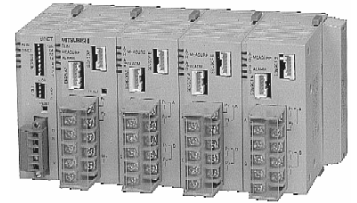


## Energy Measuring Unit (EcoMonitorPro)

MODEL EMU2-RD3-F, EMU2-RD5-F, EMU2-RD7-F (Non communication)  
 EMU2-RD3-C, EMU2-RD5-C, EMU2-RD7-C (CC-Link communication)  
 EMU2-RD2-F-4W, EMU2-RD4-F-4W (None communication; exclusive 3 phase 4 wire)  
 EMU2-RD2-C-4W, EMU2-RD4-C-4W (CC-Link communication; exclusive 3 phase 4 wire)



## Instruction manual: Detailed edition

### 1. Introduction





Thank you for purchasing Mitsubishi energy measuring unit (EcoMonitorPro).

This unit is designed to measure various parameters of electricity flowing on a power line through the current sensor.

This manual explains the procedures for installing and using the unit. Read carefully the manual, and use the unit correctly. Before installing the unit, read "Safety Precautions" to handle it correctly.

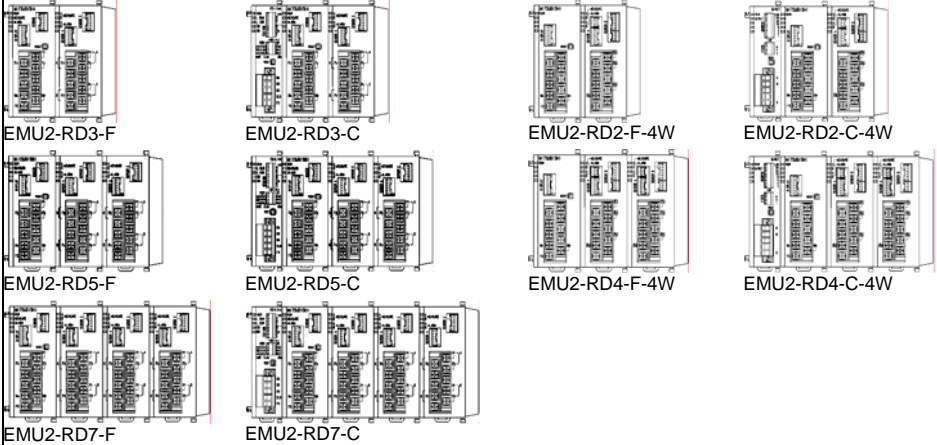



#### ■ Notation in manual

This manual uses the following signs.

Sign	Meaning
 Danger	Improper handling in disregard of the instructions can result in death or serious injury.
 Caution	Improper handling in disregard of the instructions can result in personal injury or property damage.
 Supplement	Instructions to prevent trouble of the unit and to correctly operate the unit
	Page of related information

#### ■ Confirmation of contents of package

Each unit comes with the following accessories. Check for missing ones. The accessories vary depending on the model.

Item	Quantity	Figure
Main Body	1	
Instruction manual Detailed edition (CD)	1	
Instruction manual Simple edition	1	
Connector for CC-Link communication <small>Note1</small>	1	

Note 1: Connector for CC-Link communication is bundled in only EMU2-RD\*-C or EMU2-RD\*-C-4W.

**This product should not be used for the purpose of trading or certification of electric energy.  
 For trading and certification of electric energy, use a watt-hour meter (qualified).**

### 2. Features

- This unit is designed to measure various parameters of electricity flowing on a power line through the dedicated current sensor.
- The single unit is capable of measuring the parameters on several transformer systems (differing in voltage and number of phases and wires).
- The unit can be applied to various primary voltage values and primary current values in combination with a potential transformer or a current transformer.
- It can transmit measuring data to a data collecting sequencer through CC-Link communication.

### 3.

## Safety Precautions

### 3.1 Working environment and working conditions

Do not use the unit in any of the following places. Doing so may cause malfunction or reduction in service life.

- Place where the ambient temperature exceeds the working temperature range (–5°C to 55°C)
- Place where the humidity exceeds the humidity range (30% to 80%RH) or condensation occurs
- Place with much dust, corrosive gas, salt or oily smoke
- Place where the unit may be exposed to rain or drops of water
- Place where metallic particles or inductive substances are dispersed
- Place where the daily mean temperature exceeds 35°C
- Place with much vibration or impact
- Place exposed to direct sunlight
- Place with strong electromagnetic field or much foreign noise

### 3.2 Preparation before using

- Ensure that the working environment and working conditions in the installation location conform to the specifications.
- It is necessary to set the CC-Link station number and transmission rate of this unit prior to use. Set the phase and wire system, primary voltage and primary current.

For setting, it is necessary to use the optional display unit (EMU2-D65) or logging display unit (EMU2-D65-M). Order one of these units when purchasing the measuring unit.

### 3.3 Installation and connection

Before installing and connecting the unit, read the instruction manual without fail. For safety, the unit shall be installed and connected by experts in electrical work.



## Caution

#### <Cautions for work>

- Perform wiring work in a dead state. Do not wire the unit in a live state. Doing so can cause electric shock, ground fault, unit failure and fire.
- When threading and wiring, take utmost care that cuttings and wire pieces do not enter the unit.
- Connect the wires carefully checking the wiring diagram. Improper wiring can cause unit failure, fire and electric shock.
- To prevent entry of noise, do not lay the transmission signal line and input/output signal line close to any power line or high-voltage line, and or do not bind these lines.
- Keep the dust sheets applied on the unit while wiring work. After the completion of wiring work, remove the sheets.
- When opening and closing the terminal cover, take care not to apply undue force to the cover.

#### <Connection of terminal block>

- Use electric wire of an appropriate size (1.25 mm<sup>2</sup>). Use of wire of an improper size can cause fire due to heat generation.
- Use crimp-type terminals appropriate to the electric wire size (bare round terminals for M3.5 having an outer diameter of 7.2 mm or less). Use of improper terminals can cause unit malfunction, failure, burnout or fire due to wire breaking and contact failure.
- Tighten the screws to the specified torque (0.49 to 0.78 N·m). Excessive tightening can damage the terminals and screws.
- After tightening, be sure to check that all screws have been tightened. Failure to tighten any screw can cause unit malfunction, fire or electric shock.

#### <Connection with current sensor>

- Use this product in combination with the dedicated current sensor.

● **EMU-CT50, EMU-CT100, EMU-CT250, EMU-CT400 and EMU-CT600 are designed for low-voltage circuits (maximum voltage of 460 V). These models are not applicable to high-voltage circuits. When using EMU2-CT5 (-4W), pass the secondary side (5A) of the current transformer through the sensor. The sensor can be connected directly to circuits of up to 200 V (maximum voltage of 260 V). Connecting it to a high-voltage circuit by mistake may cause burnout of the unit or fire, resulting in a hazardous situation.**

- The current sensor has polarity (directionality). When installing it, check the polarity.
- When the unit is used for a single-phase 3-wire circuit or a 3-phase 3-wire circuit, two current sensors are necessary.
- One dedicated current sensor cable can connect two current sensors.
- Connect the unit and current sensor(s) with the dedicated cable.

#### <Wiring of CC-Link communication line and input signal line>

- When the transmission signal line and input signal line are laid in parallel with a power line or a high-voltage line, keep the distance shown in the right table between them.

Condition	Distance
Low-voltage power line less than 600 V	30 cm or more
Other high-voltage power line	60 cm or more

- Use the specified cable for CC-Link connection. Dedicated CC-Link cable and dedicated CC-Link high-performance cable cannot be used simultaneously. If the cables are used simultaneously, correct data transmission cannot be assured.
- The terminal resistance shows different resistance value depending on the type of the dedicated cable.
- Connect the shielded wire of CC-Link connection cable to “SLD,” and ground “FG” according to Class D grounding (Class 3 grounding). “SLD” and “FG” are connected in the unit.
- The CC-Link transmission line is a small signal circuit. Lay the line at a distance of 10 cm or more from any heavy current circuit. If the line is laid in parallel with such a circuit over a long distance, lay the line 30 cm or more away from the circuit. When using, ground the FG terminal.

#### <Connection of FG terminal>

- For practical use, ground the FG terminal.
- Do not connect the FG terminal when performing insulation resistance test or withstand voltage test.
- A high-voltage protective element is fitted between MA and FG and between MB and FG. If high voltage is applied for withstand voltage test, the protective elements function to short-circuit MA and FG, and MB and FG.

### 3.4 Instructions for use

- **This product should not be used for the purpose of trading or certification of electric energy regulated by Measurement Law.**
- This unit has a built-in clock. Set the clock (current date and time) prior to use. The accuracy of the clock is about 1 minute per month. Adjust the time as necessary.
- Before operating the unit, carefully check that there are no bare electric wires in a live state around the unit. If bare wires are laid around the unit, immediately stop operating, and take proper measures, such as insulation and protection.
- When the clock or any other parameter is set or any setting is changed, the consistency with the currently retained data on time of occurrence of maximum and minimum values, values upon occurrence of alarms and time of occurrence of alarms may not be ensured. In this case, reset the maximum value, and clear the time of occurrence of maximum value in the past.
- If a power failure occurs during setting from the display unit or the transmission line to the main body, values cannot be set correctly. Re-set the values after power is restored.

#### Caution

- Do not disassemble or modify this product. Doing so can cause failure, electric shock or fire.
- Use the unit within the rated range stated herein. Using the unit out of the rated range may cause not only malfunction or unit failure, but also ignition or burnout.
- A protective circuit against opening of the secondary terminal is incorporated on the secondary side of Models EMU2-CT5 (-4W), EMU-CT50, EMU-CT100 and EMU-CT250. Opening the terminal during wiring work causes no problems. However, for safety, do not continuously apply current with the terminal in the open state.
- The current sensors EMU-CT400 and EMU-CT600 dedicated for this unit and the general split-type potential current transformer CW-5SL have similar shapes. But they have quite different characteristics. Connect an appropriate dedicated current sensor. If CW-5SL is connected directly to this unit, unit failure, burnout or fire may occur.

### 3.5 Instructions for maintenance

- Wipe dirt on the surface with soft dry cloth. Avoid keeping a wipe in contact with the surface or wiping with benzene or thinner.
- Check the unit for the following points to ensure correct operation of the unit for a long time. Particularly, Items ① to ③ shall be checked in daily inspection.
  - ① Check the product for damage.
  - ② Check for abnormal indication of LED lamps.
  - ③ Check for abnormal noise, odor and heat generation.
  - ④ Check for loose fittings and loose wires on the terminal block.  
(Perform the check stated in ④ in the power-off state. Failure to do so can cause electric shock, unit failure or fire.)

### 3.6 Instructions for storage

- When storing the unit, turn off power, disconnect cables and wires, and put them in vinyl bags or the like.
- When storing the unit for a long time, avoid keeping it in a place as shown below. Doing so may result in failure or decrease in service life.
  - Place where the ambient temperature is out of the range from  $-10^{\circ}\text{C}$  to  $60^{\circ}\text{C}$
  - Place where the humidity exceeds the humidity range (30% to 80%RH) or condensation occurs
  - Place with much dust, corrosive gas, salt or oily smoke
  - Place where the unit is exposed directly to rain, water droplets or sunlight
  - Place where the daily mean temperature exceeds  $35^{\circ}\text{C}$
  - Place with much vibration or impact
  - Place where metallic particles or inductive substances are dispersed

### 3.7 Instructions for disposal

Dispose of this product appropriately in accordance with national or community rule.

### 3.8 Packaging materials and instruction manual

To reduce the effects on the environment, corrugated boards are used for packaging materials, and the instruction manual is printed on recycled paper.

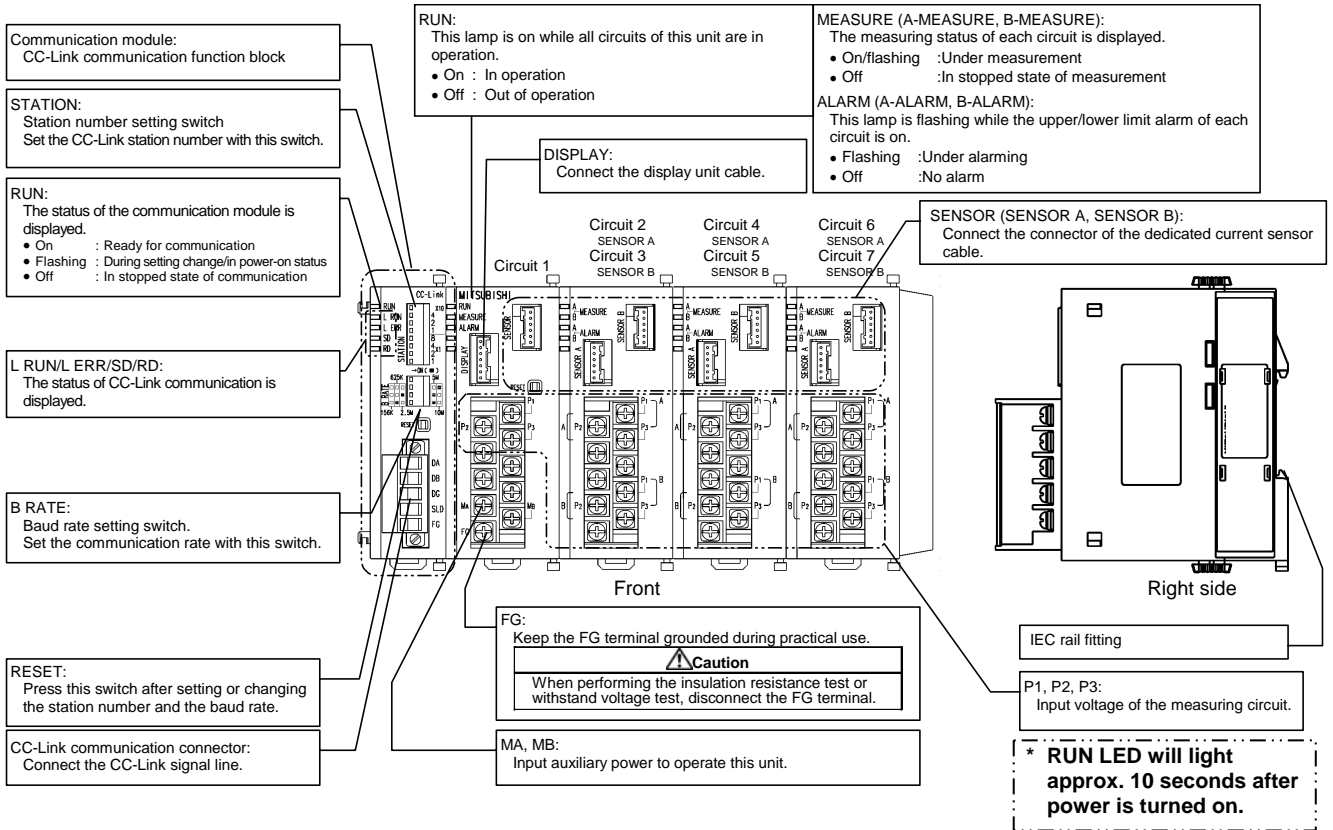
## 4. Attention

- This document and this unit are delivered after strict quality control and product inspection. If the unit or instruction manual has any defect caused by inadequacy of manufacture, we will replace it with a new one. Contact the store where you bought the unit. However, failure or damage caused by act of God or incorrect usage is not included in the warranty.
- Understand that we are not liable for any trouble on the system caused by the customer or any third party, legal problem, failure caused by improper use or during use of the unit and damage caused by other nonconformance.
- The product is warranted without charge for less than one year after the day of your purchase or the delivery to the designated place or within 18 month after the day of shipment from our plant (reckoned from the date of manufacture), whichever comes first.
- The term of free warranty will not be renewed for the repaired product.
- It is prohibited to reprint or copy part or all of this document in any form without our permission.
- We are endeavoring to update this document to follow revisions to the software and hardware, but we cannot do so under unavoidable circumstances.

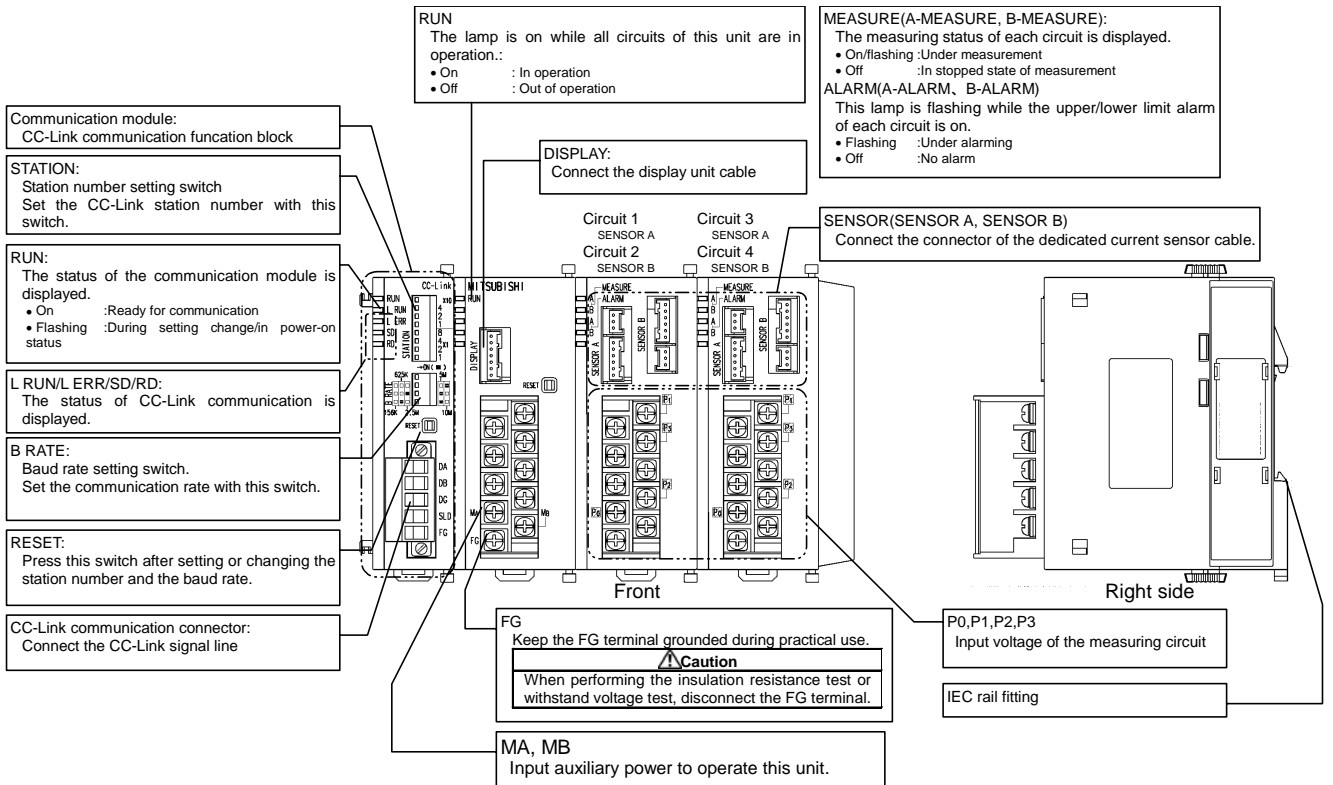
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## 6. Part Names and Functions

Example: Model EMU2-RD7-C



Example: Model EMU2-RD4-C-4W

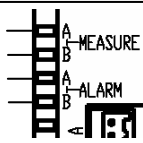


## ✓ Supplementation

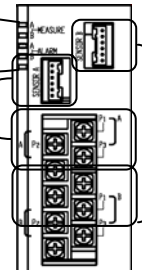
- To each of the modules for the second and following circuits, the voltage lines and sensor cables of two measuring circuits can be connected. Connect the voltage lines and sensor cables as shown right.

Connection of the circuits 2 and 3 is shown as an example. Connect the voltage line and sensor cable of each circuit to P1/P2/P3 for A and SENSOR A or P1/P2/P3 for B and SENSOR B.

Display of measuring status of circuit 2  
 Display of measuring status of circuit 3  
 Display of Alarm status of circuit 2  
 Display of Alarm status of circuit 3



Voltage and current input for circuit 2



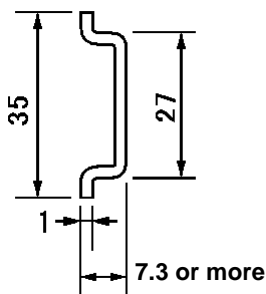
Voltage and current input for circuit 3

## 7. Installation

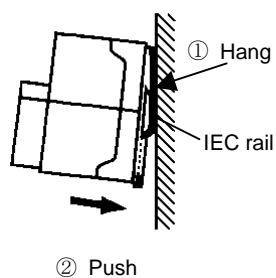
### ⚠ Caution

· For safety, the unit shall be installed and connected by experts in electrical work.

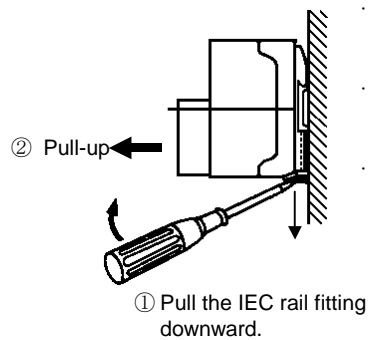
#### ● Applicable IEC rail (35 mm)



#### ● Installation



#### ● Removal



- Fit the IEC rail with M4 or M5 screws at distances of 25 to 100 mm.
- When connecting some rails, secure both ends with slide preventive fittings.
- When installing the unit after once it was removed from the IEC rail, install it while pushing the IEC rail fitting upward.

## 8. Wiring Procedures

- Connect all cables. When wiring, check the phase and wire system of the circuit to be connected, and see the relevant wiring diagram. When connecting a potential transformer or a current transformer, see the transformer instruction manual.
- If the current sensor is installed in a strong magnetic field near a transformer or a large current cable bus bar, the measurements may be affected. Install the sensor as far as possible from such a device.

### 8.1 Connection of voltage lines, sensor cables and sensors

Below given is an example of connection for measurement of some transformer systems (differing in voltage and number of phases and wires) by one unit (example of connection of EMU2-RD7-C).

Circuit 1: 3-phase 3-wire system, primary voltage 690 V, primary current 800 A (A 690 V/110 V potential transformer is separately necessary.)

Circuit 2: 3-phase 3-wire system, primary voltage 440 V, primary current 250 A (A 440 V/110 V potential transformer is separately necessary.)

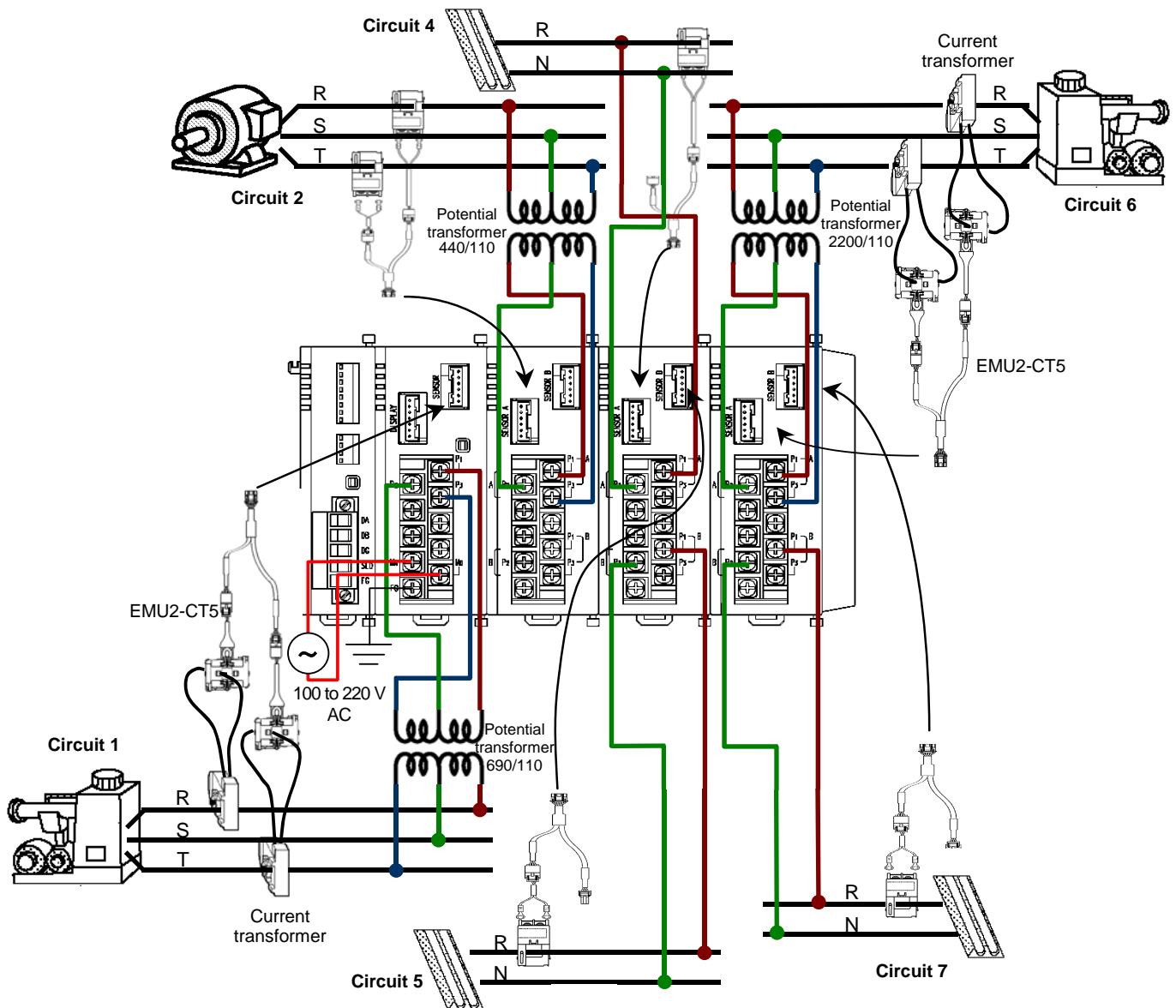
Circuit 3: Not used

Circuit 4: Single-phase 2-wire system, primary voltage 110 V, primary current 50 A

Circuit 5: Single-phase 3-wire system, primary voltage 110 V, primary current 100 A

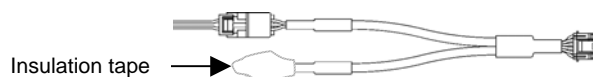
Circuit 6: 3-phase 3-wire system, primary voltage 2200 V, primary current 400 A (A 2200 V/110 V potential transformer is separately necessary.)

Circuit 7: Single-phase 2-wire system, primary voltage 110 V, primary current 50 A



### ✓ Supplementation

- When the unit is used for a single-phase 2-wire circuit, the side 3 of the current sensor cable is not used. Disconnect the side 3 of the cable from the connector, and protect the terminal with insulating tape as shown below.



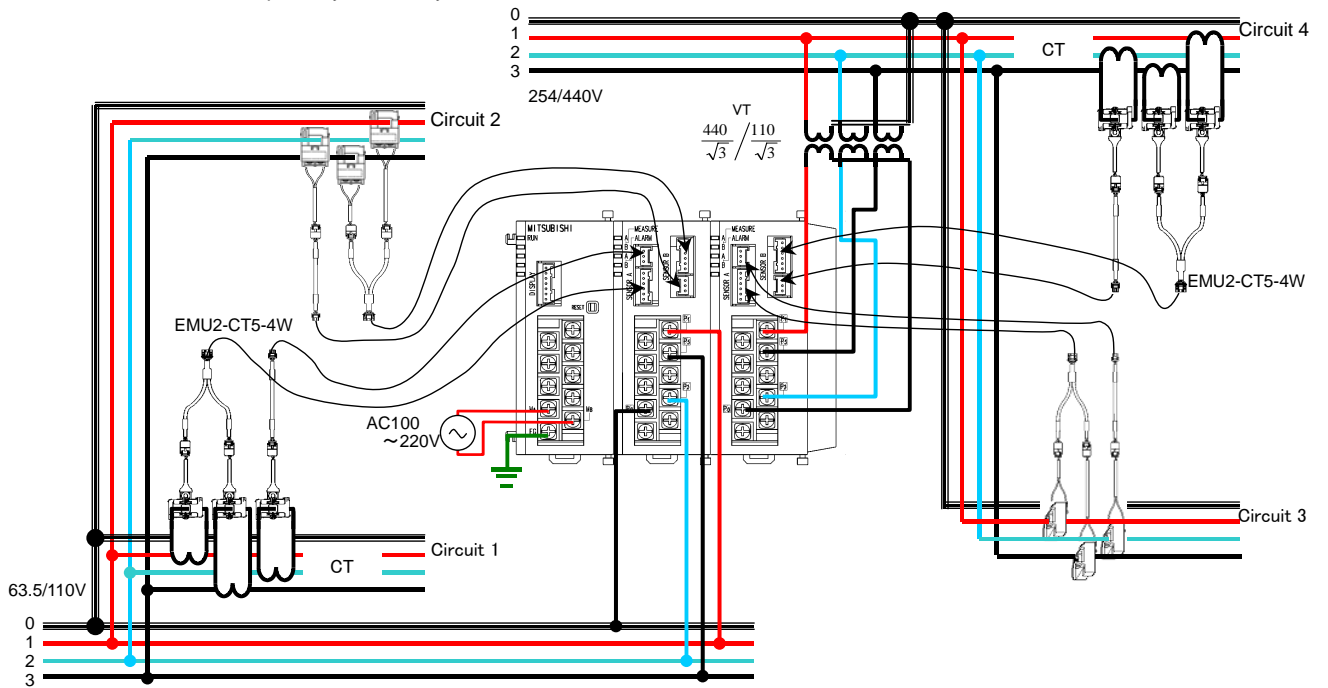
Below given is an example of connection for measurement of 2 transformer systems (differing in voltage and number of phases and wires) by one unit (example of connection of EMU2-RD4-F-4W).

Circuit 1: primary voltage 63.5/110V, primary current 800A (EMU2-CT5-4W)-----800/5A current transformer is separately necessary.

Circuit 2: primary voltage 63.5/110V, primary current 250 A (EMU-CT250)

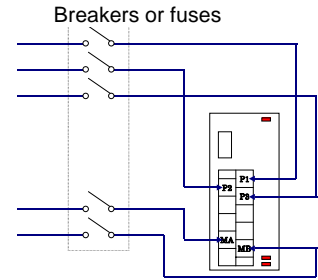
Circuit 3: primary voltage 254/440V, primary current 600 A (EMU-CT600)----- $\frac{440}{\sqrt{3}} / \frac{110}{\sqrt{3}} V$  potential transformer is separately necessary.

Circuit 4: primary voltage 254/440V, primary current 1000 A (EMU2-CT5-4W) ----- $\frac{440}{\sqrt{3}} / \frac{110}{\sqrt{3}} V$  potential transformer and 1000/5A current transformer are separately necessary.





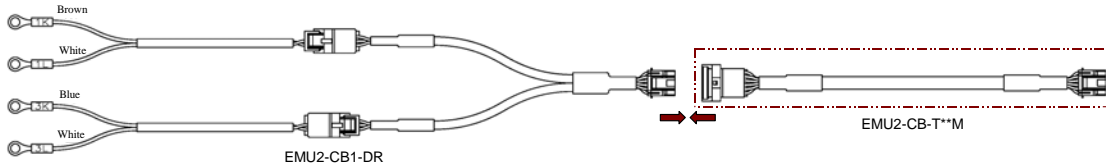
- When the unit is used for a circuit of 440 V or more, use a potential transformer without fail. Connect the secondary side of the potential transformer to the terminals P1 to P3.
- Pass the secondary side (5 A) of the current transformer through EMU2-CT5 (-4W).
- As the current transformer, a general current transformer for 5 A can be used.
- It is recommended to connect protective devices (breakers or fuses) to the auxiliary supply voltage input (terminals MA and MB) and the voltage input circuit (terminals P1, P2 and P3) for maintenance to change the wiring or replace a device.



## ■ Extension of current sensor cable

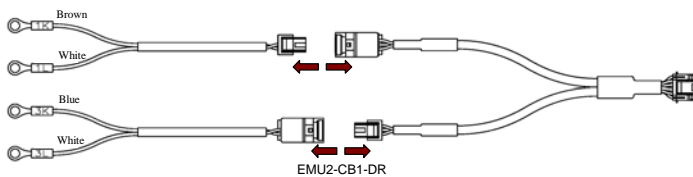
The current sensor cable EMU2-CB1-DR/EMU2-CT5 (-4W) can be extended in accordance with the following procedures.

- ◆ Extension with current sensor extension cable EMU2-CB-T\*\*M (standard type)



- ◆ Extension with current sensor extension cable EMU2-CB-T\*\*MS (separate type)

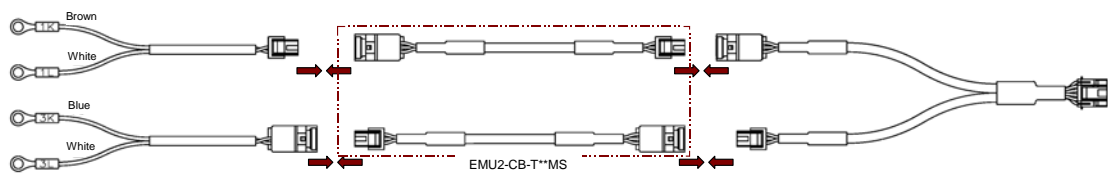
1) Disconnect the connectors.



### ✓ Supplementation

- For EMU2-CT50, EMU2-CT100, EMU2-CT250, EMU2-CT400 and EMU2-CT600, the cable length can be extended to up to 50 m (the total wiring length is up to 50.5 m).
- For EMU2-CT5 (-4W), the cable length can be extended to up to 10 m (the total wiring length is up to 10.5 m).
- Use EMU2-CB-T\*\*MS when the side 1 is installed at a distance from the side 3.

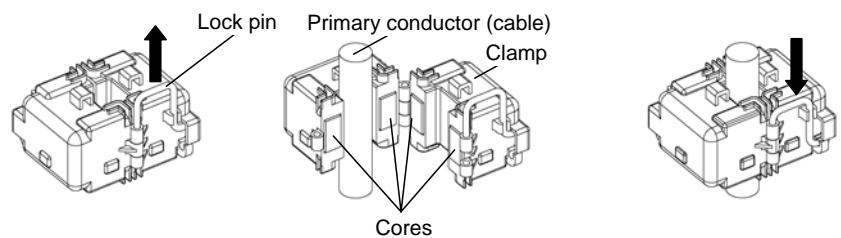
2) Connect the extension cables.



## ■ Fitting of EMU2-CT5 (-4W)

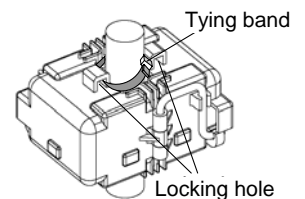
Fit the sensor to the cable of the circuit to be measured in accordance with the following procedures.

- 1) Slide the lock pin in the arrow direction.
- 2) Pass the electric wire into the clamp, and close the clamp.
- 3) Push the lock pin until it is locked while keeping the clamp with fingers in the fully closed state.



## ⚠ Caution

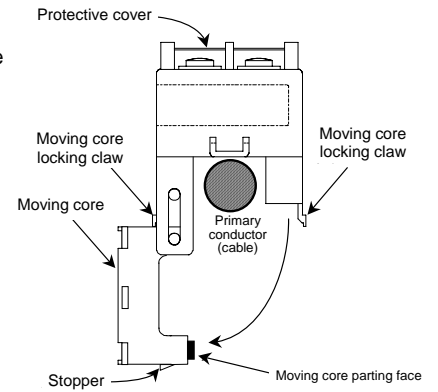
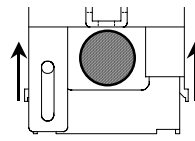
- The lock pin is a metallic part. Touching a live part may cause electric shock, unit failure or fire.
- The cores may be damaged by shock. The damaged cores affect directly the unit performance. Take care not to give shock to them.
- Even minute particles between core mating surfaces affect directly the performance (lower measurements may be obtained). Check the surfaces carefully.
- If undue force is applied to the open clamp, the clamp may be damaged. If the clamp is set in a wrong direction, normal measurement cannot be performed.
- To secure them through electric wire and the sensor, use tying bands 2.6 mm or less in width. To secure them, pass each tying band to one of the current sensor locking holes. Lightly tie the bands. Take care not to tighten the bands excessively. (The current sensor has four locking holes in all on both sides.)



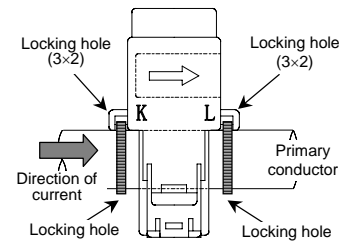
## ■ Fitting of EMU-CT50/CT100/CT250

Fit the sensor to the cable of the circuit to be measured.

- 1) Open the moving core as shown right.  
Slowly lift the moving core locking claws on both sides of the moving core to open and remove them from the stoppers. **Do not open the core forcibly. Doing so may break the claws.**
- 2) Insert the cable from beneath taking care not to bring the cable into contact with the core parting faces. 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 →.)
- 3) After checking that the core parting faces are free from dirt, close the moving core. Push up the moving core until the stoppers are securely locked. (When the moving core securing claws on both sides catch on the stoppers, you hear two clicks.)



- 4) Pass the tying bands into the current sensor locking holes to secure the sensor with the cable. Lightly tie the band. Take care not to tighten the bands excessively. (The current sensor has four locking holes in all on both sides.)
- 5) Cut off the residual parts of the tying bands with nippers appropriately.
- 6) Remove the protective cover of the secondary terminal lifting the center of the protective cover, and connect the specified sensor cable. **Check the terminal symbols shown on the secondary terminal surface, and take care not to connect the cable incorrectly.**



### ✓ Supplementation

- When opening the moving core of the split type current sensor, **do not open the moving core locking claws excessively.** Doing so may damage the moving core locking claws.
- The applicable electric wire size is shown below.

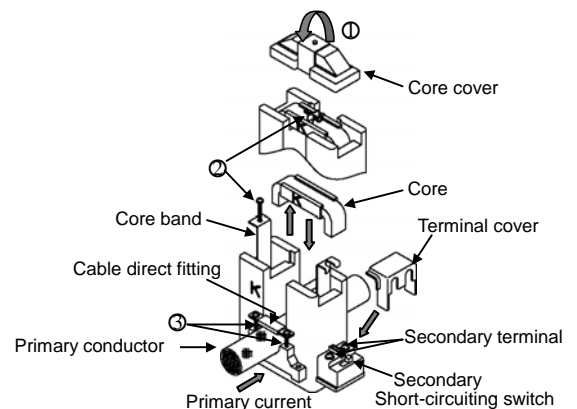
		EMU-CT50	EMU-CT100	EMU-CT250
Applicable wire size (reference)	IV wire	60 mm <sup>2</sup> or less	60 mm <sup>2</sup> or less	150 mm <sup>2</sup> or less
	CV wire	38 mm <sup>2</sup> or less	38 mm <sup>2</sup> or less	150 mm <sup>2</sup> or less

These applicable electric wire sizes have been determined based on the values shown on the catalogs of general vinyl-coated wires. The wire to be used may have a different sheath thickness. Check whether the wire to be used can be passed through the sensor referring to the drawing of external dimensions of the product.

## ■ Fitting of EMU-CT400/CT600

Fit the sensor to the cable of the circuit to be measured in accordance with the following procedures.

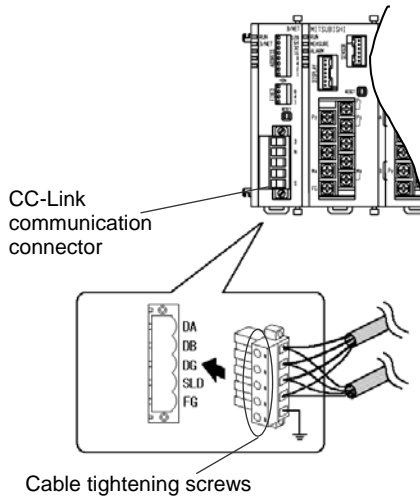
- 1) Remove the band ① in the arrow (upward) direction, and remove the core cover.
- 2) Remove the terminal cover, and set the secondary short-circuiting switch to "Short."
- 3) Loosen the screw ②, open the core band, and remove the core. Take care that dust does not adhere to the core.
- 4) Loosen the screws ③, and fit the main body onto the cable. Then, tighten the screws ③ to secure the cable using the cable direct fitting. Tighten the screws to such an extent that the direct fitting is not bent.
- 5) Set "K" on the removed core and "K" on the main body on the same side, return the core as it was, and tighten the core band with the screw ②.
- 6) Fit the core cover, and secure it with the band ①.
- 7) After connecting the secondary terminal and the multi-circuit power measuring unit, set the secondary short-circuiting switch to "Open," and fit the terminal cover.



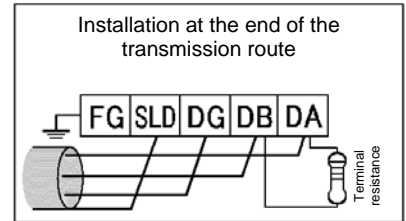
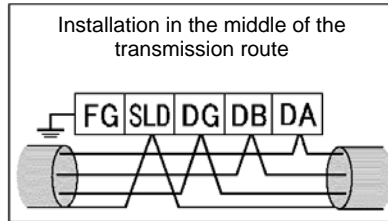
### ✓ Supplementation

- Before passing the cable, ensure that the current sensor is fitted in the correct direction. Current flows from K to L.  
K: Power supply side  
L: Load side

## 8.2 Connection of CC-Link communication line



- ① Draw out the CC-Link communication connector from the unit.
- ② Loosen the cable tightening screws on the CC-Link communication connector. Use a thin slotted screwdriver (blade edge thickness: 0.6 mm/overall length: 3.5 mm).
- ③ Insert the signal line according to the marking on the side of the CC-Link communication connector.
- ④ Secure the line with the tightening screws (recommended tightening torque: 0.5 to 0.6 N·m).



Wire type	In the case of connection of 1 wire	In the case of connection of 2 wires
Solid wire	0.2 mm <sup>2</sup> to 2.5 mm <sup>2</sup>	2 wires × 0.2 mm <sup>2</sup> to 1.0 mm <sup>2</sup>
Twisted wire	0.2 mm <sup>2</sup> to 2.5 mm <sup>2</sup>	2 wires × 0.2 mm <sup>2</sup> to 1.5 mm <sup>2</sup>
Twisted wire with bar terminal (without insulating sleeve)	0.25 mm <sup>2</sup> to 2.5 mm <sup>2</sup>	2 wires × 0.25 mm <sup>2</sup> to 1.0 mm <sup>2</sup>
Twisted wire with bar terminal (with insulating sleeve)	0.25 mm <sup>2</sup> to 2.5 mm <sup>2</sup>	-

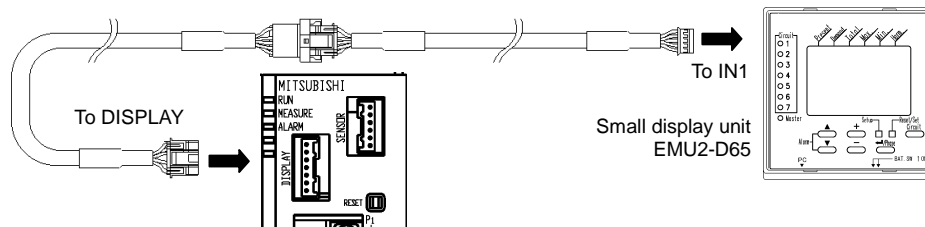
\*1: The length of the signal line coating to be removed is 7 mm.

\*2: Do not solder-plate the core wires.

### ✓ Supplementation

- Use the specified cable for CC-Link connection. The dedicated CC-Link cable and dedicated CC-Link high-performance cable must not be used simultaneously. If the cables are used simultaneously, correct data transmission cannot be assured. The terminal resistance shows different resistance value depending on the type of the dedicated cable.
- Connect the shielded wire of the CC-Link connection cable to "SLD," and ground "FG" according to Class D grounding (Class 3 grounding). "SLD" and "FG" are connected in the unit.
- The CC-Link transmission line is a small signal circuit. Lay the line at a distance of 10 cm or more from any heavy current circuit. If the line is laid in parallel with such a circuit over a long distance, lay the line 30 cm or more away from the circuit. When using, ground the FG terminal.
- As the CC-Link communication line, use a dedicated line, and ensure that the total wiring distance, station-to-station distance and terminal resistance are appropriate to B RATE. If a dedicated line is not used or any wiring requirement is not met, normal communication may not be made. (For the dedicated line and wiring requirements, see the instruction manual for CC-Link master unit.)
- It is necessary to fit the terminal resistance supplied with the CC-Link master unit to the units on both sides of the CC-Link communication line. When the measuring unit is connected at an end of the CC-Link transmission line, connect it between the terminals DA and DB.
- The terminal resistance varies depending on the type of the CC-Link cable to be used. See the manual for the terminal resistance supplied with the CC-Link master unit.

## 8.3 Connection of display unit (example of model EMU2-D65)



### ✓ Supplementation

- For the details, see the instruction manual for the display unit.

### 9.1 Setting of CC-Link station number and transmission rate

When connecting this unit to the CC-Link transmission line, set a unique station number (STATION) for the unit before applying power to the unit, and set the transmission rate (B RATE). A unit provided with the CC-Link communication function communicates mutually with another unit at the transmission rate that has been set by using the station number. Set the station number and communication rate without fail.

To set the station number, change the setting of the station number setting switch (● see page 5).

To set the transmission rate, change the setting of the B RATE setting switch (● see page 5).

#### 1 Set the station number (STATION).

- This unit is a remote device station that occupies one station.

The station number setting range is from 1 to 64.

- The station number is the sum of the values of the station number setting switch toggles that are set to ON.

- To turn on the station number setting switch toggles, use a thin screwdriver or bar.

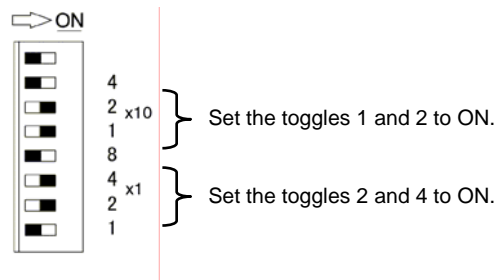
- When setting the station number of this unit to 36, set the switch as shown below.

· Turn on the switch toggles 1 and 2 on the ×10 side of the station number setting switch and the switch toggles 2 and 4 on the ×1 side (The arrow => indicates the ON position.)

×10 (tens place) = (1+2) × 10 = 30

×1 (unit's place) = (2+4) × 1 = 6

→ 30 + 6 = 36 ... Station No. 36



#### 2 Set the transmission rate (B RATE).

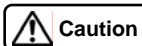
- To set the B RATE setting switch, use a thin slotted screwdriver.
- The relationship between the transmission rate and the setting switch is shown below.

Transmission rate	156k	625k	2.5M	5M	10M
Setting	<input checked="" type="checkbox"/> <input type="checkbox"/>	<input checked="" type="checkbox"/> <input type="checkbox"/>	<input checked="" type="checkbox"/> <input type="checkbox"/>	<input checked="" type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input checked="" type="checkbox"/>
	<input type="checkbox"/> <input checked="" type="checkbox"/>	<input type="checkbox"/> <input checked="" type="checkbox"/>	<input type="checkbox"/> <input checked="" type="checkbox"/>	<input type="checkbox"/> <input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> <input type="checkbox"/>
	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>	<input checked="" type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input checked="" type="checkbox"/>	<input type="checkbox"/> <input checked="" type="checkbox"/>

\* If the switch is set to a state not shown above, an error occurs.

#### 3 If the station number and/or the transmission rate are/is set or changed after power is applied to the unit, press the reset switch.

- If the reset switch is not pressed, the setting(s) will be made ineffective.
- It takes some seconds until the settings are reset. Keep pressing the reset switch, and release the switch after ensuring that RUN LED is turned off.



**Caution**

- Do not use a mechanical pencil to change the setting of the station number switch or the transmission rate switch. Broken leads and lead powders may be scattered on the internal circuit, thereby causing malfunction or failure.
- The station-to-station cable length and the maximum total cable extension distance vary depending on the transmission rate.

- Take care that a station number is not duplicated in a transmission route. If a number is duplicated, an error occurs.
- The number of units that meets the following conditions 1 and 2 can be connected on CC-Link. When only energy measuring units are connected, up to 42 units can be connected.

Condition 1:  $\{(1 \times a) + (2 \times b) + (3 \times c) + (4 \times d)\} \leq 64$

a: Number of units occupying one station

b: Number of units occupying two stations

c: Number of units occupying three stations

d: Number of units occupying four stations

Condition 2:  $\{(16 \times A) + (54 \times B) + (88 \times C)\} \leq 2304$

A: Number of remote I/O station, B: Number of remote device stations, C: Number of local stations

## 9.2 Setting of ratings

For setting, it is necessary to use the optional small display unit (EMU2-D65) or logging display unit (EMU2-D65-M). Order one of these units when purchasing this unit.

In case of EMU2-RD3-F/C, EMU2-RD5-F/C, EMU2-RD7-F/C

### ■ Phase and wiring [Default: 3-phase 3-wire]

One of the following systems can be set for each circuit.  
Single-phase 2-wire, single-phase 3-wire and 3-phase 3-wire

### ■ Primary voltage [Default: 220 V]

The primary voltage values applicable to each unit type are shown below. The primary voltage can be selected from the following values for each circuit.

Settings
110 V, 220 V, 440 V, 690 V, 1100 V, 2200 V, 3300 V, 6600 V, 11000 V, 13200 V, 13800 V 15000 V, 16500 V, 22000 V, 24000 V, 33000 V, 66000 V, 77000 V, 110000 V

### ✓ Supplementation

- On a single-phase 3-wire circuit, use the unit at the primary voltage setting of 110 V.
- The unit can be connected directly to a 110 V or 220 V circuit. To connect it to a circuit of 440 V or more, a potential transformer must be connected externally.

### ■ Sensor type and primary current [Default: Direct sensor/100 A]

The primary current must be set according to the sensor type as shown below. One of the following settings can be selected for each circuit.

Sensor type		Primary current setting
Direct sensor	EMU-CT50	50A
	EMU-CT100	100A
	EMU-CT250	250A
	EMU-CT400	400A
	EMU-CT600	600A
5A sensor	EMU2-CT5	5A, 6A, 7.5A, 8A, 10A, 12A, 15A, 20A, 25A, 30A, 40A, 50A, 60A, 75A, 80A, 100A, 120A, 150A, 200A, 250A, 300A, 400A, 500A, 600A, 750A, 800A, 1000A, 1200A, 1500A, 1600A, 2000A, 2500A, 3000A, 4000A, 5000A, 6000A, 7500A, 8000A, 10000A, 12000A, 20000A, 25000A, 30000A

### Caution

**EMU-CT50, EMU-CT100, EMU-CT250, EMU-CT400 and EMU-CT600 are designed for low-voltage circuits (maximum voltage of 460 V). These models are not applicable to high-voltage circuits. When using EMU2-CT5, pass the secondary side (5A) of the current transformer through the sensor. The model can be connected directly to circuits of up to 200 V (maximum voltage of 260 V). Connecting it to a high-voltage circuit by mistake may cause burnout of the unit or a fire, resulting in a hazardous situation.**

### ✓ Supplementation

- When EMU2-CT5 is used, set the ratings of the primary CT.
- Ensure that the product of primary voltage setting and primary current setting does not exceed 88665 kW (the setting range is limited by the full-load power). For example, if the primary current is set to 30000 A when the primary voltage setting is 110000 V, the primary voltage setting is automatically initialized to 220 V. If the primary voltage is set to 110000 V when the primary current setting is 30000 A, the primary current setting is automatically initialized to 100 A.

### ■ Demand time limit [Default: 2 min]

The current demand time limit and the power demand time limit can be set separately. One of the following settings of each item can be selected for each circuit.

Item	Settings
Current demand time limit	0, 10 sec, 20 sec, 30 sec, 40 sec, 50 sec, 1 to 15 min (in 1-min steps), 20 min, 25 min and 30 min
Power demand time limit	0, 10 sec, 20 sec, 30 sec, 40 sec, 50 sec, 1 to 15 min (in 1-min steps), 20 min, 25 min and 30 min

■ **Upper and lower limit settings [Defaults: Upper limit setting = Max. setting Lower limit setting = Min. setting]**

The upper and lower limits can be set for each circuit as shown below. The upper and lower limits can be set only on the display unit. They cannot be set by CC-Link communication.

◆ **Current demand upper/lower limit settings**

Rated primary current setting	Min. upper/lower limit setting	Setting step	Max. upper/lower limit setting
5A to 30A	0.00A	0.01A	Rated primary current setting
40A to 300A	0.0A	0.1A	
400A to 3000A	0A	1A	
4000A to 30000A	0A	10A	

◆ **Voltage upper/lower limit setting**

Rated primary voltage setting	Min. upper/lower limit setting	Setting step	Max. upper/lower limit setting
110 V to 220 V	0.0 V	0.1 V	Rated primary voltage setting × (15/11)
440 V to 2200 V	0 V	1 V	
3300 V to 110000 V	0 V	10 V	

◆ **Power demand upper/lower limit setting**

Full-load power (kW)	Min. upper/lower limit setting	Setting step	Max. upper/lower limit setting
Less than 12	0.000 kW	0.001 kW	Full-load power
12 to less than 120	0.00 kW	0.01 kW	
120 to less than 1200	0.0 kW	0.1 kW	
1200 to less than 12000	0 kW	1 kW	
12000 to less than 120000	0 kW	10 kW	
120000 or over	0 kW	100 kW	

◆ **Power factor upper/lower limit setting**

Min. upper/lower limit setting	Setting step	Max. upper/lower limit setting
LEAD 0.50	0.05	LAG 0.50

◆ **Alarm delay time [Default: 10 sec]**

The setting is applied to all upper/lower limit alarms.

Setting value
0, 5 sec, 10 sec, 20 sec, 30 sec, 40 sec, 50 sec, 1 to 5 min (in 1-min steps)

■ **Phase and wire system**

Fixed 3-phase 4-wire

■ **Primary voltage [Default: 220/380 V]**

The primary voltage can be selected from the following values for every 2 circuits. (Primary voltage is common for circuit1 and circuit2, or circuit3 and circuit4)

Settings
63.5/110V, 110/190V, 120/208V, 220/380V, 240/415V, 254/440V


✓ **Supplementation**

- The unit can be connected directly to a 110 V or 220 V circuit. To connect it to a circuit of 440 V or more, a potential transformer must be connected externally.

■ **Sensor type and primary current [Default: Direct sensor/100 A]**

The primary current must be set according to the sensor type as shown below. One of the following settings can be selected for each circuit.

Sensor type		Primary current setting
Direct sensor	EMU-CT50	50A
	EMU-CT100	100A
	EMU-CT250	250A
	EMU-CT400	400A
	EMU-CT600	600A
5A sensor	EMU2-CT5 -4W	5A, 6A, 7.5A, 8A, 10A, 12A, 15A, 20A, 25A, 30A, 40A, 50A, 60A, 75A, 80A, 100A, 120A, 150A, 200A, 250A, 300A, 400A, 500A, 600A, 750A, 800A, 1000A, 1200A, 1500A, 1600A, 2000A, 2500A, 3000A, 4000A, 5000A, 6000A, 7500A, 8000A, 10000A, 12000A, 20000A, 25000A, 30000A

 **Caution**

EMU-CT50, EMU-CT100, EMU-CT250, EMU-CT400 and EMU-CT600 are designed for low-voltage circuits (maximum voltage of 460 V). These models are not applicable to high-voltage circuits. When using EMU2-CT5-4W, pass the secondary side (5A) of the current transformer through the sensor. The model can be connected directly to circuits of up to 200 V (maximum voltage of 260 V). Connecting it to a high-voltage circuit by mistake may cause burnout of the unit or a fire, resulting in a hazardous situation.

✓ **Supplementation**

- When EMU2-CT5 -4W is used, set the ratings of the primary CT.

■ **Demand time limit [Default: 2 min]**

The current demand time limit and the power demand time limit can be set separately. One of the following settings of each item can be selected for each circuit.

Item	Settings
Current demand time limit	0, 10 sec, 20 sec, 30 sec, 40 sec, 50 sec, 1 to 15 min (in 1-min steps), 20 min, 25 min and 30 min
Power demand time limit	0, 10 sec, 20 sec, 30 sec, 40 sec, 50 sec, 1 to 15 min (in 1-min steps), 20 min, 25 min and 30 min

■ **Upper and lower limit settings [Defaults: Upper limit setting = Max. setting Lower limit setting = Min. setting]**

The upper and lower limits can be set for each circuit as shown below. The upper and lower limits can be set only on the display unit. They cannot be set by CC-Link communication.

◆ **Current demand upper/lower limit settings**

Rated primary current setting	Min. upper/lower limit setting	Setting step	Max. upper/lower limit setting
5A to 30A	0.00A	0.01A	Rated primary current setting
40A to 300A	0.0A	0.1A	
400A to 3000A	0A	1A	
4000A to 30000A	0A	10A	

◆ **Voltage upper/lower limit setting**

Rated primary voltage setting	Min. upper/lower limit setting	Setting step	Max. upper/lower limit setting
63.5/110V to 240/415V	0.0 V	0.1 V	Rated primary voltage setting × (15/11)
254/440V	0 V	1 V	

✓ **Supplementation**

- Voltage upper/lower limit setting is common for circuit1 and circuit2, or circuit3 and circuit4.
- Voltage upper/lower limit monitors not "phase voltage" but "line voltage"

◆ Power demand upper/lower limit setting

Full-load power (kW)	Min. upper/lower limit setting	Setting step	Max. upper/lower limit setting
Less than 12	0.000 kW	0.001 kW	Full-load power
12 to less than 120	0.00 kW	0.01 kW	
120 to less than 1200	0.0 kW	0.1 kW	
1200 to less than 12000	0 kW	1 kW	
12000 to less than 120000	0 kW	10 kW	

◆ Power factor upper/lower limit setting

Min. upper/lower limit setting	Setting step	Max. upper/lower limit setting
LEAD 0.50	0.05	LAG 0.50

◆ Alarm delay time [Default: 10 sec]

The setting is applied to all upper/lower limit alarms.

Setting value
0, 5 sec, 10 sec, 20 sec, 30 sec, 40 sec, 50 sec, 1 to 5 min (in 1-min steps)

✓ **Supplementation**

- When any setting is changed, settings and measuring data are initialized according to the following table. Reset the relevant parameters.

Parameter to be initialized	Setting item	Phase and wire system	Sensor type	Primary voltage	Primary current	Demand time limit	Alarm setting					Clock
							Current	Voltage	Electric power	Power factor	Delay time	
Settings	Sensor input switching	Initialize										
	Primary voltage	Initialize			*1							
	Primary current	Initialize	Initialize	*1								
	Demand time limit											
	Current upper/lower limit setting	Initialize	Initialize		Initialize							
	Voltage upper/lower limit setting	Initialize		Initialize								
	Electric power upper/lower limit setting	Initialize	Initialize	Initialize	Initialize							
	Power factor upper/lower limit setting											
	Alarm delay time											
Measuring data	Current upper/lower limit alarm value and date and time of occurrence	Initialize	Initialize		Initialize		Initialize					
	Voltage upper/lower limit alarm value and date and time of occurrence	Initialize		Initialize				Initialize				
	Electric power upper/lower limit alarm value and date and time of occurrence	Initialize	Initialize	Initialize	Initialize				Initialize			
	Power factor upper/lower limit alarm value and date and time of occurrence	Initialize	Initialize	Initialize	Initialize					Initialize		
	Current Instantaneous/total	Initialize	Initialize		Initialize							
	Demand current Instantaneous/max./min.	Initialize	Initialize		Initialize	Initialized when setting for current is changed						
	Voltage Instantaneous/max./min./total	Initialize		Initialize								
	Electric power Instantaneous	Initialize	Initialize	Initialize	Initialize							
	Demand power Instantaneous/max./min.	Initialize	Initialize	Initialize	Initialize	Initialized when setting for electric power is changed						
	Power factor Instantaneous/max./min.	Initialize	Initialize	Initialize	Initialize							
	Reactive power	Initialize	Initialize	Initialize	Initialize							
	Frequency	Initialize										
	High-frequency current total effective value	Initialize	Initialize		Initialize							
	High-frequency voltage total effective value	Initialize		Initialize								
	High-frequency current total distortion factor	Initialize	Initialize		Initialize							
	High-frequency voltage total distortion factor	Initialize		Initialize								
	High-frequency current n-th effective value	Initialize	Initialize		Initialize							
	High-frequency voltage n-th effective value	Initialize		Initialize								
	High-frequency current n-th distortion factor	Initialize	Initialize		Initialize							
	High-frequency voltage n-th distortion factor	Initialize		Initialize								
Electric power												
Reactive power energy												

Note 1: The primary voltage and primary current must be set to ensure that the product of primary voltage setting and primary current setting does not exceed 88665 kW. For example, if the primary current is set to 30000 A when the primary voltage setting is 110000 V, the primary voltage setting is automatically initialized to 220 V. If the primary voltage is set to 110000 V when the primary current setting is 30000 A, the primary current setting is automatically initialized to 100 A.

Note 2: When the time is changed over a time limit (30 min), the parameter is initialized. It is not initialized when the change is made within one time limit.



## 10. Operations of Instrument

### 10.1 Measuring functions

The measuring parameters are shown in the following table.

Measuring item		Measuring parameters of each unit type	
		EMU2-RD3-F/C EMU2-RD5-F/C EMU2-RD7-F/C	EMU2-RD2-F/C-4W EMU2-RD4-F/C-4W
	Details		
Instantaneous current value	R	●	●
	S <sup>Note 1</sup>	●	●
	T <sup>Note 1</sup>	●	●
	N		●
	Total	●	●
Current demand * The moving average in the specified time limit is indicated.	R	●	●
	S <sup>Note 1</sup>	●	●
	T <sup>Note 1</sup>	●	●
	N		●
	Maximum	●	●
	Minimum	●	●
	Date and time of occurrence of max. and min.	●	●
Voltage	R-S	●	●
	S-T <sup>Note 1</sup>	●	●
	T-R <sup>Note 1</sup>	●	●
	R-N		●
	S-N		●
	T-N		●
	Total	●	●
	Maximum	●	●
	Minimum	●	●
	Date and time of occurrence of max. and min.	●	●
Current value of electric power		●	●
Power demand * The moving average in the specified time limit is indicated.	Current value	●	●
	Maximum	●	●
	Minimum	●	●
	Date and time of occurrence of max. and min.	●	●
Reactive power		●	●
Power factor	Current value	●	●
	Maximum	●	●
	Minimum	●	●
	Date and time of occurrence of max. and min.	●	●
Frequency		●	●
High-frequency current total effective value/distortion factor	R	●	●
	S		●
	T <sup>Note 1</sup>	●	●
High-frequency voltage total effective value/distortion factor	R-S	●	
	S-T <sup>Note 1</sup>	●	
	R-N, S-N, T-N		●
High-frequency current n-th effective value/content	R	●	●
	S		●
	T <sup>Note 1</sup>	●	●
High-frequency voltage n-th effective value/content	R-S	●	
	S-T <sup>Note 1</sup>	●	
	R-N, S-N, T-N		●
Electric power		●	●
Reactive power energy		●	●

Note 1: When the phase and wire system is set to single-phase 2-wire, these parameters are not measured.

✓ **Supplementation** -----

- Measuring parameters to be displayed on the display unit can be selected. For the details, see the instruction manual for each display unit.
- The measuring conditions of following item vary with the phase wire system.

Item	Phase wire system	Measuring condition
Total current	Single-phase 2-wire	Total current = $I_R$
	Single-phase 3-wire, 3-phase 3-wire	Total current = $(I_R + I_T)/2$
	3-phase 4-wire	Total current = $(I_R + I_S + I_T)/3$
Total voltage	Single-phase 2-wire	Total voltage = $V_{R-S}$
	Single-phase 3-wire, 3-phase 3-wire	Total voltage = $(V_{R-S} + V_{T-R})/2$
	3-phase 4-wire	Total voltage = $(V_{R-S} + V_{S-T} + V_{T-R})/3$
Maximum current	Single-phase 3-wire	Larger value of $I_R$ or $I_T$
	3-phase 3-wire	Largest value of $I_R$ , $I_S$ and $I_T$
	3-phase 4-wire	Largest value of $I_R$ , $I_S$ , $I_T$ and $I_N$
Minimum current	Single-phase 3-wire	Smaller value of $I_R$ or $I_T$
	3-phase 3-wire	Smallest value of $I_R$ , $I_S$ and $I_T$
	3-phase 4-wire	Smallest value of $I_R$ , $I_S$ and $I_T$
Maximum voltage	Single-phase 3-wire	Larger value of $V_{R-S}$ or $V_{T-R}$
	3-phase 3-wire	Largest value of $V_{R-S}$ , $V_{S-T}$ and $V_{T-R}$
	3-phase 4-wire	Largest value of $V_{R-S}$ , $V_{S-T}$ and $V_{T-R}$
Minimum voltage	Single-phase 3-wire	Smaller value of $V_{R-S}$ or $V_{T-R}$
	3-phase 3-wire	Smallest value of $V_{R-S}$ , $V_{S-T}$ and $V_{T-R}$
	3-phase 4-wire	Smallest value of $V_{R-S}$ , $V_{S-T}$ and $V_{T-R}$

**10.2 Monitoring function**

The parameters to be monitored are shown in the following table.

Monitoring item	Detail
	Value upon occurrence
Current demand upper/lower limit alarm	Date and time of occurrence
	Value upon occurrence
Voltage upper/lower limit alarm	Date and time of occurrence
	Value upon occurrence
Power demand upper/lower limit alarm	Date and time of occurrence
	Value upon occurrence
Power factor upper/lower limit alarm	Date and time of occurrence
	Value upon occurrence

✓ **Supplementation** -----

- This unit has only a function to monitor the conditions of occurrence of upper/lower limit alarms and the history of upper/lower limit alarms (date and time of occurrence and values upon occurrence) on the display unit.
- To monitor the current and electric power as instantaneous values, set the demand time limit to 0 second.
- The upper and lower limits can be set only on the display unit. They cannot be set by CC-Link.
- Each value upon occurrence and date and time of occurrence can be checked only on the display unit. They cannot be read by CC-Link. On CC-Link, only the alarm status can be checked.

### 10.3 How to use the monitoring function

This unit can monitor the upper and lower limits of measurements of voltage, current demand, power demand and power factor separately.

<Monitor setting>

- Upper limit setting : Set the measurement upper limits. For the settings and the setting ranges, see page 11.
- Lower limit setting : Set the measurement lower limits. For the settings and the setting ranges, see page 11.
- Alarm delay time : If the measurement is kept higher than the upper limit setting or lower than the lower limit setting for less than the specified alarm delay time, the alarm is not given. This function is useful in removing the rush current of load from the parameters to be monitored. For the setting and the setting range, see page 12.

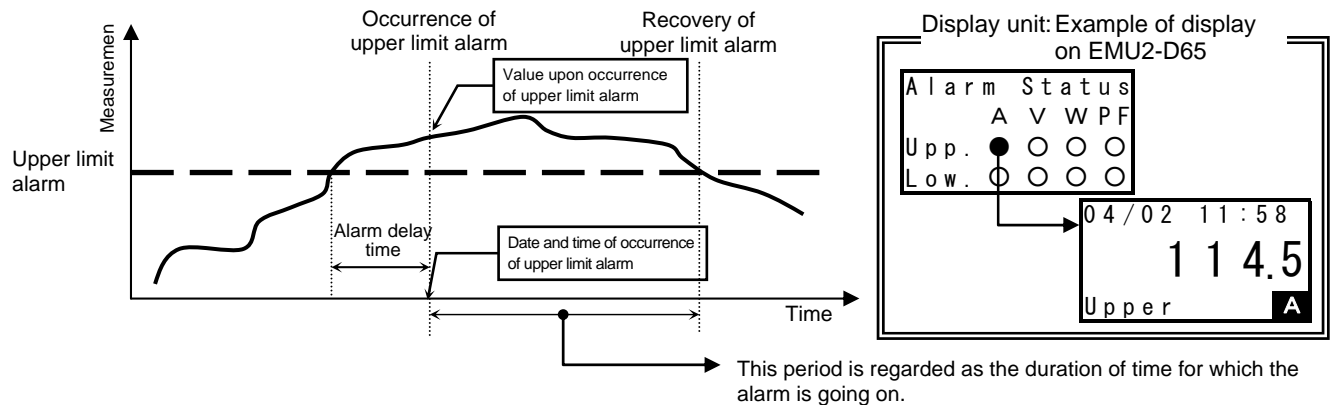
<Conditions of occurrence of alarm>

	Mode	Condition of occurrence of alarm
Upper limit monitoring	Occurrence	Measurement > Upper limit setting Alarm delay time can be set.
	Recovery	Measurement ≤ Upper limit setting
Lower limit monitoring	Occurrence	Measurement < Lower limit setting Alarm delay time can be set.
	Recovery	Measurement ≥ Lower limit setting

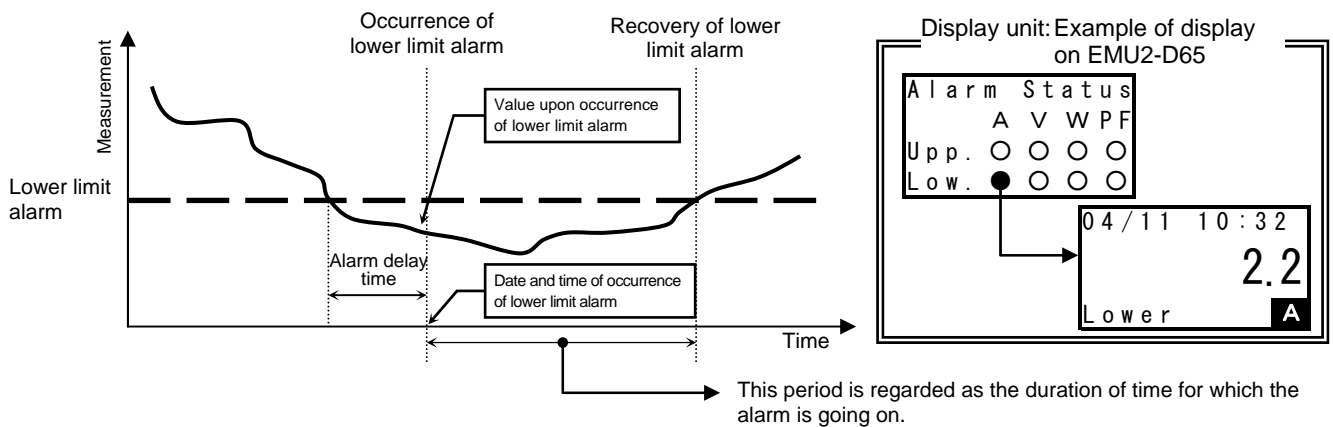
<Monitoring data>

- Alarm status : Indicates whether the alarm has occurred or not.
- Value upon occurrence of alarm : Value upon occurrence of the alarm (when condition of occurrence of alarm was met) (not the maximum value)
- Date and time of occurrence of alarm : Date and time when the alarm occurred (condition of occurrence of alarm was met)

#### Example of current demand upper limit alarm



#### Example of current demand lower limit alarm



## 10.4 Resolution of measuring data

The resolution of measuring data is determined as follows according to the rating settings (phase and wire system, primary voltage and primary current).

### ■ Voltage and harmonic voltage RMS

Rated primary voltage setting	Resolution	
110 V to 220 V	1st decimal place	0.1 V
440 V to 2200 V	Integer	1 V
3300 V to 110000 V	x10	10 V

### ■ Current, current demand and harmonic current RMS

Rated primary voltage setting	Resolution	
5A to 30A	2nd decimal place	0.01A
40A to 300A	1st decimal place	0.1A
400A to 3000A	Integer	1A
4000A to 30000A	x10	10A

### ■ Harmonic distortion rate

1st decimal place: 0.1%

### ■ Power factor

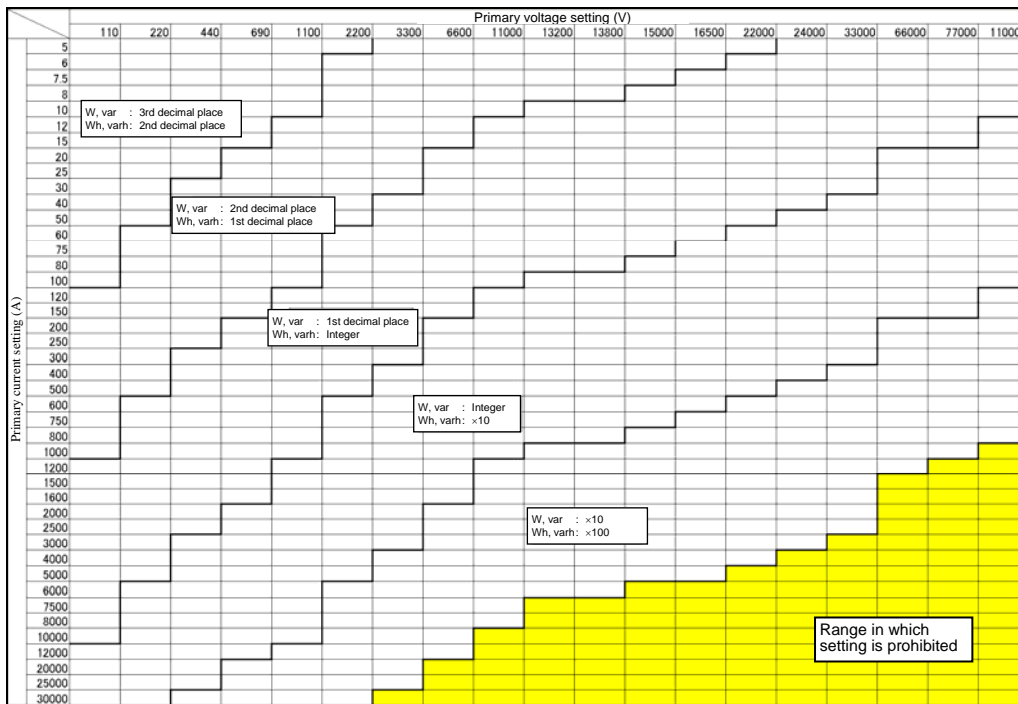
3rd decimal place: 0.001

### ■ Frequency

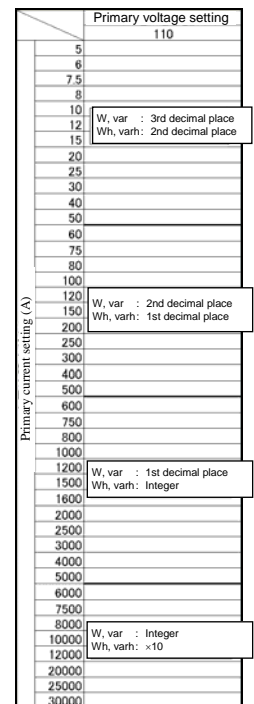
1st decimal place: 0.1 Hz

### ■ Electric power, power demand, reactive power, electric energy and reactive power energy

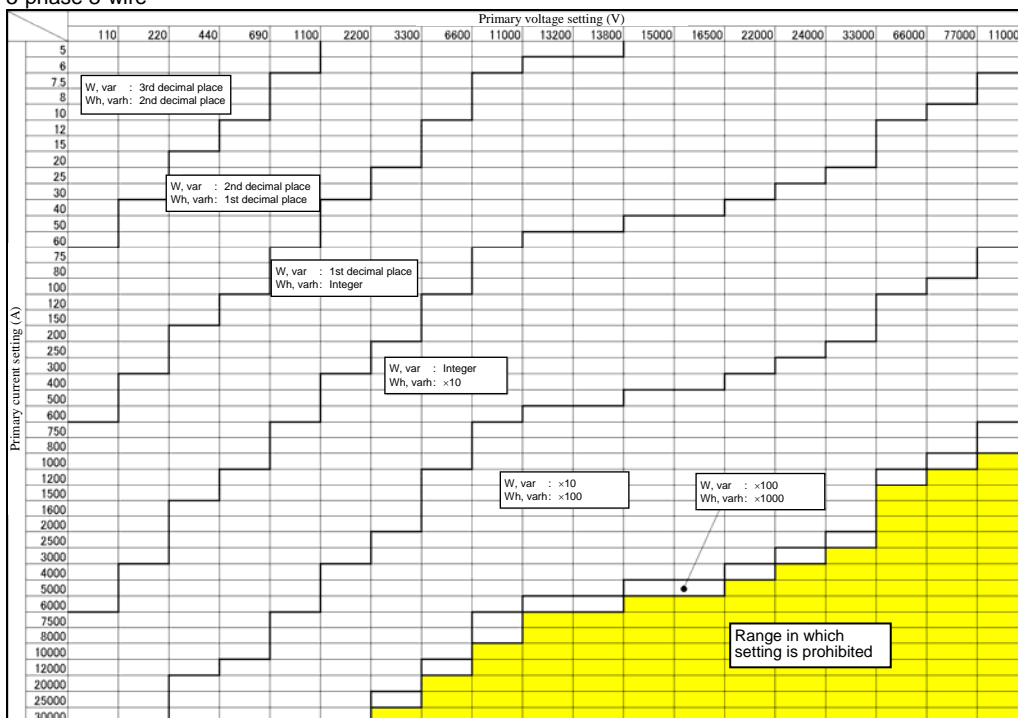
Single-phase 2-wire



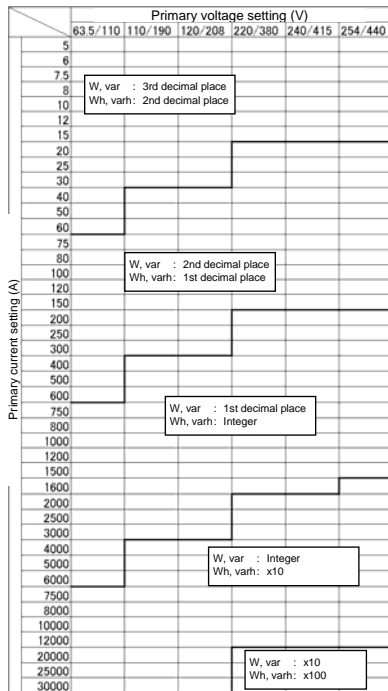
Single-phase 3-wire



3-phase 3-wire



3-phase 4-wire



### 10.5 Restrictions on measuring data

For some seconds (about 10 seconds) just after power is applied to this unit, measurement and communication cannot be made. For some seconds just after ratings of this unit are set or changed, measurement and communication cannot be made. During measurement, the unit operates as shown below.

Measuring parameter	Operation of this unit	
	Indication on display unit	Data transmitted through CC-Link
Current Demand current	When the input current is less than 0.5% of the rated current, 0 A is displayed. When the input current exceeds 140% of the rated current, 140% is displayed as a fixed value.	Same as on the left
Voltage	In the case of 220 V direct setting: When the input voltage to this unit is less than 30 V, 0 V is displayed. When the input voltage to this unit exceeds 315 V, 315 V is displayed as a fixed value. In the case of other setting When the input voltage to this unit is less than 15 V, 0 V is displayed. When the input voltage to this unit exceeds 157.5 V, 157.5 V is displayed as a fixed value.	Same as on the left
Electric power Reactive power	When the displayed value of voltage is 0 V or the displayed value of current is 0 A, 0 kW and 0 kvar are displayed. When the full-load power is less than 0.4%, 0 kW and 0 kvar are displayed. When the full-load power exceeds 140%, 140% is displayed as a fixed value.	Same as on the left
Power factor	When the displayed value of voltage is 0 V or the displayed value of current is 0 A, 1.000 is displayed.	Same as on the left
Frequency	Voltage condition In the case of 220 V direct setting When the input voltage to this unit is 160 V or less, 0 Hz is displayed. In the case of other setting When the input voltage to this unit is 80 V or less, 0 Hz is displayed.	Measurement incompleteness error (error code 17h) is returned.
	Frequency condition When the frequency is less than 44.5 Hz, 44.5 Hz is displayed as a fixed value. When the frequency exceeds 66.5 Hz, 66.5 Hz is displayed as a fixed value.	Same as on the left
Harmonic voltage	In the case of 220 V direct setting When the input voltage to this unit is 160 V or less, 0 V and 0% are displayed. In the case of other setting: When the input voltage to this unit is 80 V or less, 0 V and 0% are displayed.	Measurement incompleteness error (error code 17h) is returned.
Harmonic current	Input voltage condition In the case of 220 V direct setting When the input voltage to this unit is 160 V or less, 0 A and 0% are displayed. In the case of other setting: When the input voltage to this unit is 80 V or less, 0 A and 0% are displayed.	Measurement incompleteness error (error code 17h) is returned.
	Current condition When the input current is less than 0.5% of the rated current, 0 A and 0% are displayed.	Same as on the left

\* The displayed input voltage is not the voltage on the primary side of VT, but the voltage input to this unit.

#### ✓ Supplementation

- After ratings are set or settings are changed on this unit, it takes some seconds until the operation of the unit stabilizes. The unit does not perform measurement during this period. (MEASURE LED is off.) The error code 44h is returned through CC-Link communication.

This section gives troubleshooting procedures and Q&A.

**11.1 Troubleshooting**

If abnormal sound, odor, smoke or heat is generated from this unit, immediately turn off power. If you think the unit is in failure, check the unit as stated below before sending it for repair.

**There are differences among measurements.**

- Although the current value is indicated, the electric energy (integrated value) is not measured.
- Measurements differ from those obtained by other instruments.

Check that MEASURE LED (see page 5) on the front panel of the main body is on. If the LED is not on, the main body is not wired or is wired incorrectly.

Check that an appropriate type of sensor is used. If the rating of the sensor in use is different from the primary current setting, correct measurement cannot be performed.

Check the polarity and wiring of the current sensor in accordance with the following procedures.

Points to be checked		
①	Disconnect all current sensors, and make sure that the current value is 0 A while voltage is kept input in the unit.	If the current value is not 0 A, the sensor input circuit may have been burnt out (when a general potential transformer is directly connected), or other parts of the unit may be defective. Consult Mitsubishi Electric System & Service Co., Ltd. or the local distributor.
②	Current	<p>Check that <math>I_1</math> is correctly measured.</p> <ul style="list-style-type: none"> <li>● If a measurement is given on the <math>I_3</math> side, the wires on the sides 1 and 3 are connected contrarily.</li> <li>● If the current is lower, the current sensor may be loosely fitted.</li> </ul>
	Electric power	<p>Check that the electric power is correctly measured.</p> <p>Reference</p> <p>For 1P3W  <math>W = \text{Voltage, } V_{R-S} \times \text{Current, } I_1</math></p> <p>For 3P3W  <math>W = \text{Voltage, } V_{R-S} \times \text{Current, } I_1 \times \sqrt{3}/2</math></p> <p>When a minus value is displayed:</p> <ul style="list-style-type: none"> <li>● Make sure that the terminals K and L of the current sensor are connected correctly.</li> <li>● Make sure that the current line is passed through the current sensor in the correct direction. Check the arrow direction printed on the nameplate (the arrow mark from the power supply side to the load side).</li> </ul>
③	Connect only the side 3 of the current sensor, and check the indication as stated in ②.	

Check the wiring of the voltage line.

Make sure that the wires are connected correctly to P1, P2 and P3. Check the wiring both on the unit side and on the circuit connecting side.

Check the wiring for short-circuiting and breaking.

**The current measured by this unit differs from that measured by another instrument (by more than the allowable error).**

Ensure that the instrument used for comparison can indicate correctly effective values. This unit indicates effective values.

When the instrument used for comparison indicates not effective values, but mean values, if the current on the circuit to be measured has distortion, the values obtained by the instrument largely differ from those obtained by this unit.

Make sure that the secondary side of CT is not short-circuited. When the unit is connected with our split type potential current transformer CW-5S (L), make sure that the secondary short-circuiting switch is not set to "Short."

Only dedicated current sensors can be connected to this unit. Make sure that other current sensors are not connected.

**Although values are shown on the LCD, the values cannot be monitored through communication.**

**When CC-Link is used:**

Check that the dedicated cable is used and that the dedicated high-performance cable is not used together with the cable.

Check that the transmission line is connected correctly and electric wires are not broken.

Check that the station number (STATION) and transmission rate (B RATE) settings are proper. Make sure that the reset switch has been pressed after settings were changed.

### ■ General

<b>Q</b>	<b>To what degree of overvoltage and overcurrent does the unit withstand? Is it necessary to connect a protective circuit out of the unit?</b>
<b>A</b>	Instantaneous : Up to 20 times the rated current and up to twice the rated voltage Instantaneous: Current is applied 9 times for 0.5 sec at intervals of 1 min and once for 5 sec. Continuous : Up to 1.1 times the rated current and rated voltage
<b>Q</b>	<b>Can this unit be used as a watt-hour meter?</b>
<b>A</b>	The unit can be used to measure the electric energy and control the consumption of electric energy. However, it should not be used for the purpose of trading or certification of electric energy regulated by Measurement Law.
<b>Q</b>	<b>Is it easy to check for wiring failures?</b>
<b>A</b>	Check the state of measurement of electric energy. If MEASURE LED on the front panel of the main body (see page 5) is on, the electric energy is being measured. Make sure that the electric energy value is approximate to the value obtained by the following formula to confirm more reliably that the unit is wired correctly. $\sqrt{3} \times \text{current} \times \text{voltage} \times (0.8 \text{ to } 1.0)$
<b>Q</b>	<b>Is it secure to open the secondary terminal of the current sensor?</b>
<b>A</b>	The secondary side of each of Models EMU2-CT5 (-4W), EMU-CT50, EMU-CT100 and EMU-CT250 has a built-in protective circuit against opening of the secondary terminal. No problem occurs by opening the terminal during wiring work. However, for safety, do not continuously apply current while the terminal is open. Although the secondary side of each of Models EMU-CT400 and EMU-CT600 has a built-in protective circuit against opening of the secondary terminal, keep the secondary short-circuiting switch of the product in "Short" during wiring work. After the completion of the work, set the secondary short-circuiting switch to "Open." If the switch is not set to "Open," measurement will not be performed correctly.
<b>Q</b>	<b>When a load, such as a welder, is used, current flows into the unit for only a short time (for example, 2 cycles). Can it measure the current correctly?</b>
<b>A</b>	This unit measures the parameters in a sampling period of 4340 Hz (at 50 and 60 Hz). The display updating period for display of measurement results on the display unit (EMU2-D65 or EMU2-D65-M) and the updating period for communication data output through communication, such as CC-Link, are 500 msec at the shortest. To determine the electric quantities, such as current, voltage, electric power, power factor, frequency, high-frequency voltage and high-frequency current, the results of measurement in a 500 msec period are processed by 2 second moving-average method (to be concrete, the moving average of four measurements obtained in a 500 msec period is calculated). Therefore, the mean values of these parameters are displayed. The maximum and minimum values of these electric parameters are calculated from the mean values. Accordingly, the unit cannot measure the instantaneous current correctly. The electric energy (integrated value) is continuously measured in a sampling period of 4340 Hz without intermission of measurement by processing separately from the above-mentioned instantaneous data processing. Therefore, the unit can measure the load in a short period.
<b>Q</b>	<b>The measurements obtained by this unit differ from those obtained by another instrument. Why?</b>
<b>A</b>	There are various possible causes. Check the following points. ① Check the wiring (particularly the polarity of the current sensor and connection of the voltage circuit). ② Check that the parting faces of the split type current sensor are engaged without gaps and are not separated. ③ Check that there is no foreign matter between the parting faces of the split type current sensor.

### ■ Q&A relating to specifications

<b>Q</b>	<b>To what is the measurement accuracy designed?</b>
<b>A</b>	For the electric energy, the measurement accuracy indicates the allowable range of error of readings. When the reading is 10 kWh, the error is $\pm 0.2$ kWh. For the measuring parameters other than the electric energy, the measurement accuracy indicates the allowable ranges of error for the rating input. When the rated current is set to 250 A, the allowable range for current is $250 \text{ A} \pm 1\%$ .
<b>Q</b>	<b>Is the accuracy of the current sensor included?</b>
<b>A</b>	The accuracy of the current sensor is not included in the accuracy of this unit. The maximum allowable error is the sum of the allowable error of this unit and the error of the current sensor.
<b>Q</b>	<b>To what range is minute current measured?</b>
<b>A</b>	The measurement of current is indicated starting from the range in which the current exceeds 0.5% of the rated current. In the range in which the current is less than 0.5% of the rated current, the measurement result is indicated as 0. However, also in this range, the electric energy is measured. Even when the indicated value of current is 0, the measurement of electric energy will increase if such a condition lasts for a long time. The electric energy is measured at a load of about 0.4% or more of the full-load power.

## ■ Q&A relating to installation

<b>Q</b>	<b>Can it be installed without the IEC rail?</b>
<b>A</b>	No. Use the IEC rail.
<b>Q</b>	<b>What diameter of electric wire can be fitted to the current sensor?</b>
<b>A</b>	<p>The nominal sectional areas of 600 V vinyl-coated conductors having applicable electric wire diameters are shown below (reference values).</p> <ul style="list-style-type: none"> <li>IV electric wire (600 V vinyl-insulated electric wire) 60 mm<sup>2</sup> (EMU-CT50/CT100), 150 mm<sup>2</sup> (EMU-CT250) 500 mm<sup>2</sup> × 1 pc., 325 mm<sup>2</sup> × 2 pcs. (EMU-CT400/CT600)</li> <li>CV electric wire (600-V vinyl-insulated electric wire) 38 mm<sup>2</sup> (EMU-CT50/CT100), 150 mm<sup>2</sup> (EMU-CT250, 100 mm<sup>2</sup> is recommended) 500 mm<sup>2</sup> × 1 pc., 325 mm<sup>2</sup> × 2 pcs. (EMU-CT400/CT600)</li> </ul> <p>The above values are the standard nominal sectional areas. These electric wires may not pass through the sensor owing to the error of the outer diameters of vinyl insulators finished by manufacturers or deformation (bending) of the wires. Check the wire on site.</p>
<b>Q</b>	<b>To what should attention be paid when fitting the current sensor?</b>
<b>A</b>	Models EMU2-CT5 (-4W), EMU-CT50, EMU-CT100, EMU-CT250, EMU-CT400 and EMU-CT600 are split type sensors. If the parting faces are not completely engaged or there is foreign matter between the parting faces, the sensor cannot exhibit sufficient performance. Fit the sensor carefully.

## ■ Q&A relating to connection

<b>Q</b>	<b>Do the current sensor and the power measuring unit have polarity?</b>
<b>A</b>	<p>Yes.</p> <p>Connect the current sensor secondary terminals (k and l) to the power measuring unit terminals with appropriate symbols. If the terminals are connected to improper poles, the electric power and electric energy cannot be measured correctly although the current can be measured.</p>
<b>Q</b>	<b>To what should attention be given for correct wiring?</b>
<b>A</b>	<p>Check the polarity of the primary current of the current sensor. "K" and "L" are shown on the power supply side and the load side of the circuit, respectively. An arrow mark is shown in the direction from K to L.</p> <p>In the case of a 3-wire circuit, check that the current sensor is connected to this unit without misconnection on the sides 1 and 3. Check that the voltage input terminals P1, P2 and P3 are connected correctly.</p>
<b>Q</b>	<b>How can the wiring between the current sensor and this unit be extended?</b>
<b>A</b>	<p>For the cables for the split current sensors EMU-CT50, EMU-CT100, EMU-CT250, EMU-CT400 and EMU-CT600, trunk cables are available. The wiring length can be increased to up to 50 m.</p> <p>For Model EMU2-CT5 (-4W), the wiring length can be increased to up to 10.5 m by using the cable supplied with the sensor. To further increase the length, use the potential current transformer for split type CW-5S (L), and extend the wiring on the secondary side of CW-5S (L).</p>

## ■ Q&A relating to setting

<b>Q</b>	<b>Is setting necessary?</b>
<b>A</b>	<p>It is necessary to set at least the phase and wire system, primary current, primary voltage and sensor type. Set these items appropriately to the circuit to be connected.</p> <p>For setting, one of the optional small display unit (EMU2-D65) or logging display unit (EMU2-D65-M) is necessary.</p>
<b>Q</b>	<b>Is the unit disordered if the primary current setting is different from the rated current of the connected current sensor?</b>
<b>A</b>	The unit will not be disordered or burnt out. But quite different measurements will be obtained.
<b>Q</b>	<b>Why is it necessary to set the date and time?</b>
<b>A</b>	<p>The time of occurrence of maximum and minimum values, and time of occurrence of upper/lower alarms are measured. To measure these values, time control is necessary. Therefore, the unit has a built-in clock. Set the clock without fail.</p>



## 12.1 Common specifications

Item		Specification		
Phase wire		EMU2-RD3-F/C EMU2-RD5-F/C EMU2-RD7-F/C	Applicable to single-phase 2-wire, single-phase 3-wire and 3-phase 3-wire	
		EMU2-RD2-F/C-4W EMU2-RD4-F/C-4W	Applicable to 3-phase 4-wire	
Rating input	Voltage circuit (Note 1)	EMU2-RD3-F/C EMU2-RD5-F/C EMU2-RD7-F/C	110V, 220V, 440V, 690V, 1100V, 2200V, 3300V, 6600V, 11000V, 13200V, 13800V, 15000V, 16500V, 22000V, 24000V, 33000V, 66000V, 77000V, 110000V	
	Current circuit	EMU2-RD2-F/C-4W EMU2-RD4-F/C-4W	63.5/110V, 110/190V, 120/208V, 220/380V, 240/415V, 254/440V	
	Frequency		50A, 100A, 250A, 400A, 600A (The dedicated split type current sensor is used. The current on the current sensor primary side is displayed in any case.) 5A (The dedicated split type 5A current sensor is used. The 5A sensor is used in a 2-stage structure in combination with a current transformer (CT), and the primary current can be set to up to 30000 A.) (Note 2)	
Auxiliary power supply ratings		100 VAC to 220 VAC (+10%, -15%) 50 Hz/60 Hz		
Tolerances for main body (not including current sensor)		Current, voltage, electric power, reactive power and freq. Power factor Electric energy and reactive power energy High-frequency current and high-frequency voltage	±1.0% (to rating input) ±3.0% ±2.0% (range of 5 to 100% of rating, power factor 1) ±2.5%	
Data updating period		500 msec * The integrated values of Wh and varh are constantly accumulated (following short-cycle load fluctuations).		
Demand time limit setting range		0, 10 sec, 20 sec, 30 sec, 40 sec, 50 sec, 1 to 15 min (in 1-min steps), 20 min, 25 min and 30 min		
Compensation for power failure	(1) Wh (integrated value) (2) Max. and min. values (3) Upper and lower limit values (4) Setting data	(1) to (3) : Stored in EEPROM (nonvolatile memory) (stored in period of 10 min and stored upon power failure) (4) : Stored in EEPROM (nonvolatile memory) (stored upon change in settings) * Upon occurrence of power failure, the measurements and settings shown left are not erased.		
	Clock	The clock IC is backed up by a capacitor.		
	Clock backup time	<b>Accumulated time of power failure: Approx. 168 hours (at 25°C) (Note 3)</b> * The clock is initialized (12:00 on Jan. 1, 2003) when the accumulated time exceeds the setting.		
Clock accuracy (Note 4)		Approx. 1 min/month		
Connection to sensor	Sensor cable	Use of dedicated cable (optional)		
	Wiring length to current sensor	For split-type 5A sensor: Extension of 10 m (10.5 m in combination with the length of the cable supplied with the sensor) Split-type sensor: Extension of up to 50 m		
Connection to display unit	Cable	Use of dedicated cable		
	Wiring length	Extension of up to 10 m		
	Number of connected units	Up to 7 units (To connect two units or more, power supply and connecting cables (optional) for display units are necessary.)		
Consumed VA	Voltage circuit	0.1 VA at each phase (at 110 V AC) or 0.2 VA at each phase (at 220 V AC)		
	Current circuit	0.1 VA at each phase (on primary side of current sensor)		
	Auxiliary power supply circuit	EMU2-RD3-F	At 100 VAC: 6.5 (8.0) VA, at 220 VAC: 8.0 (9.5) VA	The parenthesized values apply in the case where the display unit EMU2-D65 is used.
		EMU2-RD5-F	At 100 VAC: 8.0 (9.5) VA, at 220 VAC: 9.5 (11.0) VA	
		EMU2-RD7-F	At 100 VAC: 9.5 (11.0) VA, at 220 VAC: 11.0 (12.5) VA	
		EMU2-RD3-C	At 100 VAC: 7.5 (9.0) VA, at 220 VAC: 9.0 (10.5) VA	
EMU2-RD5-C		At 100 VAC: 9.0 (10.5) VA, at 220 VAC: 10.5 (12.0) VA		
EMU2-RD7-C	At 100 VAC: 10.5 (12.0) VA, at 220 VAC: 12.0 (13.5) VA			
Working temperature range		-5°C to 55°C (daily mean temperature: 35°C or less)		
Working humidity range		30% to 85%RH (no condensation)		
Storage temperature range		-10°C to 60°C		
Withstand voltage at commercial frequency	Between all electric circuits and housing		1500 V AC for 1 minute	
	Between all current circuits (on current sensor primary side) and voltage circuits and auxiliary power supply		1500 V AC for 1 minute	
	Between all current circuits (on current sensor primary side) and voltage circuits and all output		1500 V AC for 1 minute	
	Between all voltage circuits and all current circuits (on current sensor primary side)		1500 V AC for 1 minute	
Insulation resistance		10 MΩ or more (500 V DC) in the same places as shown above		
Installing method		Installation with IEC rail		

Applicable electric wire and applicable crimp-type terminal (terminal block)

Applicable electric wire: 1.25 mm<sup>2</sup>  
Applicable crimp-type terminal: Terminal 7.2 mm or less in diameter for M3.5  
(Ex.: R1.25-3.5, bare round type)

Item	Specification	
Terminal tightening torque	0.49 to 0.78 N·m	
Mass	EMU2-RD3-F ----- 0.6kg EMU2-RD5-F ----- 0.8kg EMU2-RD7-F ----- 1.0kg EMU2-RD3-C ----- 0.6 kg EMU2-RD5-C ----- 0.8 kg EMU2-RD7-C ----- 1.0 kg	EMU2-RD2-F-4W ----- 0.5kg EMU2-RD4-F-4W ----- 0.7 kg EMU2-RD2-C-4W ----- 0.5kg EMU2-RD4-C-4W ----- 0.7 kg
External dimensions (W×D×H) in mm	EMU2-RD3-F ----- 90×97×98 EMU2-RD5-F ----- 127.5×97×98 EMU2-RD7-F ----- 165×97×98 EMU2-RD3-C ----- 115×97×98 EMU2-RD5-C ----- 152.5×97×98 EMU2-RD7-C ----- 190×97×98	EMU2-RD2-F ----- 90 x97x98 EMU2-RD4-F ----- 127.5x97x98 EMU2-RD2-C ----- 115×97×98 EMU2-RD4-C ----- 152.5×97×98
Expected product life	10 years	

Note 1 : 110 V and 220 V circuits can be connected directly. An external potential transformer is necessary for circuits of 440 V or more.

Note 2 : When the 5A sensor is used, the primary current can be set to the following values.

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

**Note 3 : “168 hours” is the compensation time for continuous energized condition for 1 hour or more.**

Note 4 : The unit has one clock common to the circuits.

## 12.2 CC-Link communication specifications

Item	Specification
Number of occupied stations	Remote device station occupying one station
Maximum number of connected units	The following conditions must be met. When the system consists only of this type of units, up to 42 units can be connected. Condition 1: $\{(1 \times a) + (2 \times b) + (3 \times c) + (4 \times d)\} \leq 64$ a : Number of units occupying 1 station b : Number of units occupying 2 stations c : Number of units occupying 3 stations d : Number of units occupying 4 stations Condition 2: $\{(16 \times A) + (54 \times B) + (88 \times C)\} \leq 2304$ A : Number of remote I/O stations B : Number of remote device stations C : Number of local station
Transmission rate (B RATE)	Changeable to 156 K, 625 K, 2.5 M, 5 M or 10 M (The station-to-station cable length and the maximum total cable distance vary depending on the transmission rate.)
Station number (STATION)	Setting in range from 1 to 64 (Set the station number without fail.)
CC-Link version	Ver. 1.10
Connecting cables	For CC-Link connection, use the specified cables. The terminal resistance varies depending on the type of the dedicated cable. For the details of the dedicated cables and terminal resistance, see the manual supplied with the master unit.

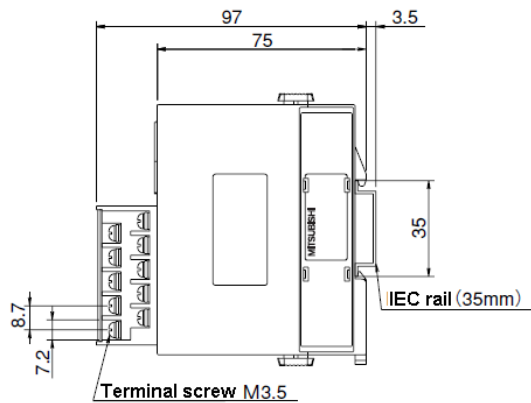
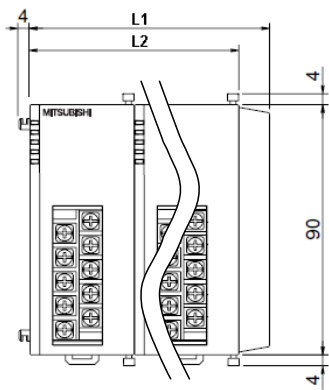
## 13. Peripheral Devices

The following products are available.

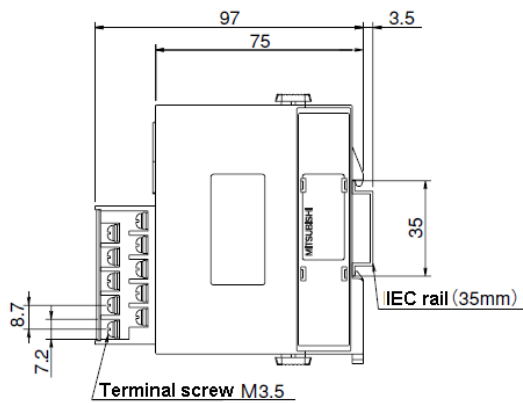
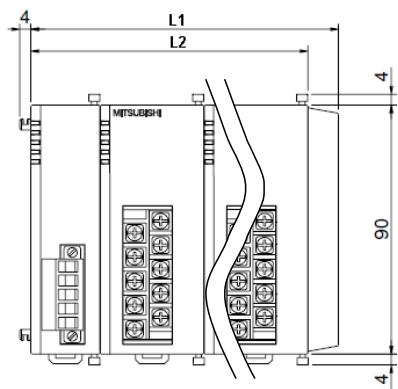
Product name	Model	Remarks
Current sensor	EMU-CT50	50A Split-type sensor
	EMU-CT100	100A Split-type sensor
	EMU-CT250	250A Split-type sensor
	EMU-CT400	400A Split-type sensor
	EMU-CT600	600A Split-type sensor
	EMU2-CT5	5A Split-type sensor, integrated with two 5A sensors and 0.5-m cable
	EMU2-CT5-4W	5A Split-type sensor, integrated with three 5A sensors and 0.5-m cable, for 3 phase 4 wire
Current sensor cable	EMU2-CB1-DR	0.5 m
	EMU2-CB1-DR-4W	0.5 m, for 3 phase 4wire
	EMU2-CB-T1M	1 m
	EMU2-CB-T5M	5 m
	EMU2-CB-T10M	10 m
	EMU2-CB-T20M	20 m
	EMU2-CB-T1MS	1 m Separate type, a pair of two cables
	EMU2-CB-T5MS	5 m Separate type, a pair of two cables
	EMU2-CB-T10MS	10 m Separate type, a pair of two cables
Display unit	EMU2-D65	Small display unit with 1-m connecting cable
	EMU2-D65-M	Logging display unit with 1-m connecting cable

# 14. External Dimensions

Unit: mm.



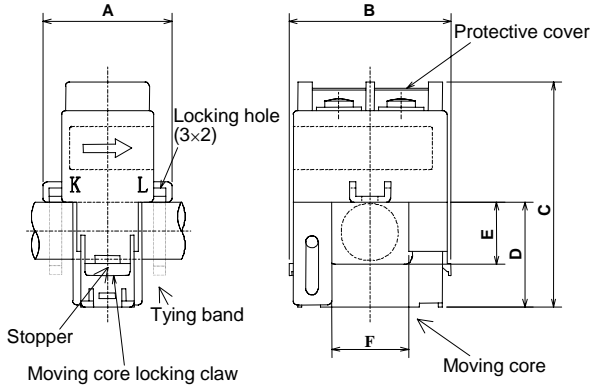
Model name	L1	L2
EMU2-RD3-F, EMU2-RD2-F-4W	86	75
EMU2-RD5-F EMU2-RD4-F-4W	123.5	112.5
EMU2-RD7-F	161	150



Model name	L1	L2
EMU2-RD3-C EMU2-RD2-C-4W	111	100
EMU2-RD5-C EMU2-RD4-C-4W	148.5	137.5
EMU2-RD7-C	186	175

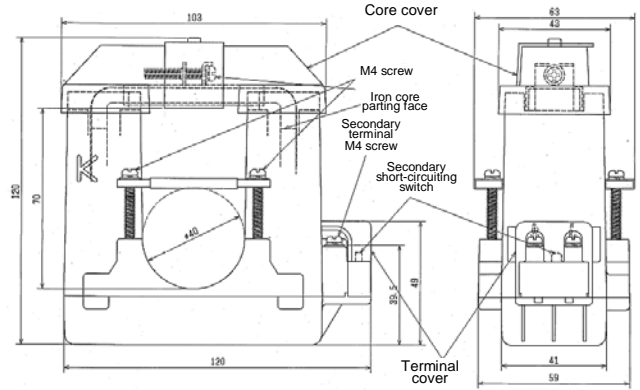
**■ Dedicated current sensors**

◆ EMU-CT50, EMU-CT100, EMU-CT250

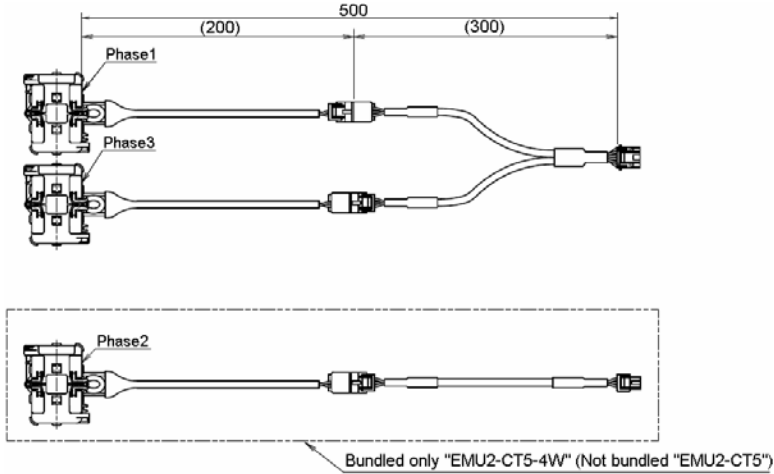


Model	A	B	C	D	E	F
EMU-CT50/CT100	31.5	39.6	55.2	25.7	15.2	18.8
EMU-CT250	36.5	44.8	66	32.5	22	24

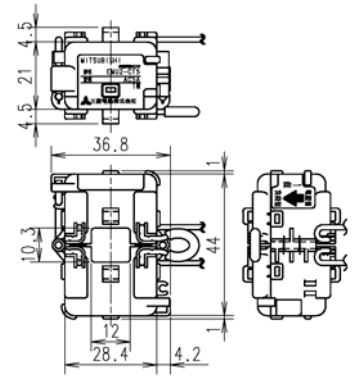
◆ EMU-CT400, EMU-CT600



◆ EMU2-CT5, EMU2-CT5-4W

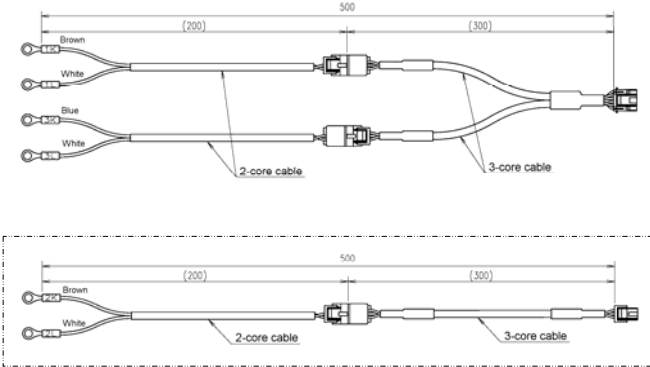


Details of sensor

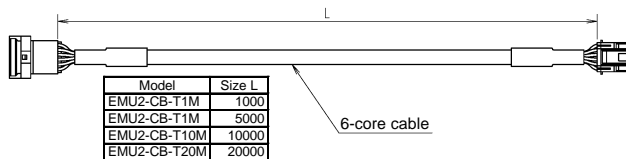


**■ Dedicated cable**

◆ EMU2-CB1-DR, EMU2-CB1-DR-4W

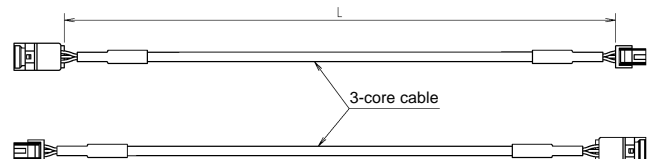


◆ EMU2-CB-T\*\*M



Model	Size L
EMU2-CB-T1M	1000
EMU2-CB-T1M	5000
EMU2-CB-T10M	10000
EMU2-CB-T20M	20000

◆ EMU2-CB-T\*\*MS



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

\* Pair of two cables



## 16. Enquiry

Contact one of the following offices.

Country/ Region	Company	Address	Telephone
Indonesia	P.T. SAHABAT INDONESIA	JL Muara Karang Selatan Blok A/Utara No. 1 kav. NO. 11 P.O. Box 5045/Jakarta/11050, Jakarta Indonesia	+62-(0)21-6621780
Korea	MITSUBISHI ELECTRIC AUTOMATION KOREA CO., LTD.	2Fl. Dong Seo Game Channel Bldg., 1F 660-11 Deungchon-Dong, Kanguseo-ku, Seoul, 157-030 Korea	+82-2-3668-6567
Lao PDR	SOCIETE LAO IMPORT-EXPORT	43-47 Lane Xang Road P.O. BOX 2789 VT Vientiane Lao PDR.	21-215043, 21-215110
Myanmar	PEACE MYANMAR ELECTRIC CO., LTD.	NO. 216, Bo Aung Gyaw Street, Botataung 1161, Yangon, Myanmar	+95-(0)1-202589, 202449, 202590
Nepal	Watt & Volt House Co., Ltd.	KHA 2-65, Volt House Dilli Bazar Post Box: 2108, Katmandu, Nepal	+977-1-411330
Pakistan	Prince Electric Co.	16 Brandreth Road Lahore 54000, Pakistan	+92-(0)42-7654342
Philippines	EDISON ELECTRIC INTERGRATED, INC.	24th Fl. Galleria Corporate Center Edsa Cr. Ortigas Ave. uezon City, Metro Manila, Philippines	+63-(0)2-643-8691
Taiwan	Setsuyo Enterprise Co., Ltd.	6F, NO. 105 Wu-Kung 3rd rd., Wu-Ku Hsiang, Taipen Hsien Taiwan	+866-(0)2-2298-8889
Thailand	UNITED TRADING & IMPORT CO. LTD.	77/12 Bumrungmuang Road, Klong Mahanak, Pomprab Bangkok 10100	+66-223-4220-3
Vietnam	Sa Giang Techno Co., Ltd.	207/4 Nguyen Van Thu St., Dist 1, Ho Chi Minh City, Vietnam	848-821-6453