

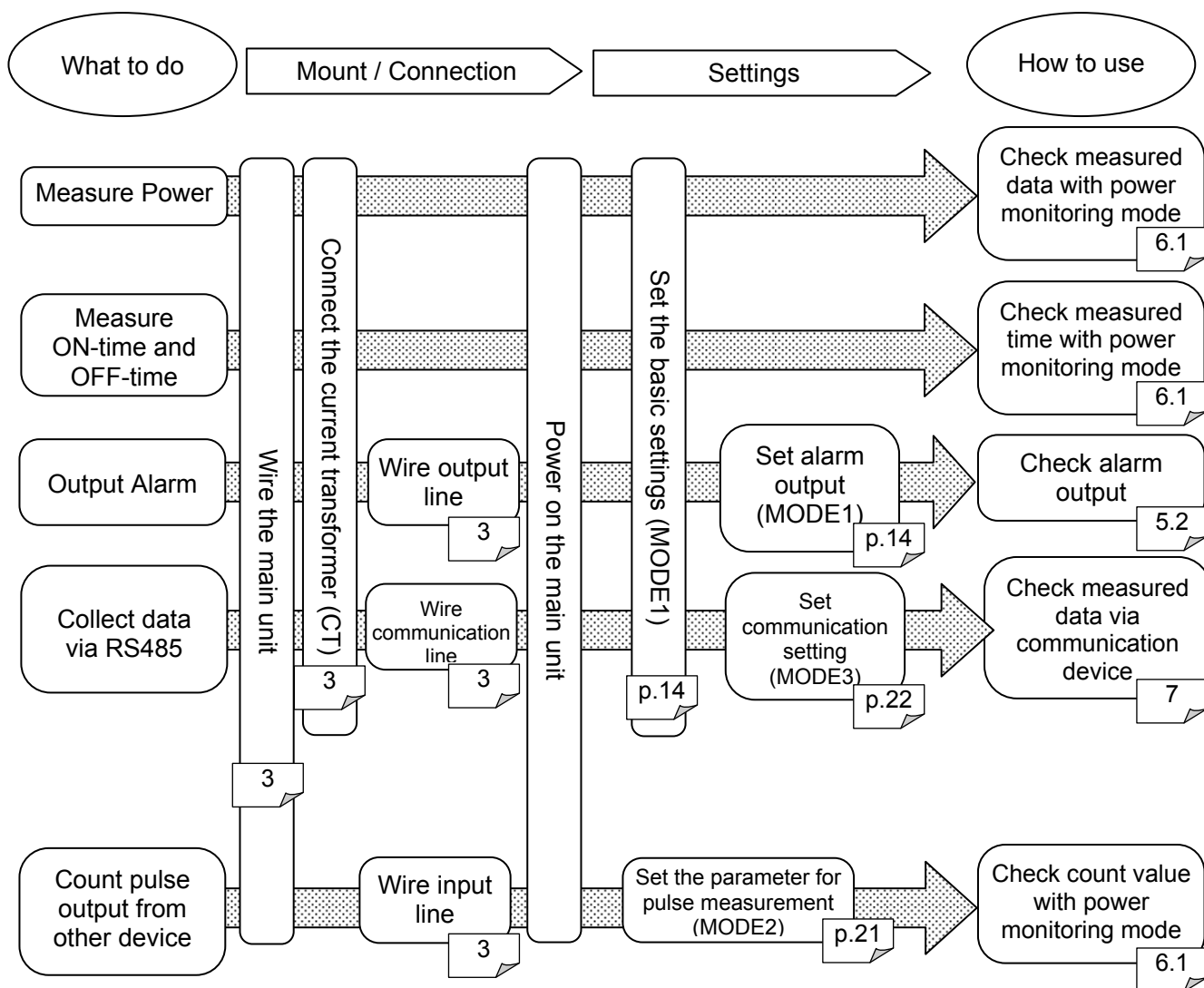
KW8M Eco-POWER METER 1A/5A CT input type User's Manual

Basic setting to measure by Eco-POWER METER

When wiring the main unit and the current transformer (CT) and setting the basic setting after power on, you can measure the power.

The basic setting of MODE1 is necessary to measure.

In order to use the other functions, the settings of the each parameter are necessary.



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 the secondary side circuit of an inverter. It could lead an exothermic heat or breakdown.

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Introduction

Thank you very much indeed for purchasing
“KW8M Eco-POWER METER”.

In this manual, we explain the usage of “KW8M
Eco-POWER METER” in detail.

Please use it correctly after understanding the content
enough.

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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°C 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 surge

◇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

- Installation and wiring must be performed by expert personnel for electrical work or electric piping.
- The power supply terminal and voltage input terminal of the main unit is common. Therefore if additional noise affects the power supply line, incorrect measurements may result.
- Eco-POWER METER is designed to be used in a control panel.

■ 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.
- This can't measure the power that flows reverse such as a regenerative electric power. If you measure a reverse power, it shows "0.00kW" and it doesn't count.
- 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.

■ 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 Features and Structure

■ With KW8M Eco-POWER METER, electrical power (voltage, current, etc.), power factor, frequency, etc are measured using AC voltage and AC current input via one of the following systems: single-phase two-wire system, single-phase three-wire system, three-phase three-wire system or three-phase four-wire system.

This also works as an hour meter, that is measured power-on or power-off time, and as a counter that is for pulse output equipment like flow meter.

■ **Eco-POWER METER is designed chiefly to manage saving energy. It is neither intended nor can it be legally used for billing.**

1.1 Unit's Name and Part Numbers

1.1.1 Main unit

Product name	KW8M Eco-POWER METER 1A/5A CT input type
Model No.	AKW8115
Phase and Wire system	<ul style="list-style-type: none"> • Single-phase two-wire • Single-phase three-wire • Three-phase three-wire • Three-phase four-wire
Power supply	100-240V AC 50/60Hz
Measured voltage input	<ul style="list-style-type: none"> • 400VAC • 100/200VAC
Measured current input	4000A or less (Secondary side current of CT: 1A or 5A)
Terminal type	Screw terminal (M3 +/- screw)

1.1.2 Options

Product name	Model No
Terminal cover	AKT8801
Installation frame	AKW8822

1.2 Measurement items

Item		Unit	Data range (Display)
Integrated electric power	Active	kWh	0.00 to 9999999.9
	Reactive	kvarh	
	Apparent	kVAh	
Instantaneous electric power	Active	kW	0.00 to 999999.99
	Reactive	kvar	-99999.99 to 0.00 to 999999.99
	Apparent	kVA	0.00 to 999999.99
Current		A	0.0 to 6000
Voltage		V	0.0 to 9999
Electricity charge *1			0.00 to 99999999
Power Factor			0.00 to 1.00 (LEAD: Leading phase, LAG: lagging phase) (Within the range of phase angle $\theta = -90$ to 0 to 90 degree)
Frequency	Hz		47.5 to 63.0
Hour meter	ON-time	hour	0.0 to 99999.9
	OFF-time		
Pulse counter			0 to 999999999 (In case of setting to 1.000 for prescale) *2

*1 Eco-POWER METER is designed chiefly to manage saving energy.

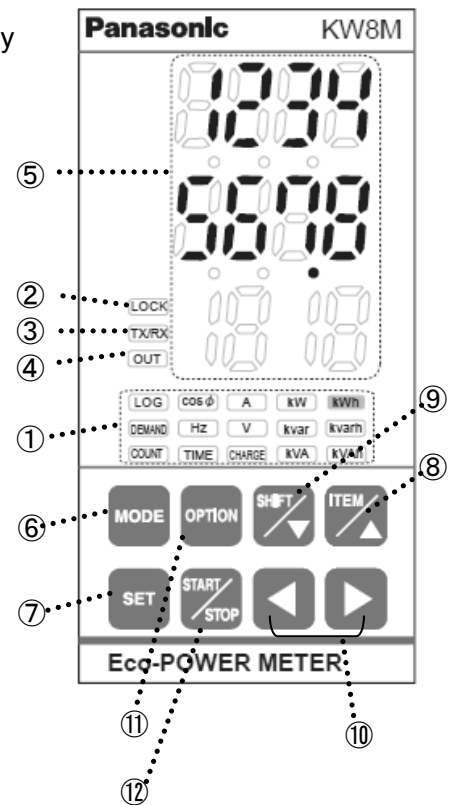
It is neither intended nor can it be legally used for billing.

*2 Display digit is changed according to the setting prescale value. (Max. 13 digits)

Chapter 2 Parts Name and Working

2.1 Parts Names

- ① Display indicator • Lighting or Blinking according to the display
- ② LOCK indicator • Lighting while in lock mode
- ③ TX/RX indicator • Blinking while communication
- ④ OUT indicator • Lighting when pulse output
- ⑤ Display each value • Display each measured value
 • Display each setting value
- ⑥ MODE Key
- ⑦ SET Key
- ⑧ ITEM / Δ Key
- ⑨ SHIFT / ∇ Key
- ⑩ Left / Right (\triangleleft / \triangleright) Keys
- ⑪ OPTION Key No use
- ⑫ START/STOP Key No use



2.2 Keys' Functions


Key	Functions
⑥ <MODE>	• Use to select setting mode
⑦ <SET>	• Use to set each value entered
⑧ $\triangleleft \frac{\text{ITEM}}{\Delta} \triangleright$	• To select measured display • To shift each mode • To change each setting value
⑨ $\triangleleft \frac{\text{SHIFT}}{\nabla} \triangleright$	• To select measured display • To shift each mode • To change each setting value
⑩ \triangleleft / Right (\triangleleft / \triangleright)	• To change each setting value
⑦ + ⑥ <SET> + <MODE>	• To reset the measured value
⑦ <SET> (continuous press 3-sec)	• All keys locked • Release lock mode while in lock mode

Chapter 3 Wiring

3.1 Main unit terminal arrangement

Function		No.		Function	
N.C.		①	⑪	P1	Measured voltage input
Power supply	L	②	⑫	P0	
	N	③	⑬	P2	
Pulse input	+	④	⑭	P3	
	—	⑤	⑮	CT1 (+)	Measured current input
Pulse output	+	⑥	⑯	CT1 (—)	
	—	⑦	⑰	CT2 (+)	
RS485	+	⑧	⑱	CT2 (—)	
	—	⑨	⑲	CT3 (+)	
	E	⑩	⑳	CT3 (—)	

Back view		
①		⑪
②		⑫
③		⑬
④		⑭
⑤		⑮
⑥		⑯
⑦		⑰
⑧		⑱
⑨		⑲
⑩		⑳

 The input voltage to each terminal is as follows.

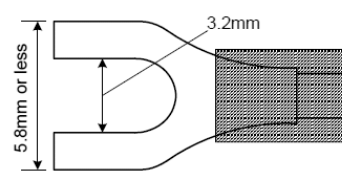
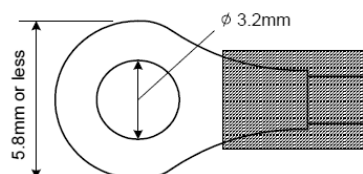
Terminal	Phase and wire	Terminal	Input voltage
Operating power supply	Single-phase, two-wire	②—③	100-240VAC (100 - 240V~) (Line voltage)
Measured voltage input	Single-phase, two-wire	⑪—⑫	0-440VAC (0-440V~) (Line voltage)
	Single-phase, three-wire	⑪—⑫—⑬	0-220VAC (0-220V~ : 3W) (Phase voltage)
	Three-phase, three-wire	⑪—⑫—⑬	0-440VAC (0-440V 3~) (Line voltage)
	Three-phase, four-wire	⑪—⑫—⑬—⑭	0-254VAC (0-254V 3N~) (Phase voltage)

◆How to wire the current input terminals

- CT has polarity. Wire correctly according to the using CT from power side (K) to load side (L), or it can't measure correctly.
- If there is some distortion by harmonic or waveform, it may not measure correctly.
Please check with the actual system before adopts it.
- Use the applicable wire. There might be occurred the malfunction, damage or electrical shock.

Caution for Wiring

- 1) Terminal fastening torque should be **0.6 to 1.0N·m**.
- 2) This has no built-in power switch, circuit breaker for power supply part. To protect the device, it is necessary to install power switch and circuit breaker in the power supply circuit.
And this has no built-in power switch, circuit breaker or fuse for measured voltage input parts.
Therefore it is necessary to install them in the circuit near this unit.
- 3) The terminal block of KW8M is designed to be wired from left. Insert wires to the terminal from the left and fasten with terminal screws.
- 4) In case using insulation sleeve, use an insulation sleeve applicable to M3 screw. Fastening torque should be 0.6 to 1.0N·m. (Refer to the below.)
- 5) We recommend the wire with the cross-sectional 0.75 to 1.25mm² for the power supply terminals and measured voltage input terminals.



3.2 Wiring Diagrams

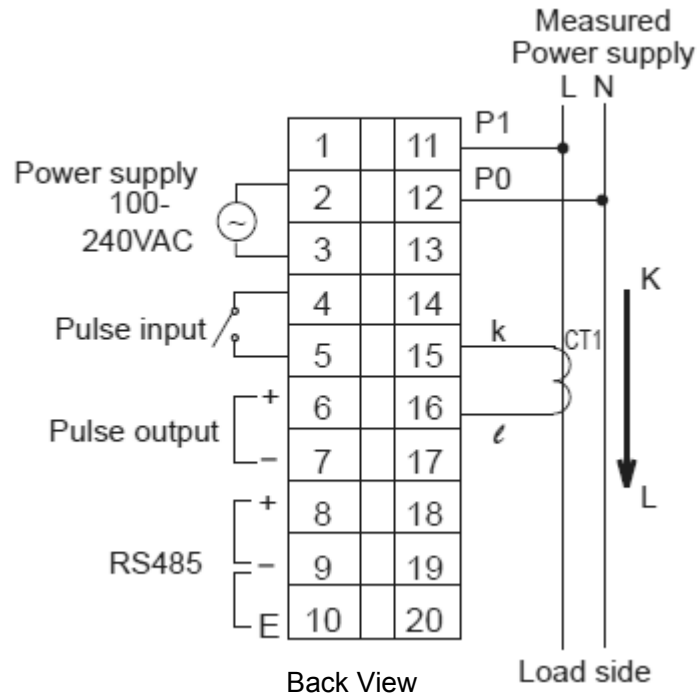
Please connect a breaker (3 to 15A) to the voltage input part for safety reasons and to protect the device. Grounding the secondary side of VT (Voltage transformer) and CT (Current transformer) is not necessary with low-voltage circuit.

* When using the several CTs, each CT is separated as far as possible. If they are near it might not measure correctly by the interference of magnetic field.

◆When measuring a load with rated input voltage

Single-phase two-wire system

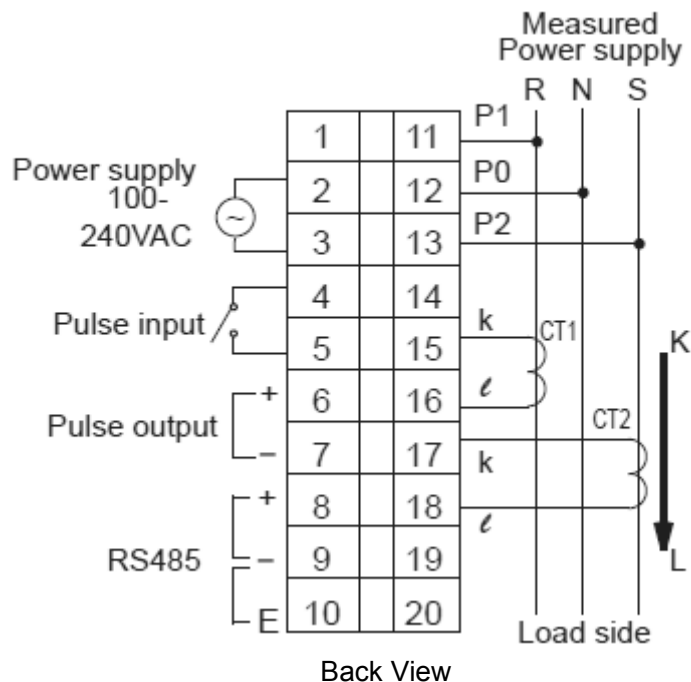
*One current transformer (CT) is required to measure single-phase two-wire system.



Single-phase three-wire

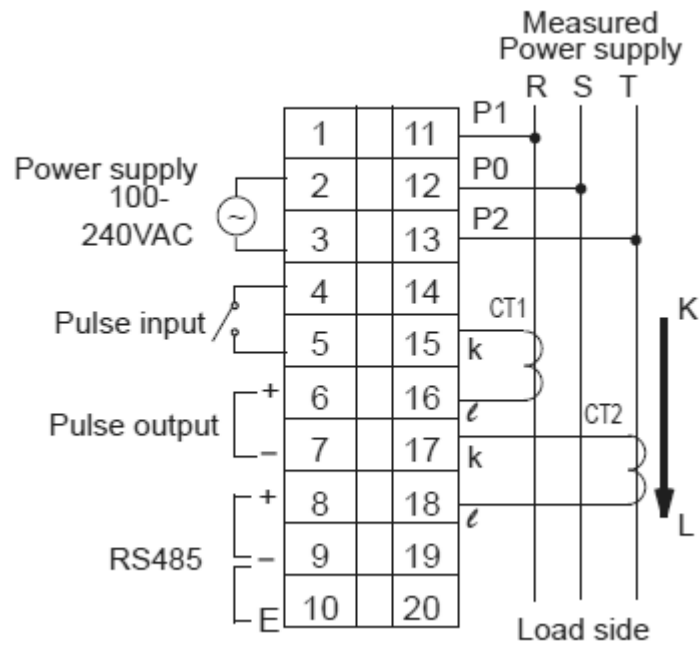
*Two CTs are required to measure single-phase three-wire system.

*Wire by diagram of single-phase 2-wire system when measure load using R-S with single-phase 3-wire system.



Three-phase three-wire system

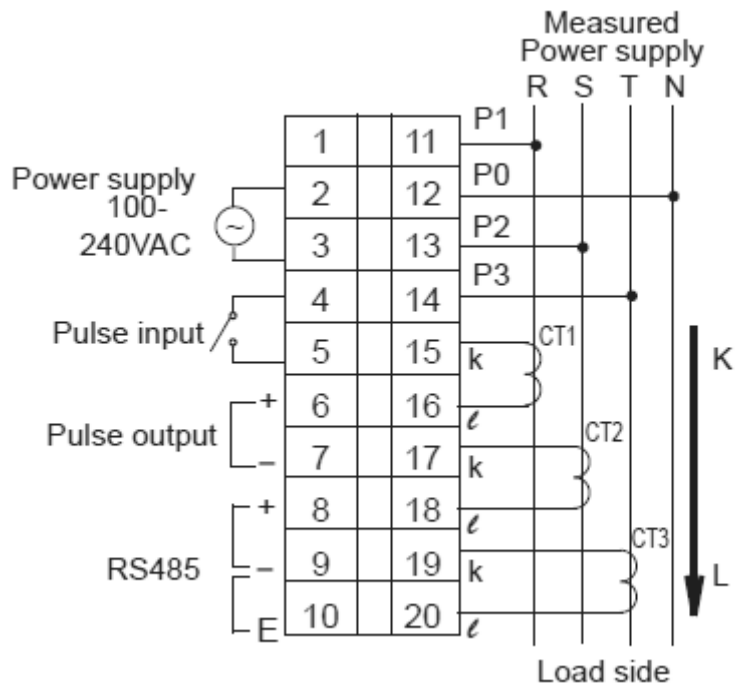
*Two CTs are required to measure three-phase three-wire system.



Back View

Three-phase four-wire system

*Three CTs are required to measure three-phase four-wire system.



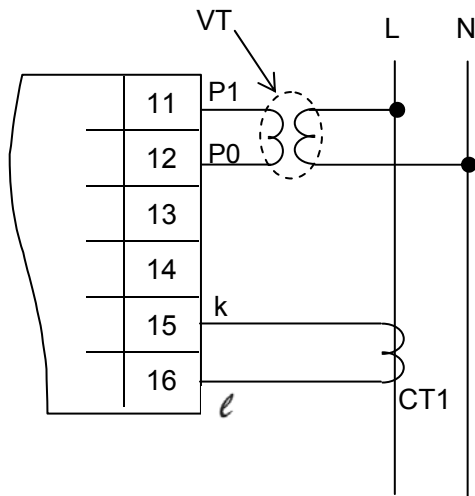
Back View

◆ When measuring a load with exceed input voltage

Voltage transformer (VT) is needed when you measure a load with over rated input voltage (440V).
Use a VT, those secondary rating is 110V.

Grounding the secondary side of VT and CT is not necessary with low-voltage circuit.

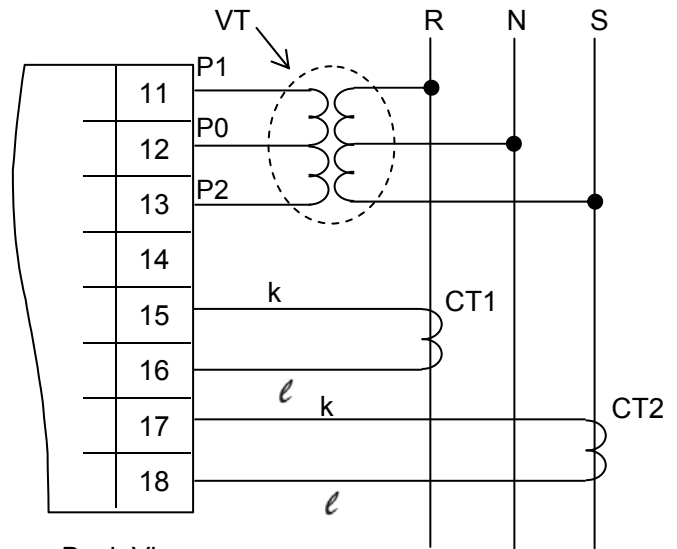
Single-phase two-wire system



Back View

No.13, 14, 17, 18, 19, 20 are not wired.

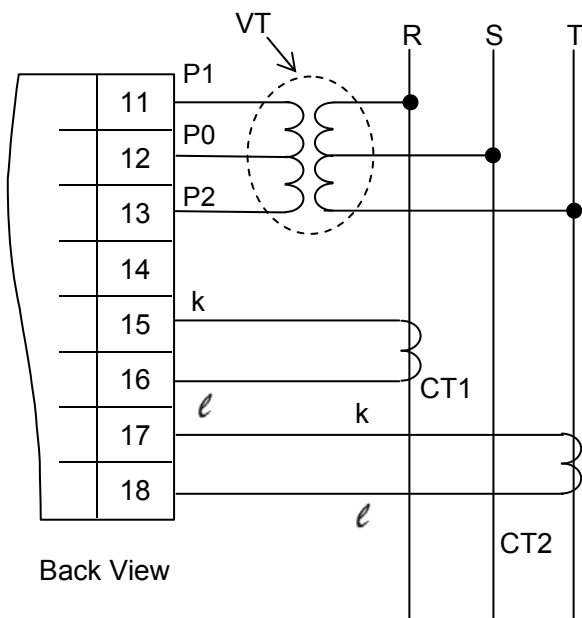
Single-phase, three-wire



Back View

No.14, 19, 20 are not wired.

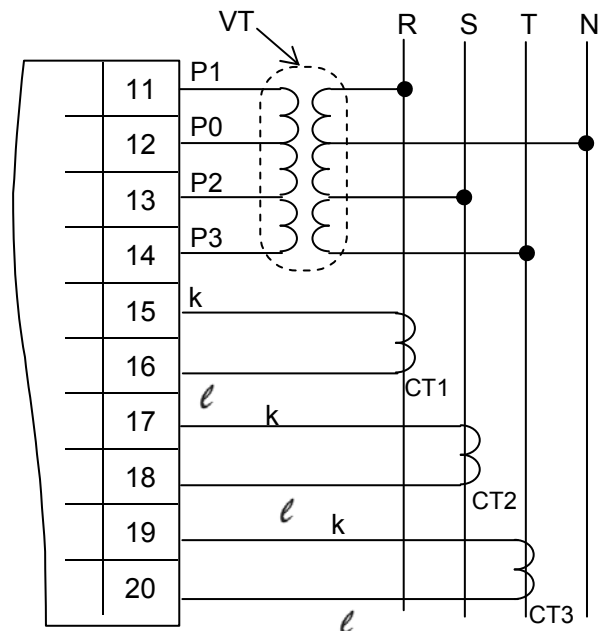
Three-phase, three-wire system



Back View

No.14, 19, 20 are not wired.

Three-phase, four-wire system

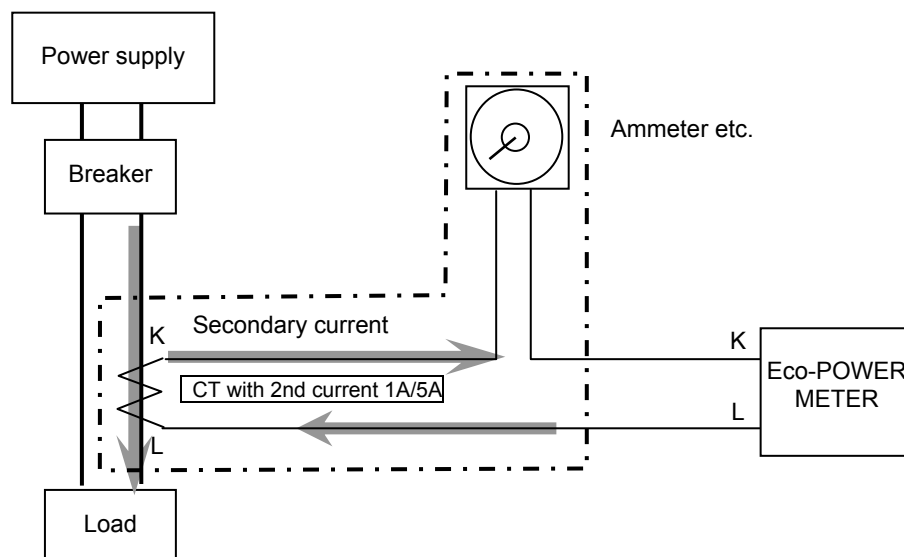
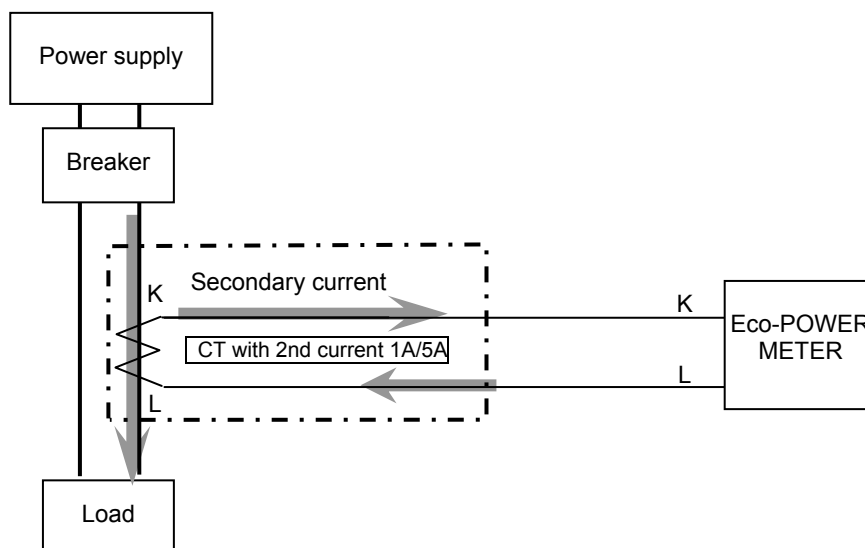


Back View

◆How to connect CT with secondary side current 1A or 5A

- (1) Select 5A or 1A 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/1A or 400A/5A, set to "400".
- (3) Connect CT according to the CT direction, power side (K) to load side (L).

(Connection example)

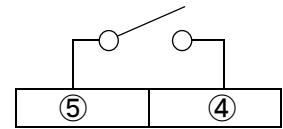
With Ammeter etc.Without Ammeter

3.3 For input connection

◇Input connection

•Contact input

Use highly reliable metal plated contacts. Since the contact's bounce time leads directly to error in the count value, use contacts with as short a bounce time as possible. In general, select 30Hz for max.counting speed.



•Non-contact input (Transistor input)

Connect with an open collector. Use the transistor with the following specifications.

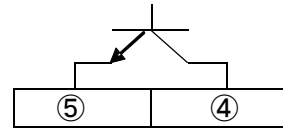
$V_{CE0}=20V$ min. $I_C=20mA$ min. $I_{CBO}=6\mu A$ max

Use transistors with a residual voltage of less than 1.5V when the transistor is ON.

*Short-circuit impedance should be less than 1k Ω .

(When the impedance is 0 Ω , drain current is approx. 7mA.)

Open-circuit impedance should be more than 100k Ω .

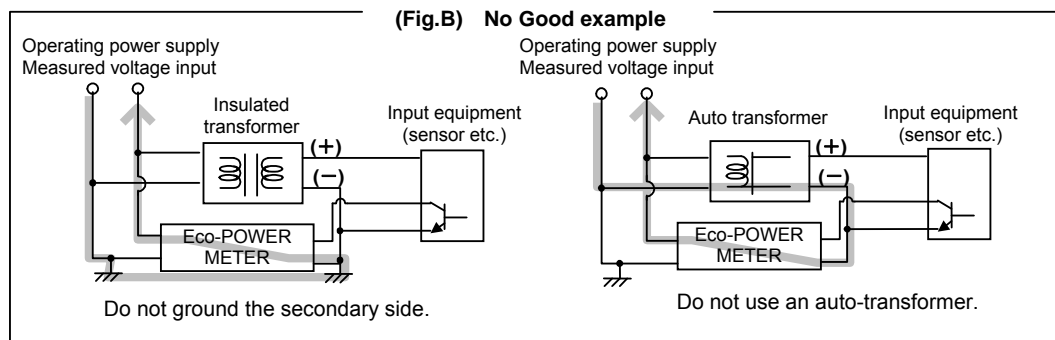
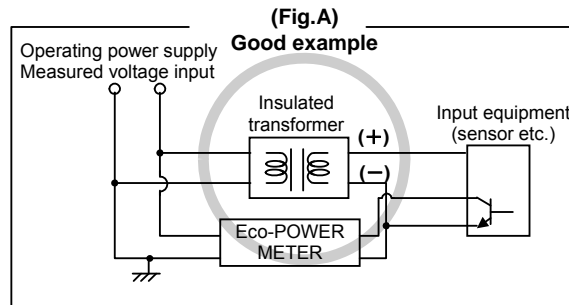


•Input wiring

Please wire as short as possible by using a shielded wire or a metallic electric wire tube individually.

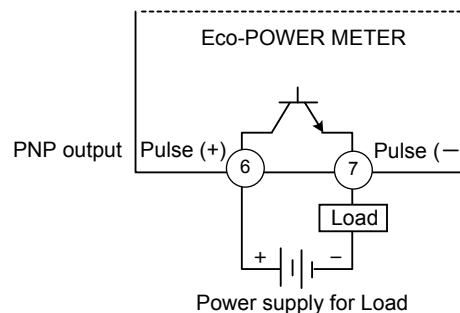
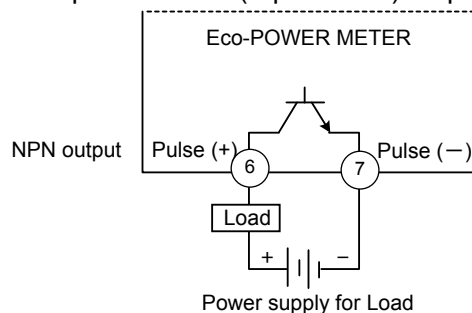
(Note)

Operating power supply input part and measured voltage input are not insulated to pulse input parts. So the input equipment must have the power supply transformer in which the secondary side is not grounded with the primary and secondary sides insulated, in order to prevent interference of the power supply circuit when connecting the external input circuit. Be sure not to use an auto-transformer.



3.4 For Output connection

Since the transistor output is insulated from the internal circuit by a photo-coupler, it can be used both as a NPN output and PNP (equal value) output.

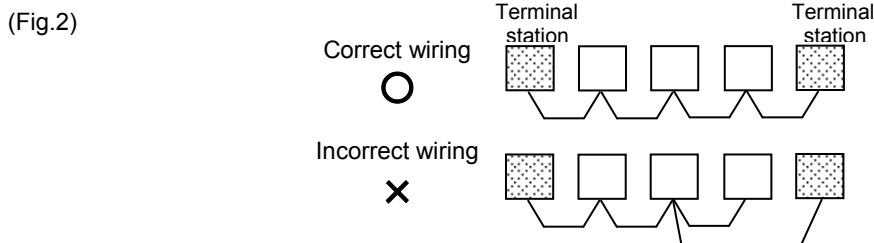
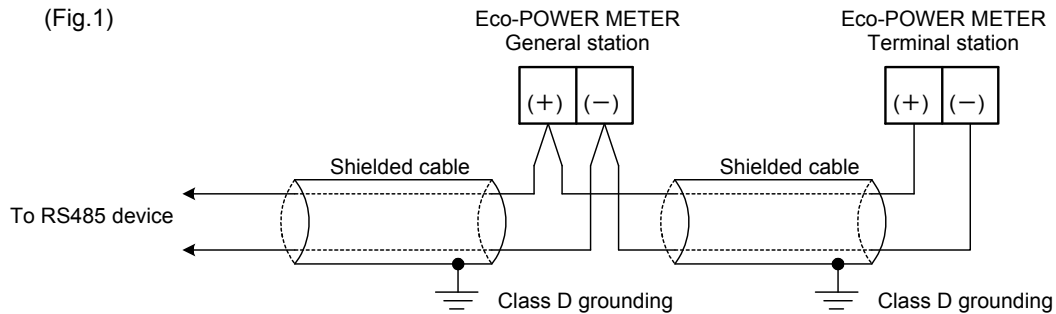


•Wire up to 100m for output connection.

If it is long, it may not work correctly due to floating capacitance of wire.

3.5 RS485 Communication

- When using shielded cable for the RS485 transmission line, ground one end.
Use a class D dedicated earth for grounding. Do not share a ground with other earth lines. (Fig.1)
- Be sure to connect with daisy chain the RS485 transmission line between each unit.
Do not use a splitter. (Fig.2)
- With a terminal station, RS485 (E) (No.10) and RS485 (-) (No.9) should be shorted.
*E terminal is not SG (signal ground) terminal. Do not ground shielded cable.



Recommended Cable

Use the transmission cables shown below for Eco-POWER METER RS485 communication system.

Cable	Conductor		Insulator		Cable diameter	Applicable cable
	Size	Resistance (at 20°C)	Material	Thickness		
Twisted-pair with shield	1.25 mm ² (AWG16) or more	Max.16.8Ω/km	Polyethylene	Max. 0.5 mm	Approx. 8.5 mm	HITACHI KPEV-S 1.25 mm ² × 1P Belden Inc. 9860
	0.5 mm ² (AWG20) or more	Max.33.4Ω/km	Polyethylene	Max. 0.5 mm	Approx. 7.8 mm	HITACHI KPEV-S 0.5 mm ² × 1P Belden Inc. 9207
VCTF	0.75 mm ² (AWG18) or more	Max.25.1Ω/km	PVC	Max. 0.6 mm	Approx. 6.6 mm	VCTF 0.75 mm ² × 2C (JIS)

Cable	Section
Twisted-pair with shield	
VCTF	

Notes

- 1) Use shielded type twist cables.
- 2) Use only one type of the transmission cables.
- 2) Do not mix different types of the cables.
- 3) Use twist pair cables under a bad noise environment.

3.6 Low Voltage Directive

When using in the application confirming to EN61010-1/IEC61010-1, make sure to satisfy the following conditions.

- (1) Pulse output part and communication part secure only basic insulation. In order to secure reinforced (double) insulation demanded by EN 61010-1/ IEC61010-1, secure basic insulation or more with load side for output part and secure basic insulation or more with communication system side for communication part.
- (2) Provide the voltage input part with an EN60947-1 or EN60947-3 compliant circuit breaker.
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.
- (3) Use a wire with basic insulation or more for a wire cramped (or connected) CT.

【Environmental conditions】

- Overvoltage category II, Pollution degree 2
- Indoor use
- An ambient temperature of -10 to 50°C
- An ambient non-condensing humidity of 35 to 85%RH (at 20°C)
- Altitude of 2000m or less

【Mount the product in a place with】

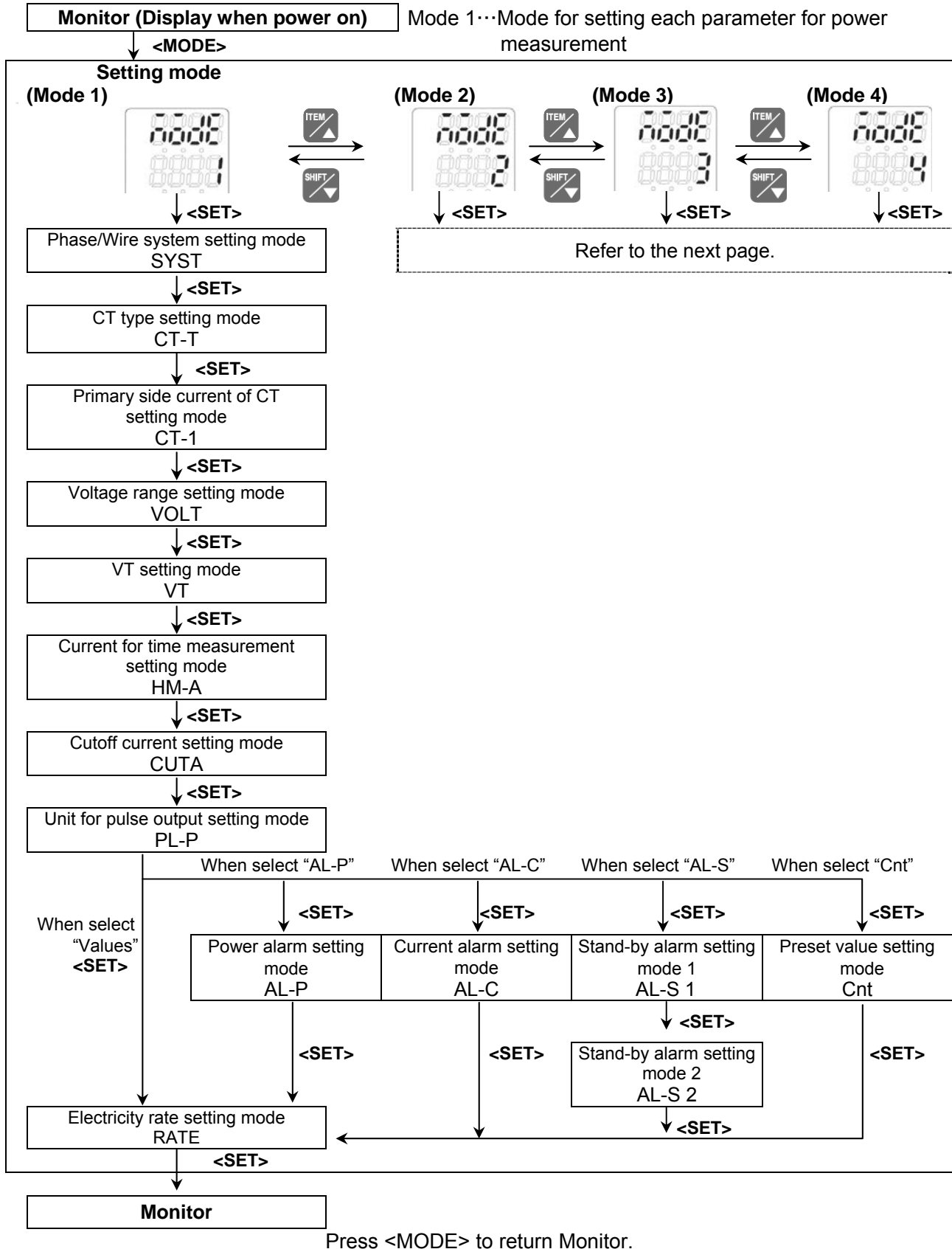
- A minimum of dust, and an absence of corrosive gases
- No flammable, explosive gasses
- Few mechanical vibrations or shocks
- No exposure to direct sunlight
- No large capacity electromagnetic switches or cables through which large current is flowing

Chapter 4 Settings

4.1 Operation procedure

【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. In order to use the other functions, set mode2, 3 and 4 according to your use.

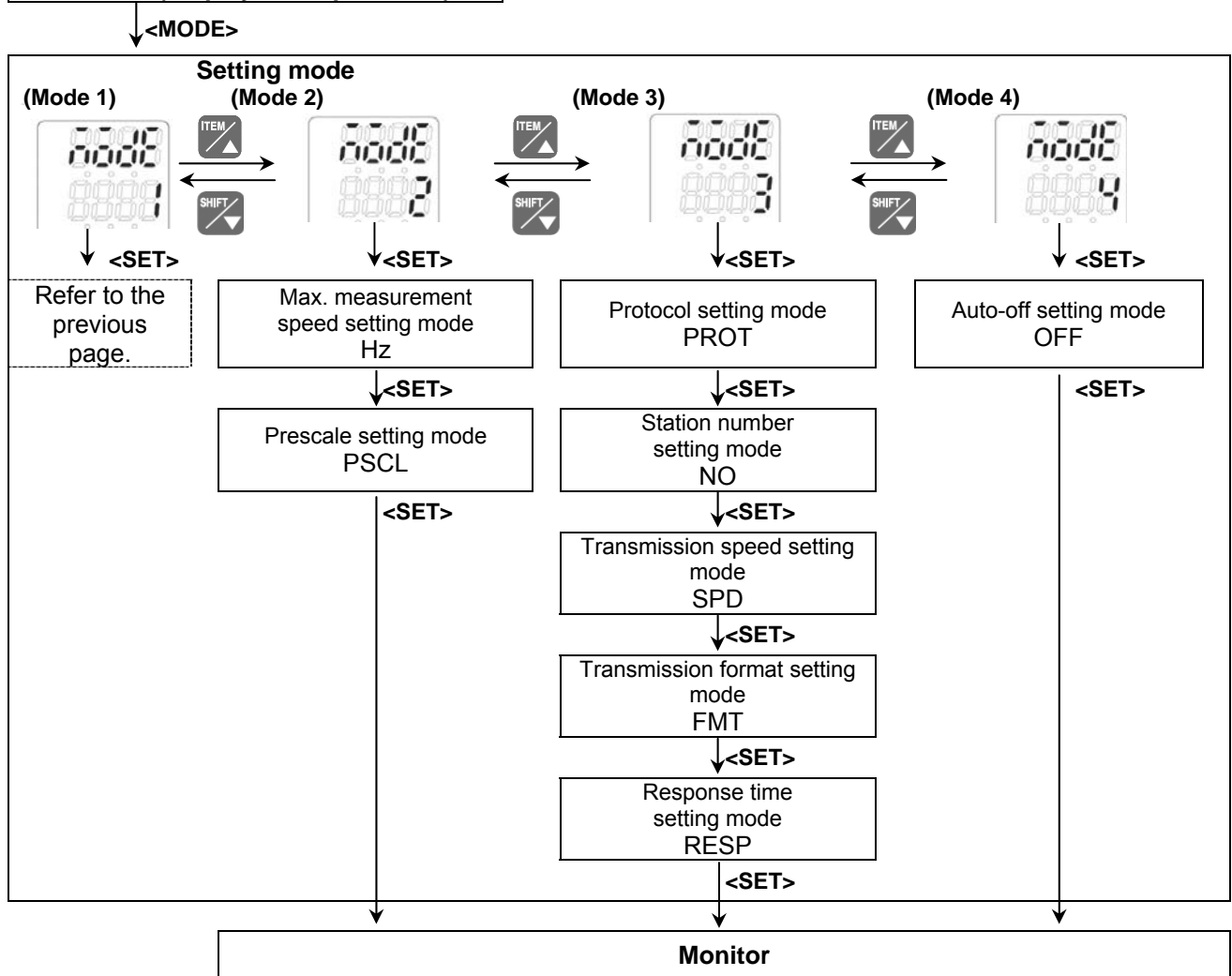


Mode 2 ...Mode for setting of each parameter for pulse measurement

Mode 3 ...Mode for setting of each parameter for serial communication

Mode 4 ...Mode for setting of each parameter for optional function

Monitor (Display when power on)



Press <MODE> to return Monitor.

◆ Initial value list

Mode 1		Mode 2	
Item	Initial value	Item	Initial value
Phase/Wire system	1P2W	Max. counting speed	2000
CT type	50	Pre-scale	1.000
Primary side current of CT	1	Unit	CNT
Voltage range	400	Mode 3	
VT	1.00		
Current for time measurement	1.0	Item	Initial value
Cutoff current	1.0	Protocol	MEWTOCOL
Unit for pulse output	0.001	Station number	1
Power alarm	999999.99	Transmission speed	19200
Current alarm	100.0	Transmission format	8bit-o
Stand-by alarm 1	100.0	Response time	5
Stand-by alarm 2	0	Mode 4	
Preset value	0		
Electricity charge	10.00	Item	Initial value
		Auto-off	0

4.2 Setting Mode Explanation

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

4.2.1 MODE1

(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 / Three-phase 4-wire.

*When 1P3W or 3P3W is selected, it doesn't measure 1P2W system correctly. And when 3P4W is selected, it doesn't measure 1P2W, 1P3W, 3P3W system correctly. Select the accurate phase and wire system according to the measured system.

CT type setting mode **CT-T**

Mode defines input current type of CT.

• Select from 1A / 5A.

• When the secondary side current of CT is 5A, select "5A".

Primary side current of CT setting mode **CT-1**

Mode defines primary side current of using CT, its secondary side current of 1A or 5A.

It is necessary to set the primary side current of using CT.

• Primary side current of CT can be set the range of 1 to 4000 (Initial 5).

• When connecting 5ACT 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".

Voltage range setting mode **VOLT**

Mode defines voltage range of Eco-Power Meter.

• Select from 400/200.

• When it measures load of 400V system, select "400".

When it measures load of 100/200V system, select "200".

*In case measuring the load of 100/200V system with selecting "400", the resolution will be down. Select the correct voltage range.

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.

*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(400) x 0.05 x VT ratio".)

Current for time measurement setting mode **HM-A**

Mode defines current ratio for time measurement. It measures ON-time and OFF-time according to the setting.

• It can be set the range of 1.0% to 100.0%F.S.

ex) When 10.0 is set, the current exceeds 10.0%F.S is measured as ON-time, the current under 10.0%F.S is measured as OFF-time.

*Measured current is the current of L1(CT1)-phase.

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 1.0% to 50.0%.

ex) When set to 10.0, current 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/Cnt.

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" is set, alarm is output at the time when instantaneous electric power is over the setting value.

When "AL-C" is set, alarm is output at the time when current is over the setting value.

When "AL-S" is set, alarm is output at the time when current is under the setting value and it passes the setting time.

When "Cnt" is set, it output at the time when count value reaches preset value set by preset value setting mode.

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 999999.99kW.

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 1.0 to 100.0%.

Stand-by alarm setting mode 1 **ALS1**

**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 1.0~100.0%.

Stand-by alarm setting mode 2 **ALS2**

**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.

Preset value setting mode **Cnt**

**Only when "Cnt" is selected on unit for pulse output setting mode.*

Mode defines count value used for output.

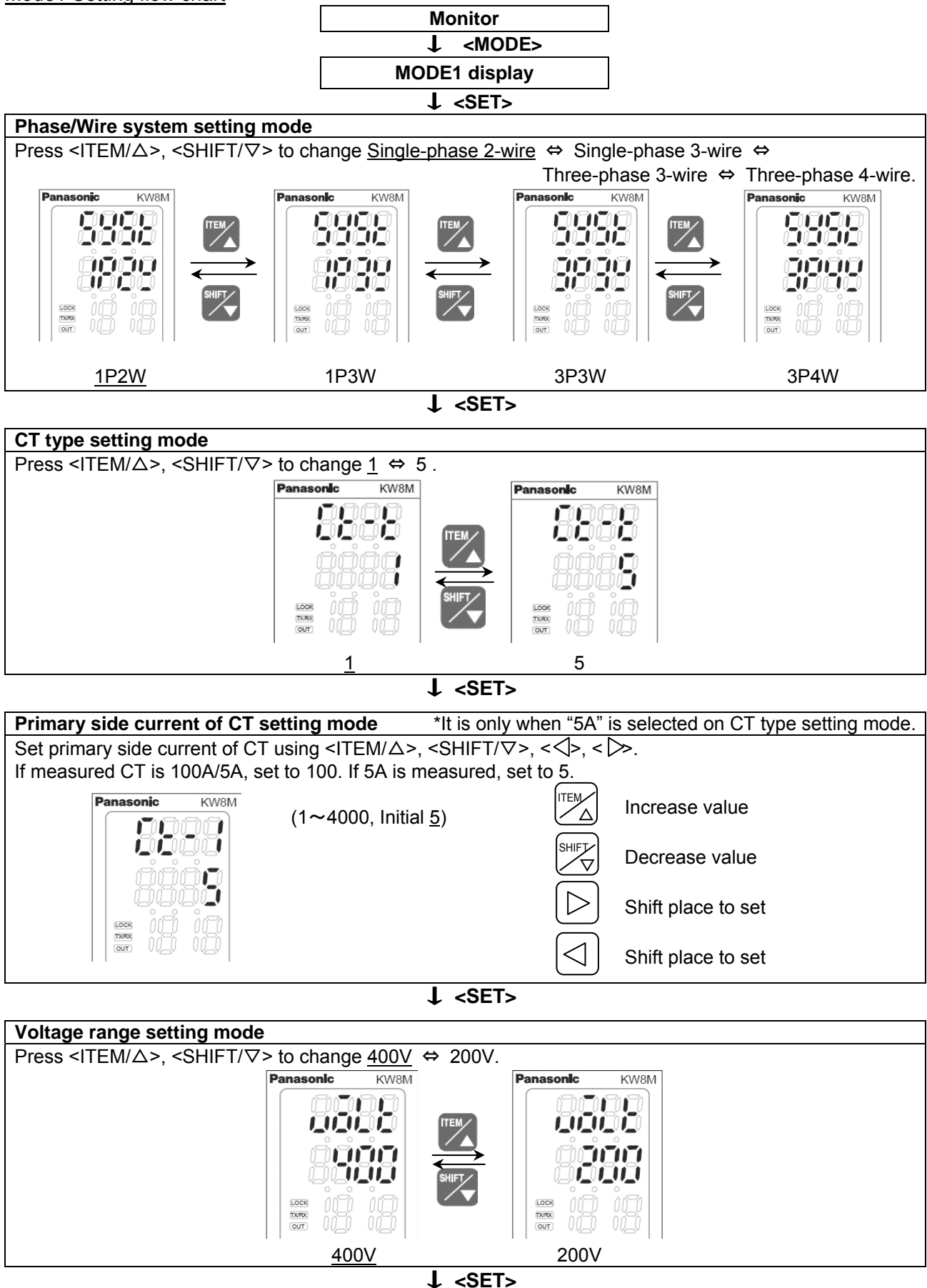
• It is set the range of (0 × prescale setting value) to (99999999 × prescale setting value).

Electricity charge setting mode **RATE**

Mode defines electricity charge ratio used as a standard per 1kWh.

• It can be set the range of 0.00 to 99.99 /1kWh. (Initial 10.00)

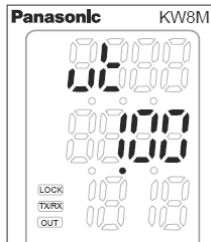
Mode1 Setting flow chart



VT ratio setting mode

Set VT ratio using <ITEM/Δ>, <SHIFT/▽>, <◀>, <▶>.

If the VT is 440/110, set to "4.00".



(1.00~99.99)



Increase value



Decrease value



Shift place to set



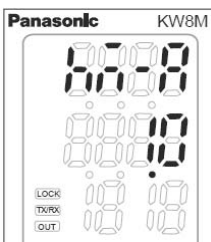
Shift place to set

↓ <SET>

Current for time measurement setting mode

Set current for time measurement using <ITEM/Δ>, <SHIFT/▽>, <◀>, <▶>.

If you measure the current over 50.0%F.S, set to "50.0".



(1.0~100.0)



Increase value



Decrease value



Shift place to set



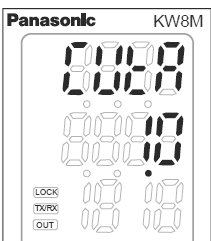
Shift place to set

↓ <SET>

Cutoff current setting mode

Set cutoff current using <ITEM/Δ>, <SHIFT/▽>, <◀>, <▶>.

If you don't measure the current under 10.0%F.S, set to "10.0".



(1.0~50.0)



Increase value



Decrease value



Shift place to set

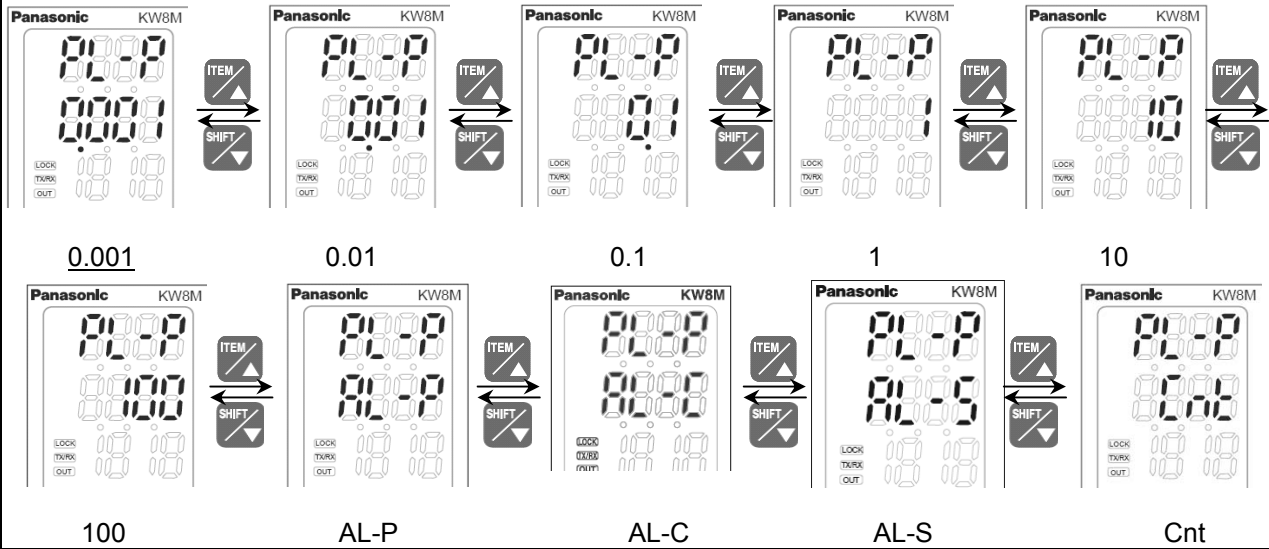


Shift place to set

↓ <SET>

Unit for pulse output setting mode

Press <ITEM/Δ>, <SHIFT/▽> to change 0.001 ⇄ 0.01 ⇄ 0.1 ⇄ 1 ⇄ 10 ⇄ 100 ⇄ AL-P(Alarm) ⇄ AL-C(Alarm) ⇄ AL-S(Alarm) ⇄ Cnt (Count output).

**Power alarm value setting mode**

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

Display changes to set an alarm value after "AL-P" is displayed at the upper line for 1 sec.

Set power for alarm using <ITEM/Δ>, <SHIFT/▽>, <◀>, <▶>. (0.00 to 999999.99)

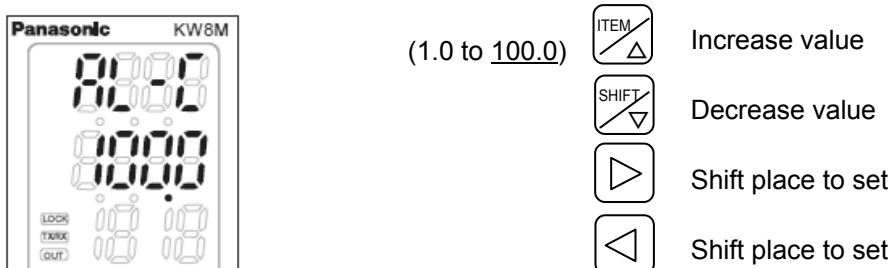


↓ <SET>

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/Δ>, <SHIFT/▽>, <◀>, <▶>.



↓ <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/Δ>, <SHIFT/▽>, <◀>, <▶>.



(1.0 to 100.0)



Increase value



Decrease value



Shift place to set

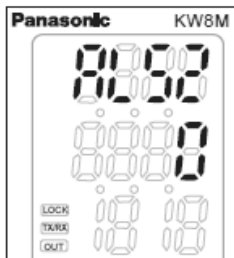


Shift place to set

↓ <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/Δ>, <SHIFT/▽>, <◀>, <▶>.



(0 to 9999 minutes)



Increase value



Decrease value



Shift place to set



Shift place to set

* "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 display of instantaneous electric power, current, voltage, frequency and PF. After reset the alarm, start to monitor the stand-by power again.

↓ <SET>

Preset value setting mode *It is only when "Cnt" is selected on unit for pulse output setting mode.

Display changes to set an alarm value after "Cnt" is displayed at the upper line for 1 sec.

Set preset value to output using <ITEM/Δ>, <SHIFT/▽>, <◀>, <▶>



(0 x Prescale value to 99 999999 x Prescale value)



Increase value



Decrease value

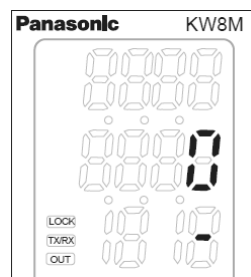


Shift place to set

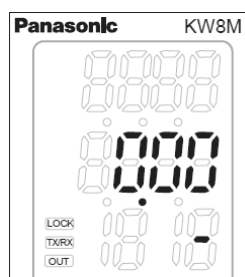


Shift place to set
Over 9 digits, it shifts to the upper digit.

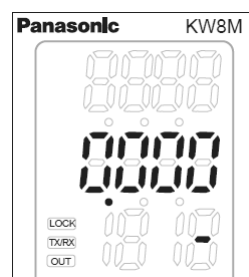
After
1sec.



When prescale value is an integer.



When prescale value is to two places of decimals.



When prescale value is to three places of decimals.

↓ <SET>

Electricity charge setting mode

Set the rate per 1kWh using <ITEM/Δ>, <SHIFT/▽>, <◀>, <▶>.



(0.00~99.99, Initial 10.00)



Increase value



Decrease value



Shift place to set



Shift place to set

↓ <SET>

Monitor

4.2.2 MODE2

(Mode for setting of each parameter for pulse measurement)

Max. counting speed setting mode **Hz**

Mode defines max. counting speed.

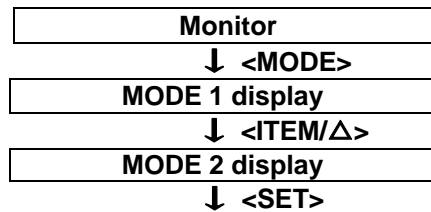
- Select from 2000(2kHz)/30(30Hz).

Pre-scale setting mode **PSCL**

Mode defines pre-scale value used for changing count value.

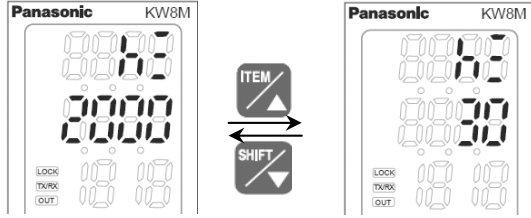
- It can be set the range of 0.001 to 100.000. (Initial 1.000)
- The position of decimal point set with this mode is applied to count value and preset value.
ex) When 0.01 (Last 2-digit) is set, the decimal point of count value and preset value has 2 digit under decimal point.

MODE2 Setting flow chart



Max. counting speed setting mode

Press <ITEM/Δ>, <SHIFT/▽> to change 2000 (2kHz) ⇔ 30(30Hz).



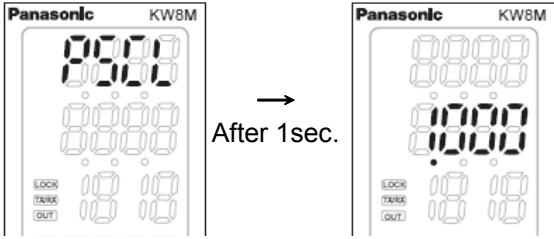
2000 30

↓ <SET>

Pre-scale setting mode

Set pre-scale value using <ITEM/Δ>, <SHIFT/▽>, <▷>, <◁>.

(0.001 to 100.000, initial: 1.000)



After 1sec.

ITEM Increase value

SHIFT Decrease value

▷ Shift place to set

◁ Shift place to set

*The decimal point set with this mode is applied to count value and preset value.



4.2.3 MODE3

(Mode for setting of each parameter for serial communication (RS485))

Protocol setting mode **PROT**

Mode defines communication protocol of main unit via serial communication (RS485).

- Select from MEWTOCOL / MODBUS(RTU).

Station number setting mode **NO**

Mode defines an individual station no. for each unit when two or more units communicate via serial communication (RS485).

- It can be set the range of 1 to 99.

Transmission speed (Baud rate) setting mode **SPD**

Mode defines serial communication (RS485) transmission speed. Define the transmission speed according to the master's (PLC etc.).

- Select from 38400/19200/9600/4800/2400[bps].

Transmission format setting mode **FMT**

Mode defines serial communication (RS485) transmission format (Data length, Parity).

Define the transmission format according to the master's (PLC etc.).

- Select from 8bit-o/7bit-n/7bit-E/7bit-o/8bit-n/8bit-E.
- “n (none)” means parity is not available.
- “E (Even)” means parity is even number.
- “o (odd)” means parity is odd number.
- *With MODBUS (RTU) protocol, it works only with 8bit.

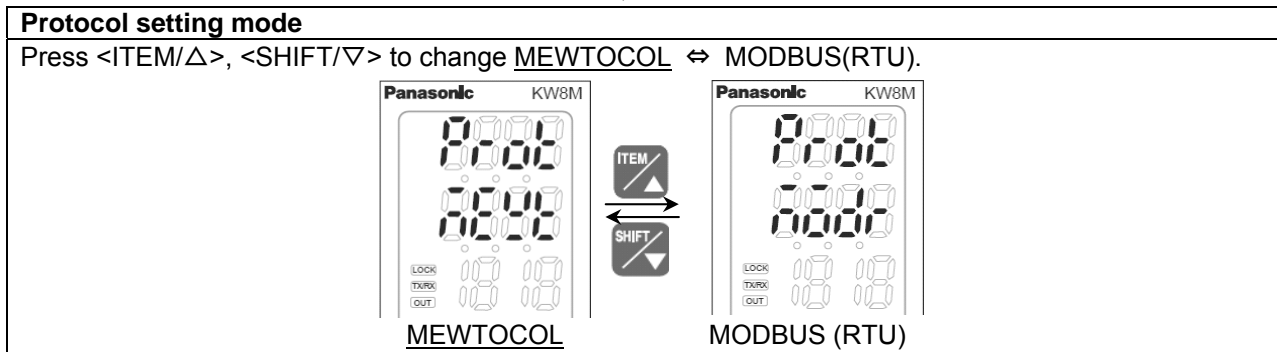
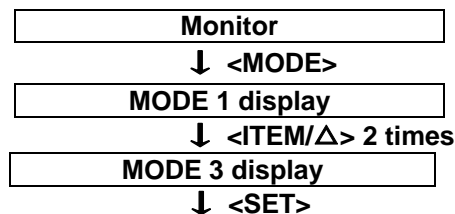
Response time setting mode **RESP**

Mode defines serial communication (RS485) response time of main unit.

When command is received, it sends response after setting response time passes.

- It can be set the range of 1 to 99 ms. (Initial 5)

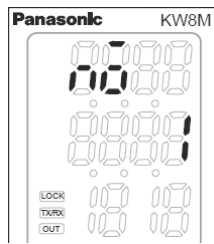
MODE3 Setting flow chart



↓ <SET>

Station number setting mode

Set the station number using <ITEM/Δ>, <SHIFT/▽>, <◀>, <▶>.



(1 to 99)



Increase value



Decrease value



Shift place to set

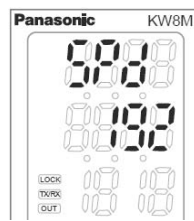


Shift place to set

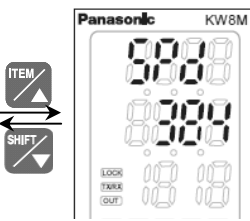
↓ <SET>

Transmission speed setting mode

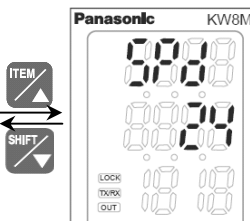
Press <ITEM/Δ>, <SHIFT/▽> to change 19200 ⇄ 38400 ⇄ 2400 ⇄ 4800 ⇄ 9600.



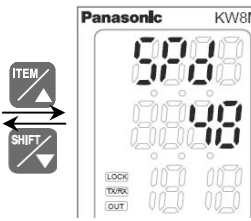
19200bps



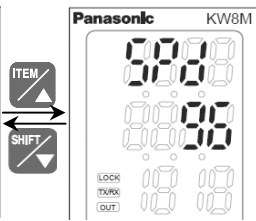
38400bps



2400bps



4800bps



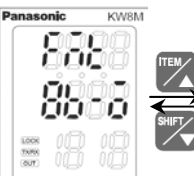
9600bps

↓ <SET>

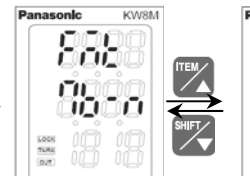
Transmission format setting mode

Press <ITEM/Δ>, <SHIFT/▽> to change 8bit-o ⇄ 7bit-n ⇄ 7bit-E ⇄ 7it-o ⇄ 8bit-n ⇄ 8bit-E.

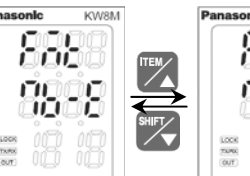
n: not available E: even number o: odd number



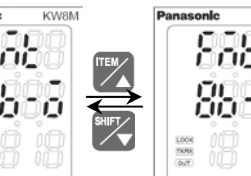
8bit-o



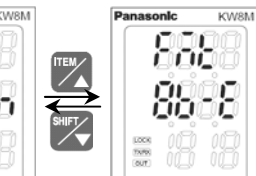
7bit-n



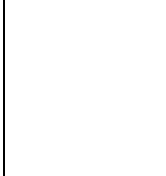
7bit-E



7it-o



8bit-n

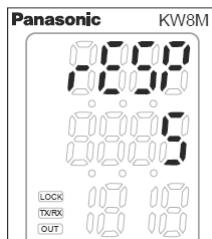


8bit-E

↓ <SET>

Response time setting mode

Set the response time using <ITEM/Δ>, <SHIFT/▽>, <◀>, <▶>.



(1 to 99 ms initial: 5)



Increase value



Decrease value



Shift place to set



Shift place to set

↓ <SET>

Monitor

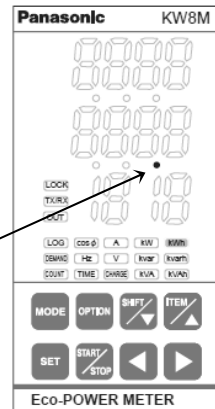
4.2.4 MODE4

(Mode for setting of each parameter for optional function)

Auto-off setting mode **OFF**

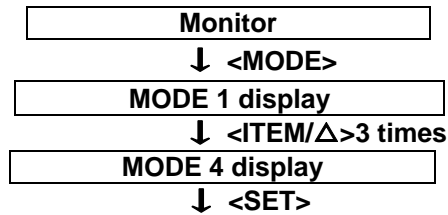
Display LED turns off automatically when there is no key operation for a long time.

- Off time can be set the range of 0 to 99min.
- "0" should be set if you want to turn always light on.
- "1~99" should be set if you want to turn light off at setting time.
- After turns off the backlight, any key operation makes it turns on.
- After turns off the backlight, one decimal point at the right end is blinking.



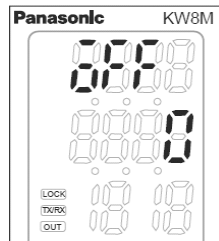
Decimal point (Right end)

MODE4 Setting flow chart



Auto-off setting mode

Set auto-off time by minute using <ITEM/Δ>, <SHIFT/▽>, <◀>, <▶>.



(0 to 99 min.)



Increase value



Decrease value



Shift place to set



Shift place to set

"0" should be set to turn always light on.

"1 to 99" should be set to turn light off at setting time (minute).

While light off, press any key to light on.

↓ <SET>

Monitor

Chapter 5 Various Functions

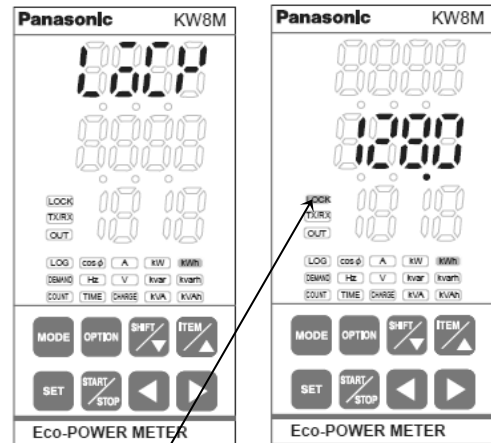
5.1 LOCK mode

It is the mode makes all keys unable. Use when you want to fix one of the measurement displays (For all displays). In this mode, you can not input by any keys.

When you press <SET>key continuously for about 3sec., the "LOCK" is displayed and the indicator lights. After about 3 sec., "LOCK" is disappeared and the display shift to previous display. All keys become locked (pressing them will have no effect).

Press <SET>key continuously for about 3sec. again to release Lock mode. The "LOCK" indicator goes off and the lock mode is released (unlocked).

Lock
indicator



5.2 Display while communication

TX/RX indicator is blinking while Eco-POWER METER is under communication.

TX/RX indicator

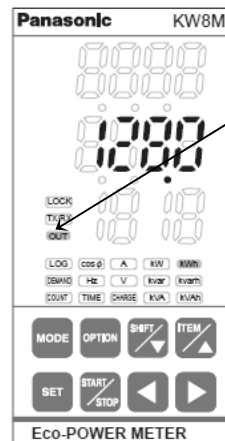


5.3 Display when pulse output

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

"OUT" indicator is lighting when pulse output.

OUT indicator



5.3.1 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: about 100ms)

5.3.2 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.

5.3.3 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.

5.3.4 Stand-by power alarm

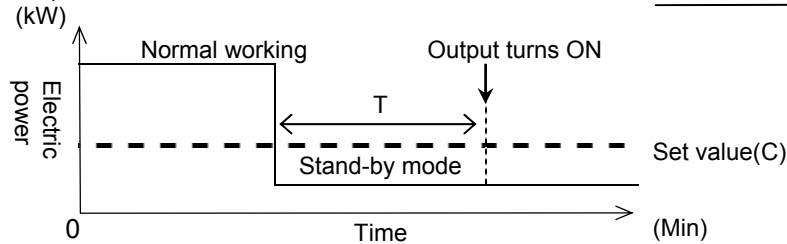
When it detects stand-by power (current) of the measured load, pulse output (transistor output) turns on in order to notice.

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.

You can reset the alarm by pressing <SET> with the instantaneous electric power display.

(Working flow chart)



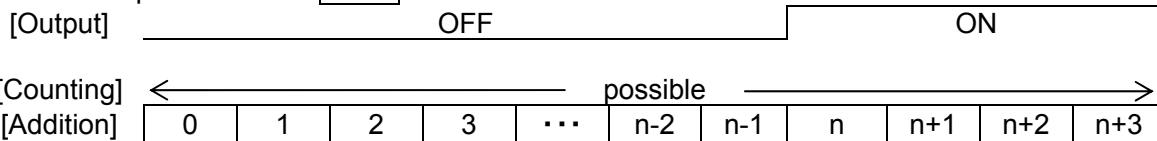
5.3.5 Output depends on count value

Set the preset value and pulse output (transistor output) turns on the time when count value reaches the preset value.

5.4 Counter function

5.4.1 Operation mode

Maintain output hold count **HOLD**



- (1) Output control is maintained after count-up completion and until reset. However counting is possible despite of count-up completion.
- (2) It reverts "0" after counting up full scale, but output control is maintained. However output is OFF if count value or preset value is changed.

5.4.2 Change the Preset Value

It is possible to change the preset value even during counting. However note the following points.

◇When the pre-scale value is "1.000". (PSCL=1.000)

- (1) If the preset value is changed to the value less than the count value, counting will continue until it reaches full scale, returns to "0" and then reaches the new preset value.
- (2) If the preset value is changed to "0", it will not count up at start with "0". It counts up when the counting value comes to "0" again (after reach to full scale). However output is OFF if count value or preset value is changed.
- (3) When the count value is fixed, output is changed according to the changing of preset value as below.
 - ① If the preset value is changed to the value less than the count value or same as count value, output is ON.
(Count value \geq Preset value)
 - ② If the preset value is changed to the value more than the count value, output is OFF.
(Count value $<$ Preset value)

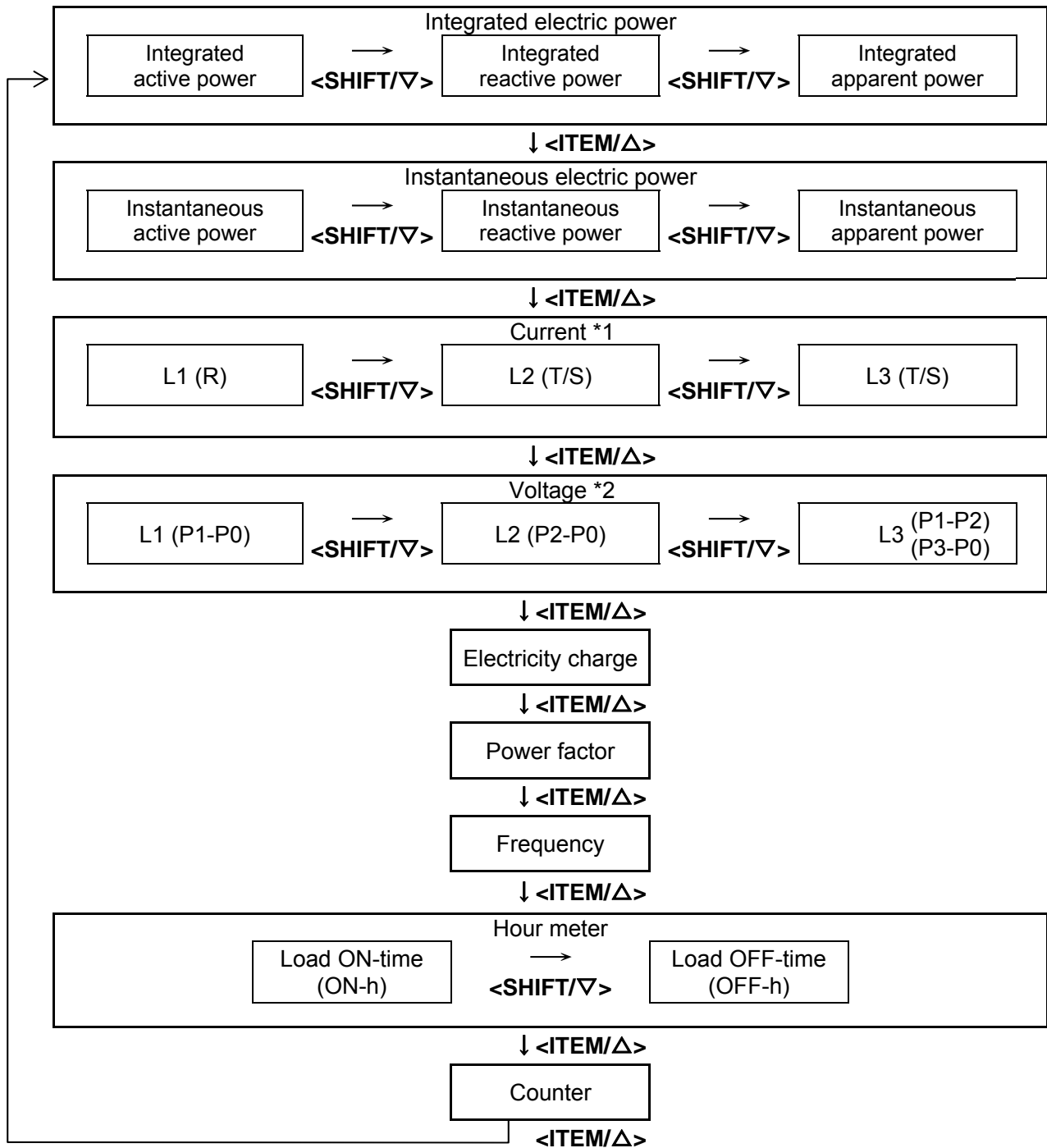
◇When the pre-scale is not "1.000". (PSCL \neq 1.000)

Even if the preset value is changed after counting to full scale, output is not changed.

Chapter 6 Display of each Value

6.1 Outline for the Working of Display

It displays measured value as below.



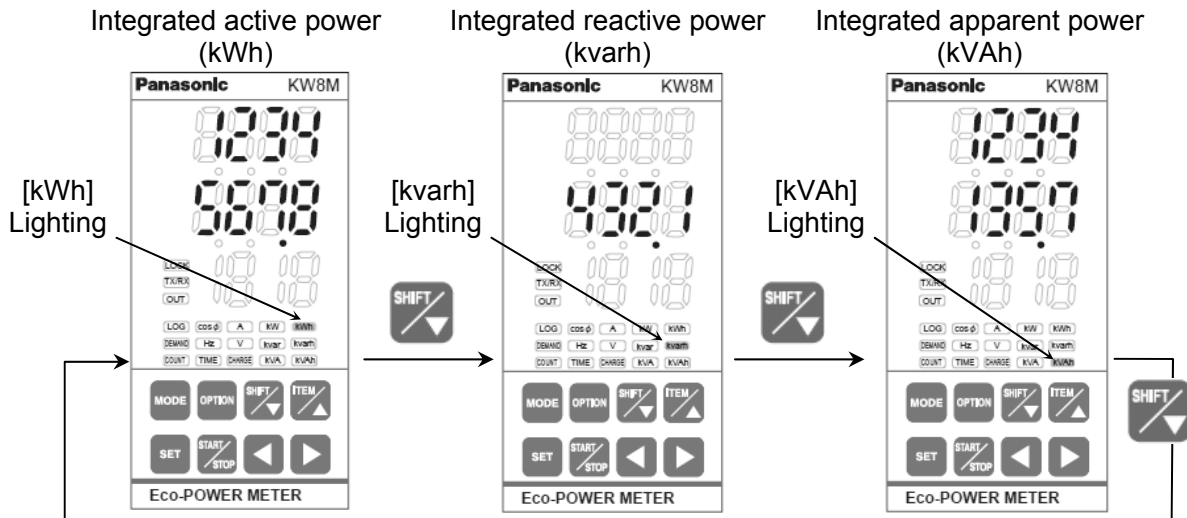
*1,2

The display is changed according to the phase and wire system.

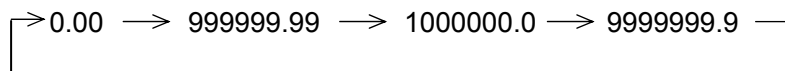
	Current	Voltage
1P2W system	L1(R)-current	L1(P1-P0)-voltage
1P3W system	L1(R)-current L2(T)-current	L1-voltage, L2-voltage (P1-P0) (P2-P0)
3P3W system	L1(R)-current, L2(T)-current, L3(S)-current	L1-voltage, L2-voltage, L3-voltage (P1-P0) (P2-P0) (P1-P2)
3P4W system	L1(R)-current, L2(S)-current, L3(T)-current	L1-voltage, L2-voltage, L3-voltage (P1-P0) (P2-P0) (P3-P0)

6.1.1 Integrated Electric Power

- It displays the integrated electric power.
- Press <SHIFT/▽> to shift active power, reactive power, apparent power.



- Integrated electric power is measured and displayed from 0.00 to 9999999.9 (kWh/kvarh/kVAh).
- The decimal point is changed automatically.

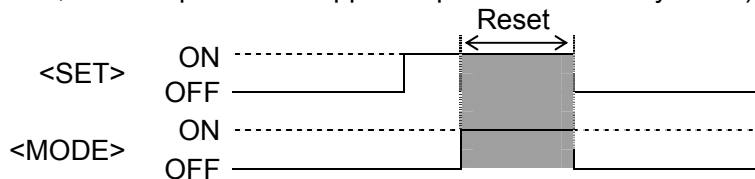


(After reaching the full-scale (9999999.9), the value reverts to 0.00 but continues to measure.)

*Although instantaneous reactive power is “–(minus)” value when leading phase and it shows “–(minus)” in the display, it doesn’t integrate the integrated apparent power.

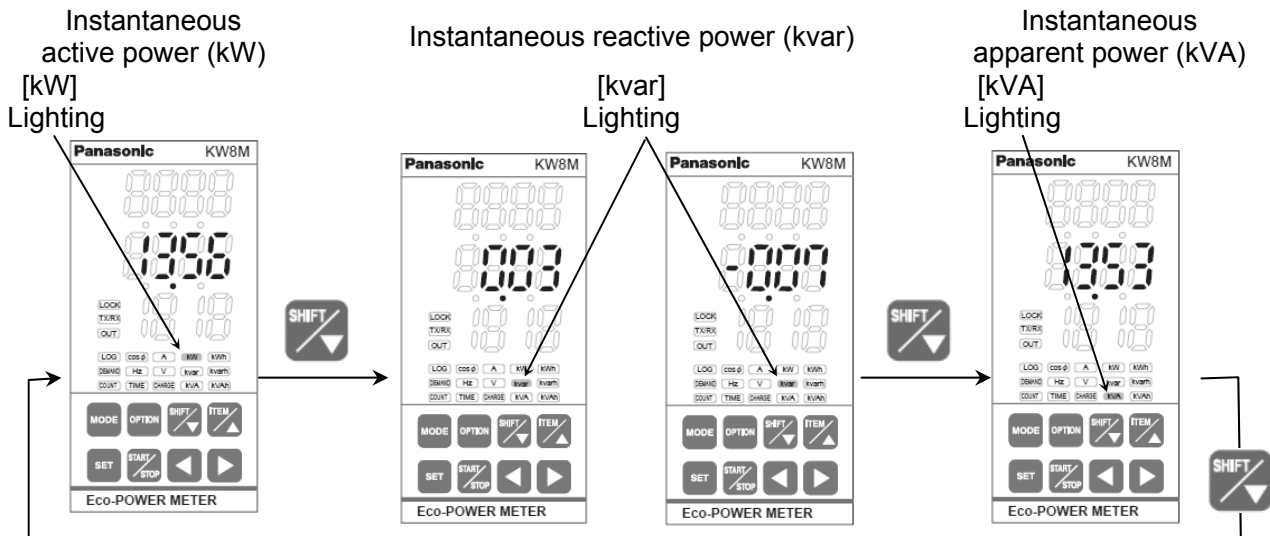
How to reset the integrated electric power (active/reactive/apparent)

- Hold down <SET> and press <MODE> makes integrated electric power clear.
(Active power, reactive power and apparent power are reset by each.)



6.1.2 Instantaneous Electric Power

- It displays the Instantaneous electric power.
- Press <SHIFT/▽> to shift active power, reactive power, apparent power.

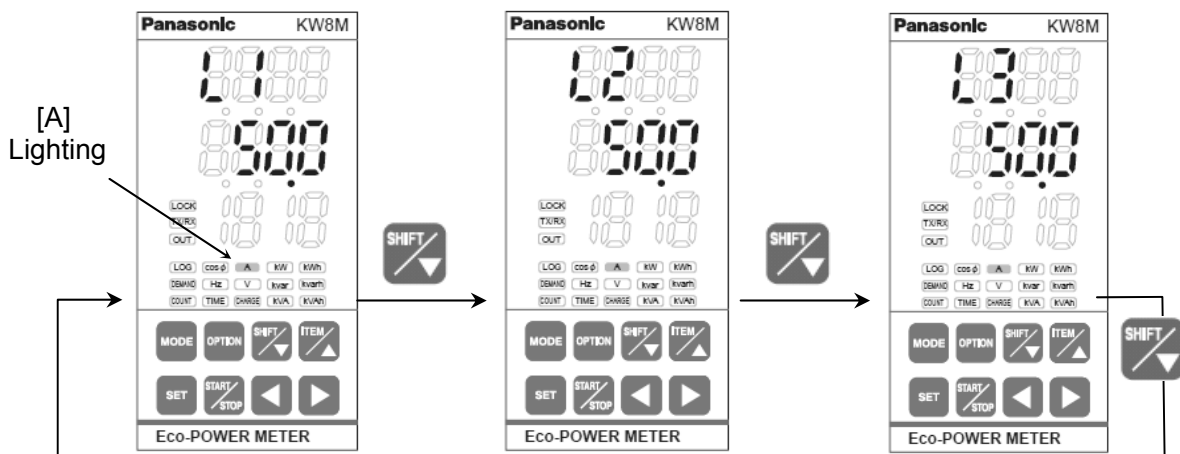


*Instantaneous reactive power is “–(minus)” value when leading phase and it shows “–(minus)” in the display. It is “+ (plus)” value when lagging phase, but it doesn’t show “+ (plus)”.

6.1.3 Current

- It displays the current value of the load.
- Press <SHIFT/▽> to change L1(CT1)-phase, L2(CT2)-phase, L3(CT3)-phase current.

*Before start measuring, select phase and wire system according to the measured load.
When 1P3W or 3P3W is selected, it doesn’t measure 1P2W system correctly. When 3P4W system is selected, it doesn’t measure 1P2W, 1P3W, 3P3W system correctly.
Select phase and wire system according to the measured system. (Refer to the explanation of setting mode.)



- 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	L1	L2	L3
Single-phase two-wire	L1(R) current	(Skip)	(Skip)
Single-phase three-wire	L1(R) current	L2 (T) current	(Skip)
Three-phase three-wire	L1(R) current	L2 (T) current	L3 (S) current
Three-phase four-wire	L1(R) current	L2 (S) current	L3 (T) current

6.1.4 Voltage

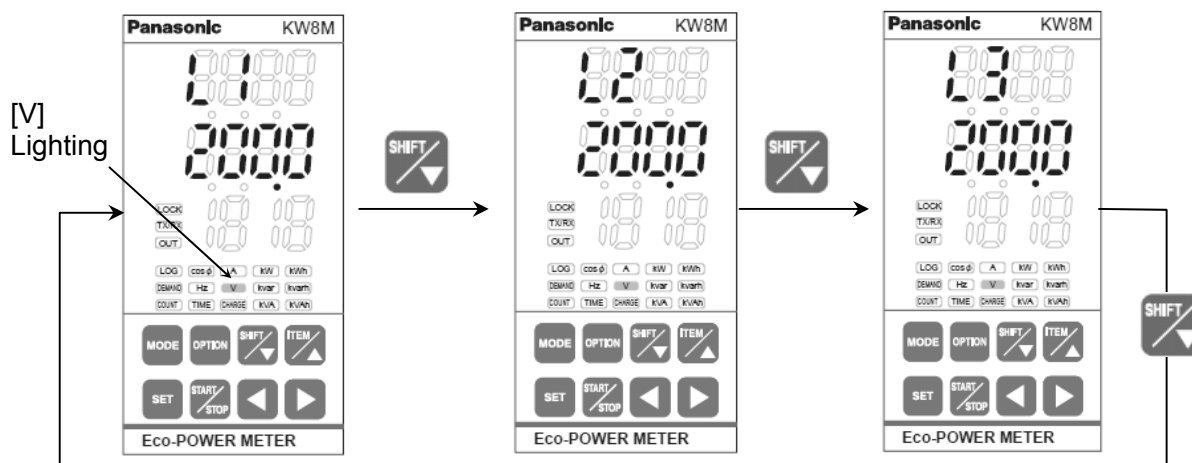
•It displays the voltage value of the load.

•Press <SHIFT/▽> to change voltage between P1 and P0, P2 and P0, P3 and P0.

*Before start measuring, select phase and wire system according to the measured load.

When 1P3W or 3P3W is selected, it doesn't measure 1P2W system correctly. When 3P4W system is selected, it doesn't measure 1P2W, 1P3W, 3P3W system correctly.

Select phase and wire system according to the measured system. (Refer to the explanation of setting mode.)



•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(400) 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.

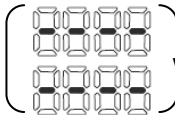
Display System	L1 V	L2 V	L3 V
Single-phase two-wire	Between P1 and P0 (R) voltage(line-voltage)	(Skip)	(Skip)
Single-phase three-wire	R voltage (phase-voltage)	S voltage (phase-voltage)	(Skip)
Three-phase three-wire	Between P1 and P0 (R) voltage (line-voltage)	Between P2 and P0 (T) voltage (line-voltage)	Between P1 and P2 (S) voltage (line-voltage)
Three-phase four-wire	R voltage (phase-voltage)	S voltage (phase-voltage)	T voltage (phase-voltage)

6.1.5 Electricity Charge

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



*When the value exceeds '99999999',

 will be displayed.

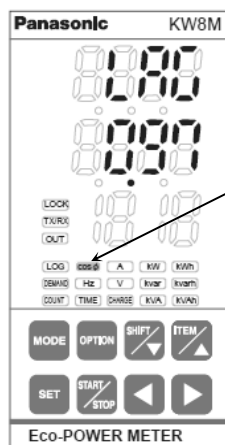
6.1.6 Power factor

- It displays the loads' power factor.

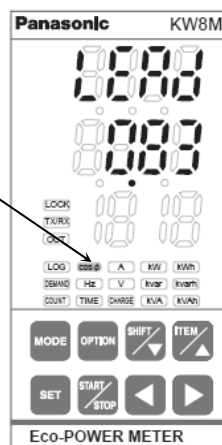
*Before start measuring, select phase and wire system according to the measured load.

When selected system does not meet it, it can not measure correctly. (Refer to the explanation of setting mode.)

Sample of lagging phase



Sample of leading phase



- How to calculate power factor

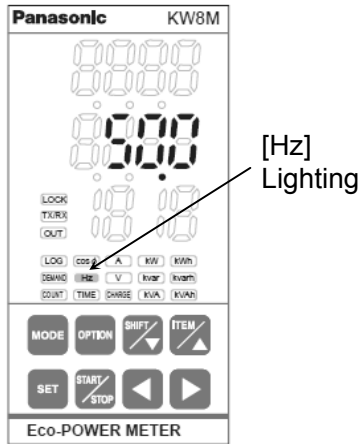
Eco-POWER METER displays power factor by calculating as below.

Power factor operation is a method assuming balanced load. The error might be big when it measures unbalanced load.

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

6.1.7 Frequency

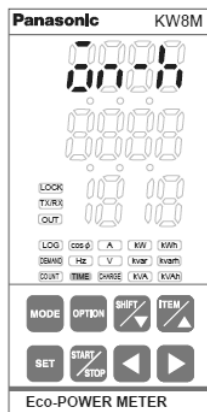
- It displays the frequency.



6.1.8 Hour meter

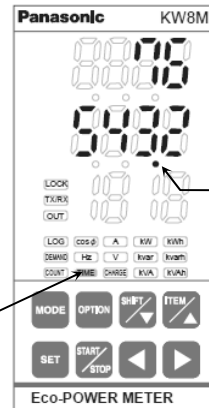
- It displays the load ON-time or load OFF-time measured by CT1.
- Press <SHIFT/▽> to change the load ON-time to load OFF-time.
- *"ON-h" and "OFF-h" display disappears after a few seconds by pressing <ITEM/△> or <SHIFT/▽>.

ON-time (h)

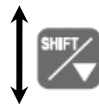


after a few seconds

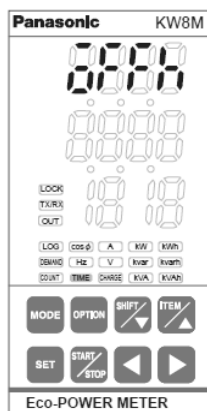
[TIME]
Lighting



Blinking the decimal point
during measurement of
ON-time

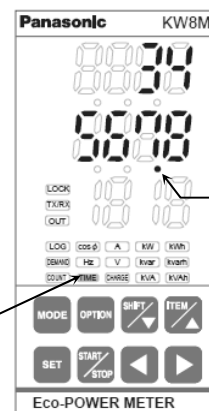


OFF-time (h)



after a few seconds

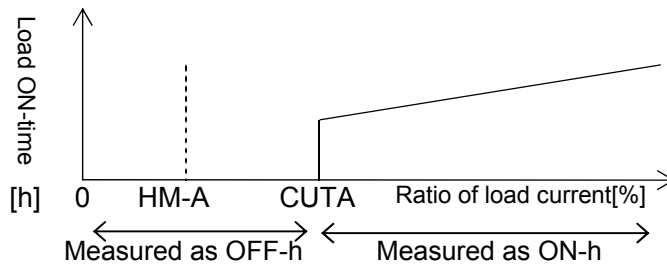
[TIME]
Blinking



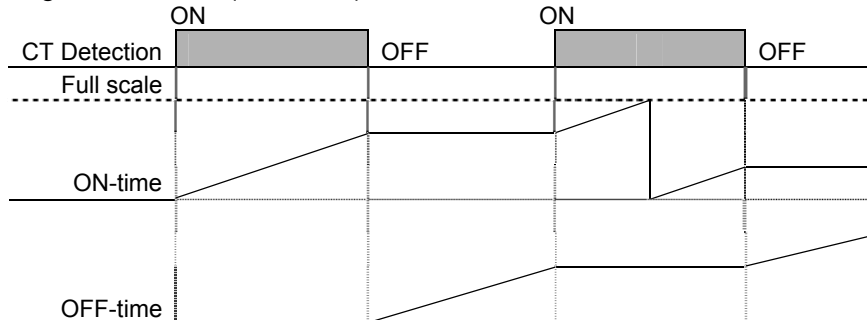
Blinking the decimal point
during measurement of
OFF-time

*When load current is under the setting current for time measurement (HM-A), it measures as OFF-time. When load current is exceeded to the setting current for time measurement (HM-A), it measures as ON-time. Current for time measurement (HM-A) is set to under cutoff current (CUTA), all current is measured as OFF-time.

*Current flow of CT1

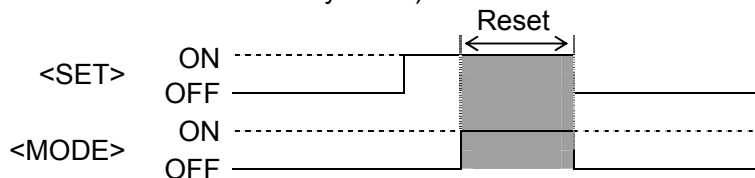


*After reaching the full scale (99999.9h), the value reverts to 0.0h but continues to measure.



How to Reset ON/OFF-time

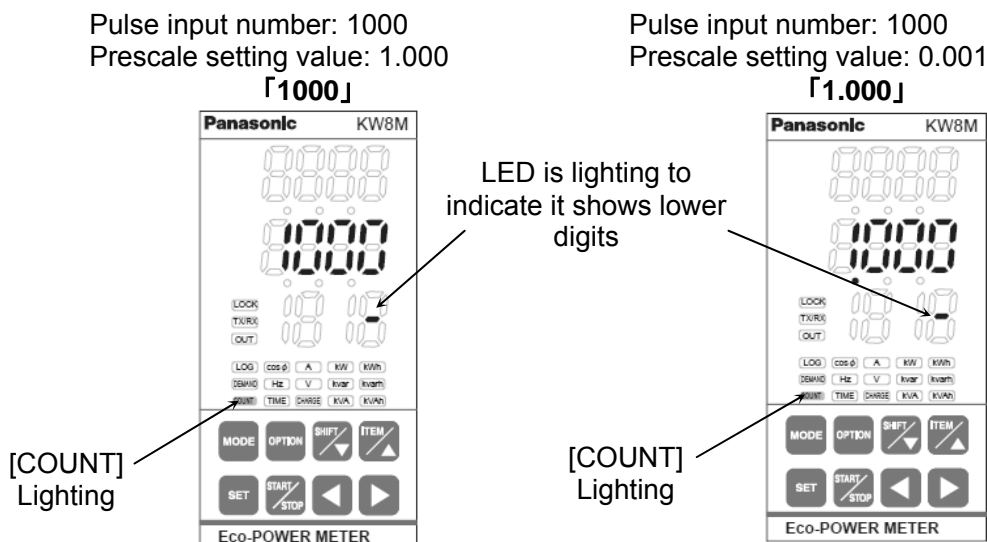
• Hold down <SET> and press <MODE> makes ON-time or OFF-time clear.
(ON-time and OFF-time are reset by each.)



6.1.9 Counter

• It displays present count value (pulse input value).

*The position of decimal point for count-number and preset value is decided according to the setting at 'Pre-scale setting mode'. (Refer to Setting Mode Explanation.)

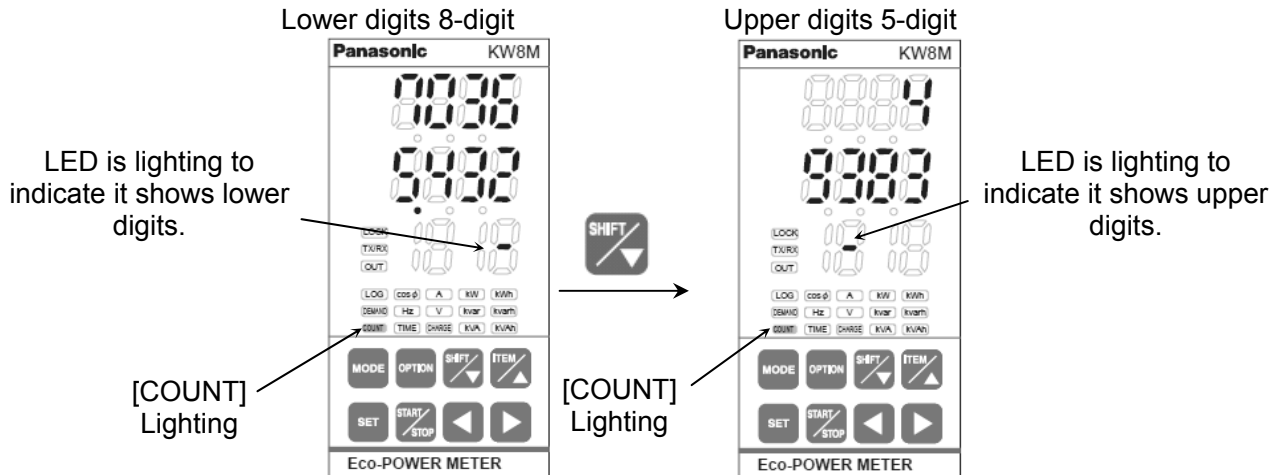


- When the count-number is 8 digits or more, press <SHIFT/▽> to change the upper digits and the lower digits.

Pulse input number: 98765432

Prescale setting value: 50.001

「4938370365.432」



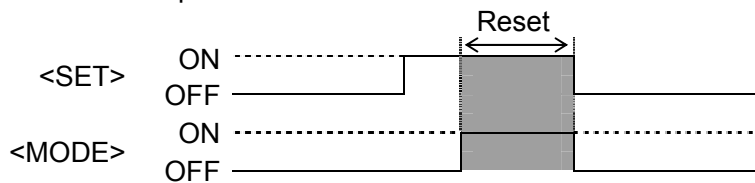
*After reaching the full scale (99999999 x prescale value), the value reverts to 0 but continues to measure.

How to enter preset value

- It is entered and set at preset setting mode of MODE1. (Refer to Setting Mode Explanation.)

How to Reset Count value

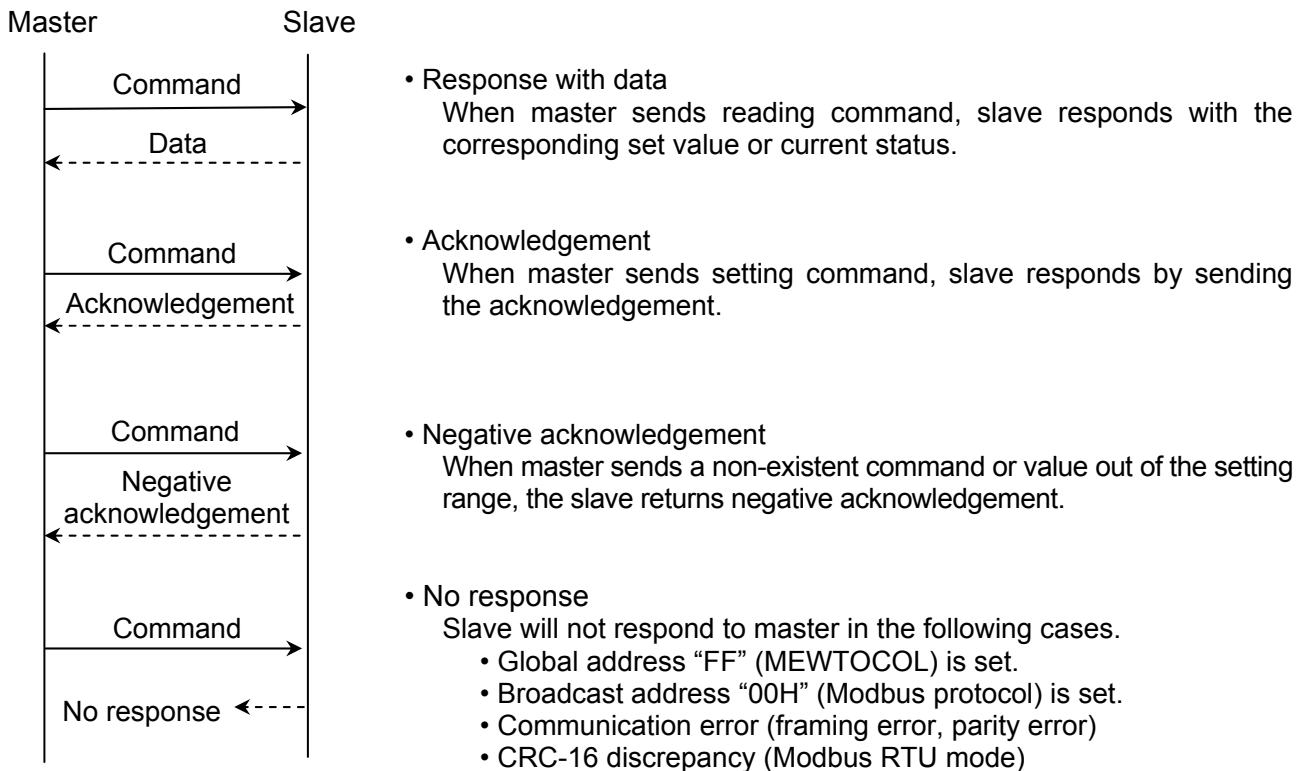
- Hold down <SET> and press <MODE> makes count value clear.



Chapter 7 Communications

7.1 Communication Procedures

Communication starts with command transmission from the host computer (hereafter Master) and ends with the response of Eco-POWER METER (hereafter Slave).



7.2 Communication timing

- ◆ The minimum access time from the master is 1 sec. (Minimum time for update the data)
Eco-POWER METER may not response due to noise and so on, be sure to check that it receives the response from Eco-POWER METER.
- ◆ In order to improve the communication quality, we recommend to send the transmission again.

Communication timing of RS485

◇Eco-POWER METER (Slave) side

When Eco-POWER METER (Slave) starts transmission to RS485 communication line, it is arranged so as to provide an idle status transmission period of about 1 to 99ms (setting available)+Tb before sending the response to ensure the synchronization on the receiving side. After sending the response, master can disconnect the transmitter from the communication line within transmission period 20ms.
(Tb: Transmission period may be longer (0 to 60ms) due to Eco-POWER METER's process.)

◇Master side (Cautions of setting a program)

At communication, keep the following conditions.

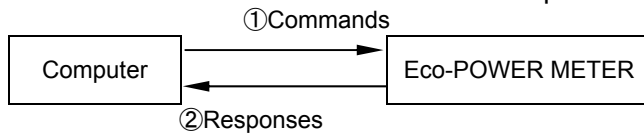
- 1) Set the program so that the master can disconnect the transmitter from the communication line within the transmission period of about 2ms after sending the command in preparation for reception of the response from Eco-POWER METER (Slave).
- 2) To avoid collision of transmissions between the master and Eco-POWER METER (Slave), send a next command after checking that the master received the response.

7.3 MEWTOCOL Communication

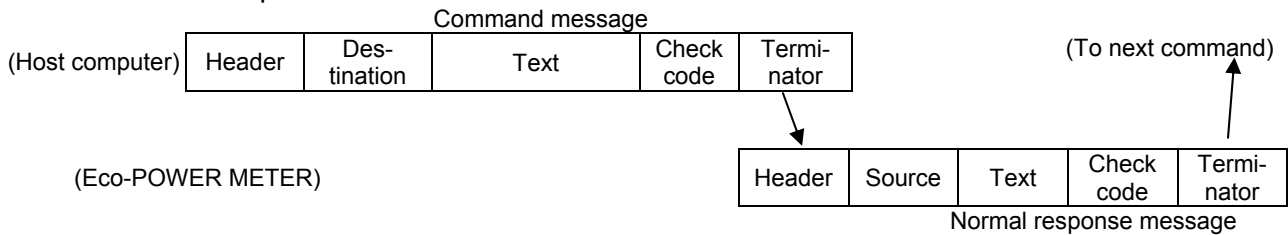
7.3.1 Overview of MEWTOCOL-COM (RS485)

◆ Command and response functions

The computer sends commands (instructions) to Eco-POWER METER, and receives responses in return. This enables the computer and Eco-POWER METER to converse with each other, so that various kinds of information can be obtained and provided.



◆ Command and response formats



◇ Control codes

Name	Character	ASCII code	Explanation
Header	%	25H	Indicates the beginning of a message.
Command	#	23H	Indicates that the data comprises a command message.
Normal response	\$	24H	Indicates that the data comprises a normal response message.
Error response	!	21H	Indicates that the data comprises a response message when an error occurs.
Terminator	CR	0DH	Indicates the end of a message.

◇ Destination and source AD (H), (L)

Two-digit decimal 01 to 99 (ASCII codes)

Command messages contain a station number for Eco-POWER METER that receives the message. When FF (ASCII code table) is used, however, the transmission is a global transmission (sent to all stations at once).

Note) When a global transmission is sent, no response to the command message is returned.

◇ Block check code Bcc (H), (L)

Two-digit hexadecimal 00 to FF (ASCII codes)

These are codes (horizontal parity) that are used to detect errors in the transmitted data.

If “**” is entered instead of “Bcc”, however, messages can be transmitted without the Bcc. In this case, the Bcc is included with the response

◇ Error code Err (H), (L)

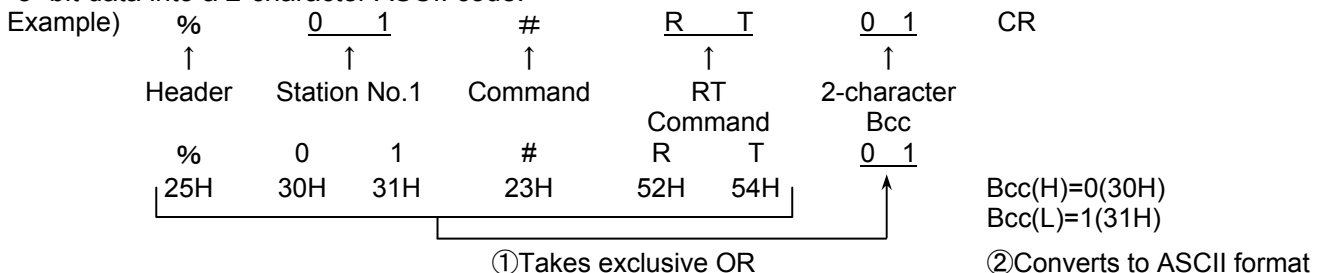
Two-digit hexadecimal 00 to FF (ASCII codes)

These indicate the content if an error occurs.

◆ Bcc (Block Check Code)

-The Bcc is a code that carries out an error check using horizontal parity, to improve the reliability of the data being sent.

-The Bcc uses an exclusive OR from the header (%) to the final character of the text, and converts the 8-bit data into a 2-character ASCII code.



7.3.2 Data Register List

Data register	Name	Unit	Kind of data	Range	R/W
DT00050	Rate	0.01	Unsigned 16bit	0 to 9999	R/W
DT00060	CT type	Rated A (rms)	Unsigned 16bit	2 types: 1, 5	R/W
DT00061	Unit for Pulse output	—	Unsigned 32bit	1(0.001),10(0.01),100(0.1), 1000(1),10000(10),100000(100) 999 (Instantaneous electric power: Values of DT00064, 00065)	R/W
DT00062				777 (Ratio for current alarm: Value of DT00069) 555 (Count value for output: Values of DT00158,00159) 333 (Ratio and time for Stand-by alarm: Value of DT00077,00078)	
DT00063	Primary side current value when CT 5A	1A	Unsigned 16bit	1 to 4000	R/W
DT00064	Alarm value (Instantaneous power)	0.01kW	Unsigned 32bit	0 to 999999999	R/W
DT00065					
DT00066	VT ratio	0.01	Unsigned 16bit	100 to 9999	R/W
DT00067	Current threshold for time measurement	0.1%	Unsigned 16bit	10 to 1000	R/W
DT00068	Cutoff current	0.1%	Unsigned 16bit	10 to 500	R/W
DT00069	Ratio for current alarm	0.1%	Unsigned 16bit	10 to 1000	R/W
DT00070	Voltage range	—	Unsigned 16bit	1; 400V 2; 200V	R/W
DT00077	Ratio for stand-by current	0.1%	Unsigned 16bit	10 to 1000	R/W
DT00078	Time for stand-by alarm	1min.	Unsigned 16bit	0 to 9999	R/W
DT00100	Integrated active power	0.01kWh	Unsigned 32bit	0 to 9999999999	R/W
DT00101					
DT00102	Integrated reactive power	0.01kvarh	Unsigned 32bit	0 to 9999999999	R/W
DT00103					
DT00104	Integrated apparent power	0.01kVAh	Unsigned 32bit	0 to 9999999999	R/W
DT00105					
DT00107	Current L1(R)	0.1A	Unsigned 16bit	0 to 60000	R
DT00108	Current L2(T/S)	0.1A	Unsigned 16bit	0 to 60000	R
DT00109	Current L3(S/T)	0.1A	Unsigned 16bit	0 to 60000	R
DT00111	Power factor	0.01	Signed 16bit	-99 to 100	R
DT00112	Frequency	0.1Hz	Unsigned 16bit	0 to 1000	R
DT00150	Load ON-time	0.1h	Unsigned 32bit	0 to 9999999	R/W
DT00151					
DT00152	Load OFF-time	0.1h	Unsigned 32bit	0 to 9999999	R/W
DT00153					
DT00154	Pulse count value	—	Unsigned 32bit	0 to 999999999	R/W
DT00155					
DT00158	Preset value	—	Unsigned 32bit	0 to 999999999	R/W
DT00159					
DT00160	Prescale value	0.001	Unsigned 32bit	0 to 100000	R/W
DT00161					
DT00162	Max. counting speed	Hz	Unsigned 16bit	30, 2000	R/W
DT00163	Auto-off time	min	Unsigned 16bit	0 to 99 (0:always on)	R/W

Data register	Name	Unit	Kind of data	Range	R/W
DT00170	Voltage L1V(R)	0.1V	Unsigned 32bit	0 to 99999	R
DT00171					
DT00172	Voltage L2V(S/T)	0.1V	Unsigned 32bit	0 to 99999	R
DT00173					
DT00174	Voltage L3V(S/T)	0.1V	Unsigned 32bit	0 to 99999	R
DT00175					
DT00176	Instantaneous active power	0.01kW	Unsigned 32bit	0 to 99999999	R
DT00177					
DT00178	Instantaneous reactive power	0.01kvar	Signed 32bit	-99999999 to 99999999	R
DT00179					
DT00180	Instantaneous apparent power	0.01kVA	Unsigned 32bit	0 to 99999999	R
DT00181					

Note1) R: Read W: Write

2) Data register except specified is 0.

3) DT00061, 00062 (Unit for pulse output) is numerical value (in the range of data register).

4) If each setting value is wrote by communication, it memories to internal EEP-ROM at the same time. Therefore, change setting frequently makes EEP-ROM's life short. Avoid to usage like this.

5) Write a data within the range when you write it.

7.3.3 Error Codes

◇Basic procedure errors

Error code	Error name	Explanation
40H	Bcc error	• A Bcc error occurred in the command data.
41H	Format error	• A command message was sent that does not fit the transmission format.
42H	No support error	• A command was sent that is not supported.
43H	Procedure error	• Delimiter with multiple frames was sent. • The response shall be multiple frames.

◇Application error

Error code	Error name	Explanation
60H	Parameter error	• The data code is not "D".
61H	Data error	• Word No. is specified without decimal. (0000F etc.) • The starting word No. is bigger than the ending word No. • Writing data has a code that is not hexadecimal.
62H	Registration error	• Too many registrations have been entered (more than 17). • "MD" command was sent when some registration has been exist. • "MG" command was sent when registration has not been entered.

◇Self-diagnostic error

Error code	Error name	Explanation
45H	Operation error	• At "WD" command, writing data is exceeded the range of data register.

7.3.4 Command

Eco-POWER METER has 5 kinds of commands.

Command name	Code	Explanation
Read data area	RD	Reads the contents of data area.
Write data to data area	WD	Writes data to a data area.
Resister or Reset data monitored	MD	Resisters the data to be monitored.
Monitoring start	MG	Monitors a registered data.
Read status	RT	Reads the specifications of Eco-POWER METER and error code if an error occurs.

◆[RD]: Read data area (Reads the contents of data area.)

◇Command

%	Destination $\times 10^1$ $\times 10^0$	#	R	D	D	Starting word No. 5 characters $\times 10^4$ $\times 10^3$ $\times 10^2$ $\times 10^1$ $\times 10^0$					Ending word No. 5 characters $\times 10^4$ $\times 10^3$ $\times 10^2$ $\times 10^1$ $\times 10^0$					Bcc $\times 16^1$ $\times 16^0$	CR
---	--	---	---	---	---	--	--	--	--	--	--	--	--	--	--	------------------------------------	----

◇Normal response (Read successful)

%	Source $\times 10^1$ $\times 10^0$	\$	R	D	First register contents 4 characters $\times 16^1$ $\times 16^0$ $\times 16^3$ $\times 16^2$				Last register contents 4 characters $\times 16^1$ $\times 16^0$ $\times 16^3$ $\times 16^2$				Bcc $\times 16^1$ $\times 16^0$	CR
					(lower word)		(higher word)		(lower word)		(higher word)			

◇Error response

%	Source $\times 10^1$ $\times 10^0$!	Error code $\times 16^1$ $\times 16^0$	Bcc $\times 16^1$ $\times 16^0$	CR
(Common to each command)					

◆[WD]: Write data area (Writes data to a data area.)

◇Command

%	Destination $\times 10^1$ $\times 10^0$		#	W	D	D	Starting word No. 5 characters $\times 10^4$ $\times 10^3$ $\times 10^2$ $\times 10^1$ $\times 10^0$					Ending word No. 5 characters $\times 10^4$ $\times 10^3$ $\times 10^2$ $\times 10^1$ $\times 10^0$					First writing data 4 characters $\times 16^1$ $\times 16^0$ $\times 16^3$ $\times 16^2$				⇒
																		(lower word)		(higher word)	

◇Normal response (Write successful)

◇Normal response (Write successful)

%	Source	\$	W	D	Bcc	CR
	$\times 10^1$ $\times 10^0$				$\times 16^1$ $\times 16^0$	

⇒

Last writing data 4 characters				Bcc	CR
$\times 16^1$	$\times 16^0$	$\times 16^3$	$\times 16^2$	$\times 16^1$	$\times 16^0$
(lower word)		(higher word)			

◆[MD]: Register or Reset data monitored (Registers the data to be monitored.) *Up to 16 points can be registered for one unit.

◇Command (Register)

%	Destination $\times 10^1$ $\times 10^0$		#	M	D	D	Word No. 5 characters $\times 10^4$ $\times 10^3$ $\times 10^2$ $\times 10^1$ $\times 10^0$					D	Word No. 5 characters $\times 10^4$ $\times 10^3$ $\times 10^2$ $\times 10^1$ $\times 10^0$					Bcc $\times 16^1$ $\times 16^0$	CR
---	--	--	---	---	---	---	---	--	--	--	--	---	---	--	--	--	--	------------------------------------	----

◇Command (Register reset)

%	Destination $\times 10^1$ $\times 10^0$	#	M	D	F	F	F	F	F	F	Bcc $\times 16^1$ $\times 16^0$	CR
												16 points max.

◇Normal response (Registration successful)

%	Source $\times 10^1$ $\times 10^0$	\$	M	D	BCC $\times 16^1$ $\times 16^0$	CR
						Fixed (6 characters)

◆[MG]: Monitoring start (Monitors a registered data.)

◇Command

%	Destination $\times 10^1$ $\times 10^0$	#	M	G	Bcc $\times 16^1$ $\times 16^0$	CR
---	--	---	---	---	------------------------------------	----

◇Normal response (Monitoring successful)

%	Source $\times 10^1$ $\times 10^0$	\$	M	G	0	0	0	No. of characters in data line 2 characters $\times 16^1$ $\times 16^0$	Data ① 4 characters $\times 16^1$ $\times 16^0$ $\times 16^3$ $\times 16^2$				Data ② 4 characters $\times 16^1$ $\times 16^0$ $\times 16^3$ $\times 16^2$				Bcc $\times 16^1$ $\times 16^0$	CR
									(lower word)		(higher word)		(lower word)		(higher word)			

◆[RT]: Read the status of Eco-POWER METER (Reads the specifications of Eco-POWER METER and error codes if an error occurs.)

◇Command

%	Destination $\times 10^1$ $\times 10^0$	#	R	T	Bcc $\times 16^1$ $\times 16^0$	CR
---	--	---	---	---	------------------------------------	----

◇Normal response (Read successful)

%	Source ×10 ¹ ×10 ⁰		\$	R	T	Model code 1 2 characters ×16 ¹ ×16 ⁰		Model code 2 2 characters ×16 ¹ ×16 ⁰		Version 4 characters ×16 ³ ×16 ² ×16 ¹ ×16 ⁰				Operation mode 2 characters ×16 ¹ ×16 ⁰		Error flag 2 characters ×16 ¹ ×16 ⁰		Self-diagnostic error No. 4 characters ×16 ¹ ×16 ⁰ ×16 ³ ×16 ²				Bcc ×16 ¹ ×16 ⁰		CR	
																			(lower word)		(higher word)				

*With this unit, it responses "99" for Model code1, "16" for Model code2.

*With this unit, it responses "99" for Model code1, "16" for Model code2.

Note) The maximum number of reading slaves is 26 (57 bytes), the maximum number of writing slaves is 23 (55 bytes).

7.4 MODBUS (RTU) Communication

7.4.1 Overview of MODBUS (RTU)

◆8-bit binary data in command is transmitted as it is.

Data format	Start bit	: 1 bit
	Data bit	: 8 bits *7bits is not available.
	Parity	: No parity, Even parity, Odd parity Selectable
	Stop bit	: 1 bit (Fixed)
	Error detection	: CRC-16 (Cyclic Redundancy Check)
	Data interval	: 3.5 character transmission time or more

◆Message configuration

RTU mode is configured to start after idle time processing of more than 3.5 character transmissions and end after idle time processing of more than 3.5 character transmissions.

3.5 idle characters	Slave address	Function code	Data	Error check CRC-16	3.5 idle characters
	8-bit	8-bit	* * bits	16-bit	

Master judges the transmission complete after no command for 4-characters idle time and process the command.

*Transmission speed and judgment time to complete transmission

Transmission speed (bps)	Judgment time to complete (ms)
38400	about 1.00
19200	about 2.00
9600	about 4.00
4800	about 8.00
2400	about 16.00

◇Slave address:

Slave address is an individual instrument number on the slave side and is set within the range 1 to 99 (01H to 63H). Master identifies slaves by the slave address of the requested message.

Slave informs master which slave is responding to master by placing its own address in the response message. Slave address 0 (00H, broadcast address) can identify all slaves connected. However slaves do not respond.

◇Function code: Function code is command code for the slave to undertake the following action types.

Function code	Contents
03(03H)	DT Read
06(06H)	DT1 word write
16(10H)	DT several data write

Function code is used to discern whether the response is normal (acknowledgement) or if any error (negative acknowledgement) has occurred when slave returns response message to master.

When acknowledgement is returned, slave simply returns original function code. When negative acknowledgement is returned, MSB of original function code is set as 1 for response.

For example, when the master sends request message setting 00H to function code by mistake, slave returns 80H by setting MSB to 1, because the former is an illegal function.

For negative acknowledgement, the exception codes below are set to data of response message and returned to master in order to inform it of what kind of error has occurred.

Exception code	Contents
1(01H)	Illegal Function (Non-existent function)
3(03H)	Illegal data value (Value out of the device numbers)

note1) Even if it commands to write (06H.10H) to non-existent data address, slave response with acknowledgement. However, it doesn't write.

note2) Even if it commands to write the value out of the setting range, slave response with acknowledgement. However, it doesn't write.

note3) The maximum number of reading slaves is 26 (57 bytes), the maximum number of writing slaves is 23 (55 bytes).

◇Data: Data depends on the function code.

A request message from the master side is composed of data item, number of data and setting data.

A response message from the slave side is composed of number of bytes, data and exception code in negative acknowledgement.

◇Error check: 16-bit data to detect communication errors. Refer to the next.

◇Acknowledgement response

When command is to write 1 point, same message of command is responded.

When command is to write several points, part of command message (6 bytes) is responded.

◆Error check

After calculating CRC-16 (Cyclic Redundancy Check) from slave address to the end of data, the calculated 16-bit data is appended to the end of message in sequence from low order to high order.

<How to calculate CRC>

In CRC system, the information is divided by the polynomial series. The remainder is added to the end of the information and transmitted. The generation of polynomial series is as follows.

(Generation of polynomial series: $X^{16} + X^{15} + X^2 + 1$)

- 1) Initialize the CRC-16 data (assumed as X) (FFFFH).
- 2) Calculate exclusive OR (XOR) with the 1st data and X. This is assumed as X.
- 3) Shift X one bit to the right. This is assumed as X.
- 4) When a carry is generated as a result of the shift, XOR is calculated by X of 3) and the fixed value (A001H). This is assumed as X. If a carry is not generated, go to step 5).
- 5) Repeat steps 3) and 4) until shifting 8 times.
- 6) XOR is calculated with the next data and X. This is assumed as X.
- 7) Repeat steps 3) to 5).
- 8) Repeat steps 3) to 5) up to the last data.
- 9) Set X as CRC-16 to the end of message in sequence from low order to high order.

◆Message example

<1> Reading electricity rate (0032H) of address 1

• Command

3.5 idle characters	Slave address (01H)	Function code (03H)	Data item (0032H)	Number of data (0001H)	Error check CRC-16 (25C5H)	3.5 idle characters
	1	1	2	2	2	←character number

• Response message from slave in normal status (When Rate=1000(10.00) [03E8H])

3.5 idle characters	Slave address (01H)	Function code (03H)	Number of response byte (02H)	Number of data (03E8H)	Error check CRC-16 (B8FAH)	3.5 idle characters
	1	1	1	2	2	←character number

<2> Setting electricity rate (0032H) of address 1 (When rate is set to 20.00(2000) [07D0H])

• Command

3.5 idle characters	Slave address (01H)	Function code (06H)	Data item (0032H)	Number of data (07D0H)	Error check CRC-16 (2BA9H)	3.5 idle characters
	1	1	2	2	2	←character number

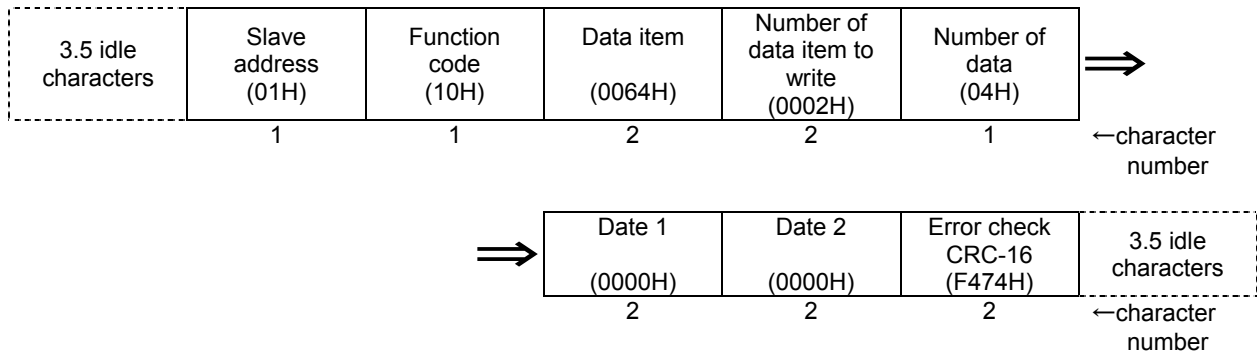
• Response message from slave in normal status

3.5 idle characters	Slave address (01H)	Function code (06H)	Data item (0032H)	Number of data (07D0H)	Error check CRC-16 (2BA9H)	3.5 idle characters
	1	1	2	2	2	←character number

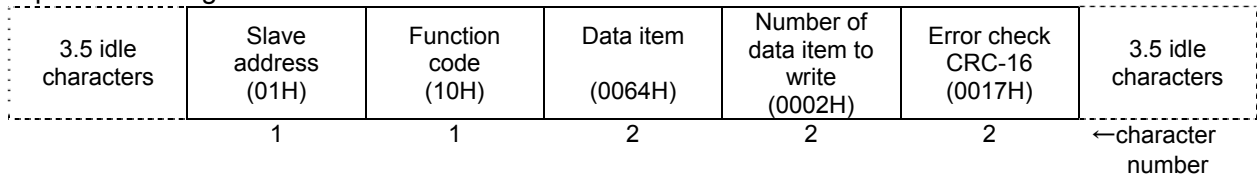
<3> Reset integrated electric power (0064H, 0065H:2-word) of address 1

(When setting to 0 [0000, 0000H])

• Command



• Response message from slave in normal status



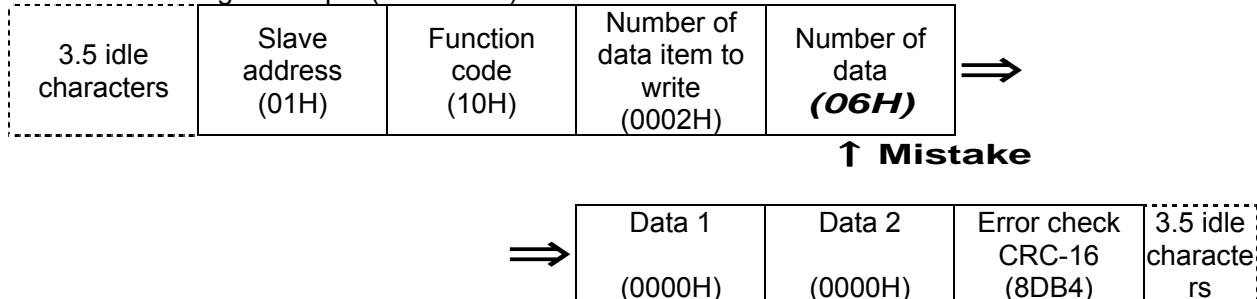
• A response message from the slave in exception (error) status

(When number of data has been mistaken.)

Function code MSB is set to 1 for the response message in exception (error) status (90H).

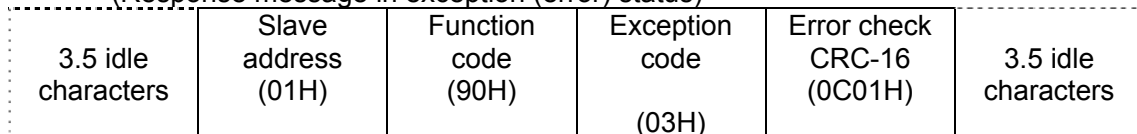
The exception code 03H (Value out of the device numbers) is returned as contents of error.

<Mistaken message example (Command)>



<Response message from slave to mistaken command

(Response message in exception (error) status)>



7.4.2 Data Register List

Data item (MEWTOCOL)	Name	Unit	Kind of date	Range: Hexadecimal (Range: Decimal)	MODBUS Function code
0032H (DT00050)	Rate	0.01	Unsigned 16bit	0H to 270FH (0 to 9999)	03H/ 06H/10H
003CH (DT00060)	CT type	Rated A (rms)	Unsigned 16bit	1H(1), 5H(5)	03H/ 06H/10H
003DH<LSB> (DT00061)	Unit for Pulse output	—	Unsigned 32bit	1H(1)<0.001>, AH(10)<0.01>, 64H(100)<0.1>, 3E8H(1000)<1>, 2710H(10000)<10>, 186A0H(100000)<100>, 3E7H(999) <Instantaneous electric power: Values of DT0040H, 0041H> 309H(777) <Ratio for current alarm: Value of DT0045H> 22B(555) <Count value for output: Values of DT009AH,009BH> 14DH(333) <Ratio and time for Stand-by alarm: Value of 004DH,004EH>	03H/ 06H/10H
003EH<MSB> (DT00062)					
003FH (DT00063)	Primary side current value when CT 5A	1A	Unsigned 16bit	1H to FA0H (1 to 4000)	03H/ 06H/10H
0040H<LSB> (DT00064)	Alarm value (Instantaneous active power)	0.01kW	Unsigned 32bit	0H to 5F5E0FFH (0 to 99999999)	03H/ 06H/10H
0041H<MSB> (DT00065)					
0042H (DT00066)	VT ratio	0.01	Unsigned 16bit	64H to 270FH (100 to 9999)	03H/ 06H/10H
0043H (DT00067)	Current threshold for time measurement	0.1%	Unsigned 16bit	AH to 3E8H (10 to 1000)	03H/ 06H/10H
0044H (DT00068)	Cutoff current	0.1%	Unsigned 16bit	AH to 1F4H (10 to 500)	03H/ 06H/10H
0045H (DT00069)	Current alarm value	0.1%	Unsigned 16bit	AH to 3E8H (10 to 1000)	03H/ 06H/10H
0046H (DT00070)	Voltage range	—	Unsigned 16bit	1H(1):400V, 2H(2):200V	03H/ 06H/10H
004DH (DT00077)	Current ratio for stand-by alarm	0.1%	Unsigned 16bit	AH to 3E8H (10~1000)	03H/ 06H/10H
004EH (DT00078)	Time for stand-by Alarm	—	Unsigned 16bit	1H to 270FH (1~9999)	03H/ 06H/10H
0064H<LSB> (DT00100)	Integrated active power	0.01kWh	Unsigned 32bit	0H to 3B9AC9FFH (0 to 999999999)	03H/ 06H/10H
0065H<MSB> (DT00101)					
0066H<LSB> (DT00102)	Integrated reactive power	0.01kvarh	Unsigned 32bit	0H to 3B9AC9FFH (0 to 999999999)	03H/ 06H/10H
0067H<MSB> (DT00103)					
0068H<LSB> (DT00104)	Integrated apparent power	0.01kVAh	Unsigned 32bit	0H to 3B9AC9FFH (0 to 999999999)	03H/ 06H/10H
0069H<MSB> (DT00105)					
006BH (DT00107)	Current L1(R)	0.1A	Unsigned 16bit	0H to EA60H (0 to 60000)	03H
006CH (DT00108)	Current L2(T/S)	0.1A	Unsigned 16bit	0H to EA60H (0 to 60000)	03H
006DH (DT00109)	Current L3(S/T)	0.1A	Unsigned 16bit	0H to EA60H (0 to 60000)	03H
006FH (DT00111)	Power factor	0.01	Signed 16bit	FF9DH to 64H (-99 to 100)	03H
0070H (DT00112)	Frequency	0.1	Unsigned 16bit	0H to 3E8H (0 to 1000)	03H

Data item (MEWTOCOL)	Name	Unit	Kind of data	Range: Hexadecimal (Range: Decimal)	MODBUS Function code
0096H<LSB> (DT00150)	Load ON-time	0.1h	Unsigned 32bit	0H to F423FH (0 to 999999)	03H/ 06H/10H
0097H<MSB> (DT00151)					
0098H<LSB> (DT00152)	Load OFF-time	0.1h	Unsigned 32bit	0H to F423FH (0 to 999999)	03H/ 06H/10H
0099H<MSB> (DT00153)					
009AH<LSB> (DT00154)	Pulse count value	—	Unsigned 32bit	0H to 5F5E0FFH (0 to 99999999)	03H/ 06H/10H
009BH<MSB> (DT00155)					
009EH<LSB> (DT00158)	Preset value	—	Unsigned 32bit	0H to 5F5E0FFH (0 to 99999999)	03H/ 06H/10H
009FH<MSB> (DT00159)					
00A0H<LSB> (DT00160)	Prescale value	—	Unsigned 32bit	0H to 186A0H (0 to 100000)	03H/ 06H/10H
00A1H<MSB> (DT00161)					
00A2H (DT00162)	Max. counting speed	Hz	Unsigned 16bit	1EH (30), 7D0H (2000)	03H/ 06H/10H
00A3H (DT00163)	Auto-off time	min	Unsigned 16bit	0H to 63H (0 to 99)	03H/ 06H/10H
00AAH<LSB> (DT00170)	Voltage L1V (R)	0.1V	Unsigned 32bit	0H to 1869FH (0 to 99999)	03H
00ABH<MSB> (DT00171)					
00ACH<LSB> (DT00172)	Voltage L2 (S/T)	0.1V	Unsigned 32bit	0H to 1869FH (0 to 99999)	03H
00ADH<MSB> (DT00173)					
00AEH<LSB> (DT00174)	Voltage L3V (S/T)	0.1V	Unsigned 32bit	0H to 1869FH (0 to 99999)	03H
00AFH<MSB> (DT00175)					
00B0H<LSB> (DT00176)	Instantaneous active power	0.01kW	Unsigned 32bit	0H to 5F5E0FFH (0 to 99999999)	03H
00B1H<MSB> (DT00177)					
00B2H<LSB> (DT00178)	Instantaneous reactive power	0.01kvar	Signed 32bit	FF676981H to 5F5E0FFH (-99999999 to 99999999)	03H
00B3H<MSB> (DT00179)					
00B4H<LSB> (DT00180)	Instantaneous apparent power	0.01kVA	Unsigned 32bit	0H to 5F5E0FFH (0 to 99999999)	03H
00B5H<MSB> (DT00181)					

<LSB>: Least significant byte

<MSB>: Most significant byte

note 1) 03H: Read 06H/10H: Write

2) Data register except specified is "0".

3) If each setting value is wrote by communication, it memories to internal EEP-ROM at the same time. Therefore, change setting frequently makes EEP-ROM's life short. Avoid to usage like this.

4) Write a data within the range when you write it.

Chapter 8 Specifications

8.1 Main unit

Rated operating voltage	100 to 240V AC	
Rated frequency	50/60Hz common	
Rated power consumption	8VA	
Inrush current	Max. 30A (240VAC at 25°C)	
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°C (-25 to +70°C at storage)	
Ambient humidity	30 to 85%RH (at 20°C non-condensing)	
Breakdown voltage(initial)	Between the isolated circuits: 2000V for 1min note) Cut-off current: 10mA	A)Outer edge (enclosure) —All terminals B)Insulated circuit •Operating power supply terminals— Analog input terminals •Operating power supply terminals— Pulse input terminal •RS485—All other terminals •Pulse output terminals— All other terminals note1)
Insulation resistance(initial)	Between the isolated circuits: 100MΩor more (measured at 500V DC)	
Vibration resistance	10 to 55Hz (1cycle/min) single amplitude : 0.375mm (1h on 3 axes)	
Shock resistance	Min. 294m/s ² (5 times on 3 axes)	
Display method	8-digit, 7-segment LED	
Power failure memory method	EEP-ROM (more than 100,000 overwrite)	
Size	48 x 96 x 98.5 mm	
Weight	approx.265g (without mounting bracket)	

note1) Analog input terminals: No.11 to 20 / Pulse input terminal: No.4 and 5

8.2 Input Specifications

8.2.1 Electric power input

Phase and wire system		Single-phase two-wire system Single-phase three-wire system Three-phase three-wire system Three-phase four-wire system
Input voltage	Rating	Single-phase two-wire : 0 -440V AC (Line voltage) Single-phase three-wire : 0 -220V AC (Phase voltage) Three-phase three-wire : 0 -440V AC (Line voltage) Three-phase four-wire : 0 -254V AC (Phase voltage)
	Allowable measurement voltage	Up to 120% of rated input voltage Single-phase two-wire : 0-528V AC (Line voltage) Single-phase three-wire : 0-264V AC (Phase voltage) Three-phase three-wire : 0-528V AC (Line voltage) Three-phase four-wire : 0-300V AC (Phase 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 440V system. (Secondary voltage rating of a VT is 110V.)
Input current	Measured current (Primary side current of CT)	1 to 4000A (Set with setting mode) *Use CT with secondary side current 1A or 5A.
	Rated input current (Secondary side current of CT)	1A or 5A (Select with setting mode)
	Allowable measured current	120% of rated input current
	Current overload capacity	1000% of rated input current 3 sec.
Special functions	Cut-off current	1.0 to 50.0%F.S
	Cut-off voltage	Under 5% of rated voltage (Fixed) (Under the value calculated by rated voltage x 0.05 x VT ratio)
	Current threshold for hour meter	1.0 to 100.0%F.S.
Accuracy (without error in CT and VT)	Instantaneous electric power (active/ apparent) Integrated electric power (active/ apparent) Voltage Current Electricity charge	$\pm(1.0\% \text{ F.S.} + 1\text{digit})$ (at 20°C, rated input, rated frequency, power-factor 1) *Accuracy coverage: 5 to 100% of rated current
	Instantaneous electric power (reactive) Integrated electric power (reactive)	$\pm(2.0\% \text{ F.S.} + 1\text{digit})$ (at 20°C, rated input, rated frequency, power-factor 1)
	Hour meter	$\pm(0.01\% + 1\text{digit})$ (at 20°C) [In case power on start or current energizing] $\pm(0.01\% + 1\text{s} \pm 1\text{digit})$
	Temperature characteristics	$\pm(1.0\% \text{ F.S.} / 10^\circ\text{C} + 1\text{digit})$ (Range of -10 to 50°C, rated input, power-factor 1)
	Frequency characteristics	$\pm(1.0\% \text{ F.S.} + 1\text{digit})$ (Frequency change $\pm 5\%$ based on rated frequency, rated input, power-factor 1)

8.2.2 Pulse input

Input mode		Addition (Fixed)
Max. counting speed		2kHz /30Hz (Select with setting mode)
Pulse input		Min. input signal width: 0.25ms (When 2kHz selected) /16.7ms (When 30Hz selected) ON:OFF ratio = 1 : 1
Input signal		Contact / No contact (open collector) • Impedance when shorted: Max. 1kΩ • Residual voltage when shorted: Max. 2V • Impedance when open: Min. 100kΩ
Output mode		HOLD (Over count)
Pre-scale setting	Decimal point	Set to 3rd decimal places
	Range	0.001 to 100.000 (Selectable with setting mode)

8.3 Pulse output (Transistor output) Specifications

Number of output point	1 point
Insulation method	Optical coupler
Output type	Open collector
Output capacity	100mA 30V DC
Pulse width	approx. 100ms
ON state voltage drop	1.5V or less
OFF state leakage current	100 μ A or less
Pulse output unit	0.001/0.01/0.1/1/10/100kWh/Alarm(AL-P)/ Current alarm(AL-C) /Stand-by alarm (AL-S) /Counter(Cnt) (Selectable with setting mode)

* We recommend the setting of minimum unit for pulse output for measurement shown as below.

Output pulse: 4-pulse or less per 1sec.

How to calculate

(Unit for pulse output: PL-P) > (Max. measurement power [kW]) \div (3600[s] \times 4 [pulse/s])

Caution (1) Improper unit setting may cause miss counting.

(2) If the OFF time is too short, there is a possibility of counting errors.

8.4 Communication Specifications

Interface		Conforming to RS485
Protocol		MEWTOCOL/MODBUS(RTU) (selectable with setting mode)
Isolation status		Isolated with the internal circuit
Number of connected units		99 (max.) *2 *3
Transmission distance		1200m (max.) *1
Transmission speed		38400/19200/9600/4800/2400bps (selectable with setting mode)
Transmission Format	Data length	8bit/7bit (selectable with setting mode) *4
	Parity	Not available / Odd number / Even number (selectable with setting mode)
	Stop bit	1bit (fixed)
Communication method		Half-duplex
Synchronous system		Synchronous communication method
Ending resistance		approx. 120Ω(built-in)

*1 Please check with the actual devices when some commercial devices with RS485 interface are connected. The number of connected devices, transmission distance, and transmission speed may be different according to using transmission line.

*2 For RS485 converter on the computer side, we recommend SI-35 and SI-35USB (from LINE EYE Co.,Ltd.).

*3 When using SI-35,SI-35USB or PLC from our company (which can be connected up to 99 units), up to 99 Eco-POWER METER can be connected. In case using this system with the other devices, up to 31 Eco-POWER METER can be connected.

*4 With MODBUS(RTU) protocol, it works only with 8bit.

8.5 Self-diagnostic function

If an error occurs, the following indication will be given.

Indicator	Meaning	Output status	To recover
ERR0	CPU error	OFF	Turn the power off and then on again.
ERR1	Memory error*		EEP-ROM life ended. Replace the unit.

*Includes the possibility that the EEPROM's life has expired.

8.6 Power Failure Memory

Eco-POWER METER memories integrated electric power and working status to internal EEPROM until when power supply is off. (Power failure guarantee)

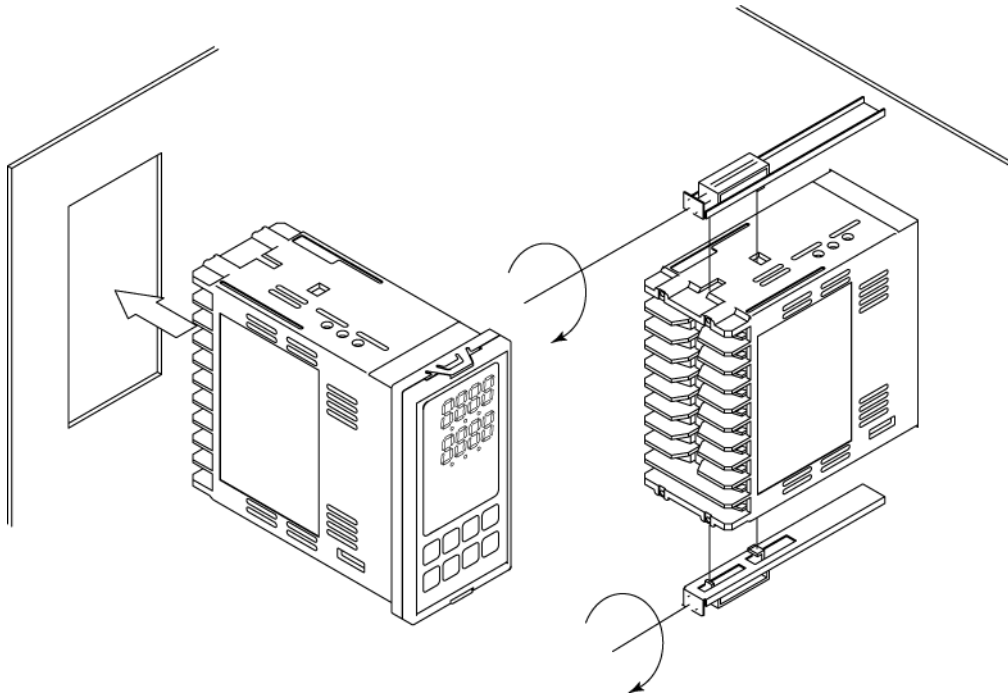
And every time to change each setting, each setting value is memorized to internal EEPROM at the same time. Therefore, change setting frequently makes EEPROM's life short. Avoid to usage like this.

*Especially be careful if you set by communication.

8.7 Applicable standard

Safety standard	EN61010-1		
EMC	EMI EN61326-1	Radiation interference field strength Noise terminal voltage	CISPR11 class A CISPR11 class A
	EMS EN61326-1	Static discharge immunity RF electromagnetic field immunity EFT/B immunity Surge immunity Conductivity noise immunity Power frequency magnetic field immunity Voltage dip / Instantaneous stop / Voltage fluctuation immunity	EN61000-4-2 EN61000-4-3 EN61000-4-4 EN61000-4-5 EN61000-4-6 EN61000-4-8 EN61000-4-11

9.3 Panel mounting



- 1) Insert a unit from the front of the panel.
 - 2) Attach the mounting bracket by the holes at the top and bottom of case and secure in place with screws.
- Fastening torque: approx. $0.12\text{N}\cdot\text{m}$
 - Panel thickness: 1 to 15mm

Chapter 10 Q&A

Q1	I'd like to measure by Eco-POWER METER. Measured load is 50 to 60A in normal operation. But the inrush current is 130 to 140 A. Which CT is selected? (100A or 250A)
A1	Select 100ACT. Stable current more than 1 second is necessary to measure. The inrush current seems to be a few ms, therefore it can't measure it. In case there is current over 1 second (inrush current), it measures it and select 250A CT.
Q2	Current and voltage are displayed. But it can't measure an electric power.
A2	<ul style="list-style-type: none"> •Do you install CT to the correct position and correct direction? CT has directions. Install CT according to the direction marked. From power supply side (K) to load side (L). •Do you wire measurement voltage input correctly? When phases of voltage and current are not matched, it can't measure correctly. Please check the wiring.
Q3	How long do I extend CT cable?
A3	You can extend up to about 10 m with cable of AWG#22 or more. We can't guarantee the specifications if you extend more than 10m.
Q4	How do you guarantee the accuracy of measurement with low current range?
A4	Up to 5% for CT rating. In case of CT50A, it guarantees for an electric power with current 2.5A or more.
Q5	How long do I extend pulse input cable?
A5	You can extend up to 10m with shielded wire or a metallic electric wire tube individually.
Q6	What do I use the function of primary side current of CT for.
A6	It is assumed that the use for 2 nd stage CT with combination of CT. You set the primary side current of 1 st stage CT (refer to mode1). In order to measure a large capacity current such as 1000A, it converts to 5A (small current) and measures the load.
Q7	Are there any attachments in order to fix CT?
A7	Sorry but there is no attachment.
Q8	Eco-POWER METER measures only voltage and current. How is it measure an electric power? What is the reason why it can't measure when CT is connected wrong direction?
A8	Electric power is calculated using instantaneous voltage and instantaneous current. When CT is connected wrong direction, it measures minus value in fact, but it displays 0kW with Eco-POWER METER.

Please contact

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