input, external output, communication.
Insulation resistance			10 MΩ or more(500 V DC)	
Mass			0.25 kg	
External dimensions			75(W) × 90(H) × 75(D) (Except for the protruding portions) (Maximum dimension including the protruding portions: 79(W) × 90(H) × 75(D))	

*1: In case you measure the larger voltage than instrument rating, please use the transformer (VT) for the instrument.
(For single-phase 2-wire and three-phase 3-wire: The measurable range is the primary voltage of VT up to 110000 V and the secondary voltage of VT up to 220 V)
(For single-phase 3-wire: Cannot measure the voltage)
(For three-phase 4-wire: The measurable range is the primary voltage of VT up to 110000 V and the secondary voltage of VT up to 220 V)
The transformer of star - delta connection and delta - star connection can't measure correctly because of the phase shifting. Please use transformer of same wire connection.

*2: In case you measure the larger current than instrument rating, please use the transformer (CT) for the instrument.
(The measurable range is the primary current of CT up to 30000 A, the secondary current of CT is fixed to 5 A.)

*3: Do not include the relative error of the division form current sensor.
For relative error of current sensor, refer to "12.4 Specifications of option devices (Split type current sensor)".

*4: The following measurement items (virtual measurement values) shall have an accuracy of 2%.
Current: 2-phase current (1P3W, 3P3W), N-phase current (3P4W)
Voltage: 1 and 3 line voltage (1P3W, 3P3W), 1 and 2 line voltage, 2 and 3 line voltage, 1 and 3 line voltage (3P4W)

*5: As a function linked to contact monitoring, the periodic electric energy and the operating time can be measured.

*6: When combined with the following products, it will be out of the conformity standard.
Option unit: B/NET Communication Unit (Model: EMU4-CM-B)
Split type current sensor: (Model: EMU-CT5-A, EMU-CT50-A, EMU-CT100-A, EMU-CT250-A)

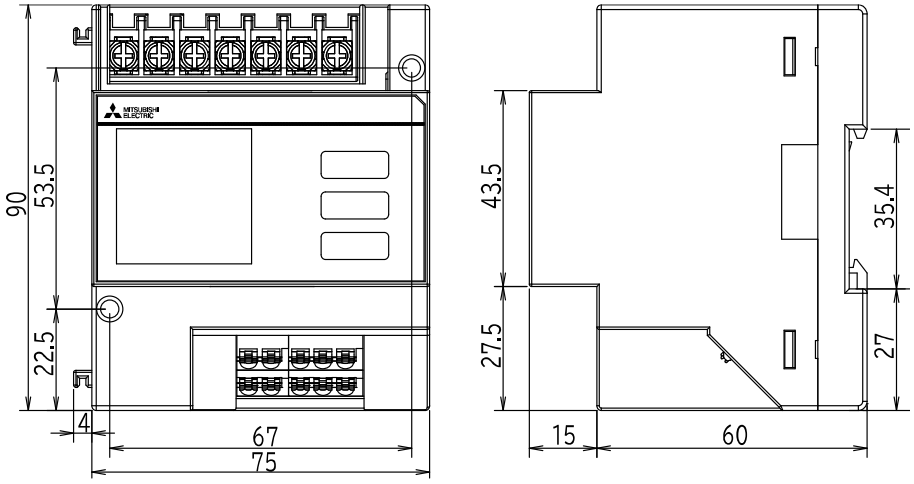
12.2 Specifications of MODBUS RTU communications

Items	Specifications
Communication method	RS-485 2-wire half duplex
Communication protocol	MODBUS RTU mode (binary data transfer)
Synchronization method	Asynchronous
Transmission wiring type	Multi-point bus (either directly on the trunk cable, forming a daisy-chain)
Baud rate	2400, 4800, 9600, 19200, 38400 bps (default: 19200 bps)
Data bit	8 bits
Stop bit	1, 2 bit (default: 1 bit)
Parity bit	EVEN, ODD, NONE (default: EVEN)
Slave address	1 to 255 (default: 1) (But 0 is impossible of authorization for a broadcast address. 248 to 255 is reserve.)
Response time	1 second or shorter from completion of receiving query data to response transmission
Communications distance	Maximum 1200 m
Connectable devices	Maximum 31 devices
Termination resistor	120 Ω 1／2 W
Applicable wire	SPEV(SB)-MPC- 0.2 × 2 P (produced by Fujikura Dia Cable) or its equivalent

12.3 External dimensions

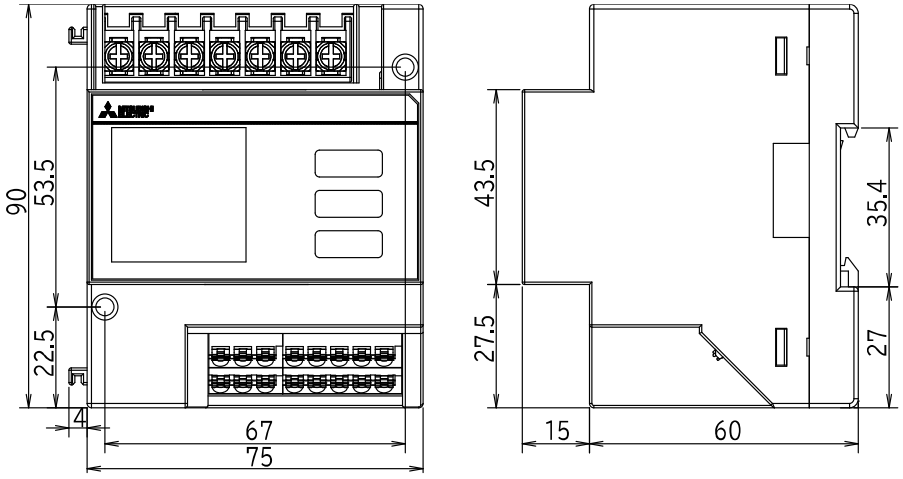
(1) Energy Measuring Unit only

■EMU4-BD1A-MB



Unit: mm

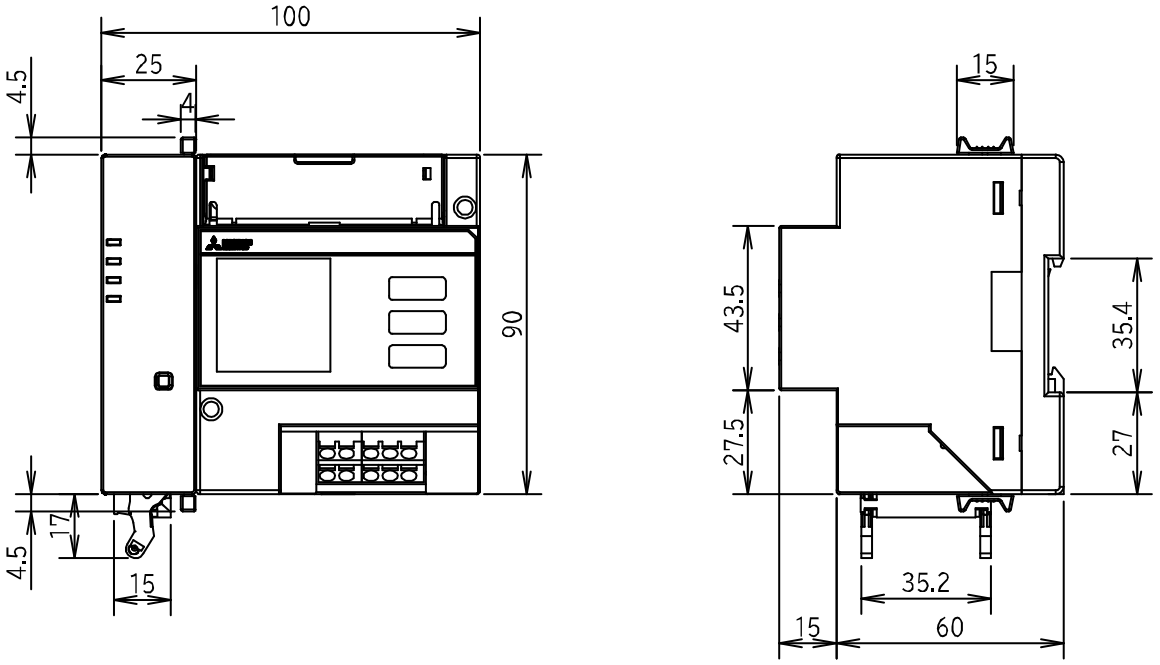
■EMU4-HD1A-MB



Unit: mm

(2) Combination with option unit

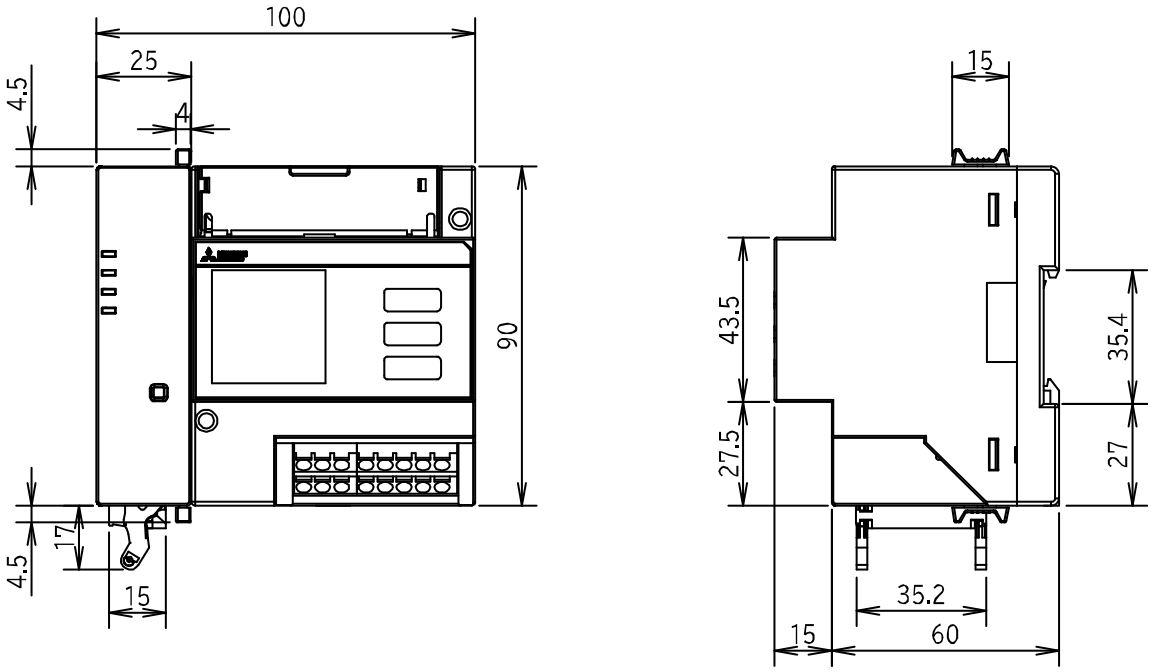
■EMU4-BD1A-MB (connect EMU4-CM-B or EMU4-CM-C)



Unit: mm

*The figure above shows a combination with EMU4-CM-C.
The external dimensions are the same when combined with EMU4-CM-B.

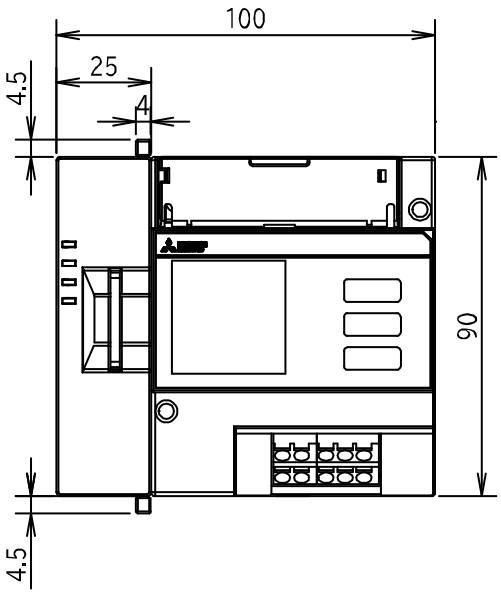
■EMU4-HD1A-MB (connect EMU4-CM-B or EMU4-CM-C)

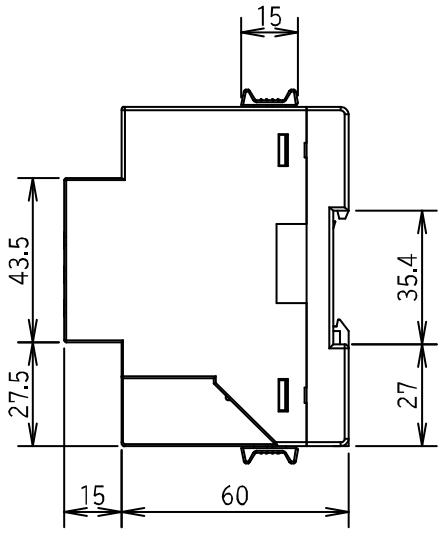


Unit: mm

*The figure above shows a combination with EMU4-CM-C.
The external dimensions are the same when combined with EMU4-CM-B.

■EMU4-BD1A-MB（connect EMU4-LM or EMU4-CM-CIFB）

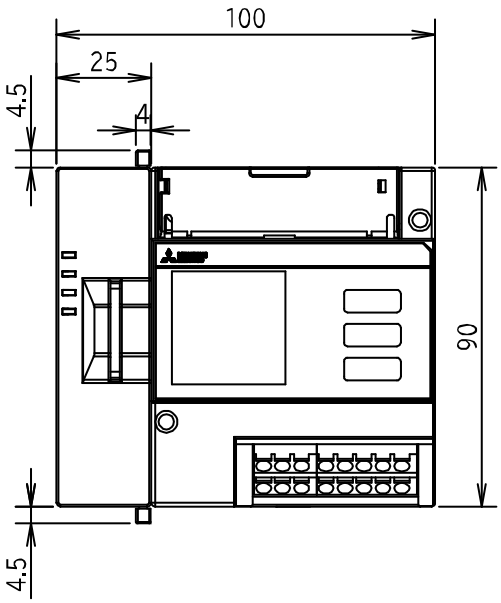


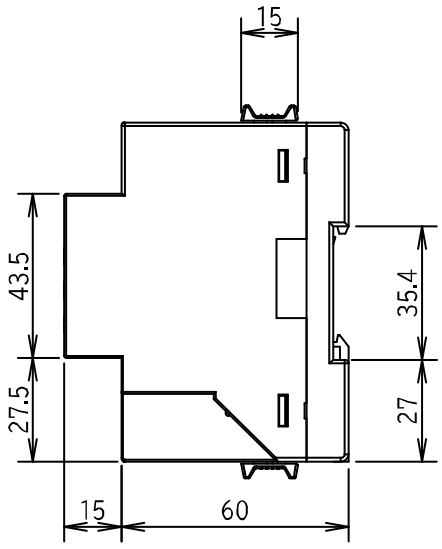


Unit: mm

*The figure above shows a combination with EMU4-LM.
The external dimensions are the same when combined with EMU4-CM-CIFB.

■EMU4-HD1A-MB（connect EMU4-LM or EMU4-CM-CIFB）

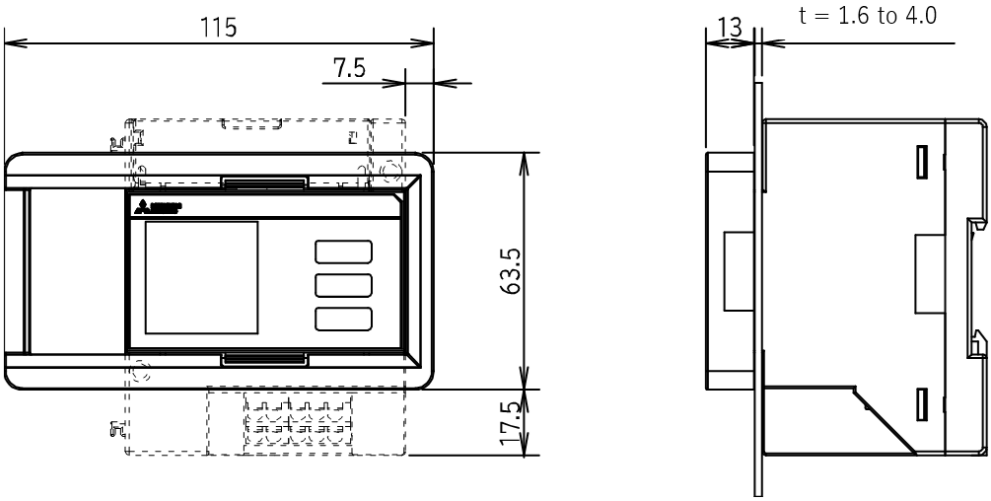




Unit: mm

*The figure above shows a combination with EMU4-LM.
The external dimensions are the same when combined with EMU4-CM-CIFB.

(3) Mounting on panel
■EMU4-BD1A-MB (use EMU4-PAT)



Unit: mm

*The external dimensions for EMU4-HD1A-MB are the same.

12.4 Specifications of option devices(Split type current sensor)

Item	Specifications		
Model	EMU-CT50	EMU-CT100	EMU-CT250
Rated primary current	50 A AC	100 A AC	250 A AC
Rated secondary current	16.66 mA	33.33 mA	66.66 mA
Rated load	0.1 VA		
Relative error	±1% (5 to 100% range of rating, RL ≤ 10 Ω)		
Variability of phase difference	±30′ (5 to 100% range of rating, RL ≤ 10 Ω)		
Pollution degree	2		
Operating temperature range	-5 to +55°C (Daily average temperature is +35°C or lower)		
Operating humidity range	5 to 95%RH (No condensation)		
Standard for CE Marking/UKCA Marking	EN 61010-2-032		
Mass (per device)	0.1 kg		

⚠ CAUTION	Use an electric wire of the size of penetrating this current sensor for a primary side cable, do not use a non-insulation electric wire or a metal for a primary cable. Please check the maximum voltage for the combination measurement unit.

Item	Specifications				
Model	EMU-CT50-A	EMU-CT100-A	EMU-CT250-A	EMU-CT400-A	EMU-CT600-A
Rated primary current	50 A AC	100 A AC	250 A AC	400 A AC	600 A AC
Rated secondary current	16.66 mA	33.33 mA	66.66 mA	66.66 mA	66.66 mA
Rated load	0.1 VA				
Relative error	±1% (5 to 100% range of rating, RL ≤ 10 Ω)				
Variability of phase difference	±45′ (10% to 100% of rating, RL≦10 Ω) ±60′ (5% of rating, RL≦10 Ω)		±40′ (5% to 100% of rating , RL≦10Ω)		
Pollution degree	–			2	
Operating temperature Range (*1)	-5 to +55°C (Daily average temperature is +35°C or lower)				
Operating humidity range	30 to 85%RH (No condensation)				
Standard for CE Marking/UKCA Marking	–			EN 61010-2-032	
Mass (per device)	0.1 kg		0.2 kg	0.3 kg	0.4 kg

*1 When using EMU-CT600-A to comply with UL/c-UL standards, please use it within the range of -5℃ to +50℃.

⚠ CAUTION	Use an electric wire of the size of penetrating this current sensor for a primary side cable, do not use a non-insulation electric wire or a metal for a primary cable. Please check the maximum voltage for the combination measurement unit.

Item	Specifications		
Model	EMU2-CT5	EMU2-CT5-4W	EMU-CT5-A
Rated primary current	5 A AC		
Rated secondary current	1.66 mA		
Rated load	0.1 VA		
Relative error	±1% (5 to 100% range of rating, RL ≤ 10 Ω)		
Variability of phase difference	±30′ (5 to 100% range of rating, RL ≤ 10 Ω)		±45′ (10% to 100% of rating, RL≦10 Ω) ±60′ (5% of rating, RL≦10 Ω)
Pollution degree	2		–
Operating temperature range	-5 to +55°C (Daily average temperature is +35°C or lower)		
Operating humidity range	5 to 95%RH (No condensation)		30 to 85%RH (No condensation)
Standard for CE marking/UKCA Marking	EN 61010-2-032		–
Mass (per device)	0.1 kg		

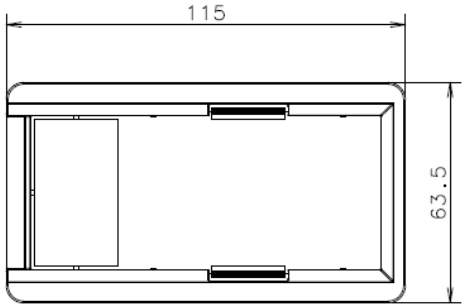
⚠ CAUTION	Use an electric wire of the size of penetrating this current sensor for a primary side cable, do not use a non-insulation electric wire or a metal for a primary cable. Please check the maximum voltage for the combination measurement unit.

12.5 External dimensions of option devices

Describes the external dimensions of option devices.
For Option units and options (option for Logging Unit), refer to the instruction manual for each instrument.

12.5.1 Option for Energy Measuring Unit

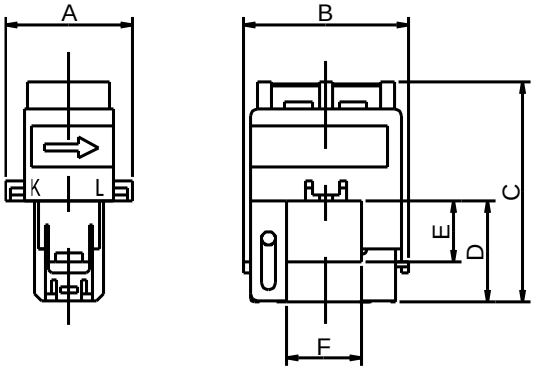
■The attachment for panel mounting (EMU4-PAT)



Unit: mm

12.5.2 Split type current sensor

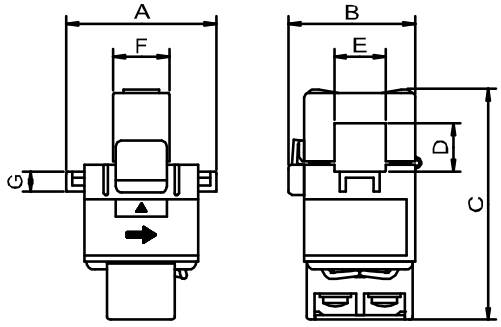
■Split type current sensor (Connection with general wire type) (EMU-CT50, EMU-CT100, EMU-CT250)



Unit: mm

Model	A	B	C	D	E	F
EMU-CT50、EMU-CT100	31.5	39.6	55.2	25.7	15.2	18.8
EMU-CT250	36.5	44.8	66	32.5	22	24

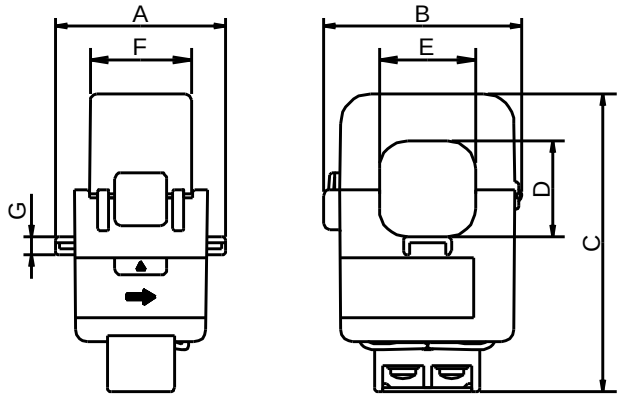
■Split type current sensor (Connection with general wire type) (EMU-CT5-A, EMU-CT50-A, EMU-CT100-A)



Unit: mm

Model	A	B	C	D	E	F	G
EMU-CT5-A、EMU-CT50-A	37.4	31.6	57.5	12.2	12.8	14	5
EMU-CT100-A	43.6	33.6	65	16.2	16.2	19	5

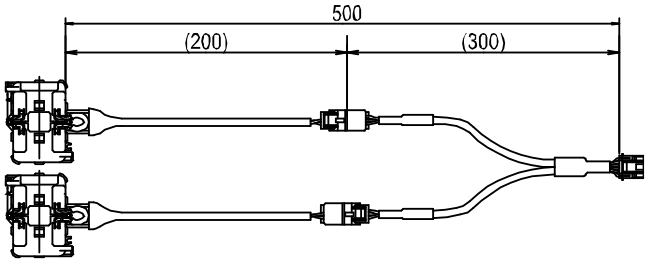
■Split type current sensor (Connection with general wire type) (EMU-CT250-A, EMU-CT400-A, EMU-CT600-A)



Unit: mm

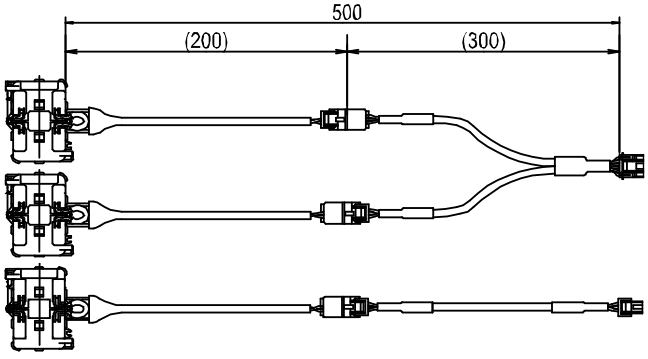
Model	A	B	C	D	E	F	G
EMU-CT250-A	42.6	49.4	74.5	24	24	25.2	4.5
EMU-CT400-A、EMU-CT600-A	44.9	67.2	94	36	36	27	4.5

■Split type current sensor(Connection with dedicated cable type)
(EMU2-CT5)



Unit: mm

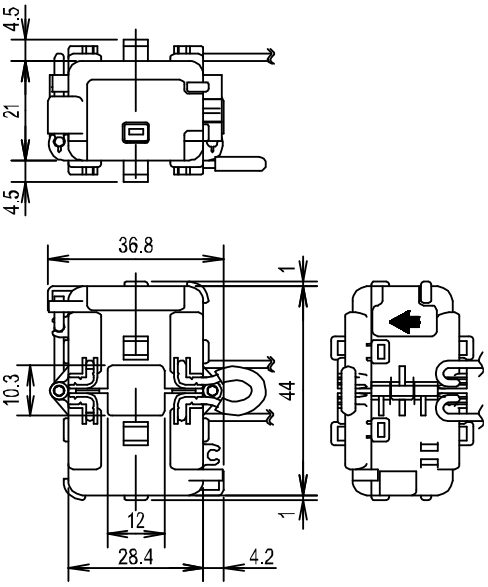
■Split type current sensor(Connection with dedicated cable type)
(EMU2-CT5-4W)



Unit: mm

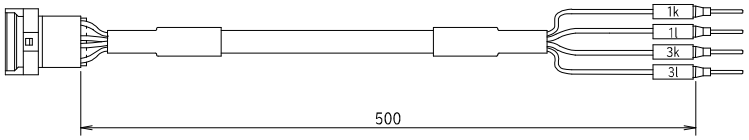
Details for sensor part

Unit: mm



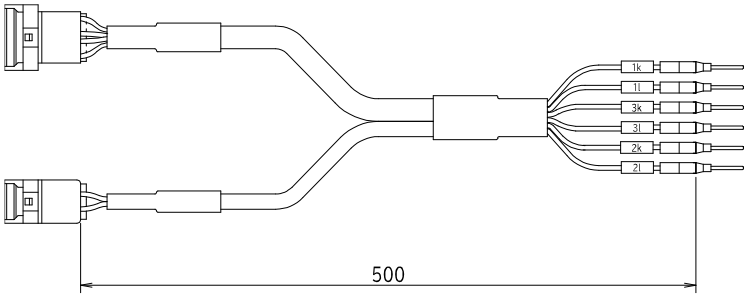
12.5.3 Dedicated cable

■Split type 5A current sensor cable（EMU2-CB-Q5A）



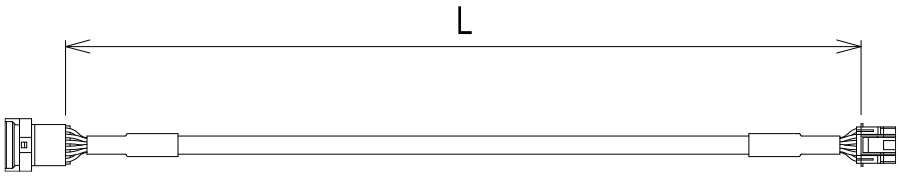
Unit: mm

■Split type 5A current sensor cable（EMU2-CB-Q5A-4W）



Unit: mm

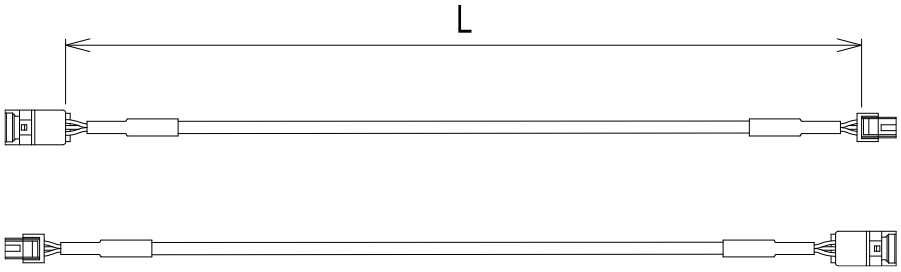
■Split type 5A current sensor extension cable（standard type）（EMU2-CB-T**M）



Model	EMU2-CB-T1M	EMU2-CB-T5M	EMU2-CB-T10M
L size	1000	5000	10000

Unit: mm

■Split type 5A current sensor extension cable（separate type）（EMU2-CB-T**MS）



Model	EMU2-CB-T1MS	EMU2-CB-T5MS	EMU2-CB-T10MS
L size	1000	5000	10000

Unit: mm

13. Care

⚠ DANGER	●Do not touch the live part such as the connection terminal while it is energized. Failure to do so may cause electric shock, a fire, a failure etc. ●If the voltage applied to the instrument drops below approximately 40 V, the display will disappear, but please do not touch the terminals or circuits as voltage may be applied. It may cause electric shock, a fire, a failure, a malfunction etc.

⚠ WARNING	Work under the electric outage condition. Do not do hot-line work. Failure to do so may cause electric shock, a fire, a failure etc.

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

Care as follows:

(1) If the surface of this equipment is dirty with dust, wipe it with a dry cloth each time.
(2) Do not let a chemical cloth remain on the surface for an extended period of time nor wipe the surface with thinner or benzene. Cause deformation.

14. Storage

⚠ DANGER	●Do not touch the live part such as the connection terminal while it is energized. Failure to do so may cause electric shock, a fire, a failure etc. ●If the voltage applied to the instrument drops below approximately 40 V, the display will disappear, but please do not touch the terminals or circuits as voltage may be applied. It may cause electric shock, a fire, a failure, a malfunction etc.

⚠ WARNING	Work under the electric outage condition. Do not do hot-line work. Failure to do so may cause electric shock, a fire, a failure etc.

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

Storage as follows:

(1) Removing the unit
①Turn off the power to the circuit to which is connected.
②Disconnect any cables that are connected.
③Remove the unit in the reverse order of the mounting. (Please refer to “5. Attaching and removing”.)

(2) Storage
Turn off the power, disconnect the wires, remove the unit from the panel, and store it in a polyethylene bag.

15. Maintenance

⚠ DANGER	●Do not touch the live part such as the connection terminal while it is energized. Failure to do so may cause electric shock, a fire, a failure etc. ●If the voltage applied to the instrument drops below approximately 40 V, the display will disappear, but please do not touch the terminals or circuits as voltage may be applied. It may cause electric shock, a fire, a failure, a malfunction etc.

⚠ WARNING	Work under the electric outage condition. Do not do hot-line work. Failure to do so may cause electric shock, a fire, a failure etc.

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

Maintenance as follows:

(1) Daily maintenance
①No damage on this unit.
②No abnormal heat.
③No abnormal noise or smell.
④No interfere with the reading of the displayed values by dust and dirt or LCD failure.
⑤No dust or dirt adhering to the current-carrying part.

(2) Periodical maintenance
Please maintenance every year the listed below:
①No damage on this unit.
②No cable disconnection.
③No looseness wire connection to terminal blocks. If there is any looseness, retighten with the appropriate torque.

16. Troubleshooting

This chapter explains the details of problems and how to deal with them.
If the contents described here do not solve the problem, contact our sales representative near you.
(For details, (For details, refer to the end of this manual.).

16.1 In case you think the unit is in failure

If you think the unit is in failure, check the following before sending for repair.

Phenomenon	There is a difference in the measured value. Example 1: Electric energy (Integrated value) is not measured even if the current value is indicated. Example 2: The measured value is different compared to other measuring instruments.
Check point	●Are the power supply side and the load side of the power line connection reversed? ●Are the set values (Phase wire system, primary voltage, primary current) correct? ●Are the wiring short-circuited or disconnected?

Phenomenon	The current value measured by another measuring instrument and this instrument is different (More than the allowable error).
Check point	Check that the measuring instrument used for comparison indicates the rms value correctly. The instrument indicates rms values. 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.

16.2 About error number

In case the display part indicates the error number as below, adopt measures indicated in the table below.
If the unit does not resume after measures, it may be in failure.
Contact our sales representative near you.

Error No.	Details of the error	Measures
002	FRAM error	Press the reset button until the display (LCD) turns off or restore auxiliary power supply.
003	Memory error	
004	Timeout error	
005	Setting value out of range error	Press [DISP/SET] button.
009	Communication module error	Make sure that the communication module is connected properly, then turn on the power again auxiliary.
261	Communication error	The communication line is broken or not properly connected. Check that the signal symbols are correct, and that the communication connector and terminal screws are not loose.
262		Communication lines are busy. It will automatically return after a while. If it occurs repeatedly, please contact sales outlet.
263	Measuring unit failure	The energy measuring unit has failed. Please contact Mitsubishi Electric system service or sales outlet (Please mention the error number when you contact us).
264	Communication error	●In the case of B/NET transmission The following three points can be considered. Please confirm it. ・ Is the B/NET transmission dedicated power supply turned off? ・ Is the B/NET transmission line disconnected? ・ Are the transmission lines connected correctly? (Check that the signal symbols D, N, and S are correct, and that the screws for the B/NET transmission connector and each terminal are not loose.) ●In the case of CC-Link communication The following two points can be considered. Please confirm it. ・ Is the CC-Link communication line disconnected? ・ Are the communication lines connected correctly? (Check that the signal symbols DA, DB, DG, and SLD are correct, and that the screws of the CC-Link communication connector and each terminal are not loose.)
265		
266	Communication error between option units	Communication between the energy measuring unit and option unit has failed. Please reset the energy measuring unit.
281	B/NET communication error	B/NET address is duplicated. Please check all addresses or station numbers of the energy measuring unit and terminals connected to it.
901	Logging unit error	The write protect switch of the SD memory card of the logging unit is ON. Turn off the write protect switch.
902		A measuring element that cannot be measured by the energy measuring unit is set as a logging element. Please reset the logging conditions.
903	Memory error in option unit	Reading the internal memory has failed. Turn on the auxiliary power again.
904		
905	Time error	Please reset the current time.
907	Logging setting error	The logging setting data file specifications may be incorrect or out of the data range. Check the contents of the setting data file again.
912	Communication error between option units	(Refer to ” Error No.266” in this chapter.)

16.3 Q&A

■General

Q	To what degree is the unit durable against overvoltage and over current?
A	Durability is as follows: Momentary*: Up to 10 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.

Q	Can the unit be used as an electric energy meter?
A	This unit cannot be used for deal and proof of electric energy measurement stipulated in the measurement law.

Q	Are errors in wiring verifiable easily?
A	They are verifiable by the indication for discrimination support function for improper connection. (Please refer to"17. Appendix: Discrimination support function for improper connection x.")

Q	Is it OK to open the secondary terminals of the current sensor?
A	Do not open the secondary terminal of the current sensor. The split type current sensor has a built-in secondary terminal open protection circuit, so it will not cause an immediate fire, burnout, or other accident, but for safety, do not open it.

■Q&A about specifications

Q	What does "Allowable tolerance" mean?
A	For electric energy, it indicates the tolerance range for the measurement reading. For example, if the reading is 10KWh, the error is ±0.2KWh. For measurement elements other than electric energy, the allowable error range for rated input is shown. For current, when the rated current is set to 5A, the allowable range is ±1% of 5A.

Q	Is accuracy of the split type current sensor included?
A	Accuracy of the split type current sensor 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 current sensor.

Q	To what degree an area of micro current is measured?
A	A current value is measured from the area exceeding 0.1% of the rated current. In an area below 0.1%, measurement result is indicated as "0" (zero). However, in that case, still, the amount of electricity is being measured. Even if the indicated value is "0," measurement value will increase in continuing measurement for a long time. The amount of electricity is measured with a load that is about 0.1% or more of full load power.

Q	Is measurement of inverter circuit possible?
A	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&A about installation

Q	What is wire diameter that allows installing the split type current sensor?
A	The following lists the nominal cross-sectional areas of the conductor of 600-V vinyl coated wires that can penetrate. (Values for reference)

形名 Model	IV wire (600-V vinyl insulated wire)	CV wire (600-V vinyl insulated wire)
EMU-CT50-A	38mm^2	22mm^2
EMU-CT100-A	60mm^2	60mm^2
EMU-CT250-A	200mm^2	150mm^2
EMU-CT400-A	500mm^2	400mm^2
EMU-CT600-A	500mm^2	400mm^2
EMU-CT50	60mm^2	38mm^2
EMU-CT100	60mm^2	38mm^2
EMU-CT250	150mm^2	150mm^2(100mm^2 is recommended)

The above shows the standard nominal cross-sectional areas.
Due to the outer difference of finished vinyl insulation and deformation (bending) depending on manufacturers, a wire may not penetrate.
Make verification on site.

Q	What are the points when installing the split type current sensor?
A	The split type current sensor are split-type. If split surfaces are not engaged sufficiently or a foreign object exists between the split surfaces, adequate performances are not obtained. Pay attention in installation.

■Q&A about connection

Q	Does polarity exist in connection between the split type current sensor and the unit?
A	Yes. Make connections so that secondary terminals of the split type current sensor (k, l) and terminal symbols of unit agree with each other. If polarity is incorrect, the current value is measurable, but the electric power and the electrical energy cannot be measured correctly.

Q	Are there any key points in avoiding errors in wiring?
A	Check polarity of the split type current sensor on the primary current side. Power supply side of the circuit is indicated as “K,” and the load is indicated as “L.” An arrow indicates the direction from K to L. Check the split type current sensor and the module are connected correctly for the 1-side circuit, 2-side circuit and 3-side circuit. Besides, check that voltage inputs for voltage transform unit are connected correctly among P1, P2, P3, and P0.

Q	How do wires extend between the split type current sensor and the module?
A	The split type current sensor (Connection with general wire type) is extendable up to 50m. The split type current sensor (Connection with dedicated cable type) is extendable up to 11 m, using together with an extension cable. To extend the wire further, use the current transformer CW-5S/ CW-5SL for split-type instrument in combination, extending the secondary wiring on CW-5S/ CW-5SL side.

■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.

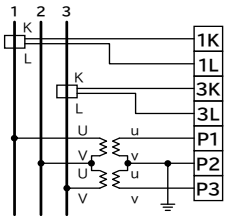
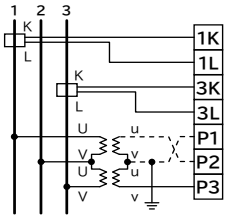
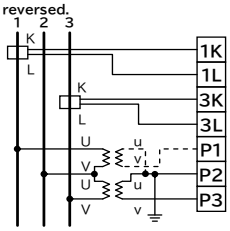
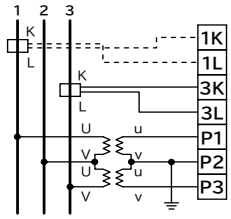
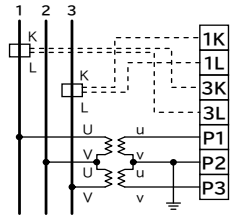
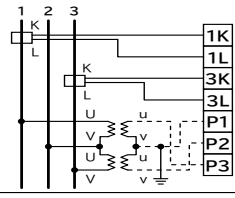
Q	If a primary current setting value is different from that of rated current on a connected the split type current sensor, does it cause a breakdown?
A	It does not cause breakdown or burning. However, measurement values will be totally incorrect.

17. Appendix: Discrimination support function for improper connection

■Display example of discrimination support function for improper connection

Display example (Connection example for three-phase 3-wire(2CT)) ----Indicates improper connection

＊The shaded areas in the table are affected by improper connection. Also, the broken lines in the connection diagram are the improper connections.

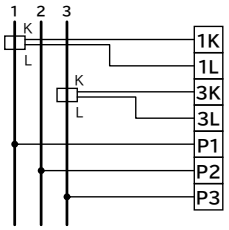
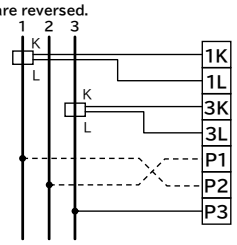
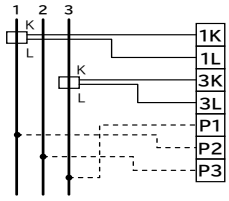
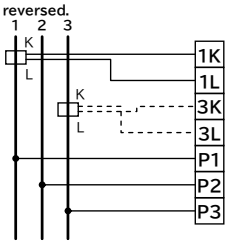
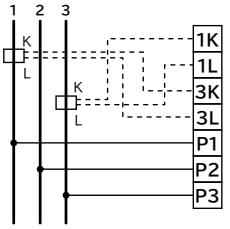
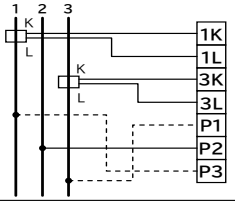
No.	Power factor (Input)	At equilibrium load($V_{12}=V_{23}$, $I_1=I_3$)												Connection					
		Phase angle display				Electric power display		Voltage display			Current display			Voltage			Current		Wiring
		$\angle V_{12}$	$\angle V_{23}$	$\angle I_1$	$\angle I_3$	W_1	W_3	V_{12}	V_{23}	V_{31}	I_1	I_2	I_3	1	2	3	CT (side"1"	CT (side"3"	
Normal status	Forward 70.7%	0	300	345	225	$W_1>W_3$		$V_{12}=V_{23}=V_{31}$			$I_1=I_2=I_3$			P1	P2	P3	Forward	Forward	
	Forward 86.6%			0	240														
	100.00%			30	270	$W_1=W_3$													
	Delayed 86.6%			60	300	$W_1<W_3$													
	Delayed 70.7%			75	315														
1	Forward 70.7%	0	60	165	45	W1=Negative value W3=Positive value		$V_{12}=V_{23}=V_{31}$			$I_1=I_2=I_3$			P2	P1	P3	Forward	Forward	Connection between P1 and P2 are reversed. 
	Forward 86.6%			180	60														
	100.00%			210	90														
	Delayed 86.6%			240	120														
	Delayed 70.7%			255	135														
2	Forward 70.7%	0	120	165	45	W1=Negative value W3=Positive value		$V_{12}=V_{23}<V_{31}$			$I_1=I_2=I_3$			P2	P1	P3	Forward	Forward	Connection of VT on side "1" is reversed. 
	Forward 86.6%			180	60														
	100.00%			210	90														
	Delayed 86.6%			240	120														
	Delayed 70.7%			255	135														
3	Forward 70.7%	0	300	165	225	W1=Negative value W3=Positive value		$V_{12}=V_{23}=V_{31}$			$I_1=I_3<I_2$			P1	P2	P3	1K 1L Reverse	Forward	Connection of CT on side "1" is reversed. 
	Forward 86.6%			180	240														
	100.00%			210	270														
	Delayed 86.6%			240	300														
	Delayed 70.7%			255	315														
4	Forward 70.7%	0	300	225	345	W1=Negative value W3=Positive value		$V_{12}=V_{23}=V_{31}$			$I_1=I_2=I_3$			P1	P2	P3	3K 3L Forward	1K 1L Forward	CT on side "1" and "3" are swapped. 
	Forward 86.6%			240	0														
	100.00%			270	30	$W_1=W_3=0$													
	Delayed 86.6%			300	60	W_1=Positive value W_3=Negative value													
	Delayed 70.7%			315	75														
5	Forward 70.7%	0	300	225	105	W_1=Negative value W_3=Negative value		$V_{12}=V_{23}=V_{31}$			$I_1=I_2=I_3$			P3	P1	P2	Forward	Forward	The VT terminals are connected to the measuring instrument's P1, P2, and P3 terminals in the order of P2, P3, and P1. 
	Forward 86.6%			240	120														
	100.00%			270	150	$W_1=0$ W_3=Negative value													
	Delayed 86.6%			300	180	W1=Positive value W3=Negative value													
	Delayed 70.7%			315	195														

＊This table is an example for a three-phase three-wire system (2CT).
In the case of three-phase three-wire system (3CT), the misconnection support display is the same.
However, it cannot detect misconnection of CT on the 2nd side.

Display example (Connection example for single-phase 3-wire)

----Indicates improper connection

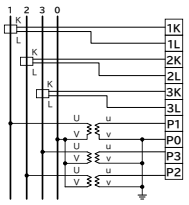
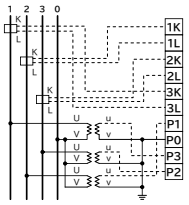
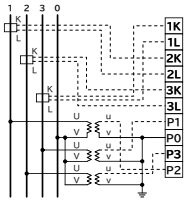
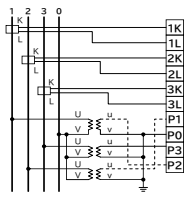
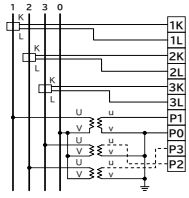
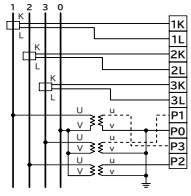
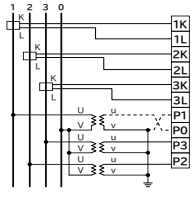
＊The shaded areas in the table are affected by improper connection. Also, the broken lines in the connection diagram are the improper connections.

No.	Power factor (input)	At equilibrium load(V12=V23, I1=I3)												Connection					
		Phase angle display				Electric power display		Voltage display			Current display			Voltage			Current		Wiring
		$\angle V_{12}$	$\angle V_{23}$	$\angle I_1$	$\angle I_3$	W_1	W_3	V_{12}	V_{23}	V_{31}	I_1	I_2	I_3	1	2	3	CT (side"1"	CT (side"3"	
Normal status	Forward 70.7%	0	180	315	135	$W_1=W_3$		$V_{12}=V_{23}<V_{31}$			$I_1=I_3$ $I_2=0$			P1	P2	P3	Forward	Forward	
	Forward 86.6%			330	150														
	100.00%			0	180														
	Delayed 86.6%			30	210														
	Delayed 70.7%			45	225														
1	Forward 70.7%	0	0	135	315	W1=Negative value W3=Positive value		$V_{12}=V_{23}<V_{31}$			$I_1=I_3$ $I_2=0$			P2	P1	P3	Forward	Forward	Connection between P1 and P2 are reversed. 
	Forward 86.6%			150	330														
	100.00%			180	0														
	Delayed 86.6%			210	30														
	Delayed 70.7%			225	45														
2	Forward 70.7%	0	0	135	315	W1=Negative value W3=Positive value		$V_{12}>V_{23}=V_{31}$			$I_1=I_3$ $I_2=0$			P2	P3	P1	Forward	Forward	The VT terminals are connected to the measuring instrument's P1, P2, and P3 terminals in the order of P2, P3, and P1. 
	Forward 86.6%			150	330														
	100.00%			180	0														
	Delayed 86.6%			210	30														
	Delayed 70.7%			225	45														
3	Forward 70.7%	0	180	315	315	W1=Positive value W3=Negative value		$V_{12}=V_{23}<V_{31}$			$I_1=I_3<I_2$			P1	P2	P3	Forward	3K 3L Reverse	Connection of CT on side "3" is reversed. 
	Forward 86.6%			330	330														
	100.00%			0	0														
	Delayed 86.6%			30	30														
	Delayed 70.7%			45	45														
4	Forward 70.7%	0	180	135	315	W1=Negative value W3=Negative value		$V_{12}=V_{23}<V_{31}$			$I_1=I_3$ $I_2=0$			P1	P2	P3	3K 3L Forward	1K 1L Forward	CT on side "1" and "3" are swapped. 
	Forward 86.6%			150	330														
	100.00%			180	0														
	Delayed 86.6%			210	30														
	Delayed 70.7%			225	45														
5	Forward 70.7%	0	180	135	315	W1=Negative value W3=Negative value		$V_{12}=V_{23}<V_{31}$			$I_1=I_3$ $I_2=0$			P3	P2	P1	Forward	Forward	The VT terminals are connected to the measuring instrument's P1, P2, and P3 terminals in the order of P3, P2, and P1. 
	Forward 86.6%			150	330														
	100.00%			180	0														
	Delayed 86.6%			210	30														
	Delayed 70.7%			225	45														

Display example (Connection example for three-phase 4-wire)

----Indicates improper connection

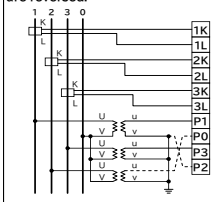
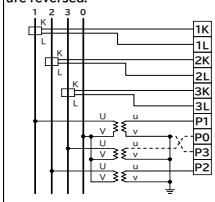
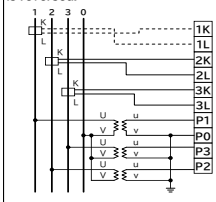
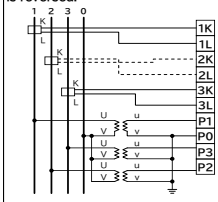
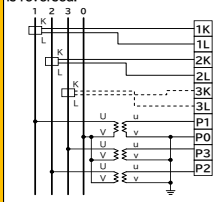
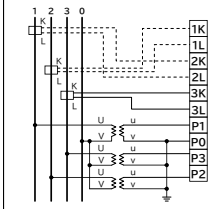
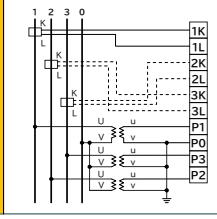
＊The shaded areas in the table are affected by improper connection. Also, the broken lines in the connection diagram are the improper connections.

No.	Power factor (input)	At equilibrium load ($V_{1N}=V_{2N}=V_{3N}$, $I_1=I_2=I_3$)														Connection							
		Phase angle display						Electric power display			Voltage display			Current display			Voltage				Current			Wiring
		$\angle V_{1N}$	$\angle V_{2N}$	$\angle V_{3N}$	$\angle I_1$	$\angle I_2$	$\angle I_3$	W_1	W_2	W_3	V_{1N}	V_{2N}	V_{3N}	I_1	I_2	I_3	1	2	3	0	CT (side"1"	CT (side"2"	CT (side"3"	
Normal status	Forward 70.7%	0	120	240	315	75	195	$W_1=W_2=W_3$			$V_{1N}=V_{2N}=V_{3N}$			$I_1=I_2=I_3$			P1	P2	P3	P0	Forward	Forward	Forward	
	Forward 86.6%				330	90	210																
	100.00%				0	120	240																
	Delayed 86.6%				30	150	270																
	Delayed 70.7%				45	165	285																
1	Forward 70.7%	0	120	240	315	75	195	$W_1=W_2=W_3$			$V_{1N}=V_{2N}=V_{3N}$			$I_1=I_2=I_3$			P3	P1	P2	P0	3K 3L Forward	1K 1L Forward	2K 2L Forward	Negative phase sequence. 
	Forward 86.6%				330	90	210																
	100.00%				0	120	240																
	Delayed 86.6%				30	150	270																
	Delayed 70.7%				45	165	285																
	Forward 70.7%	Same as above															P3	P1	P2	P0	2K 2L Forward	3K 3L Forward	1K 1L Forward	Negative phase sequence. 
	Forward 86.6%																						
	100.00%																						
	Delayed 86.6%																						
	Delayed 70.7%																						
2	Forward 70.7%	0	240	120	190	315	75	W_1=Negative value W_2=Positive value W_3=Positive value			$V_{1N}=V_{2N}=V_{3N}$			$I_1=I_2=I_3$			P2	P1	P3	P0	Forward	Forward	Forward	.Connection between P1 and P2 are reversed. 
	Forward 86.6%				210	330	90	W_1=Negative value W_2=0 W_3=Positive value															
	100.00%				240	0	120	W_1=Negative value W_2=Negative value W_3=Positive value															
	Delayed 86.6%				270	30	150	W_1=0 W_2=Negative value W_3=Positive value															
	Delayed 70.7%				285	45	165	W_1=Positive value W_2=Negative value W_3=Positive value															
3	Forward 70.7%	0	240	120	315	75	195	W_1=Positive value W_2=Negative value W_3=Positive value			$V_{1N}=V_{2N}=V_{3N}$			$I_1=I_2=I_3$			P1	P3	P2	P0	Forward	Forward	Forward	Connection between P2 and P3 are reversed. 
	Forward 86.6%				330	90	210	W_1=Positive value W_2=Negative value W_3=0															
	100.00%				0	120	240	W_1=Positive value W_2=Negative value W_3=Negative value															
	Delayed 86.6%				30	150	270	W_1=Positive value W_2=0 W_3=Negative value															
	Delayed 70.7%				45	165	285	W_1=Positive value W_2=Positive value W_3=Negative value															
4	Forward 70.7%	0	240	120	75	195	315	W_1=Positive value W_2=Positive value W_3=Negative value			$V_{1N}=V_{2N}=V_{3N}$			$I_1=I_2=I_3$			P3	P2	P1	P0	Forward	Forward	Forward	Connection between P1 and P3 are reversed. 
	Forward 86.6%				90	210	330	W_1=0 W_2=Positive value W_3=Negative value															
	100.00%				120	240	0	W_1=Negative value W_2=Positive value W_3=Negative value															
	Delayed 86.6%				150	270	30	W_1=Negative value W_2=Positive value W_3=0															
	Delayed 70.7%				165	285	45	W_1=Negative value W_2=Positive value W_3=Positive value															
5	Forward 70.7%	0	330	30	135	255	15	W1=Negative value W2=Positive value W3=Positive value			$V_{1N}<V_{2N}=V_{3N}$			$I_1=I_2=I_3$			P0	P2	P3	P1	Forward	Forward	Forward	Connection between P1 and P0 are reversed. 
	Forward 86.6%				150	270	30																
	100.00%				180	300	60																
	Delayed 86.6%				210	330	90																
	Delayed 70.7%				225	345	105																

Display example (Connection example for three-phase 4-wire)

----Indicates improper connection

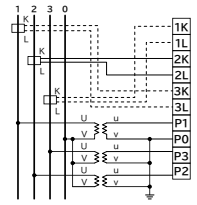
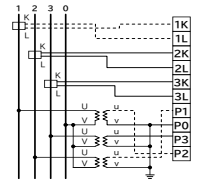
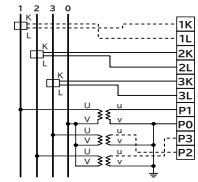
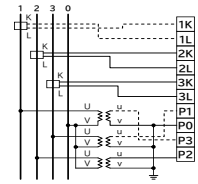
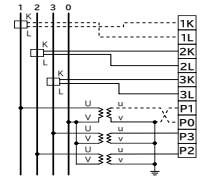
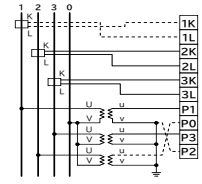
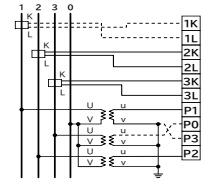
＊The shaded areas in the table are affected by improper connection. Also, the broken lines in the connection diagram are the improper connections.

No.	Power factor (input)	At equilibrium load ($V_{1N}=V_{2N}=V_{3N}$, $I_1=I_2=I_3$)														Connection							
		Phase angle display						Electric power display			Voltage display			Current display			Voltage				Current			Wiring
		$\angle V_{1N}$	$\angle V_{2N}$	$\angle V_{3N}$	$\angle I_1$	$\angle I_2$	$\angle I_3$	W_1	W_2	W_3	V_{1N}	V_{2N}	V_{3N}	I_1	I_2	I_3	1	2	3	0	CT (side"1"	CT (side"2"	CT (side"3"	
6	Forward 70.7%	0	330	300	345	105	225	W1=Positive value W2=Negative value W3=Positive value			$V_{1N}=V_{3N}>V_{2N}$			$I_1=I_2=I_3$			P1	P0	P3	P2	Forward	Forward	Forward	Connection between P2 and P0 are reversed. 
	Forward 86.6%				0	120	240																
	100.00%				30	150	270																
	Delayed 86.6%				60	180	300																
	Delayed 70.7%				75	195	315																
7	Forward 70.7%	0	60	30	285	45	165	W1=Positive value W2=Positive value W3=Negative value			$V_{1N}=V_{2N}>V_{3N}$			$I_1=I_2=I_3$			P1	P2	P0	P3	Forward	Forward	Forward	Connection between P3 and P0 are reversed. 
	Forward 86.6%				300	60	180																
	100.00%				330	90	210																
	Delayed 86.6%				0	120	240																
	Delayed 70.7%				15	135	255																
8	Forward 70.7%	0	120	240	135	75	195	W1=Negative value W2=Positive value W3=Positive value			$V_{1N}=V_{2N}=V_{3N}$			$I_1=I_2=I_3$			P1	P2	P3	P0	1K 1L Reverse	Forward	Forward	Connection of CT on side "1" is reversed. 
	Forward 86.6%				150	90	210																
	100.00%				180	120	240																
	Delayed 86.6%				210	150	270																
	Delayed 70.7%				225	165	285																
9	Forward 70.7%	0	120	240	315	255	195	W1=Positive value W2=Negative value W3=Positive value			$V_{1N}=V_{2N}=V_{3N}$			$I_1=I_2=I_3$			P1	P2	P3	P0	Forward	2K 2L Reverse	Forward	Connection of CT on side "2" is reversed. 
	Forward 86.6%				330	270	210																
	100.00%				0	300	240																
	Delayed 86.6%				30	330	270																
	Delayed 70.7%				45	345	285																
10	Forward 70.7%	0	120	240	315	75	15	W1=Positive value W2=Positive value W3=Negative value			$V_{1N}=V_{2N}=V_{3N}$			$I_1=I_2=I_3$			P1	P2	P3	P0	Forward	Forward	3K 3L Reverse	Connection of CT on side "3" is reversed. 
	Forward 86.6%				330	90	30																
	100.00%				0	120	60																
	Delayed 86.6%				30	150	90																
	Delayed 70.7%				45	165	105																
11	Forward 70.7%	0	120	240	75	315	195	W_1=Positive value W_2=Negative value W_3=Positive value			$V_{1N}=V_{2N}=V_{3N}$			$I_1=I_2=I_3$			P1	P2	P3	P0	2K 2L Forward	1K 1L Forward	Forward	CT on side "1" and "2" are swapped. 
	Forward 86.6%				90	330	210	W_1=0 W_2=Negative value W_3=Positive value																
	100.00%				120	0	240	W_1=Negative value W_2=Negative value W_3=Positive value																
	Delayed 86.6%				150	30	270	W_1=Negative value W_2=0 W_3=Positive value																
	Delayed 70.7%				165	45	285	W_1=Negative value W_2=Positive value W_3=Positive value																
12	Forward 70.7%	0	120	240	315	195	75	W_1=Positive value W_2=Positive value W_3=Negative value			$V_{1N}=V_{2N}=V_{3N}$			$I_1=I_2=I_3$			P1	P2	P3	P0	Forward	3K 3L Forward	2K 2L Forward	CT on side "2" and "3" are swapped. 
	Forward 86.6%				330	210	90	W_1=Positive value W_2=0 W_3=Negative value																
	100.00%				0	240	120	W_1=Positive value W_2=Negative value W_3=Negative value																
	Delayed 86.6%				30	270	150	W_1=Positive value W_2=Negative value W_3=0																
	Delayed 70.7%				45	285	165	W_1=Positive value W_2=Negative value W_3=Positive value																

Display example (Connection example for three-phase 4-wire)

----Indicates improper connection

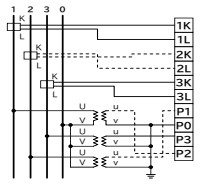
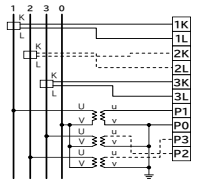
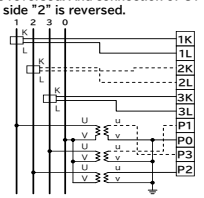
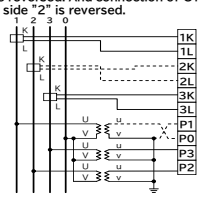
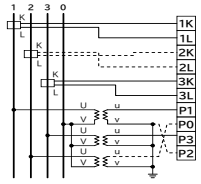
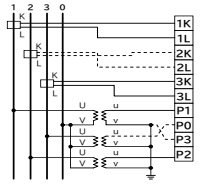
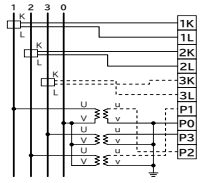
＊The shaded areas in the table are affected by improper connection. Also, the broken lines in the connection diagram are the improper connections.

No.	Power factor (input)	At equilibrium load ($V_{1N}=V_{2N}=V_{3N}$, $I_1=I_2=I_3$)														Connection						
		Phase angle display						Electric power display			Voltage display			Current display			Voltage				Current			Wiring
		$\angle V_{1N}$	$\angle V_{2N}$	$\angle V_{3N}$	$\angle I_1$	$\angle I_2$	$\angle I_3$	W_1	W_2	W_3	V_{1N}	V_{2N}	V_{3N}	I_1	I_2	I_3	1	2	3	0	CT (side"1"	CT (side"2"	CT (side"3"	
13	Forward 70.7%	0	120	240	195	75	315	W_1=Negative value W_2=Positive value W_3=Positive value			$V_{1N}=V_{2N}=V_{3N}$			$I_1=I_2=I_3$			P1	P2	P3	P0	3K 3L Forward	Forward	1K 1L Forward	CT on side "1" and "3" are swapped. 
	Forward 86.6%				210	90	330	W_1=Negative value W_2=Positive value W_3=0																
	100.00%				240	120	0	W_1=Negative value W_2=Positive value W_3=Negative value																
	Delayed 86.6%				270	150	30	W_1=0 W_2=Positive value W_3=Negative value																
	Delayed 70.7%				285	165	45	W_1=Positive value W_2=Positive value W_3=Negative value																
14	Forward 70.7%	0	240	120	15	315	75	W_1=Positive value W_2=Positive value W_3=Positive value			$V_{1N}=V_{2N}=V_{3N}$			$I_1=I_2=I_3$			P2	P1	P3	P0	1K 1L Reverse	Forward	Forward	Connection between P1 and P2 are reversed. And connection of CT on side "1" is reversed. 
	Forward 86.6%				30	330	90	W_1=Positive value W_2=0 W_3=Positive value																
	100.00%				60	0	120	W_1=Positive value W_2=Negative value W_3=Positive value																
	Delayed 86.6%				90	30	150	W_1=0 W_2=Negative value W_3=Positive value																
	Delayed 70.7%				105	45	165	W_1=Negative value W_2=Negative value W_3=Positive value																
15	Forward 70.7%	0	240	120	135	75	195	W_1=Negative value W_2=Negative value W_3=Positive value			$V_{1N}=V_{2N}=V_{3N}$			$I_1=I_2=I_3$			P1	P3	P2	P0	1K 1L Reverse	Forward	Forward	Connection between P2 and P3 are reversed. And connection of CT on side "1" is reversed. 
	Forward 86.6%				150	90	210	W_1=Negative value W_2=Negative value W_3=0																
	100.00%				180	120	240	W_1=Negative value W_2=Negative value W_3=Negative value																
	Delayed 86.6%				210	150	270	W_1=Negative value W_2=0 W_3=Negative value																
	Delayed 70.7%				225	165	285	W_1=Negative value W_2=Positive value W_3=Negative value																
16	Forward 70.7%	0	240	120	255	195	315	W_1=Negative value W_2=Positive value W_3=Negative value			$V_{1N}=V_{2N}=V_{3N}$			$I_1=I_2=I_3$			P3	P2	P1	P0	1K 1L Reverse	Forward	Forward	Connection between P1 and P3 are reversed. And connection of CT on side "1" is reversed. 
	Forward 86.6%				270	210	330	W_1=0 W_2=Positive value W_3=Negative value																
	100.00%				300	240	0	W_1=Positive value W_2=Positive value W_3=Negative value																
	Delayed 86.6%				330	270	30	W_1=Positive value W_2=Positive value W_3=0																
	Delayed 70.7%				345	285	45	W_1=Positive value W_2=Positive value W_3=Positive value																
17	Forward 70.7%	0	330	30	315	255	15	W1=Positive value W2=Positive value W3=Positive value			$V_{1N}<V_{2N}=V_{3N}$			$I_1=I_2=I_3$			P0	P2	P3	P1	1K 1L Reverse	Forward	Forward	Connection between P1 and P0 are reversed. And connection of CT on side "1" is reversed. 
	Forward 86.6%				330	270	30																	
	100.00%				0	300	60																	
	Delayed 86.6%				30	330	90																	
	Delayed 70.7%				45	345	105																	
18	Forward 70.7%	0	330	300	165	105	225	W1=Negative value W2=Negative value W3=Positive value			$V_{1N}=V_{3N}>V_{2N}$			$I_1=I_2=I_3$			P1	P0	P3	P2	1K 1L Reverse	Forward	Forward	Connection between P2 and P0 are reversed. And connection of CT on side "1" is reversed. 
	Forward 86.6%				180	120	240																	
	100.00%				210	150	270																	
	Delayed 86.6%				240	180	300																	
	Delayed 70.7%				255	195	315																	
19	Forward 70.7%	0	60	30	105	45	165	W1=Negative value W2=Positive value W3=Negative value			$V_{1N}=V_{2N}>V_{3N}$			$I_1=I_2=I_3$			P1	P2	P0	P3	1K 1L Reverse	Forward	Forward	Connection between P3 and P0 are reversed. And connection of CT on side "1" is reversed. 
	Forward 86.6%				120	60	180																	
	100.00%				150	90	210																	
	Delayed 86.6%				180	120	240																	
	Delayed 70.7%				195	135	255																	

Display example (Connection example for three-phase 4-wire)

----Indicates improper connection

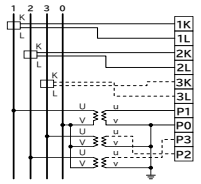
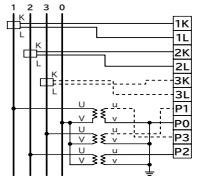
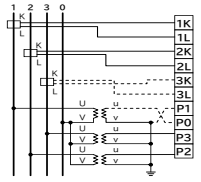
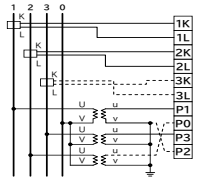
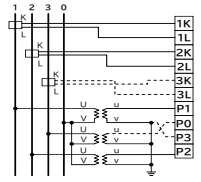
＊The shaded areas in the table are affected by improper connection. Also, the broken lines in the connection diagram are the improper connections.

No.	Power factor (input)	At equilibrium load ($V_{1N}=V_{2N}=V_{3N}$, $I_1=I_2=I_3$)														Connection							
		Phase angle display						Electric power display			Voltage display			Current display			Voltage				Current			Wiring
		$\angle V_{1N}$	$\angle V_{2N}$	$\angle V_{3N}$	$\angle I_1$	$\angle I_2$	$\angle I_3$	W_1	W_2	W_3	V_{1N}	V_{2N}	V_{3N}	I_1	I_2	I_3	1	2	3	0	CT (side"1"	CT (side"2"	CT (side"3"	
20	Forward 70.7%	0	240	120	195	135	75	W_1=Negative value W_2=Negative value W_3=Positive value			$V_{1N}=V_{2N}=V_{3N}$			$I_1=I_2=I_3$			P2	P1	P3	P0	Forward	2K 2L Reverse	Forward	Connection between P1 and P2 are reversed. And connection of CT on side "2" is reversed. 
	Forward 86.6%				210	150	90	W_1=Negative value W_2=0 W_3=Positive value																
	100.00%				240	180	120	W_1=Negative value W_2=Positive value W_3=Positive value																
	Delayed 86.6%				270	210	150	W_1=0 W_2=Positive value W_3=Positive value																
	Delayed 70.7%				285	225	165	W_1=Positive value W_2=Positive value W_3=Positive value																
21	Forward 70.7%	0	240	120	315	255	195	W_1=Positive value W_2=Positive value W_3=Positive value			$V_{1N}=V_{2N}=V_{3N}$			$I_1=I_2=I_3$			P1	P3	P2	P0	Forward	2K 2L Reverse	Forward	Connection between P2 and P3 are reversed. And connection of CT on side "2" is reversed. 
	Forward 86.6%				330	270	210	W_1=Positive value W_2=Positive value W_3=0																
	100.00%				0	300	240	W_1=Positive value W_2=Positive value W_3=Negative value																
	Delayed 86.6%				30	330	270	W_1=Positive value W_2=0 W_3=Negative value																
	Delayed 70.7%				45	345	285	W_1=Positive value W_2=Negative value W_3=Negative value																
22	Forward 70.7%	0	240	120	75	15	315	W_1=Positive value W_2=Negative value W_3=Negative value			$V_{1N}=V_{2N}=V_{3N}$			$I_1=I_2=I_3$			P3	P2	P1	P0	Forward	2K 2L Reverse	Forward	Connection between P1 and P3 are reversed. And connection of CT on side "2" is reversed. 
	Forward 86.6%				90	30	330	W_1=0 W_2=Negative value W_3=Negative value																
	100.00%				120	60	0	W_1=Negative value W_2=Negative value W_3=Negative value																
	Delayed 86.6%				150	90	30	W_1=Negative value W_2=Negative value W_3=0																
	Delayed 70.7%				165	105	45	W_1=Negative value W_2=Negative value W_3=Positive value																
23	Forward 70.7%	0	330	30	135	75	15	W1=Negative value W2=Negative value W3=Positive value			$V_{1N}<V_{2N}=V_{3N}$			$I_1=I_2=I_3$			P0	P2	P3	P1	Forward	2K 2L Reverse	Forward	Connection between P1 and P0 are reversed. And connection of CT on side "2" is reversed. 
	Forward 86.6%				150	90	30																	
	100.00%				180	120	60																	
	Delayed 86.6%				210	150	90																	
	Delayed 70.7%				225	165	105																	
24	Forward 70.7%	0	330	300	345	285	225	W1=Positive value W2=Positive value W3=Positive value			$V_{1N}=V_{3N}>V_{2N}$			$I_1=I_2=I_3$			P1	P0	P3	P2	Forward	2K 2L Reverse	Forward	Connection between P2 and P0 are reversed. And connection of CT on side "2" is reversed. 
	Forward 86.6%				0	300	240																	
	100.00%				30	330	270																	
	Delayed 86.6%				60	0	300																	
	Delayed 70.7%				75	15	315																	
25	Forward 70.7%	0	60	30	285	225	165	W1=Positive value W2=Negative value W3=Negative value			$V_{1N}=V_{2N}>V_{3N}$			$I_1=I_2=I_3$			P1	P2	P0	P3	Forward	2K 2L Reverse	Forward	Connection between P3 and P0 are reversed. And connection of CT on side "2" is reversed. 
	Forward 86.6%				300	240	180																	
	100.00%				330	270	210																	
	Delayed 86.6%				0	300	240																	
	Delayed 70.7%				15	315	255																	
26	Forward 70.7%	0	240	120	195	315	255	W_1=Negative value W_2=Positive value W_3=Negative value			$V_{1N}=V_{2N}=V_{3N}$			$I_1=I_2=I_3$			P2	P1	P3	P0	Forward	Forward	3K 3L Reverse	Connection between P1 and P2 are reversed. And connection of CT on side "3" is reversed. 
	Forward 86.6%				210	330	270	W_1=Negative value W_2=0 W_3=Negative value																
	100.00%				240	0	300	W_1=Negative value W_2=Negative value W_3=Negative value																
	Delayed 86.6%				270	30	330	W_1=0 W_2=Negative value W_3=Negative value																
	Delayed 70.7%				285	45	345	W_1=Positive value W_2=Negative value W_3=Negative value																

Display example (Connection example for three-phase 4-wire)

----Indicates improper connection

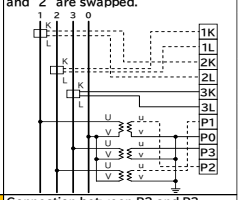
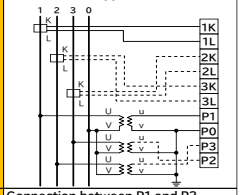
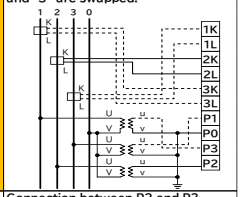
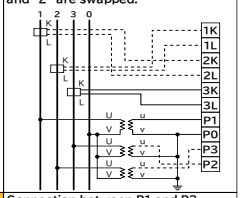
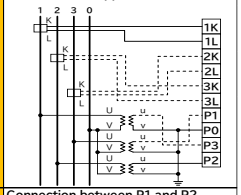
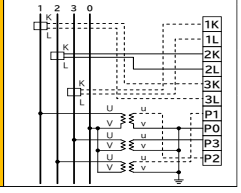
＊The shaded areas in the table are affected by improper connection. Also, the broken lines in the connection diagram are the improper connections.

No.	Power factor (input)	At equilibrium load($V_{1N}=V_{2N}=V_{3N}$, $I_1=I_2=I_3$)														Connection							
		Phase angle display						Electric power display			Voltage display			Current display			Voltage				Current			Wiring
		$\angle V_{1N}$	$\angle V_{2N}$	$\angle V_{3N}$	$\angle I_1$	$\angle I_2$	$\angle I_3$	W_1	W_2	W_3	V_{1N}	V_{2N}	V_{3N}	I_1	I_2	I_3	1	2	3	0	CT (side"1"	CT (side"2"	CT (side"3"	
27	Forward 70.7%	0	240	120	315	75	15	W_1=Positive value W_2=Negative value W_3=Negative value			$V_{1N}=V_{2N}=V_{3N}$			$I_1=I_2=I_3$			P1	P3	P2	P0	Forward	Forward	3K 3L Reverse	Connection between P2 and P3 are reversed. And connection of CT on side "3" is reversed. 
	Forward 86.6%				330	90	30	W_1=Positive value W_2=Negative value W_3=0																
	100.00%				0	120	60	W_1=Positive value W_2=Negative value W_3=Positive value																
	Delayed 86.6%				30	150	90	W_1=Positive value W_2=0 W_3=Positive value																
	Delayed 70.7%				45	165	105	W_1=Positive value W_2=Positive value W_3=Positive value																
28	Forward 70.7%	0	240	120	75	195	135	W_1=Positive value W_2=Positive value W_3=Positive value			$V_{1N}=V_{2N}=V_{3N}$			$I_1=I_2=I_3$			P3	P2	P1	P0	Forward	Forward	3K 3L Reverse	Connection between P1 and P3 are reversed. And connection of CT on side "3" is reversed. 
	Forward 86.6%				90	210	150	W_1=0 W_2=Positive value W_3=Positive value																
	100.00%				120	240	180	W_1=Negative value W_2=Positive value W_3=Positive value																
	Delayed 86.6%				150	270	210	W_1=Negative value W_2=Positive value W_3=0																
	Delayed 70.7%				165	285	225	W_1=Negative value W_2=Positive value W_3=Negative value																
29	Forward 70.7%	0	330	30	135	255	195	W1=Negative value W2=Positive value W3=Negative value			$V_{1N}<V_{2N}=V_{3N}$			$I_1=I_2=I_3$			P0	P2	P3	P1	Forward	Forward	3K 3L Reverse	Connection between P1 and P0 are reversed. And connection of CT on side "3" is reversed. 
	Forward 86.6%				150	270	210																	
	100.00%				180	300	240																	
	Delayed 86.6%				210	330	270																	
	Delayed 70.7%				225	345	285																	
30	Forward 70.7%	0	330	300	345	105	45	W1=Positive value W2=Negative value W3=Negative value			$V_{1N}=V_{3N}>V_{2N}$			$I_1=I_2=I_3$			P1	P0	P3	P2	Forward	Forward	3K 3L Reverse	Connection between P2 and P0 are reversed. And connection of CT on side "3" is reversed. 
	Forward 86.6%				0	120	60																	
	100.00%				30	150	90																	
	Delayed 86.6%				60	180	120																	
	Delayed 70.7%				75	195	135																	
31	Forward 70.7%	0	60	30	285	45	345	W1=Positive value W2=Positive value W3=Positive value			$V_{1N}=V_{2N}>V_{3N}$			$I_1=I_2=I_3$			P1	P2	P0	P3	Forward	Forward	3K 3L Reverse	Connection between P3 and P0 are reversed. And connection of CT on side "3" is reversed. 
	Forward 86.6%				300	60	0																	
	100.00%				330	90	30																	
	Delayed 86.6%				0	120	60																	
	Delayed 70.7%				15	135	75																	

Display example (Connection example for three-phase 4-wire)

----Indicates improper connection

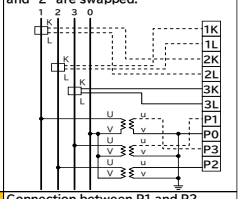
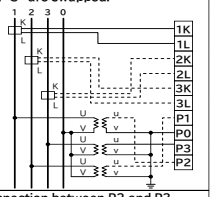
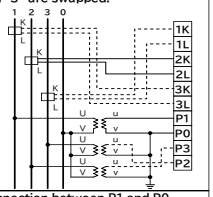
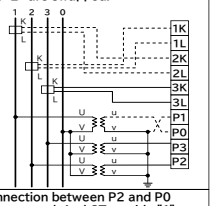
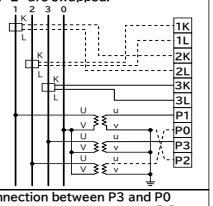
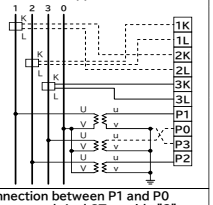
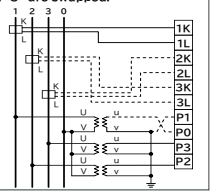
＊The shaded areas in the table are affected by improper connection. Also, the broken lines in the connection diagram are the improper connections.

No.	Power factor (input)	At equilibrium load($V_{1N}=V_{2N}=V_{3N}$, $I_1=I_2=I_3$)															Connection							
		Phase angle display						Electric power display			Voltage display			Current display			Voltage				Current			Wiring
		$\angle V_{1N}$	$\angle V_{2N}$	$\angle V_{3N}$	$\angle I_1$	$\angle I_2$	$\angle I_3$	W_1	W_2	W_3	V_{1N}	V_{2N}	V_{3N}	I_1	I_2	I_3	1	2	3	0	CT (side"1"	CT (side"2"	CT (side"3"	
32	Forward 70.7%	0	240	120	315	195	75	$W_1=W_2=W_3$			$V_{1N}=V_{2N}=V_{3N}$			$I_1=I_2=I_3$			P2	P1	P3	P0	2K 2L Forward	1K 1L Forward	Forward	Connection between P1 and P2 are reversed. And CT on side "1" and "2" are swapped. 
	Forward 86.6%				330	210	90																	
	100.00%				0	240	120																	
	Delayed 86.6%				30	270	150																	
	Delayed 70.7%				45	285	165																	
	Forward 70.7%	Same as above															P1	P3	P2	P0	Forward	3K 3L Forward	2K 2L Forward	Connection between P2 and P3 are reversed. And CT on side "2" and "3" are swapped. 
	Forward 86.6%																							
	100.00%																							
	Delayed 86.6%																							
	Delayed 70.7%																							
	Forward 70.7%	Same as above															P3	P2	P1	P0	3K 3L Forward	Forward	1K 1L Forward	Connection between P1 and P3 are reversed. And CT on side "1" and "3" are swapped. 
	Forward 86.6%																							
	100.00%																							
	Delayed 86.6%																							
	Delayed 70.7%																							
33	Forward 70.7%	0	240	120	75	315	195	$W_1=W_2=W_3$			$V_{1N}=V_{2N}=V_{3N}$			$I_1=I_2=I_3$			P1	P3	P2	P0	2K 2L Forward	1K 1L Forward	Forward	Connection between P2 and P3 are reversed. And CT on side "1" and "2" are swapped. 
	Forward 86.6%				90	330	210																	
	100.00%				120	0	240																	
	Delayed 86.6%				150	30	270																	
	Delayed 70.7%				165	45	285																	
	Forward 70.7%	Same as above															P3	P2	P1	P0	Forward	3K 3L Forward	2K 2L Forward	Connection between P1 and P3 are reversed. And CT on side "2" and "3" are swapped. 
	Forward 86.6%																							
	100.00%																							
	Delayed 86.6%																							
	Delayed 70.7%																							
	Forward 70.7%	Same as above															P2	P1	P3	P0	3K 3L Forward	Forward	1K 1L Forward	Connection between P1 and P2 are reversed. And CT on side "1" and "3" are swapped. 
	Forward 86.6%																							
	100.00%																							
	Delayed 86.6%																							
	Delayed 70.7%																							

Display example (Connection example for three-phase 4-wire)

----Indicates improper connection

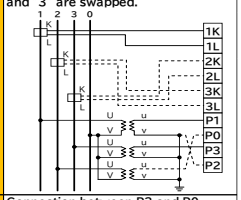
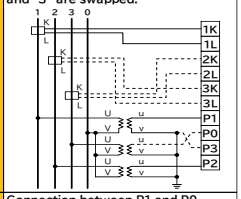
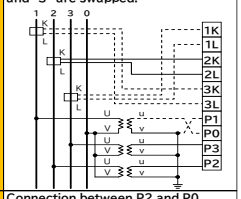
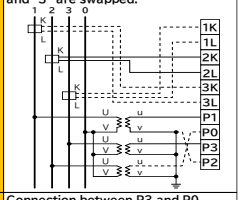
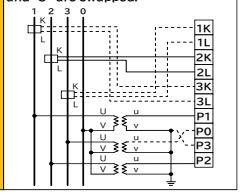
＊The shaded areas in the table are affected by improper connection. Also, the broken lines in the connection diagram are the improper connections.

No.	Power factor (input)	At equilibrium load ($V_{1N}=V_{2N}=V_{3N}$, $I_1=I_2=I_3$)															Connection							
		Phase angle display						Electric power display			Voltage display			Current display			Voltage				Current			Wiring
		$\angle V_{1N}$	$\angle V_{2N}$	$\angle V_{3N}$	$\angle I_1$	$\angle I_2$	$\angle I_3$	W_1	W_2	W_3	V_{1N}	V_{2N}	V_{3N}	I_1	I_2	I_3	1	2	3	0	CT (side"1"	CT (side"2"	CT (side"3"	
34	Forward 70.7%	0	240	120	195	75	315	$W_1=W_2=W_3$			$V_{1N}=V_{2N}=V_{3N}$			$I_1=I_2=I_3$			P3	P2	P1	P0	2K 2L Forward	1K 1L Forward	Forward	Connection between P1 and P3 are reversed. And CT on side "1" and "2" are swapped. 
	Forward 86.6%				210	90	330																	
	100.00%				240	120	0																	
	Delayed 86.6%				270	150	30																	
	Delayed 70.7%				285	165	45																	
	Forward 70.7%	Same as above															P2	P1	P3	P0	Forward	3K 3L Forward	2K 2L Forward	Connection between P1 and P2 are reversed. And CT on side "2" and "3" are swapped. 
	Forward 86.6%																							
	100.00%																							
	Delayed 86.6%																							
	Delayed 70.7%																							
	Forward 70.7%	Same as above															P1	P3	P2	P0	3K 3L Forward	Forward	1K 1L Forward	Connection between P2 and P3 are reversed. And CT on side "1" and "3" are swapped. 
	Forward 86.6%																							
	100.00%																							
	Delayed 86.6%																							
	Delayed 70.7%																							
35	Forward 70.7%	0	330	30	255	135	15	W_1=Negative value W_2=Negative value W_3=Positive value			$V_{1N}<V_{2N}=V_{3N}$			$I_1=I_2=I_3$			P0	P2	P3	P1	2K 2L Forward	1K 1L Forward	Forward	Connection between P1 and P0 are reversed. And CT on side "1" and "2" are swapped. 
	Forward 86.6%				270	150	30	W_1=0 W_2=Negative value W_3=Positive value																
	100.00%				300	180	60	W_1=Positive value W_2=Negative value W_3=Positive value																
	Delayed 86.6%				330	210	90																	
	Delayed 70.7%				345	225	105																	
36	Forward 70.7%	0	330	300	105	345	225	W1=Negative value W2=Positive value W3=Positive value			$V_{1N}=V_{3N}>V_{2N}$			$I_1=I_2=I_3$			P1	P0	P3	P2	2K 2L Forward	1K 1L Forward	Forward	Connection between P2 and P0 are reversed. And CT on side "1" and "2" are swapped. 
	Forward 86.6%				120	0	240																	
	100.00%				150	30	270																	
	Delayed 86.6%				180	60	300	W_1=Negative value W_2=0 W_3=Positive value																
	Delayed 70.7%				195	75	315	W_1=Negative value W_2=Negative value W_3=Positive value																
37	Forward 70.7%	0	60	30	45	285	165	W1=Positive value W2=Negative value W3=Negative value			$V_{1N}=V_{2N}>V_{3N}$			$I_1=I_2=I_3$			P1	P2	P0	P3	2K 2L Forward	1K 1L Forward	Forward	Connection between P3 and P0 are reversed. And CT on side "1" and "2" are swapped. 
	Forward 86.6%				60	300	180																	
	100.00%				90	330	210	W1=0 W2=0 W3=Negative value																
	Delayed 86.6%				120	0	240	W1=Negative value W2=Positive value W3=Negative value																
	Delayed 70.7%				135	15	255																	
38	Forward 70.7%	0	330	30	135	15	255	W1=Negative value W2=Positive value W3=Negative value			$V_{1N}<V_{2N}=V_{3N}$			$I_1=I_2=I_3$			P0	P2	P3	P1	Forward	3K 3L Forward	2K 2L Forward	Connection between P1 and P0 are reversed. And CT on side "2" and "3" are swapped. 
	Forward 86.6%				150	30	270																	
	100.00%				180	60	300	W1=Negative value W2=0 W3=0																
	Delayed 86.6%				210	90	330	W1=Negative value W2=Negative value W3=Positive value																
	Delayed 70.7%				225	105	345																	

Display example (Connection example for three-phase 4-wire)

----Indicates improper connection

＊The shaded areas in the table are affected by improper connection. Also, the broken lines in the connection diagram are the improper connections.

No.	Power factor (input)	At equilibrium load ($V_{1N}=V_{2N}=V_{3N}$, $I_1=I_2=I_3$)														Connection							
		Phase angle display						Electric power display			Voltage display			Current display			Voltage				Current			Wiring
		$\angle V_{1N}$	$\angle V_{2N}$	$\angle V_{3N}$	$\angle I_1$	$\angle I_2$	$\angle I_3$	W_1	W_2	W_3	V_{1N}	V_{2N}	V_{3N}	I_1	I_2	I_3	1	2	3	0	CT (side"1"	CT (side"2"	CT (side"3"	
39	Forward 70.7%	0	330	300	345	225	105	W_1=Positive value W_2=Negative value W_3=Negative value			$V_{1N}=V_{3N}>V_{2N}$			$I_1=I_2=I_3$			P1	P0	P3	P2	Forward	3K 3L Forward	2K 2L Forward	Connection between P2 and P0 are reversed. And CT on side "2" and "3" are swapped. 
	Forward 86.6%				0	240	120	W_1=Positive value W_2=0 W_3=Negative value																
	100.00%				30	270	150	W1=Positive value W2=Positive value W3=Negative value																
	Delayed 86.6%				60	300	180																	
	Delayed 70.7%				75	315	195																	
40	Forward 70.7%	0	60	30	285	165	45	W1=Positive value W2=Negative value W3=Positive value			$V_{1N}=V_{2N}>V_{3N}$			$I_1=I_2=I_3$			P1	P2	P0	P3	Forward	3K 3L Forward	2K 2L Forward	Connection between P3 and P0 are reversed. And CT on side "2" and "3" are swapped. 
	Forward 86.6%				300	180	60																	
	100.00%				330	210	90																	
	Delayed 86.6%				0	240	120	W_1=Positive value W_2=Negative value W_3=0																
	Delayed 70.7%				15	255	135	W_1=Positive value W_2=Negative value W_3=Negative value																
41	Forward 70.7%	0	330	30	15	255	135	W1=Positive value W2=Positive value W3=Negative value			$V_{1N}<V_{2N}=V_{3N}$			$I_1=I_2=I_3$			P0	P2	P3	P1	3K 3L Forward	Forward	1K 1L Forward	Connection between P1 and P0 are reversed. And CT on side "1" and "3" are swapped. 
	Forward 86.6%				30	270	150																	
	100.00%				60	300	180																	
	Delayed 86.6%				90	330	210	W_1=0 W_2=Positive value W_3=Negative value																
	Delayed 70.7%				105	345	225	W_1=Negative value W_2=Positive value W_3=Negative value																
42	Forward 70.7%	0	330	300	225	105	345	W1=Negative value W2=Negative value W3=Positive value			$V_{1N}=V_{3N}>V_{2N}$			$I_1=I_2=I_3$			P1	P0	P3	P2	3K 3L Forward	Forward	1K 1L Forward	Connection between P2 and P0 are reversed. And CT on side "1" and "3" are swapped. 
	Forward 86.6%				240	120	0																	
	100.00%				270	150	30	W1=0 W2=Negative value W3=0																
	Delayed 86.6%				300	180	60	W1=Positive value W2=Negative value W3=Negative value																
	Delayed 70.7%				315	195	75																	
43	Forward 70.7%	0	60	30	165	45	285	W_1=Negative value W_2=Positive value W_3=Negative value			$V_{1N}=V_{2N}>V_{3N}$			$I_1=I_2=I_3$			P1	P2	P0	P3	3K 3L Forward	Forward	1K 1L Forward	Connection between P3 and P0 are reversed. And CT on side "1" and "3" are swapped. 
	Forward 86.6%				180	60	300	W_1=Negative value W_2=Positive value W_3=0																
	100.00%				210	90	330	W1=Negative value W2=Positive value W3=Positive value																
	Delayed 86.6%				240	120	0																	
	Delayed 70.7%				255	135	15																	

Warranty

Before using the product, please confirm the following product warranty details.
If you have any questions or if there is a problem, contact our sales representative near you. (See back cover).

■ Gratis warranty period and Gratis warranty extent

During the gratis warranty period, if the product has a failure or defect (hereinafter collectively referred to as "failure") that is the responsibility of our company, we will replace the product free of charge through the store where you purchased it or our service company.
However, if on-site repairs are required in Japan or overseas, the actual expenses required for dispatching engineers will be charged.

【Gratis warranty period】
The gratis warranty period for the product shall be 12 months from the date of purchase or delivery to the location designated by the customer.
However, we will limit the gratis warranty period to 18 months from the date of manufacture, with a maximum distribution period of 6 months after shipment of our products. In addition, the gratis warranty period for repaired products shall not exceed the gratis warranty period before repair.

【Gratis warranty extent】
(1) In principle, the customer is requested to perform the primary failure diagnosis.
However, at the customer's request, the Company or the Company's service network can perform this work for a fee. In this case, if the cause of the failure is our company, the repair will be free of charge.
(2) This is limited to cases where the usage conditions, usage method, usage environment, etc., are in a normal state in accordance with the conditions and precautions described in the instruction manual, the caution label on the product itself, etc.
(3) Even within the gratis warranty period, repairs will be charged in the following cases.
①Failure caused by inappropriate storage or handling, carelessness, or negligence by the customer, or failure caused by the customer's hardware, selection, or other design details.
②Failure caused by the customer modifying the product without our consent.
③Failure that could have been avoided if the customer's device had been provided with a safety device based on legal regulations or a function, structure, etc. that should be provided according to the conventional wisdom of the industry, when our products are incorporated into your equipment and used.
④Failure that could have been prevented if the maintenance described in the instruction manual, etc., had been performed.
⑤Failure due to external factors such as fire, abnormal voltage, etc. and natural disasters such as earthquakes, lightning, wind and flood damage.
⑥Failure due to reasons unforeseeable by the level of science and technology at the time of shipment from our company.
⑦Any other failure that is beyond our responsibility or that the customer acknowledges is beyond our responsibility.

Note that the warranty here means the warranty for each delivered item, and we do not offer any free warranty for damages caused by failure of the delivered product.

■ Exclusion of warranty liability for opportunity loss, secondary loss, etc.

Regardless of whether it is within or outside the gratis warranty period, we will not be responsible for the following.
(1) Failure caused by reasons not attributable to the company.
(2) Opportunity loss and loss of profits due to failure of our products.
(3) Damages, secondary damages, compensation for accidents, and damages to products other than our products caused by special circumstances, whether or not we have foreseen them.
(4) Compensation for secondary costs such as replacement work by the customer, on-site work accompanying replacement, readjustment of on-site machinery and equipment, start-up test run, and other work.

■ Product application

(1) For use of products described in this manual, they shall be used for a purpose which shall not lead to a material accident even when a failure or malfunction of the products occurs, and a backup or fail-safe function shall be implemented systematically at external of the device in the event of a failure or malfunction.
(2) The products listed in this catalog are designed and manufactured as general-purpose products for general industrial use. Therefore, use for special applications such as the following devices and systems is exempt from application.
①Applications that have a large impact on the public, such as nuclear power plants of electric power companies and other power plants.
②Applications that require our company to build a special quality assurance system, such as railway companies and government offices.
③Aerospace, medical, railroad, combustion/fuel systems, passenger vehicles, manned transport equipment, recreational equipment, safety equipment, servers and air conditioning equipment for cooling servers, etc., applications that are expected to have a large impact on life, human body and property.

In the unlikely event that the product is used, we will not be held responsible for the quality, performance, or safety (including, but not limited to, default liability, defect liability, quality assurance liability, tort liability, and product liability) of the product described in this catalog.
However, the product may be used for such purposes if the customer acknowledges that it should be used for limited purpose only, a backed up or fail-safe function by equipment and agrees not to require special quality. Please contact our sales office for details.

■ Others

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Although every effort has been made to keep the contents of this manual up to date with software and hardware revisions, but in some cases synchronization may be unavoidable.

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Energy Measuring Unit

Please refer to our website for service network.
Our website address: https://www.mitsubishielectric.com/fa/

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