INSTRUCTION MANUAL
(DETAILED VERSION)

GROUND OVERVOLTAGE & REVERSE POWER PROTECTION DEVICE

DVRR-72

DAIICHI ELECTRONICS CO., LTD.

Contents

Introduction

Thank you for purchasing the DVRR-72 ground overvoltage & reverse power protection device.
This instruction manual describes the items necessary for proper handling of this product, so please read it carefully before use.

Safety precautions

■ Environment conditions
Please be sure to use this product in a place that meets the following conditions.
In places that do not meet this condition, it may cause malfunction or failure and product life decline.
- Within the range of ambient temperature -20 to +60℃, humidity 5 to 90% RH.
- Environment with low corrosive gas, dust, salt and oil smoke. (Corrosive gas : SO_2 / H_2S, etc.)
- Environment that is not affected by vibration or shock.
- Environment with less external noise.
- Altitude 2000m or less.

If this unit directly measures an inverter output of cycle control, SCR phase angle control or PWM control, an error may increase due to its operation principle.

■ Outdoor use conditions
When using this product in an outdoor panel, please note the following items.
- These products are not a dustproof, waterproof, and splash proof construction.
  Please avoid the place with much dust. Moreover, please install in the place not exposed to rain or water drop. (IP code : IP40)
- Please do not install in the place where sunlight hits directly.
  Direct exposure to sunlight may cause discoloration or deterioration of the nameplate.
  Also, if the surface temperature exceeds 80℃, the case may be deformed.
- Please note that if the ambient temperature of this product exceeds an average daily temperature of 40℃, the product life will be reduced.

■ Instllation and wiring
Please refer to this instruction manual for installtion and the wiring.

⚠CAUTION	● Please refer to connection diagram for the wiring. ● Please avoid hot line work. ● Please use an electrical wire size suitable with the rated current. ● Use an appropriate length for stripping wire sheath. If it is too long, the wire may short-circuit with the adjacent wire. If it is too short, the wire will not fit well and may cause poor contact. ● Caution against short-circuits due to wire whiskers. ● This product should be used in combination with a dedicated current sensor. The current sensor should not be used beyond the input rating. ● The current sensor is for low voltage circuits only. They cannot be used in high-voltage circuits. When using in a high-voltage circuit, connect a 5A rated current sensor (CTF-5A) to the second side of the instrument current transformer (secondary rating 5A). ● Primary cables to be connected to the current sensor should be insulated wires that can be penetrated. Do not use non-insulated wires or conductors (bus bars, etc.). ● Dust adhesion or rust on the split surface of the core of the current sensor will deteriorate the characteristics and cause errors. Be careful not to get the core split surface dirty during installation. If the surface gets dirty, clean it with dry cloth. ● The secondary of the current sensor should not be continuously energized in the open state for safety reasons. However, since a protection circuit for opening the secondary terminal is built-in, there is no problem with opening the secondary during the wiring work period. ● Current sensors have polarity, so connect them with care. ● The contact capacity of the control output is 125V AC, 70mA, 200V DC, 70mA. Please pay attention to the operating voltage when using the product.

■ Preparation
Before using this product, be sure to set the product. Read this manual and set up the product correctly.
Incorrect settings will result in incorrect operation.

■ Maintenance and inspection
- Inspection during energization is dangerous and prohibited.
- There are no replacement parts for periodic inspections.
- Please wipe off lightly with the dry soft cloth for cleaning.
  Please do not use organic solvents such as alcohol, chemicals, or cleaners.

■ Storage
When storing this product for a long period, please keep it in a place that satisfies the following environmental conditions.
- Within the range of ambient temperature (-20 to 70℃) and humidity (5 to 90%RH).
- Place where average daily temperature does not exceed 40℃.
- Locations with little dust, corrosive gases, salt and oil smoke.
- A place not subject to vibration or shock.
- Location without influence of external noise.

■ Countermeasures against troubles
We will take back the actual product for repair in principle if it breaks down.

■ Disposal
Please dispose of this product as industrial waste (noncombustible).
Mercury parts and a nickel-cadmium battery are not used for this product.

■ Warranty period
The warranty period of the product is one year after the date of delivery.

■ Warranty scope
In the state of normal use of product-specification within the range according to this instruction manual, this product in trouble within the warranty period will be performed exchange or repair gratuitously.
However, it is not warranted in the following cases.
- Malfunction due to handling that is not described in the instruction manual or specifications.
- Failure due to reasons other than the purchased or delivered product.
- Failure due to modification or repair that is not our responsibility after purchase or delivery.
- The failure is caused by a phenomenon that could not be foreseen by the science and technology that was in practical use at the time of purchase or contract.
- Damage that could have been avoided if our product had been incorporated into your equipment and your equipment had the functions, structure, etc. that are generally accepted in the industry.
- When the product is used in a manner other than its intended use.
- Damage caused by external factors beyond our control such as fire, abnormal voltage, etc., or natural disasters such as earthquakes, lightning, windstorms, floods, etc.

This warranty is a warranty only for the delivered product. Cannot warrant the damage induced by trouble of this product.

■ System design considerations
This product uses highly reliable components in its internal circuits.
However, malfunctions or failures may occur due to accidental failure of components.
System design considerations (duplication, installation of fail-safe circuits) should be made in accordance with the required reliability level of the system.

■ Product replacement cycle
Although it depends on the usage conditions, we recommend renewal after 10 years.

■ Changes in the instruction manual
The contents of this instruction manual are subject to change without notice due to product improvement or other reasons.

Composition of type

Type: DVRR-72-

Specification code: 0

① Model	
A	Model A

② Power supply	
1	AC85 to 264V DC80 to 143V
2	DC20 to 57V

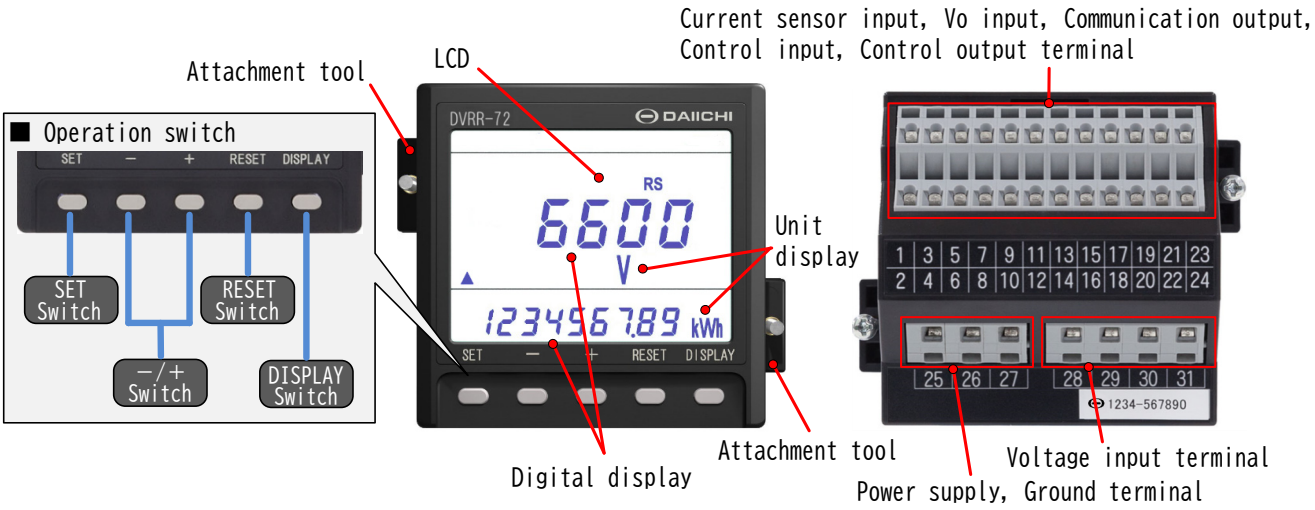
③ Rated zero-phase voltage	
1	AC1V (ZPD)
3	AC1V (EVT)

1. Product outline

1.1 Features of product

- Reverse power relay (RPR) and ground overvoltage relay (OVGR), multi-meter function, and backup power supply are integrated.
- Split-type current sensor input allows installation without cleavage cables or wires.
- High-speed response (measurement response of 100ms or less)
- Screw-less spring-type terminal block the adoption. Wiring man-hours can be reduced.
- Can be used with unbalanced loads.

1.2 Part names

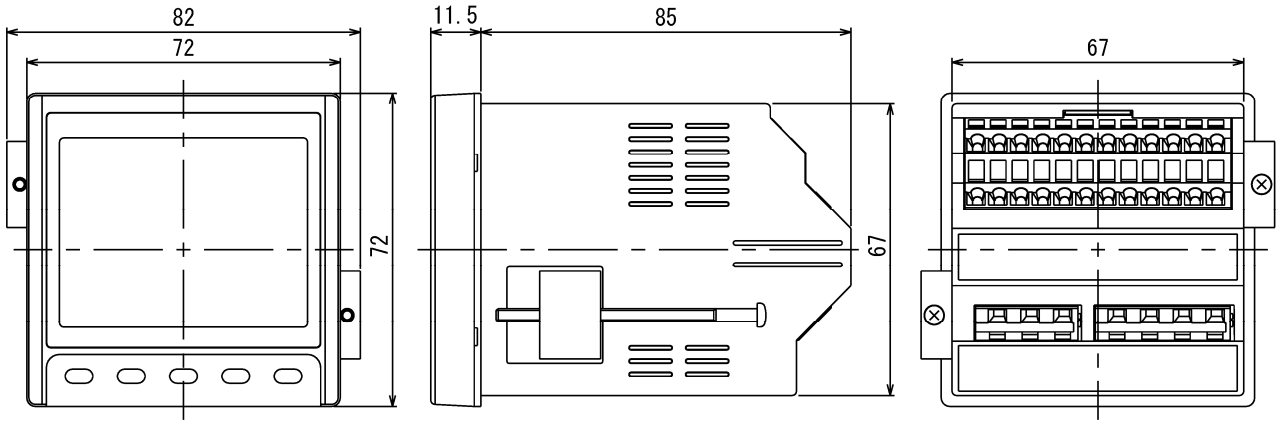


1.3 Bundled items

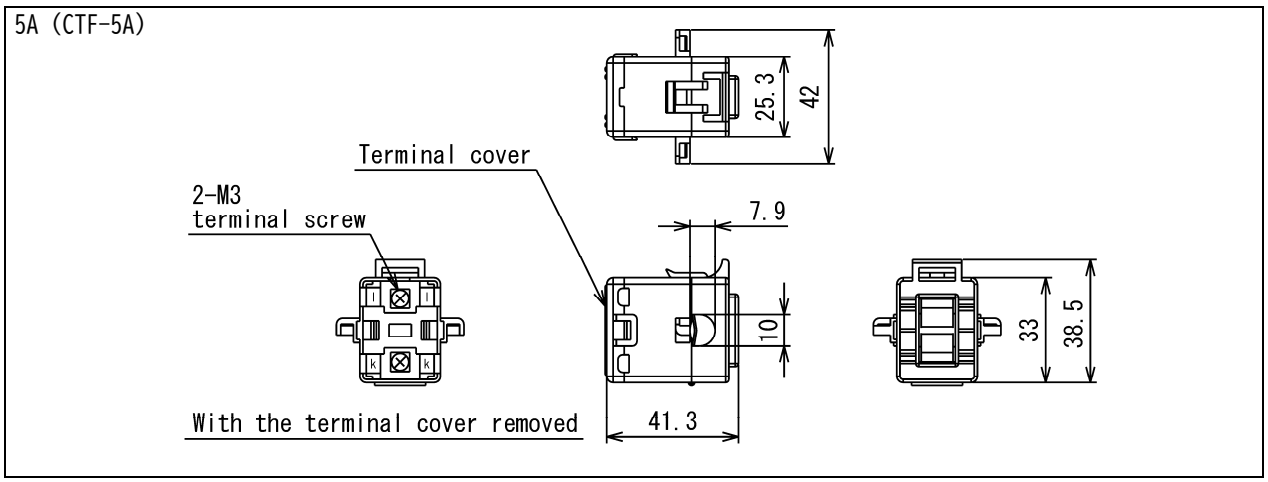
① Attachment tool ····· 2
② Termination resister for communication (100Ω) ····· 1

2. Outline dimension

2.1 DVRR-72

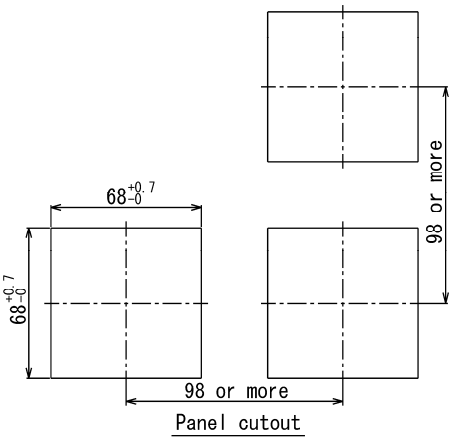


2.2 Current sensor (Option)：Made by MULTI MEASURING INSTRUMENTS Co., Ltd.



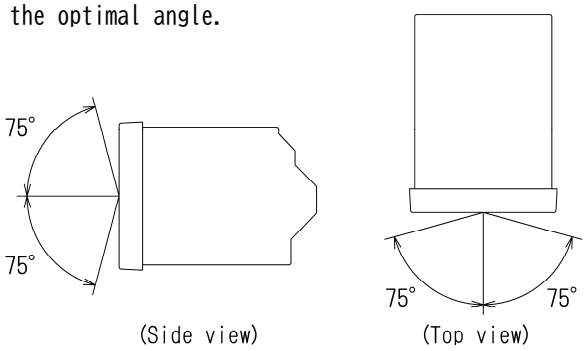
3. Installation instructions

■ Panel cutout dimensions



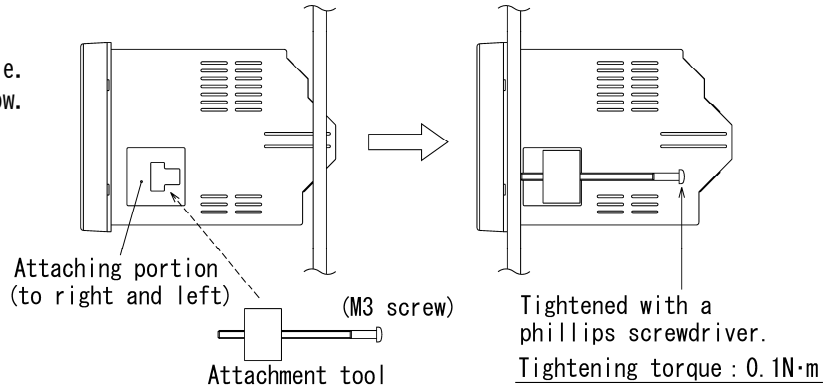
■ Mounting position

Since the LCD contrast is changed in accordance with the monitoring angle, please be installed at the optimal angle.



■ Installation

Insert from the front panel cut hole.
Install as shown in the figure below.

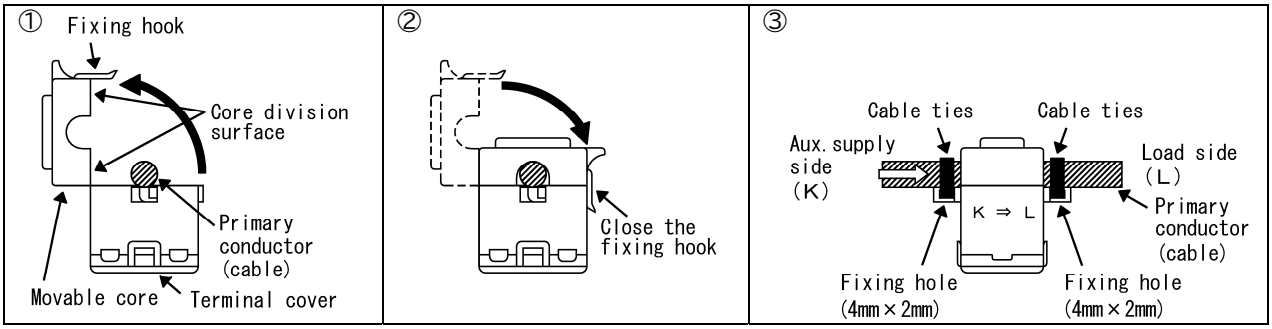


■ Connection of current sensor

① Remove the fixing hooks, and open the movable core.

② Please check the mounting direction of the current sensor. (Symbol : Power supply side K, Load side L)
Pass the wirees in the center of the current sensor.

③ Make sure that there is no dust on the core division surface.
Until the sound of the fixing hook is, please close the movable core.
To secure the current sensor to the wire in the cable ties.



● Solderless terminal to be used in the secondary terminal of the current sensor, please use the Solderless terminal of the specified. Solderless terminal for M3 screw (Without insulation sleeve)
Tightening torque : 0.5 to 0.6 N·m

● CT inside diameter and wiring length of current sensor

Primary current	Type	CT inside diameter	Wiring length (Max.) (1)(2)
5A	CTF-5A	10mm	10m/20m

Note(1) Use cables of AWG20 (approx. 0.5 mm²) or more. And do not ground the secondary-side wiring (including shielded wires).

Note(2) The secondary maximum wiring length varies depending on the cable used.
AWG20 (approx. 0.5mm²) : 10m, AWG18 (approx. 0.75mm²) or more : 20m.

■ Connection method

(1) Applicable wire

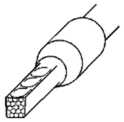
Terminal is a screw-less spring-type terminal. Fit wire size, please refer to the table below.

Terminal	Wire	Applicable wire					
		Single wire	Flexible stranded wire	Stranded wire, rod terminal (Ferrule with insulating collar)	Stranded wire, rod terminal (Ferrule without insulating collar)	Two stranded wire, rod terminal (Twin ferrule with insulating collar)	Delamination of wire
Voltage input, Power supply, Ground	Cross-sectional area	0.08 to 2.5mm²		0.25 to 1.5mm²		0.5mm²×2	5 to 6mm
	AWG	28 to 12		24 to 16		22	
Current sensor, Communication output, Control input, Control output, Zero-phase voltage (Vo) input	Cross-sectional area	0.08 to 2.5mm²		0.25 to 1.5mm²		0.5mm²×2	
	AWG	28 to 12		24 to 16		22	

Flexible stranded wire

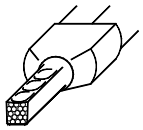
Single wire

Stranded wire, rod terminal
(Ferrule with insulating collar)



Stranded wire, rod terminal
(Ferrule without insulating collar)

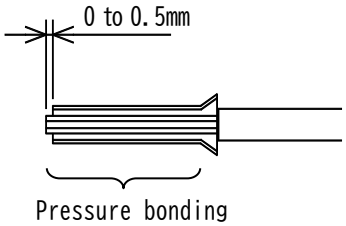
Two stranded wire, rod terminal
(Twin ferrule with insulating collar)



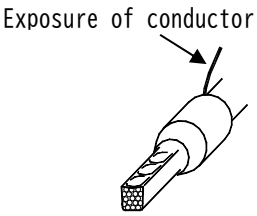
Twin ferrule with insulating collar can crimp more two standard wires at the same time. Please use in the case of two wires to daisy chain, such as one terminal.

In case of flexible stranded wire, please be careful not to loosen the wire.
There is a rod terminal as a preventive measure. Rod terminal of recommendation, please refer to the following. Also, please use a dedicated crimping tool to rod terminal.

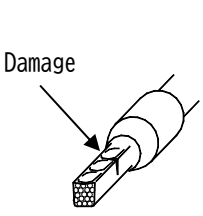
- Rod terminal : Made by WAGO, Ferrule with insulating collar／Ferrule without insulating collar, 216 series
- Crimping tool : Made by WAGO, Ferrule crimping tool 206-204 (Applicable wire : 0.25mm² to 4mm²)
- Please use a rod terminal that matches the wire size.
- The tip of the wire, please cut the length of the rod terminal (or about 0.5mm long).
- After the rod terminal crimping, please check the appearance.



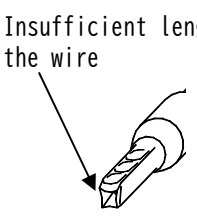
○



× Exposure of conductor



× Damage to the side



× Wire peeling shortage

(2) Connection method

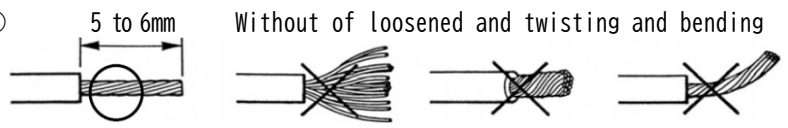
① Stripping 5 to 6mm a coating of the tip of the wire. Or, crimping the rod terminal.
The screwdriver of the flat-blade screwdriver cutting edge (3.5mm × 0.5mm)

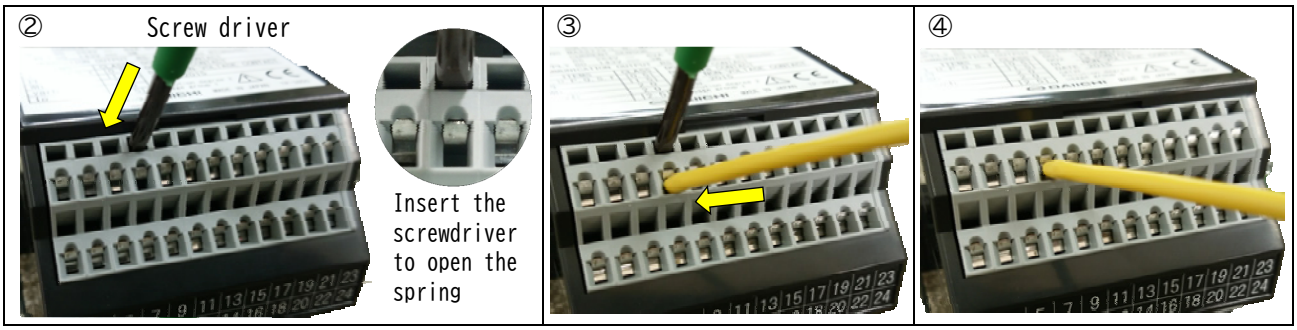
② Insert the screwdriver to screwdriver insertion slot, open the spring.

③ To insert the wire to the wire insertion slot.

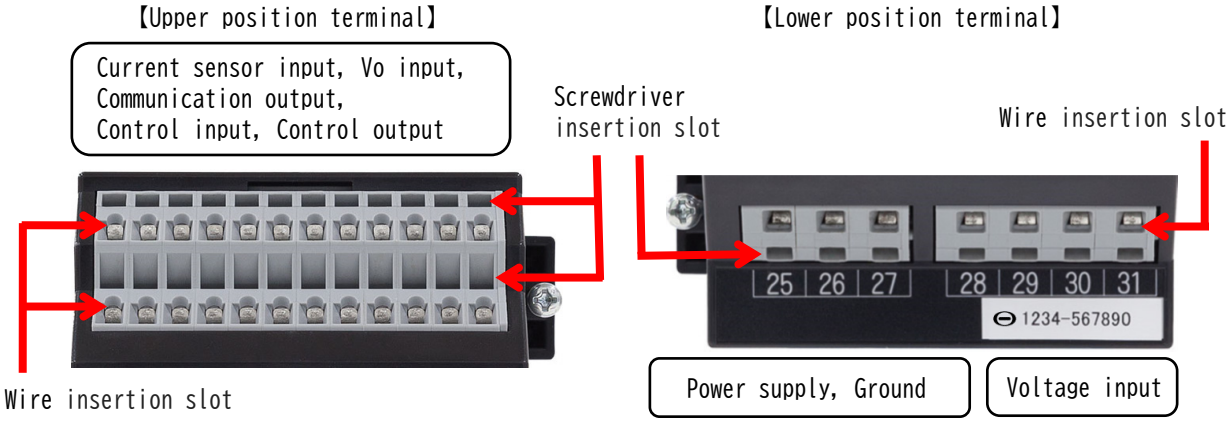
④ Pull out the screwdriver, close the spring.

【Recommended screwdriver】
Cutting edge 3.5mm × 0.5mm
WAGO made screwdriver
210-720, 210-657, 210-658,
210-120J, 210-350/01, 210-258J





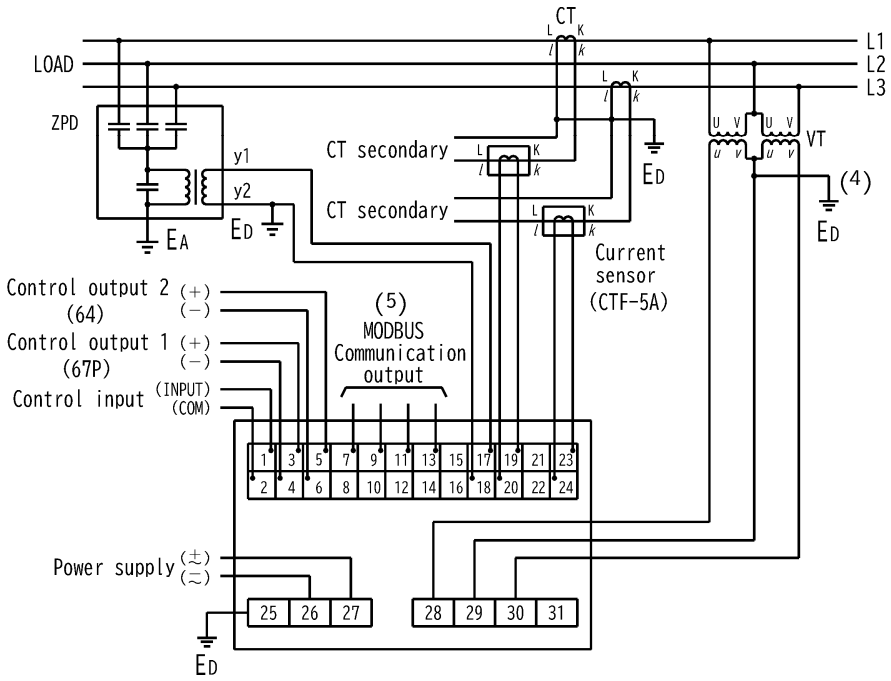
【Screwdriver and wire insertion slot】



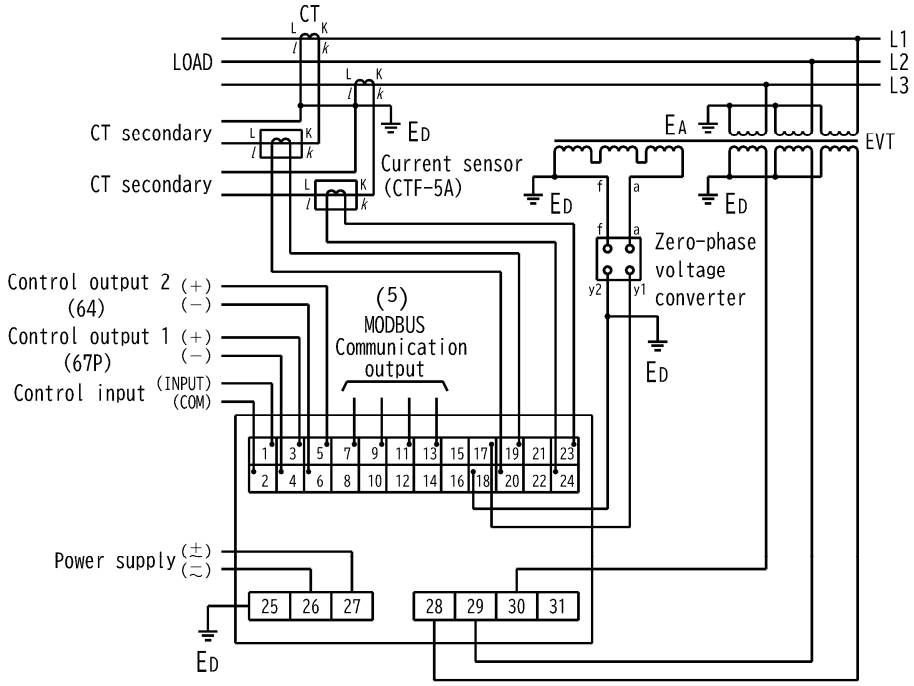
4. Connection (3)

When inputting current, be sure to use in combination with a dedicated current sensor.
Direct wiring of the secondary side of a current transformer for instruments may cause failure.

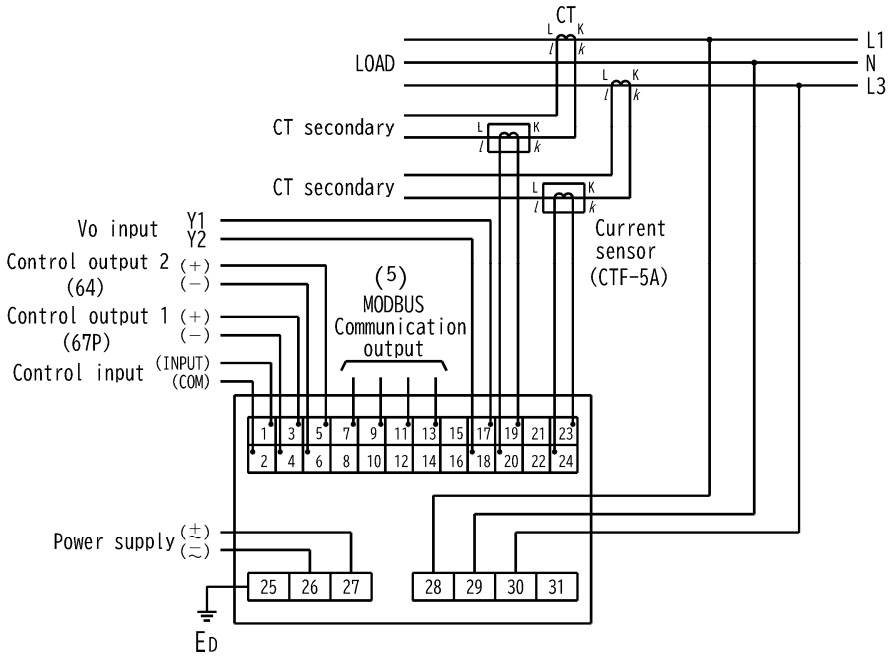
■ 3-phase 3-wire (ZPD)



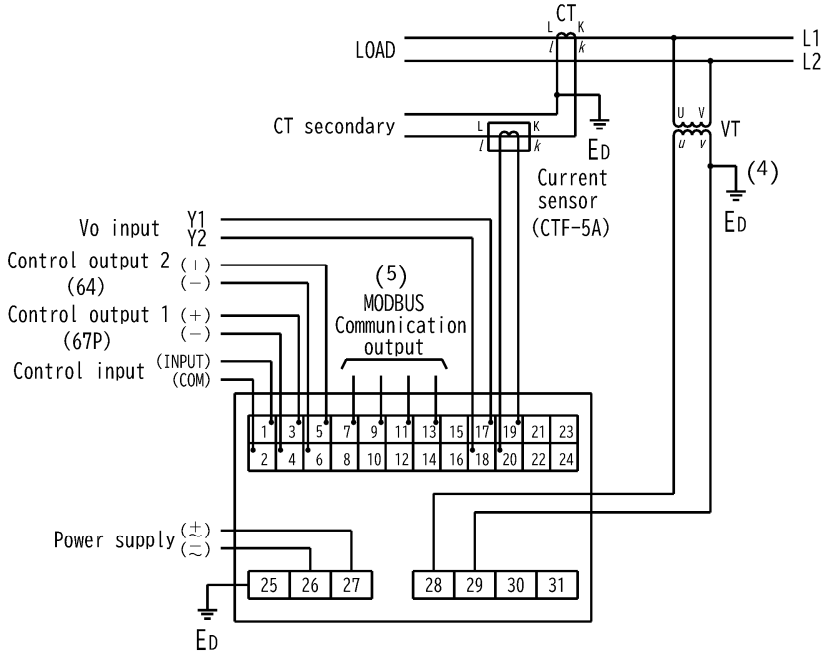
■ 3-phase 3-wire (EVT)



■ 1-phase 3-wire

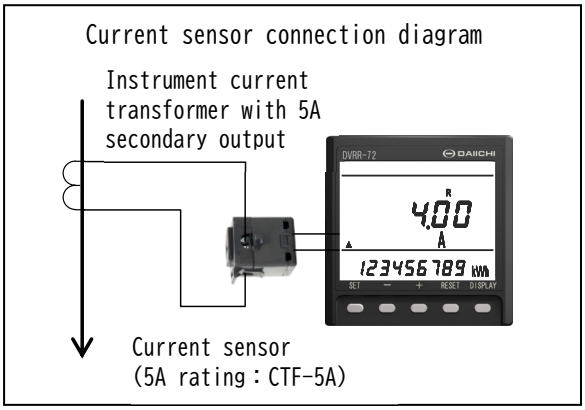


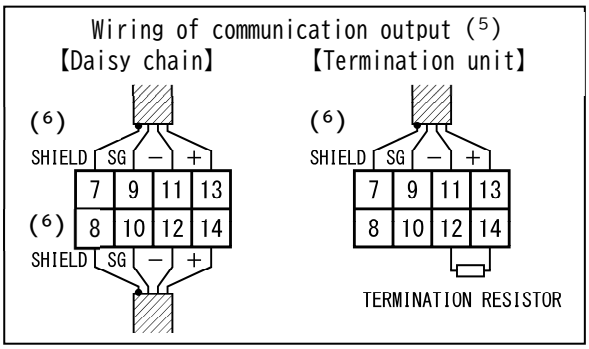
■ 1-phase 2-wire



Note(3) Use an instrument transformer (VT) and a current transformer (CT) with a secondary rating of 5 A, and ground the secondary side. Also, use a current sensor (CTF-5A) with a 5A rating connected to the secondary of the instrument current transformer.

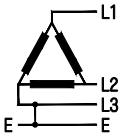
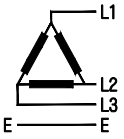
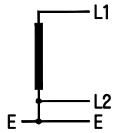
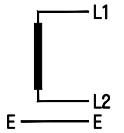
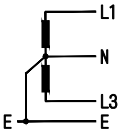
Note(4) Be sure to ground terminal 29 in the voltage input circuit.





<Note>
Please use a twisted cable for the secondary wiring of the current sensor in consideration of inductive noise.
Please use a cable size of 0.5SQ or more (finished outer diameter 3mm or less).

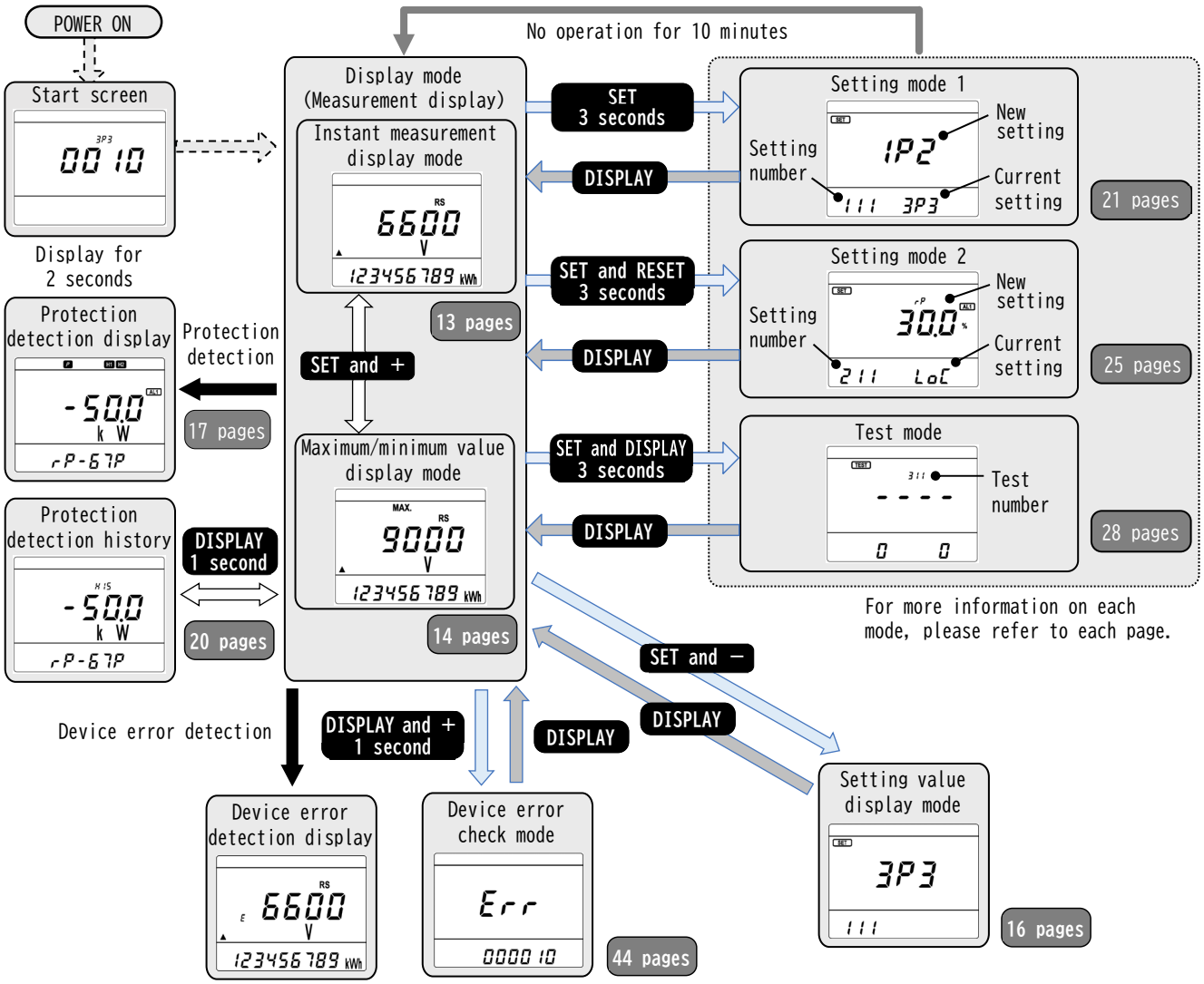
Maximum rated voltage by wiring type

Wiring type	3 phase 3 wire (Ground)	3 phase 3 wire (Ungrounded)	1 phase 2 wire (Ground)	1 phase 2 wire (Ungrounded)	1 phase 3 wire
					
Maximum rated voltage	220V(L-L)	480V(L-L)	220V(L-L)	480V(L-L)	220V(L-N) 440V(L-L)

Note(5) Communication output terminal (7-8, 9-10, 11-12 ,13-14) are connected internally respectively.
In case of the daisy chain, please connect in accordance with the diagram above.
Connect the supplied resistor between (+) and (-) of the MODBUS communication output terminal only for devices that are terminated in the connection configuration.

Mote(6) This terminal is for relaying shielded wires of communication cables (for daisy chain) and is not connected to ground or internal common.

5. Operation and display



6. Display mode

6.1 Measurement display

About active energy status display	
●	Flashes while the amount of active energy is being measured. When the amount of electric energy is not being measured, the display is off.

Switch	Operation
SET	Switching between valid operation screens
−／+	Switching of measurement items
RESET (Pressing for more than 1 second)	Reset of each alarm (Instant measurement display mode)
	Reset of maximum value / minimum value (Maximum / Minimum value display mode)
DISPLAY	Switching of phase / line / average value (AVG) for measurement display
SET (Pressing for more than 3 second)	Switch to setting mode 1
SET and RESET (Pressing for more than 3 second)	Switch to setting mode 2
SET and DISPLAY (Pressing for more than 3 second)	Switch to test mode

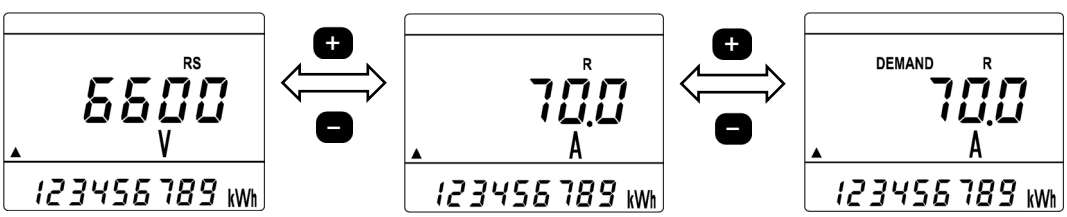
About the measurement items symbol			
U	Voltage	S	Apparent power
I	Current	PF	Power factor
Id	Demand current	f	Frequency
P	Active power	Vo	Zero-phase voltage
Pd	Demand active power	Wh	Active energy
Q	Reactive power	varh	Reactive energy

6.2 Instantaneous measurement display mode

(1) Switching of main-monitor display

Press the【SET】switch, to display the【▲】(operation effective display).
Then by pressing the【+】【−】switch the displays of the main-monitor.

〔 Voltage (U) display 〕 〔 Current (I) display 〕 〔 Demand current (Id) display 〕



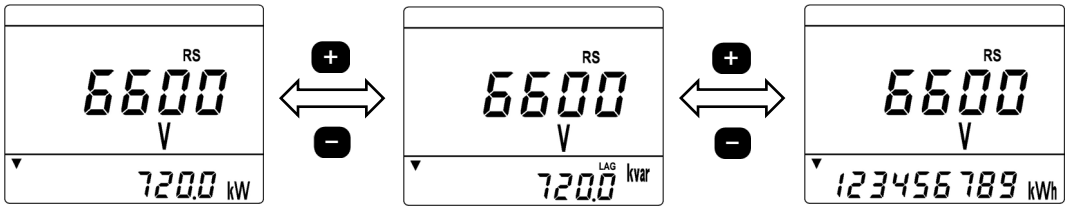
Measuring is switched in the following order.

U ⇔ I ⇔ Id ⇔ P ⇔ Pd ⇔ Q ⇔ S ⇔ PF ⇔ f ⇔ Vo ⇔ OFF

(2) Switching of the sub-monitor display element

Press the【SET】switch, to display the【▼】(operation effective display).
Then by pressing the【+】【−】switch the displays of the sub-monitor.

〔Active power (P) display〕 〔Reactive power (Q) display〕 〔Receiving active energy (Wh) display〕

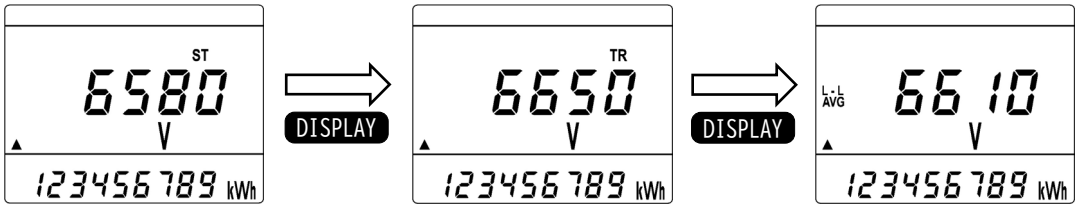


Measuring is switched in the following order.

P ⇔ Q ⇔ Wh ⇔ -Wh ⇔ varh(LAG) ⇔ varh(LEAD) ⇔ -varh(LAG) ⇔ -varh(LEAD) ⇔ OFF

(3) Switching of phase (line) / average value (AVG) display

By pressing the【DISPLAY】switch the phase (line) display of the main-monitor.



Measuring is switched in the following order.

	Measurement element (1, 2, 3, N : Phase, AVG : Average)	
	3 phase 3 wire	1 phase 3 wire
Voltage	U(L1-2) ⇔ U(L2-3) ⇔ U(L3-1) ⇔ U(L-L AVG)	U(L1-N) ⇔ U(L3-N) ⇔ U(L1-3) ⇔ U(L-N AVG)
Current, Demand current	I(L1) ⇔ I(L2) ⇔ I(L3) ⇔ I(AVG)	I(L1) ⇔ I(L3) ⇔ I(N) ⇔ I(AVG)
Active power, Demand active power	—	—
Reactive power	—	—
Apparent power	—	—
Power factor	—	—
Zero-phase voltage	—	—

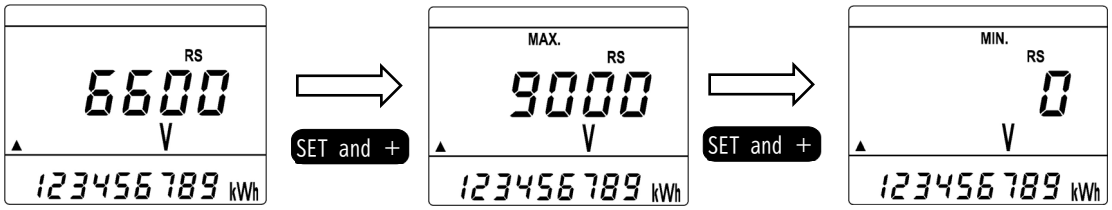
Display of phase / line, can be switched in the settings.

Setting	L123N	RSTN	UVWN
Phase, line display	L1	R	U
	L2	S	V
	L3	T	W
	N	N	N

6.3 Maximum value and minimum value display mode

Pressing the【SET】and【+】at instant measurement display mode, the switches to the maximum value display mode. (In maximum value display mode, to display the "MAX.")
Pressing the【SET】and【+】at maximum value display mode, the switches to the minimum value display mode. (In minimum value display mode, to display the "MIN.")
The maximum value/ minimum value display mode, will be switched to the measuring pressing the【+】【−】switch. And, pressing the【DISPLAY】switch the phase (line).

〔Instant measurement display mode〕 〔Maximum value display mode〕 〔Minimum value display mode〕



6.4 Reset

(1) Control output reset

The control output can be reset by pressing the 【RESET】 switch for 1 second or more on the protection detection screen or instant measurement display mode. However, this is limited to when the control output return method setting is set to "HoLd (manual return)" and the protection detection is restored. If the return method setting is "Auto (automatic return)", the control output is automatically reset when protection detection returns.
For detailed control output reset, refer to 7. Protection function.

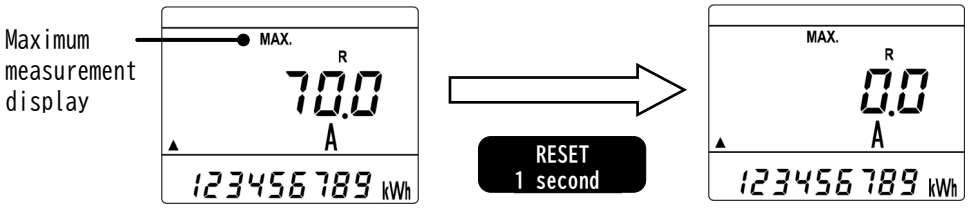
<Note> When the carry out this operation in the maximum / minimum measurement display mode, the maximum value / minimum value of measurement element in display is reset. Always instant measurement display mode, please carry out this operation.

(2) Maximum value ／ Minimum value reset

Resets the maximum value and the minimum value of the various measurement values.
Reset method has the two types.
Reset each measurement individually. Collectively reset all of the maximum value / minimum value.

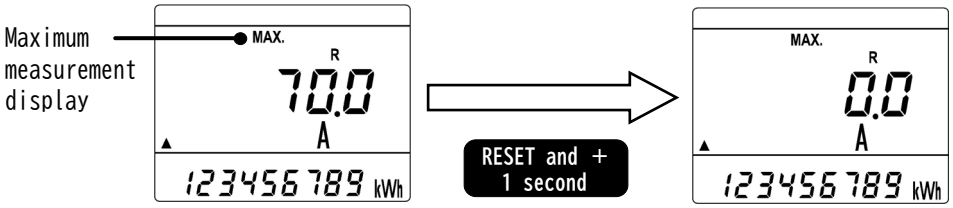
a) Reset each measurement individually
Resets the maximum and minimum values of a particular measurement element.
This operation does not reset the other maximum value and minimum value.
① Displays the measurement that want to reset.
② Press the【RESET】for more than 1 second.

<Note> If this operation is performed in the instantaneous measurement display mode, the alarm output will also be reset. Be sure to display the maximum and minimum values you want to reset before performing this operation.



Maximum value display mode　　Reset completion

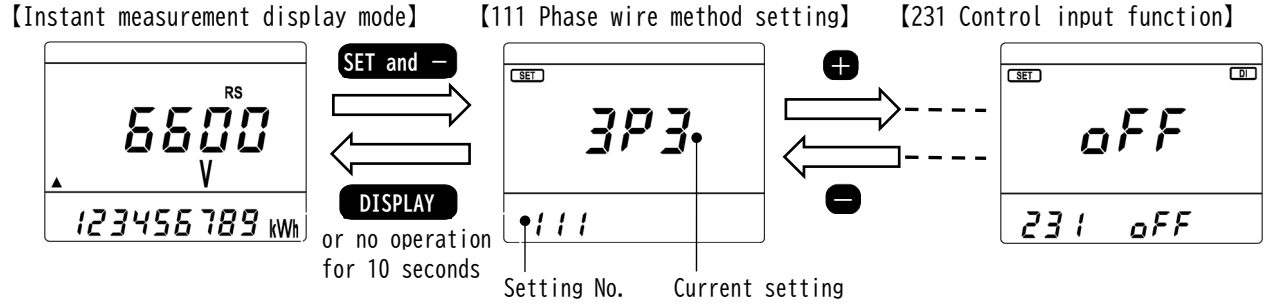
b) Collectively reset
Resets the maximum and minimum values of all measurement.
Can be operated in the same way in the control input by the setting.
① Press【RESET】and【＋】simultaneously for 1 second or longer in the maximum/minimum value measurement display mode.



Maximum value display mode　　Reset completion

6.5 Setting value display mode

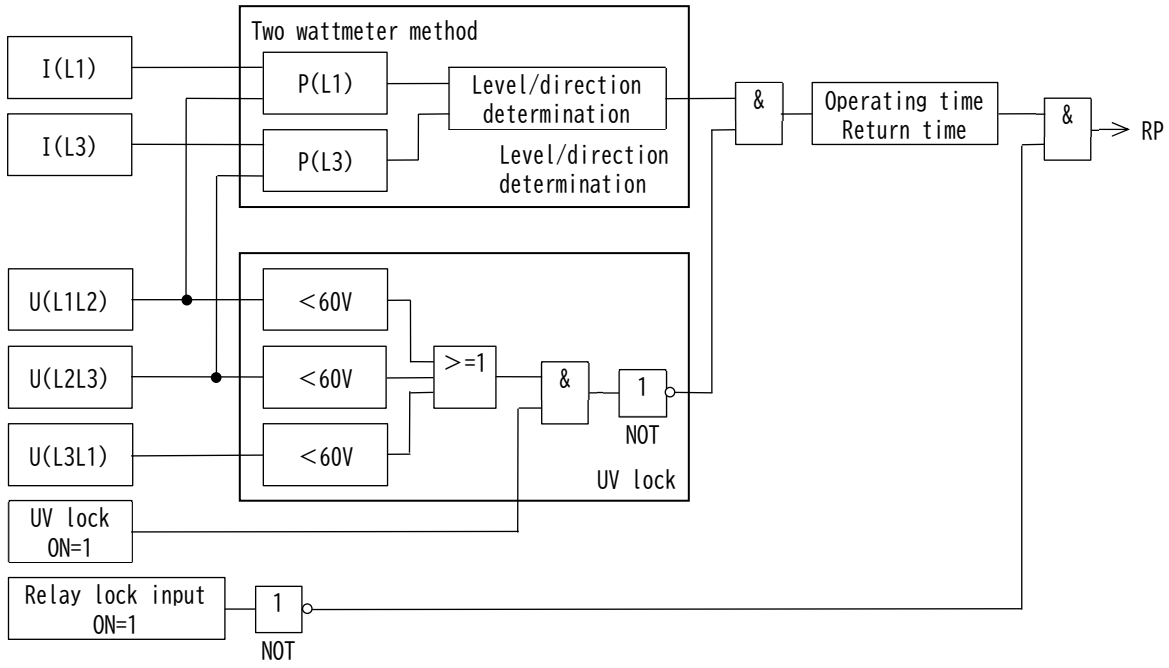
From the instant measurement display mode, press【SET】and【－】to enter setting value display mode.
In the setting value display mode, pressing the【＋】【－】switch switches the setting item, allowing you to check the current setting value of each setting item.
If the switch is not operated for 10 seconds or if the【DISPLAY】switch is pressed, it will return to the instantaneous measurement display mode.



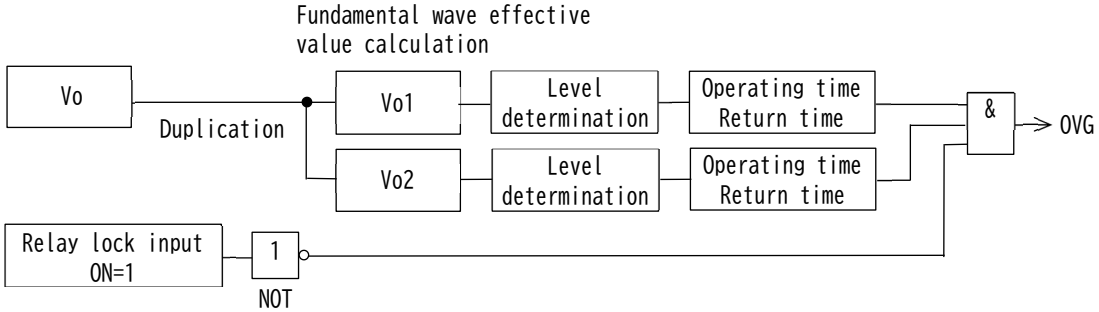
7. Protection functions

7.1 Protection detection block diagram

■ Reverse power RP



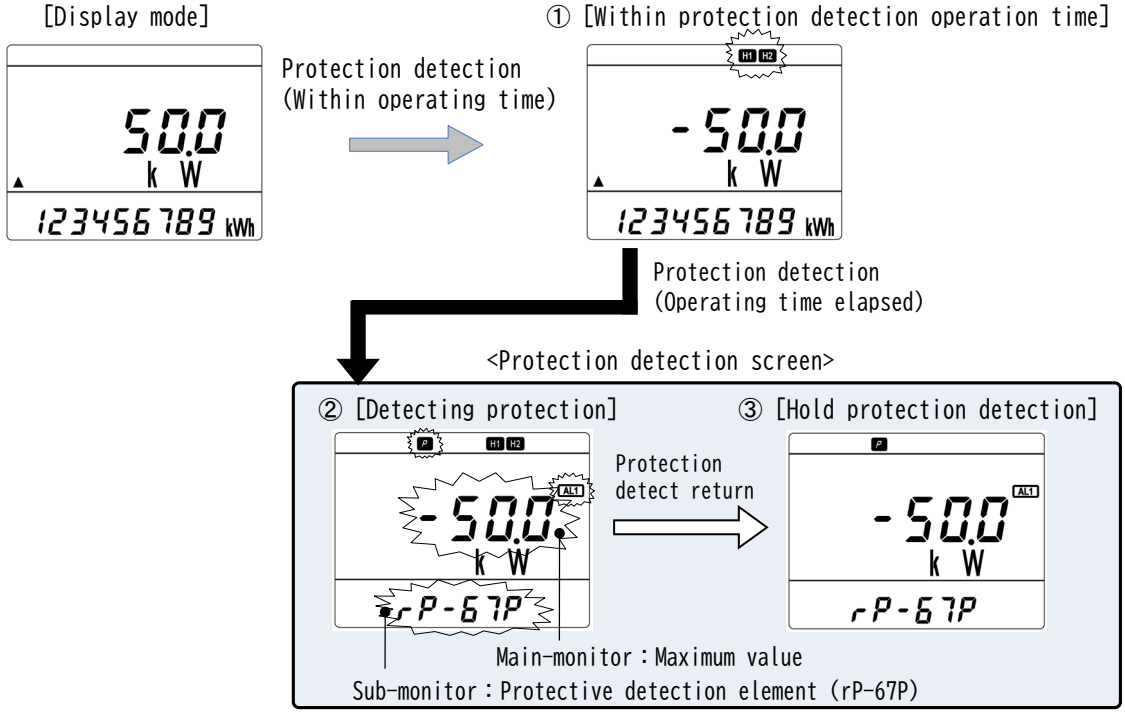
■ Ground overvoltage OVG



7.2 Protection detection

(1) Protection detection operation

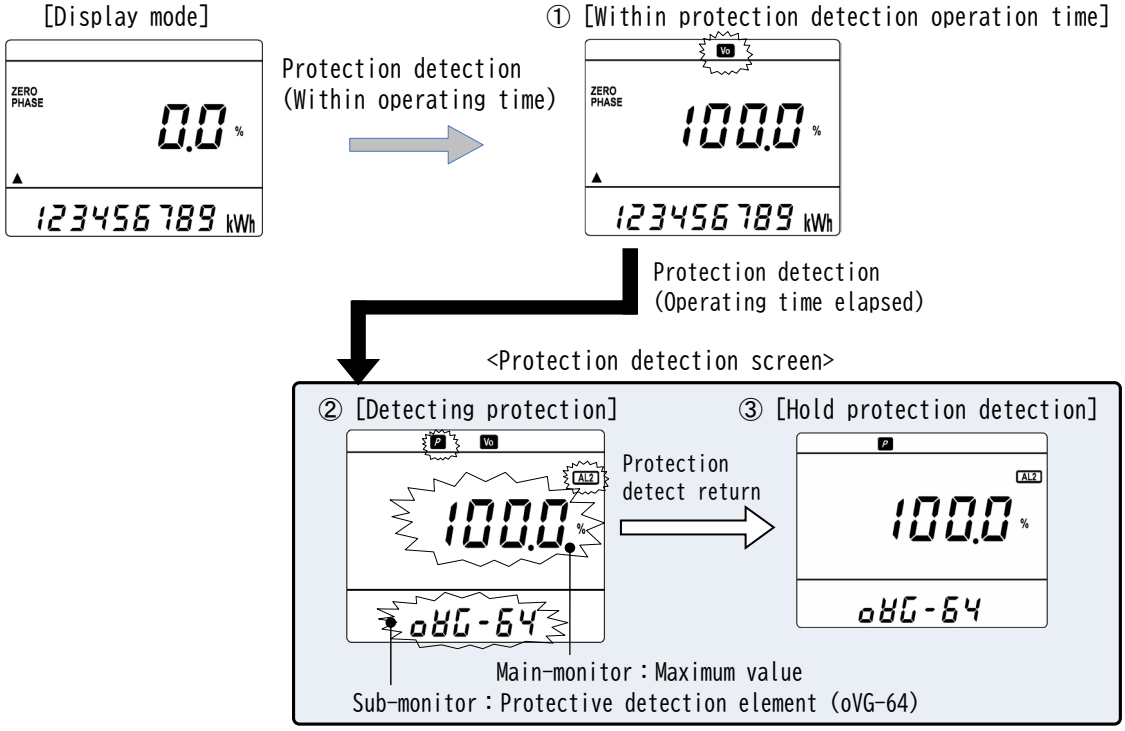
Element	Protection detection operation
Reverse power [RP] (67P)	① If the operating value is exceeded and the operating time is within, the pre-alarm display [H1] and reverse power detection display [H2] flicker on the LCD. ② When the operating time set value is exceeded, the LCD automatically switches to the protection detection screen and control output 1 is ON. The protection detection screen displays the maximum value at the time of detection for the main monitor. In addition, the secondary monitor displays protection detection elements. ③ When the detection returns, the LCD retains the protection detection element and the maximum value. When the control output 1 return method setting is "Auto (Auto return)", the control output 1 is OFF. <Caution> If the backlight operation setting is set to "Auto (Auto off)", the backlight will turn on when reverse power is detected. In addition, the backlight is always on during the protection detection screen.



Explanation of display symbols

Mark	Content	Within protection detection operation time	Detecting protection	Holding protection detection
[H1]	Reverse power pre-alarm	Flicker display	Display ON	Display OFF
[H2]	Reverse power detection	Flicker display (within pre-alarm operating time)	Display ON	Display OFF
[P]	Protection detection	Display OFF	Flicker display	Display ON
[AL1]	Control output 1	Display OFF	Flicker display	Display OFF (Auto return) Display ON (Manual return)

Element	Protection detection operation
Ground overvoltage [OVG] (64)	① If the operating value is exceeded and the operating time is within, the ground overvoltage [Vo] flicker on the LCD. ② When the operating time set value is exceeded, the LCD automatically switches to the protection detection screen and control output 2 is ON. The protection detection screen displays the maximum value at the time of detection for the main monitor. In addition, the secondary monitor displays protection detection elements. ③ When the detection returns, the LCD retains the protection detection element and the maximum value. When the control output 2 return method setting is "Auto (Auto return)", the control output 2 is OFF. <Caution> If the backlight operation setting is set to "Auto (Auto off)", the backlight will turn on when ground overvoltage is detected. In addition, the backlight is always on during the protection detection screen.

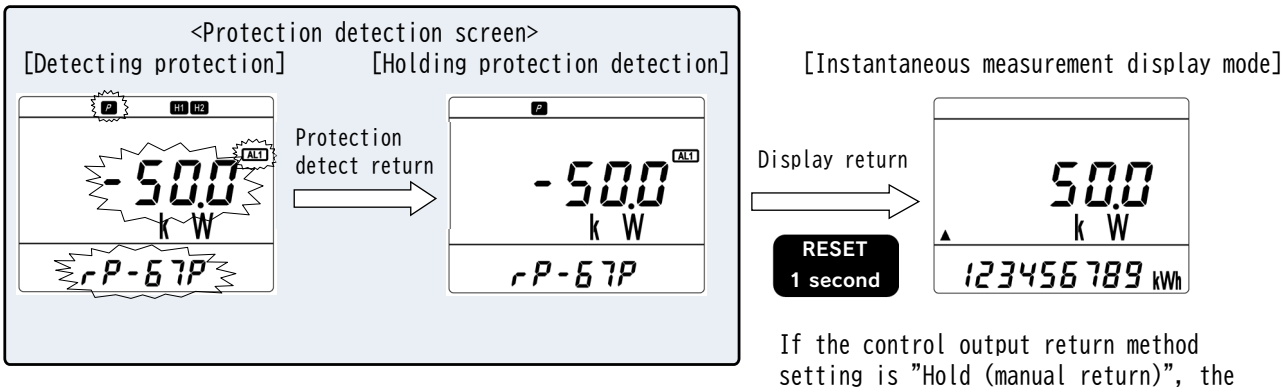


Explanation of display symbols

Mark	Content	Within protection detection operation time	Detecting protection	Holding protection detection
[Vo]	Ground overvoltage detection	Flicker display	Display ON	Display OFF
[P]	Protection detection	Display OFF	Flicker display	Display ON
[AL2]	Control output 2	Display OFF	Flicker display	Display OFF (Auto return) Display ON (Manual return)

(2) Return operation

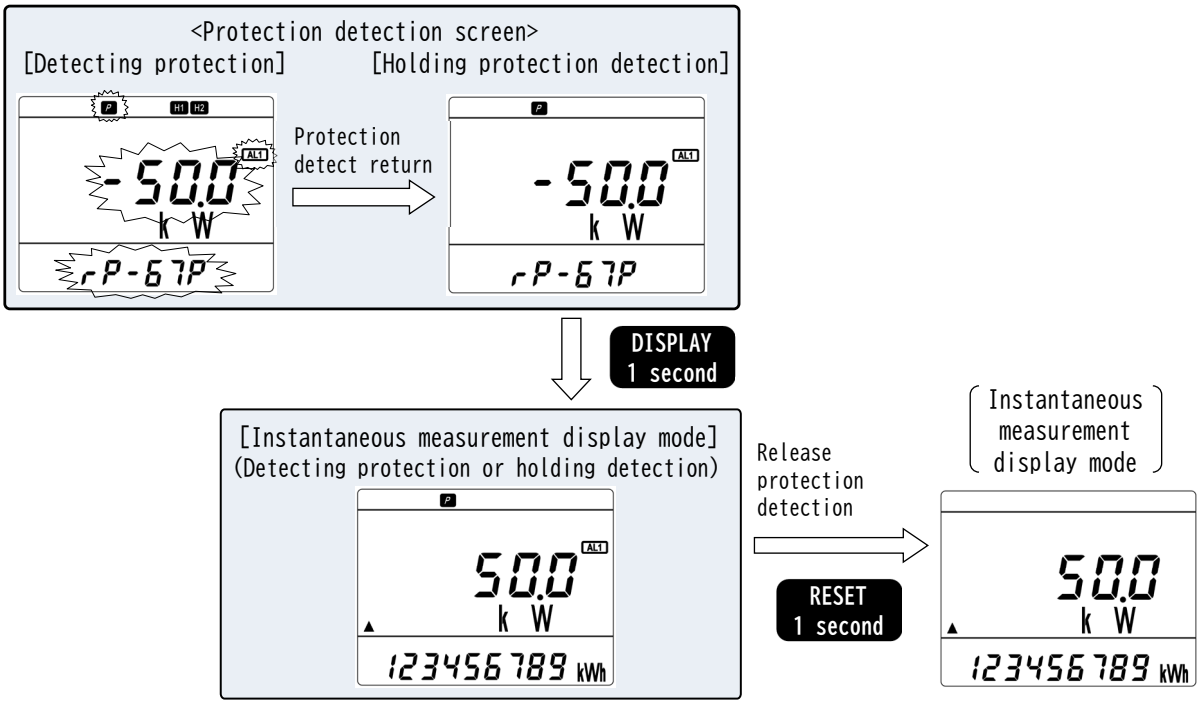
If the【RESET】switch is pressed for 1 second or longer after return from protection detection, the protection detection screen will be canceled and the display will return to the instantaneous measurement display mode.
At this time, if the return method setting of control output 1 or control output 2 is "Hold (manual return)", the control output is also turned OFF at the same time.



If the control output return method setting is "Hold (manual return)", the control output will also return at the same time.

(3) Special operation when protection is detected

If the【DISPLAY】switch is pressed for 1 second or more during protection detection display, it will switch to instantaneous measurement display mode.
After return from protection detection, press the【RESET】switch for 1 second or more to release the protection detection state.



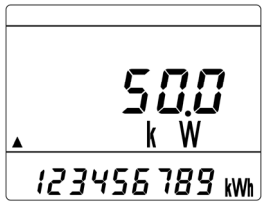
<Note> If the switch from the protection detection screen to the instantaneous measurement display mode, you cannot return to the protection detection screen. To check the maximum value during protection detection, check the protection detection history display.

7.3 Protection detection history

(1) Protection detection history display

The most recent detection value is recorded for the record of protection detection by reverse power detection and ground overvoltage detection.
Pressing the【DISPLAY】switch for 1 second or longer from the instantaneous measurement display mode switches to the protection detection history display.
In protection detection history display, the detection value (maximum value during detection) of each protection element is displayed.
The maximum value of protection elements without detection history is displayed as "－－－－".

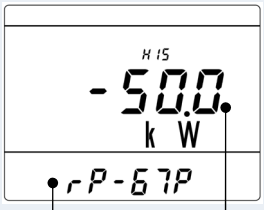
[Instantaneous measurement display mode]



DISPLAY
1 second

<Protection detection history display>

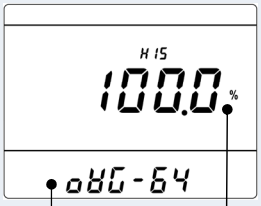
[Reverse power detection]



Main-monitor
: Maximum value

Sub-monitor
: Protective detection element
(rP-67P)

[Ground overvoltage detection]



Main-monitor
: Maximum value

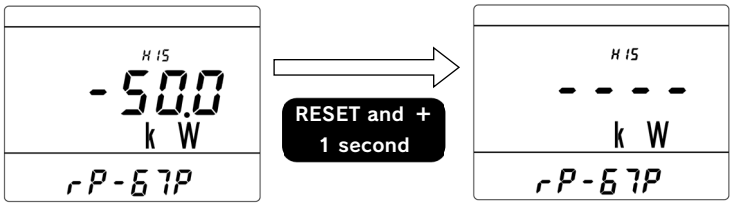
Sub-monitor
: Protective detection element
(oVG-64)

HIS : HISTORY

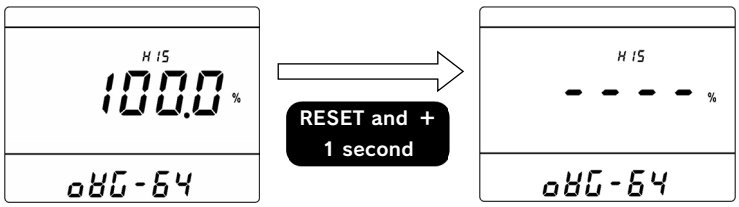
(2) Protection detection history reset

When the【RESET】and【+】switch is pressed for 1 seconds or more while the protection detection history is displayed, the detection history being displayed is reset.

[Reverse power detection]



[Ground overvoltage detection]

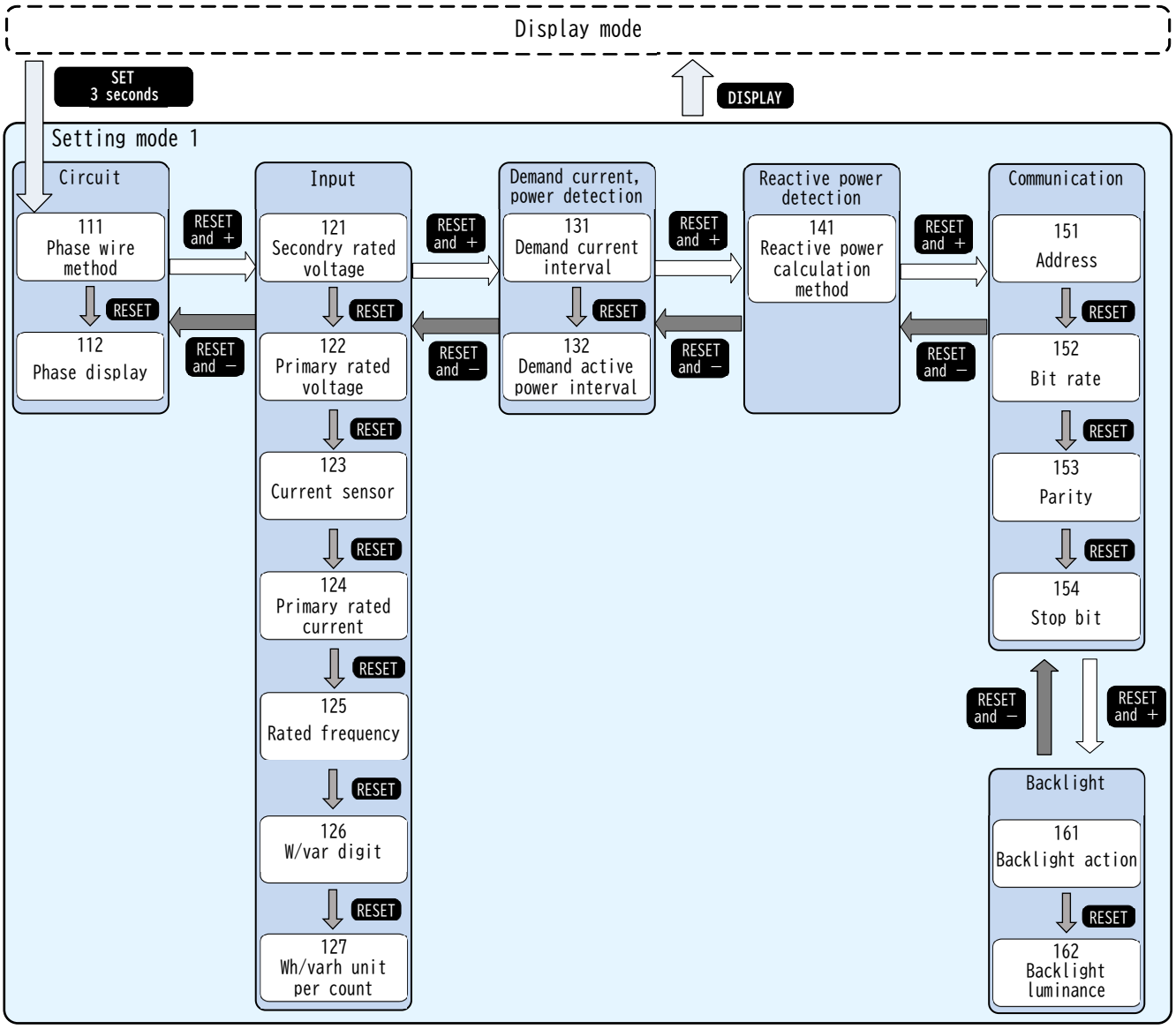


8. Setting

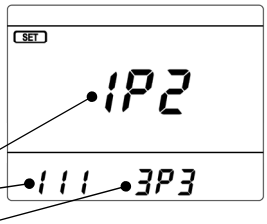
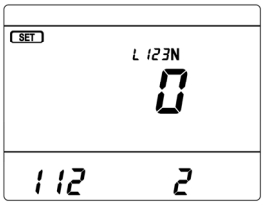
8.1 Setting mode 1

(Setting of circuit, input, interval, reactive power, communication output, backlight action)

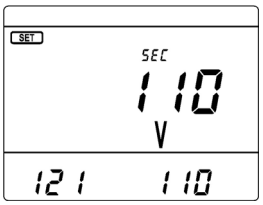
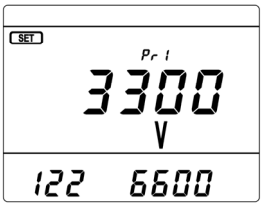
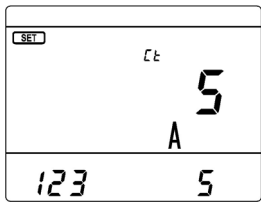
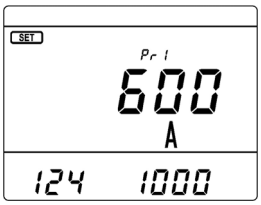
(1) Setting mode 1 flowchart

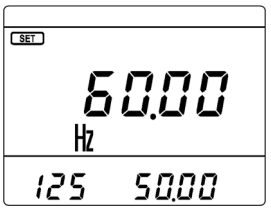
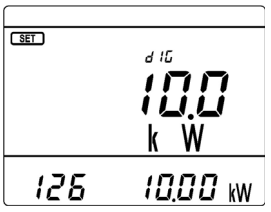
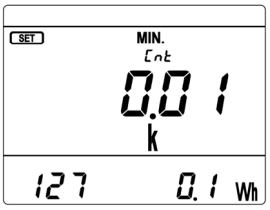


(2) Circuit

Setting No.	Setting item	Contents of setting
111	Phase wire method	Set the phase wire method of the input circuit. Setting value is selecting in the【+】【−】. To update the setting value in the【SET】. Input circuit: 3-phase 3-wire: 3P3; 1-phase 3-wire: 1P3; 1-phase 2-wire: 1P2 
112	Phase display	Set the display method of the phases and lines. Setting value is selecting in the 【+】【−】. To update the setting value in the【SET】. Phase display: L123N: 0; RSTN: 1; UVWN: 2 

(3) Input

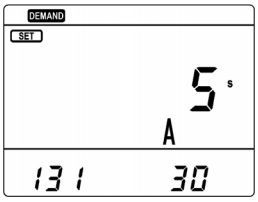
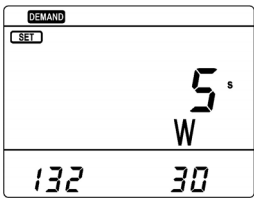
<table>
<tr><th>Setting No.</th><th>Setting item</th><th>Contents of setting</th></tr>
<tr><td>121</td><td>Secondary rated voltage</td><td>Display the secondary rated voltage.
(110V display fixed)
<table><tr><th>Secondary rated voltage</th></tr><tr><td>110V</td></tr></table>  </td></tr>
<tr><td>122</td><td>Primary rated voltage</td><td>Set the primary rated voltage relative to the secondary rated voltage.
Setting value is selecting in the【+】【−】.
To update the setting value in the【SET】.
<table><tr><th>No.</th><th>Primary rating</th><th>No.</th><th>Primary rating</th><th>No.</th><th>Primary rating</th></tr><tr><td>1</td><td>110.0V</td><td>12</td><td>880V</td><td>23</td><td>13.20kV</td></tr><tr><td>2</td><td>110V</td><td>13</td><td>990V</td><td>24</td><td>13.80kV</td></tr><tr><td>3</td><td>220.0V</td><td>14</td><td>1100V</td><td>25</td><td>16.50kV</td></tr><tr><td>4</td><td>220V</td><td>15</td><td>1650V</td><td>26</td><td>18.40kV</td></tr><tr><td>5</td><td>380V</td><td>16</td><td>2200V</td><td>27</td><td>20.00kV</td></tr><tr><td>6</td><td>400V</td><td>17</td><td>2.20kV</td><td>28</td><td>22.00kV</td></tr><tr><td>7</td><td>415V</td><td>18</td><td>3300V</td><td>29</td><td>33.00kV</td></tr><tr><td>8</td><td>440V</td><td>19</td><td>3.30kV</td><td>30</td><td>66.00kV</td></tr><tr><td>9</td><td>460V</td><td>20</td><td>6600V</td><td>31</td><td>77.0 kV</td></tr><tr><td>10</td><td>480V</td><td>21</td><td>6.60kV</td><td>32</td><td>110.0 kV</td></tr><tr><td>11</td><td>690V</td><td>22</td><td>11.00kV</td><td></td><td></td></tr></table> 
<Note> When using direct connection, set the primary rated voltage setting and secondary rated voltage setting to the same value.</td></tr>
<tr><td>123</td><td>Current sensor</td><td>Display the current sensor to be used.
(5A display fixed)
<table><tr><th>Current sensor</th></tr><tr><td>5A</td></tr></table>
<Note> Please use in combination with general-purpose instrument current transformer.  </td></tr>
<tr><td>124</td><td>Primary rated current</td><td>Set the primary rated current. Setting value is selecting in the【+】【−】.
To update the setting value in the【SET】.
<table><tr><th>No.</th><th>Primary rating</th><th>No.</th><th>Primary rating</th><th>No.</th><th>Primary rating</th></tr><tr><td>1</td><td>5.00A</td><td>17</td><td>120.0A</td><td>33</td><td>2000A</td></tr><tr><td>2</td><td>6.00A</td><td>18</td><td>150.0A</td><td>34</td><td>2500A</td></tr><tr><td>3</td><td>7.50A</td><td>19</td><td>200.0A</td><td>35</td><td>3000A</td></tr><tr><td>4</td><td>8.00A</td><td>20</td><td>250.0A</td><td>36</td><td>3500A</td></tr><tr><td>5</td><td>10.00A</td><td>21</td><td>300.0A</td><td>37</td><td>4000A</td></tr><tr><td>6</td><td>12.00A</td><td>22</td><td>400A</td><td>38</td><td>4500A</td></tr><tr><td>7</td><td>15.00A</td><td>23</td><td>500A</td><td>39</td><td>5000A</td></tr><tr><td>8</td><td>20.00A</td><td>24</td><td>600A</td><td>40</td><td>6000A</td></tr><tr><td>9</td><td>25.00A</td><td>25</td><td>750A</td><td>41</td><td>7500A</td></tr><tr><td>10</td><td>30.00A</td><td>26</td><td>800A</td><td>42</td><td>8000A</td></tr><tr><td>11</td><td>40.0A</td><td>27</td><td>900A</td><td>43</td><td>9.00kA</td></tr><tr><td>12</td><td>50.0A</td><td>28</td><td>1000A</td><td>44</td><td>10.00kA</td></tr><tr><td>13</td><td>60.0A</td><td>29</td><td>1200A</td><td>45</td><td>12.00kA</td></tr><tr><td>14</td><td>75.0A</td><td>30</td><td>1500A</td><td>46</td><td>15.00kA</td></tr><tr><td>15</td><td>80.0A</td><td>31</td><td>1600A</td><td>47</td><td>20.00kA</td></tr><tr><td>16</td><td>100.0A</td><td>32</td><td>1800A</td><td>48</td><td>30.00kA</td></tr></table> 
<Note> Please set it according to the instrument current transformer (CT) used.</td></tr>
</table>

Setting No.	Setting item	Contents of setting
125	Rated frequency	Set the rated frequency. Setting value is selecting in the 【+】【−】. To update the setting value in the 【SET】. Rated frequency: 50.00Hz / 60.00Hz 
126	W/var digit	Set the display digits for active power and reactive power. Setting value is selecting in the【+】【−】. To update the setting value in the【SET】. W/var digit: 3 digits / 4 digits 
127	Wh/varh unit per count	Set the unit for the minimum count value of the energy display. Counts up to 9 digits (999999999) with the settled unit as the least significant digit, and counts from 0 again if the maximum value is exceeded. Setting value is selecting in the【+】【−】. To update the setting value in the【SET】. 

Full load power kW/kvar (7)		Setting value kWh/kvarh			
	Below 1	0.01	0.001	0.0001	0.00001
Over 1	Below 10	0.1	0.01	0.001	0.0001
Over 10	Below 100	1	0.1	0.01	0.001
Over 100	Below 1,000	(8) 10	1	0.1	0.01
Over 1,000	Below 10,000	(8) 100	(8) 10	1	0.1
Over 10,000	Below 100,000	(8) 1,000	(8) 100	(8) 10	1
Over 100,000	Below 1,000,000	Disable	(8) 1,000	(8) 100	(8) 10
Over 1,000,000	Below 10,000,000	Disable	Disable	(8) 1,000	(8) 100

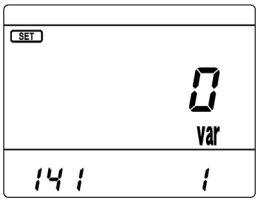
Note(7) Full load power (kW/kvar)
= K × Primary rated voltage [V] × Primary rated current [A] × 10^{-3}
(K : 3 phase 3 wire=√3, 1 phase 3 wire=2, 1 phase 2 wire=1)
Note(8) Units of display of the integrated power energy is MWh / Mvarh.

(4) Demand current, active power detection

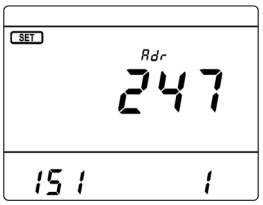
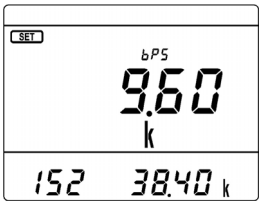
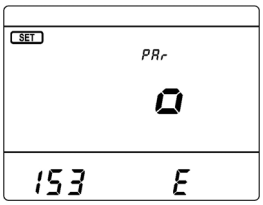
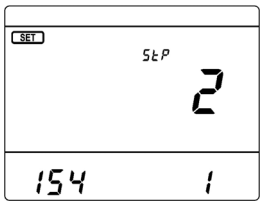
Setting No.	Setting item	Contents of setting
131 132	Demand current interval Demand active power interval	Set the demand current and demand active power measurement interval. Setting value is selecting in the 【+】【−】. To update the setting value in the【SET】. The display at the time of setting is displayed as second → s, minute → min.  

Interval		
0 second	1 minite	8 minites
5 seconds	2 minites	9 minites
10 seconds	3 minites	10 minites
20 seconds	4 minites	15 minites
30 seconds	5 minites	20 minites
40 seconds	6 minites	25 minites
50 seconds	7 minites	30 minites

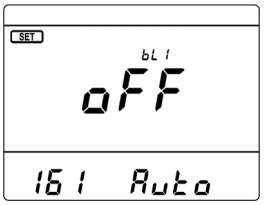
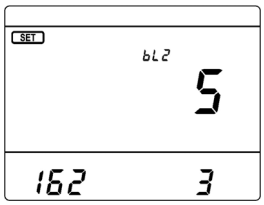
(5) Reactive power

Setting No.	Setting item	Contents of setting
141	Reactive power calculation method	Set the calculation method of reactive power. Setting value is selecting in the 【+】【−】. To update the setting value in the【SET】. Reactive power calculation method $Q=UI\sin\phi$: 0 $Q=\sqrt{(S^2-P^2)}$: 1 

(6) Communication

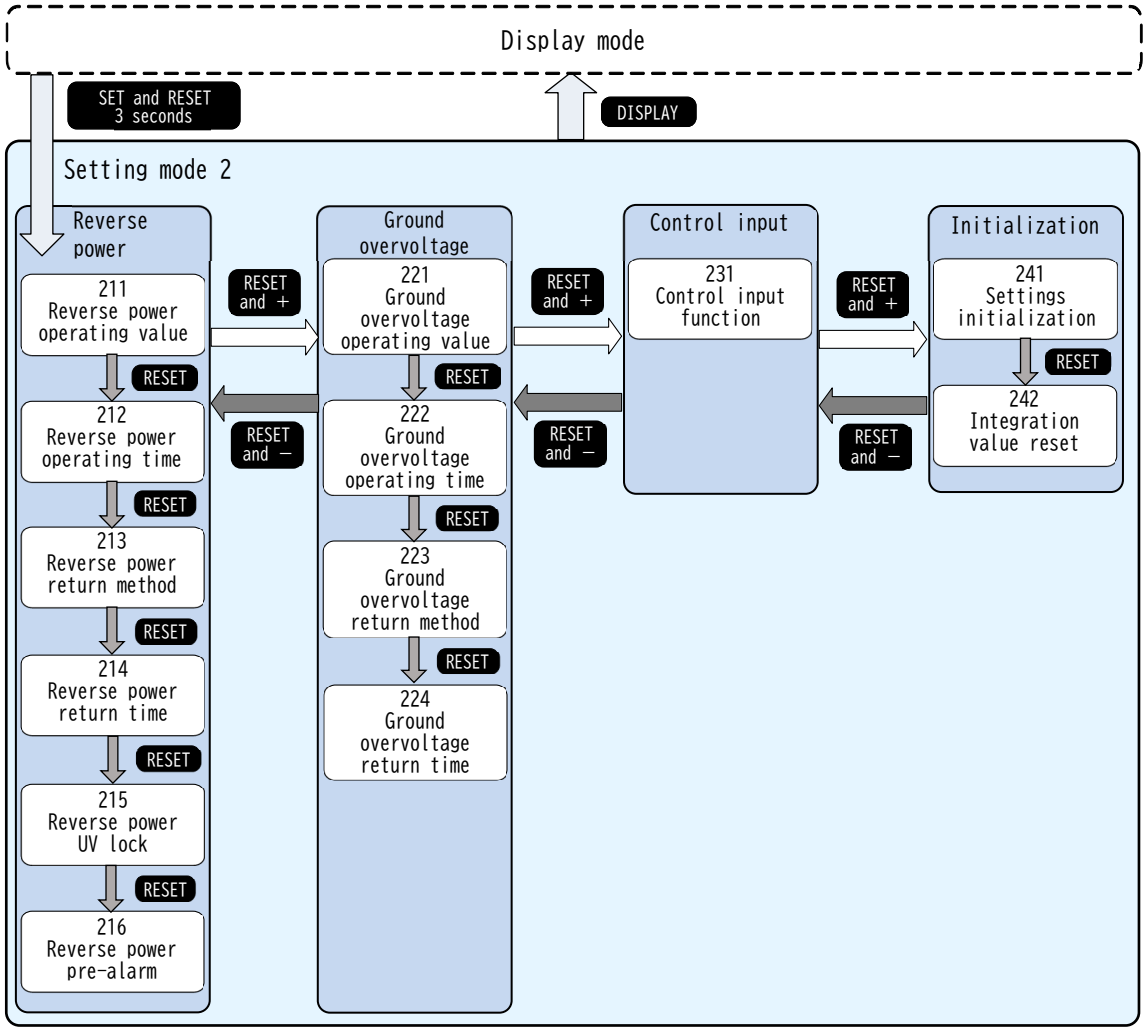
Setting No.	Setting item	Contents of setting
151	Address	Set the device address for MODBUS communication output. Setting value is selecting in the 【+】【−】. To update the setting value in the【SET】. Address: 1 to 247 
152	Bit rate	Set the bit rate (bps) for MODBUS communication output. Setting value is selecting in the 【+】【−】. To update the setting value in the【SET】. Bit rate 4800bps : 4.80k 9600bps : 9.60k 19200bps : 19.20k 38400bps : 38.40k 
153	Parity	Set the parity for MODBUS communication output. Setting value is selecting in the 【+】【−】. To update the setting value in the【SET】. Parity None : — Even number : E Odd number : o 
154	Stop bit	Set the stop bit for MODBUS communication output. Setting value is selecting in the【+】【−】. To update the setting value in the【SET】. Stop bit 1 bit : 1 2 bit : 2 

(7) Backlight

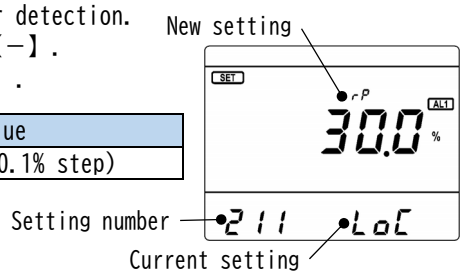
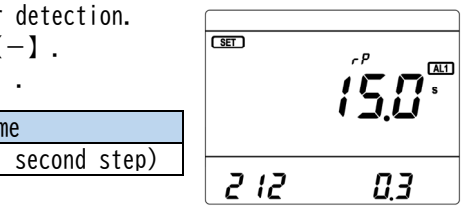
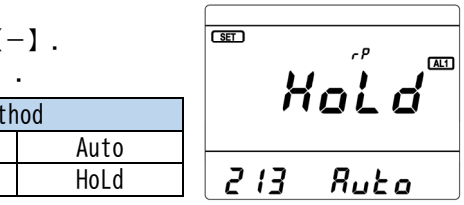
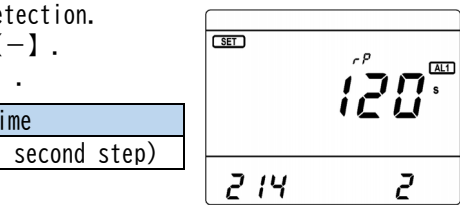
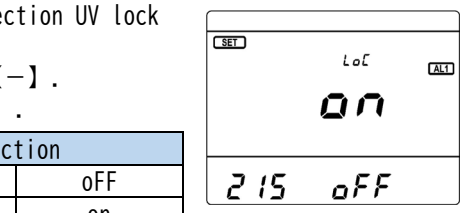
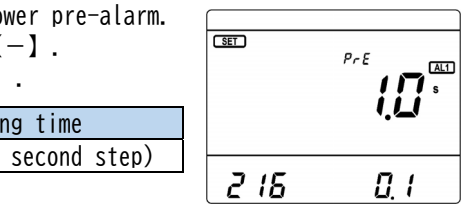
Setting No.	Setting item	Contents of setting
161	Backlight action	Set the backlight action. Setting value is selecting in the【+】【−】. To update the setting value in the【SET】. Backlight action Auto off : Auto Always-on : on Always-off : oFF  Auto off is lights off the backlight after 5 minutes of no switch operation. After lights off the backlight, operate any switch to lights on the backlight.
162	Backlight luminance	Set the luminance of the backlight. Setting value is selecting in the【+】【−】. To update the setting value in the【SET】. Backlight luminance Bright : 5 4 3 2 Dark : 1 

8.2 Setting mode 2 (Setting of reverse power, ground overvoltage, control input, initialization)

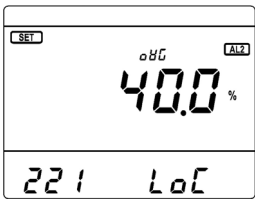
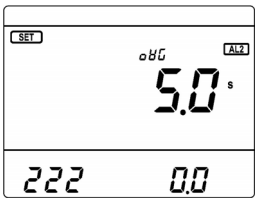
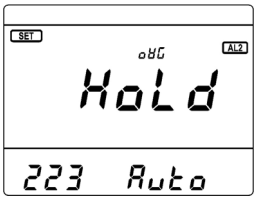
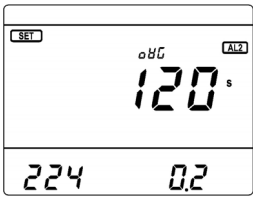
(1) Setting mode 2 flowchart



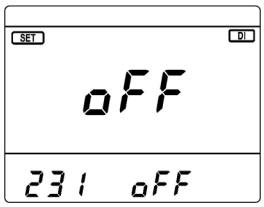
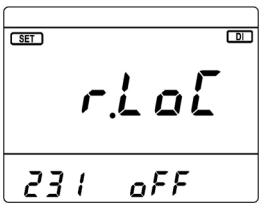
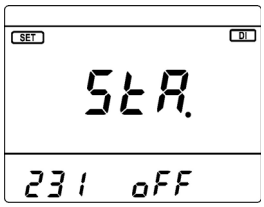
(2) Reverse power

<table>
<tr><th>Setting No.</th><th>Setting item</th><th>Contents of setting</th></tr>
<tr><td>211</td><td>Reverse power operating value</td><td>Set the operating value of reverse power detection.
Setting value is selecting in the【+】【−】.
To update the setting value in the【SET】.
<table><tr><th>Operating value</th></tr><tr><td>Lock, 0.2 to 30.0% (0.1% step)</td></tr></table>  </td></tr>
<tr><td>212</td><td>Reverse power operating time</td><td>Set the operating time for reverse power detection.
Setting value is selecting in the【+】【−】.
To update the setting value in the【SET】.
<table><tr><th>Operating time</th></tr><tr><td>0.1 to 15.0 seconds (0.1 second step)</td></tr></table>  </td></tr>
<tr><td>213</td><td>Reverse power return method</td><td>Set the control output 1 return method.
Setting value is selecting in the【+】【−】.
To update the setting value in the【SET】.
<table><tr><th colspan="2">Return method</th></tr><tr><td>Auto return</td><td>Auto</td></tr><tr><td>Manual return</td><td>HoLd</td></tr></table>  </td></tr>
<tr><td>214</td><td>Reverse power return time</td><td>Set the return time for reverse power detection.
Setting value is selecting in the【+】【−】.
To update the setting value in the【SET】.
<table><tr><th>Return time</th></tr><tr><td>2 to 600 seconds (1 second step)</td></tr></table>  </td></tr>
<tr><td>215</td><td>Reverse power UV lock</td><td>Set the ON/OFF of the reverse power detection UV lock function.
Setting value is selecting in the【+】【−】.
To update the setting value in the【SET】.
<table><tr><th colspan="2">UV lock function</th></tr><tr><td>Unused</td><td>oFF</td></tr><tr><td>Use</td><td>on</td></tr></table>  </td></tr>
<tr><td>216</td><td>Reverse power pre-alarm</td><td>Set the operating time of the reverse power pre-alarm.
Setting value is selecting in the【+】【−】.
To update the setting value in the【SET】.
<table><tr><th>Pre-alarm operating time</th></tr><tr><td>0.1 to 1.0 seconds (0.1 second step)</td></tr></table>  </td></tr>
</table>

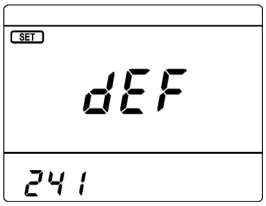
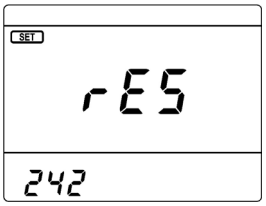
(3) Ground overvoltage

Setting No.	Setting item	Contents of setting
221	Ground overvoltage operating value	Set the operating value of ground overvoltage detection. The zero-phase voltage (3810V at 6600V primary voltage) that occurs at a complete ground fault is 100%. Setting value is selecting in the【+】【−】. To update the setting value in the【SET】. 
		Operating value: Lock, 2.0 to 40.0% (0.1% step)
222	Ground overvoltage operating time	Set the operating time of ground overvoltage detection. Setting value is selecting in the【+】【−】. To update the setting value in the【SET】. 
		Operating time: 0.0 to 5.0 seconds (0.1 second step)
223	Ground overvoltage return method	Set the control output 2 return method. Setting value is selecting in the【+】【−】. To update the setting value in the【SET】. 
		Return method: Auto return — Auto; Manual return — HoLd
224	Ground overvoltage return time	Set the return time for ground overvoltage detection. Setting value is selecting in the【+】【−】. To update the setting value in the【SET】. 
		Return time: 0.2 seconds, 2 to 600 seconds (1 second step)

(4) Control input

Setting No.	Setting item	Contents of setting
231	Control input function	Sets the function of the control input. Setting value is selecting in the【+】【−】. To update the setting value in the【SET】.   
		Control input function: Unused — oFF; Relay lock input — r.LoC; State input — StA.

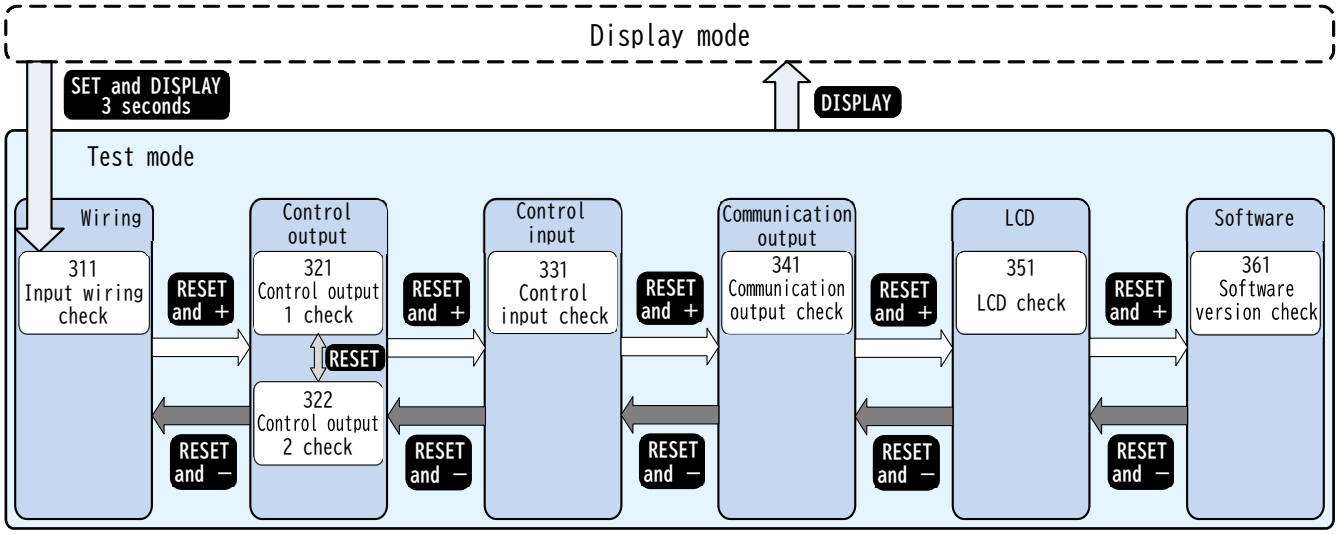
(5) Initialization

Setting No.	Setting item	Contents of setting
241	Settings initialization	Pressing【SET】for 3 seconds initializes each setting value (returns to the initial setting value). 
242	Integration value reset	Reset (=0) each power amount. Press【SET】for 3 seconds to reset all accumulated values. 〔 Wh, -Wh, varh (LAG), -varh (LAG), varh (LEAD), -varh (LEAD) 〕 

9. Test mode

Test mode is equipped with features that can be utilized, such as during start-up of equipment.

<Note> During protection detection and detection hold, test mode cannot be entered.
Also, the protection detection function is disabled during the test mode.

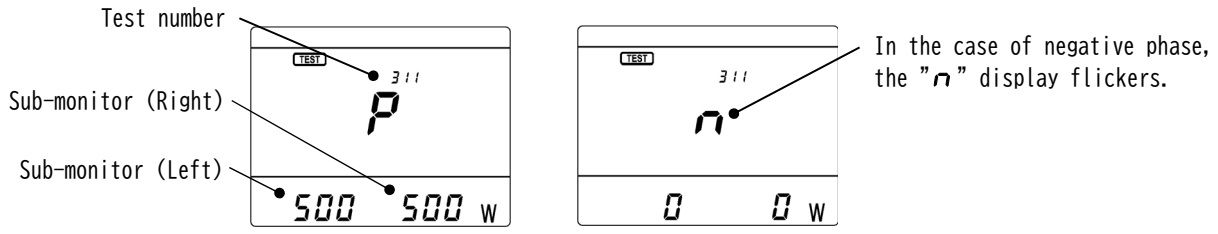


(1) Input wiring check

The connection state of voltage input and current input can be check.
Displays each phase of the active power value, and phase sequence of voltage.
Therefore, it will easily determine the mistake of connection of input.

Display example

● Phase display (3P3W)
Positive phase sequence "P" (Positive),
Negative phase sequence "n" (Negative),
Display when no input : "----" (In case of 1P3W, 1P2W circuit : "----")

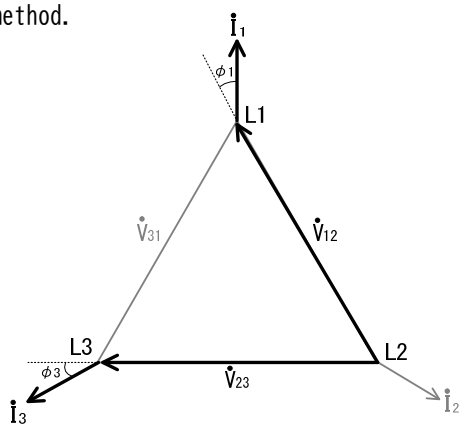


● Active power display for each phase
Sub-monitor (Left) : L1 phase of active power
Sub-monitor (Right) : L3 phase of active power

The three-phase active power is calculated by the two-wattmeter method.

$$\text{Three-phase active power} = \dot{V}_{12} \cdot \dot{I}_1 + \dot{V}_{23} \cdot \dot{I}_3$$
$$= \underline{V_{12} \cdot I_1 \cdot \cos\phi 1} + \underline{V_{23} \cdot I_3 \cdot \cos\phi 3}$$
(L1 phase active power) (L3 phase active power)

Test mode displays the active power of the L1 and L3 phases above.
Three-phase active power ($\sqrt{3}$ × rated voltage × rated current × 1.05 × power factor 1) is displayed as 1000 (100.0%). Also, the L1 phase active power is displayed as 500 (50.0%) and the L3 phase active power as 500 (50.0%). (In the case of a single-phase circuit, the L3 phase active power is displayed as 0.)



【Vector diagram (3P3W)】

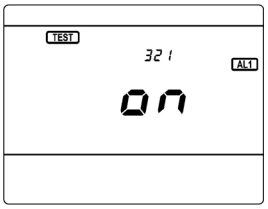
● Input wiring confirmation example
Example 1) Input condition : 3P3W 110V, 5.25A, Power factor 1
・Normal wiring
L1 phase active power = 110V×5.25A×cos 30° ≒ 500
L3 phase active power = 110V×5.25A×cos 330° ≒ 500
・Reverse wiring of primary side (K, L) or secondary side (k, l) of L1 phase current
L1 phase active power = 110V×5.25A×cos 210° ≒ -500
L3 phase active power = 110V×5.25A×cos 330° ≒ 500

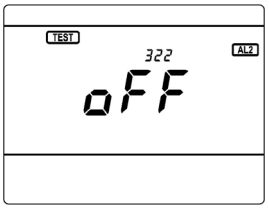
Example 2) Input condition : 3P3W 110V, 5.25A, Power factor LEAD 0.86
・Normal wiring
L1 phase active power = 110V×5.25A×cos (30° - 30.7°) ≒ 577
L3 phase active power = 110V×5.25A×cos (330° - 30.7°) ≒ 283
・Reverse wiring of primary side (K, L) or secondary side (k, l) of L1 phase current
L1 phase active power = 110V×5.25A×cos (210° - 30.7°) ≒ -577
L3 phase active power = 110V×5.25A×cos (330° - 30.7°) ≒ 283

<Note> All connection mistake can not determine.

(2) Control output check

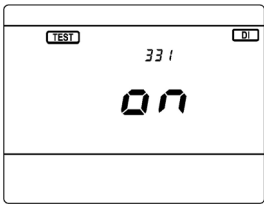
Measurement (voltage, current) with no input, can check the operation of output.
The operation of Reverse power (control output 1) can be check by the [321].
The operation of Ground overvoltage (control output 2) can be check by the [322].
『OFF (oFF)』: Control output OFF
『ON (on)』 : Control output ON
Switch the 『OFF (oFF)』⇔『ON (on)』 in the【SET】switch.
Please use it, such as the connection confirmation of the connection destination.





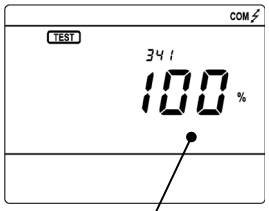
(3) Control input check

Check of control input
State of the control input is displayed on the screen.
『OFF (oFF)』: Control input OFF
『ON (on)』 : Control input ON

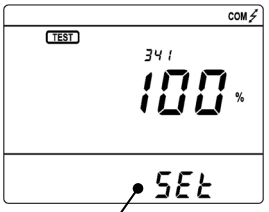


(4) Communication output check

Check of communication output
Measurement (voltage, current) with no input, numeric data of fixed communication output (0%, 50%, 100%, SEq) will be able to reply.
Select the numeric data in the【+】【−】switch, and press the 【SET】switch, the measurement data of all measuring elements have been changed.
Numerical data : 0%, 50%, 100%, SEq (sequence number)



Output value

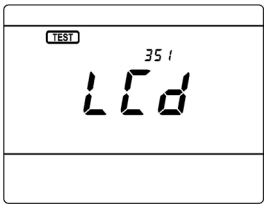


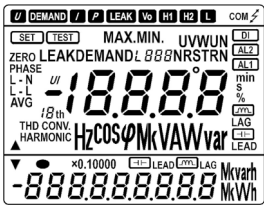
Display on output

Please use it, such as counter test of the host system.
With regard to the sequence number, please refer to the "DVRR-72 Communication Specifications".

(5) LCD check

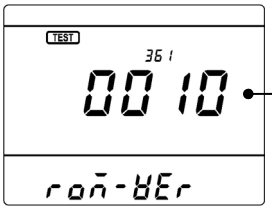
Check of LCD
The LCD can be check.
Every time the【SET】switch is pressed, display is switched over.





(6) Software version check

Software version
Version of the software can be check.



Software version

10. Specification

(1) Rating

Item		Specification	Note
Input circuit (9)		Common use for 3 phase 3 wire [3P3W] (2VT2CT), 1 phase 3 wire [1P3W], 1 phase 2 wire [1P2W]	Settable
AC input	Rated voltage	3P3W, 1P2W : 110V AC 50/60Hz 1P3W : 100-200V AC 50/60Hz	
	Rated current	AC5A (10)	
	Zero-phase voltage	AC1V (11)	Complete ground fault
Power supply	Power supply range Power consumption	(1) 85 to 264V AC (Rated voltage. 100/110V AC, 5VA) 50/60Hz (Rated voltage. 200/220V AC, 5VA) 50/60Hz 80 to 143V DC (Rated voltage. 100/110V DC, 2W)	
		(2) 20 to 57V DC (Rated voltage. 24V DC, 3.5W) (Rated voltage. 48V DC, 3W)	
	Inrush current (time constant)	110V AC : 2.2A or less (Approx. 3ms) 220V AC : 4.4A or less (Approx. 3ms) 110V DC : 1.6A or less (Approx. 3ms)	
		24V DC : 2.7A or less (Approx. 2.2ms) 48V DC : 5.3A or less (Approx. 2.2ms)	

Note(9) This product can be used under conditions of three-phase voltage unbalance, unbalanced loads, and reverse phase order.

Note(10) Use the split type AC current sensor CTF-5A (MULTI MEASURING INSTRUMENTS Co., Ltd.) in a configuration combined with a current transformer for instrumentation.

Note(11) Please prepare the following separately for zero-phase voltage input.

・ZPD : ZPC-9B [HIKARI TRADING CO.,LTD.]

・EVT : CF-107V (190V rating) or CF-107AV (110V rating) [HIKARI TRADING CO.,LTD.]

(2) Performance

Measurement item	Measurement range / Display specification	Display and communication output		Note
		Class index	Intrinsic error (12)(13)	
Voltage	110V AC to 110.0kV AC	0.5	±0.5%	
Current, Demand current	5.00A to 30.00kA AC	0.5	±0.5%	Demand current is for display only
Active power, Demand active power	By primary voltage and current setting	0.5	±0.5%	Demand active power is for display only.
Reactive power	By primary voltage and current setting	0.5	±0.5%	
Apparent power	By primary voltage and current setting	0.5	±0.5%	Voltage equilibrium is a requirement.
Power factor	LEAD 0.000 to 1.000 to LAG 0.000	1.5	±1.5%	Display error is % of electrical angle 90° .
Frequency	45.00 to 65.00Hz	0.5	±0.5%	
Zero-phase voltage	0.0 to 100.0%	5.0	±5.0%	% of primary rated voltage. Communication output is for maximum zero-phase voltage only.
Active energy	Display : 9 digits, Unit : kWh or MWh	2.0	±2.0%	Error is % of true value
Reactive energy	Display : 9 digits, Unit : kvarh or Mvarh	2.0	±2.0%	Error is % of true value

Note(12) The intrinsic error of the digital display is % of full scale, and the output is % of output span. This product has a larger error when directly measuring the following inverter outputs.
Cycle control, SCR phase angle control, PWM

Note(13) This is the performance of the product alone. Current sensor error is not included.

(3) Protective function

Elements	Item		specification	allowable error	Note
Reverse power (67P)	RP	Operating value	Lock, 0.2 to 30.0% (0.1% step) % of rated current	Operating value ≧5% ：Setting value ±5% Operating value 1 to 5% ：Setting value ±10% Operating value ＜1% ：Setting value ±5mA	Voltage input ：Rated voltage Current phase ：Maximum sensitivity angle direction Maximum sensitivity angle ：180° ±5°
		Return value	Operating value 75% or more (Setting value ＜1%) Operating value 90% or more (Setting value ≧1%)	—	
		Operating time	0.1 to 15.0s (0.1s step)	Setting value ±50ms	
		Return time	2 to 600s (1s step)	Setting value ±200ms	
	Pre-alarm	Operating time	0.1 to 1.0s (0.1s step) Less than or equal to RP operating time	Setting value ±50ms	The operation value and return value are output only for the same communication output as the RPR set value.
		Return time	Depends on RP setting	Setting value ±200ms	
	UV lock function		ON：Use, OFF：Unused	Secondary rated voltage 110V setting：60V±5%	Locked by OR of each phase.
Ground overvoltage (64)	OVG	Operating value	Lock, 2.0 to 40.0% (0.1% step)	Operating value 2.0 to 40.0% ：Setting value ±5% (stand-alone) Operating value ≧2.5% ：Setting value ±25% (ZPD or EVT combination) Operating value ＜2.5% ：Setting value ±30% (ZPD or EVT combination)	The zero-phase voltage during a complete earth fault is 100%.
		Return value	Operating value 80% or more	—	
		Operating time	0.0 to 5.0s (0.1s step)	Operating time＝0.0s ：40ms or less Operating time＜2.0s ：Setting value ±100ms Operating time≧2.0s ：Setting value ±5%	
		Return time	200ms, 2 to 600s (1s step)	Return time ≦200ms ：Setting value ±50ms Return time ≧2s ：Setting value ±200ms	
Backup function		Compensation time	5 seconds (14)		
		Functions	A backup circuit maintains the protective detection function for a compensation time after the power is turned off. (15) (Power supply 85 to 264V AC, 80 to 143V DC only)		

Note(14) This is the compensation time when more than 3 minutes have elapsed after the power supply is applied. If the applied time is short, the compensation time may not be satisfied.

Note(15) Display, backlight, communication output, and control input are not covered by the compensation.

(4) Control function

① Control input

Item		Specification, Performance	
Input point		1	
Input rating		Non-voltage contact input. Contact capacity : 24V DC, 10mA	
Minimum operating pulse width		100ms, continuous application possible	
Function	Relay lock input	Lock the control output (RP, OVG) during stabilization during input. Output the control input status via MODBUS communication.	Settable
	State input	Output the control input status via MODBUS communication.	

② Control output

Item	Specification, Performance
Output point	2 Control output 1 : Reverse power (67P), Control output 2 : Ground overvoltage (64)
Output form	Optical MOS-FET relay, Normally-open contact (1a contact)
Contact capacity (16)	125V AC, 70mA (Resistance load, Inductive load) 200V DC, 70mA (Resistance load, Inductive load)
Return method	Auto (automatic return) or Hold (manual return) switchable by setting

Note(16) This product cannot trip a circuit breaker directly.
When using this product as a tripping contact, connect a relay or other device with a contact capacity suitable for the circuit breaker.

(5) Measurement function

① Elements

Measurement item	Measurement possible item (1, 2, 3, N : Phase, Σ : Total)			Max.	Min.	Note
	3P3W	1P3W	1P2W			
Voltage	U12, U23, U31, ULLavg	U1N, U3N, U13, ULNavg	U	○	○	Select setting of phase display. 「L1-2-3-N」, 「R-S-T-N」, 「U-V-W-N」
Current	I1, I2, I3, Iavg	I1, I3, IN, Iavg	I	○	○	
Demand current	Id1, Id2, Id3, Idavg	Id1, Id3, IdN, Idavg	Id	○	○	
Active power	ΣP		P	○	○	
Demand active power	ΣPd		Pd	○	○	
Reactive power	ΣQ		Q	○	○	Select the calculation method. $Q=UI\sin\phi$ or $Q=\sqrt{(S^2-P^2)}$
Apparent power	ΣS		S	○	○	The voltage balances of 3-phase 3-wire are conditions.
Power factor	ΣPF		PF	○	○	「----」 is displayed at the case of low input. 3E8H (1000) is output.
Frequency	f			○	○	If the input is low, it will display and output 0.
Zero-phase voltage	Vo			○	—	
Active energy	Receiving / Transmission			—	—	Receiving / Transmission is measured individually.
Reactive energy	Receiving (LAG·LEAD) / Transmission (LAG·LEAD)			—	—	Receiving (LAG/LEAD) and Transmission (LAG/LEAD) is measured individually.

② Characteristics and Functions

Item		Specification	
Operating method		Current, Voltage	Effective value calculation method
		Demand current	Arithmetic method according with bimetallic type (Time to reach 95 % of a final constant value)
		Demand active power	Average value within the interval setting
		Active power, Active energy	Time-division multiplication method
		Reactive power, Reactive energy	Time division multiplication method ($Q=UI\sin\phi$) or the method for calculating from the power and apparent power [$Q=\sqrt{(S^2-P^2)}$]. (Selected in the setting)
		Apparent power	Calculates for voltage and current
		Power factor	Calculates for active power and reactive power
		Frequency	Zero cross cycle computing type
		Zero-phase voltage	Fundamental wave effective value calculation method
Measurement response	Display	1 second	
	Communication output	100ms or less (Bitrate at set to 19200bps, 38400bps)	
Interval setting	Demand current	0 s / 5 s / 10 s / 20 s / 30 s / 40 s / 50 s / 1 min / 2 min / 3 min / 4 min / 5 min / 6 min / 7 min / 8 min / 9 min / 10 min / 15 min / 20 min / 25 min / 30 min Response time for 0-second setting is 1 second or less.	
	Demand active power		
Influence of temperature	Protection	20℃±20℃ : Within tolerance 20℃±40℃ : Within two times of tolerance	
	Measurement	23℃±10℃ : Within intrinsic error	
Power interruption backup		Maximum value, Minimum value, Integrated value, Each setting value. Maintained in nonvolatile memory.	

(6) Communication output

Item	Specification
Output point	1
Communication method	RS-485 Half-duplex two-wire asynchronous system
Protocol	Modbus RTU mode (For details of the protocol, please refer to the separate volume "Communication Specifications".)
Bit rate	4800bps / 9600bps / 19200bps / 38400bps
Modulation code	NRZ
Start bit	1 bit
Data length	8 bit
Parity	NONE / Even number / Odd number
Stop bit	1 bit / 2 bit
Transmission character	Binary
Cable length	1000m (The total extension)
Address	1 to 247 (Connection is possible to 31 sets.)
Error detection	CRC-16 ($X^{16}+X^{15}+X^2+1$)
Terminating resistor	Externally attached to the terminal section. 1W 100Ω (attached to the product)
Transmission data	Setting values, Status information, Measured values (For details on transmitted data, please refer to the separate "Communication Specifications")

(7) Other Functions

Item		Specification
Setting value confirmation function		Setting values can be confirmed without entering the screen for setting.
Test function		Outputs a known value for the communication output without applying input. Turns control output ON/OFF without applying input. Display the state of the control input on the screen. Check the state of the input wiring by the voltage phase status (positive and reverse phase) and the power value of each phase.
Display	LCD	Main-monitor : 4,1/2 digits Character height : 10mm Sub-monitor : 9 digits Character height : 5.8mm
	Backlight	White backlight Backlight can select brightness from five steps of 1 to 5. Always-on, Auto off (after 5 minutes without operating), Always-off. Setting is possible
LCD view angle		Upper and lower view angle 75° , Right and left view angle 75°
Input consumption VA	Voltage circuit	0.25VA or less
	Current circuit	0.05VA or less (Current sensor primary)
	Zero-phase circuit	0.01VA or less

(8) Electrical strength, Mechanical Strength

Item		Specification	
Overload capacity	Voltage circuit	2 times 10 seconds (once) and 1.2 times continuation of rated voltage.	
	Current circuit	40 times 1 second (2 times, 1 minute interval) and 20 times 2 seconds (2 times, 1 minute interval) and 1.5 times 30 minutes (once) and 1.2 times continuation of rated current.	
	Power supply circuit	1.5 times 10 seconds (once) and 1.2 times continuation of rated voltage (AC power supply) 1.5 times 10 seconds (once) and 1.3 times continuation of rated voltage (DC power supply)	
Insulation resistance		Between power supply, three-phase voltage input, current input, zero-phase voltage input and guound. (Ground : Communication output, control output, control input)	Over 50MΩ at 500V DC
		Between power supply and three-phase voltage input, current input, zero-phase voltage input, control input, communication output, control output.	
		Between three-phase voltage input, current input and zero-phase voltage input.	
		Between communication output, control output, control input.	
		Between control outputs.	
Voltage test		Between power supply, three-phase voltage input, current input, zero-phase voltage input and guound. (Ground : Communication output, control output, control input)	2210V AC (50/60Hz) 5 seconds
		Between power supply and three-phase voltage input, current input, zero-phase voltage input, control input, communication output, control output.	
		Between three-phase voltage input, current input and zero-phase voltage input.	
		Between communication output, control output, control input.	500V AC (50/60Hz) 5 seconds
		Between control outputs.	

Item	Specification	
Impulse voltage test	Between power supply, three-phase voltage input, current input, zero-phase voltage input and guound. (Ground : Communication output, control output, control input)	6kV 1.2/50μs Both positive and negative polarities, for 3 times each.
	Between power supply and three-phase voltage input, current input, zero-phase voltage input, control input, communication output, control output.	
	Between three-phase voltage input, current input, zero-phase voltage input and power supply, control input, communication output, control output.	
	Between power supply terminals (Other circuits are grounded)	
	Between three-phase input terminals (Other circuits are grounded)	
Vibration	IEC 60068-2-6 : 2007 Frequency range : 10 to 55Hz, Single amplitude : 0.15mm, Sweep cycle : 10 times	
Impact	IEC 60068-2-27 : 2008 Peak acceleration : 500m/s^2	

(9) Noise immunity

Item	Specification
Damped oscillatory wave immunity IEC61000-4-12	When a damping vibration waveform of peak voltage 2.5kV, frequency 1MHz ±10% is applied three times for 30 seconds, there shall be no measurement error within ±10% and no malfunction. And, do not be a communication error and stop. ・Three-phase voltage input circuit (Normal / Common) ・Current input circuit (Common) ・Power supply circuit (Normal / Common) ・Zero-phase voltage input circuit (Common)
Square impulse immunity For B-402 Standards	When 1μs, 100ns width noise is applied repeatedly for 5 minutes, measurement error should be within 10% and no malfunction should occur. And, do not be a communication error and stop. ・Power supply circuit (Normal / Common) 1500V or more ・Three-phase voltage input circuit (Normal / Common) 1500V or more ・Current input circuit (Common) 1500V or more ・Zero-phase voltage input circuit (Common) 1500V or more ・Control output circuit (Common) 1000V or more ・Control input circuit (Common) 1000V or more ・Communication output circuit (Induction) 1000V or more
Radio wave immunity	The product shall not malfunction within ±10% of error when exposed to intermittent exposure to 150MHz and 400MHz band radio waves at 5W at 1m and to cell phone and wireless LAN (2.4GHz band and 5GHz band) radio waves at 0.5m. And, do not be a communication error and stop.
Electrostatic discharge immunity IEC 61000-4-2	Perform under normal conditions of use. Measurement error should be within 10% at contact discharge 8kV and air discharge 15kV, and malfunction shall not occur. And, do not be a communication error and stop. Capacitor charge method.

(10) Configuration

Item	Specification
Case outline	72×72×85mm (W×H×D)
International protection	IP40
Material	ABS(V-0)
Terminal block	Spring pressure terminal block
Mass	Approx. 300g

(11) Environmental condition

Item	Specification
Safety	IEC 61010-1 : 2010 Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements Measurement Category Ⅲ, Pollution degree 2, Maximum use voltage : 300V (line to neutral voltage)
Operating temperature and humidity limits	Performance guarantee : 0 to 40℃, 30 to 90% RH (Non condensing) Operating value, operating time, etc. must be within the allowable tolerance. Operation guarantee : -20 to +60℃, 30 to 90% RH (Non condensing) Operating value, operating time, etc. shall be within twice the allowable tolerance.
Storage temperature limits	-25 to +70℃

(12) Compliance standard

Item	Specification
Protection	Digital type ground relay set for high voltage power receiving JIS C 4612 : 2020 ([17]) Power protection relay JEC 2500 : 2010 ([17]) Voltage relay JEC 2511 : 1995 ([17])
Measurement	Direct acting indicating instrument JIS C 1102 : 2011 Transducer IEC 60688 : 2012, JIS C 1111 : 2019 Active energy IEC 62053-21 : 2003, JIS C 1271-1 : 2011 Reactive energy IEC 62053-23 : 2003, JIS C 1273-1 : 2011
Communication	TIA-485-A : 2003

Note([17]) Excluding requirements for contact capacity.

(13) Measuring range

Measurands	Measuring range		Low input cut	Limiter
Line voltage	Secondary rating 110V	0 to 150V 1P3W : 0 to 300V	Less than 20% of full scale Phase sequence check : Less than 2% of full scale	101% of full scale
Phase voltage	Secondary rating 110V	1P3W : 0 to 150V	Less than 20% of full scale	101% of full scale
Current, Demand current	0 to rated current		Less than 0.05% of the rating	201% of the rating
Active power Demand active power Reactive power	- rated power to 0 to + rated power Rated power [kW] = VT ratio × CT ratio ・VT ratio : Primary rated voltage/110 ・CT ratio : Primary rated current/5		Less than ±0.05% of the rating	-201%, +201% of the rating
Apparent power	0 to + rated power Rated power [kW] = VT ratio × CT ratio ・VT ratio : Primary rated voltage/110 ・CT ratio : Primary rated current/5		Less than ±0.05% of the rating	0%, +201% of the rating
Power factor	LEAD 0 to 1 to LAG 0		"----" is displayed (out of measurement range) when it is 20% or less of the voltage full scale or 2% or less of the current rating.	LEAD 0, LAG 0 「----」is displayed of low input. Output equivalent to power factor 1.
Frequency	45 to 65Hz		0Hz at 20% or less of the voltage full scale.	44.80Hz, 65.20Hz 0.00Hz for low input.
Zero-phase voltage	0.0 to 100.0% (% of rated voltage)		Less than 1.5% of the rated voltage	120% of rated voltage
Active energy	0 to 999999999kWh (MWh) By the setting and the full load power, position and unit of the decimal point (k/M) is changed.		—	—
Reactive energy	0 to 999999999kvarh (Mvarh) By the setting and the full load power, position and unit of the decimal point (k/M) is changed.		—	—

(14) Default settings

Setting mode	Item		Default setting
Setting 1	111	Phase wire method	3P3 : 3 phase 3 wire
	112	Phase display	1 : RSTN
	121	Secondary rated voltage	110V
	122	Primary rated voltage	6600V
	123	Current sensor	5A
	124	Primary rated current	5.00A
	125	Rated frequency	50.00Hz
	126	W/var digit	4 digits
	127	Wh/varh unit per count	0.001kWh
	131	Demand current interval	0 second
	132	Demand active power interval	0 second
	141	Reactive power calculation method	0 : Q=UIsinϕ
	151	Address	1
	152	Bit rate	19.20kbps
	153	Parity	0 : odd number
	154	Stop bit	1
	161	Backlight action	AUTO : Automatic OFF
	162	Backlight luminance	3
Setting 2	211	Reverse power operating value	LOC : Lock
	212	Reverse power operating time	0.1 seconds
	213	Reverse power return method	AUTO : Automatic return
	214	Reverse power return time	10 seconds
	215	Reverse power UV lock	OFF
	216	Reverse power pre-alarm	0.1 seconds
	221	Ground overvoltage operating value	LOC : Lock
	222	Ground overvoltage operating time	0.1 seconds
	223	Ground overvoltage return method	AUTO : Automatic return
	224	Ground overvoltage return time	0.2 seconds
	231	Control input function	OFF

11. Maintenance and Inspection

11.1 Inspection

(1) Daily Inspection

Inspect the following items

① Discoloration of the LCD display or damage to the case.

② Detection of equipment abnormality.

③ No dust or dirt on the product.

(2) Periodic inspection

Although it depends on the operating conditions of the product and the installation environment, we recommend periodic inspections every 2 to 4 years if the ambient temperature, dust, and other environmental conditions are favorable.
For those that have been in operation for more than 10 years, an annual inspection is recommended.

11.2 Maintenance

When performing maintenance, pay attention to the following items.

① Do not change the wiring of the input and power supply while the power is on.

② When it is unavoidable to inspect the outputs while power is supplied, be careful not to touch the output wiring or human body to the input or power supply.

③ When checking input, output, or power supply voltage, be sure to check the wiring diagram.

④ Wiping the nameplate with alcohol or other solvents may erase the display items.
Wipe the nameplate with a dry cloth only. The display may light up while wiping the LCD display.
This phenomenon is caused by static electricity in the filter, which naturally discharges and returns to normal if the filter is left for a while.

⑤ If the LCD surface is pressed strongly, it will be broken.
When the LCD surface is pressed hard, the filter and the LCD surface may come into contact with each other, resulting in a blotch-like appearance. This is due to changes in the ambient environment and is not an abnormality, and will return to normal during use.

⑥ When performing periodic inspections, the inspection time can be shortened by using the test mode.

⑦ Please confirm the implementation and operation procedures before implementing each mode.

11.3 Test

11.3.1 Reverse power (67P) test

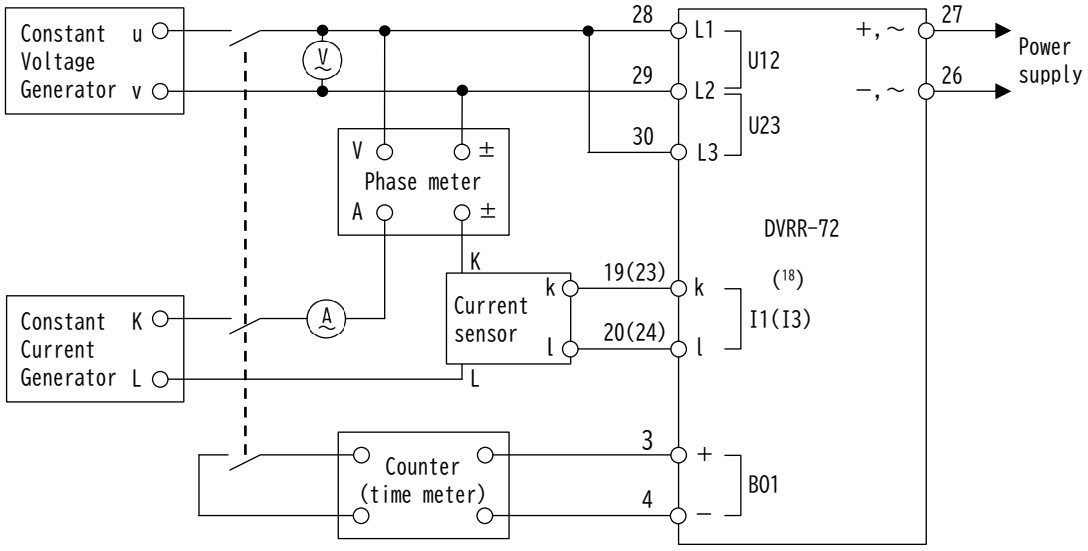
(1) Test method (Single-phase)

Test item	Test method	Test condition		Judgment criteria
		Operating value	Operating time	
Operating value	The voltage input is kept constant at the 110V AC, the current input is gradually increased with a phase difference of 180° from the voltage, and the current value at which the reverse power is detected is measured.	Setting value	Minimum	Operating value ≧5% : Setting value ±5% Operating value 1 to 5% : Setting value ±10% Operating value <1% : Setting value ±5mA
Operating time	With the voltage input constant at the 110V AC, the current input is suddenly changed from 0 to 200% of the operating value with a phase difference of 180° from the voltage, and the time from application to control output 1 being turned on is measured.	Minimum	Setting value	Setting value ±50ms
Phase characteristics	With the voltage input constant at the 110V AC and the current input constant at 200% of the operating value setting, the phase of the current relative to the voltage is gradually changed from a phase angle outside the detection range (operating phase angle of about ±90°) in the leading or lagging direction and the highest sensitivity angle at which reverse power is detected is measured. * See the formula below " −" is LEAD, " +" is LAG.	Minimum	Minimum	180° ±5°

$$* \text{Maximum sensitivity angle} = \frac{\text{Operating phase angle (LEAD)} + \text{Operating phase angle (LAG)}}{2} + 180°$$

<Note> When testing with a single-phase, the operating value is √3 times the set value.

(2) Example of test configuration (single-phase)



Note(18) When testing the I3 side, connect to terminals 23 (k) and 24 (l).

<Caution> Be sure to perform the test in combination with the dedicated current sensor.
Applying current input directly to the terminals without using a current sensor will cause damage.

(3) Reverse power operating power and operating current calculation method

Operating power and operating current values can be calculated as follows (constant 110V AC)
When testing single-phase, the operating current value is multiplied by √3.

(Method of calculating operating power value)
Operating power value [W] = √3 × 110V × 5A × Operating value setting [%] / 100

(Method of calculating operating current value)
・Three-phase input (During operation)
Operating current value [A] = 5A × Operating value setting [%] / 100

・Single-phase input (During testing)
Operating current value [A] = √3 × 5A × Operating value setting [%] / 100

Table of operating value power values and operating current values for each operating value setting (example)

Reverse power operating value setting	Three-phase input (During operation)		Single-phase input (During testing)	
	Operating power	Operating current	Operating power	Operating current
0.2%	1.9W	0.010A	1.9W	0.017A
0.5%	4.8W	0.025A	4.8W	0.043A
1.0%	9.5W	0.050A	9.5W	0.087A
5.0%	47.6W	0.250A	47.6W	0.433A
10.0%	95.3W	0.500A	95.3W	0.866A
20.0%	190.5W	1.000A	190.5W	1.732A
30.0%	285.8W	1.500A	285.8W	2.598A

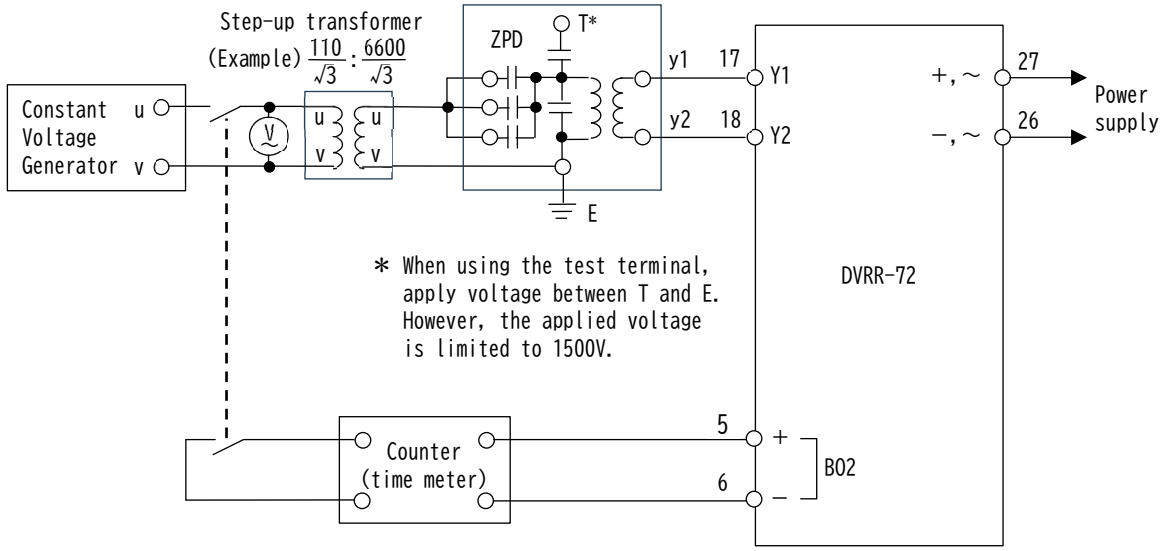
11.3.2 Ground overvoltage (64) test

(1) Test method

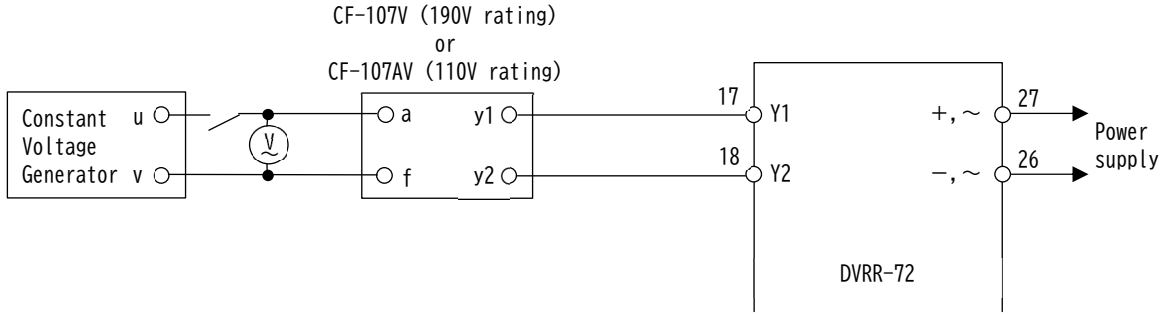
Test item	Test method	Test condition		Judgment criteria
		Operating value	Operating time	
Operating value	Gradually increase the zero-phase voltage input and measure the voltage value at which the ground overvoltage is detected.	5.0%	0.1s	Setting value ±25% (ZPD or EVT combination)
Operating time	The zero-phase voltage input is abruptly changed from 0 to 150% of the operating value setting, and the time from the application of the voltage to when control output 2 is turned on is measured.	Minimum	Maximum 5s	Setting value ±100ms

(2) Example of test configuration

● ZPD method



● EVT method



(3) Calculation of zero-phase voltage input value
The zero-phase voltage input value is calculated as follows

● ZPD method
Zero-phase voltage input value [V] = Operating setting value [%] / 100 × 6600 V / √3

Operating setting value	Zero-phase voltage input value
2.0%	76.21V (132/√3V)
5.0%	190.5V (330/√3V)
20.0%	762.1V (1320/√3V)
40.0%	1524V (2640/√3V)

<Step-up transformer is not used>
Apply the zero-phase voltage input value to the primary of the ZPD.

<Step-up transformer is used>
Apply the zero-phase voltage input value divided by the VT ratio to the primary of the step-up transformer.

● EVT method
Zero-phase voltage input value [V] = Operating setting value [%] / 100 × Rated tertiary voltage [V]

Operating setting value	Zero-phase voltage input value	
	190V rating	110V rating
2.0%	3.8V	2.2V
5.0%	9.5V	5.5V
20.0%	38.0V	22.0V
40.0%	76.0V	44.0V

12. Self-diagnostic function

This product performs self-diagnosis as shown in the table below.
When an device error is detected, the control output is locked and the device error is output via the device error detection display and communication output.
The error status bit of the device error can be checked in the device error check mode.

● Error status bit

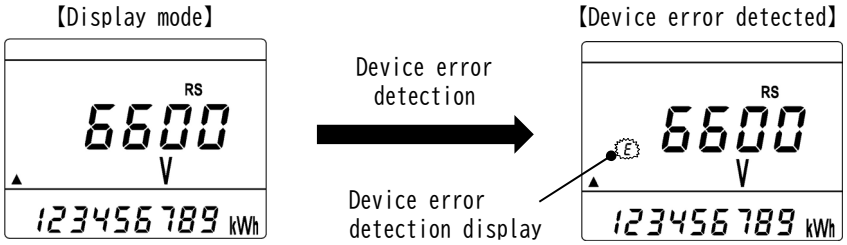
B5	B4	B3	B2	B1	B0

Bit	Self-diagnosis items	Contents of diagnosis	Processing at the time of device abnormality
B0	Memory duplication match check	Monitors duplicated setting data for consistency. Detects device errors in case of discrepancies.	Control output is locked, device error is output via communication output, and if the error continues for 15 seconds or longer, device error detection is displayed. Automatic recovery occurs when the device abnormality is resolved.
B1	A/D conversion accuracy check	Monitors whether the accuracy of A/D conversion is within the specified value. Detects device errors when outside the specified range.	
B2	Device power supply check	Monitors whether the internal power supply voltage is within the specified value. Detects device errors when outside the specified range.	
B3	ROM check	Check ROM data of CPU at startup. Detects device abnormality due to ROM data abnormality.	Locks control output, outputs device errors via communication output, and displays device error detection. (19)
B4	RAM check	Check RAM data of CPU at startup. Detects device abnormality due to RAM data abnormality.	
B5	Nonvolatile memory check	Nonvolatile memory data is checked at startup. Detects device errors due to non-volatile memory data errors.	

Note(19) When an device error occurs in error status bit B3 to B5, turn off the power once and then turn it back on again.

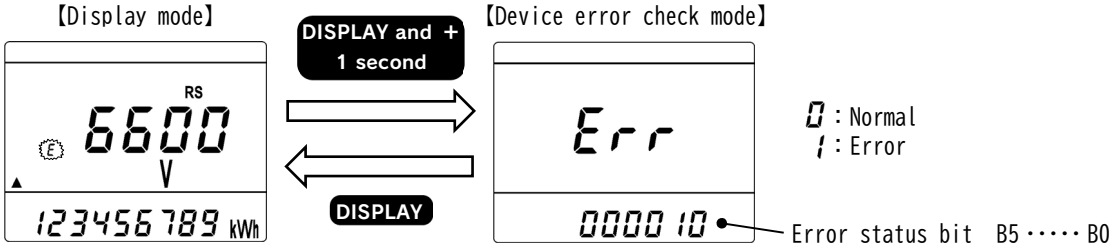
(1) Device error detection display

If an device error is detected, device error detection [E] will blink.



(2) Device error check mode

Pressing the【DISPLAY】and【+】switch simultaneously for 1 second from the display mode will enter the device error check mode. Pressing the【DISPLAY】switch returns to the display mode.



13. Troubleshooting

Trouble	Probable cause	Treatment
Display is not lights	Power supply has not been applied to terminal number 26 and 27.	Please by applying a power supply.
	Failure of equipment.	Replacement of equipment.
Backlight disappears	The display is off by the auto off function, or it is set to always off.	Please press the switch or check the backlight operation setting.
The error of the measurement value is large	Primary ratings for voltage and current are incorrectly set.	Please check the primary rated voltage and the primary rated current setting.
	Wiring is wrong.	Please check the wiring.
	Rated frequency out of range (45 to 65Hz).	This product can not be used.
Active energy and reactive energy errors are large. (Display, communication output)	Primary ratings for voltage and current are incorrectly set.	Check the primary rated voltage and the primary rated current setting.
	Wiring is wrong.	Please check the wiring.
Communication error occurs	The communication cable is disconnected or not properly connected (polarity, etc.).	Please refer to the confirmation of communication cable.
	Communication setting is wrong. (Address, Bit rate, Parity, Stop bit)	Please check the settings of communication output.
Control output is not output	Operation value is set to ”lock”.	Please check the settings of operating values.
Control output does not recover	Return method is set to ”manual return”.	Please check the settings of return method.
	Return time within setting.	Please check the setting of return time.

Appendix Tables

■ Appendix 1-1
Rated active power table (3 phase 3 wire)

Primary rated voltage / Primary rated current	110.0kV [W]	77.00kV [W]	66.00kV [W]	33.00kV [W]	22.00kV [W]	20.00kV [W]	18.40kV [W]	16.50kV [W]	13.80kV [W]	13.20kV [W]
5A	1000 k	700.0 k	600.0 k	300.0 k	200.0 k	181.8 k	167.3 k	150.0 k	125.5 k	120.0 k
6A	1200 k	840.0 k	720.0 k	360.0 k	240.0 k	218.2 k	200.7 k	180.0 k	150.5 k	144.0 k
7.5A	1500 k	1050 k	900.0 k	450.0 k	300.0 k	272.7 k	250.9 k	225.0 k	188.2 k	180.0 k
8A	1600 k	1120 k	960.0 k	480.0 k	320.0 k	290.9 k	267.6 k	240.0 k	200.7 k	192.0 k
10A	2000 k	1400 k	1200 k	600.0 k	400.0 k	363.6 k	334.5 k	300.0 k	250.9 k	240.0 k
12A	2400 k	1680 k	1440 k	720.0 k	480.0 k	436.4 k	401.5 k	360.0 k	301.1 k	288.0 k
15A	3000 k	2100 k	1800 k	900.0 k	600.0 k	545.5 k	501.8 k	450.0 k	376.4 k	360.0 k
20A	4000 k	2800 k	2400 k	1200 k	800.0 k	727.3 k	669.1 k	600.0 k	501.8 k	480.0 k
25A	5000 k	3500 k	3000 k	1500 k	1000 k	909.1 k	836.4 k	750.0 k	627.3 k	600.0 k
30A	6000 k	4200 k	3600 k	1800 k	1200 k	1091 k	1004 k	900.0 k	752.7 k	720.0 k
40A	8000 k	5600 k	4800 k	2400 k	1600 k	1455 k	1338 k	1200 k	1004 k	960.0 k
50A	10.00 M	7000 k	6000 k	3000 k	2000 k	1818 k	1673 k	1500 k	1255 k	1200 k
60A	12.00 M	8400 k	7200 k	3600 k	2400 k	2182 k	2007 k	1800 k	1505 k	1440 k
75A	15.00 M	10.50 M	9000 k	4500 k	3000 k	2727 k	2509 k	2250 k	1882 k	1800 k
80A	16.00 M	11.20 M	9600 k	4800 k	3200 k	2909 k	2676 k	2400 k	2007 k	1920 k
100A	20.00 M	14.00 M	12.00 M	6000 k	4000 k	3636 k	3345 k	3000 k	2509 k	2400 k
120A	24.00 M	16.80 M	14.40 M	7200 k	4800 k	4364 k	4015 k	3600 k	3011 k	2880 k
150A	30.00 M	21.00 M	18.00 M	9000 k	6000 k	5455 k	5018 k	4500 k	3764 k	3600 k
200A	40.00 M	28.00 M	24.00 M	12.00 M	8000 k	7273 k	6691 k	6000 k	5018 k	4800 k
250A	50.00 M	35.00 M	30.00 M	15.00 M	10.00 M	9091 k	8364 k	7500 k	6273 k	6000 k
300A	60.00 M	42.00 M	36.00 M	18.00 M	12.00 M	10.91 M	10.04 M	9000 k	7527 k	7200 k
400A	80.00 M	56.00 M	48.00 M	24.00 M	16.00 M	14.55 M	13.38 M	12.00 M	10.04 M	9600 k
500A	100.0 M	70.00 M	60.00 M	30.00 M	20.00 M	18.18 M	16.73 M	15.00 M	12.55 M	12.00 M
600A	120.0 M	84.00 M	72.00 M	36.00 M	24.00 M	21.82 M	20.07 M	18.00 M	15.05 M	14.40 M
750A	150.0 M	105.0 M	90.00 M	45.00 M	30.00 M	27.27 M	25.09 M	22.50 M	18.82 M	18.00 M
800A	160.0 M	112.0 M	96.00 M	48.00 M	32.00 M	29.09 M	26.76 M	24.00 M	20.07 M	19.20 M
900A	180.0 M	126.0 M	108.0 M	54.00 M	36.00 M	32.73 M	30.11 M	27.00 M	22.58 M	21.60 M
1000A	200.0 M	140.0 M	120.0 M	60.00 M	40.00 M	36.36 M	33.45 M	30.00 M	25.09 M	24.00 M
1200A	240.0 M	168.0 M	144.0 M	72.00 M	48.00 M	43.64 M	40.15 M	36.00 M	30.11 M	28.80 M
1500A	300.0 M	210.0 M	180.0 M	90.00 M	60.00 M	54.55 M	50.18 M	45.00 M	37.64 M	36.00 M
1600A	320.0 M	224.0 M	192.0 M	96.00 M	64.00 M	58.18 M	53.53 M	48.00 M	40.15 M	38.40 M
1800A	360.0 M	252.0 M	216.0 M	108.0 M	72.00 M	65.45 M	60.22 M	54.00 M	45.16 M	43.20 M
2000A	400.0 M	280.0 M	240.0 M	120.0 M	80.00 M	72.73 M	66.91 M	60.00 M	50.18 M	48.00 M
2500A	500.0 M	350.0 M	300.0 M	150.0 M	100.0 M	90.91 M	83.64 M	75.00 M	62.73 M	60.00 M
3000A	600.0 M	420.0 M	360.0 M	180.0 M	120.0 M	109.1 M	100.4 M	90.00 M	75.27 M	72.00 M
3500A	700.0 M	490.0 M	420.0 M	210.0 M	140.0 M	127.3 M	117.1 M	105.0 M	87.82 M	84.00 M
4000A	800.0 M	560.0 M	480.0 M	240.0 M	160.0 M	145.5 M	133.8 M	120.0 M	100.4 M	96.00 M
4500A	900.0 M	630.0 M	540.0 M	270.0 M	180.0 M	163.6 M	150.5 M	135.0 M	112.9 M	108.0 M
5000A	1000 M	700.0 M	600.0 M	300.0 M	200.0 M	181.8 M	167.3 M	150.0 M	125.5 M	120.0 M
6000A	1200 M	840.0 M	720.0 M	360.0 M	240.0 M	218.2 M	200.7 M	180.0 M	150.5 M	144.0 M
7500A	1500 M	1050 M	900.0 M	450.0 M	300.0 M	272.7 M	250.9 M	225.0 M	188.2 M	180.0 M
8000A	1600 M	1120 M	960.0 M	480.0 M	320.0 M	290.9 M	267.6 M	240.0 M	200.7 M	192.0 M
9000A	1800 M	1260 M	1080 M	540.0 M	360.0 M	327.3 M	301.1 M	270.0 M	225.8 M	216.0 M
10000A	2000 M	1400 M	1200 M	600.0 M	400.0 M	363.6 M	334.5 M	300.0 M	250.9 M	240.0 M
12000A	2400 M	1680 M	1440 M	720.0 M	480.0 M	436.4 M	401.5 M	360.0 M	301.1 M	288.0 M
15000A	3000 M	2100 M	1800 M	900.0 M	600.0 M	545.5 M	501.8 M	450.0 M	376.4 M	360.0 M
20000A	4000 M	2800 M	2400 M	1200 M	800.0 M	727.3 M	669.1 M	600.0 M	501.8 M	480.0 M
30000A	6000 M	4200 M	3600 M	1800 M	1200 M	1091 M	1004 M	900.0 M	752.7 M	720.0 M

■ Appendix 1-2
Rated active power table (3 phase 3 wire)

Primary rated voltage / Primary rated current	11.00kV [W]	6600V [W]	3300V [W]	2200V [W]	1650V [W]	1100V [W]	990V [W]	880V [W]	690V [W]	480V [W]
5A	100.0 k	60.00 k	30.00 k	20.00 k	15.00 k	10.00 k	9000	8000	6273	4364
6A	120.0 k	72.00 k	36.00 k	24.00 k	18.00 k	12.00 k	10.80 k	9600	7527	5236
7.5A	150.0 k	90.00 k	45.00 k	30.00 k	22.50 k	15.00 k	13.50 k	12.00 k	9409	6545
8A	160.0 k	96.00 k	48.00 k	32.00 k	24.00 k	16.00 k	14.40 k	12.80 k	10.04 k	6982
10A	200.0 k	120.0 k	60.00 k	40.00 k	30.00 k	20.00 k	18.00 k	16.00 k	12.55 k	8727
12A	240.0 k	144.0 k	72.00 k	48.00 k	36.00 k	24.00 k	21.60 k	19.20 k	15.05 k	10.47 k
15A	300.0 k	180.0 k	90.00 k	60.00 k	45.00 k	30.00 k	27.00 k	24.00 k	18.82 k	13.09 k
20A	400.0 k	240.0 k	120.0 k	80.00 k	60.00 k	40.00 k	36.00 k	32.00 k	25.09 k	17.45 k
25A	500.0 k	300.0 k	150.0 k	100.0 k	75.00 k	50.00 k	45.00 k	40.00 k	31.36 k	21.82 k
30A	600.0 k	360.0 k	180.0 k	120.0 k	90.00 k	60.00 k	54.00 k	48.00 k	37.64 k	26.18 k
40A	800.0 k	480.0 k	240.0 k	160.0 k	120.0 k	80.00 k	72.00 k	64.00 k	50.18 k	34.91 k
50A	1000 k	600.0 k	300.0 k	200.0 k	150.0 k	100.0 k	90.00 k	80.00 k	62.73 k	43.64 k
60A	1200 k	720.0 k	360.0 k	240.0 k	180.0 k	120.0 k	108.0 k	96.00 k	75.27 k	52.36 k
75A	1500 k	900.0 k	450.0 k	300.0 k	225.0 k	150.0 k	135.0 k	120.0 k	94.09 k	65.45 k
80A	1600 k	960.0 k	480.0 k	320.0 k	240.0 k	160.0 k	144.0 k	128.0 k	100.4 k	69.82 k
100A	2000 k	1200 k	600.0 k	400.0 k	300.0 k	200.0 k	180.0 k	160.0 k	125.5 k	87.27 k
120A	2400 k	1440 k	720.0 k	480.0 k	360.0 k	240.0 k	216.0 k	192.0 k	150.5 k	104.7 k
150A	3000 k	1800 k	900.0 k	600.0 k	450.0 k	300.0 k	270.0 k	240.0 k	188.2 k	130.9 k
200A	4000 k	2400 k	1200 k	800.0 k	600.0 k	400.0 k	360.0 k	320.0 k	250.9 k	174.5 k
250A	5000 k	3000 k	1500 k	1000 k	750.0 k	500.0 k	450.0 k	400.0 k	313.6 k	218.2 k
300A	6000 k	3600 k	1800 k	1200 k	900.0 k	600.0 k	540.0 k	480.0 k	376.4 k	261.8 k
400A	8000 k	4800 k	2400 k	1600 k	1200 k	800.0 k	720.0 k	640.0 k	501.8 k	349.1 k
500A	10.00 M	6000 k	3000 k	2000 k	1500 k	1000 k	900.0 k	800.0 k	627.3 k	436.4 k
600A	12.00 M	7200 k	3600 k	2400 k	1800 k	1200 k	1080 k	960.0 k	752.7 k	523.6 k
750A	15.00 M	9000 k	4500 k	3000 k	2250 k	1500 k	1350 k	1200 k	940.9 k	654.5 k
800A	16.00 M	9600 k	4800 k	3200 k	2400 k	1600 k	1440 k	1280 k	1004 k	698.2 k
900A	18.00 M	10.80 M	5400 k	3600 k	2700 k	1800 k	1620 k	1440 k	1129 k	785.5 k
1000A	20.00 M	12.00 M	6000 k	4000 k	3000 k	2000 k	1800 k	1600 k	1255 k	872.7 k
1200A	24.00 M	14.40 M	7200 k	4800 k	3600 k	2400 k	2160 k	1920 k	1505 k	1047 k
1500A	30.00 M	18.00 M	9000 k	6000 k	4500 k	3000 k	2700 k	2400 k	1882 k	1309 k
1600A	32.00 M	19.20 M	9600 k	6400 k	4800 k	3200 k	2880 k	2560 k	2007 k	1396 k
1800A	36.00 M	21.60 M	10.80 M	7200 k	5400 k	3600 k	3240 k	2880 k	2258 k	1571 k
2000A	40.00 M	24.00 M	12.00 M	8000 k	6000 k	4000 k	3600 k	3200 k	2509 k	1745 k
2500A	50.00 M	30.00 M	15.00 M	10.00 M	7500 k	5000 k	4500 k	4000 k	3136 k	2182 k
3000A	60.00 M	36.00 M	18.00 M	12.00 M	9000 k	6000 k	5400 k	4800 k	3764 k	2618 k
3500A	70.00 M	42.00 M	21.00 M	14.00 M	10.50 M	7000 k	6300 k	5600 k	4391 k	3055 k
4000A	80.00 M	48.00 M	24.00 M	16.00 M	12.00 M	8000 k	7200 k	6400 k	5018 k	3491 k
4500A	90.00 M	54.00 M	27.00 M	18.00 M	13.50 M	9000 k	8100 k	7200 k	5645 k	3927 k
5000A	100.0 M	60.00 M	30.00 M	20.00 M	15.00 M	10.00 M	9000 k	8000 k	6273 k	4364 k
6000A	120.0 M	72.00 M	36.00 M	24.00 M	18.00 M	12.00 M	10.80 M	9600 k	7527 k	5236 k
7500A	150.0 M	90.00 M	45.00 M	30.00 M	22.50 M	15.00 M	13.50 M	12.00 M	9409 k	6545 k
8000A	160.0 M	96.00 M	48.00 M	32.00 M	24.00 M	16.00 M	14.40 M	12.80 M	10.04 M	6982 k
9000A	180.0 M	108.0 M	54.00 M	36.00 M	27.00 M	18.00 M	16.20 M	14.40 M	11.29 M	7855 k
10000A	200.0 M	120.0 M	60.00 M	40.00 M	30.00 M	20.00 M	18.00 M	16.00 M	12.55 M	8727 k
12000A	240.0 M	144.0 M	72.00 M	48.00 M	36.00 M	24.00 M	21.60 M	19.20 M	15.05 M	10.47 M
15000A	300.0 M	180.0 M	90.00 M	60.00 M	45.00 M	30.00 M	27.00 M	24.00 M	18.82 M	13.09 M
20000A	400.0 M	240.0 M	120.0 M	80.00 M	60.00 M	40.00 M	36.00 M	32.00 M	25.09 M	17.45 M
30000A	600.0 M	360.0 M	180.0 M	120.0 M	90.00 M	60.00 M	54.00 M	48.00 M	37.64 M	26.18 M

■ Appendix 1-3
Rated active power table (3 phase 3 wire)

Primary rated voltage / Primary rated current	460V [W]	440V [W]	415V [W]	400V [W]	380V [W]	220.0V [W]	110.0V [W]
5A	4182	4000	3773	3636	3455	2000	1000
6A	5018	4800	4527	4364	4145	2400	1200
7.5A	6273	6000	5659	5455	5182	3000	1500
8A	6691	6400	6036	5818	5527	3200	1600
10A	8364	8000	7545	7273	6909	4000	2000
12A	10.04 k	9600	9055	8727	8291	4800	2400
15A	12.55 k	12.00 k	11.32 k	10.91 k	10.36 k	6000	3000
20A	16.73 k	16.00 k	15.09 k	14.55 k	13.82 k	8000	4000
25A	20.91 k	20.00 k	18.86 k	18.18 k	17.27 k	10.00 k	5000
30A	25.09 k	24.00 k	22.64 k	21.82 k	20.73 k	12.00 k	6000
40A	33.45 k	32.00 k	30.18 k	29.09 k	27.64 k	16.00 k	8000
50A	41.82 k	40.00 k	37.73 k	36.36 k	34.55 k	20.00 k	10.00 k
60A	50.18 k	48.00 k	45.27 k	43.64 k	41.45 k	24.00 k	12.00 k
75A	62.73 k	60.00 k	56.59 k	54.55 k	51.82 k	30.00 k	15.00 k
80A	66.91 k	64.00 k	60.36 k	58.18 k	55.27 k	32.00 k	16.00 k
100A	83.64 k	80.00 k	75.45 k	72.73 k	69.09 k	40.00 k	20.00 k
120A	100.4 k	96.00 k	90.55 k	87.27 k	82.91 k	48.00 k	24.00 k
150A	125.5 k	120.0 k	113.2 k	109.1 k	103.6 k	60.00 k	30.00 k
200A	167.3 k	160.0 k	150.9 k	145.5 k	138.2 k	80.00 k	40.00 k
250A	209.1 k	200.0 k	188.6 k	181.8 k	172.7 k	100.0 k	50.00 k
300A	250.9 k	240.0 k	226.4 k	218.2 k	207.3 k	120.0 k	60.00 k
400A	334.5 k	320.0 k	301.8 k	290.9 k	276.4 k	160.0 k	80.00 k
500A	418.2 k	400.0 k	377.3 k	363.6 k	345.5 k	200.0 k	100.0 k
600A	501.8 k	480.0 k	452.7 k	436.4 k	414.5 k	240.0 k	120.0 k
750A	627.3 k	600.0 k	565.9 k	545.5 k	518.2 k	300.0 k	150.0 k
800A	669.1 k	640.0 k	603.6 k	581.8 k	552.7 k	320.0 k	160.0 k
900A	752.7 k	720.0 k	679.1 k	654.5 k	621.8 k	360.0 k	180.0 k
1000A	836.4 k	800.0 k	754.5 k	727.3 k	690.9 k	400.0 k	200.0 k
1200A	1004 k	960.0 k	905.5 k	872.7 k	829.1 k	480.0 k	240.0 k
1500A	1255 k	1200 k	1132 k	1091 k	1036 k	600.0 k	300.0 k
1600A	1338 k	1280 k	1207 k	1164 k	1105 k	640.0 k	320.0 k
1800A	1505 k	1440 k	1358 k	1309 k	1244 k	720.0 k	360.0 k
2000A	1673 k	1600 k	1509 k	1455 k	1382 k	800.0 k	400.0 k
2500A	2091 k	2000 k	1886 k	1818 k	1727 k	1000 k	500.0 k
3000A	2509 k	2400 k	2264 k	2182 k	2073 k	1200 k	600.0 k
3500A	2927 k	2800 k	2641 k	2545 k	2418 k	1400 k	700.0 k
4000A	3345 k	3200 k	3018 k	2909 k	2764 k	1600 k	800.0 k
4500A	3764 k	3600 k	3395 k	3273 k	3109 k	1800 k	900.0 k
5000A	4182 k	4000 k	3773 k	3636 k	3455 k	2000 k	1000 k
6000A	5018 k	4800 k	4527 k	4364 k	4145 k	2400 k	1200 k
7500A	6273 k	6000 k	5659 k	5455 k	5182 k	3000 k	1500 k
8000A	6691 k	6400 k	6036 k	5818 k	5527 k	3200 k	1600 k
9000A	7527 k	7200 k	6791 k	6545 k	6218 k	3600 k	1800 k
10000A	8364 k	8000 k	7545 k	7273 k	6909 k	4000 k	2000 k
12000A	10.04 M	9600 k	9055 k	8727 k	8291 k	4800 k	2400 k
15000A	12.55 M	12.00 M	11.32 M	10.91 M	10.36 M	6000 k	3000 k
20000A	16.73 M	16.00 M	15.09 M	14.55 M	13.82 M	8000 k	4000 k
30000A	25.09 M	24.00 M	22.64 M	21.82 M	20.73 M	12.00 M	6000 k

■ Appendix 2

Rated active power table (1 phase 3 wire)

Primary rated voltage / Primary rated current	110.0V [W]
5A	1000
6A	1200
7.5A	1500
8A	1600
10A	2000
12A	2400
15A	3000
20A	4000
25A	5000
30A	6000
40A	8000
50A	10.00 k
60A	12.00 k
75A	15.00 k
80A	16.00 k
100A	20.00 k
120A	24.00 k
150A	30.00 k
200A	40.00 k
250A	50.00 k
300A	60.00 k
400A	80.00 k
500A	100.0 k
600A	120.0 k
750A	150.0 k
800A	160.0 k
900A	180.0 k
1000A	200.0 k
1200A	240.0 k
1500A	300.0 k
1600A	320.0 k
1800A	360.0 k
2000A	400.0 k
2500A	500.0 k
3000A	600.0 k
3500A	700.0 k
4000A	800.0 k
4500A	900.0 k
5000A	1000 k
6000A	1200 k
7500A	1500 k
8000A	1600 k
9000A	1800 k
10000A	2000 k
12000A	2400 k
15000A	3000 k
20000A	4000 k
30000A	6000 k

■ Appendix 3-1

Rated active power table (1 phase 2 wire)

Primary rated voltage / Primary rated current	110.0kV [W]	77.00kV [W]	66.00kV [W]	33.00kV [W]	22.00kV [W]	20.00kV [W]	18.40kV [W]	16.50kV [W]	13.80kV [W]	13.20kV [W]
5A	500.0 k	350.0 k	300.0 k	150.0 k	100.0 k	90.91 k	83.64 k	75.00 k	62.73 k	60.00 k
6A	600.0 k	420.0 k	360.0 k	180.0 k	120.0 k	109.1 k	100.4 k	90.00 k	75.27 k	72.00 k
7.5A	750.0 k	525.0 k	450.0 k	225.0 k	150.0 k	136.4 k	125.5 k	112.5 k	94.09 k	90.00 k
8A	800.0 k	560.0 k	480.0 k	240.0 k	160.0 k	145.5 k	133.8 k	120.0 k	100.4 k	96.00 k
10A	1000 k	700.0 k	600.0 k	300.0 k	200.0 k	181.8 k	167.3 k	150.0 k	125.5 k	120.0 k
12A	1200 k	840.0 k	720.0 k	360.0 k	240.0 k	218.2 k	200.7 k	180.0 k	150.5 k	144.0 k
15A	1500 k	1050 k	900.0 k	450.0 k	300.0 k	272.7 k	250.9 k	225.0 k	188.2 k	180.0 k
20A	2000 k	1400 k	1200 k	600.0 k	400.0 k	363.6 k	334.5 k	300.0 k	250.9 k	240.0 k
25A	2500 k	1750 k	1500 k	750.0 k	500.0 k	454.5 k	418.2 k	375.0 k	313.6 k	300.0 k
30A	3000 k	2100 k	1800 k	900.0 k	600.0 k	545.5 k	501.8 k	450.0 k	376.4 k	360.0 k
40A	4000 k	2800 k	2400 k	1200 k	800.0 k	727.3 k	669.1 k	600.0 k	501.8 k	480.0 k
50A	5000 k	3500 k	3000 k	1500 k	1000 k	909.1 k	836.4 k	750.0 k	627.3 k	600.0 k
60A	6000 k	4200 k	3600 k	1800 k	1200 k	1091 k	1004 k	900.0 k	752.7 k	720.0 k
75A	7500 k	5250 k	4500 k	2250 k	1500 k	1364 k	1255 k	1125 k	940.9 k	900.0 k
80A	8000 k	5600 k	4800 k	2400 k	1600 k	1455 k	1338 k	1200 k	1004 k	960.0 k
100A	10.00 M	7000 k	6000 k	3000 k	2000 k	1818 k	1673 k	1500 k	1255 k	1200 k
120A	12.00 M	8400 k	7200 k	3600 k	2400 k	2182 k	2007 k	1800 k	1505 k	1440 k
150A	15.00 M	10.50 M	9000 k	4500 k	3000 k	2727 k	2509 k	2250 k	1882 k	1800 k
200A	20.00 M	14.00 M	12.00 M	6000 k	4000 k	3636 k	3345 k	3000 k	2509 k	2400 k
250A	25.00 M	17.50 M	15.00 M	7500 k	5000 k	4545 k	4182 k	3750 k	3136 k	3000 k
300A	30.00 M	21.00 M	18.00 M	9000 k	6000 k	5455 k	5018 k	4500 k	3764 k	3600 k
400A	40.00 M	28.00 M	24.00 M	12.00 M	8000 k	7273 k	6691 k	6000 k	5018 k	4800 k
500A	50.00 M	35.00 M	30.00 M	15.00 M	10.00 M	9091 k	8364 k	7500 k	6273 k	6000 k
600A	60.00 M	42.00 M	36.00 M	18.00 M	12.00 M	10.91 M	10.04 M	9000 k	7527 k	7200 k
750A	75.00 M	52.50 M	45.00 M	22.50 M	15.00 M	13.64 M	12.55 M	11.25 M	9409 k	9000 k
800A	80.00 M	56.00 M	48.00 M	24.00 M	16.00 M	14.55 M	13.38 M	12.00 M	10.04 M	9600 k
900A	90.00 M	63.00 M	54.00 M	27.00 M	18.00 M	16.36 M	15.05 M	13.50 M	11.29 M	10.80 M
1000A	100.0 M	70.00 M	60.00 M	30.00 M	20.00 M	18.18 M	16.73 M	15.00 M	12.55 M	12.00 M
1200A	120.0 M	84.00 M	72.00 M	36.00 M	24.00 M	21.82 M	20.07 M	18.00 M	15.05 M	14.40 M
1500A	150.0 M	105.0 M	90.00 M	45.00 M	30.00 M	27.27 M	25.09 M	22.50 M	18.82 M	18.00 M
1600A	160.0 M	112.0 M	96.00 M	48.00 M	32.00 M	29.09 M	26.76 M	24.00 M	20.07 M	19.20 M
1800A	180.0 M	126.0 M	108.0 M	54.00 M	36.00 M	32.73 M	30.11 M	27.00 M	22.58 M	21.60 M
2000A	200.0 M	140.0 M	120.0 M	60.00 M	40.00 M	36.36 M	33.45 M	30.00 M	25.09 M	24.00 M
2500A	250.0 M	175.0 M	150.0 M	75.00 M	50.00 M	45.45 M	41.82 M	37.50 M	31.36 M	30.00 M
3000A	300.0 M	210.0 M	180.0 M	90.00 M	60.00 M	54.55 M	50.18 M	45.00 M	37.64 M	36.00 M
3500A	350.0 M	245.0 M	210.0 M	105.0 M	70.00 M	63.64 M	58.55 M	52.50 M	43.91 M	42.00 M
4000A	400.0 M	280.0 M	240.0 M	120.0 M	80.00 M	72.73 M	66.91 M	60.00 M	50.18 M	48.00 M
4500A	450.0 M	315.0 M	270.0 M	135.0 M	90.00 M	81.82 M	75.27 M	67.50 M	56.45 M	54.00 M
5000A	500.0 M	350.0 M	300.0 M	150.0 M	100.0 M	90.91 M	83.64 M	75.00 M	62.73 M	60.00 M
6000A	600.0 M	420.0 M	360.0 M	180.0 M	120.0 M	109.1 M	100.4 M	90.00 M	75.27 M	72.00 M
7500A	750.0 M	525.0 M	450.0 M	225.0 M	150.0 M	136.4 M	125.5 M	112.5 M	94.09 M	90.00 M
8000A	800.0 M	560.0 M	480.0 M	240.0 M	160.0 M	145.5 M	133.8 M	120.0 M	100.4 M	96.00 M
9000A	900.0 M	630.0 M	540.0 M	270.0 M	180.0 M	163.6 M	150.5 M	135.0 M	112.9 M	108.0 M
10000A	1000 M	700.0 M	600.0 M	300.0 M	200.0 M	181.8 M	167.3 M	150.0 M	125.5 M	120.0 M
12000A	1200 M	840.0 M	720.0 M	360.0 M	240.0 M	218.2 M	200.7 M	180.0 M	150.5 M	144.0 M
15000A	1500 M	1050 M	900.0 M	450.0 M	300.0 M	272.7 M	250.9 M	225.0 M	188.2 M	180.0 M
20000A	2000 M	1400 M	1200 M	600.0 M	400.0 M	363.6 M	334.5 M	300.0 M	250.9 M	240.0 M
30000A	3000 M	2100 M	1800 M	900.0 M	600.0 M	545.5 M	501.8 M	450.0 M	376.4 M	360.0 M

■ Appendix 3-2

Rated active power table (1 phase 2 wire)

Primary rated voltage / Primary rated current	11.00kV [W]	6600V [W]	3300V [W]	2200V [W]	1650V [W]	1100V [W]	990V [W]	880V [W]	690V [W]	480V [W]
5A	50.00 k	30.00 k	15.00 k	10.00 k	7500	5000	4500	4000	3136	2182
6A	60.00 k	36.00 k	18.00 k	12.00 k	9000	6000	5400	4800	3764	2618
7.5A	75.00 k	45.00 k	22.50 k	15.00 k	11.25 k	7500	6750	6000	4705	3273
8A	80.00 k	48.00 k	24.00 k	16.00 k	12.00 k	8000	7200	6400	5018	3491
10A	100.0 k	60.00 k	30.00 k	20.00 k	15.00 k	10.00 k	9000	8000	6273	4364
12A	120.0 k	72.00 k	36.00 k	24.00 k	18.00 k	12.00 k	10.80 k	9600	7527	5236
15A	150.0 k	90.00 k	45.00 k	30.00 k	22.50 k	15.00 k	13.50 k	12.00 k	9409	6545
20A	200.0 k	120.0 k	60.00 k	40.00 k	30.00 k	20.00 k	18.00 k	16.00 k	12.55 k	8727
25A	250.0 k	150.0 k	75.00 k	50.00 k	37.50 k	25.00 k	22.50 k	20.00 k	15.68 k	10.91 k
30A	300.0 k	180.0 k	90.00 k	60.00 k	45.00 k	30.00 k	27.00 k	24.00 k	18.82 k	13.09 k
40A	400.0 k	240.0 k	120.0 k	80.00 k	60.00 k	40.00 k	36.00 k	32.00 k	25.09 k	17.45 k
50A	500.0 k	300.0 k	150.0 k	100.0 k	75.00 k	50.00 k	45.00 k	40.00 k	31.36 k	21.82 k
60A	600.0 k	360.0 k	180.0 k	120.0 k	90.00 k	60.00 k	54.00 k	48.00 k	37.64 k	26.18 k
75A	750.0 k	450.0 k	225.0 k	150.0 k	112.5 k	75.00 k	67.50 k	60.00 k	47.05 k	32.73 k
80A	800.0 k	480.0 k	240.0 k	160.0 k	120.0 k	80.00 k	72.00 k	64.00 k	50.18 k	34.91 k
100A	1000 k	600.0 k	300.0 k	200.0 k	150.0 k	100.0 k	90.00 k	80.00 k	62.73 k	43.64 k
120A	1200 k	720.0 k	360.0 k	240.0 k	180.0 k	120.0 k	108.0 k	96.00 k	75.27 k	52.36 k
150A	1500 k	900.0 k	450.0 k	300.0 k	225.0 k	150.0 k	135.0 k	120.0 k	94.09 k	65.45 k
200A	2000 k	1200 k	600.0 k	400.0 k	300.0 k	200.0 k	180.0 k	160.0 k	125.5 k	87.27 k
250A	2500 k	1500 k	750.0 k	500.0 k	375.0 k	250.0 k	225.0 k	200.0 k	156.8 k	109.1 k
300A	3000 k	1800 k	900.0 k	600.0 k	450.0 k	300.0 k	270.0 k	240.0 k	188.2 k	130.9 k
400A	4000 k	2400 k	1200 k	800.0 k	600.0 k	400.0 k	360.0 k	320.0 k	250.9 k	174.5 k
500A	5000 k	3000 k	1500 k	1000 k	750.0 k	500.0 k	450.0 k	400.0 k	313.6 k	218.2 k
600A	6000 k	3600 k	1800 k	1200 k	900.0 k	600.0 k	540.0 k	480.0 k	376.4 k	261.8 k
750A	7500 k	4500 k	2250 k	1500 k	1125 k	750.0 k	675.0 k	600.0 k	470.5 k	327.3 k
800A	8000 k	4800 k	2400 k	1600 k	1200 k	800.0 k	720.0 k	640.0 k	501.8 k	349.1 k
900A	9000 k	5400 k	2700 k	1800 k	1350 k	900.0 k	810.0 k	720.0 k	564.5 k	392.7 k
1000A	10.00 M	6000 k	3000 k	2000 k	1500 k	1000 k	900.0 k	800.0 k	627.3 k	436.4 k
1200A	12.00 M	7200 k	3600 k	2400 k	1800 k	1200 k	1080 k	960.0 k	752.7 k	523.6 k
1500A	15.00 M	9000 k	4500 k	3000 k	2250 k	1500 k	1350 k	1200 k	940.9 k	654.5 k
1600A	16.00 M	9600 k	4800 k	3200 k	2400 k	1600 k	1440 k	1280 k	1004 k	698.2 k
1800A	18.00 M	10.80 M	5400 k	3600 k	2700 k	1800 k	1620 k	1440 k	1129 k	785.5 k
2000A	20.00 M	12.00 M	6000 k	4000 k	3000 k	2000 k	1800 k	1600 k	1255 k	872.7 k
2500A	25.00 M	15.00 M	7500 k	5000 k	3750 k	2500 k	2250 k	2000 k	1568 k	1091 k
3000A	30.00 M	18.00 M	9000 k	6000 k	4500 k	3000 k	2700 k	2400 k	1882 k	1309 k
3500A	35.00 M	21.00 M	10.50 M	7000 k	5250 k	3500 k	3150 k	2800 k	2195 k	1527 k
4000A	40.00 M	24.00 M	12.00 M	8000 k	6000 k	4000 k	3600 k	3200 k	2509 k	1745 k
4500A	45.00 M	27.00 M	13.50 M	9000 k	6750 k	4500 k	4050 k	3600 k	2823 k	1964 k
5000A	50.00 M	30.00 M	15.00 M	10.00 M	7500 k	5000 k	4500 k	4000 k	3136 k	2182 k
6000A	60.00 M	36.00 M	18.00 M	12.00 M	9000 k	6000 k	5400 k	4800 k	3764 k	2618 k
7500A	75.00 M	45.00 M	22.50 M	15.00 M	11.25 M	7500 k	6750 k	6000 k	4705 k	3273 k
8000A	80.00 M	48.00 M	24.00 M	16.00 M	12.00 M	8000 k	7200 k	6400 k	5018 k	3491 k
9000A	90.00 M	54.00 M	27.00 M	18.00 M	13.50 M	9000 k	8100 k	7200 k	5645 k	3927 k
10000A	100.0 M	60.00 M	30.00 M	20.00 M	15.00 M	10.00 M	9000 k	8000 k	6273 k	4364 k
12000A	120.0 M	72.00 M	36.00 M	24.00 M	18.00 M	12.00 M	10.80 M	9600 k	7527 k	5236 k
15000A	150.0 M	90.00 M	45.00 M	30.00 M	22.50 M	15.00 M	13.50 M	12.00 M	9409 k	6545 k
20000A	200.0 M	120.0 M	60.00 M	40.00 M	30.00 M	20.00 M	18.00 M	16.00 M	12.55 M	8727 k
30000A	300.0 M	180.0 M	90.00 M	60.00 M	45.00 M	30.00 M	27.00 M	24.00 M	18.82 M	13.09 M

■ Appendix 3-3

Rated active power table (1 phase 2 wire)

Primary rated voltage / Primary rated current	460V [W]	440V [W]	415V [W]	400V [W]	380V [W]	220.0V [W]	110.0V [W]
5A	2091	2000	1886	1818	1727	1000	500
6A	2509	2400	2264	2182	2073	1200	600
7.5A	3136	3000	2830	2727	2591	1500	750
8A	3345	3200	3018	2909	2764	1600	800
10A	4182	4000	3773	3636	3455	2000	1000
12A	5018	4800	4527	4364	4145	2400	1200
15A	6273	6000	5659	5455	5182	3000	1500
20A	8364	8000	7545	7273	6909	4000	2000
25A	10.45 k	10.00 k	9432	9091	8636	5000	2500
30A	12.55 k	12.00 k	11.32 k	10.91 k	10.36 k	6000	3000
40A	16.73 k	16.00 k	15.09 k	14.55 k	13.82 k	8000	4000
50A	20.91 k	20.00 k	18.86 k	18.18 k	17.27 k	10.00 k	5000
60A	25.09 k	24.00 k	22.64 k	21.82 k	20.73 k	12.00 k	6000
75A	31.36 k	30.00 k	28.30 k	27.27 k	25.91 k	15.00 k	7500
80A	33.45 k	32.00 k	30.18 k	29.09 k	27.64 k	16.00 k	8000
100A	41.82 k	40.00 k	37.73 k	36.36 k	34.55 k	20.00 k	10.00 k
120A	50.18 k	48.00 k	45.27 k	43.64 k	41.45 k	24.00 k	12.00 k
150A	62.73 k	60.00 k	56.59 k	54.55 k	51.82 k	30.00 k	15.00 k
200A	83.64 k	80.00 k	75.45 k	72.73 k	69.09 k	40.00 k	20.00 k
250A	104.5 k	100.0 k	94.32 k	90.91 k	86.36 k	50.00 k	25.00 k
300A	125.5 k	120.0 k	113.2 k	109.1 k	103.6 k	60.00 k	30.00 k
400A	167.3 k	160.0 k	150.9 k	145.5 k	138.2 k	80.00 k	40.00 k
500A	209.1 k	200.0 k	188.6 k	181.8 k	172.7 k	100.0 k	50.00 k
600A	250.9 k	240.0 k	226.4 k	218.2 k	207.3 k	120.0 k	60.00 k
750A	313.6 k	300.0 k	283.0 k	272.7 k	259.1 k	150.0 k	75.00 k
800A	334.5 k	320.0 k	301.8 k	290.9 k	276.4 k	160.0 k	80.00 k
900A	376.4 k	360.0 k	339.5 k	327.3 k	310.9 k	180.0 k	90.00 k
1000A	418.2 k	400.0 k	377.3 k	363.6 k	345.5 k	200.0 k	100.0 k
1200A	501.8 k	480.0 k	452.7 k	436.4 k	414.5 k	240.0 k	120.0 k
1500A	627.3 k	600.0 k	565.9 k	545.5 k	518.2 k	300.0 k	150.0 k
1600A	669.1 k	640.0 k	603.6 k	581.8 k	552.7 k	320.0 k	160.0 k
1800A	752.7 k	720.0 k	679.1 k	654.5 k	621.8 k	360.0 k	180.0 k
2000A	836.4 k	800.0 k	754.5 k	727.3 k	690.9 k	400.0 k	200.0 k
2500A	1045 k	1000 k	943.2 k	909.1 k	863.6 k	500.0 k	250.0 k
3000A	1255 k	1200 k	1132 k	1091 k	1036 k	600.0 k	300.0 k
3500A	1464 k	1400 k	1320 k	1273 k	1209 k	700.0 k	350.0 k
4000A	1673 k	1600 k	1509 k	1455 k	1382 k	800.0 k	400.0 k
4500A	1882 k	1800 k	1698 k	1636 k	1555 k	900.0 k	450.0 k
5000A	2091 k	2000 k	1886 k	1818 k	1727 k	1000 k	500.0 k
6000A	2509 k	2400 k	2264 k	2182 k	2073 k	1200 k	600.0 k
7500A	3136 k	3000 k	2830 k	2727 k	2591 k	1500 k	750.0 k
8000A	3345 k	3200 k	3018 k	2909 k	2764 k	1600 k	800.0 k
9000A	3764 k	3600 k	3395 k	3273 k	3109 k	1800 k	900.0 k
10000A	4182 k	4000 k	3773 k	3636 k	3455 k	2000 k	1000 k
12000A	5018 k	4800 k	4527 k	4364 k	4145 k	2400 k	1200 k
15000A	6273 k	6000 k	5659 k	5455 k	5182 k	3000 k	1500 k
20000A	8364 k	8000 k	7545 k	7273 k	6909 k	4000 k	2000 k
30000A	12.55 M	12.00 M	11.32 M	10.91 M	10.36 M	6000 k	3000 k

DAIICHI ELECTRONICS CO., LTD.

Tokyo Office : 11-13, Hitotsuya 1-chome, Adachi-ku, Tokyo, 121-8639, JAPAN.
TEL：+81-3-3885-2411 , FAX：+81-3-3858-3966

Kyoto Office : 1-19, Ichinobe-Nishikawahara, Jyoyou-shi, Kyoto, 610-0114, JAPAN.
TEL：+81-774-55-1391 , FAX：+81-774-54-1353

DATE：February 15, 2025