



Energy Measuring Unit Energy Measuring Extension Model for Same Voltage System
Energy Measuring Unit Energy Measuring Extension Model for Different Voltage System

MODEL

EMU4-A2

EMU4-VA2

User's Manual (Details)

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





Safety precautions

Thank you for purchasing the Energy Measuring Unit.

- This manual describes setup and usage for the Energy Measuring Unit. Before using the product, please read this manual carefully to ensure correct use. Especially, in the case of where this unit is to be installed, please read "1. Precautions for Use" to ensure correct use.
- Make sure that the end users read this manual and then keep the manual in a safe place for future reference.
- Make sure to deliver this manual to the end-user.
- If you are considering using this unit for special purpose such as nuclear power plants, aerospace, medical care or passenger vehicles please refer to our sales representative.(For details, please see at the end of this manual.)

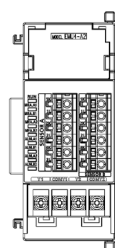
■ Notations in this manual

Use the following marks in this manual.

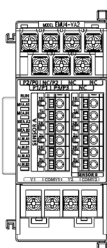
Mark	Meaning of the icons
 Danger	Indicates that incorrect handling may result in death or severe injury, ignoring this marking.
 Caution	Indicates that incorrect handling may result in injury or property damage, ignoring this marking.
 Supplement	Indicates that precautions to avoid a malfunction and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

■ Checking package contents

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



or



Energy Measuring Unit×1



User's Manual (Digest) x1

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

■ Related materials

Refer to the following documents as necessary. You can download them from the Mitsubishi FA Global site.

Title	Ref. No.
Energy Measuring Unit EcoMonitorLight/EcoMonitorPlus Series MODBUS I/F Specification	LSPY-9025
Energy Measuring Unit Programming Manual (CC-Link) For ver.1 remote device station	LEN160305
Energy Measuring Unit Programming Manual (CC-Link) For ver.2 remote device station	LEN160316
Energy Measuring Unit Programming Manual (CC-Link IE Field Network Basic) (SLMP)	LEN180123

■ Trademark

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

Feature

- This unit is the option device of Energy Measuring Unit (EcoMonitorPlus).
- Extension this unit is capable to measure multiple circuits.
- You can measure different voltage system using EMU4-VA2

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1. Precautions for Use

1.1 Precautions for Operating Environment and Conditions

This unit is premised on being used in pollution degree 2 (Note 1) environment. When used in higher pollution degree, protect this unit from pollution on another device side to be incorporated.

Over voltage category of measuring circuit in this unit is CAT III (Note 1), and that of auxiliary power circuit (MA, MB) is CAT III (Note 1).

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

Places the Ambient temperature exceeds the range -5 - +55°C.
Places the Relative humidity exceeds the range 30-85% or places with dewfall.
Dust, corrosive gas, saline and oil smoke exist.
Places exposed to rain or water drop.

Places metal fragments or conductive substances are flying.

Places the average daily temperature exceeds 35°C.
Vibration and impact exceed the specifications.

Places exposed to direct sunlight.
Places in strong electromagnetic field or places large amounts of external noise exist.
Altitude exceeds 2000m.

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

1.2 Matters concerning the precaution before use

- Use the unit in the specified usage environment and conditions.
- To set this unit, dedicated energy measuring unit (EMU4-BM1-MB, EMU4-HM1-MB, EMU4-LG1-MB or EMU4-CNT-MB) is necessary. For the setting method, refer to User's manual (Details) of the energy measuring unit.
- To set this unit, dedicated small-size display unit (EMU4-D65) is necessary. For the setting method, refer to User's manual (Details) of the display unit.

1.3 Installation and Wiring Precautions



• **Shut off the external power supply for the unit in all phases before installing or wiring. Failure to do so may cause an electric shock or damage of this unit.**
• **Work under the electric outage condition when installing and wiring. Failure to do so may cause electric shock, a failure of the unit, a fire etc.**



<Precautions for Electric work>

- Any person who is involved in the installation and the wiring of this unit should be fully competent to do this work.
- Keep the space around this product (all directions except the back) is 30 mm or more (100 mm or more for UL standard compliance).
- When tapping or wiring, take care not to entering any foreign objects such as chips and wire pieces into this unit.
- Check the connection diagram when wiring. Wrong wiring may cause failure of the unit, a fire or electric shock.
- For protection against noise, **transmission lines and input/output lines shall not be placed close to or bound together with the power lines and high-voltage lines.**
- The wires to be connected to this unit shall be placed in a duct or fixed together by cramping. If the electric wires are not placed in the duct or cramped together, loosen wires or their movement or careless stretch may cause a breakage of the unit or wire or a malfunction due to poor contact of electric wires.
- If transmission lines and input/output lines are placed close to or bound together with the power lines and high-voltage lines, keep distance as below between them.(Except for the input side of terminal block) If there is concern about the influence of noise even if the distance is as follows, we recommend using a shielded cable.

Condition	Distance
Power line 600V or less	300mm or longer
Other power line	600mm or longer

<Connection of terminal block>

- Strip the wires with proper length. Overlong stripping length may cause short to next wire. Shorter stripping length may cause contact failure.
- Take care not to short to next terminal by a filament. (Do not plate the wires with solder.)
- Do not connect three or more wires to one terminal of a terminal block for preventing loose contact and wires dropout.
- Use appropriate size of electric wires. If inappropriate size of electric wire is used, it may cause a fire due to generated heat.
- Tighten the screw within the specified torque. Under tightening can cause drop of the screw, short circuit or malfunction. Over tightening can damage the screw and/or unit, resulting in drop, short circuit or malfunction.
- After tightening the screws, be sure to check all the screws tightened. Loose screw may cause malfunction of the unit, a fire or electric shock.
- Be sure to attach the terminal cover to prevent electric shock.
- Use the crimp-type terminal appropriated for the size of electric wires. If inappropriate crimp-type terminal is used, a wire breakage or a contact failure may occur, which may cause a device malfunction, a failure, a burnout or a fire.
- Frame GND terminal must be grounded according to the D-type ground (ground resistance is not exceed 100Ω).
- Do not directly touch any conductive part of the unit. Doing so can cause electric shock, failure or malfunction of the unit.
- Do not input voltage and current at NC terminals. Doing so can cause failure or malfunction of the unit.

<Connection with the current sensor>

- When using this product, make sure to use it in combination with current sensor (EMU-CT**, EMU-CT**-A, EMU2-CT5 and EMU2-CT5-4W). **This product cannot connect with the secondary side (5A) of current transformer.** Please not to exceed the rating of this product for input of current sensor. For further details, please refer to current sensor manual to maintain the functionality and the accuracy of this product.
- The dedicated current sensor (EMU-CT**, EMU-CT**-A) is used only for low voltage circuit. It cannot be used for a high voltage circuit. EMU2-CT5 and CT5-4W should be used with the secondary side (5A) of transformer transfixed. If it is connected with a high-voltage circuit by mistake, it may cause a burnout of the device and a fire. It is critically dangerous. For the allowable maximum voltage of current sensor, refer to instruction manual (detail) of Energy Measuring Unit (EMU-BM1-MB, EMU4-HM1-MB)
- The dedicated current sensor has a polarity (directionality). Be careful about it when installing the unit.
- If the wires connected to this unit are strongly pulled off, it may cause a malfunction or a breakage to the unit or the wire.

<Connection of frame GND terminal>

- Do not exceed the specified voltage when doing an insulation resistance test and a commercial frequency withstand voltage test.
- Frame FG terminal must be grounded according to the D-type ground.
- To prevent persons with little knowledge about electric equipment from electric shock, panel must be taken either following measure.
Lock the panel so that only those who get an education about electric equipment and have sufficient knowledge can unlock, or shut off power supply automatically by opening the panel.
Cover the dangerous part of this unit.

1.4 Precautions for Use

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

Caution

- Do not disassemble or modify this unit. It may cause failure, malfunction, injury or fire.
- Use this unit within the ratings specified in this manual. If it is used outside the ratings, it may cause not only malfunction or failure but also fire burnout.
- The secondary side of the models EMU2-CT5, EMU-CT50, EMU-CT100, EMU-CT250, EMU-CT50-A, EMU-CT100-A, EMU-CT250-A, EMU-CT400-A, EMU-CT600-A is equipped with the protective circuit against opening of secondary terminals. Opening them during the wiring work causes no problems. However, for safety, please do not continuously energize the module with the terminals open.
- The current sensors dedicated to this unit EMU-CT400/600 resemble the split current transformer for general gauges CW-5SL closely in appearance. However, characteristics are completely different. Be sure to connect the dedicated current sensor. Connecting CW-5SL to this unit directly may cause failure of the device, a burnout or a fire.

1.5 Maintenance Precautions

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

Caution

Do periodical maintenance under the electric outage condition. Failure to do so may cause electric shock, failure of the unit or a fire. Tighten the terminal regularly to prevent a fire.

1.6 Storage Precautions

- To store this unit, turn off the power and remove wires, and put it in a plastic bag.
- For long-time storage, avoid the following places. Failure to follow the instruction may cause a failure and reduced life of the unit.
 - Places the Ambient temperature exceeds the range -10 - +60°C.
 - Places the average daily temperature exceeds 35°C.
 - Places the Relative humidity exceeds the range 30-85% or places with dewfall.
 - Vibration and impact exceed the specifications.
 - Dust, corrosive gas, saline and oil smoke exist.
 - Places metal fragments or conductive substances are flying.
 - Places exposed to rain or water drop.

1.7 Disposal Precautions

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

1.8 About packaging materials and this manual

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

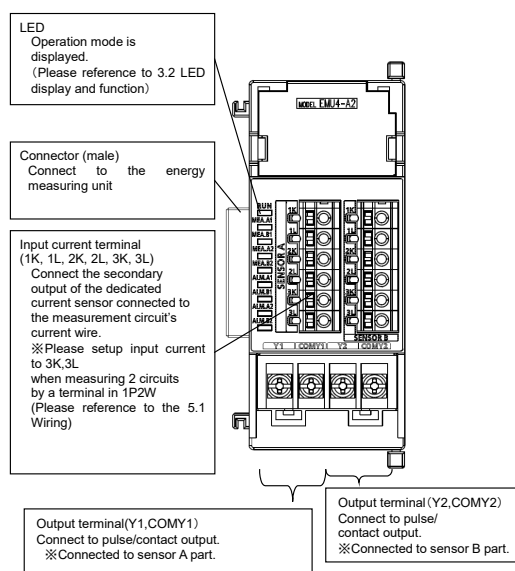
2. Disclaimer

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

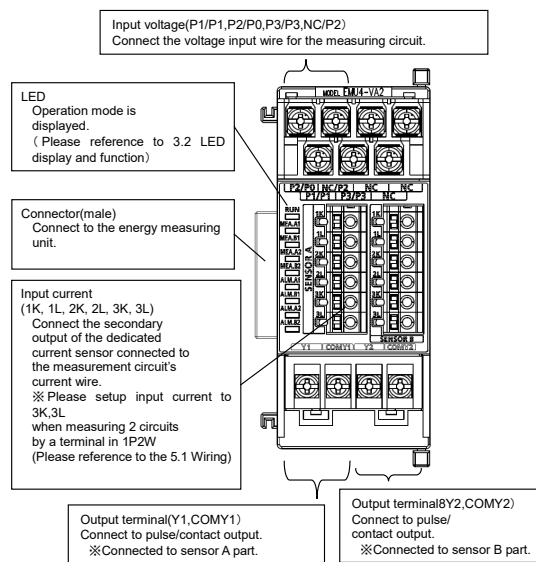
3. Name and function of each part

3.1 Name of each part

(1)EMU4-A2

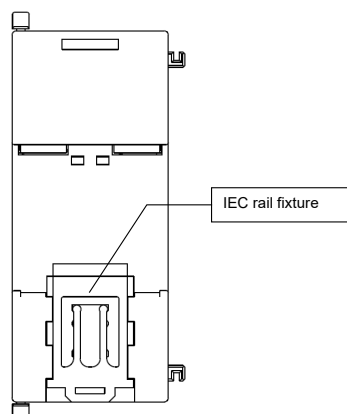


(2)EMU4-VA2

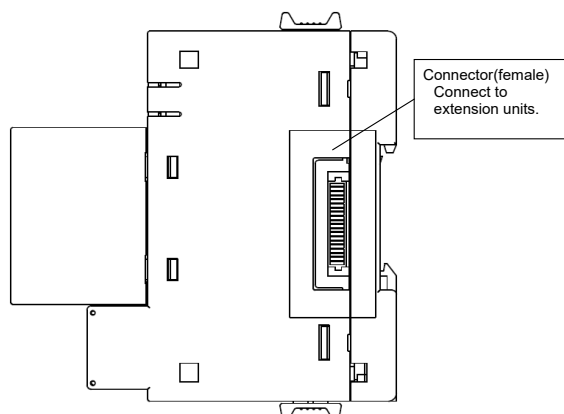


(3)Back view and side view

Back view




Right side



3.2 Indication and function of LEDs

The names and operations of LEDs are as follows.

Name	Color	Function	Status
RUN LED	Red	Indicate operating status of this unit.	ON: Normal operation OFF: Power off or hardware failure ^{※1}
MEA. A1 LED	Red	Indicate measuring status of this circuit A1.	ON: In the middle of measuring OFF: Halting measurement
MEA. B1 LED	Red	Indicate measuring status of this circuit B1.	ON: In the middle of measuring OFF: Halting measurement
MEA. A2 LED ^{※2}	Red	Indicate measuring status of this circuit A2.	ON: In the middle of measuring OFF: Halting measurement
MEA. B2 LED ^{※2}	Red	Indicate measuring status of this circuit B2.	ON: In the middle of measuring OFF: Halting measurement
ALM. A1 LED	Red	Indicate occurrence status of upper/lower limit alert of the circuit A1.	ON: An error occurs ^{※1} Blink ^{※3} : Upper/lower limit alert is issued OFF: No alert
ALM. B1 LED	Red	Indicate occurrence status of upper/lower limit alert of the circuit B1.	ON: An error occurs ^{※1} Blink ^{※3} : Upper/lower limit alert is issued OFF: No alert
ALM. A2 LED ^{※2}	Red	Indicate occurrence status of upper/lower limit alert of the circuit A2.	ON: An error occurs ^{※1} Blink ^{※3} : Upper/lower limit alert is issued OFF: No alert
ALM. B2 LED ^{※2}	Red	Indicate occurrence status of upper/lower limit alert of the circuit B2.	ON: An error occurs ^{※1} Blink ^{※3} : Upper/lower limit alert is issued OFF: No alert

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

※2: In the case of single-phase 2-wire system, these indicate the status of the measured circuit of the current sensor in No.1 side of the circuit. (Reference to 3.3 2 circuits measuring in 1P2W)

※3: Repeat 500msec lighting and 500msec extinction.

3.3 2 circuits measuring in 1P2W

This unit can measure 2 circuits in the case wiring type 1P2W.

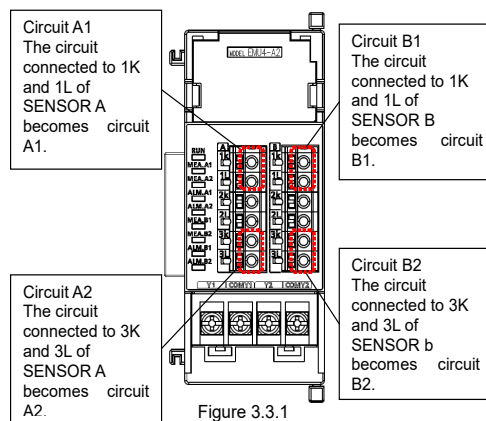
It is a function to measure the 1P2W of 1-N and 3-N branched from 1P3W. (Reference to Figure 3.3.2)

2 circuits measuring can be conducted when current sensor is connected to 1 side (1K, 1L) and 3 side (3K, 3L). (Reference to Figure 3.3.1 and 3.3.2)

Please reference to  5 Procedure for wiring.

Please reference to  6 Setting and EMU4-D65 User's Manual (Details) when setup for measuring 2 circuits.

You can only measure same primary current value in 1 side and 3 side when 2 circuit measuring mode.



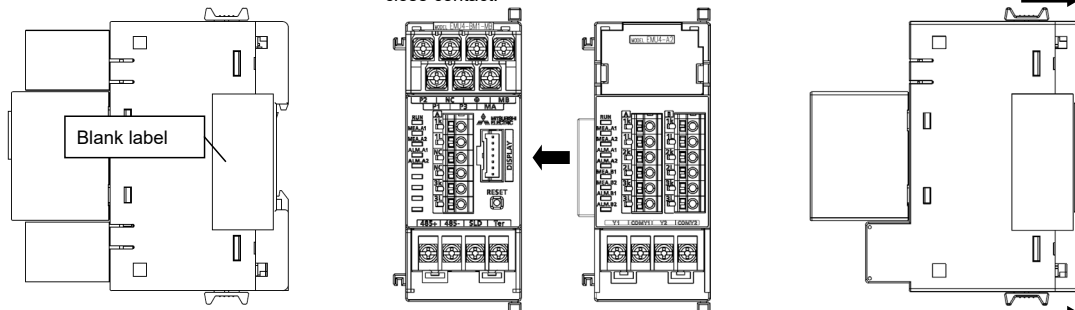
4. Attaching and removing the unit

⚠Caution

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

4.1 How extension to measure unit

- Peel off the label pasted right part of measure unit
- Plug connector (male) to connector (female) of measure unit for brought into close contact.
- Rock the extension unit to slide consolidated claws (green).



※Up to 3 units can be connected in a measure unit.

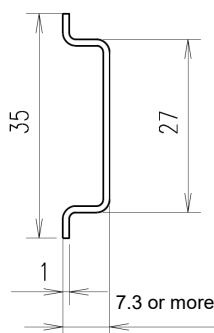
※EMU4-BM1-MB, EMU4-HM1-MB, EMU4-LG1-MB and EMU4-CNT-MB are the connectable unit as a measure unit.

⚠Caution

Do not disassemble or modify this unit. It may cause failure, malfunction, injury or fire.

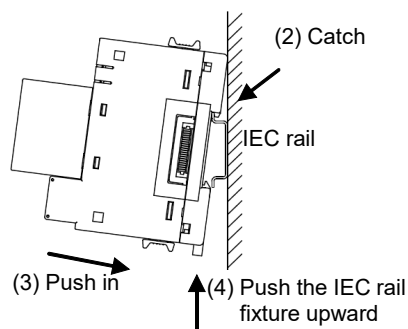
4.2 Mounting on IEC rail

- Applicable IEC rail (35mm)

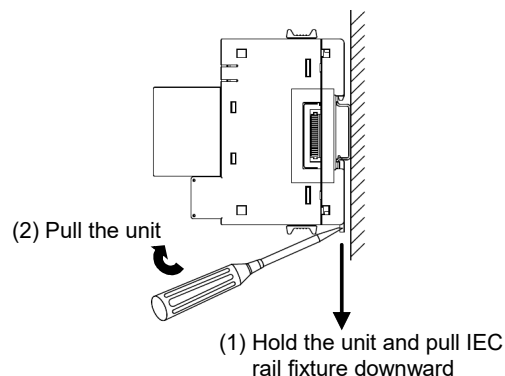


- Mounting

- Pull IEC rail fixture downward

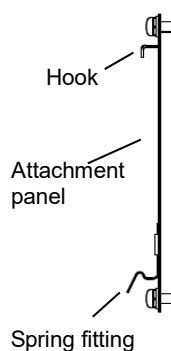


- Removing



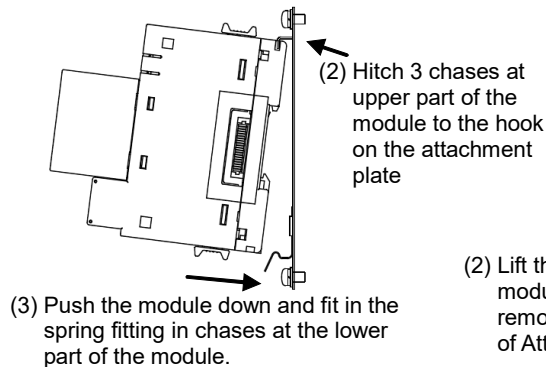
4.3 Mounting on JIS agreement type attachment

- JIS agreement type attachment

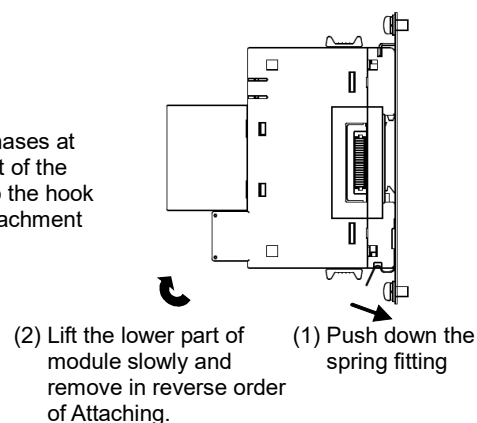


- Mounting

- Push the stopper of the IEC rail above



- Removing



5. Procedure for wiring

Follow the wiring diagram for external connections of this unit.

To use this unit, Base unit (EMU4-BM1-MB, EMU4-HM1-MB, EMU4-LG1-MB, EMU4-CNT-MB) is necessary.

When using this unit, current sensor (EMU-CT***, EMU-CT***-A, EMU2-CT5 or EMU2-CT5-4W) is necessary
(Note) "****" indicates the rated current of the current sensor (50/100/250/400/600).

Please select current sensor refer to below table if UL is required.

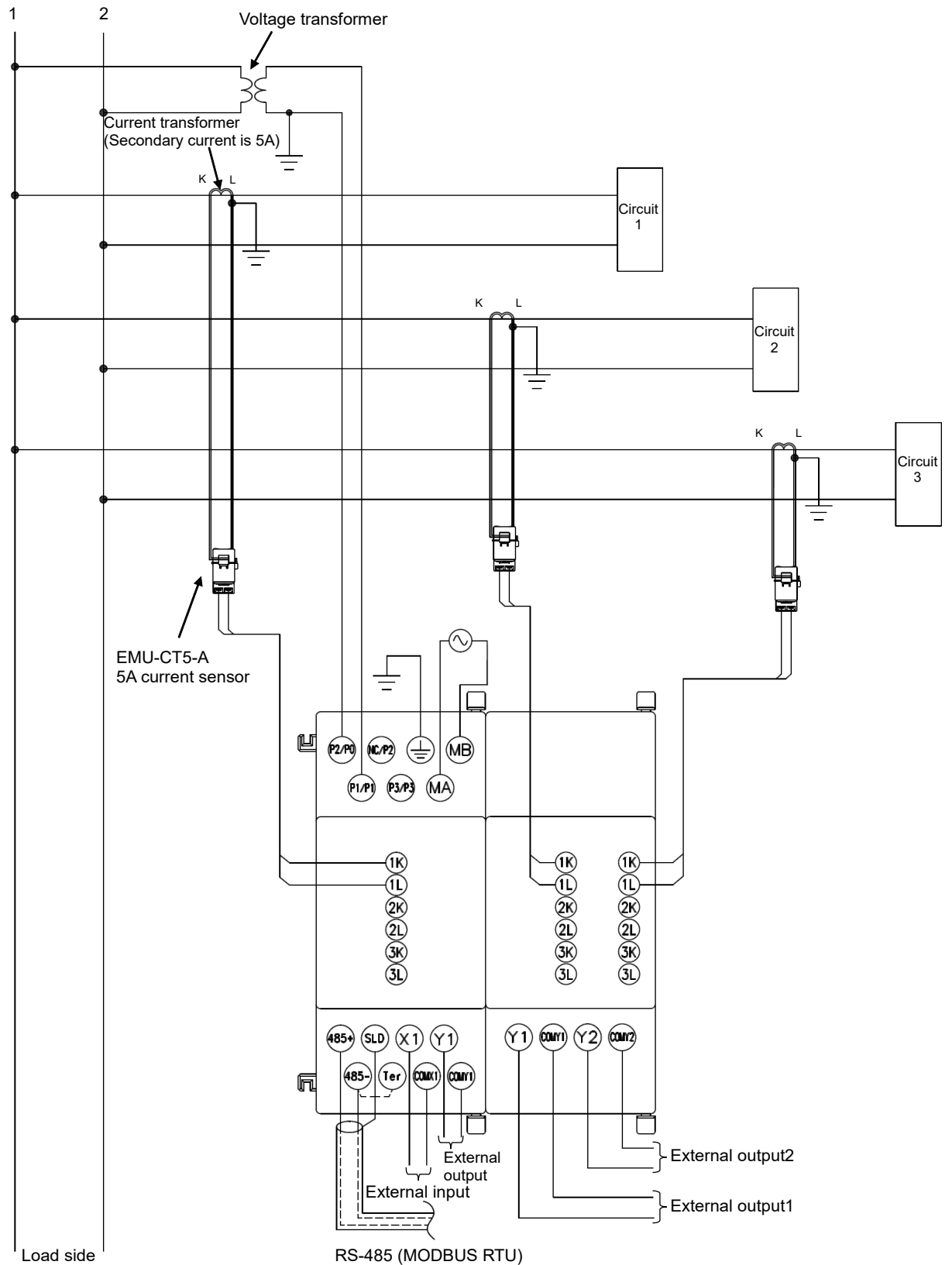
When UL compliance is unnecessary			When UL compliance is necessary		
Useable current sensor			Useable current sensor		
Model	Support	Remark	Model	Support	Remark
EMU-CT50	○	Connection with general wire	EMU-CT50	○	Connection with general wire
EMU-CT100	○		EMU-CT100	○	
EMU-CT250	○		EMU-CT250	○	
EMU-CT400	○		EMU-CT400	×	
EMU-CT600	○		EMU-CT600	×	
EMU-CT5-A	○		EMU-CT5-A	×	
EMU-CT50-A	○		EMU-CT50-A	×	
EMU-CT100-A	○		EMU-CT100-A	×	
EMU-CT250-A	○		EMU-CT250-A	×	
EMU-CT400-A	○		EMU-CT400-A	○	
EMU-CT600-A	○		EMU-CT600-A	○	
EMU2-CT5	○	Connection with dedicated cable	EMU2-CT5	○	Connection with dedicated cable
EMU2-CT5-4W	○		EMU2-CT5-4W	○	

5.1 Wiring for EMU4-A2

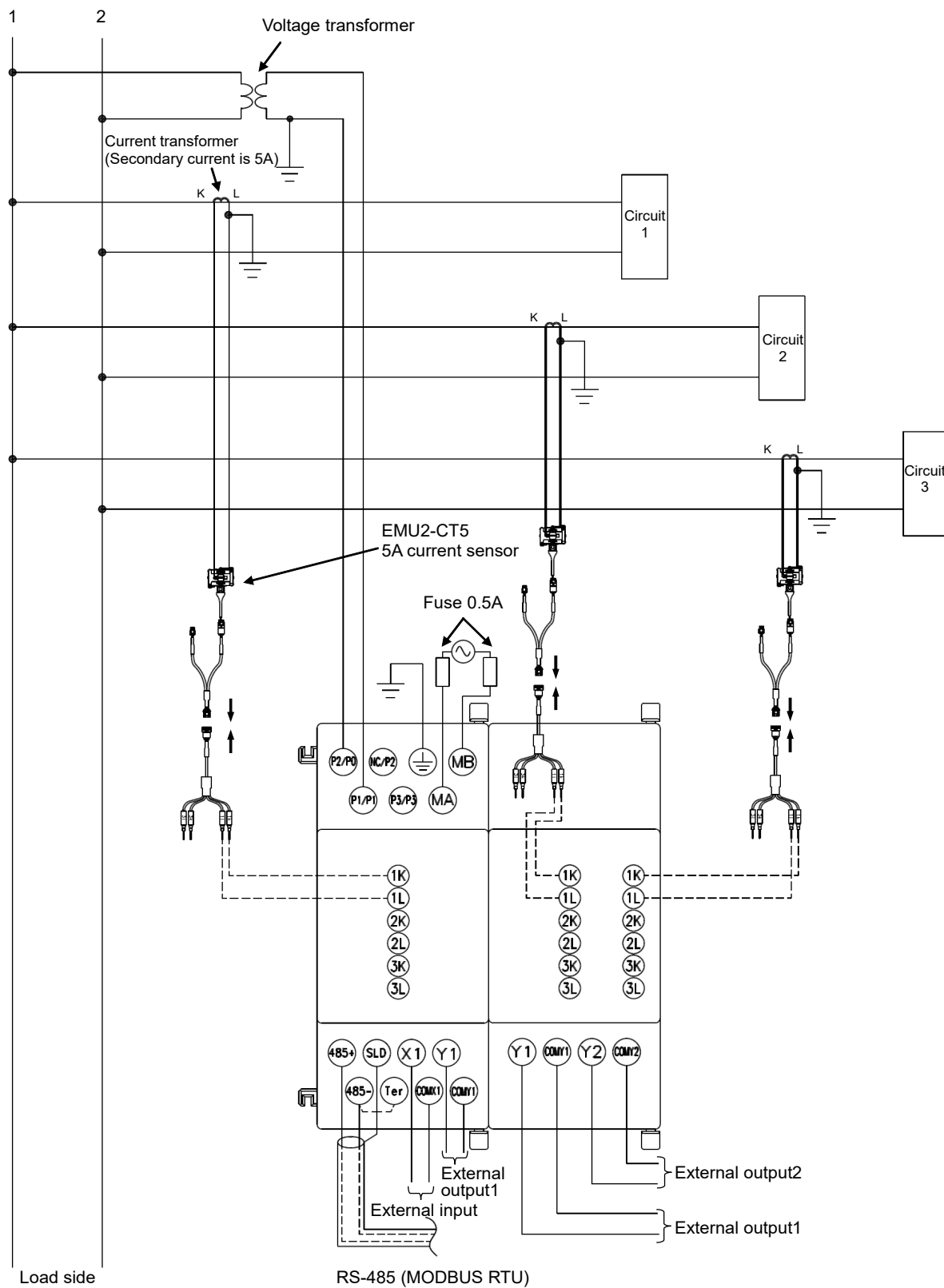
(1) 1P2W (High voltage circuits)

① Not conforming to UL

Power supply side



② Confitming to UL
Power supply side



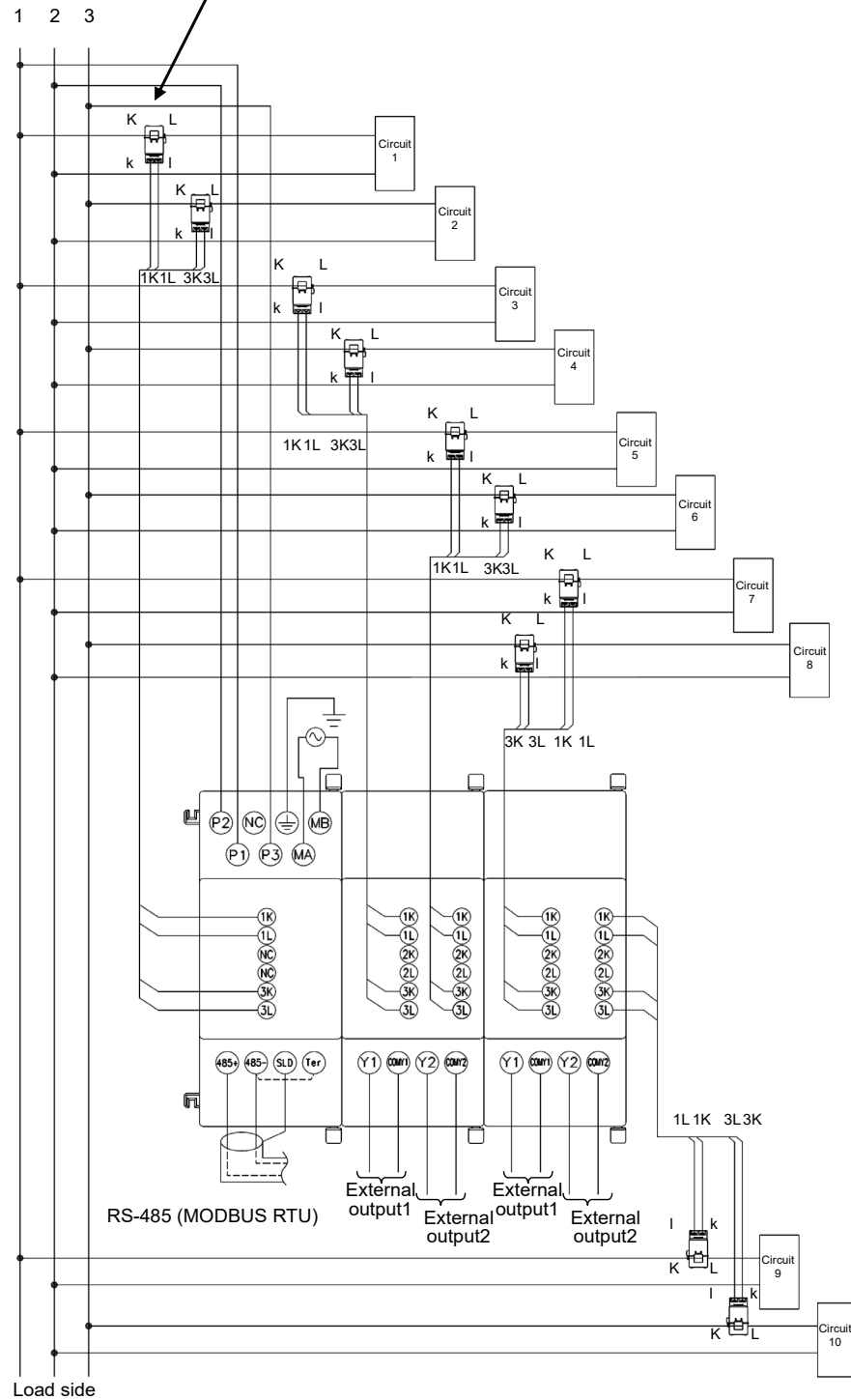
1: The 3 sides of the current sensor cable are not used.

Remove the 3 sides of the cable from the connector part, and treat the connector and terminal part with insulating tape.

- ① Not confirming to UL

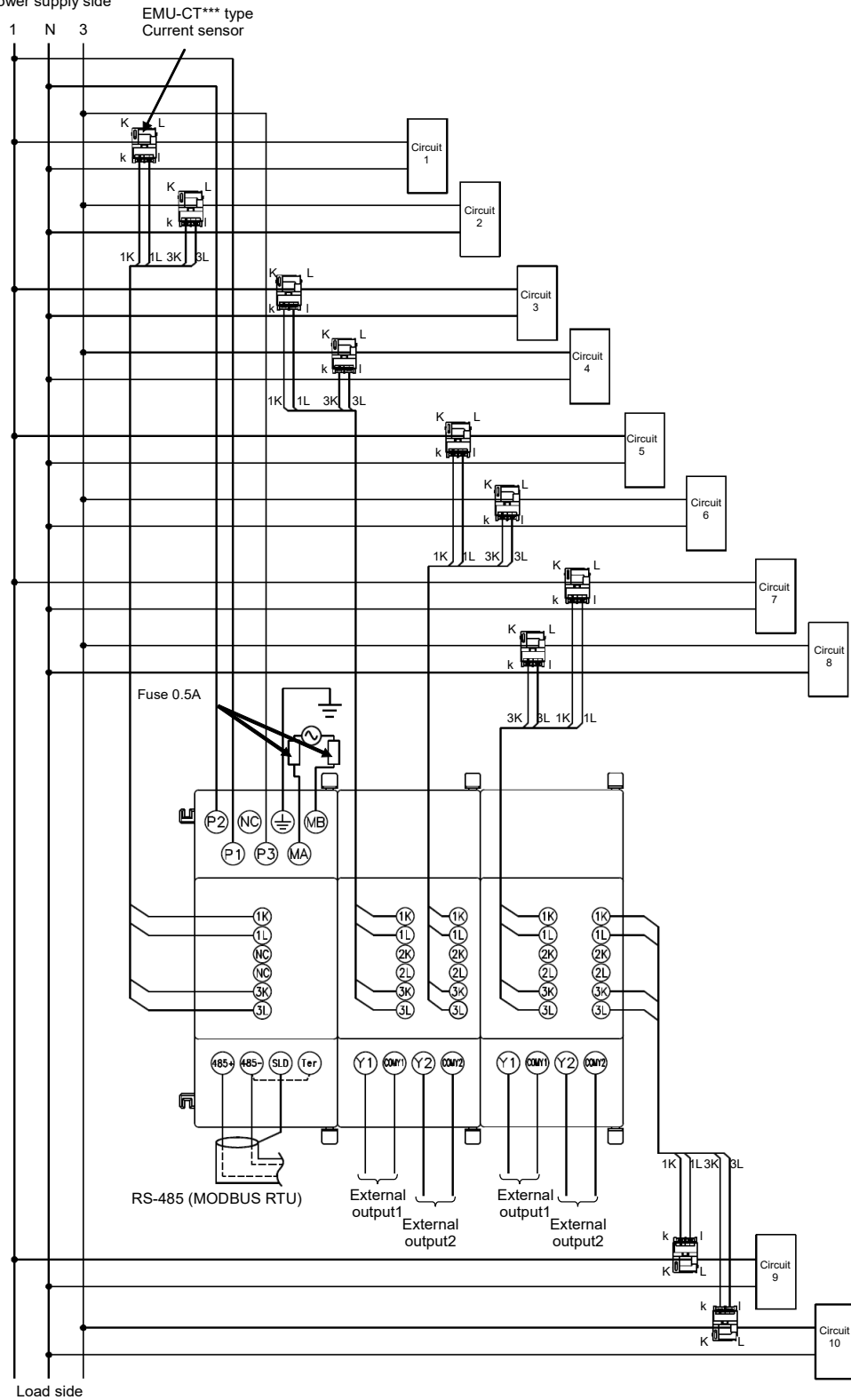
1 N 3

EMU-CT*** type
Current sensor



② Confirming to UL

Power supply side

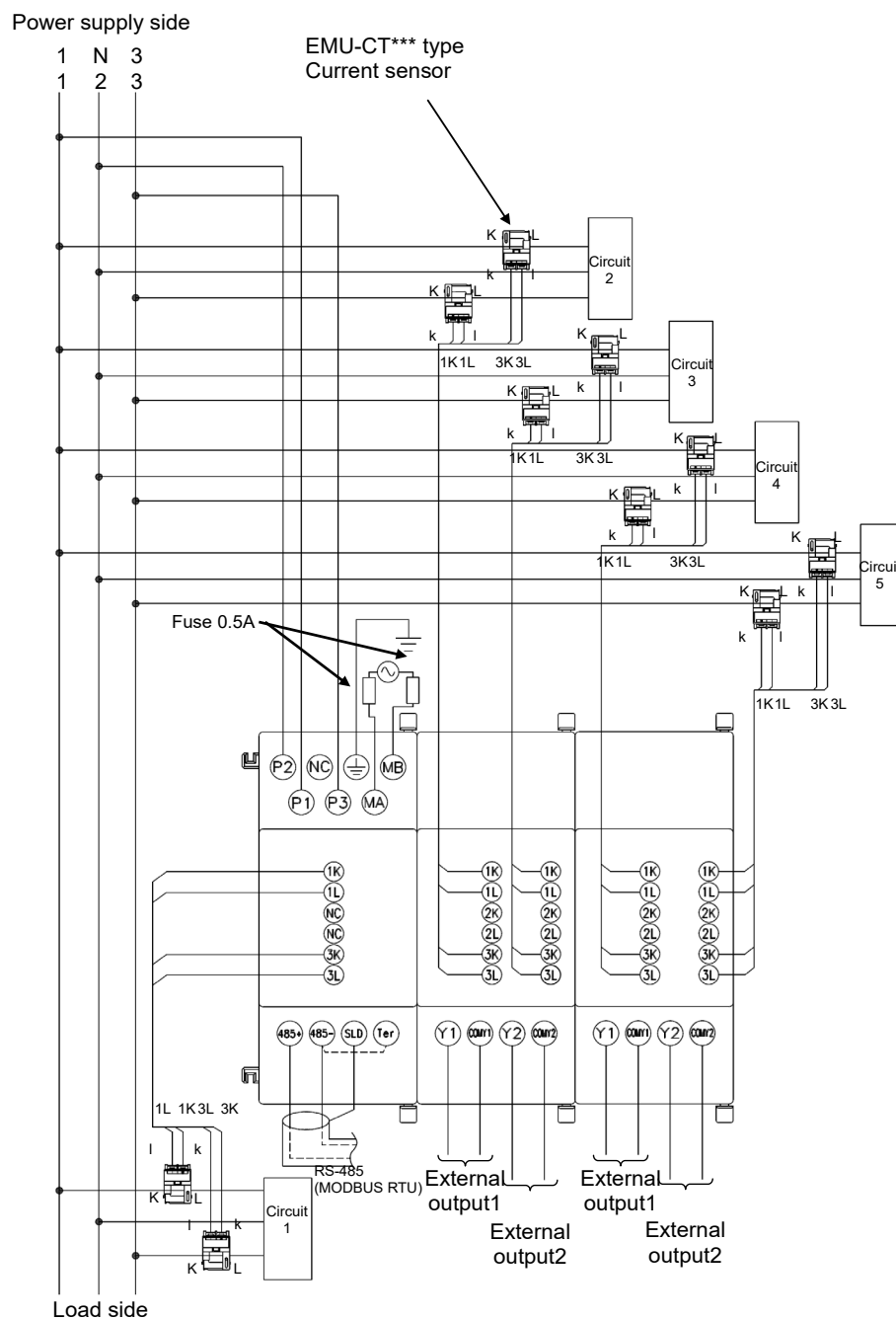


① Not confirming to UL

1	N	3
1	2	3



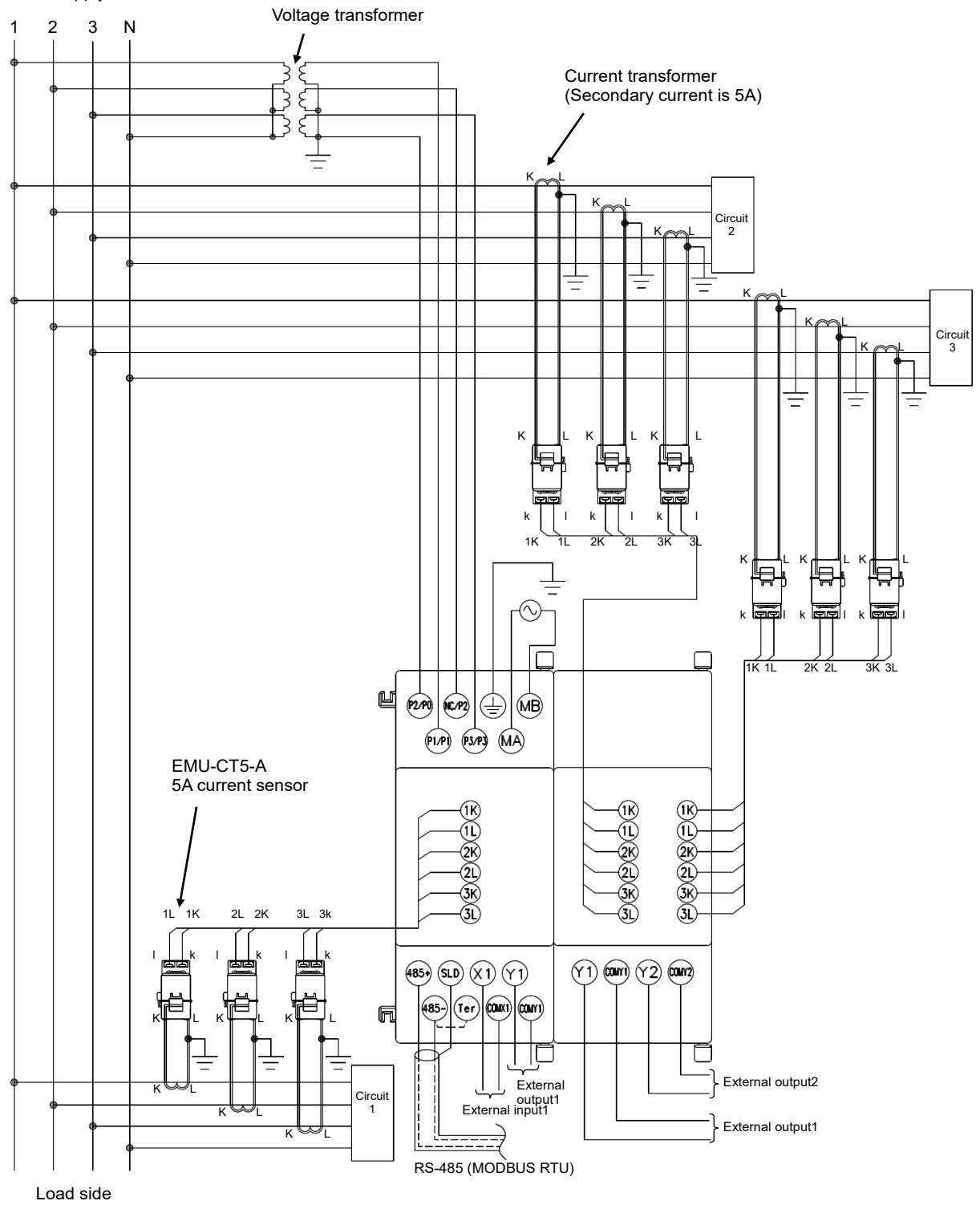
② Confirming to UL



(4) 3P4W (High voltage circuits)

① Not conforming to UL

Power supply side



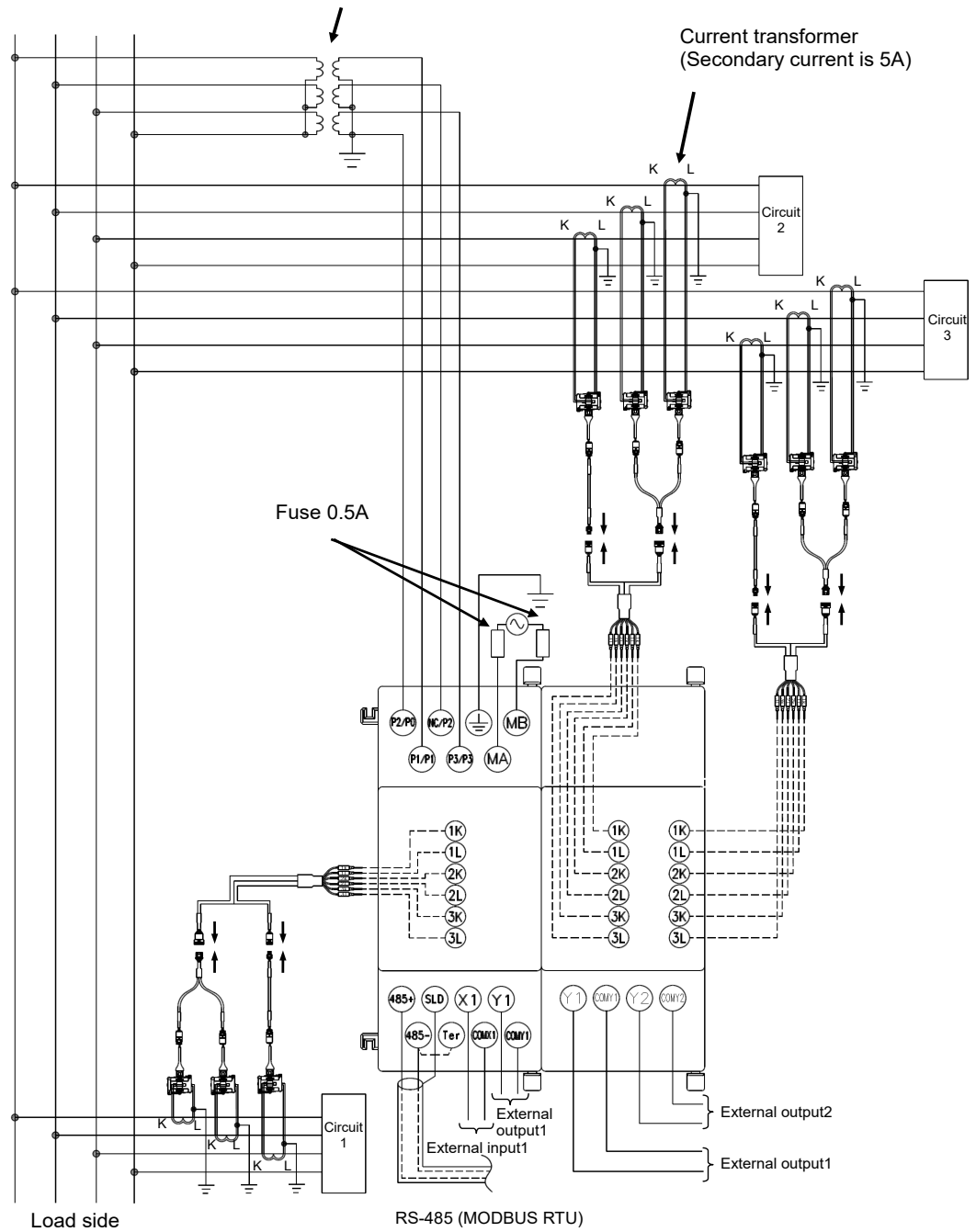
② Confirming to UL

Power supply side

1 2 3 N

Voltage transformer

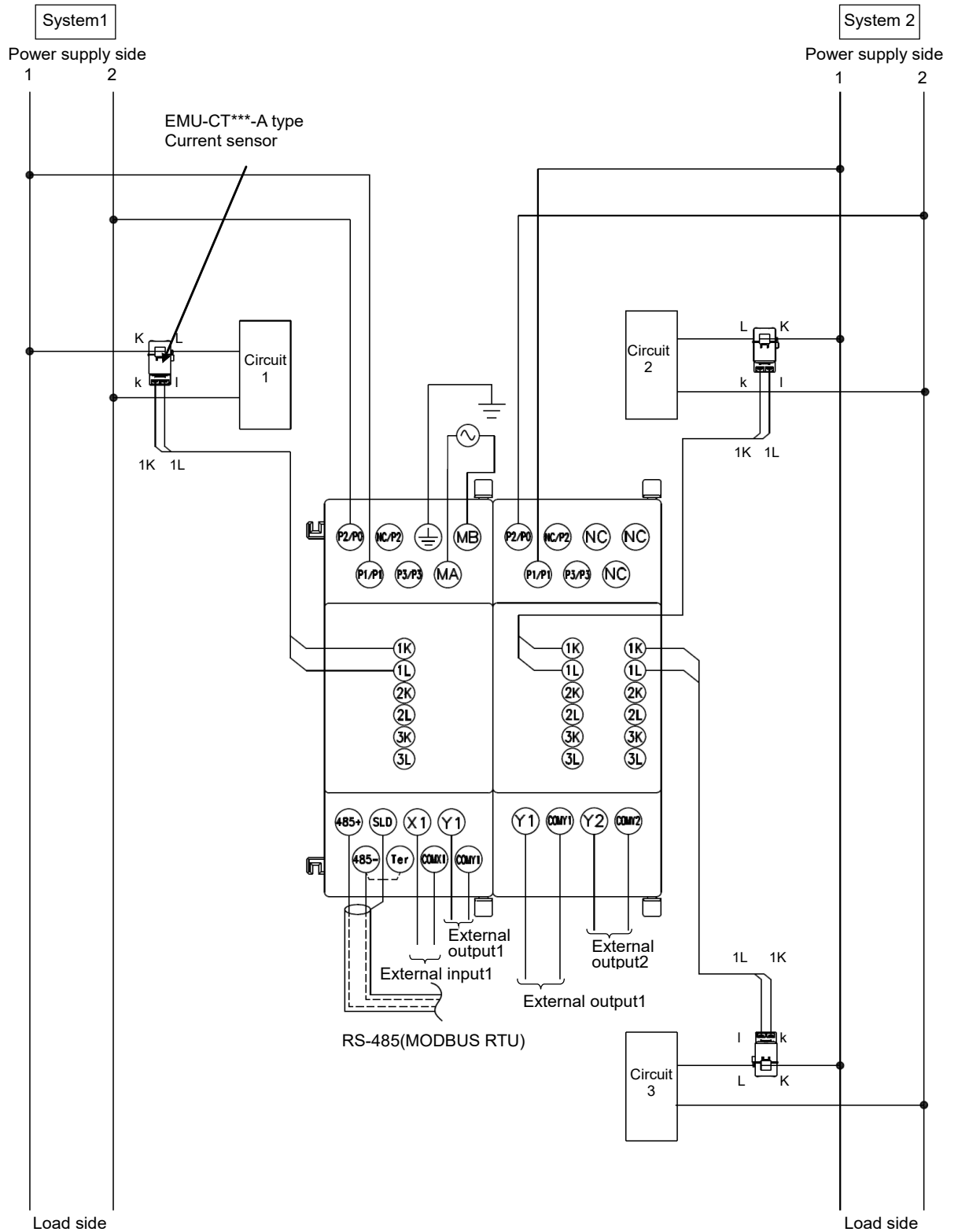
Current transformer
(Secondary current is 5A)



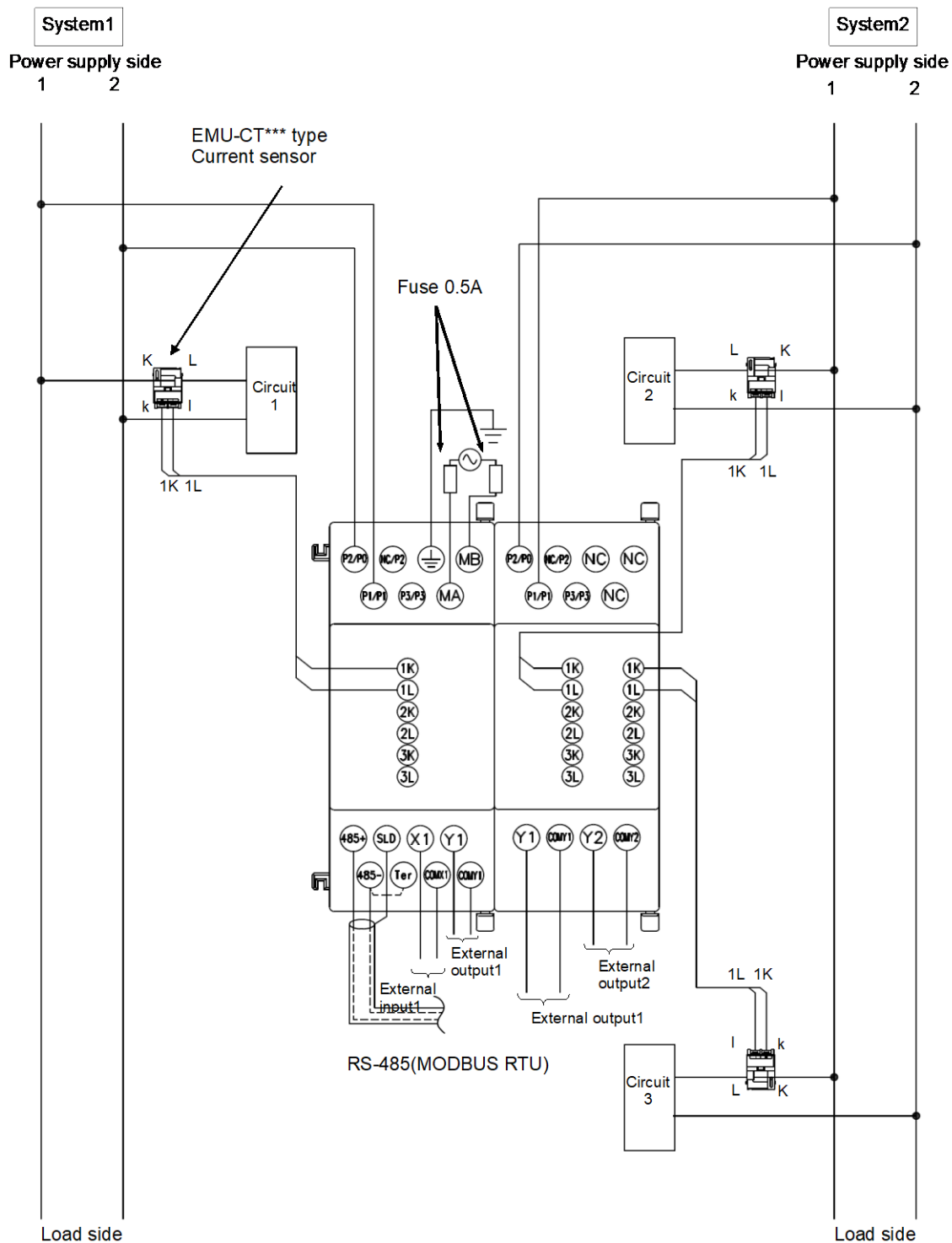
5.2 Wiring for EMU4-VA2

(1) 1P2W (Low voltage circuits)

① Not confirming to UL

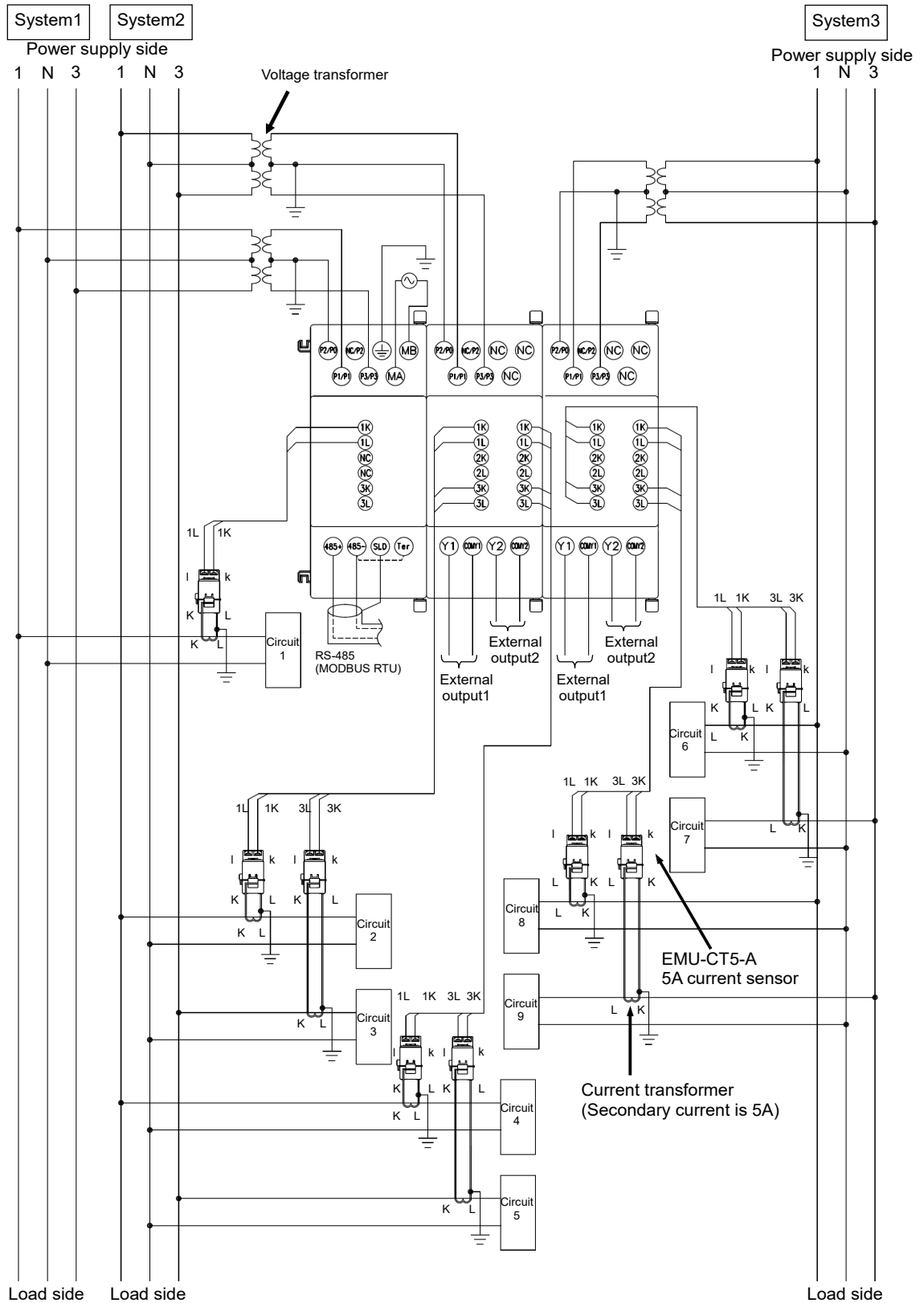


② Confirming to UL

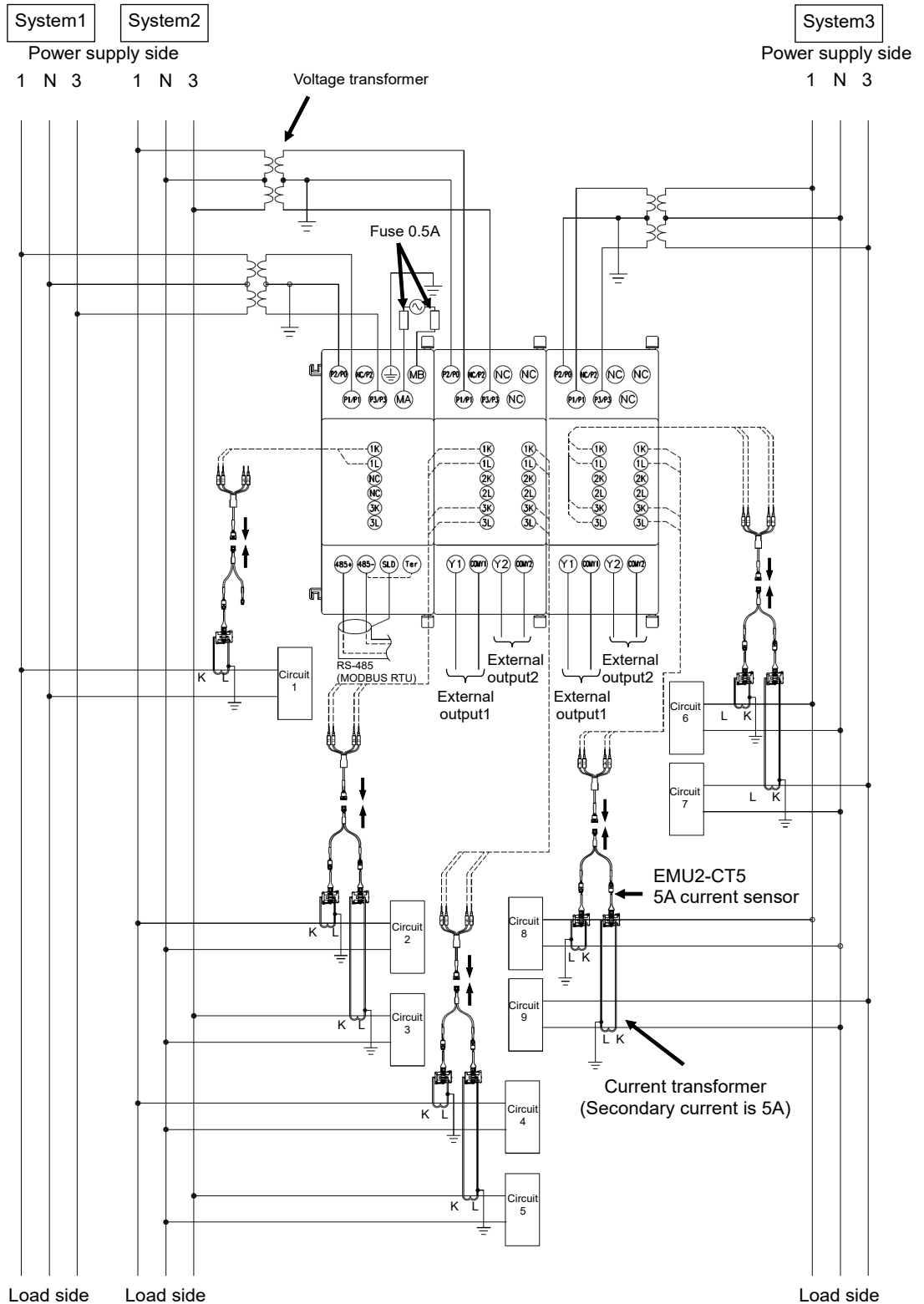


(2) 1P2W (High voltage circuits, 2 circuits measuring)

① Not conforming to UL



② Confirming to UL



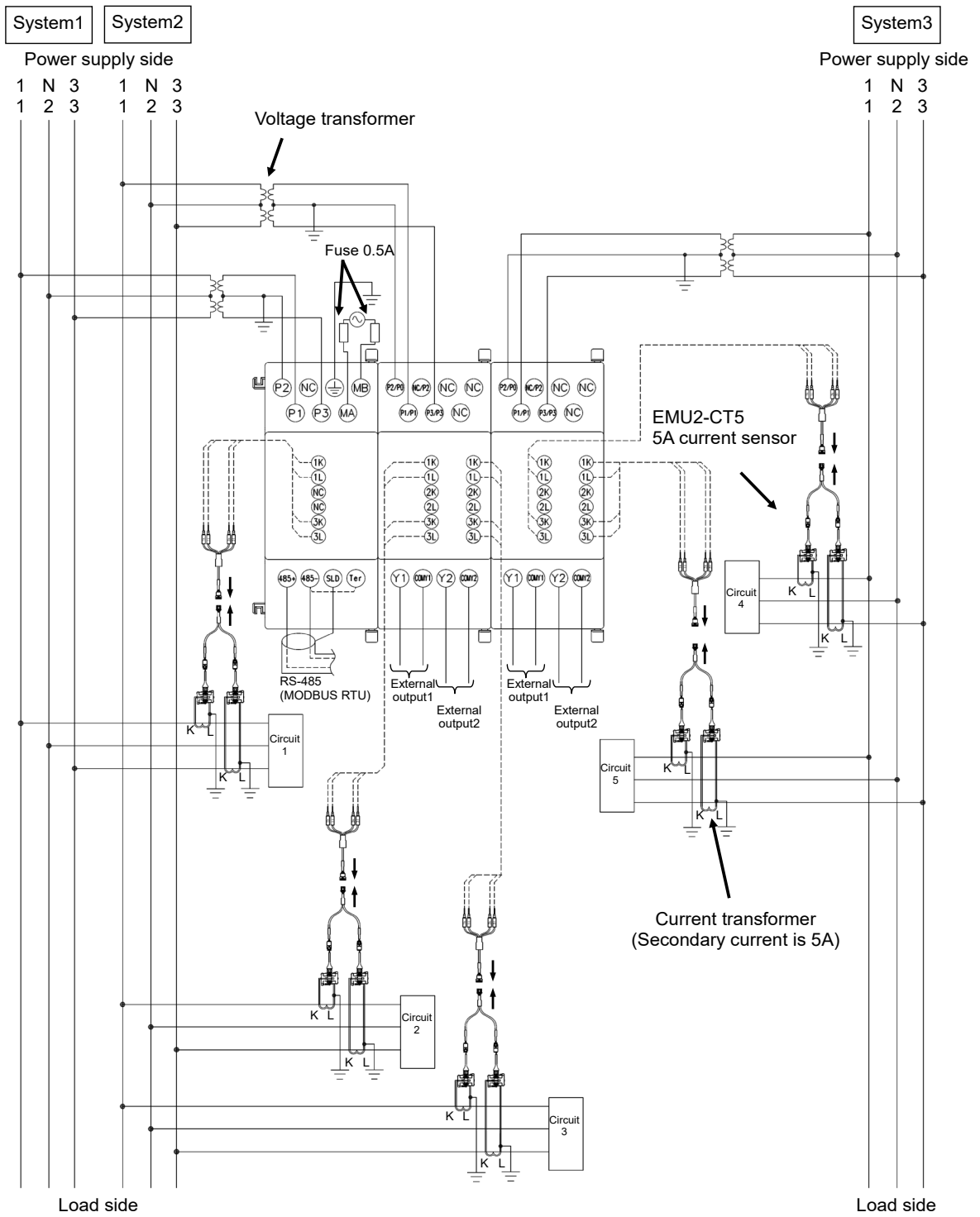
1: The 3 sides of the current sensor cable are not used.

Remove the 3 sides of the cable from the connector part, and treat the connector and terminal part with insulating tape.

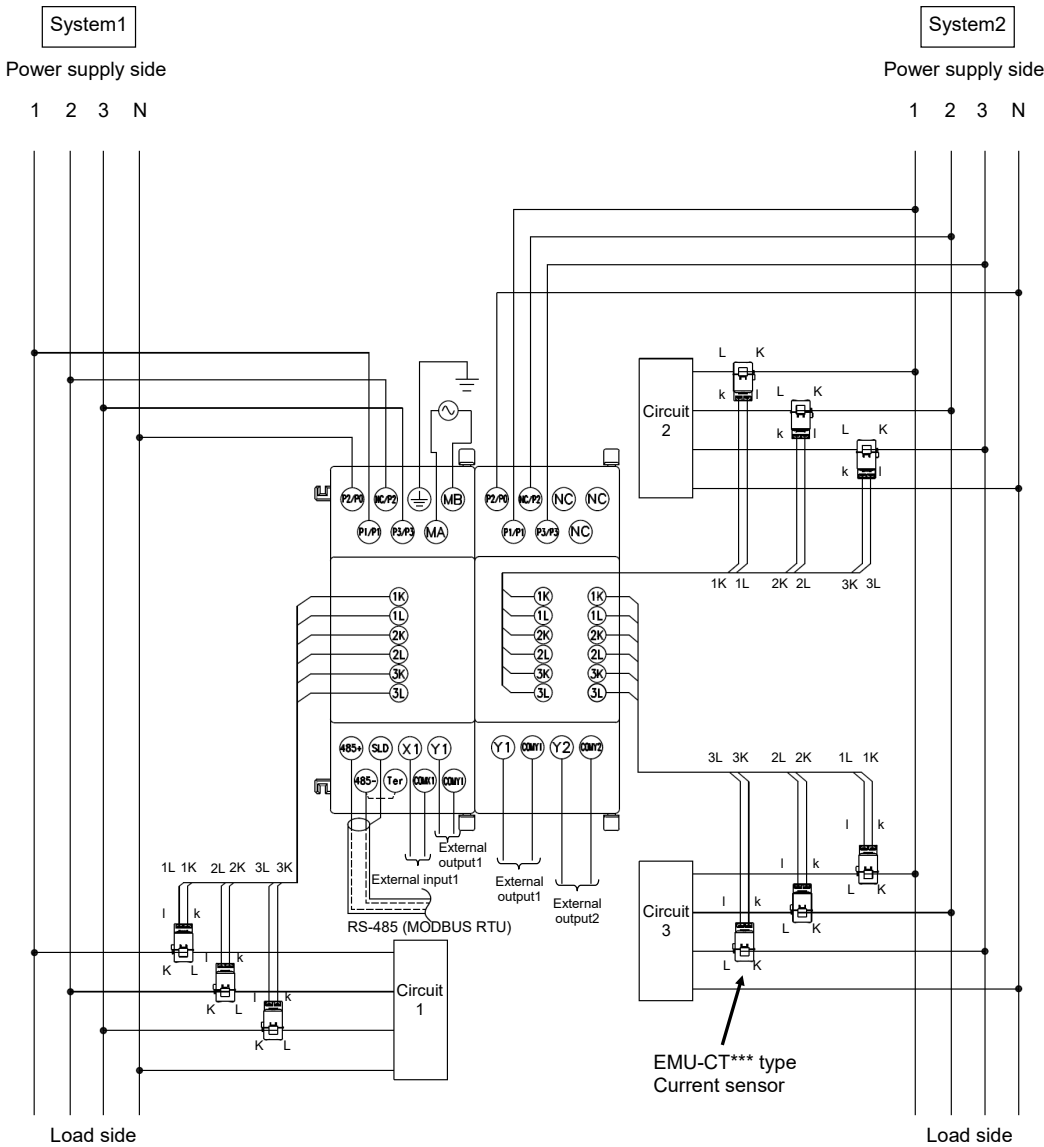
① Not confirming to UL



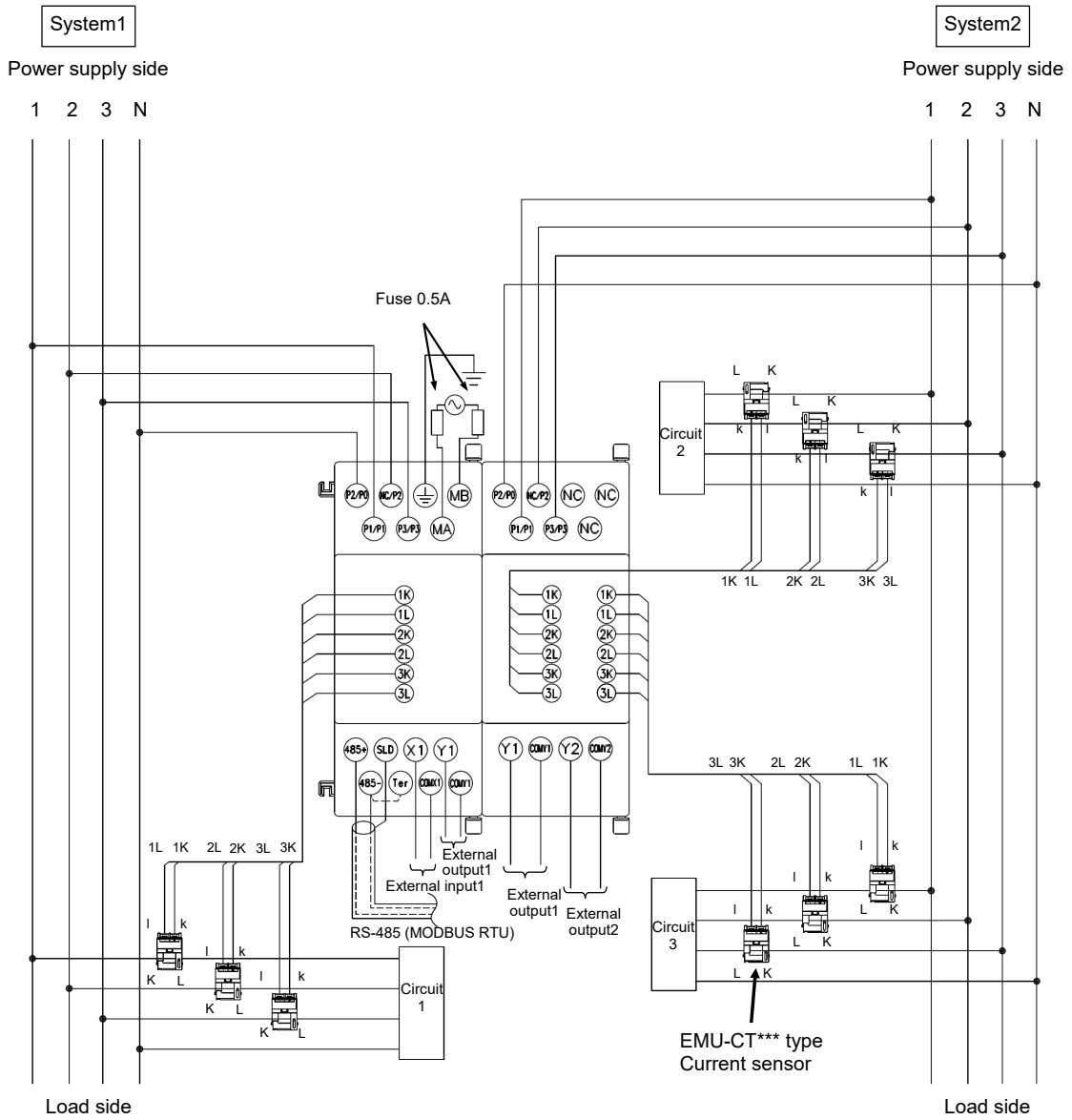
② Confirming to UL



(4) 3P4W (Low voltage circuits)
① Not confirming to UL



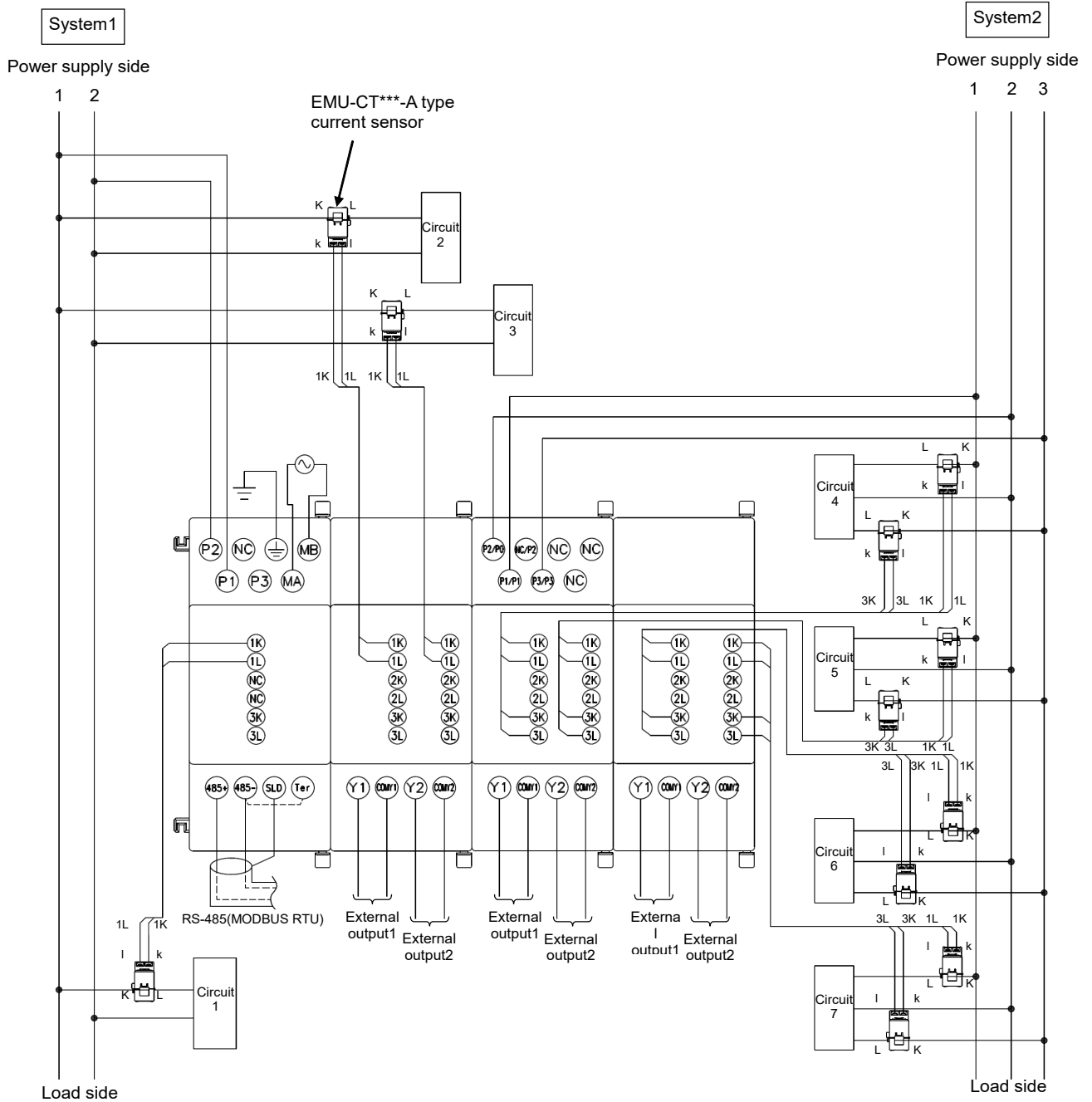
② Confirming to UL



5.3 Extension of EMU4-A2, EMU4-VA2

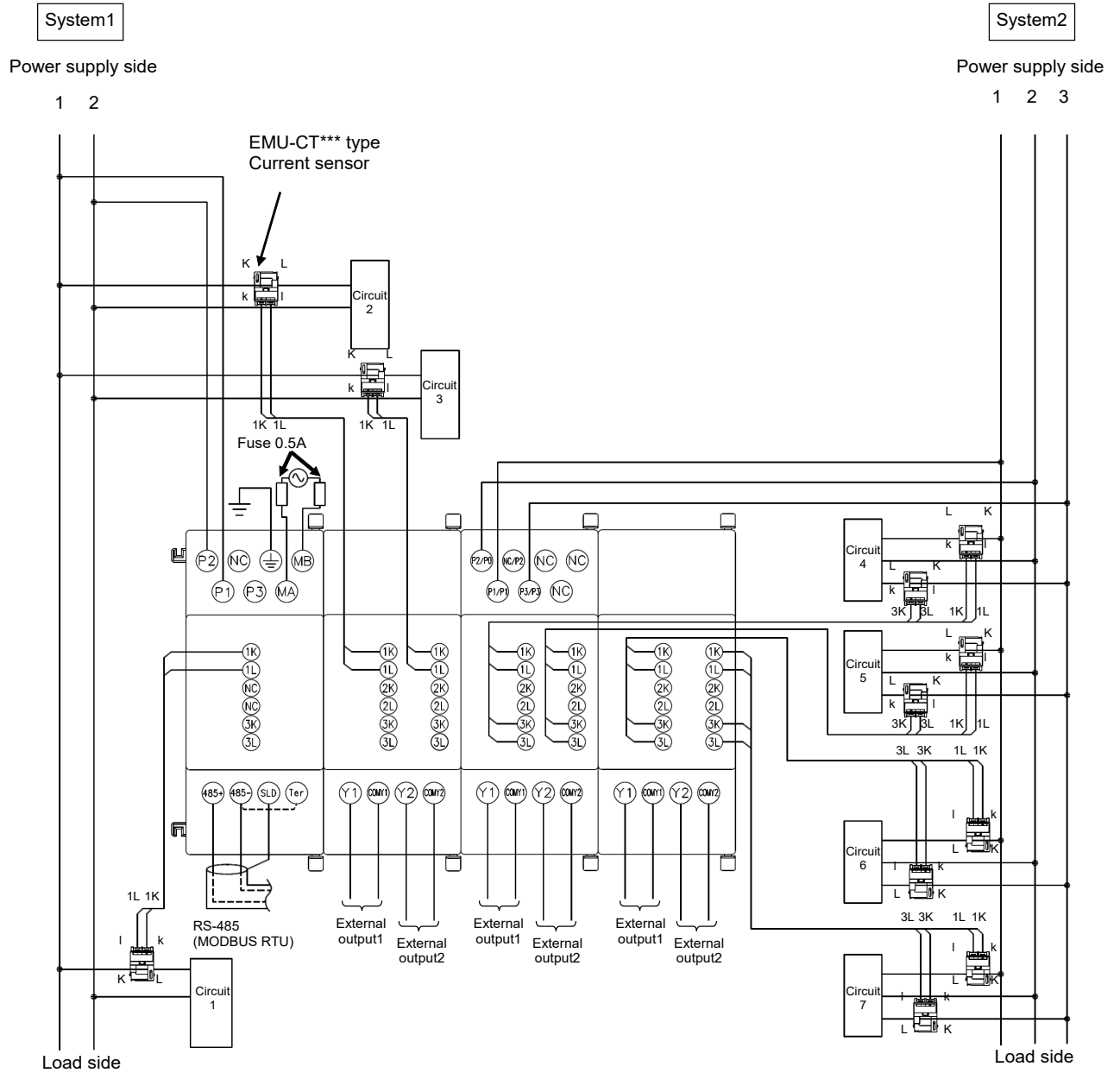
(1) Not conforming to UL

System1: 1P2W (Low voltage circuit), System2: 3P3W (Low voltage circuit)



(2) Confirming to UL.

System1: 1P2W(Low voltage circuit) , System2: 3P3W(Low voltage circuit)



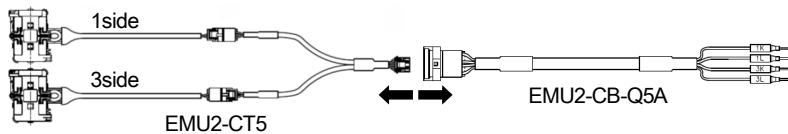
5.4 Precautions for the connection wire

⚠Cautions	<ul style="list-style-type: none">For protection against noise, transmission lines and input/output lines shall not be placed close to or bound together with the power lines and high-voltage lines. Keep distance as below between them. (except for the terminal block) If there is concern about the influence of noise even if the distance is as follows, we recommend using a shielded cable.	
	Condition	Distance
	High-voltage line 600V or less	300mm or more
	Other high-voltage line	600mm or more
	<ul style="list-style-type: none">For the actual usage, connect the FG terminal to ground. (D-type ground: Type 3) Connect it directly to the ground terminal.Do not connect to FG terminal during the insulation resistance test and pressure test. Refer to “User’s manual (Details)” Chapter 11 “Specifications” for the applying place.The current sensors dedicated to this unit EMU-CT400/600 resemble the split current transformer for general gauges CW-5SL closely in appearance. However, characteristics are completely different. Be sure to connect the dedicated current sensor. Connecting CW-5SL to this unit directly may cause failure of the device, a burnout or a fire.	

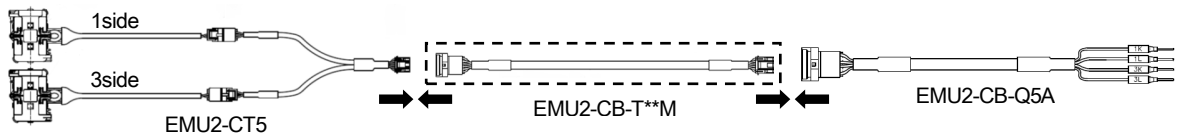
- Maximum voltage of the circuit connected to EMU4-BM1-MB is 260V, EMU4-HM1-MB is 480 (In 3P4W wiring is 277 / 480V). For the circuit over this voltage, use the transformer. Using the transformer, primary voltage is configurable up to 11000V. Secondary voltage can be set up to 220V.)
- For MODBUS communication wiring, recommended to have the extra length wires about 200mm (When extended to B / NET transmission from MODBUS communication, use of MODBUS communication wiring is possible).
- Make sure that before connecting the cable, the orientation of the current sensor is correct for attachment. K to L is the correct direction. K: power source side, L: load side
- EMU-CT*** and EMU-CT***-A are extendable up to 50m.
- EMU2-CT5 and EMU2-CT5-4W can be extended as follows.

(1) When extending EMU2-CT5 with a current sensor extension cable: EMU2-CB-T ** M (You can extend up to 11m with extension cable)

①Remove the connector.

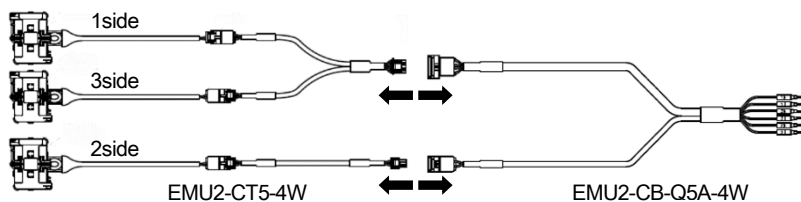


②Connect the current sensor extension cable.

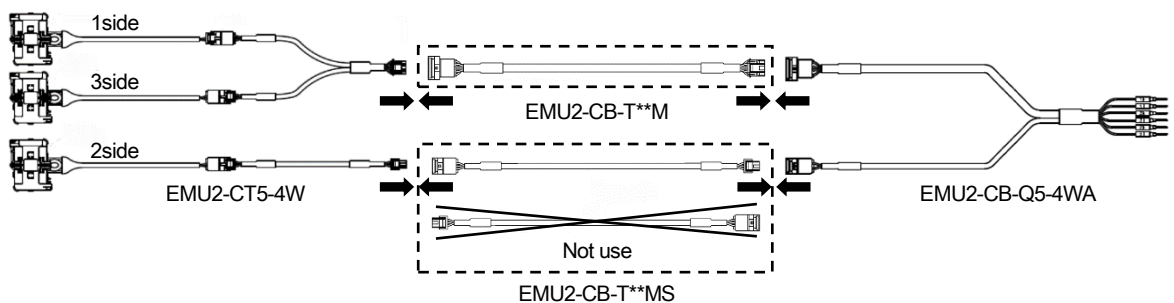


(2) When extending EMU2-CT5-4W with a current sensor extension cable: EMU2-CB-T ** M and EMU2-CB-T ** MS (You can extend up to 11m with extension cable)

①Remove the connector.



②Connect the current sensor extension cable.



(3) If you want to extend a longer distance than the above (1) and (2), please extend the secondary side of current transformer (CT).

- EMU2-CT5 and EMU2-CT5-4W are extendable up to 11 m, using together with an extension cable. To extend the wire further, use the current transformer CW-5S (L) for split-type instrument in combination, extending the secondary wiring on CW-5S (L) side.
- EMU-CT*** and EMU-CT***-A are used only for low voltage circuit. It cannot be used for a high voltage circuit. EMU2-CT5 and EMU2-CT5-4W should be used with the secondary side (5A) of transformer transfixed. If they are used for the circuit directly, they should be used under 200V.
- Connect the k and l terminals on the secondary side of current sensor to the 1k and 1l (2k,2l,3k,3l) terminals of the measuring unit.

5.3.1 How to connect wire

<Voltage input terminals, External input/output terminals>

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

【EMU4-A2】

	Applicable wire	Tightening torque	Applicable crimp-type terminal
Terminals of external input/output	Stranded wire: AWG22-16 (0.3 - 1.3mm ²) Single wire: AWG22-16 (0.65 - 1.25mm)	0.5 - 0.6 N·m	For M3 screw of external diameter below 6.1mm

【EMU4-VA2】

	Applicable wire	Tightening torque	Applicable crimp-type terminal
Power supply terminals, Voltage input terminals	Stranded wire: AWG22-16 (0.3 - 1.3mm ²) Single wire: AWG22-16 (0.65 - 1.25mm)	0.8 - 1.0N·m	For M3.5 screw of external diameter below 7.1mm
External input/output terminals	Stranded wire: AWG26-16 (0.3 - 1.3mm ²) Single wire: AWG26-16 (0.65 - 1.25mm)	0.5 - 0.6N·m	For M3 screw of external diameter below 6.1mm

<Current input terminals>

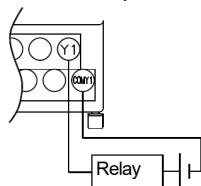
- Stripping length of the used wire in use has to be 10 to 11mm.
- In case using stranded wire, take measures so that the filament should not vary by using a bar terminal or by processing the point twisted.
- When attaching and detaching cables to/from the terminal, use the push button. Check that the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

Applicable wire	Applicable crimp-type terminal
stranded wire: AWG20-16 (0.5 - 1.3mm ²) single wire: AWG24-17 (0.5 - 1.2mm)	TGV TC-1.25-11T (by NICHIFU) equivalent

5.3.2 Connection of external input / external output

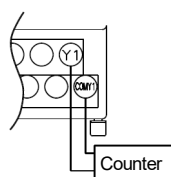
In case using external input and/or external output, refer to the following.

External output: For the case of contact output



No-voltage a-contact
DC 35V 75mA or,
AC 24V 75mA (power factor : 1)

External output: For the case of pulse output



No-voltage a-contact
DC 35V 75mA or,
AC 24V 75mA (power factor : 1)

Wiring length of external input (Reference value)

The wire length for each wire diameter is below. Please refer to wiring.

※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

The data can be setup is showed below.

6.1.1 Phase wire system

Setup is showed in below table in each unit. Range can setup in EMU4-A2 is same the unit connected to left side.

Model	Unit connected to left side	Setting value
EMU4-A2	EMU4-BM1-MB	1P2W, 1P3W, 3P3W
	EMU4-HM1-MB	1P2W, 1P3W, 3P3W , 3P4W
	EMU4-LG1-MB	
EMU4-VA2	—	1P2W, 1P3W, 3P3W , 3P4W

6.1.2 2 circuits measuring

Setup 2 circuits measuring when wiring type is setup 1P2W in 6.1.1

2 circuits measuring
ON , Off

6.1.3 Primary voltage

Set the rated voltage of the measuring circuit.

Please setup [non-use of VT] when not using VT, or [Use] when using VT.

Please setup the primary voltage of VT when setting [Use]. Setup value is showed in below table in each unit, phase wire system.

Model	Unit connected to left side	Wiring type	Use or non-use of VT	Setting value
EMU4-A2	EMU4-BM1-MB	1P2W/3P3W	Non-use of VT	[Direct voltage]: 110V, 220V
			Use of VT	[Primary voltage]: 440V , 690V, 1100V, 2200V, 3300V, 6600V, 11000V, 13200V, 13800V, 15000V, 16500V, 22000V, 24000V, 33000V, 66000V, 77000V, 110000V, SP* ※You can set [Special primary voltage] and [Special secondary voltage] when SP setting. Can be set in the 1V step. [Special primary voltage]: 1 to 110000V (440V) [Special secondary voltage]: 1 to 220V (110V)
		1P3W	Non-use of VT (Hold)	[Direct voltage]: 110V
		1P3W	Non-use of VT (Hold)	[Direct voltage]: 110V, 220V , 440V
	Excepting EMU4-BM1-MB	1P2W/3P3W	Use of VT	[Primary voltage]: 440V , 690V, 1100V, 2200V, 3300V, 6600V, 11000V, 13200V, 13800V, 15000V, 16500V, 22000V, 24000V, 33000V, 66000V, 77000V, 110000V, SP* ※You can set [Special primary voltage] and [Special secondary voltage] when SP setting. Can be set in the 1V step. [Special primary voltage]: 1 to 110000V (440V) [Special secondary voltage]: 1 to 220V (110V)
		1P3W	Non-use of VT (Hold)	[Direct voltage]: 110V , 220V
		3P4W	Non-use of VT	[Direct voltage]: 63.5V, 100V, 105V, 110V, 115V, 120V, 127V, 200V, 220V , 230V, 240V, 242V, 250V, 254V, 265V, 277V
			Use of VT	[Special primary voltage]: 1 to 63500V (440V) [Special secondary voltage]: 1 to 220V (64V) Can be set in the 1V step.
EMU4-VA2	—	1P2W/3P3W	Non-use of VT	[Direct voltage]: 110V, 220V , 440V
			Use of VT	[Primary voltage]: 440V , 690V, 1100V, 2200V, 3300V, 6600V, 11000V, 13200V, 13800V, 15000V, 16500V, 22000V, 24000V, 33000V, 66000V, 77000V, 110000V, SP* ※You can set [Special primary voltage] and [Special secondary voltage] when SP setting. Can be set in the 1V step. [Special primary voltage]: 1 to 110000V (440V) [Special secondary voltage]: 1 to 220V (110V)
		1P3W	Non-use of VT (Hold)	[Direct voltage]: 110V , 220V
		3P4W	Non-use of VT	[Direct voltage]: 63.5V, 100V, 105V, 110V, 115V, 120V, 127V, 200V, 220V , 230V, 240V, 242V, 250V, 254V, 265V, 277V
			Use of VT	[Special primary voltage]: 1 to 63500V (440V) [Special secondary voltage]: 1 to 220V (64V) Can be set in the 1V step.

6.1.4 Primary current

Set the rated current of the measuring circuit.

Primary current is set below value by the sensor type. Value is common regardless of unit.

Sensor type	Setting value
Direct sensor (Use of EMU-CT***, EMU-CT***-A)	[Primary current]: 50A, 100A , 250A, 400A, 600A
5A Sensor (Use of EMU2-CT5, EMU2-CT5-4W, EMU-CT5-A)	[Primary current]: 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, SP※ ※Setup the [Special primary current] in SP setting. 10A less than, the upper two digits. 10A or more is possible to set the upper three digits. [Special primary current]: 5.0 to 30000A(100A)

Caution

- EMU-CT*** and EMU-CT***-A are used only for low voltage circuit. It cannot be used for a high voltage circuit. EMU2-CT5 and EMU2-CT5-4W should be used with the secondary side (5A) of transformer transfixed. If they are used for the circuit directly, they should be used under 200V. If it is connected with a high-voltage circuit by mistake, it may cause a burnout of the device and a fire. It is critically dangerous



Supplement

- Please setup CT rating of primary side when use EMU2-CT5, EMU2-CT5-4W or EMU-CT5-A.
- Primary voltage setting value × primary current setting value can not be set in excess of 88665kW.

For example, if the primary current is set to 30,000 A when the primary voltage setting is 110,000 V, the primary voltage setting is automatically initialized to 220 V. If the primary voltage is set to 110,000 V when the primary current setting is 30,000 A, the primary current setting is automatically initialized to 100 A.

6.1.5 Demand time

Current demand alarm, electric energy can be setup in each. It is common regardless the unit type.

Setting item	Setting value
Current demand time	0sec, 10 sec, 20 sec, 30 sec, 40 sec, 50 sec, 1min, 2 min , 3 min, 4min, 5 min, 6 min, 7 min, 8 min, 9 min, 10 min, 11 min, 12 min, 13 min, 14 min, 15 min, 20 min, 25 min, 30 min
Power demand time	0sec, 10 sec, 20 sec, 30 sec, 40 sec, 50 sec, 1min, 2 min , 3 min, 4min, 5 min, 6 min, 7 min, 8 min, 9 min, 10 min, 11 min, 12 min, 13 min, 14 min, 15 min, 20 min, 25 min, 30 min

6.1.6 Electric energy converted value

Setup the conversion rate and conversion unit of electric converted value.

You can't setup in EMU4-BM1-MB. Setup electric energy conversion rate of 2 circuit (3 side) in 1P2W.

Electric energy converted value = Electric energy × Wh conversion rate

Setting item	Setting value
Wh conversion rate	0.001 to 10000 (1.000)
Unit	Off , Wh, kWh, MWh, J, m ² , m ³ , L, kL, sec, min, hour, piece, unit, g, kg, t, ¥, \$

6.1.7 Cut-off rate of current※

Set the cut-off value when measuring current. Measured current is 0 when measured current is lower than Cut-off current.

Cut-off current = Rated current × Cut-off rate.

Setup is common regardless of unit type. Please setup the the electric energy equivalent rate of 3 side circuits in second circuit.

※The ratio of measured lower current limit (cut-off current) to primary current.


Primary current × cut-off rate = cut-off current

Setting item	Setting value
Cut-off current	0.1 to 50.0% (0.5)

6.1.8 Simple measurement

Setup the whether to do simple measurement.

Setup is common regardless of unit type. Please setup the power factor of 3 side circuits in second circuit in 1P2W.

Please reference to  7.3 Simple measurement

Setting item	Setting value
Simple measurement	OFF , ON
Setup for power factor	-0.01 ~ 100 ~ 0.00

6.1.9 Operating time

Setup the whether to measure operating time. Setting value is showed below table.

Please setup operating time 1side and 3side in 2 circuits measuring in 1P2W.

Operating time is integration time while current measuring when select Current. Operating time is integration time while Contact input is ON when Contact input.

Model	Setting value
Extence of counting of operation time	OFF, ON
Counting method of operating time	Current

6.1.10 External output

Setup the output method of the contact output terminal.

Setup external output in which circuit because of external output terminal is only 1 in 1P2W.

External output	Setting item
External output	Non. Pulse output, Alarm output
Target of external output (1P2W only)	1, 2 *If the target of external output is 1K, 1L connection side circuit, Set [1]. If the target of external output is 3K, 3L connection side circuit, Set [2].

。 Setup below items when external output is setup pulse output.

External output	Setting item														
Pulse output	<p>Setting range is changed by the value of Full load power.</p> <table> <tr> <th>Total load power(kW)</th><th>Setting range</th></tr> <tr> <td>Less than 12</td><td>0.001, 0.01, 0.1, 1</td></tr> <tr> <td>12 or more Less than 120</td><td>0.01, 0.1, 1, 10</td></tr> <tr> <td>120 or more Less than 1200</td><td>0.1, 1, 10, 100</td></tr> <tr> <td>1200 or more Less than 12000</td><td>1, 10, 100, 1000</td></tr> <tr> <td>12000 or more Less than 120000</td><td>10, 100, 1000, 10000</td></tr> <tr> <td>120000 or more</td><td>100, 1000, 10000, 100000</td></tr> </table>	Total load power(kW)	Setting range	Less than 12	0.001 , 0.01, 0.1, 1	12 or more Less than 120	0.01 , 0.1, 1, 10	120 or more Less than 1200	0.1 , 1, 10, 100	1200 or more Less than 12000	1 , 10, 100, 1000	12000 or more Less than 120000	10 , 100, 1000, 10000	120000 or more	100 , 1000, 10000, 100000
Total load power(kW)	Setting range														
Less than 12	0.001 , 0.01, 0.1, 1														
12 or more Less than 120	0.01 , 0.1, 1, 10														
120 or more Less than 1200	0.1 , 1, 10, 100														
1200 or more Less than 12000	1 , 10, 100, 1000														
12000 or more Less than 120000	10 , 100, 1000, 10000														
120000 or more	100 , 1000, 10000, 100000														

6.1.11 Setup for upper and lower limit alarm

Setup the whether to monitor upper and lower limit alarm.

Please refer to 7.2 Upper/lower limit monitoring function for more details.

Showed below table. Please setup upper and lower limit alarm of second circuit (3 side circuit) in 2 circuits measuring in 1P2W.

Setting item		Setting values
Upper and lower limit	Current demand upper limit N phase current demand upper limit	0~120% of primary current (100% of Primary current) The minimum step of settable value is varies by primary current. Less than 40A : Step 0.01A 40A ~ 400A : Step 0.1A 400A ~ 4000A : Step 1A 4000A ~ : Step 10A
	Current demand lower limit	0~120% of primary current (0% of primary current) The minimum step of settable value is varies by primary current. Lower than 40A : Step 0.01A 40A ~ 400A : Step 0.1A 400A ~ 4000A : Step 1A 4000A ~ : Step 10A
	Line voltage upper limit Phase voltage upper limit	0~100%×15/11 of primary voltage (110% of primary voltage) The minimum step of settable value is varies by primary voltage. Less than 300V : Step 0.1V 300V ~ 3000V : Step 1V 3000V ~ : Step 10V
	Line voltage lower limit Phase voltage lower limit	0~100%×15/11 of primary voltage (0% of primary voltage) The minimum step of settable value is varies by primary voltage. Less than 300V : Step 0.1V 300V ~ 3000V : Step 1V 3000V ~ : Step 10V
	Electric power upper limit	-120~0~120% of full load (100% of full load) The minimum step of settable value is varies by full load. Less than 12kW : Step 0.001kW 12kW ~ 120kW : Step 0.01kW 120kW ~ 1200kW : Step 0.1kW 1200kW ~ 12000kW : Step 1kW 12000kW ~ 120000kW : Step 10kW 120000kW ~ : Step 100kW
	Electric power lower limit	-120~0~120% of full load (0% of full load) The minimum step of settable value is varies by full load. Less than 12kW : Step 0.001kW 12kW ~ 120kW : Step 0.01kW 120kW ~ 1200kW : Step 0.1kW 1200kW ~ 12000kW : Step 1kW 12000kW ~ 120000kW : Step 10kW 120000kW ~ : Step 100kW
	Power factor upper limit	-0.050, -0.100, ...-0.950, 1.000, 0.950, ...0.100, 0.050 (-0.500)
	Power factor lower limit	-0.050, -0.100, ...-0.950, 1.000, 0.950, ...0.100, 0.050 (0.500)
	Pulse converted upper limit	1 to 999999 (100000)
	Current unbalance rate upper limit	0.01 to 999.99% (30.00%)
	Voltage unbalance rate upper limit	0.01 to 999.99% (3.00%)
Alarm delay time		0sec , 5sec, 10sec, 20sec, 30sec, 40sec, 50sec, 1min, 2min, 3min, 4min, 5min
Reset method		Auto , Hold

6.2 Initialization of related item by changing the setup

Setup value and measured data is initialized after change the setup value according to table 6.2.1 and 6.2.2.

Please setup again.

Table 6.2.1 List of initialization when changing setup value (setup data)

[illegible]

Mark	Contents
<input type="radio"/>	Initialize
<input checked="" type="radio"/>	Initialize based on the wirinf type.
<input type="checkbox"/>	Initialize when pulse input is turned to be contact area input in the condition that upper/lower limitof pulse conversion in.
<input type="checkbox"/>	Initialize when upper pulse conversion is setup in upper/lower limit element.

Table 6.2.2 List of initialization when changing setup value (Measured data and operating data)

Measured value (initialized)	Integral value		Max		Min		Setup items
	○	■	○	■	○	■	
Electric energy(consumption)							Wiring type
Regenerate electric energy							Vr use or non-use
Reactive electric energy							2 circuits measuring
Electric energy conversion							Direct voltage
Electric energy conversion (3phase)							Primary voltage
Operating time							Special primary voltage
Electric energy(consumption) (3phase)							Special secondary voltage
Regenerate electric energy(3phase)							Current sensor type
Operating time (3phase)							Primary current
Line voltage (all phases)	○		○		○		5A sensor primary special current
Line voltage (1-2)	○		○		○		Demand electric energy alarm
Line voltage (2-3)	○		○		○		Demand current alarm
Phase voltage (All phases)	○		○		○		Current sensor type(3side)
Power factor (All phases)	○		○		○		Primary current(3side)
Power factor (1 phase)	○		○		○		5A sensor special primary current (3side)
Power factor (3phase)	○		○		○		Demand electric energy (3side)
Demand current (All phases)	○		○		○		Demand current alarm(3side)
Demand current (1 phase)	○		○		○		Modbus address
Demand current (3 phase)	○		○		○		Modbus baudrate
Demand electric power (All phases)	○		○		○		Modbus parity
Demand electric power (1 phase)	○		○		○		Modbus stopbit
Demand electric power (3 phase)	○		○		○		External output setup
Current unbalance rate	○		○		○		External output target circuit
Voltage unbalance rate	○		○		○		Pulse output unit
Line voltage (all phases)	○		○		○		Electric energy conversion
Line voltage (1-2)	○		○		○		Electric energy conversion unit
Line voltage (2-3)	○		○		○		Electric energy conversion(3side)
Phase voltage (All phases)	○		○		○		Electric energy conversion(3side)
Power factor (All phases)	○		○		○		Operating time
Power factor (1 phase)	○		○		○		Operating time measuring items
Power factor (3phase)	○		○		○		Operating time(3side)
Demand current (All phases)	○		○		○		Operating time measuring items(3side)
Demand current (1 phase)	○		○		○		Cut-off setup
Demand current (3 phase)	○		○		○		Cut-off setup (3side)
Demand electric power (All phases)	○		○		○		Upper limit alarm exence
Demand electric power (1 phase)	○		○		○		Upper limit alarm element
Demand electric power (3 phase)	○		○		○		Upper limit alarm value
Current unbalance rate	○		○		○		Alarm mask line
Voltage unbalance rate	○		○		○		Alarm reset mode
Line voltage (all phases)	○		○		○		Upper and lower limit alarm element(3side)
Line voltage (1-2)	○		○		○		Upper and lower limit alarm element (3side)
Line voltage (2-3)	○		○		○		Upper and lower limit alarm value (3side)
Phase voltage (All phases)	○		○		○		Alarm mask time (3side)
Power factor (All phases)	○		○		○		Alarm reset mode (3side)
Power factor (1 phase)	○		○		○		Logging ID
Power factor (3phase)	○		○		○		Logging deletion
Demand current (All phases)	○		○		○		Simple measuring setup
Demand current (1 phase)	○		○		○		Power factor setup in simple measuring
Demand current (3 phase)	○		○		○		Power factor setup in simple measuring (2phase)
Demand electric power (All phases)	○		○		○		
Demand electric power (1 phase)	○		○		○		
Demand electric power (3 phase)	○		○		○		

7. Operation

7.1 Measurement

Measurement elements are showed below table in each unit.

In the case displaying in Display unit.

Displayed items		EMU4-A2/ EMU4-VA2					
		Wh+A+4 items			Harmonics		
		1P2W		1P3W	1P2W		1P3W
		1 circuit measuring	2 circuits measuring	/3P3W /3P4W	1 circuit measuring	2 circuits measuring	/3P3W /3P4W
Electric energy	Present	●	●	●	●	●	●
Electric energy (converted)	Present	○	○	○	●	●	●
Operating time	Present	○	○	○	●	●	●
Electric energy(regenerated)	Present	○	○	○	●	●	●
Current	1,2,3,N,Total※1	●	●	●	●	●	●
Demand current	1,2,3,N※1						
	Max,Min						
Voltage	1-2,2-3,3-1,1-N, 2-N,3-N, Total※2	○	○	○	●	●	●
	Max, Min						
Electric power	Present	○	○	○	●	●	●
Demand electric power	Present						
	Max, Min						
Reactive power	Present	○	○	○	●	●	●
Apparent power	Present	—	—	○※7	—	—	○※7
Power factor	Present	○	○	○	●	●	●
	Max, Min						
Frequency	Present	○	○	○	●	●	●
Harmonics current RMS/distortion	1,2,3,N※3	○	○	○	○※5	○※5	○※5
Harmonics voltage RMS /distortion	1-2,2-3, 1-N,2-N,3-N※4	○	○	○	○※5	○※5	○※5
1-13N harmonics current※9 RMS /content rate	1,2,3,N※3	—	—	—	○※5	○※5	○※5
1-13N harmonics voltage※9 RMS /content rate	1-2,2-3, 1-N,2-N,3-N※4	—	—	—	○※5	○※5	○※5
Reactive energy	Present	○	—	○	—	—	—
Current unbalance rate	Present	○※6	○※6	○	—	—	○
	Max						
Voltage unbalance rate	Present	○※6	○※6	○	—	—	○
	Max						
Time	Present	●※8	●※8	●※8	●※8	●※8	●※8
Error	—	●	●	●	●	●	●

● ...Measured data

○ ...Only displayed when selected additional items

— ...Not measured data

※1 2 and 3 phases is not displayed in wiring setting 1P2W. N phase is only displayed in 3P4W setting.

※2 Between 2 and 3 , 3 and 1 is not displayed in setting 1P2W1-N . Between 2 and N, 3 and N is displayed in 3P4W setting.

※3 If wiring setting is 1P2W, 3 phase is not displayed. 2 phase is only displayed in setting 3P4W.

※4 If wiring setting is 1P2W, between 2 and 3 is not displayed. Between 1 and N, 2 and N, 3 and N is only displayed.

※5 Either effective value and content rate ,distortion by the setting elements of HA and HV.

※6 Current unbalance rate, voltage unbalance rate is displayed 0% in 1P2W setting.

※7 Apparent power is only measured in 3P4W setting

※8 Present time is only displayed when connected EMU4-LM.

※9 3rd, 5th, 7th, 9th, 11th, 13th are displayed.

In the case monitoring with various communications

The supported communications are as follows.

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

Monitored items		EMU4-A2/ EMU4-VA2		
		1P2W		1P3W / 3P3W / 3P4W
		1 circuit measuring	2 circuits measuring	
Electric energy	Present	●	●	●
Electric energy (expansion)	Present	●	●	●
Electric energy (converted)	Present	△	△	△
Operating time	Present	●	●	●
Electric energy (regenerated) (expansion)	Present	●	●	●
Electric energy (regenerated)	Present	●	●	●
Current	1,2,3,N,Total	●	●	●
Demand current	1,2,3,N	●	●	●
	Max,Min ^{※3}	△	△	△
Voltage	1-2,2-3,3-1,1-N, 2-N,3-N,Total	●	●	●
	Max,Min ^{※3}	△	△	△
Electric power	Present	●	●	●
Demand electric power	Present	●	●	●
	Max,Min ^{※3}	△	△	△
Reactive power	Present	●	△	△
Apparent power ^{※1}	Present	—	—	△ ^{※1}
Power factor	Present	●	●	●
	Max,Min ^{※3}	△	△	△
Frequency	Present	●	●	●
Harmonics current RMS value/distortion	1,2,3,N	●	●	●
Harmonics voltage RMS value/distortion	1-2,2-3,3-1, 1-N,2-N,3-N	●	●	●
1-13N harmonics current RMS value /content rate	1,2,3,N	●	●	●
1-13N harmonics voltage RMS value /content rate	1-2,2-3, 1-N,2-N,3-N	●	●	●
Reactive energy	Present	●	●	●
Reactive energy (expansion)	Present	●	●	●
Current unbalance rate ^{※2}	Present	—	—	△
	Max ^{※3}	△	△	△
Voltage unbalance rate ^{※2}	Present	—	—	△
	Max ^{※3}	△	△	△
Time	Present	—	—	—
Error	—	●	●	●

● …Monitorable data

△… Monitorable data by somecommunication

— …Not monitorable data

Elements				Model			
				EMU4-A2, EMU4-VA2			
				1P2W	1P3W	3P3W	3P4W
Current	Average			●	●	●	●
	Phase 1			●	●	●	●
	Phase 2			—	●	●	●
	Phase 3			●※1	●	●	●
	Phase N			—	—	—	●
Current demand	Phase 1			●	●	●	●
	Phase 2			—	●	●	●
	Phase 3			●※1	●	●	●
	Phase N			—	—	—	●
Voltage	Phase 1-N			—	—	—	●
	Phase 2-N			—	—	—	●
	Phase 3-N			—	—	—	●
	Average			●	●	●	●
	1-2			●	●	●	●
	2-3			●※1	●	●	●
	3-1			—	●	●	●
Electric power	[1] ※2			●	●	●	●
	[2] ※2			●	—	—	—
Electric power demand	[1] ※2			●	●	●	●
	[2] ※2			●	—	—	—
Reactive power	[1] ※2			●	●	●	●
	[2] ※2			●	—	—	—
Apparent power					—	—	●
Power factor	[1] ※2			●	●	●	●
	[2] ※2			●	—	—	—
Frequency					●	●	●
Current unbalance rate					●	●	●
Voltage unbalance rate					●	●	●
Harmonics total current	RMS	Average Basic 3~13 th	Phase 1	●	●	●	●
			Phase 2	—	—	—	●
			Phase 3	●※1	●	●	●
			Phase N	—	—	—	●
	Distortion ratio	Average 3~13 th	Phase 1	●	●	●	●
			Phase 2	—	—	—	●
			Phase 3	●※1	●	●	●
			Phase N	—	—	—	●
Harmonics total voltage	RMS	Average Basic 3~13 th	Phase 1-N	●	●	●	●
			Phase 2-N	—	—	—	●
			Phase 3-N	●※1	●	●	●
			Phase N	—	—	—	●
			1-2	●	●	●	—
			2-3	●※1	●	●	—
	Distortion ratio	Average 3~13 th	Phase 1-N	—	—	—	●
			Phase 2-N	—	—	—	●
			Phase 3-N	—	—	—	●
			1-2	●	●	●	—
Electric energy	Comsum ption	[1]*2		●	●	●	●
		[2]*2		●	—	—	—
	Regener ated	[1]*2		●	●	●	●
		[2]*2		●	—	—	—
	Consumption (expanded)				—	—	—
	Regenerated (expanded)				—	—	—
Reactive energy	Consumption delay			●	●	●	●
	Consumption delay (expanded)			—	—	—	—
Electric energy conversion				—	—	—	—
Periodic electric energy				—	—	—	—
Operating time				—	—	—	—

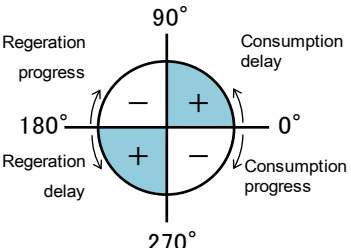
● ... Loggable data

— ... Not loggable data

*1: Shows second circuit (3 side circuit) when setting 2 circuits measuring in 1P2W.

*2: [1] shows first circuit when setting 2 circuits measuring in 1P2W. It is displayed when not setting 2 circuits measuring or 1P3W, 3P3W, 3P4W.[2] shows second circuit (3 side circuit) when setting 2 circuits measuring in 1P2W.

The details of measurement items showed below table.

Item	Details										
Electric power Reactive power Power factor	<p>The sign of measured value is showed below figure.</p> 										
RMS current value (Average)	<p>Calculated depending on the phase-wire system.</p> <table border="1"> <thead> <tr> <th>Phase-wire system</th><th>Calculating formula</th></tr> </thead> <tbody> <tr> <td>Single-phase 2-wire</td><td>phase 1 current</td></tr> <tr> <td>Single-phase 3-wire</td><td>(phase 1 current + phase 3 current) / 2</td></tr> <tr> <td>Three-phase 3-wire</td><td></td></tr> <tr> <td>Three-phase 4-wire</td><td>(phase 1 current + phase 2 current + phase 3 current) / 3</td></tr> </tbody> </table>	Phase-wire system	Calculating formula	Single-phase 2-wire	phase 1 current	Single-phase 3-wire	(phase 1 current + phase 3 current) / 2	Three-phase 3-wire		Three-phase 4-wire	(phase 1 current + phase 2 current + phase 3 current) / 3
Phase-wire system	Calculating formula										
Single-phase 2-wire	phase 1 current										
Single-phase 3-wire	(phase 1 current + phase 3 current) / 2										
Three-phase 3-wire											
Three-phase 4-wire	(phase 1 current + phase 2 current + phase 3 current) / 3										
RMS voltage value (Average)	<p>Calculated depending on the phase-wire system.</p> <table border="1"> <thead> <tr> <th>Phase-wire system</th><th>Calculating formula</th></tr> </thead> <tbody> <tr> <td>Single-phase 2-wire</td><td>1-2 line voltage</td></tr> <tr> <td>Single-phase 3-wire</td><td>(1-2 line voltage+ 2-3 line voltage) / 2</td></tr> <tr> <td>Three-phase 3-wire</td><td></td></tr> <tr> <td>Three-phase 4-wire</td><td>(1-2 line voltage+ 2-3 line voltage+ 3-1 line voltage) / 3</td></tr> </tbody> </table>	Phase-wire system	Calculating formula	Single-phase 2-wire	1-2 line voltage	Single-phase 3-wire	(1-2 line voltage+ 2-3 line voltage) / 2	Three-phase 3-wire		Three-phase 4-wire	(1-2 line voltage+ 2-3 line voltage+ 3-1 line voltage) / 3
Phase-wire system	Calculating formula										
Single-phase 2-wire	1-2 line voltage										
Single-phase 3-wire	(1-2 line voltage+ 2-3 line voltage) / 2										
Three-phase 3-wire											
Three-phase 4-wire	(1-2 line voltage+ 2-3 line voltage+ 3-1 line voltage) / 3										
Electric energy conversion	<p>Calculated below equation. Electric energy×Electric energy converted value ※Electric energy converted value : 0.001~10000 (Initial value : 1.000) ※Please refer to 6.1.6 for the converted unit that can be setup.</p>										
Operating time	<p>Measuring the time during contact input is ON or measuring current.</p> <table border="1"> <thead> <tr> <th>Measurement range</th><th>Unit</th></tr> </thead> <tbody> <tr> <td>0~999999</td><td>Time [hour]</td></tr> </tbody> </table>	Measurement range	Unit	0~999999	Time [hour]						
Measurement range	Unit										
0~999999	Time [hour]										

7.2 Upper/lower limit monitoring function

7.2.1 How to use upper/lower limit alarm function




This device can set the upper/lower limit alarm value for each measured value individually.

< Monitoring items >


Upper limit alarm items	Current demand, phase N current demand, Voltage, Electric power demand, Power factor, Pulse count
Lower limit alarm items	Current demand, Voltage, Electric power demand, Power factor,

※1 Only monitoring wiring type is setup 3P4W.

< Alarm setting >

- Upper limit value..... Set the upper limit of measured value. For setting value and setting range,  6.1.12 Setup for upper and lower limit alarm
- Lower limit valueSet the lower limit of measured value. For setting value and setting range,  6.1.12 Setup for upper and lower limit alarm
- 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. For setting value and setting range.  6.1.12 Setup for upper and lower limit alarm
- Alarm reset method.....Alarm recovery operation is different according to the alarm reset method.

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

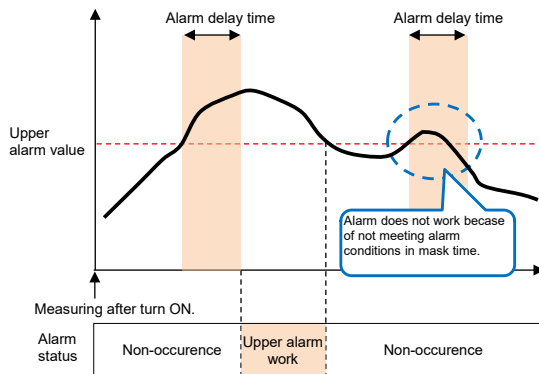
For setting  6.1.12 Setup for upper and lower limit alarm. For alarm reset operation, refer to manual (Detail) of Display Unit (EMU4-D65).

< Alarm occurrence / recovery condition >

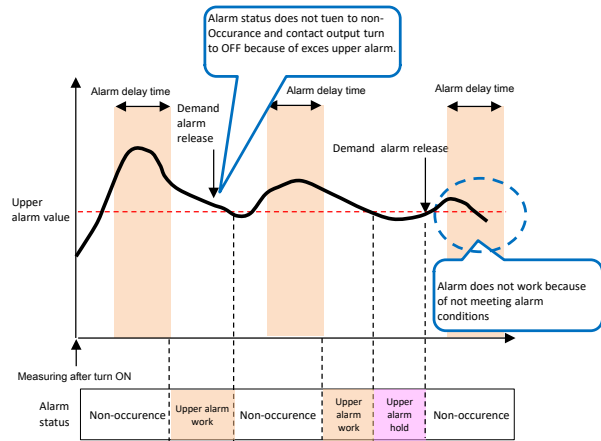
Alarm item	Alarm reset method	Alarm status		Alarm occurrence / recovery condition
Current demand Line voltage Phase voltage Electric power demand Power factor Phase N current demand Current unbalance rate Voltage unbalance rate	Auto-reset (Auto)	Upper limit alarm	Occurrence	Measured value > configured upper limit (Alarm delay time is available)
			Recovery	Measured value < configured upper limit
		Lower limit alarm	Occurrence	Measured value < configured lower limit (Alarm delay time is available)
			Recovery	Measured value ≥ configured lower limit
	Self-retention (Hold)	Upper limit monitoring	Occurrence	Measured value > configured upper limit (Alarm delay time is available)
			Retention	Measured value ≤ configured upper limit
			Recovery	Measured value < configured upper limit AND Alarm reset
		Lower limit monitoring	Occurrence	Measured value < configured lower limit (Alarm delay time is available)
			Retention	Measured value ≥ configured lower limit
			Recovery	Measured value > configured lower limit AND Alarm reset

(1) Upper limit alarm

Alarm reset method = Auto

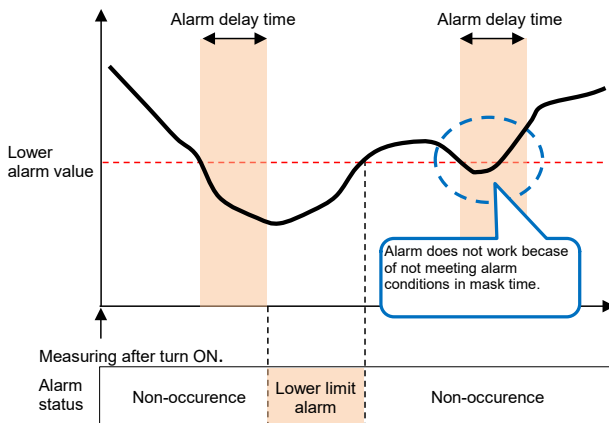


Alarm reset method = Hold

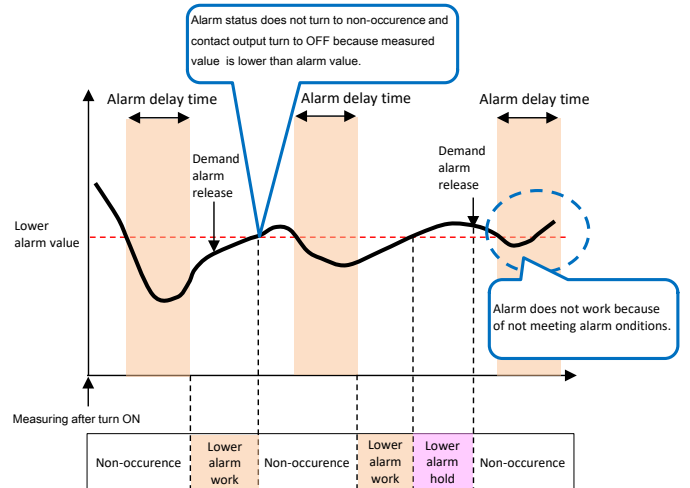


(2) Lower limit alarm

Alarm reset method = Auto



Alarm reset method = Hold



7.3 Simple measurement

This unit is equipped monitoring function without input voltage.

Each measurement elements calculated by the voltage and power factor and input current.

Measurement resolution is not guarantee.

7.3.1 Measurement elements

The elements can measure are showed below table.

		EMU4-A2/ EMU4-VA2					
		Wh+A+4 elements			Harmonics		
		1P2W		1P3W /3P3W /3P4W	1P2W		1P3W /3P3W /3P4W
		1 circuit measuring	2 circuits measuring		1 circuit measuring	2 circuits measuring	
Electric energy	Present value	●	●	●	●	●	●
Converted electric energy	Present value	○	○	○	●	●	●
Operating time	Present value	○	○	○	●	●	●
Current	1,2,3,N,Total※1	●	●	●	●	●	●
Current demand	1,2,3,N※1						
	Max,Min						
Electric power	Present value	○	○	○	●	●	●
Electric power demand	Present value						
	Max,Min						
Reactive power	Present value	○	○	○	●	●	●
Apparent power	Present value	—	—	○※3	—	—	—
Reactive energy	Present value	○	—	○	—	—	—
Current unbalance rate	Present value	○※2	○※2	○	—	—	○
	Max						
Time	Present value	●※4	●※4	●※4	●※4	●※4	●※4
Error	—	●	●	●	●	●	●

※1 2 and 3 phases is not displayed in wiring setting 1P2W. N phase is only displayed in 3P4W setting.

※2 Current unbalance rate, voltage unbalance rate is displayed 0% in 1P2W setting.

※3 Apparent power is only measured in 3P4W setting.

※4 Present time is only displayed when connected EMU4-LM.

7.3.2 Restriction of measured data in simple measuring

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

Measuring item	Behaviors of this unit and small-size display unit
Current	Current is 0A when input current is lower than cut-off setup value.
Power Reactive power Apparent power	Indicate "0W", "0var" or "0VA" if indicated current values of all phases are 0A.
Operating time	Indicate "999999h" if operating time is over 999999h.
Current unbalance rate	Indicate "9999.99" if operating time is over 9999.99.

8. Device operation

8.1 Resolution of measuring data

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

■ Voltage, harmonic voltage RMS

Primary voltage setting	Resolution	Unit
less than 300V	1 decimal places	V
300V ~ 3000V	Integer	
3000V ~	×10	

■ Current, current demand harmonic current

Primary current setting	Resolution	Unit
less than 40A	3 decimal places	A
40A ~ 400A	2 decimal places	
400A ~ 4000A	1 decimal places	
4000A ~	Integer	

■ Harmonic voltage/ Harmonic voltage distortion ratio,

1 decimal places : 0.1%

■ Power factor

1 decimal places : 0.1

■ Frequency

1 decimal places : 0.1Hz

■ Power, power demand, reactive power, apparent power

Total load power	Resolution	Unit
less than 12kW	3 decimal places	kW kvar
12 kW ~ 120 kW	2 decimal places	
120 kW ~ 1200 kW	1 decimal places	
1200 kW ~ 12000 kW	Integer	
12000 kW ~ 120000 kW	×10	
120000kW ~	×100	

■ Electric energy, reactive energy

Total load power	Resolution	Unit
less than 12kW	2 decimal places	kWh kvarh
12 kW ~ 120 kW	1 decimal places	
120 kW ~ 1200 kW	Integer	
1200 kW ~ 12000 kW	×10	
12000 kW ~ 120000 kW	×100	
120000kW ~	×1000	

■ Electric energy(expansion), reactive energy(expansion)

Total load power	Resolution	Unit
less than 12kW	5 decimal places	kWh kvarh
12 kW ~ 120 kW	4 decimal places	
120 kW ~ 1200 kW	3 decimal places	
1200 kW ~ 12000 kW	2 decimal places	
12000 kW ~ 120000 kW	1 decimal places	
120000kW ~	Integer	

Note: 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.

■ Electric energy converted value

The Unit depends on setting value.

Total load power	Resolution
less than 12kW	2 decimal places
12 kW ~ 120 kW	1 decimal places
120 kW ~ 1200 kW	Integer
1200 kW ~ 12000 kW	×10
12000 kW ~ 120000 kW	×100
120000kW ~ 1200000kW	×1000
1200000kW ~	×10000

■ Pulse converted value

The Unit depends on setting value.

Total load power	Resolution
0.001 ~ 0.01	3 decimal places
0.01 ~ 0.1	2 decimal places
0.1 ~ 1.0	1 decimal places
1 ~ 10	Integer
10 ~ 100	×10
100 ~ 1000	×100
1000 ~	×1000

• The image of the Extended electric energy
In the case measuring device has "12345.6789" as internal data.
Please multiply each value by the multiplier to calculate the measured value.

Electric energy data : "123456"

12345.6789

Electric energy data (expansion) : "456789"

8.2 Restrictions of measured data


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

Measured item	Behaviors of this unit and Indication of Small-size Display Unit
Current	Current is 0A when input current is lower than cut-off setup value.
Voltage	Indicate "0V" if RMS value is under 11V. (*1)
Power Reactive power Apparent power	Indicate "0W", "0var" or "0VA" if indicated voltage values of all phases are 0V or indicated current values of them are 0A.
Power factor	Indicate "100.0%" if indicated voltage values of all phases are 0V or indicated current values of them are 0A.
Frequency	Voltage condition: Indicate "0Hz" if voltage V12 (voltage V1N for 3P4W) is 0V. Frequency condition: Indicate "0Hz" if frequency is under 44.5Hz. Indicate "0Hz" if frequency is over 99.9Hz.
RMS value of harmonic voltage	Voltage condition: Indicate "0V" at each phase if voltage is 0V. Indicate "0V" at all phase if voltage V12 (voltage V1N for 3P4W) is 0V. Frequency condition: Indicate "0V" at all phases if frequency is under 44.5Hz.
Content rate of harmonic voltage (modulation distortion)	Voltage condition: Indicate "0%" at each phase if voltage is 0V. Indicate "0%" at all phase if voltage V12 (voltage V1N for 3P4W) is 0V. Frequency condition: Indicate "0%" at all phases if frequency is under 44.5Hz.
RMS value of harmonic current	Current condition: Indicate "0A" at each phase if voltage is 0A. Frequency condition: Indicate "0A" at all phases if frequency is under 44.5Hz. Voltage condition: Indicate "0A" at all phase if voltage V12 (voltage V1N for 3P4W) is 0V.
Content rate of harmonic current (modulation distortion)	Harmonic current condition: Indicate "0%" at each phase if harmonic current (total) is 0A. Frequency condition: Indicate "0%" at all phases if frequency is under 44.5Hz. Voltage condition: Indicate "0%" at all phase if voltage V12 (voltage V1N for 3P4W) is 0V.
Operating time(*2)	Indicate "999999h" if operating time is over 999999h.
Current unbalance rate	Indicate "999.999" if operating time is over 999.999.
Voltage unbalance rate	Indicate "999.999" if operating time is over 999.999.

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

*2: Operation time is reference value.

✓ Supplement

- This unit takes a few seconds after change rating setup and the setup. While time measuring operation can't conduct. (MEA**. LED is turned off)
- Please reference to  7.3.2 Restriction of measured data in simple measuring.

9. Reference

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

9.1 In case you think the unit is in failure

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

Obtained value is incompatible with other values.

- Integrated electric energy value is not measured though current value is indicated.
- Obtained values are different from other measuring instruments.

Check that MEA.** LED (3.2 Indication and function of LEDs) 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 the settings of phase wire system, primary voltage and primary current.

Wrong settings may cause the incorrect measurement.

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. Contact our sales representative near you.
②	Current	Check that I_1 is correctly measured.
	Power	Check that the electric power is correctly measured. Reference For 1P3W $W = \text{Voltage}, V_{1-2} \times \text{Current}, I_1$ For 3P3W $W = \text{Voltage}, V_{1-2} \times \text{Current}, I_1 \times \sqrt{3}/2$
③	Connect only the side 1 of the current sensor, and check the indication.	

Check the wiring of the voltage line.

Make sure that the wires are connected correctly to P1, P2, P3 and P0. Check the wiring both on the unit side and on the circuit connecting side.

Check whether the short circuit or disconnection is present.

Obtained values are different from other measuring instruments. (over tolerance)

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

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

Current sensor connectable to the unit is the dedicated current sensor only. Check that the proper current sensor is connected or not.

Extinction RUN LED

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

Contact our sales representative near you.

Lighting ALM A1, ALM A2 (ALM B1, ALM B2)

Error is occurred in A1, A2 side (B1, B2 side). Please check the error number in display unit.

9.2 After-sales service

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

- Gratis warranty is effective until the earlier of 1 year after the date of your purchase or 18 months after manufacturing.
- The gratis warranty shall apply if the product fails even though it is being used properly in the conditions, with the methods and under the environments in accordance with the terms and precautions described in the catalogs, the instruction manual, caution label on the product, etc.
- Repair shall be charged for the following cases even during the gratis warranty period.
 - Failures occurring due to your improper storage or handling, carelessness or fault.
 - Failures due to faulty workmanship
 - Failures due to faults in use and undue modification
 - Failures due to accidental force such as a fire, abnormal voltage, etc. and force majeure such as an earthquake, wind, flood, etc.
 - Failures due to matters unpredictable based on the level of science technology at the time of product.
- Our company shall not be liable to compensate for any loss arising from events not attributable to our company, opportunity loss and lost earning of the customer due to failure of the product, and loss, secondary loss, accident compensation, damage to other products besides our products and other operations caused by a special reason regardless of our company's predictability

9.3 Q&A

■ General

Q	To what degree is the unit durable against overvoltage and over current?
A	<p>Durability is as follows: Momentary*: Up to 20 times as high as rated current and 2 times as high as rated voltage. *Momentary means: Energizing 9 times for 0.5 seconds at 1-minute intervals, and then 1 time for 5 seconds. Continuous: Up to 1.1 times as high as rated voltage and rated current.</p>
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 reference to manual (detail) of Display unit.
Q	Is it OK to open the secondary terminals of the current sensor?
A	<p>The secondary side of the models EMU2-CT5, EMU2-CT5-4W, EMU-CT50, EMU-CT100, EMU-CT250, EMU-CT5-A, EMU-CT50-A, EMU-CT100-A, EMU-CT250-A, EMU-CT400-A, and EMU-CT600A is equipped with the protective circuit against opening of secondary terminals. Opening them during the wiring work causes no problems. However, for safety, please do not continuously energize the module with the terminals open.</p> <p>The secondary side of the models EMU-CT400, EMU-CT600, EMU-CT400-A and EMU-CT600-A is equipped with the protective circuit against opening of secondary terminals. However, during the wiring work, be sure to turn the secondary side short-circuit switch to short. After completion of work, be sure to turn the secondary short-circuit switch to open. Note that failing to turn the switch open results in an inaccurate measurement.</p>
Q	If a load such as welding equipment exists, a current flows only for a short period (e.g. 2 cycles). Is measurement possible?
A	<p>The electrical amount such as current, voltage, electric power, power factor, frequency, harmonic voltage and harmonic current is measured in a cycle of 100 ms period. So it is impossible to measure the current accurately for a short period.</p> <p>The amount of electricity and reactive power amount are measured separately from the momentary data described above, using a sampling period of 4kHz continuously without intermittence. Therefore, it is possible to measure the load for a short period.</p>
Q	Obtained values may be different from other measuring instruments. Why is it so?
A	<p>There are various possible causes. Check the following first, please:</p> <ol style="list-style-type: none"> (1) Check for wiring errors. (Especially, polarity of current sensor and connection of voltage circuit) (2) Check for the settings. (phase wires, primary voltage, primary current and sensor type) (3) On the split-type current sensor, check for the poor engagement or separation of fitting surfaces. (4) On the split-type current sensor, check for pinching of foreign object between fitting surfaces. (5) Check for the short circuit on the secondary side of the current transformer (CT). (6) Current sensor connectable to the unit is the dedicated current sensor only. Check that the proper current sensor is connected or not. (7) Check that the measuring instrument used for comparison indicates a correct RMS value. This unit indicates an RMS value. If the measuring instrument used for comparison measures an average value instead of RMS value, distortion caused by harmonic etc. in the current of the circuit to be measured causes a significant difference of values.

■ Q&A about specifications

Q	What does “Allowable tolerance” mean?
A	In terms of the amount of electricity, it means a range of tolerances in reading values. For example, when the reading value is “10 kWh,” a tolerance is ± 0.2 kWh. In terms of measured elements other than the amount of electricity, it means tolerance for the rated input. For a current, when a rated current is set to 250 A, 2.5A($\pm 1\%$) is a tolerance.
Q	Is accuracy of a current sensor included?
A	Accuracy of a 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 0.4% of the rated current. In an area below 0.4%, 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 0.4% or more of all load power.

■ Q&A about installation

Q	What is wire diameter that allows installing a current sensor?
A	<p>The following lists the nominal cross-sectional areas of the conductor of 600-V vinyl coated wires that can penetrate. (values for reference)</p> <ul style="list-style-type: none"> • IV wire (600-V vinyl insulated wire) 38mm² (EMU-CT50-A)、60mm² (EMU-CT50/CT100, EMU-CT100-A)、150mm² (EMU-CT250) 200mm² (EMU-CT250-A)、500mm² (EMU-CT400-A、EMU-CT600-A)、500 mm²×1wire、325 mm²×2wire (EMU-CT400/CT600) • CV wire (600-V vinyl insulated wire) 22mm² (EMU-CT50-A)、38mm² (EMU-CT50/CT100), 60mm² (EMU-CT100-A)、150mm² (EMU-CT250 (100mm² is recommended), EMU-CT250A) 400mm² (EMU-CT400-A、EMU-CT600-A)、500 mm² x 1 wire, 325 mm² x 2 wires (EMU-CT400/CT600) <p>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.</p>
Q	What are the points when installing a current sensor?
A	Models EMU2-CT5, EMU2-CT5-4W, EMU-CT***, EMU-CT***-A and EMU-CT5-A 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 a current sensor and the unit?
A	Yes. Make connections so that secondary terminals of current sensor (K, I) 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 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 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 a current sensor and the module?
A	A Model EMU-CT**, EMU-CT**-A are extendable up to 50m. Model EMU2-CT5, EMU2-CT5-4W are extendable up to 11 m, using together with a extension cable. To extend the wire further, use the current transformer CW-5S(L) for split-type instrument in combination, extending the secondary wiring on CW-5S(L) 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. To set this unit, dedicated small-size display unit (EMU4-D65) is necessary.
Q	If a primary current setting value is different from that of rated current on a connected current sensor, does it cause a breakdown?
A	It does not cause breakdown or burning. However, measurement values will be totally incorrect.

10. Requirement for the compliance with EMC Directives EMC

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

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

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

The energy measuring unit is the open type device (i.e. the device incorporated in other device), and needs to be installed in the conductive control panel. The unit is tested with installed in the control panel for the emission and the immunity out of the test items for the standard.
- (2) Recommended condition for installation in the control panel
 - (a) Control panel
 - Control panel needs to have conducting property.
 - When bolting the top panel, bottom panel etc. of the control panel, mask the grounding part of the panel so as not to be painted.
 - In inner panel, keep the conductivity in as large area as possible by masking the bolting part to the main panel to keep the electric contact to main panel.
 - Ground the main panel by the thick wire so as to keep high impedance even for high-frequency wave.
 - (b) Installation of power line and ground line
 - Set up the ground point to the control panel near the energy measuring unit, and ground the frame GND terminal of the unit to the ground terminal of the control panel (PE) by as thick and short wires as possible. (wire length is 30cm or shorter)

11. Specifications

11.1 Common specifications

Item			Specifications	
Model			EMU4-A2	EMU4-VA2
Phase-wire system			Same to the unit connected to left side	Single-phase 2-wire / Single-phase 3-wire / Three-phase 3-wire / Three-phase 4-wire(Change of setting)
Rating	Voltage circuit※3	Single-phase 2-wire／Three-phase 3-wire	Same to the unit connected to left side	110V, 220V, 440V AC(*1)
		Single-phase 3-wire	Same to the unit connected to left side	110V AC (b/w 1- and 2-phase, 2- and 3-phase), 220V AC (b/w 1- and 3-phase) 220V AC(b/w 1- and 2-phase, 2- and 3-phase), 440V AC (b/w 1- and 3-phase)
		Three-phase 4-wire	Same to the unit connected to left side	Min: 63.5V/110V AC, Max: 277V/480V AC(*2)
	Current circuit (*4)		50A, 100A, 250A, 400A, 600A AC (The dedicated split type current sensor is used. Each value refers to the current at the primary side of the current sensor.) 5AAC (The dedicated split type current sensor is used. 5A current sensor is used together with the current transformer (CT), and the primary-side current is configurable up to 30000A.) Secondary current Max.:66.66mA	
	Frequency		50Hz / 60Hz (Auto-detect)	
Measurable circuit count			2 circuit * 4 circuits when 2circuits measuring setup and 1P2W wiring	
Consumption VA	Voltage circuit		-	Each phase 0.1VA (at 110V AC), 0.2VA (at 220V AC), 0.4VA (at 440V AC)
	Auxiliary power supply circuit		At 110V AC : 1.0VA At 220V AC : 1.5VA	
Allowable tolerance			Current, voltage, electric power, reactive power, apparent power, frequency : ±1.0% (100% of the rating) Power factor : ±3.0% Electric energy : ±2.0% (5 - 100% range of the rating, power factor=1) Reactive energy : ±2.5% (10 - 100% range of the rating, power factor=0) Harmonic current, harmonic voltage (*2) : ±2.5%	
Data update interval			100msec *Integrated values of electric energy and reactive energy are always accumulated (following up the short-cycled load fluctuation)	
Range of demand time setting			0, 10s, 20s, 30s, 40s, 50s, 1 - 15min (1min intervals), 20min, 25min, 30min	
External output	Output signal		Non-voltage Form A contact, 2 output(1 point per circuit) (choose the function from below)	
	Function	Alarm elements	Upper limit monitoring of current demand, Lower limit monitoring of current demand, Upper limit monitoring of line voltage Lower limit monitoring of line voltage, Upper limit monitoring of phase voltage Lower limit monitoring of phase voltage, Upper limit monitoring of power demand, Lower limit monitoring of power demand, Upper limit monitoring of power factor, Lower limit monitoring of power factor, Upper limit monitoring of N phase demand current, Upper limit monitoring of current unbalance rate, Upper limit monitoring of voltage unbalance rate ,	
		Alarm reset mode	Selectable from either auto-reset or self-retention	
	Isolation		By semiconductor relay	
	Rated switching voltage and current		35V DC, 75mA 24V AC, 75mA (power factor = 1)	
	Output element		Electric energy	
Pulse output	Output signal		Non-voltage Form A contact, 2 output (*6) 1 point per circuit ・ Unit of pulse (kWH / pulse): 0.001 / 0.01 / 0.1 / 1 / 10 / 100	
	Isolation		By semiconductor relay	
	Rated switching voltage and current		35V DC, 75mA 24V AC, 75mA (power factor = 1)	
	Output pulse width		0.1 – 0.15s	
	Compensation for power failure		Stored items Setting values, Electric energy (consumption, regeneration), reactive energy, periodic electric energy, pulse count value, Operating time (stored in the nonvolatile memory)	

Item		Specifications	
Model		EMU4-A2	EMU4-VA2
Standard		CE marking (EMC: EN-61326-1: 2013, Safety: EN-61010-1: 2010) UL:UL61010-1*6*7	
Usage environment	Operating temperature	-5 - +55°C (Daily average temperature is 35°C or lower)	
	Operating humidity	30 - 85%RH (No condensation)	
	Storage temperature	-10 - +60°C	
	Operating altitude	2000m or below	
Commercial frequency withstand voltage		B/w all terminals (except for communication circuit and frame GND terminal) and casing: 2000V AC, 1min	
		B/w all terminals of current input, voltage input / auxiliary power : 2000V AC, 1min	
		B/w all terminals of current input, voltage input, auxiliary power and all terminals of digital / pulse input, pulse / alarm output, communication: 2000V AC, 1min	
		10M \square or more at the same part above (500V DC)	
Appropriate wire	Terminals of auxiliary power circuit and voltage input	-	AWG22-16(single/stranded) (Single: ϕ 0.65 ϕ 1.25 mm, stranded: 0.3-1.3mm ²)
	External input	AWG22-16(single/stranded) (Single: ϕ 0.65- ϕ 1.25mm, stranded: 0.3-1.3mm ²)	
	Terminals of current input and input	stranded:AWG20-16 (Strand wires: 0.5-1.3mm ²) Single:AWG24-17 (Single line: ϕ 0.5- ϕ 1.2mm)	
Tightening torque	Screws for terminals of auxiliary power circuit and voltage input	-	0.8 - 1.0N·m
	Screws for terminals of external input	0.5 - 0.6N·m	
Mass		0.2kg	
External dimensions (unit: mm)		37.5(W)×90(H)×92.9(D) (expect for the protruding portions) (Maximum dimension including the protruding portions: 41.5(W)×99(H)×92.9(D))	

*1: 110V, 220V AC can connected to this unit directly. For the circuit over this voltage, transformer (VT) is necessary (primary voltage of the transformer is up to 110000V).

*2: 63.5/110V – 277/480V AC can connected to this unit directly. For the circuit over this voltage, transformer (VT) is necessary. (Primary voltage of the transformer is up to 110000V (line voltage))

*3: VT ratio can be setup arbitrarily for special VT ratio in below range when wiring type is setup 1P2W, 3P3W, 3P4W.
Primary voltage of VT is 1~110000V(1Vstep), and secondary voltage is 1~220V(1Vstep).

*4: CT ratio can be setup arbitrarily for special CT ratio in below range.
Primary current of CT is 1~30000A(1A step). Secondary current of CT is hold 5A.

*5: The pulse output unit changes by the full load power.

Full load power (kW)	Setting range			
Less than 12kW	1	0.1	0.01	0.001
12kW ~ 120kW	10	1	0.1	0.01
120kW ~ 1200kW	100	10	1	0.1
1200kW ~ 12000kW	1000	100	10	1
12000kW ~ 120000kW	10000	1000	100	10
120000kW ~	100000	10000	1000	100

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

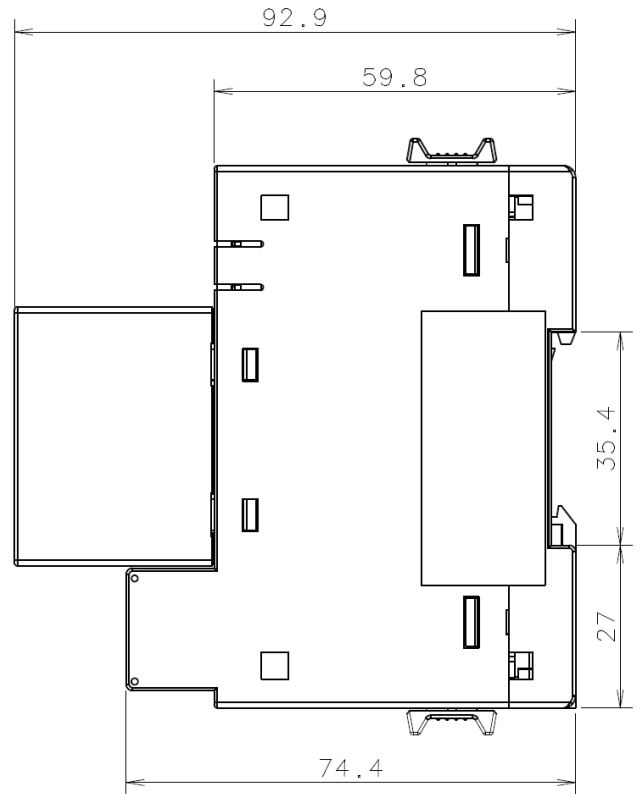
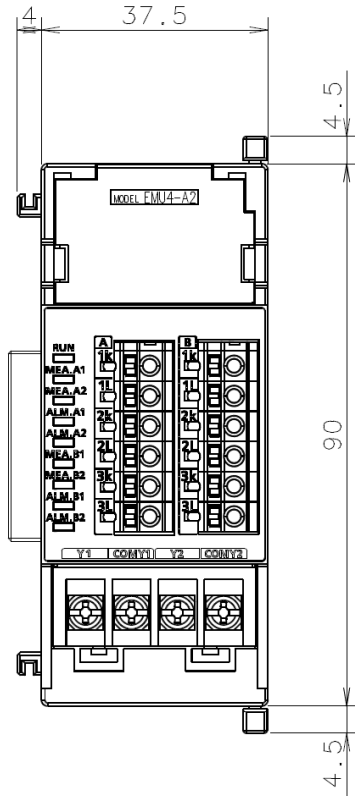
When combine it with a current sensor (Model : EMU2-CT5, EMU2-CT5-4W, EMU-CT50, EMU-CT100, EMU-CT250, EMU-CT400-A, EMU-CT600-A), it becomes UL standard.

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

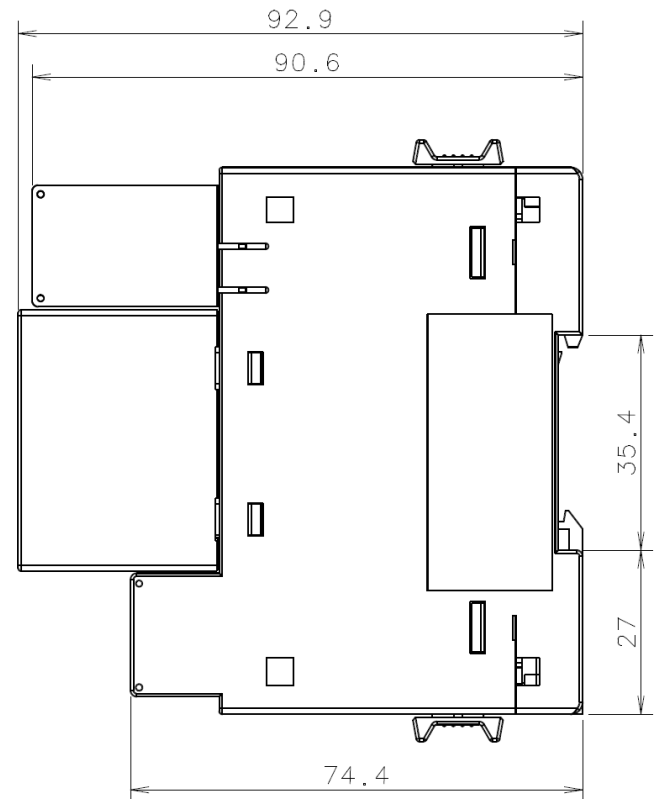
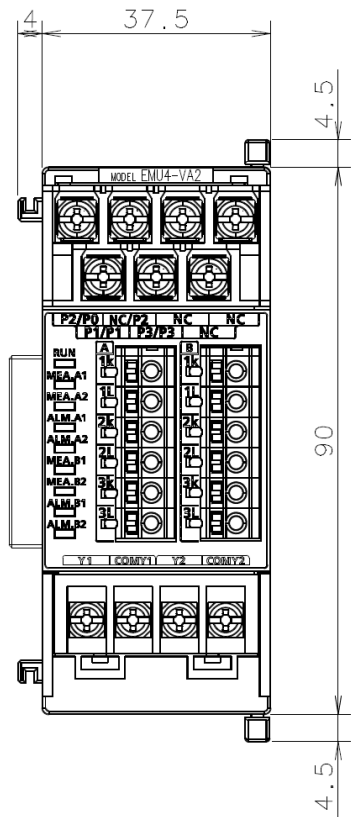
12. External dimensions

Unit: mm

■ Model EMU4-A2



■ Model EMU4-VA2



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Energy Measuring Unit Energy Measuring Extension Model for Same Voltage System

Energy Measuring Unit Energy Measuring Extension Model for Different Voltage System

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