Panasonic

KW2G
Eco-POWER METER
Expansion unit
(Power measurement and Pulse output)
User's Manual

WUME-KW2GWH/PO-03

Cautions for Your Safety

Read the manual carefully before installing, running and maintenance for proper operation.

Before using, master the knowledge of the equipment, safety information and all of other notes.

This manual uses two safety flags to indicate different levels of danger.

WARNING A handling error could cause serious physical injury to an operator and in the worst case could even be fatal.

- Always take precautions to ensure the overall safety of your system, so that the whole system remains safe in the event of failure of this product or other external factor.
- Do not use this product in areas with inflammable gas. It could lead to an explosion.
- Exposing this product to excessive heat or open flames could cause damage to the lithium battery or other electronic parts.

CAUTION A handling error could cause serious physical injury to an operator or damage to the equipment.

- To prevent abnormal exothermic heat or smoke generation, use this product at the values less than the maximum of the characteristics and performance that are assured in these specifications.
- Do not dismantle or remodel the product. It could lead to abnormal exothermic heat or smoke generation.
- Do not touch the terminal while turning on electricity. It could lead to an electric shock.
- Use the external devices to function the emergency stop and interlock circuit.
- Connect the wires or connectors securely. The loose connection might cause abnormal exothermic heat or smoke generation.
- Do not allow foreign matters such as liquid, flammable materials, metals to go into the inside of the product. It might cause exothermic heat or smoke generation.
- Do not undertake construction (such as connection and disconnection) while the power supply is on.
- Do not use at secondary side circuit of inverter. It might cause exothermic heat or damage.

Copyright and trademark

- Modbus Protocol is a communication protocol that the Modicon Inc. developed for PLC.
- Other company names and the product names are the trademarks or registered trademarks of each company.

Introduction

Thank you very much indeed for purchasing
'KW2G Eco-POWER METER Expansion unit
(Power measuremet and Pulse output)'.
In this manual, we explain the usage of
'KW2G Eco-POWER METER Expansion unit
(Power measurement and Pulse output)' in detail.
Please use it correctly after understanding the content enough.

Table of Contents

Cautions before using

■ Installation environment

◇Do not use the Unit in the following environments.

- ・Where the unit will be exposed to direct sunlight and where the ambient temperature is outside the range of -10 to 50 °C.
- ・Where the ambient humidity is outside the range of 30 to 85 % RH (at 20℃), non-condensing and where condensation might occur by sudden temperature changes
- ・Where inflammable or corrosive gas might be produced
- ・Where the unit will be exposed to excessive airborne dust or metal particles
- ・Where the unit will be exposed to water, oil or chemicals
- ・Where organic solvents such as benzene, paint thinner, alcohol, or strong alkaline solutions such as ammonia or caustic soda might adhere to the product
- ・Where direct vibration or shock might be transmitted to the product, and where water might wet the product
- ・Where the place near high-voltage cable, high-voltage device, power line, power device.
- ・Where the place near a machinery with transmission function such as amateur radio.
- ・Where the place near a machinery which occurs the big switching serge

◇Please use the Unit according to the specifications described in this manual. Otherwise, it may malfunction or cause fire and an electric shock.

- ・Connect to the power supply in compliance with the rating.
- ・Refer to the wiring diagram to ensure proper wiring for the power supply, input and output.
- ・Do not perform wiring or installation with a live line. It may also lead to circuit burnout or fire by way of the secondary CT side opening.

■ Installation

- ・Eco-POWER METER is designed chiefly to manage saving energy.
  It is neither intended nor can it be legally used for billing.
- ・Eco-POWER METER is designed to be used in a control panel.
- ・The power supply terminal and voltage input terminal of the main unit is common. Therefore if additional noise effects the power supply line, incorrect measurements may result.
- ・Installation and wiring must be performed by expert personnel for electrical work or electric piping.
- ・Do not add an excess power to the display. It might break the inner liquid crystal.

■ As to measurement

- ・If there is some distortion by harmonic or waveform, it may not measure correctly.
  Please check with the actual system before adopts it.
- ・It might not measure an instantaneous current such as an inrush current or an welding machine.
- ・When measuring the below loads, it might not satisfy with the accuracy guarantee.
  Out of rating current, Load with low power factor,
  Load with winding current, Load with ferromagnetic field
- ・Power factor operation is a method assuming balanced load. The error might be big when it measures unbalanced load.
- **・It takes time to update monitor display when many units are connected. However, data update cycle is not changed.**
- **・The unevenness will be large when using outside of rated frequency.**
  In this case, set the shift average frequency big.

■ Static electricity

- ・Discharge static electricity touching the grounded metal etc. when you touch the unit.
- ・Excessive static electricity might be generated especially in a dry place.

■ Cleaning

・Wipe dirt of the main unit with soft cloth etc. When thinner is used, the unit might deform or be discolored.

■ Power supply

・Connect a breaker to the voltage input part for safety reasons and to protect the device.
The breaker that connects to the voltage input part must arrange at the position easily reached, and display shows it is the breaker of the equipment.

・Do not turn on the power supply or input until all wiring is completed.

■ Before power on

Please note the following points when turning on power at the first time.

・Confirm there are neither wiring rubbish nor especially an electrical conduction when installed.

・Confirm neither the power supply wiring, the I/O wiring nor the power-supply voltage are wrong.

・Tighten the installation screw and the terminal screw surely.

・Use an electric wire applicable to the rated current.

Chapter 1 Unit's Outline

KW2G Eco-POWER METER is the wattmeter that can measure electric power, current, voltage, PF and so on with combination of one main unit and expansion units (Power measurement).
By connecting main unit and expansion unit (Power measurement, Power measurement and Pulse output), it can measure up to 8-circuit (16-circuit of single-phase two-wire system).

1.1 Unit's Name and Model Numbers

Product name	Model No.	Connecting method
KW2G Eco-POWER METER Expansion unit (Power measurement and Pulse output)	AKW2160G	Current transformer (CT) Connector Pulse output terminal M3＋ screw *Connect to main unit with the connector.

Note)
It is impossible to measure by only the expansion unit. Connect expansion units to the main unit.
Up to 7 expansion units are connected to 1 main unit.
Use KW2G main unit ver.1.04 or later or KW2G-H main unit ver. 1.01 or later.
If the main unit version is before this, you need to upgrade the main unit.
It is necessary the firmware and KW Version Upgrade Tool.

1.2 Combination devices

●Main unit

Product name	Model No.	Log function	Connecting method	
KW2G Eco-POWER METER Main unit	AKW2010G	Not available	・Power supply terminal (Voltage input terminal)	M3.5＋screw
			・Pulse I/O terminal	M3＋screw
KW2G-H Eco-POWER METER Main unit SD card type	AKW2020G	Available	・RS485 communication terminal	M3＋screw
			・Current transformer(CT)	Connector
			・USB communication	Connector

●Expansion unit

Product name	Model No.	Connecting method
Expansion unit (Power measurement)	AKW2110G	Current transformer (CT) Connector *Connect to main unit with the connector.
Expansion unit (Pulse input)	AKW2152G	Pulse input terminal M3＋ screw *Connect to main unit with the connector.
Expansion unit (Analog input)	AKW2182G	Analog input terminal M3＋ screw *Connect to main unit with the connector.

***In this manual, we explain the usage of 'KW2G Expansion unit (Power measurement and Pulse output)'.**

1.3 Tool

Product name	Functions	Model No
KW Monitor	・Monitoring and logging the measured values.	Download from our website. Free of charge
Power display tool KW View	・It makes graph by using data from Eco-POWER METER	Download from our website. Free of charge
KW Version Upgrade Tool	・You can upgrade the farmware of main unit and expansion unit. ・USB driver is included.	Download from our website. Free of charge

Note) Members registration is required to download.

1.4 Measurement items

Item		Unit	Data range
Integrated electric power (Active) *1		kWh/ MWh	(6-digit display) 0.00 to 9999.99MWh (minimum unit: 0.01kWh) (9-digit display) 0.00 to 9999999.99kWh (minimum unit: 0.01kWh) 0.000 to 999999.999kWh (minimum unit: 0.001kWh)
Instantaneous electric power	Active *2	kW	-9999.99 to 0.000 to 9999.99
	Reactive *3	kvar	-9999.99 to 0.00 to 9999.99
	Apparent	kVA	0.00 to 9999.99
Current	R-current	A	0.000 to 6000.00
	N/S-current	A	0.000 to 6000.00 (calculated value)
	T-current	A	0.000 to 6000.00
Voltage	R(RS)-voltage	V	0.0 to 9999.9
	S(RT)-voltage	V	0.0 to 9999.9 (calculated value)
	T(TS)-voltage	V	0.0 to 9999.9
Electricity charge *4			0.00 to 999999
Conversion value	Carbon dioxide	kg-CO_2	0.00 to 999999
Power Factor *2			-1.00 to 0.00 to 1.00 (without identify leading phase and lagging phase)

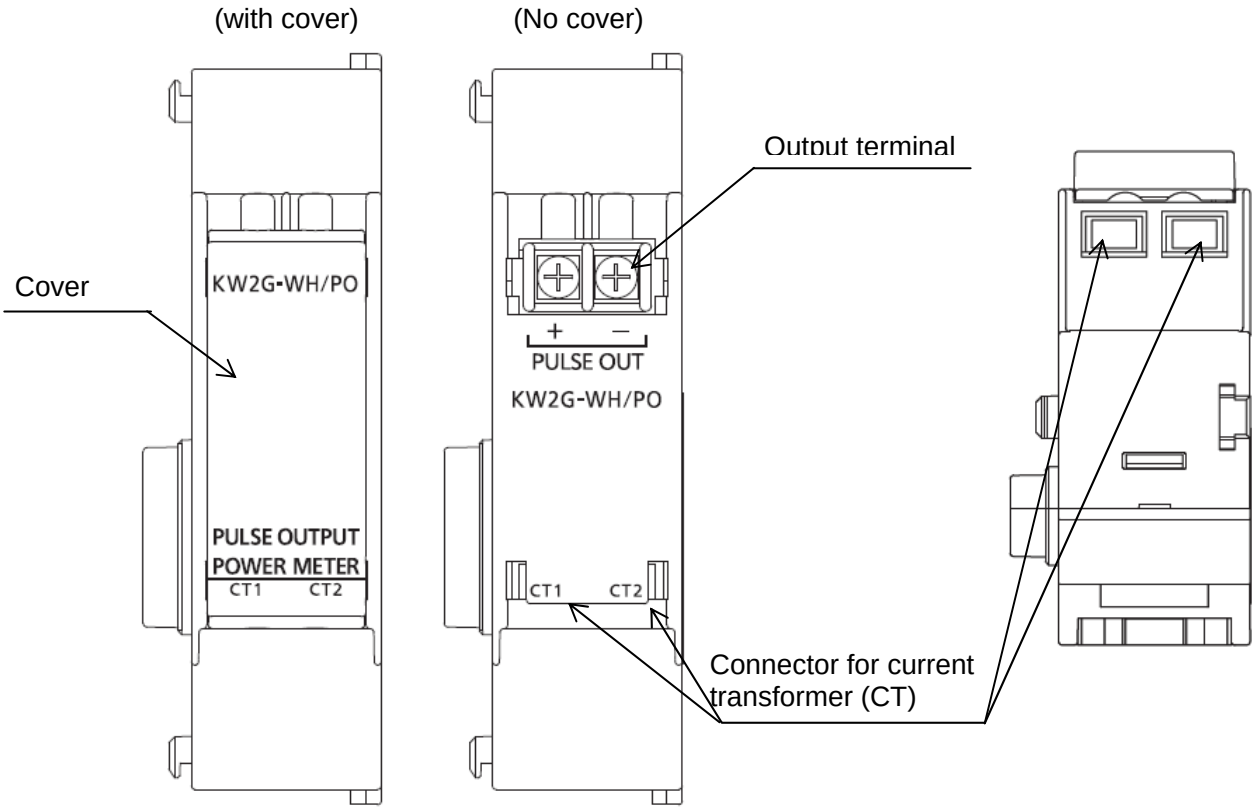
*1 Integrated electrical power is not integrated (not subtracted) when detecting regeneration power.
*2 KW2G can measure regeneration electric power.
While detecting regeneration electric power, minus is displayed on instantaneous active power and power factor.
*3 It determines pulse or minus of instantaneous reactive power by the input measuring voltage and the input measuring current.
When harmonics or a wave pattern is warped, it may not determine correctly.
*4 Eco-POWER METER is designed chiefly to manage saving energy.
It is neither intended nor can it be legally used for billing.

Chapter 2 Parts Name and Working

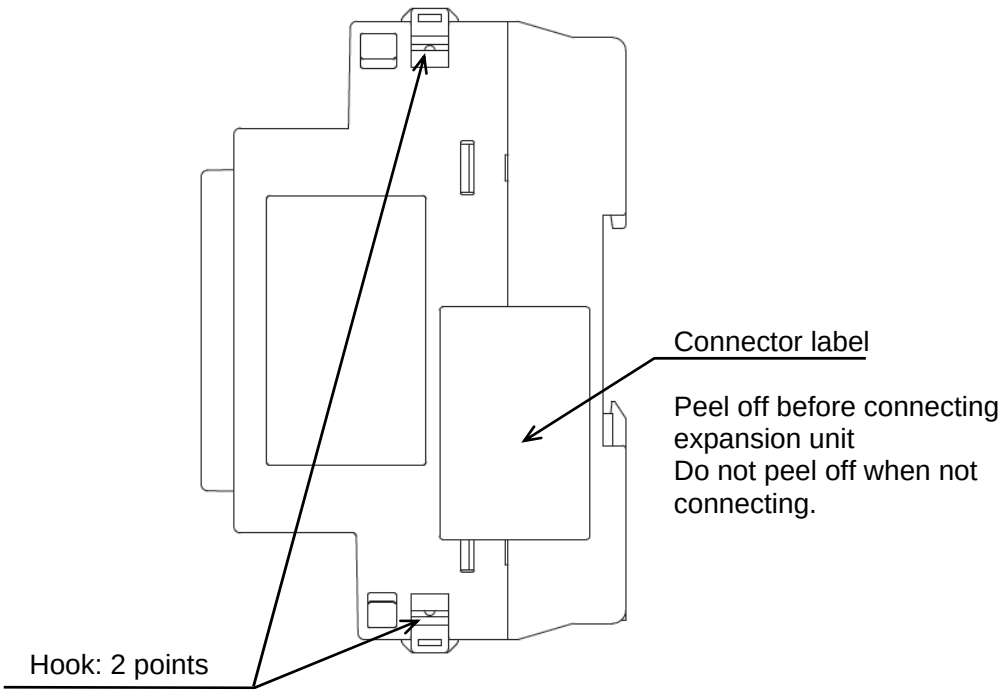
2.1 Parts Names

Front view

Bottom view



Side view



Push the hooks into the unit to fix the expansion unit.

Chapter 3 Installation

3.1 Measured-circuit

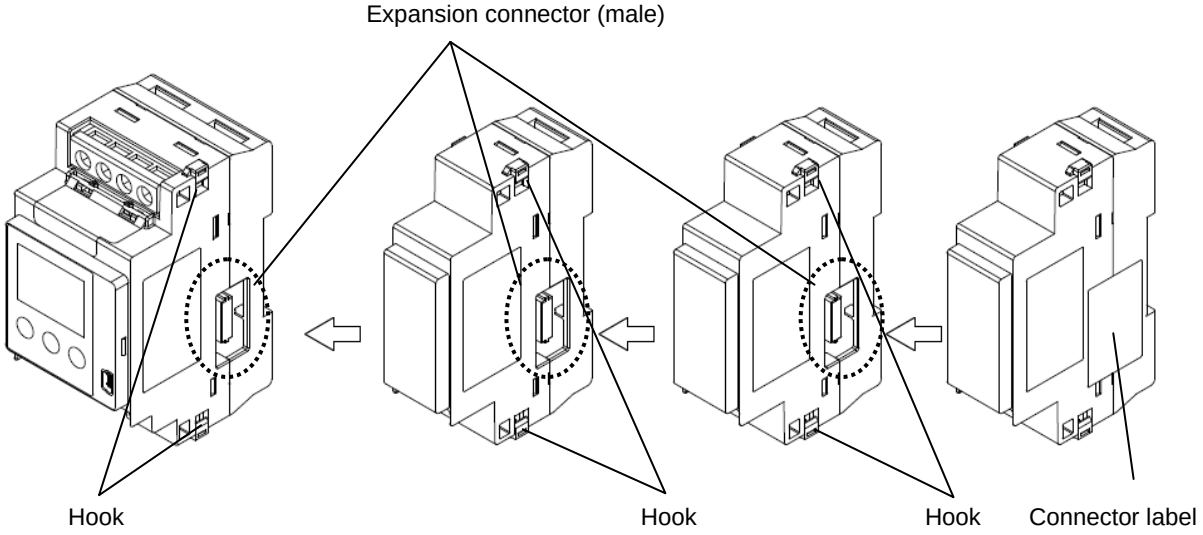
・It is not impossible to use to measure several loads by different strain power supply.
・Each unit (main unit, expansion unit(Power measurement)) can measure 2-circuit of single-phase two-wire system, and 1-circuit of single-phase three-wire system or three-phase three-wire system. Each unit can be used with different phase and wire system. However be sure to check the wiring carefully.
・It is impossible to measure by only the expansion unit. Connect expansion units to main unit.
Up to 7 expansion units are connected to 1 main unit. You can use with the combination of power measurement, pulse input and analog input as expansion units.
・Connecting a main unit and expansion units, up to 16-circuit of single-phase two-wire system, up to 8-circuit of single-phase three-wire system or three-phase three-wire system can be measured.

*Power source system
・Power source system is the electrical power system from one power source (normally one transformer).
・KW2G can measure 1-system max. 16-circuits of 1P2W system and 1-system max. 8-circuit of 1P3W and 3P3W system by connecting a main unit and expansion units (power measurement, power measurement + pulse output).
・In order to measure several systems, it is necessary to use one main unit for each system.

3.2 Connection between the main unit and the expansion unit

・Turn off the power of main unit when connecting expansion units.
・When expanding the units, peel off connector label on the side of each unit and connect male connector to female connector.
Female connector is on the other side of male connector.
・After connecting, push the hooks into the unit to fix the expansion unit.
・Up to 7 expansion units can be connected per one main unit.

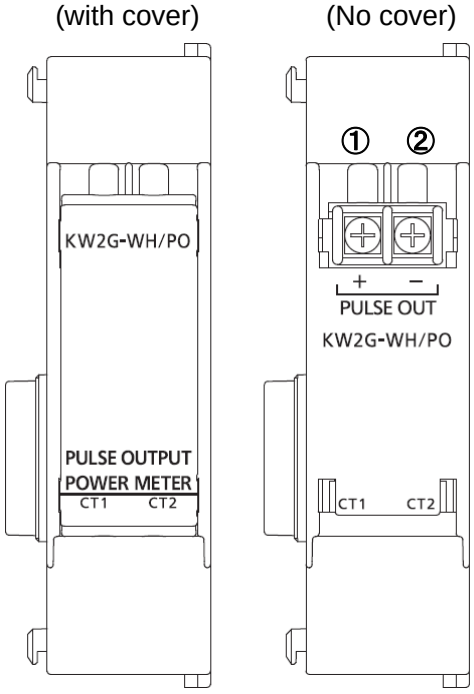
Note) Communication will be stopped or the measurement data will be lost when the units are removed or connected while turn on power.



3.3 Terminal arrangement

Be sure to wire correctly according to the terminal arrangement and wiring diagrams.
After completing wiring, be sure to attach the terminal cover for safety reasons.

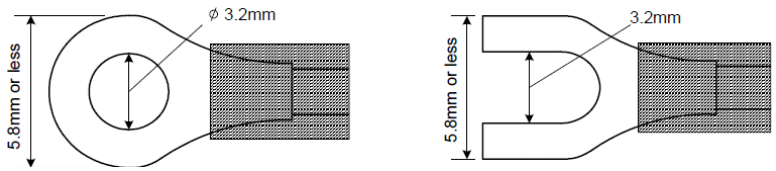
3.3.1 Expansion unit (Power measurement and Pulse output)



No.		Function	Screw
Top	①	Pulse output ＋	M3
	②	Pulse output −	
Bottom		CT1	
		CT2	

Caution for Wiring

1) Terminal fastening torque should be 0.5 to 0.6N·m for M3 screw. In case of using a crimping terminal, use it with insulating sleeve applicable to M3 screw.
width: 5.8mm or less



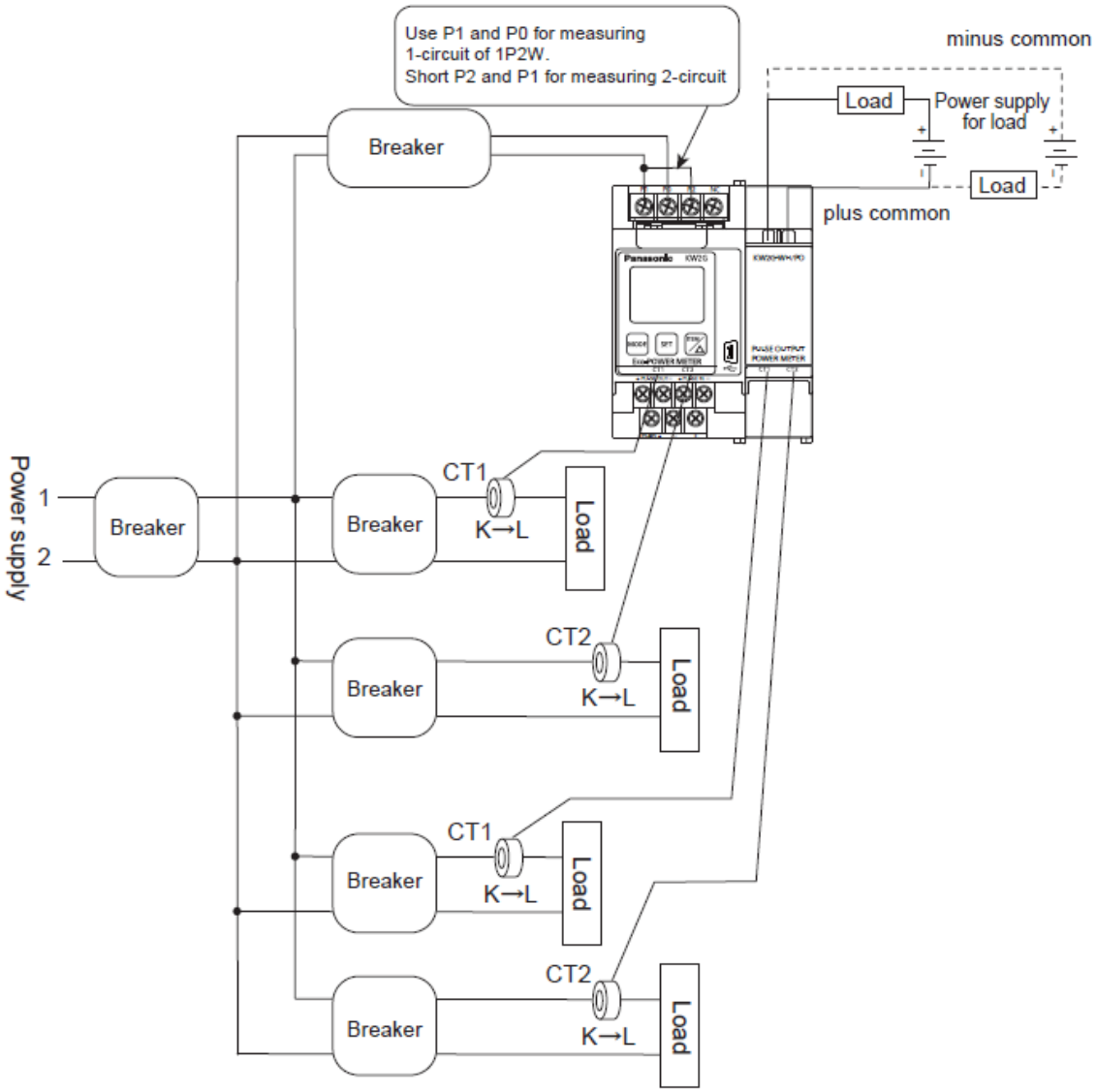
2) Use with 10m or less of the input line and 100m or less of the output line.
3) Use flame-resistant cable for each wiring.

3.4 Wiring Diagram

Please connect a breaker (3 to 15A) to the power supply (voltage input) part for safety reasons and to protect the device.

Single-phase two-wire system

◆When measuring a load with rated input voltage

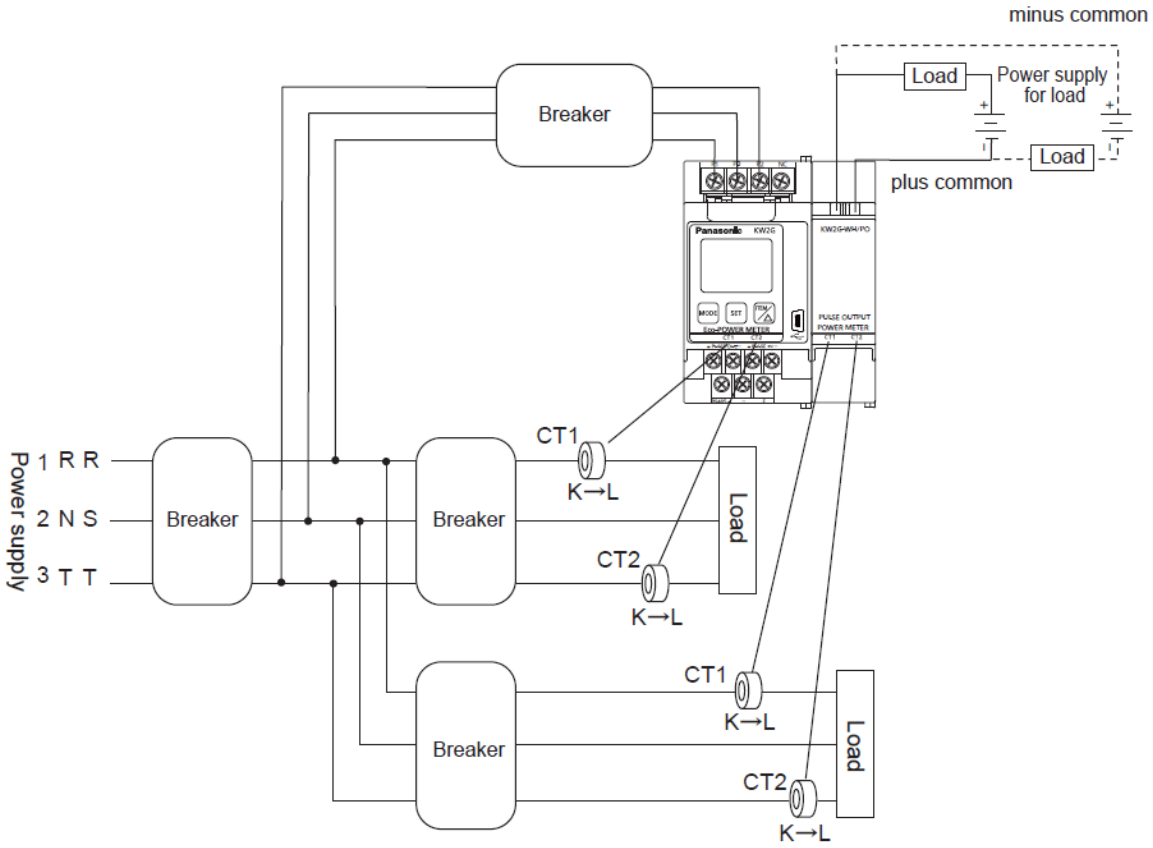


Note)
(1) When wiring CT, wire correctly according to this, K for power supply side and L for load side.
(2) Using CTs for one unit should be same.
(3) Pulse output function works according to the measuremt value of CT1.

◆When measuring a load with exceed input voltage.
Voltage transformer (VT) is needed when you measure a load with over rated input voltage.
Use VT, its secondary side rating is 110V.
Even if the secondary side voltages of VT are same, when the power source system is different, one main unit is necessary for each power source system.

Single-phase three-wire system/Three-phase three-wire system

◆When measuring a load with rated input voltage



Note)

(1) When wiring CT, wire correctly according to this, K for power supply side and L for load side.

(2) Using CTs for one unit should be same.

◆When measuring a load with exceed input voltage.

Voltage transformer (VT) is needed when you measure a load with over rated input voltage.

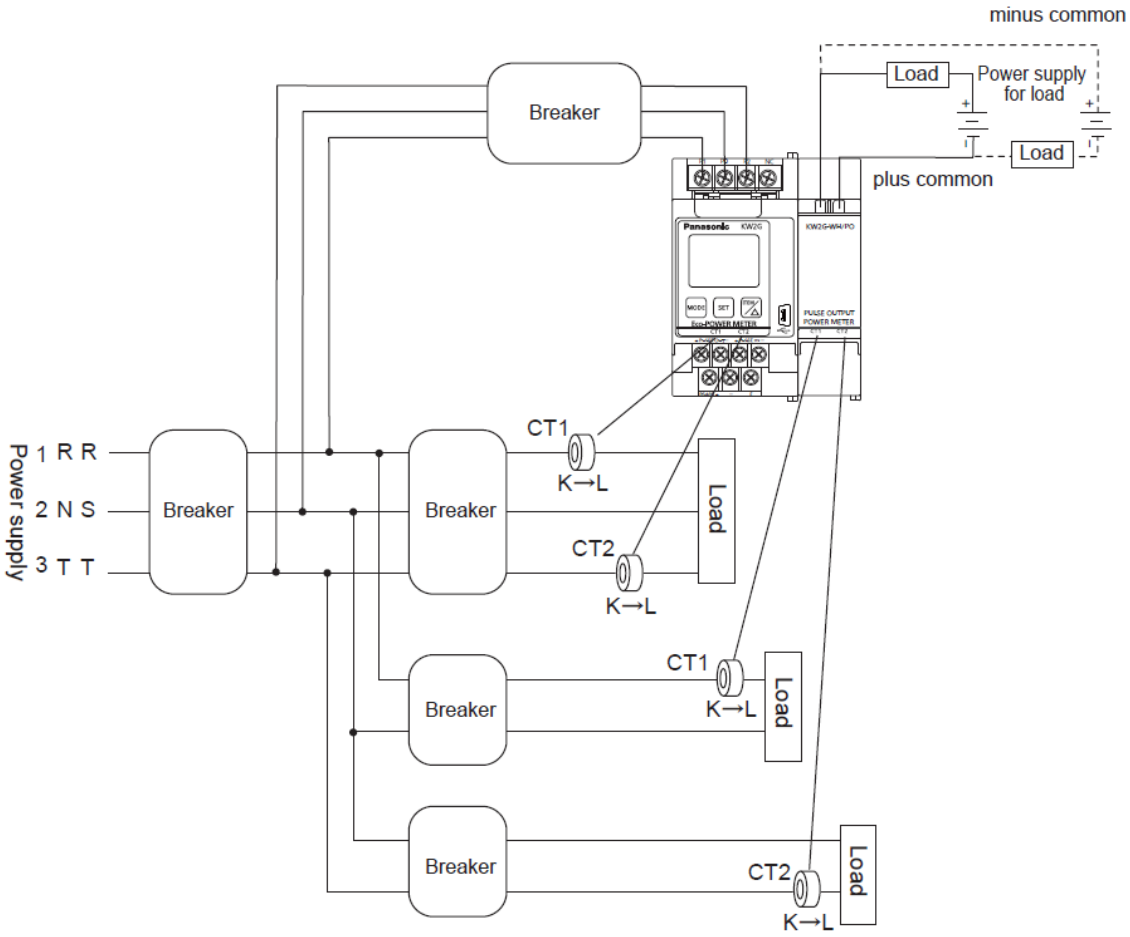
Use VT, its secondary side rating is 110V.

Even if the secondary side voltages of VT are same, when the power source system is different, one main unit is necessary for each power source system.

Single-phase three-wire system and Single-phase two-wire system

Three-phase three-wire system and Single-phase two-wire system

◆When measuring a load with rated input voltage



Note)

(1) When wiring CT, wire correctly according to this, K for power supply side and L for load side.

(2) If load to measure works with single-phase 2 wire 100V system, wire CT1 to R-phase and CT2 to T-phase. It doen't measure correctly if it wires wrong.

(3) Using CTs for one unit should be same.

◆When measuring a load with exceed input voltage.

Voltage transformer (VT) is needed when you measure a load with over rated input voltage.

Use VT, its secondary side rating is 110V.

Even if the secondary side voltages of VT are same, when the power source system is different, one main unit is necessary for each power source system.

3.5 How to attach the Current Transformer (CT)

・One CT is needed for 1 unit when measuring 1P2W (2 CTs for 2-circuit). Two CTs are needed when measuring 1P3W/3P3W. Using all CTs for one unit should be the same.
・Check beforehand that the thickness of the electric wire is smaller than the through-hole of the CT.
・When connecting CT, connect the secondary side to the terminal of the main unit first, and after that wire the primary side to a load electric wire. Incorrect order might cause an electric shock or break CT.
・The CT has polarity. Wire correctly according to the K and L marks. **Wrong direction can't measure correctly.**
・When closing CT, check that there is no foreign materials on the divided face. And make sure it is closed securely once the wire is in place; **if not the measurement value will be not accurate.**
・When CT's cable is extended, it is possible to extend up to about 10m with the cable of AWG#22 or more cross section under the environment without noise at all. Please use the thick cable as much as possible.
・If there is some distortion by harmonic or waveform, it may not measure correctly.
・Separate the wiring (strong electric part) of the measured voltage input terminal (operating power supply terminal) from the CT cable. It may not satisfy the accuracy due to noise.

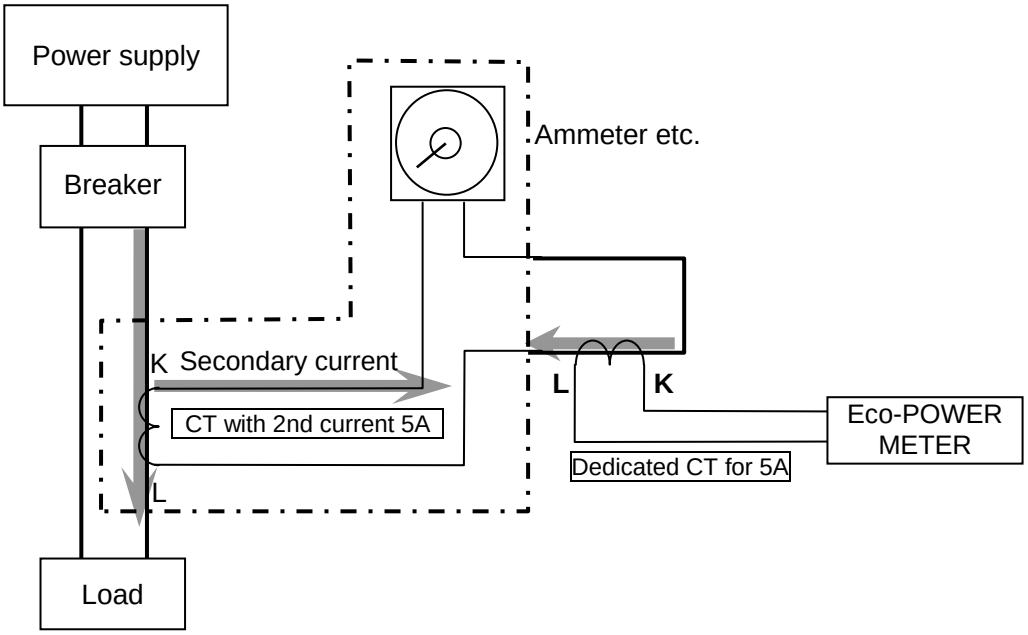
◆To connect CT with secondary side current 5A

How to set for measuring by combination with CT (secondary side current 5A)

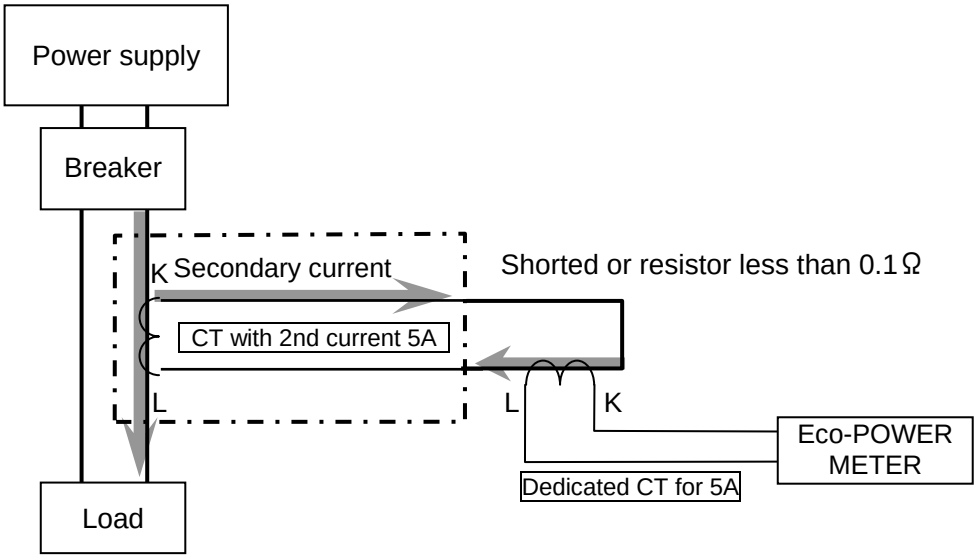
(1) Select 5A at CT type setting mode (CT-T).
(2) Set the primary current of measured CT (secondary side current 5A) at primary side current of CT setting mode (CT-1).
<ex> If the measured CT is 400A/5A, set to '400'.
(3) Clamp the dedicated CT for 5A (AKW4801C), which is connected to the main unit first, to secondary side of the CT (secondary side current 5A). CT direction (K→L) should be set for the commercial CT direction.

***Set the CT (secondary side current 5A) and the dedicated CT for 5A approximately 1m apart. If the two CTs are set too close each other, it may not measure accurately due to magnetic field interference.**

(Connection example)
With Ammeter etc.



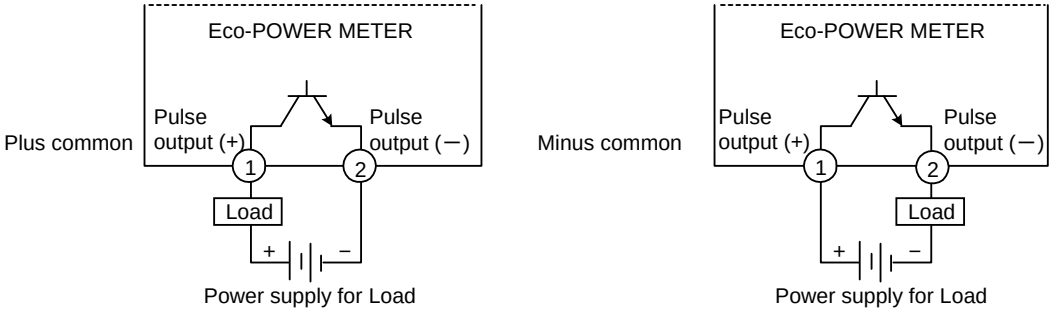
Without Ammeter



3.6 For Output connection

●Transistor output

・Since the transistor output is insulated from the internal circuit by a photo-coupler, it can be used both as a plus common and minus common.



・Wire up to 100m for output connection.

Chapter 4 Settings

4.1 Setting for KW2G Expansion unit (Power measurement and Pulse output)

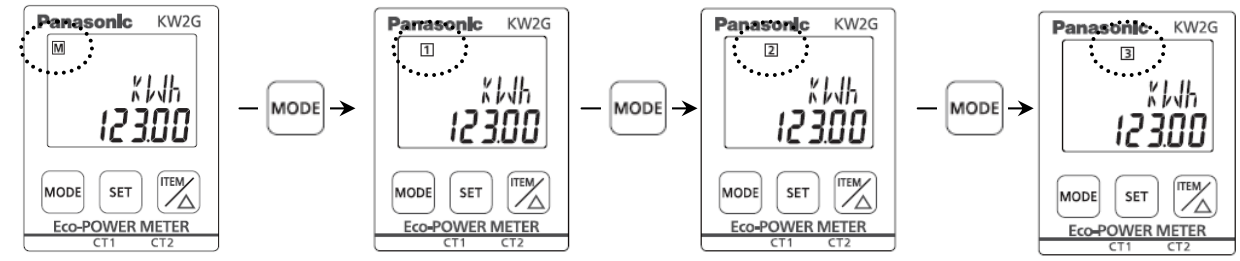
When power on, M and connected expansion unit number turn on the display of main unit. After that, it displays the monitor display (measuring value).

【Basic setting to measure】
When wiring Eco-POWER METER and CT and setting mode 1 after power on, Eco-POWER Meter can measure the electric power.

Mode 1: Mode for setting about power measurement
Mode 4: Mode for setting about optional function

【Unit change】
Before setting, press <MODE> to shift display of main unit (M) and expansion units (1 to 7) to set.

Main unit M Lighting Expansion unit 1 2 3 to 7 Lighting



◆Initial value list (Expansion unit (Power measurement and Pulse output))

Mode 1	
Item	Initial value
Phase/Wire system	1P2W
CT type	50
Primary side current of CT	5
VT ★	1.00
Shift average frequency	8
Simple measuring	OFF
Cutoff current	0.1
Unit for pulse output	0.001
Pulse output width	100
Power alarm	9999.99
Current alarm	100.0
Stand-by alarm 1	100.00
Stand-by alarm 2	0
General-purpose output	PL-L
General-purpose output ON-time	0.1
General-purpose output OFF-time	0.1

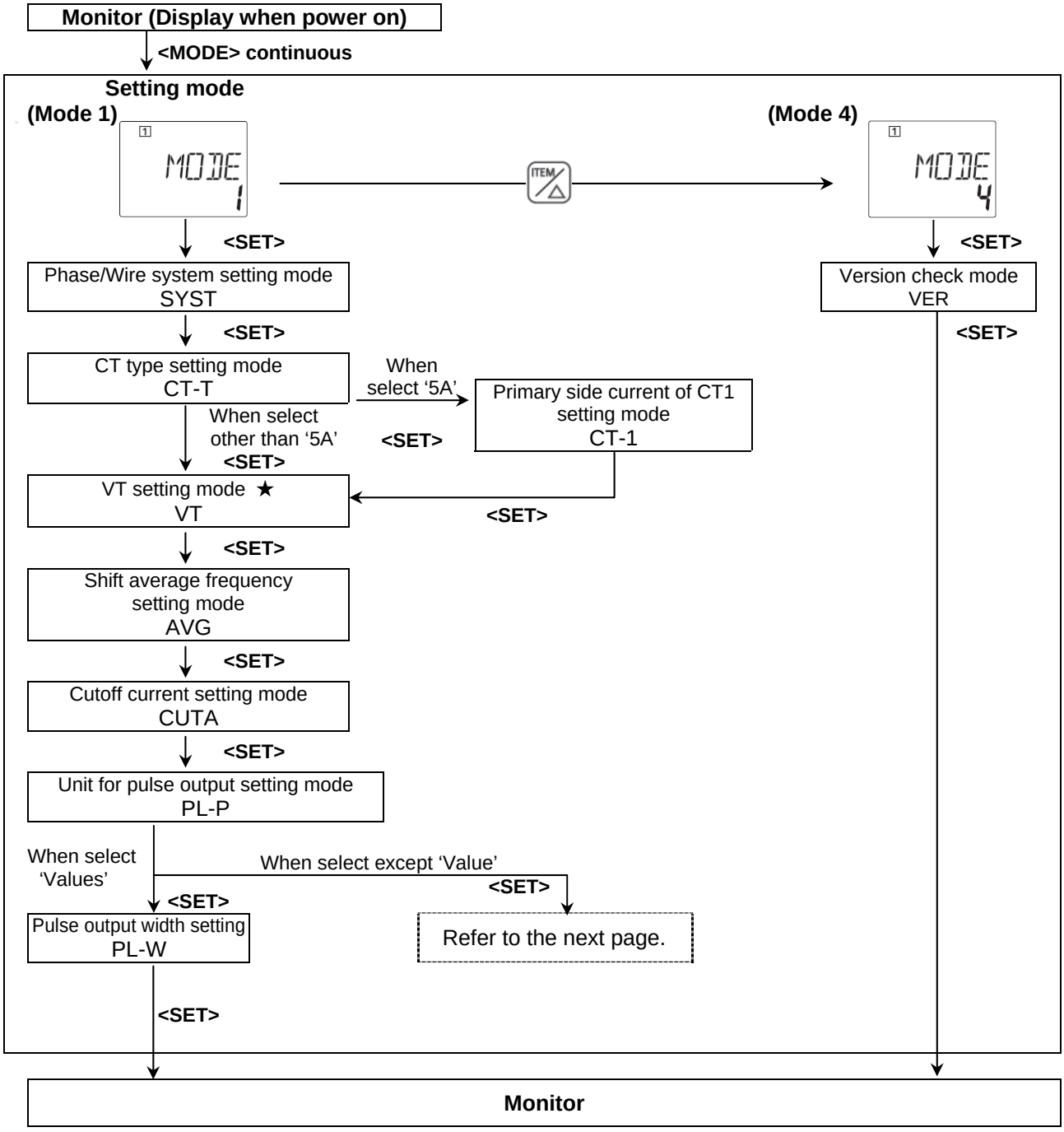
★This setting is common to the main unit and all expansion units.

Setting flow chart for Expansion unit (Power measurement and Pulse output)

Mode 1…Mode for setting each parameter for power measurement

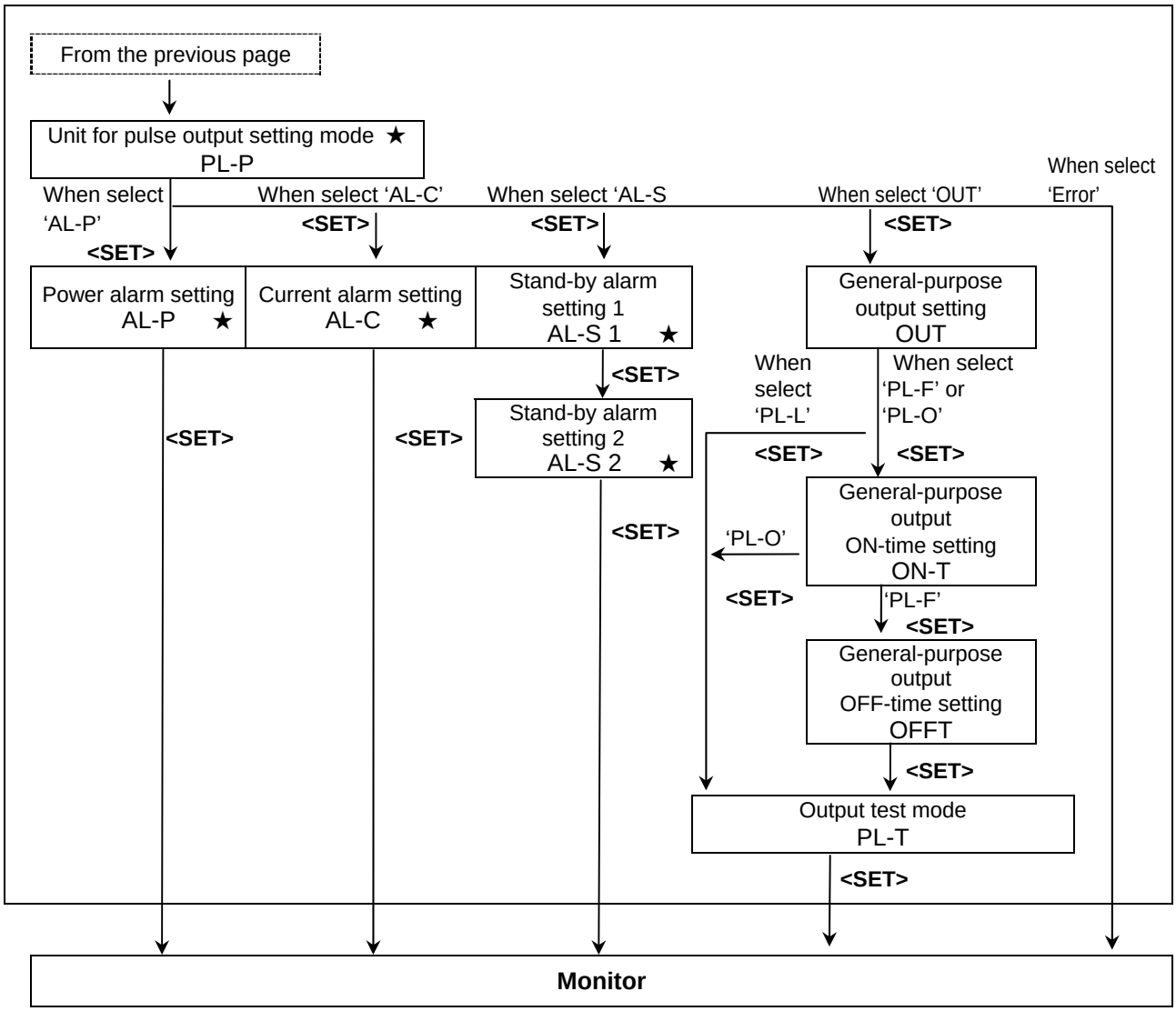
The mode with ★ mark is common to main unit and all expansion units.

Mode 4…Version check mode You can check the version of each unit.



Press <MODE> to return Monitor.

●When select except 'Value' on Unit for pulse output setting mode



Press <MODE> to return Monitor.

4.2 Setting Mode Explanation for Expansion unit

■The value with under line '__' is initial setting among each setting value. ☆Set before measurement.

4.2.1 MODE 1

(Mode for setting each parameter for power measurement.)

Phase/Wire system setting mode SYST

Mode defines phase and wire system to measure.

・Select from Single-phase 2-wire / Single-phase 3-wire / Three-phase 3-wire.
Select the system of the measured load.

*When the system is not matched with the measure system, it doesn't measure correctly.

CT type setting mode CT-T

Mode defines input current type of the dedicated CT.

・Select from the type of 5A/50A/100A/250A/400A.
・When the secondary current of CT is 5A, select '5A'.

Primary side current of CT setting mode CT-1

*Only when '5A' is selected on CT type setting mode.

Mode defines primary side current when measuring by combination with another CT, its secondary current of 5A.

It is possible to use as the second step for combination with another CT by selecting '5A' in the CT type setting mode. In this case, it is necessary to set the primary side current.

・Primary side current of the measured CT can be set the range of 1 to 4000 (Initial 5).
・When connecting 5A CT directly and measure with 5A range, set to '5'.
ex) If primary current of measured CT is 400A (secondary side is 5A), set to '400'.

VT setting mode VT

Mode defines voltage input method to the main unit, input voltage directly or uses a voltage transformer (VT) (over 440V system).

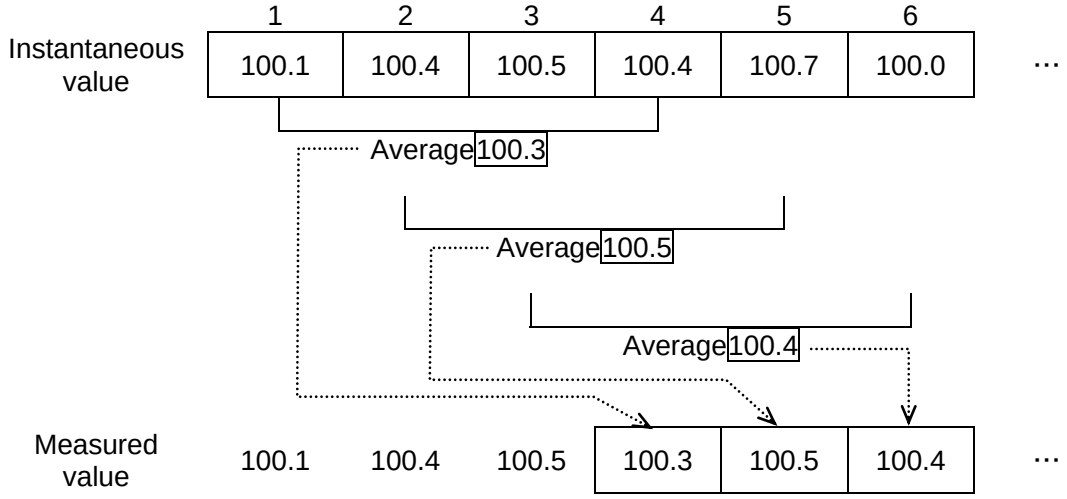
・It can be set the range of 1.00 to 99.99.
'1.00' should be set when voltage input directly without connecting VT.
'1.01 to 99.99' should be set when VT is used to input voltage.

Shift average frequency setting mode AVG

Mode defines shift average frequency for instantaneous value.

When unevenness of the measurement value is large, you can suppress the unevenness by setting bigger average frequency.
In order to measure in detail including unevenness, select '0'.

・Select from 0 / 2 / 4 / 8 / 16.
Setting of the shift average frequency reflects to electric power, current and voltage.
Ex.: When selecting '4'



Cutoff current setting mode (※) CUTA

Mode defines load current that does not measure (Cutoff current).
Use to avoid miss-measurement by wiring or induction noise at no-load.
0.00kW is displayed for instantaneous electric power, 0.0A is displayed for current. Integrated electric power is not added.

・It can be set the range of 0.1 to 50.0%.
ex) When set to 10.0, current (=power) under 10.0%F.S is not added.

Unit for pulse output setting mode PL-P

Mode defines unit used for pulse output. It defines the unit of integrated electric power for 1-pulse output.

・Select from 0.001/0.01/0.1/1/10/100kWh /AL-P/AL-C/AL-S/OUT/Error.
When one of the '0.001/0.01/0.1/1/10/100' [kWh] is set, one pulse is output at reaching the setting value.When 'AL-P(Power alarm)' is set, alarm is output at the time when instantaneous electric power is over the setting value. When 'AL-C(Current alarm)' is set, alarm is output at the time when current is over the setting value. When 'AL-S(Stand-by alarm)' is set, alarm is output at the time when current is under the setting value and it passes the setting time. When 'OUT(General-purpose output)' is set, it controls the output via communication.
When 'Error (Error alarm)' is set, alarm is output When SD memory card writing error, battery shortage, communication error between main unit and expansion unit.
* The min. pulse output cycle is 25ms in order to work correctly and output 1 to 10ms pulse output. Therefore the pulse output unit should be set as that it output 40 pulses or less in 1 second.

Pulse output width setting mode PL-W

*Only when electric power value is selected on unit for pulse output setting mode.

Mode defines pulse output width. It defines the width for 1 pulse.

・It is set the range of 1 to 100ms.

Power alarm setting mode AL-P

*Only when 'AL-P' is selected on unit for pulse output setting mode.

Mode defines instantaneous electric power used for alarm output.

・It is set the range of 0.00 to 9999.99kW.

Current alarm setting mode AL-C

*Only when 'AL-C' is selected on unit for pulse output setting mode.

Mode defines the ratio of current used for alarm output. (Ratio for the rated current)

・It is set the range of 0.1 to 100.0%.

Stand-by alarm setting mode 1 AL-S1

*Only when 'AL-S' is selected on unit for pulse output setting mode.

Mode defines the ratio of current used for threshold value to judge stand-by power. (Ratio for the rated current)

・It is set the range of 0.1 to 100.0%.

Stand-by alarm setting mode 2 AL-S2

*Only when 'AL-S' is selected on unit for pulse output setting mode.

Mode defines the time used for threshold value to judge stand-by power.

・It is set the range of 0 to 9999min.
When '0' is set, alarm is always output at the time when judging the stand-by power.
When '1 to 9999' is set, alarm is output at the time when passing the setting time with the stand-by power.
The alarm can be reset by pressing <SET> with the instantaneous electric power display. After reset the alarm, start to monitor the stand-by power again.

General-purpose output setting mode OUT

Mode defines a type of General-purpose output.

・Select from PL-L/ PL-F/ PL-O.

'PL-L (Level output)' When the designated data register is 1(ON), it output.

'PL-F (Repeat cycle output)' When the designated data register is 1(ON), it repeats on and off according to the setting.

'PL-O (One-shot output)' When the designated data register is 1(ON), it output one time and after passing the setting time, it turns off the output.

*It doesn't work with the on-time and off-time set to under 0.1s.

Output ON-time setting mode ON-T

*Only when 'PL-F' or 'PL-O' is selected on general-purpose output setting mode.

Mode defines ON-time of output for 'PL-F' and 'PL-O'.

・It is set the range of 0.1 to 10.0 sec.

Output OFF-time setting mode OFFT

*Only when 'PL-F' is selected on general-purpose output setting mode.

Mode defines OFF-time of output for 'PL-F'.

・It is set the range of 0.1 to 10.0 sec.

General-purpose output test mode PL-T

It tests the general-purpose output.

・Select from OFF/ON.

'ON' ; It can test whether it output correctly or not.

'OFF'; It doesn't test the output.

*Note that it will output when select 'ON' with <ITEM/△>.

Mode1 Setting flow chart

Monitor

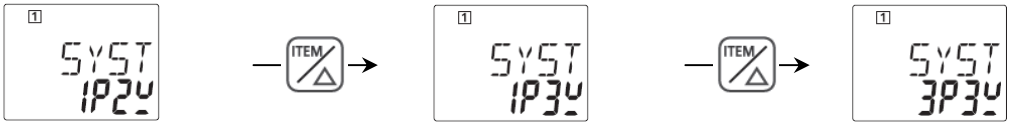
⬇ <MODE> continuous press

MODE 1 Lighting

⬇ <SET>

Phase/Wire system setting mode

Press <ITEM/△> to change Single-phase 2-wire ⇒ Single-phase 3-wire ⇒ Three-phase 3-wire.

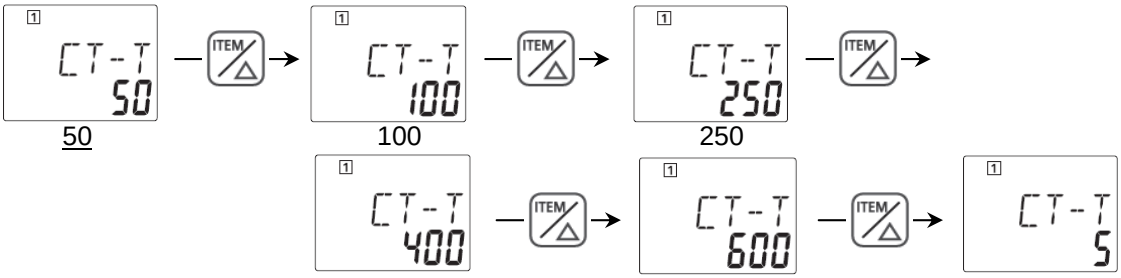


1P2W 1P3W 3P3W

⬇ <SET>

CT type setting mode

Press <ITEM/△> to change 50 ⇒ 100 ⇒ 250 ⇒ 400 ⇒ 600 ⇒ 5.

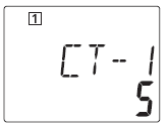


50 100 250 400 600 5

⬇ <SET>

Primary side current of CT setting mode *It is only when '5A' is selected on CT type setting mode.

Set primary side current of CT using <ITEM/△>, <SET>+<ITEM/△>.
If measured CT is 100A/5A, set to 100. If 5A is measured, set to 5.



(1 to 4000, initial: 5)

ITEM	Increase
SET + ITEM	Decrease

⬇ <SET>

VT setting mode

Set VT ratio using <ITEM/△>,<SET>+<ITEM/△>.
If the VT is 440/110, set to '4.00'.

(1.00 to 99.99)

ITEM	Increase
SET + ITEM	Decrease

⬇ <SET>

Shift average frequency setting mode

Press <ITEM/△> to change 8 ⇒ 16 ⇒ 0 ⇒ 2 ⇒ 4.

8 16 0 2 4

⬇ <SET>

Cutoff current setting mode

Set cutoff current ratio using <ITEM/△>,<SET>+<ITEM/△>.
If you don't measure the current under 10.0%F.S, set to '10.0'.

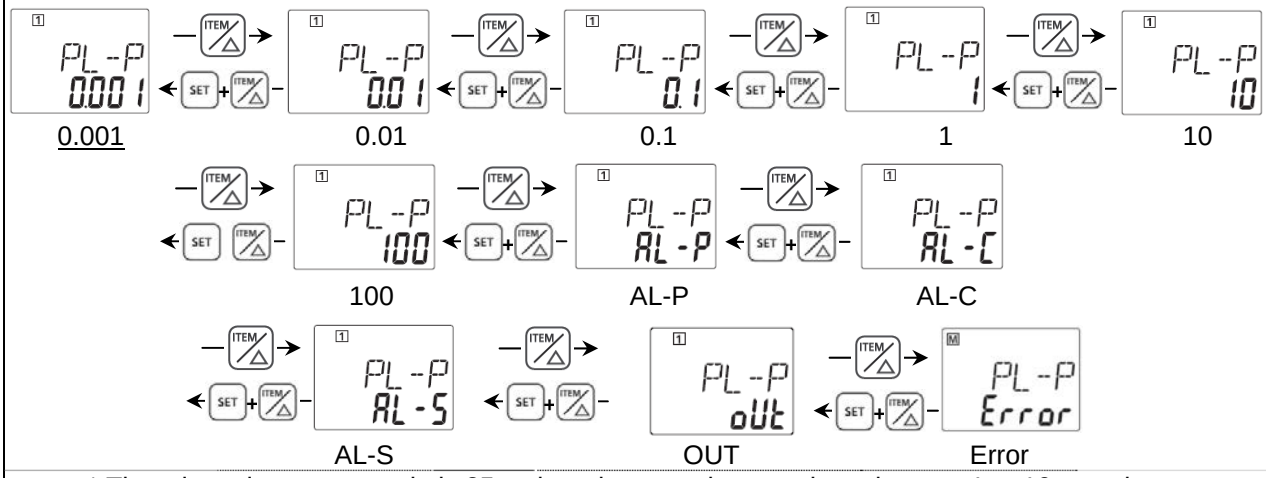
(0.1 to 50.0)

ITEM	Increase
SET + ITEM	Decrease

⬇ **<SET>**

Unit for pulse output setting mode

Press <ITEM/△>,<SET>+<ITEM/△> to change 0.001 ⇔ 0.01⇔ 0.1⇔ 1 ⇔ 10 ⇔ 100 ⇔
AL-P(Power alarm)⇔ AL-C(Current alarm)⇔ AL-S(Stand-by alarm)⇔
OUT(General-purpose output) ⇔ Error(Error alarm).

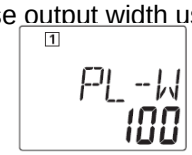


* The min. pulse output cycle is 25ms in order to work correctly and output 1 to 10ms pulse output.
Therefore the pulse output unit should be set as that it output 40 pulses or less in 1 second.

⬇ **<SET>**

Pulse output width setting mode *It is only when 'electric power value' is selected on unit for pulse output setting mode.

Set pulse output width using <ITEM/△>, <SET>+<ITEM/△>.



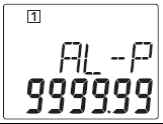
(1 to 100)

ITEM	Increase
SET + ITEM	Decrease

⬇ **<SET>**

Power alarm setting mode *It is only when 'AL-P' is selected on unit for pulse output setting mode.

Set power for alarm using <ITEM/△>,<SET>+<ITEM/△>.



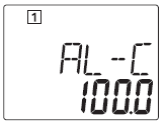
(0.00 to 9999.99)

ITEM	Increase
SET + ITEM	Decrease

⬇ **<SET>**

Current alarm setting mode *It is only when 'AL-C' is selected on unit for pulse output setting mode.

Set current ratio (for the rated current) for alarm using <ITEM/△>,<SET>+<ITEM/△>.



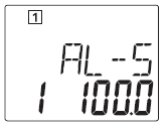
(0.1 to 100.0)

ITEM	Increase
SET + ITEM	Decrease

⬇ **<SET>**

Stand-by alarm setting mode 1 *It is only when 'AL-S' is selected on unit for pulse output setting mode.

Set a ratio (for the rated current) of current used for threshold value to judge stand-by power using <ITEM/△>,<SET>+<ITEM/△>.



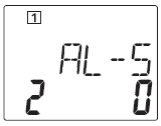
(0.1 to 100.0)

ITEM/△	Increase
SET + ITEM/△	Decrease

↓ **<SET>**

Stand-by alarm setting mode 2 *It is only when 'AL-S' is selected on unit for pulse output setting mode.

Set a time used for threshold value to judge stand-by power using <ITEM/△>,<SET>+<ITEM/△>.



(0 to 9999 min.)

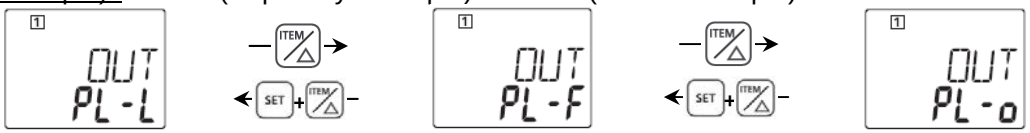
ITEM/△	Increase
SET + ITEM/△	Decrease

'0': Alarm is always output at the time when judging the stand-by power.
'1 to 9999': Alarm is output at the time when passing the setting time with the stand-by power. The alarm can be reset by pressing <SET> **with the instantaneous electric power display**. After reset the alarm, start to monitor the stand-by power again.

↓ **<SET>**

General-purpose output setting mode *It is only when 'OUT' is selected on unit for pulse output setting mode.

Press <ITEM/△>,<SET>+<ITEM/△> to change
PL-L(Level ouput) ⇔ PL-F(Repeat cycle output) ⇔ PL-O(One-shot output)

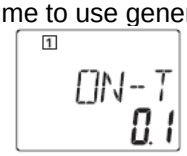


PL-L PL-F PL-O

↓ **<SET>**

Output ON-time setting mode (※) *It is only when 'PL-F' or 'PL-O' is selected on general-purpose output setting mode.

Set ON-time to use general-purpose output using <ITEM/△>, <SET>+<ITEM/△>.



(0.1 to 10.0sec)

ITEM/△	Increase
SET + ITEM/△	Decrease

↓ **<SET>**

Output OFF-time setting mode (※) *It is only when 'PL-F' is selected on general-purpose output setting mode.

Set OFF-time to use general-purpose output using <ITEM/△>, <SET>+<ITEM/△>.

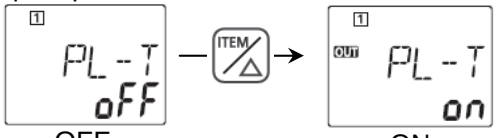
(0.1 to 10.0sec)

ITEM/△	Increase
SET + ITEM/△	Decrease

↓ **<SET>**

General-purpose output test mode (※)

Press <ITEM/△> to change OFF ⇔ ON.
Select 'ON' in order to test the output operation.



OFF ON

↓ **<SET>**

Monitor

4.2.2 Mode 4

(Mode for setting of each parameter for optional function)

Version check mode	**VER**

Mode to check version of the software.

It displays version of the software.

Mode 4 Setting flow chart

Monitor

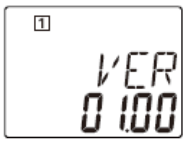
↓ **<MODE> continuous press**

MODE 2 Lighting

↓ **<ITEM/△> 1 time**

MODE 4 Lighting

↓ **<SET>**

Version check mode
It displays the version of software. 

↓ **<SET>**

Monitor

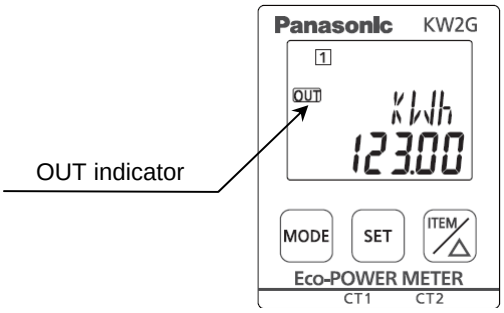
Chapter 5 Various Functions

5.1 Pulse output function

Refer to the mode 1 setting for the way to set.

'OUT' is lighting when pulse output.

When selected unit output a pulse, 'OUT' is lighting.
If you change the unit that does not output, it turns off 'OUT'.



5.1.1 Output depends on integrated electric power

Set the unit for pulse output (0.001/0.01/0.1/1/10/100kWh) and pulse output (transistor output) turns on every time when integrated electric power reaches the unit. (Pulse width: set with setting mode)

5.1.2 Instantaneous electric power alarm

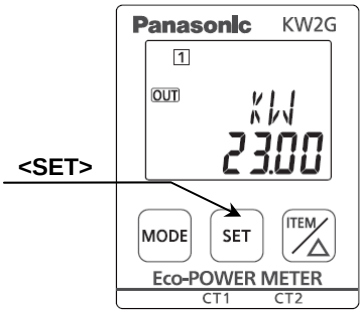
When it exceeds the setting instantaneous electric power, pulse output (transistor output) turns on in order to notice. When it falls below, the output turns off.

5.1.3 Current alarm

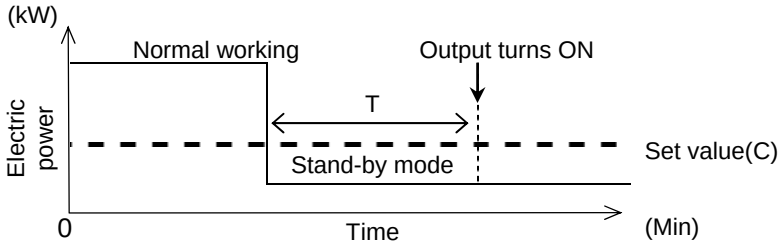
When it exceeds the setting current ratio, pulse output (transistor output) turns on in order to notice. When it falls below, the output turns off.

5.1.4 Stand-by power alarm

When it detects stand-by power (current) of the measured load, pulse output (transistor output) turns on in order to notice.
Set current (C) and stand-by time (T) to judge stand-by power.
When the measured load is satisfied the setting conditions, pulse output (transistor output) turns on in order to notice.
When it exceeds the setting value, it turns off and reset it.
You can reset the alarm by pressing <SET> with the instantaneous electric power display.



(Working flow chart)



5.1.5 General purpose output

It is possible to output via communication with setting output pattern.
Refer to 5.4 General purpose output function in detail.

5.1.6 Error alarm

When one of the errors that battery shortage, SD memory card writing error, communication error between main unit and expansion unit, pulse output (transistor output) turns on in order to notice.

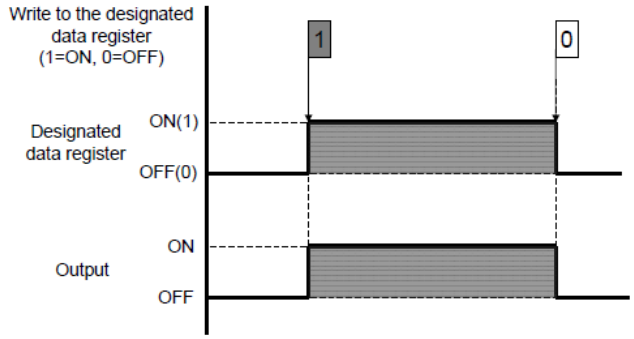
5.2 General-purpose output function

Using this general-purpose output function, it turns on or off the output by writing 0 (OFF) or 1(ON) to the designated data register via communication. When it turns on, data register is started with 0 (OFF).
*It doesn't work with the on-time and off-time set to under 0.1s.

●Operation mode

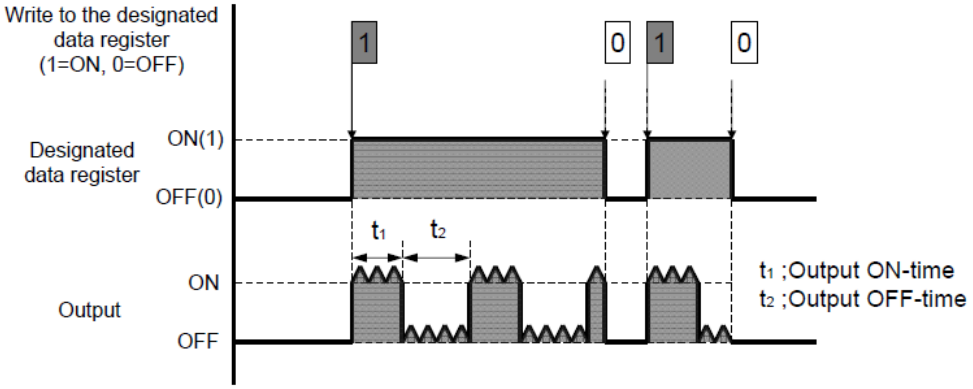
・Level output

When the designated data register is 1(ON), it turns on the output.
When the designated data register is 0(OFF), it turns off the output.



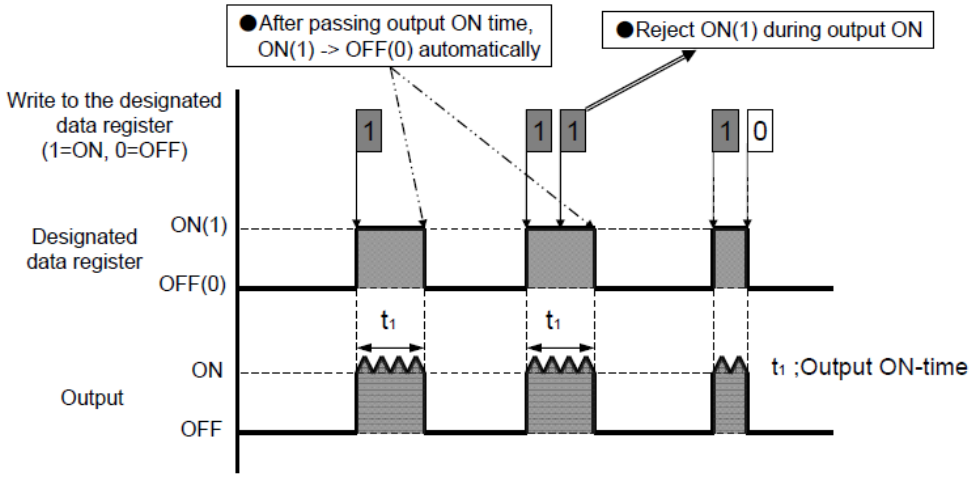
・Repeat cycle output

When the designated data register is 1(ON), it starts a repeat cycle operation.
During a repeat cycle operation, it repeats on and off according to the setting output ON-time (t1) and output OFF-time (t2).



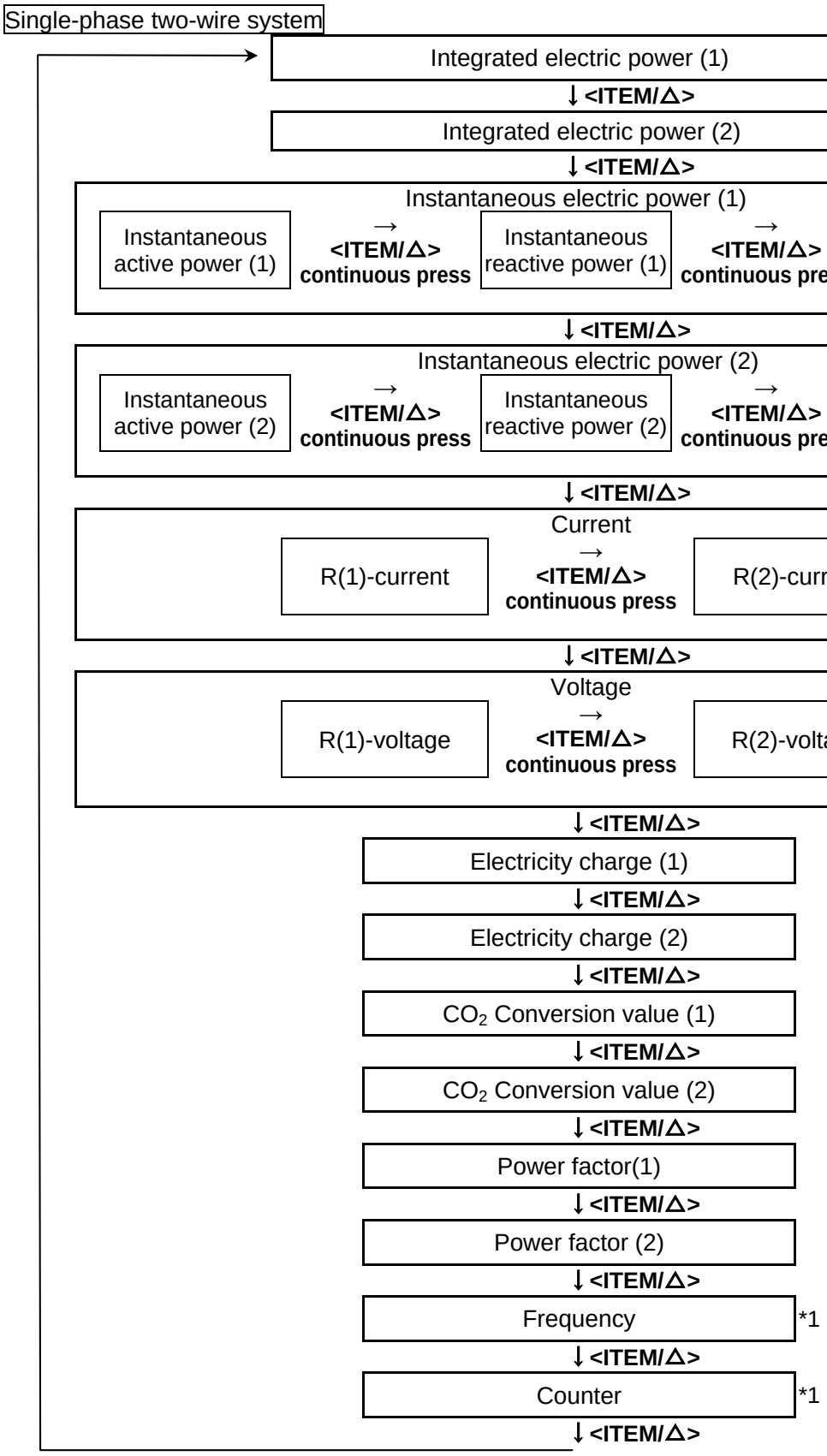
・One-shot output

When the designated data register is 1(ON), it turns on the output.
After passing the setting output ON-time (t1), the data register will be 0 (OFF) and it will turn off the output. Even if it writes 1(ON) before passing the setting output ON-time, it rejects the writing. (It doesn't reset the setting ON-time.)



Chapter 6 Display of each Value

6.1 Working of Monitor Display

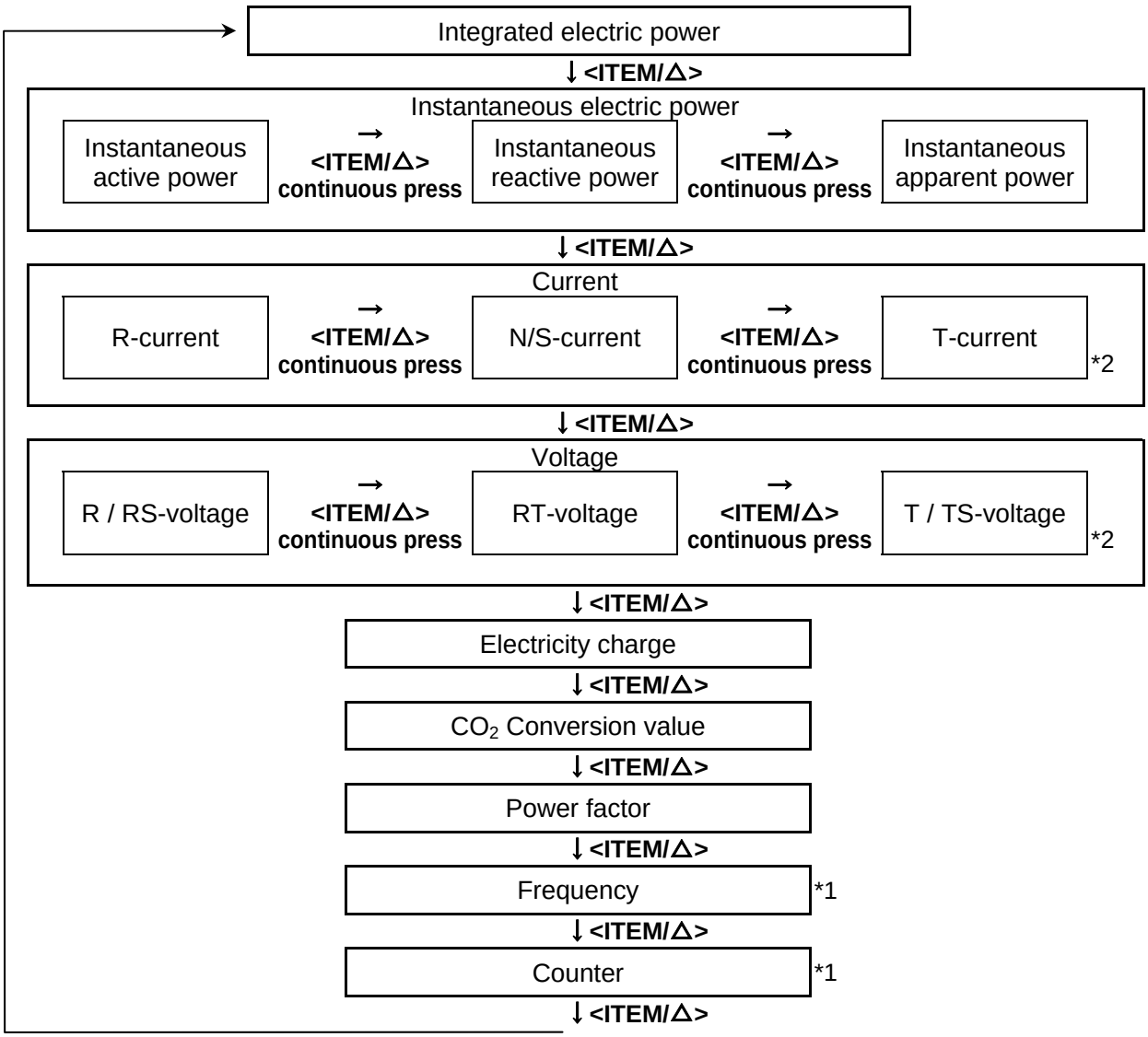


Displayed item is shifted to the other direction by pressing <ITEM/△> during pressing <SET>.
*1 Display of frequency and counter is common to all units.

(1), (2) of each item means as below.

Integrated electric power (1)	Integrated electric power calculated by voltage between P1-P0 and detected current by CT1
Integrated electric power (2)	Integrated electric power calculated by voltage between P2-P0 and detected current by CT2
Instantaneous electric power (1)	Instantaneous electric power from voltage between P1 - P0 and detected current by CT1
Instantaneous electric power (2)	Instantaneous electric power from voltage between P2 - P0 and detected current by CT2
R(1)-current	Detected current by CT1
R(2)-current	Detected current by CT2
R(1)-voltage	Voltage between P1 and P0
R(2)-voltage	Voltage between P2 and P0
Electricity charge (1)	Electricity charge for integrated electric power(1)
Electricity charge (2)	Electricity charge for integrated electric power(2)
CO_2 Conversion value (1)	CO_2 Conversion value for integrated electric power(1)
CO_2 Conversion value (2)	CO_2 Conversion value for integrated electric power(2)
Power factor (1)	Power factor of Instantaneous electric power(1)
Power factor (2)	Power factor of Instantaneous electric power(2)

Single-phase three-wire system/Three-phase three-wire system



Displayed item is shifted to the other direction by pressing <ITEM/△> during pressing <SET>.

*1 Display of frequency and counter is common to all units.
*2 Display is changed according to the phase/wire system.

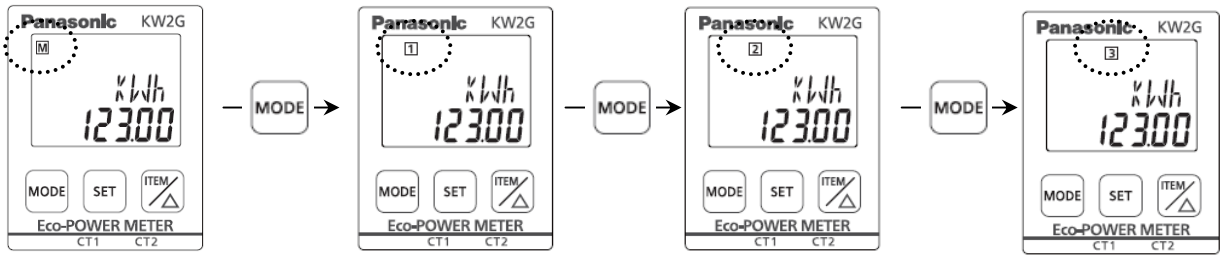
	Current	Voltage
Single-phase three-wire system	R-current, N-current, T-current	R-voltage, RT-voltage, T-voltage (P1-P0) (P1-P2) (P2-P0)
Three-phase three-wire system	R-current, S-current, T-current	RS-voltage, RT-voltage, TS-voltage (P1-P0) (P1-P2) (P2-P0)

6.2 Expansion unit display of each measurement value

【Unit change】

Press <MODE> to shift display of main unit (M) and expansion units (1 to 7).

Main unit [M] Lighting Expansion unit [1] [2] [3] to [7] Lighting



6.3 Display for power monitoring mode

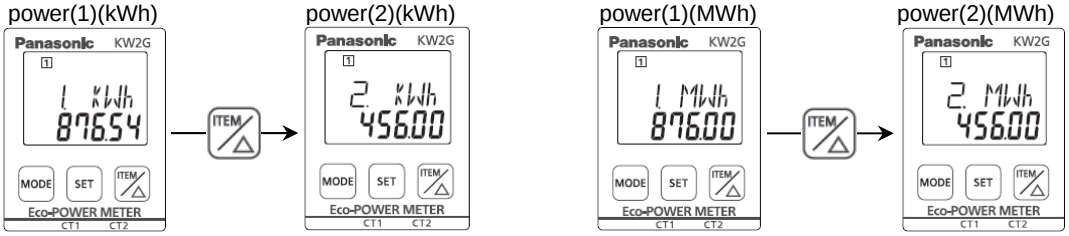
6.3.1 Integrated electric power

・It displays the integrated electric power.

Example of 1P2W

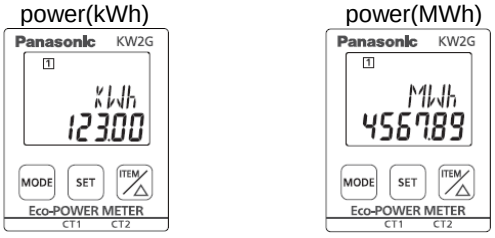
Integrated electric power (1)[1.kWh/1.MWh] is displayed first and press <ITEM/△> to display integrated electric power (2)[2.kWh/2.MWh].

integrated electric power(1)(kWh) integrated electric power(2)(kWh) integrated electric power(1)(MWh) integrated electric power(2)(MWh)



Example of 1P3W/3P3W

integrated electric power(kWh) integrated electric power(MWh)



・Integrated electric power is measured and displayed from 0.00kWh to 9999.99MWh.

・The decimal point is changed automatically.

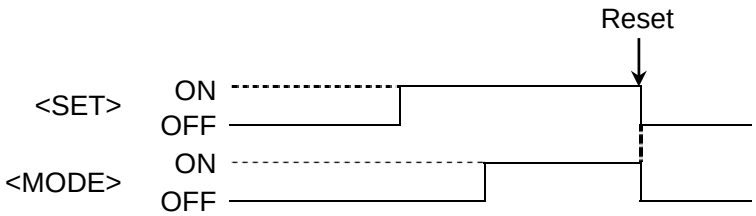
kWh kWh kWh kWh MWh MWh

0.00 → 10000.0 → 100000 → 999999 → 1000.00 → 9999.99

(After reaching the full scale (99999.9kWh), the value reverts to 0.00kWh but continues to measure.)

How to reset

・Hold down <SET> and press <MODE> makes integrated electric power clear.

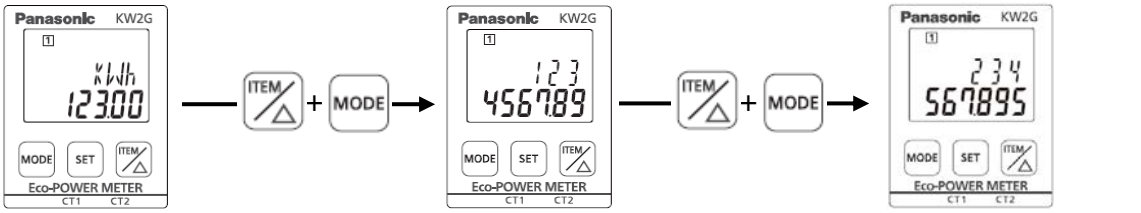


How to display with 9-digit

Integrated electric power can be displayed with 9-digit.

・Press <MODE> during pressing <ITEM/△> at integrated electric power display (kWh/MWh), it changes to integrated electric power with 9-digit (kWh) and to integrated electric power with 3-digit under decimal point (kWh).

Example of 6-digit (kWh)	Example of 9-digit (kWh) 2-digit under decimal point	Example of 9-digit (kWh) 3-digit under decimal point



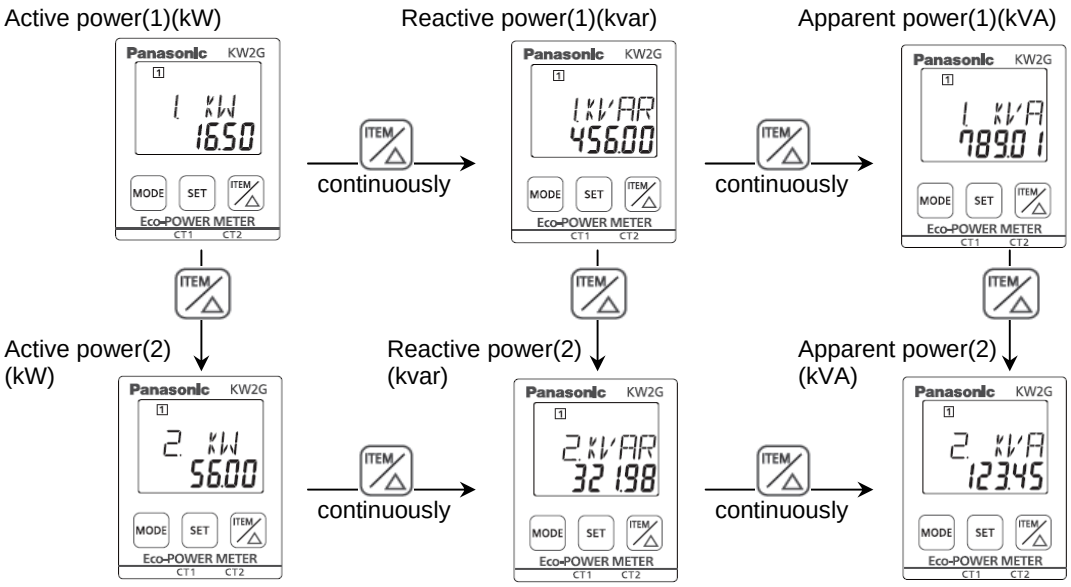
6.3.2 Instantaneous electric power

・It displays the instantaneous electric power.

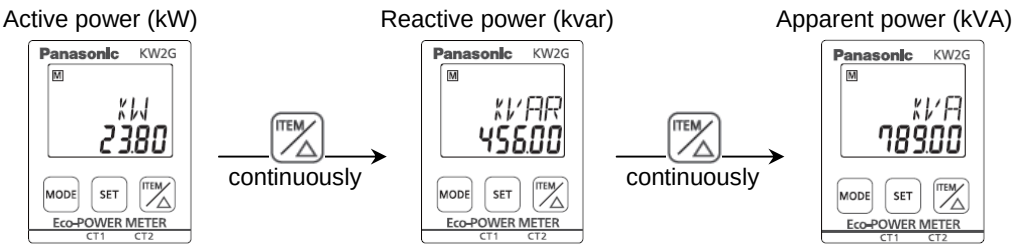
・Press <ITEM/△> continuously to shift display, instantaneous active power(kW), instantaneous reactive power (kvar) and instantaneous apparent power (kVA).

Example of 1P2W

Instantaneous active power (1)[1.kW] is displayed first and press <ITEM/△> to display instantaneous active power (2)[2.kW].



Example of 1P3W/3P3W



・It determines plus or minus of instantaneous reactive power by the input measuring voltage and the input measuring current. When harmonics or a wave pattern is warped, it may not determine correctly.

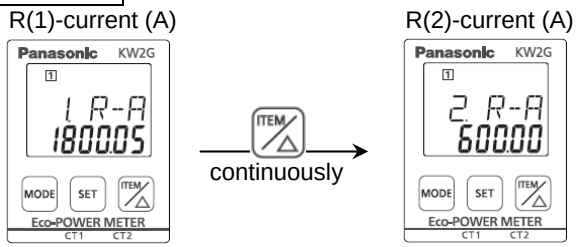
6.3.3 Current

・It displays the current value.

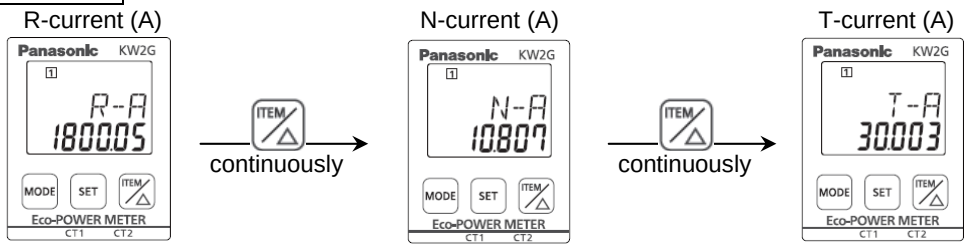
・Press <ITEM/△> continuously to shift the display.

*When the display is different from the measured load system, set to the correct system at the setting mode. (Refer to 4.2.1 Phase/wire setting mode.)

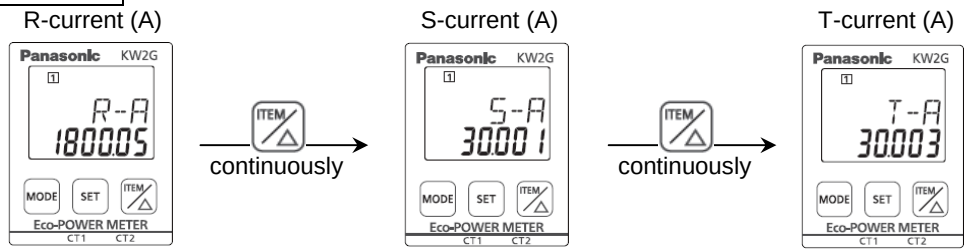
Example of 1P2W



Example of 1P3W



Example of 3P3W



・When input current exceeds 150%F.S. at each range,「 - - - - - - 」will be displayed.

・Current measurement parts

Eco-POWER METER measures the current as below.

Display / System	1.R-A / R-A	N-A / S-A	2.R-A / T-A
Single-phase two-wire system	R-current (1)	—	R-current (2)
Single-phase three-wire system	R-current	N-current	T-current
Three-phase three-wire system	R-current	S-current	T-current

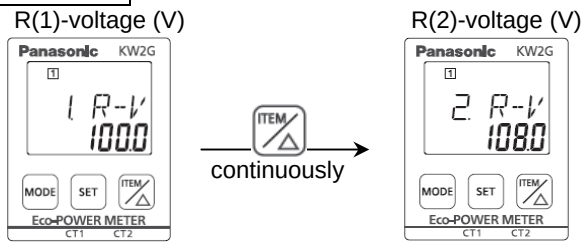
6.3.4 Voltage

・It displays the voltage value.

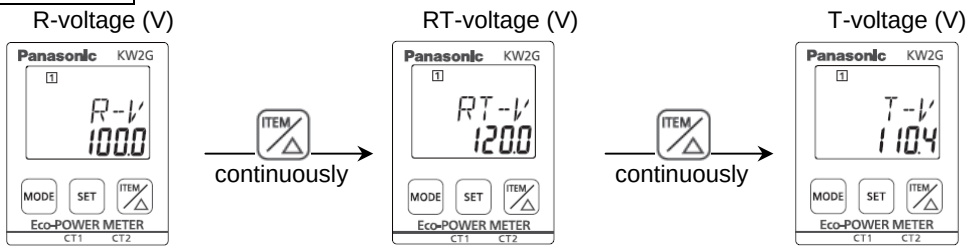
・Press <ITEM/△> continuously to shift the display.

*When the display is different from the measured load system, set to the correct system at the setting mode. (Refer to 4.2.1 Phase/wire setting mode.)

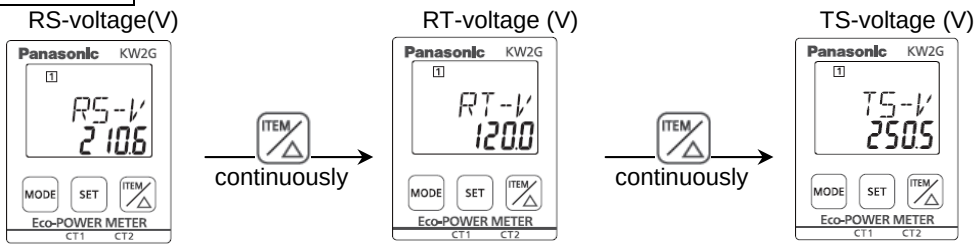
Example of 1P2W



Example of 1P3W



Example of 3P3W



・When input voltage is under 5% of rating, it displays '0.0' and doesn't measure.
('Under 5%' means the value getting from this calculation 'rated voltage 200 x 0.05 x VT ratio'.)

・When input voltage exceeds 150%F.S. at each range, 「- - - - - -」 will be displayed.

・Voltage measurement parts

Eco-POWER METER measures the voltage as below.

Display / System	1.R-V / R-V / RS-V	RT-V	2R-V / T-V / TS-V
Single-phase two-wire	R(1)-voltage (Between P1 and P0) (Line voltage)	—	R(2)-voltage (Between P2 and P0) (Line voltage)
Single-phase three-wire	R-voltage (Phase voltage)	RT-voltage (Between P1 and P2) (Line voltage)	T-voltage (Phase voltage)
Three-phase three-wire	RS-voltage (Between P1 and P0) (Line voltage)	RT-voltage (Between P1 and P2) (Line voltage)	TS-voltage (Between P2 and P0) (Line voltage)

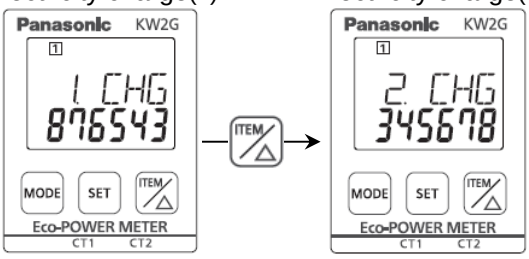
6.3.5 Electricity Charge

・It displays the standard electricity charge for the integrated electrical power.

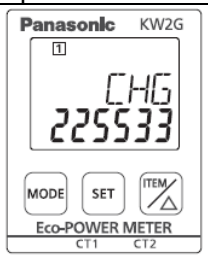
Example of 1P2W

Electricity charge(1)[1.CHG] is displayed first and press <ITEM/△> to display electricity charge(2)[2.CHG].

Electricity charge(1) Electricity charge(2)



Example of 1P3W/3P3W



・When the value exceeds '999999', 「- - - - - -」 will be displayed.

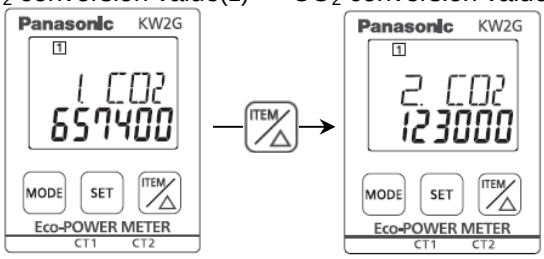
6.3.6 Carbon dioxide conversion value

・It displays the standard conversion value for the integrated electrical power.

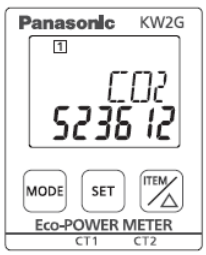
Example of 1P2W

CO_2 conversion value(1)[1.CO2] is displayed first and press <ITEM/△> to display CO_2 conversion value (2) [2.CO2].

CO_2 conversion value(1) CO_2 conversion value(2)



Example of 1P3W/3P3W



・When the value exceeds '999999', 「- - - - - -」 will be displayed.

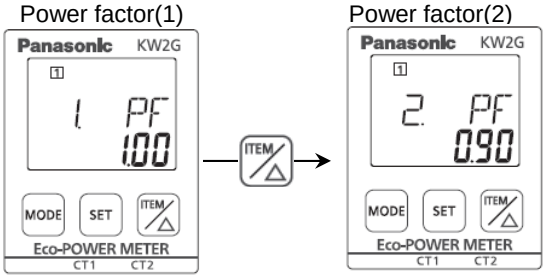
6.3.7 Power factor

・It displays power factor of the load.

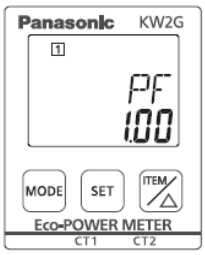
Example of 1P2W

Power factor (1)[1.PF] is displayed first and press <ITEM/△> to display power factor (2)[2.PF].

Power factor(1) Power factor(2)



Example of 1P3W/3P3W



・It displays minus value when it detects the regeneration electric power. (Ex.:-1.00)

・How to calculate power factor

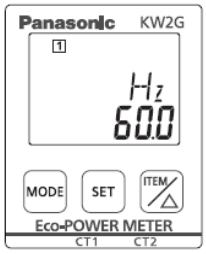
Eco-POWER METER displays power factor by calculating as below.

Single-phase two-wire	$PF = \frac{\text{Instantaneous electric power}}{\text{Voltage} \times \text{Current}}$
Single-phase three-wire	$PF = \frac{\text{Instantaneous electric power}}{2 \times \left(\text{Average of each phase V}\right) \times \left(\text{Average of each phase A}\right)}$
Three-phase three-wire	$PF = \frac{\text{Instantaneous electric power}}{\sqrt{3} \times \left(\text{Average of each phase V}\right) \times \left(\text{Average of each phase A}\right)}$

6.3.8 Frequency

・It displays the frequency of the voltage between P1 and P0.

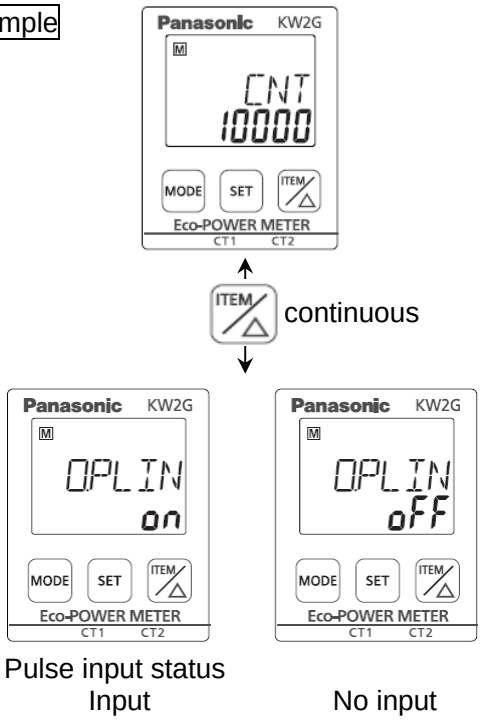
Example



6.3.9 Counter /Pulse input status

・It displays present count value (pulse input value of main unit).

Example

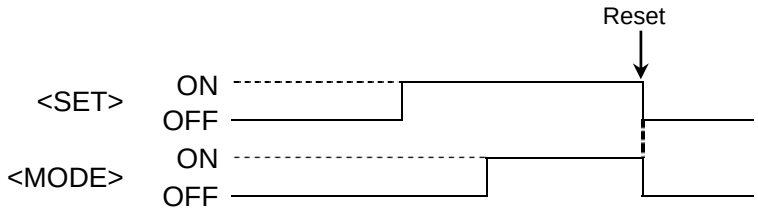


Pulse input status
Input

No input

How to Reset Count value

・At counter display, holding down <SET> and <MODE> continuously makes count value clear.



Chapter 7 Specifications

7.1 Expansion unit

Phase and wire system	Single-phase two-wire system, Single-phase three-wire system, (common) Three-phase three-wire system	
Rated operating voltage	100-240V AC (Apply to main unit)	
Rated frequency	50/60Hz common	
Rated power consumption	0.5VA/unit (240VAC at 25℃)	
Inrush current	Max. 30A (240VAC at 25℃)	
Allowable operating voltage range	85 to 264V AC (85 to 110% of rated operating voltage)	
Allowable momentary power-off time	10ms	
Ambient temperature	-10 to +50℃ (-25 to +70℃ at storage)	
Ambient humidity	30 to 85%RH (at 20℃) non-condensing	
Breakdown voltage(initial)	Between the isolated circuits: 1500V/1min Detective current: 10mA or less	A)Outer edge (enclosure)－All terminals B)Between insulated circuit ・Main unit all terminals － Expansion unit pulse output terminals *Voltage input terminals are not insulated CT input terminals.
Insulation resistance(initial)	Between the isolated circuits: 100MΩ or more (measured at 500V DC)	Same as the breakdown voltage.
Vibration resistance	16.7Hz total amplitude (double amplitude):4mm (1h on 3 axes) *1	
Shock resistance	DIN rail mounting: Min. 294m/s^2 (5 times on 3 axes)	
Connectable unit number	Max. 7 (for 1 main unit)	
Power failure Memory method	EEPROM (more than 100,000 overwrite) Memory items: Setting value, Measuring value	
Size	25×95×65 mm	
Mounting method	DIN rail mounting	
Weight	85g	

7.2 Measurement

●Electric power input (Expansion unit (Power measurement and Pulse output))

Phase and wire system		Single-phase two-wire system Single-phase three-wire system (common) Three-phase three-wire system
Measurement circuit		1-circuit (When measuring 1P2W: 2-circuit) (1-power source system)
Max. measurement circuit		8-circuit (When measuring 1P2W: 16-circuit) (One main unit ＋7 expansion units)
Input measurement Voltage *1	Rating	Single-phase two-wire system: 100-240V AC (Line voltage) Single-phase three-wire system: 100-120V AC (Phase voltage) Three-phase three-wire system: 100-240V AC (Line voltage)
	Allowable measurement voltage	85 to 110% of rated input voltage Single-phase two-wire system: 85-264V AC (Line voltage) Single-phase three-wire system: 85-132V AC (Phase voltage) Three-phase three-wire system: 85-264V AC (Line voltage)
	VT ratio	1.00 to 99.99 (Set with setting mode) ***Voltage transformer (VT) is required when you measure a load with voltage over 240VAC (Allowable measurement voltage).** ***Secondary voltage rating of VT is 110V.**
Input measurement Current	Rating	<Using the dedicated CT> ・5A/50A/100A/250A/400A/600A (Select with setting mode) <Using a commercial CT with the secondary side current 5A> ・1 to 4000A (Set with setting mode) ***Use CT with secondary side current of 5A when measure 600A or more.**
	Allowable measurement current	120% of rated input voltage
Special Functions	Cut-off current	0.1 to 50.0%F.S. (Set with setting mode)
Accuracy (without error in CT and VT)	・Integrated electric power ・Instantaneous electric power ・Electricity charge ・Conversion value	±(2.0% F.S.+1 digit) (at 20℃, rated input, rated frequency, power factor 1) ***Accuracy coverage: 10 to 100% of CT**
	Current	±(1.0% F.S.+1 digit) (at 20℃, rated input, rated frequency, power factor 1) ***Accuracy coverage: 10 to 100% of rated current**
	Voltage *1	±(1.0% F.S.+1 digit) (at 20℃, rated input, rated frequency, power factor 1)
	Temperature characteristics	±(1.0% F.S.+1 digit) (Range of -10 to 50℃, rated input, power factor 1)
	Frequency characteristics *1	±(1.0% F.S.+1 digit) (Frequency change±5% based on rated frequency for rated input, power factor 1)
Data update cycle		100ms

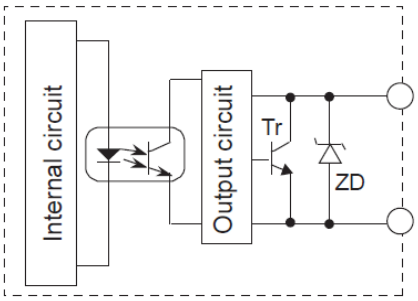
*1 Specifications for KW2G, KW2G-H Main unit

7.3 Output Specifications

●Pulse output (Transistor output)

Number of output point	1 point
Insulation method	Optical coupler
Output type	Open collector
Output capacity	100mA 30V DC
Pulse width (when pulse output with integrated electric power selected.)	1-100ms (Selectable with setting mode) *1
ON state voltage drop	1.5V or less
OFF state leakage current	100μA or less
Pulse output unit	0.001/0.01/0.1/1/10/100kWh/Power alarm(AL-P)/ Current alarm(AL-C) /Stand-by alarm (AL-S) General-purpose output (OUT) / Error alarm (Error) (Selectable with setting mode)
General-purpose output *2	Level output / Repeat cycle output / One-shot output (Selectable with setting mode)
Output ON-time, Output OFF-time	0.1 to 10.0s (Selectable with setting mode)

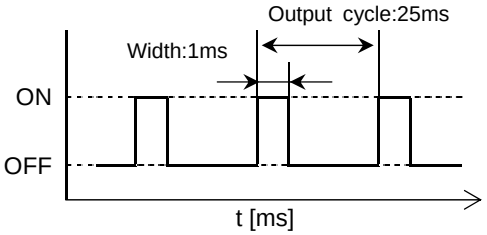
<Circuit diagram>



ZD:Zener diode for surge voltage absorb
Tr: NPN transistor

Note) Output circuit has no protection circuit for short.

*1 The max. pulse output cycle is 25ms in order to work correctly and output 1 to 10ms pulse output. Therefore the pulse output unit should be set as that it output 40 pulses or less in 1 second.



*2 In order to use the general-purpose output, it is necessary to set the output status ON or OFF via communications. In addition it doesn't work with the on-time and off-time set to under 0.1s.

How to calculate

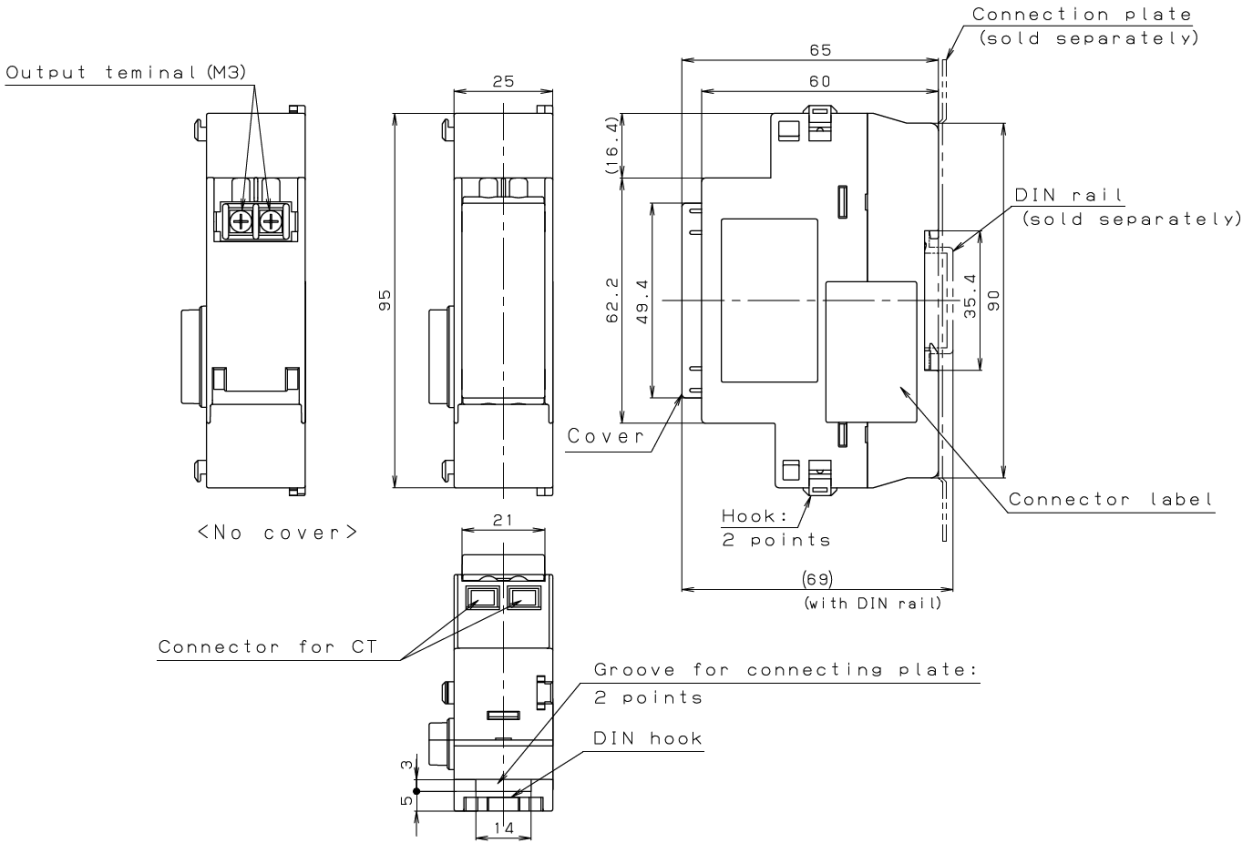
(Unit for pulse output: PL-P)＞(Max. measurement power [kW])／(3600[s] x 4 [pulse/s])
When pulse output unit is set to 0.001, the max measurement power is 144kWh,
= (3600[s]) x 40[pulse/s]) x 0.001.
When measuring the load exceed this, set the pulse output unit large one digit.

Note (1) Improper unit setting may cause miss counting.
(2) If the OFF-time is too short, there is a possibility of counting errors.

Chapter 8 Mounting

8.1 Dimensions

(Unit: mm)



Revision History

Issue Date	Manual no.	Content of revision
December, 2012	WUME-KW2GWH/PO-01	First edition
February, 2013	WUME-KW2GWH/PO-02	2nd edition firmware Ver.1.30 ［Add functions］ ・Integrated electric power display minimum unit 0.001kWh available ・General-purpose output function
August, 2013	WUME-KW2GWH/PO-03	3rd edition firmware Ver.1.40 ［Add function］ ・Error alarm output function