



Power Monitor 51A

Manual

1.1 Revision history

Version	Date	Change
0.0	10/2013	First edition
1.0	02/2014	Page 143, power accuracy corrected from 1 % to 0.5%

1.2 Contact address



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2. Introduction


2.1 Copyright and trademark


- Weidmüller owns the copyright of this manual.
- No part of this manual may be reproduced in any form or by any means without prior permission.
- Modbus Protocol is a communication protocol that developed by Modicon Inc. for PLC. Modbus is the registered trademark of Schneider Electric.
- All other company names or product names that may be mentioned in this publication are trademarks or registered trademarks of their respective owners.

2.2 Meaning of symbols

	DANGER! DANGER (red) indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. This symbol should only be used for extreme situations.
---	---

	WARNING! WARNING (orange) indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
---	---

	CAUTION! CAUTION (yellow) indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.
---	---

	NOTICE NOTICE (blue) indicates a hazardous situation, which, if not avoided, may result in damage to property.
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2.3 Declaration of conformity



The CE marking is a key indicator of a product's compliance with the requirements of the applicable EC directives.

2.4 Types / article numbers


This user manual covers the following product types / article numbers


Power Monitor 51A


1470260000

3. Safety instructions

3.1 Safety guidelines

	NOTICE
	<ul style="list-style-type: none"> • Read the manual carefully prior to installation and maintenance to ensure proper operation. • Prior to use, familiarise yourself with the equipment, safety information and instructions. • This manual uses two safety flags to indicate different levels of danger.

	WARNING!
	<p>A handling error could cause serious physical injury to an operator and in the worst case could even be fatal.</p> <ul style="list-style-type: none"> • 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 another external factor. • Do not use this product in areas with inflammable gas. This 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. • Do not open the secondary side of CT during power on the primary side current. It might cause electric shock or CT breakdown. • Protective insulation exists when the closed unit is operated and touched exclusively using the front panel. • Always use current transformers for galvanic isolation to measure currents.

	CAUTION!
	<p>A handling error could cause serious physical injury to an operator or damage to the equipment.</p> <ul style="list-style-type: none"> • To prevent abnormal exothermic heat or smoke generation, use this product at the values below the maximum of the characteristics and performance guaranteed 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. This could lead to an electric shock. • Use the external devices to operate 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 matter such as liquid, flammable materials, metals etc. to get into 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. • Never remove the terminal block while applying current to load. It might cause electric shock or CT breakdown. • Do not use at secondary side circuit of inverter. It might cause exothermic heat or damage.

3.2 General description

About this product

Power Monitor 51A is designed primarily for managing energy-saving.

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

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 -25 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 due to 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.
 - ◇ In the vicinity of high-voltage cables, high-voltage devices, power lines, power devices.
 - ◇ In the vicinity of machinery with a transmission function such as amateur radio.
 - ◇ In the vicinity of machinery where large switching surges occur.
- Please use the unit in accordance with the specifications described in this manual. Otherwise, it may malfunction or cause fire and an electric shock.
 - ◇ Connect the unit 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.
- ◇ Never remove the terminal block while applying current to load. It might cause electric shock or CT breakdown.
- ◇ Do not perform wiring or installation with a live line. This may result in circuit burnout or fire by way of the secondary CT side opening.

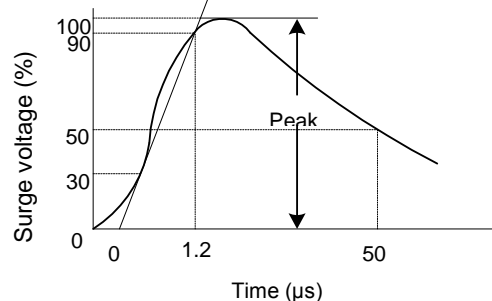
Installation

- Power Monitor 51A is designed to be used in a control panel.
- The power supply terminal and voltage input terminal of the main unit is common. Therefore if additional noise affects the power supply line, incorrect measurements may result.
- Installation and wiring must be performed by specialist personnel for electrical work or electric piping.
- Do not add excess power to the display. It might break the inner liquid crystal.
- Although the case is made from fireproof resin, do not mount it next to flammable materials. Also avoid placing it directly on top of materials that catch fire easily.
- If the operating power supply surge exceeds the following value, the internal circuit could be destroyed, so make sure you use a surge absorption element.

Surge voltage: 6,000 V

Surge wave form

[$\pm (1.2/50) \mu\text{s}$ single-polarity full-wave voltage]



- External noise up to the level shown below is treated as noise voltage, but levels higher than this could lead to malfunctioning or damage to the internal circuit. Although the case is made from fireproof resin, do not mount it next to flammable materials.

Noise voltage: 1,500 V, between operating power supply terminals

Noise wave form (noise simulator):

Rise time: 1 μ s
Pulse width: 50 ns
Polarity: Cycle: 10 ms

Note

Accurate measurement may not be possible if excessive noise is added to the input line.

- This product is designed to be used only with our options.
Options from other companies are not compatible.

Measurement

- If there is harmonic or waveform distortion, measurements may not be accurate. Please check the current system before adopting it.
- It might not measure an instantaneous current such as an inrush current or an welding machine.
- When measuring the loads below, it might not satisfy 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 that requires a balanced load. The error might be considerable when it measures unbalanced load.

3.3 Electrical precautions

Static electricity

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

Power supply

- Connect a breaker to the voltage input part for safety reasons and to protect the device.
The breaker that is connected to the voltage input part must be located in a such that it is easily reached and the display should indicate that 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 the power for the first time.

- Ensure that wiring is correct and there is no electrical conduction on installation.
- Ensure that the power supply wiring, the I/O wiring and the power-supply voltage are correct.
- Tighten the installation screw and the terminal screw securely.
- Use an electric wire applicable to the rated current.

Before changing the setup

- Set the password carefully.
- To avoid inadvertently changing the settings, you can set a password. However, if you forget the password, you will not be able to change the settings.
- We recommend that you make a note of the password when setting and changing the password.

3.4 Handling

Cleaning

- Wipe dirt off the main unit using a soft cloth etc. Using thinner might result in deformation or discoloration of the unit.

4. Description of unit

Power Monitor 51A is used to measure electrical power (voltage, current, etc.), power factor, frequency etc. 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.

It features a built-in thermistor to measure the temperature of the installation site, e.g. inside the panel board, for your reference.

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Model number	1470260000
Model name	Power Monitor 51A

4.1 Measurement data

Phase/wire system	Single-phase two-wire (1P2W) Single-phase three-wire (1P3W) Three-phase three wire (3P3W) Three-phase four-wire (3P4W) (common)
Applicable power system	100 V system, 200 V system, 400 V system
Measurement circuit	1 circuit (when measuring 1P2W: max. 3 circuits)
Input measurement voltage	0 to 500 V AC (L-L) 0 to 300 V AC (L-N)
Input measurement current	1 to 65535 A
Applicable current sensor	Secondary side current: 1 A or 5 A

4.2 Measurands

Item		Unit	Data range displayed	
Instantaneous power	Active	kW	-99999 to 0.000 to 99999	Present value
	Reactive	kvar		Maximum value
	Apparent	kVA		Minimum value
Integral power for each time zone (4 zone) (import)	Active	kWh	0.000 to 9999999.9	Present value
	Reactive	kvarh		
	Apparent	kVAh		
Integral power (import)	Active	kWh	0.000 to 9999999.9	Present value
	Reactive	kvarh		
	Apparent	kVAh		
Integral power (export)	Active	kWh	0.000 to 9999999.9	Present value
	Reactive	kvarh		
Integral power for each time zone (4 zone) (export)	Active	kWh	0.000 to 9999999.9	Present value
	Reactive	kvarh		
Current		A	0.000 to 99999 * ¹	Present value Maximum value Minimum value
Voltage		V	0.00 to 99999 * ¹	Present value Maximum value Minimum value
Power factor			-1.000 to 1.000	Present value Maximum value Minimum value
Frequency		Hz	0.00 to 99.99 * ¹	Present value Maximum value Minimum value
Pulse count value			0.000 to 99999999	Present value
Power conversion value			0.000 to 9999999.9	Present value
Temperature		degree C	-100.0 to 100.0 * ¹	Present value
Calendar			January 1, 2000 00:00:00 to December 31, 2099 23:59:59	Present value

*1 "Data range displayed" is the range that can be indicated with the main unit display, it is not a range that can be measured.

Power quality

Item		Unit	Data range displayed
Unbalanced current	Each phase	%	0.000 to 999.9
Unbalanced voltage	Each phase	%	0.000 to 999.9
Current THD (total harmonic distortion)	Each phase	%	0.000 to 400.0
Voltage THD (total harmonic distortion)	Each phase	%	0.000 to 400.0
Current harmonics (2 nd to 31 st)	Each phase	%	0.000 to 400.0
Voltage harmonics (2 nd to 31 st)	Phase	%	0.000 to 400.0
	Line		

Demand

Item		Unit	Data range displayed
Present demand *1	Active	kW	0.000 to 99999
	Reactive	kvar	
	Apparent	kVA	
	Active (export)	kW	
	Reactive (export)	kvar	
	Current	A	
Estimated demand *2		kW	0.000 to 99999
Ratio of estimated demand *2		%	0.000 to 99999
Integral power converted by pulse *2		kWh	0.000 to 999999.99

Notes

1) The demand value calculated with this function is not guaranteed.

*1 When peak demand is set, only current demand is available.
When 30-min. demand is set, active power demand and current demand are available.

*2 Only when 30-min. demand is set.

4.3 Logging items

Item		Record
Measurement max./min. value for each month with time stamp ^{*1}	Power	12 records (for 12 months)
	Current	
	Voltage	
	Power factor	
	Frequency	
	Unbalanced current	
	Unbalanced voltage	
Max. demand value (active power, reactive power, apparent power, export active power, export reactive power, current) with time stamp ^{*1}		12 records (for 12 months), max. value
Power quality with time stamp for occurrence date and period ^{*1}	Voltage interruption	Up to 10 records
	Over voltage	
	Under voltage	
	Over current	
	Under current	
Pulse output occurrence date (time stamp)	OUT1	Up to 10 records
	OUT2	

^{*1} Time stamps and power quality data can be confirmed via communication. They are not displayed.

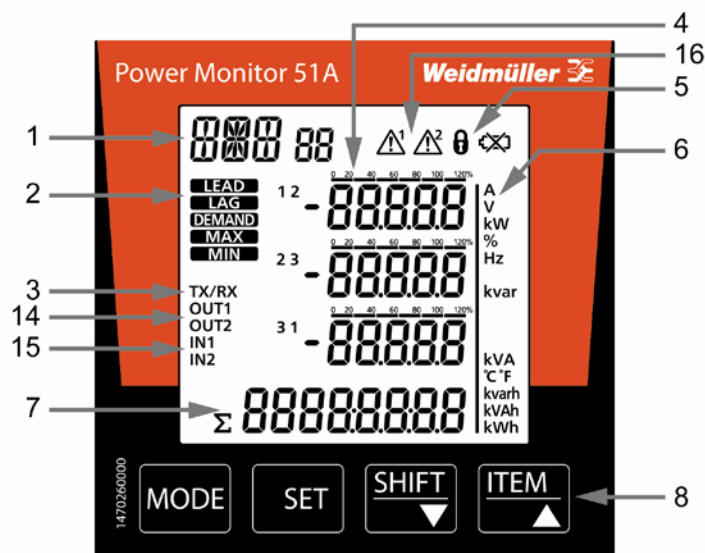
Glossary

THD (total harmonic distortion)	Ratio of harmonic distortion (voltage or current) for the fundamental frequency. A lower value indicates that the distortion is less.
Harmonics	Sinusoidal wave other than fundamental frequency. It has a frequency that is an integer multiple of the fundamental frequency. The frequency that has twice the frequency (half the wavelength) is called 2nd-order harmonics.
Voltage unbalancing	The difference between each phase voltage due to the load unbalancing. It is calculated as follows: $\frac{ \text{max. (min.) voltage of all phases} - \text{average voltage} }{\text{average voltage}} \times 100 (\%)$
Current unbalancing	The difference between each phase current due to the load unbalancing. It is calculated as follows: $\frac{ \text{max. (min.) current of all phases} - \text{average current} }{\text{average current}} \times 100 (\%)$
Power interruption	Voltage under 5% of rating is kept at 100ms or more.
Under voltage	Set the ratio for the rated voltage and it is used for threshold. Voltage under the set ratio is kept at 100 ms or more, it will be determined to be under voltage.
Under current	Set the ratio for the rated current and it is used for threshold. Current under the set ratio is kept at 100 ms or more, it will be determined to be under current.
Over current	Set the ratio for the rated current and it is used for threshold. Current over the set ratio is kept at 100 ms or more, it will be determined to be over current.
Demand in accordance with IEC 61557-12	Based on IEC61557-12 performance measuring and monitoring devices (PMD)
Sliding block interval demand	It is calculated by measured power via CT with a setting interval. Set power interval to 1 to 60 (min.) (every 1-min.). It calculates the demand during the latest finished interval and displays. One interval is started every setting time.
Fixed block interval demand	It is calculated by measured power via CT with a setting interval. Set power interval to 1 to 60 (min.) (every 1-min.) It calculates the demand during the latest finished interval and displays. When one interval finishes, the next interval starts.
Current demand	It is calculated based on a thermal demand meter. It measures an average current (current demand) within the setting interval and the max. value is considered to be the max. current demand.
30-min. demand	This works for electric power input by CR or pulse. It measures using the power during 30-min. and calculates an average (kW). Max. value of 1 month is recorded and displayed.
Peak demand	Max. value of instantaneous power during 1 month is considered peak demand. Peak demand of 12 months is recorded for 4 time zones.

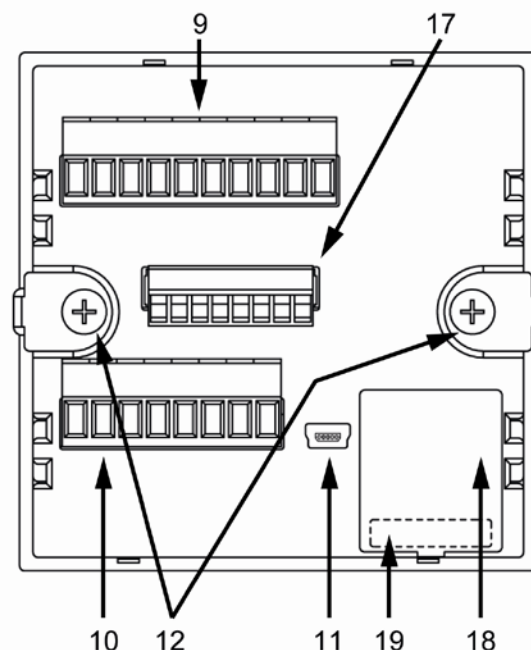
5. Overview and operation of unit

5.1 Overview of unit

<Front view>



<Rear view>



1	Item indicator	Measuring mode	Indicates the measuring item
		Setting mode	Indicates the setting item
2	Auxiliary indicator	Measuring mode	Indicates the power condition *1
3	TX/RX indicator	Measuring mode	Flashes during communication
4	Load ratio indicator	Measuring mode	Indicate the ratio of load (current) for the rating
5	Lock indicator	Measuring mode	Is lit when locked mode
6	Unit indicator	Measuring mode	Indicates the measuring unit
7	Measurement value	Measuring mode	Indicates the measuring value
		Setting mode	Indicates the setting value
8	Keys	Are used to operate the unit	
9	Terminal block A		
10	Terminal block B		
11	USB port	USB communication port	
12	Mounting clip	Are used for panel mounting (screws:M4x10mm)	
13	Log indicator	Logging mode	Indicate log type

14	Pulse output indicator	Measuring mode Logging mode Demand mode	Is lit when pulse is output
15	Pulse input indicator	Measuring mode Logging mode Demand mode	Is lit when pulse is input
16	Alarm indicator	Measuring mode Logging mode Demand mode	Is lit when pulse is output
17	Terminal block C		
18	Battery label		
19	Backup battery	Backup clock and logging data	

*1 Auxiliary indicator [LEAD][LAG] displays the phase difference between voltage and current.
 When there is a current phase delay to voltage phase, [LAG] is displayed.
 When current phase leads to voltage phase, [LEAD] is indicated.
 When power factor is "1", "0" and "-1", neither [LEAD] nor [LAG] is displayed.

5.2 Key functions

Key	Functions	
<MODE>	Measuring mode	Change to setting mode
	Setting mode	Change to setting confirmation mode and measuring mode
	Logging mode Demand mode	Change to setting mode
<SET>	Setting mode	Set setting items and setting values
	Measuring mode	Change to measuring item
	Logging mode	Select logging item to display
<SET> (press continuously for 3 seconds)	Measuring mode Logging mode Demand mode	All keys are locked
	Lock mode	Release the lock mode
<SHIFT/▽> <ITEM/Δ>	Measuring mode	Select measuring item to display
	Setting mode	Select a setting value
	Logging mode	Select logging item to display
	Demand mode	Select demand item to display























<SET> + <SHIFT/▽>	Measuring mode	Select measuring item to display
	Logging mode	Select logging item to display
	Demand mode	Select demand item to display
<MODE> + <SHIFT/▽>	Measuring mode	Select measuring item to display
	Logging mode	Select logging item to display
	Demand mode	Select demand item to display
<SET> + <ITEM/Δ>	Measuring mode	Select measuring item to display
	Logging mode	Select logging item to display
	Demand mode	Select demand item to display























Lock mode









This mode disables all the keys. In this mode you are unable to carry out input using the keys.
 When you press <SET> continuously for about 3 seconds, the lock indicator is displayed.
 Press <SET> continuously for about 3 seconds again to disable the lock mode.
 When the unit is set to use auto-display functions, the display items are automatically changed.
 Refer to chapter 7.4.5 "Settings for optional functions" for auto-display functions.

5.3 Indicators on Power Monitor 51A

The alphabet is shown as below.

	A	B	C	D	E	F	G	H	I	J	K
Value display											
Item indicator Top left											

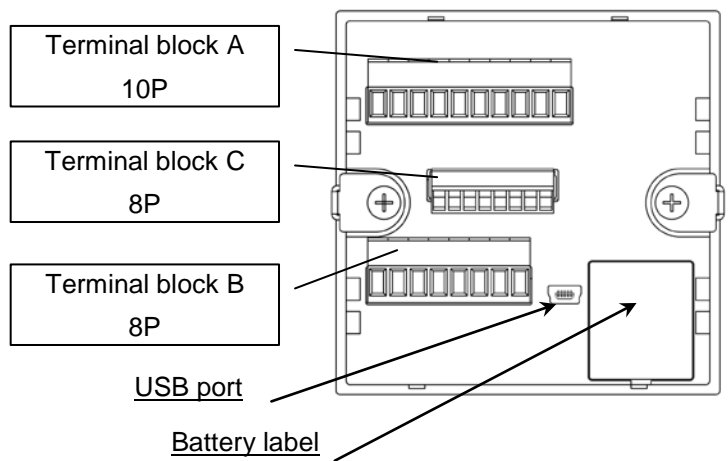
	L	M	N	O	P	Q	R	S	T	U	V
Value display											
Item indicator Top left											

	W	X	Y	Z
Value display				
Item indicator Top left				

6. Wiring

Be sure to wire correctly in accordance with the terminal arrangement and wiring diagrams.
Please connect a fuse or a breaker to the power supply part for safety reasons and to protect the device.
It does not feature a built-in power switch, circuit breaker or fuse for measured voltage input parts.
They should therefore be installed in the circuit near this unit.
Do not turn on the power supply or input until all wiring is completed.

6.1 Main unit terminal arrangement



Terminal block A

Terminal number	1	2	3	4	5	6	7	8	9	10
Functions	L+	N-	V1	V2	V3	Vn	NC	GND	D+	D-
	Power supply		Measured voltage input				unasigned	RS485		

Note

- 1) Do not use NC (unassigned) terminals for any purpose.

Terminal block B

Terminal number	1	2	3	4	5	6	7	8
Functions	K	L	K	L	K	L	K	L
	CT1		CT2		CT3		CTn	
	Measured current input							

Terminal block C

Terminal number	1	2	3	4	5	6	7	8
Functions	OUT1	COM1	OUT2	COM2	IN1+	IN1-	IN2+	IN2-
	Output 1		Output 2		Input 1		Input 2	

Notes

- 1) It is insulated between OUT1 and OUT2.
- 2) Minus terminals of input terminal are connected internally.

	NOTICE
	The input voltage to each terminal is as follows.

Terminal	Phase and wire system	Terminal No.	Input voltage
Power supply	Single-phase two-wire	1 - 2 (L+ - N-)	85 - 264 V AC 100 - 300 V DC
Measured voltage input	Single-phase two-wire	3 - 6 (V1-Vn)	0 - 500 V AC (L-L)
	Single-phase three-wire	3 - 5 - 6 (V1-V3-Vn)	0 - 500 V AC / 3W (L-L) 0 - 250 V AC / 3W (L-N)
	Three-phase three-wire	3 - 5 - 6 (V1-V3-Vn)	0 - 500 V AC (L-L)
	Three-phase four-wire	3 - 4 - 5 - 6 (V1-V2-V3-Vn)	0 - 500 V AC (L-L) 0 - 289 V AC (L-N)

Applicable wire (crimp-type terminal is recommended)

Stripping length: 7 to 8 mm

- Power supply/Measured voltage/RS485 communication

Terminal block: A

Screw size: M2.5

Tightening torque: 0.4 to 0.5 Nm

Terminal cross-section: 0.5 to 4 mm² (AWG20 to 12) for single/stranded wire
2 pcs. x 0.5 to 2 mm² (AWG20 to 14) for 2pcs. single/stranded wire

Note

- 1) Use shielded wire for RS485 communication.

- Output/Input

Terminal block:	C
Screw size:	M2
Tightening torque:	0.2 to 0.25 Nm
Terminal cross-section:	0.5 to 1.5 mm ² (AWG 20 to 16) for single/stranded wire

- CT Input (measured current)

Terminal block:	B
Screw size:	M2.5
Tightening torque:	0.4 to 0.5 Nm
Terminal cross-section:	0.5 to 4 mm ² (AWG 20 to 12) for single/stranded wire

Note

- 1) Use applicable wire according to the measured current.

6.2 Wiring diagrams

Please connect a breaker or a fuse to the power supply and voltage input part for safety reasons and to protect the device.

- Recommended breaker: 3 to 15 A
- Recommended fuse: Time-lag fuse rated current 2 A

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



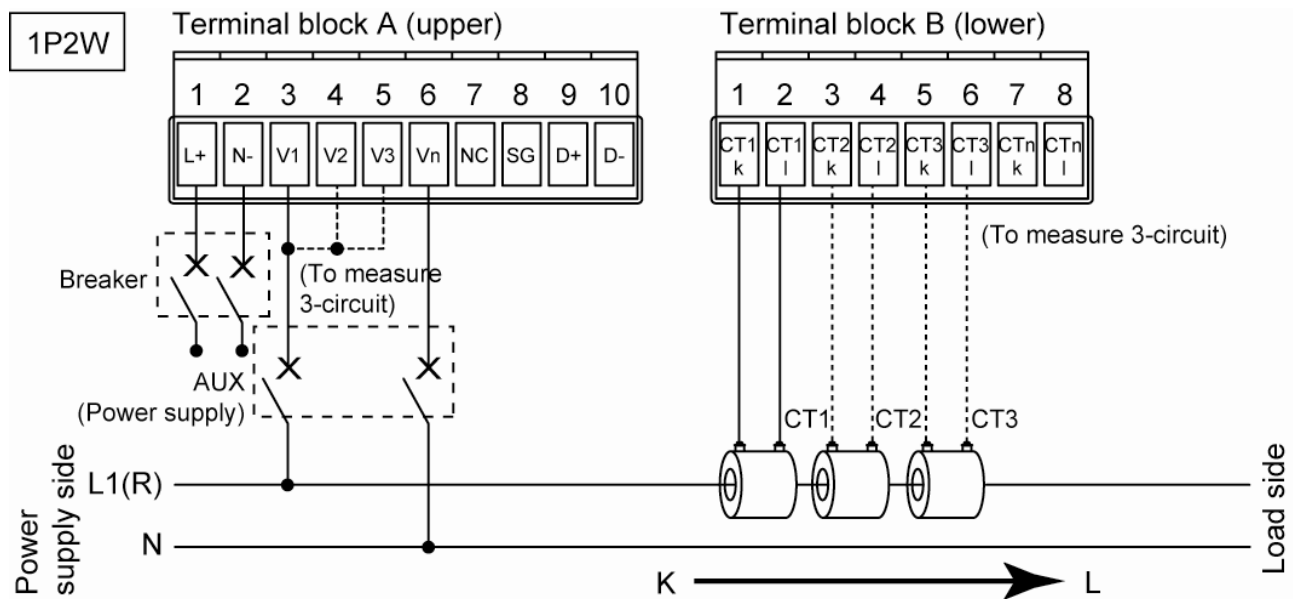
NOTICE

When using several CTs, set each CT approximately 1 m apart. If the two CTs are set too close to each other, measurements may not be accurate due to magnetic field interference.

6.2.1 Measuring a load with rated input voltage

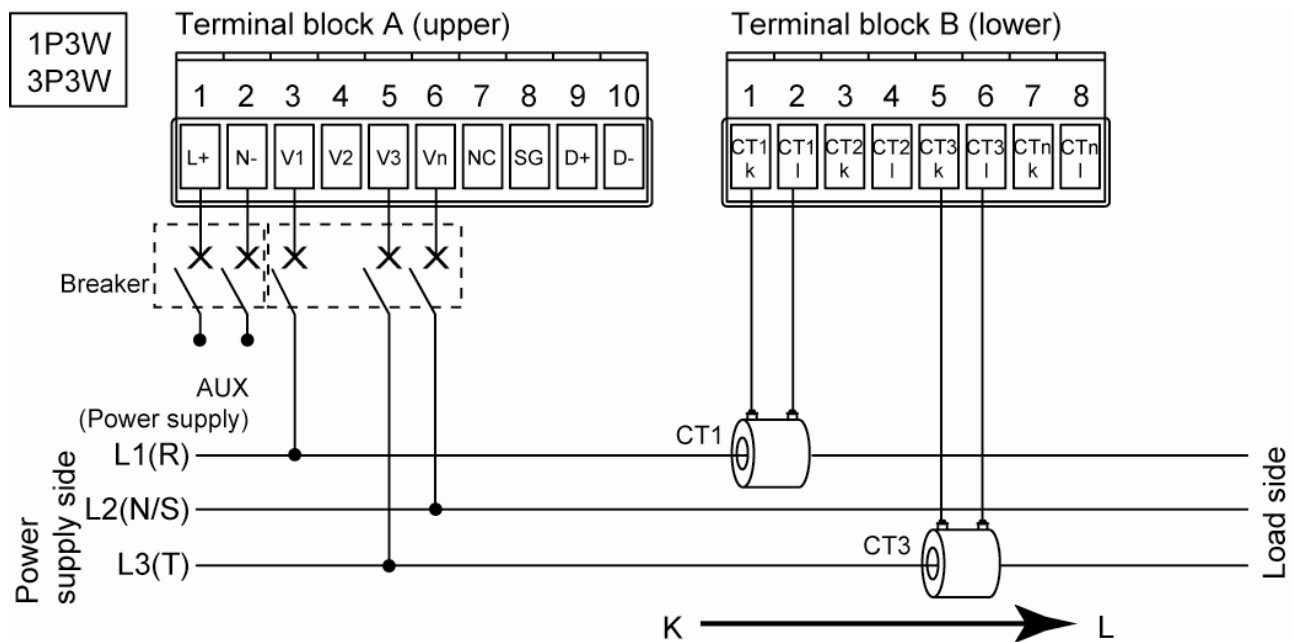
Single-phase two-wire system

- One CT is needed to measure a single-phase two-wire system.
- 2 CTs are needed to measure 2 circuits and 3 CTs are needed to measure 3 circuits.
- To measure 2 circuits, wire 3 and 4. To measure 3 circuits, wire 3 and 4 and 5.



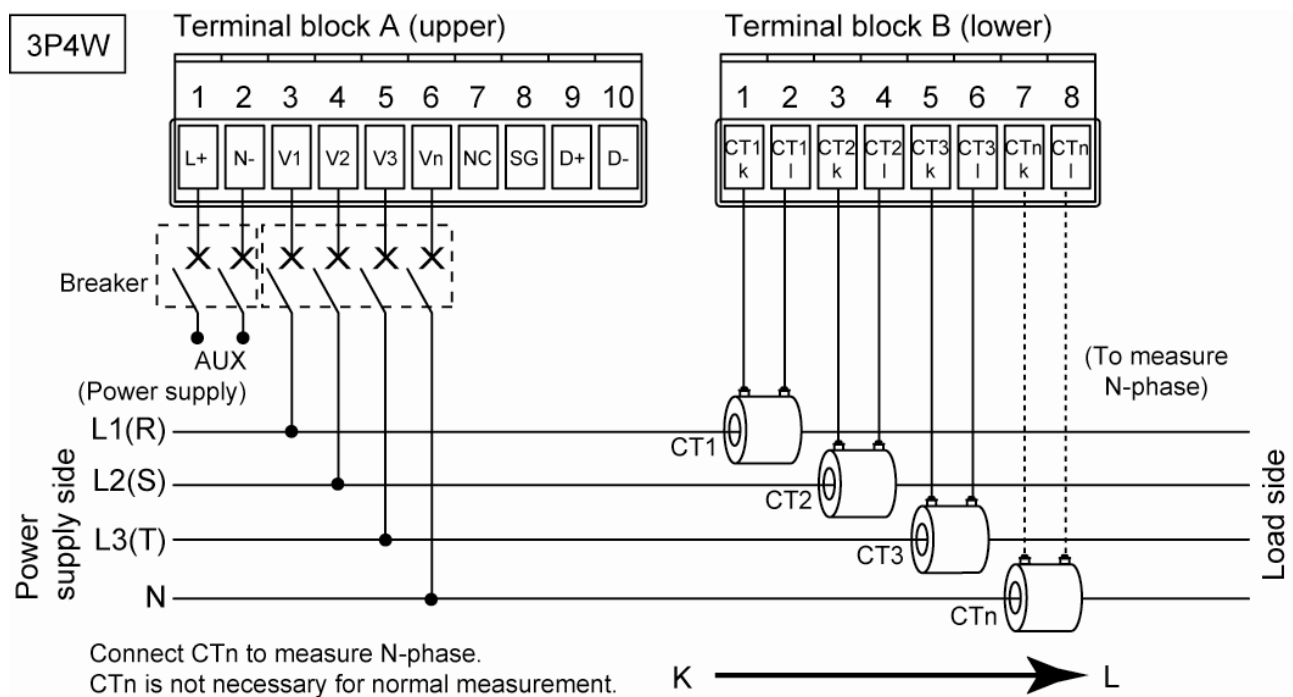
Single-phase three-wire/three-phase three-wire

- 2 CTs are needed to measure single-phase three-wire system and a three-phase three-wire system.



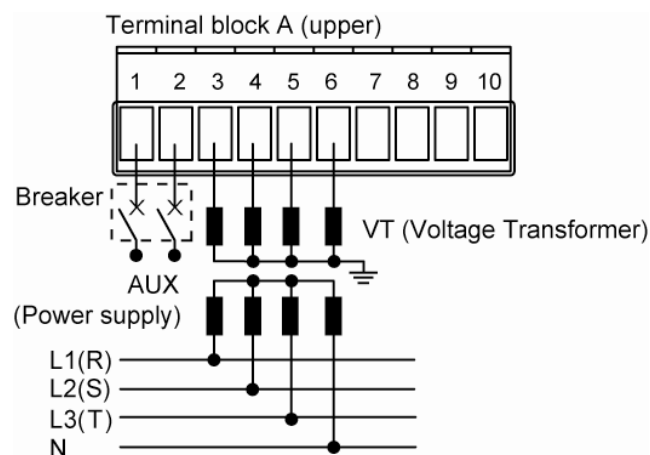
Three-phase four-wire system

- 3 CTs are needed to measure a three-phase four-wire system.




6.2.2 Measuring a load with excessive input voltage

- A voltage transformer (VT) is needed to measure a load with excessive input voltage.
- Use a VT whose secondary voltage rating is 110 V.
- Grounding the secondary side of the VT and CT is not necessary with a low-voltage circuit.



6.3 Attaching the Current Transformer (CT)

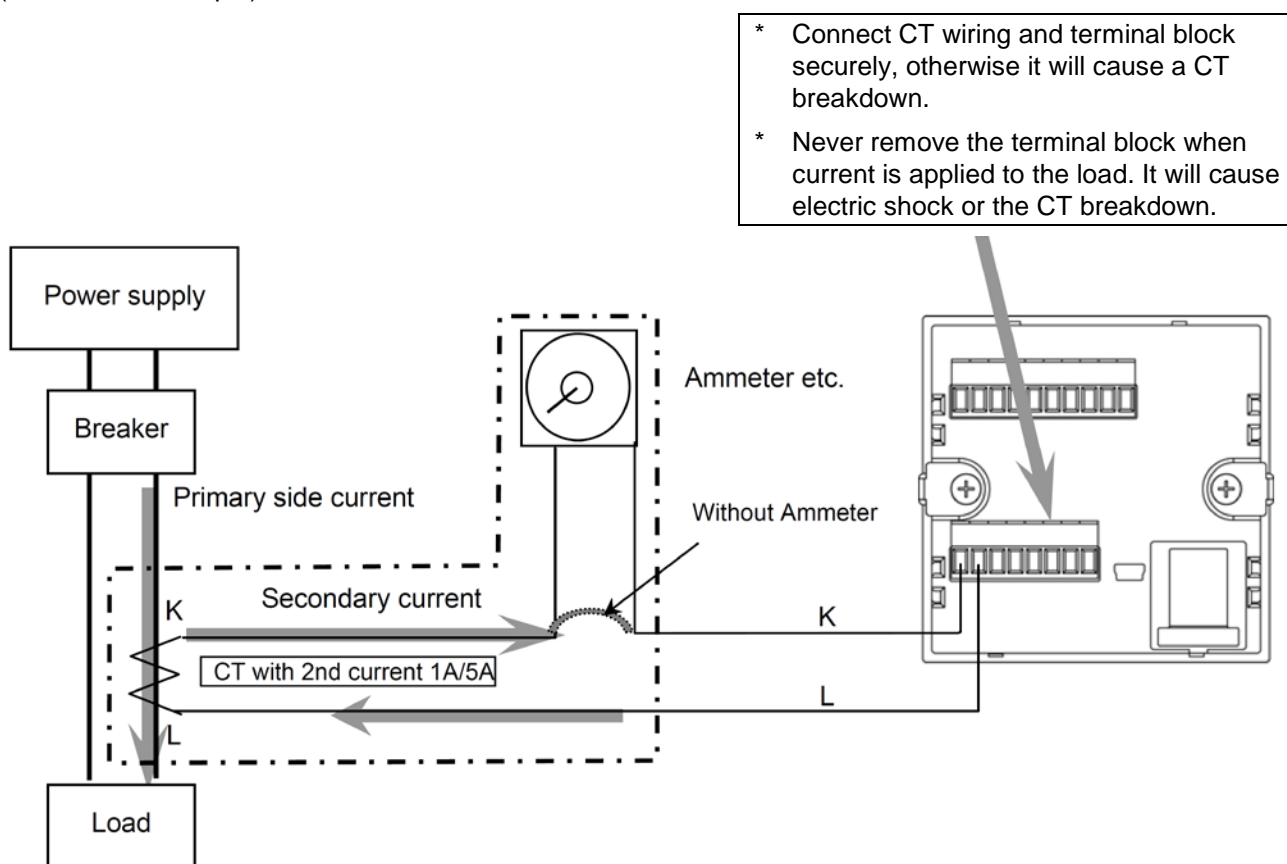
	DANGER!
	<ul style="list-style-type: none">• Never open the secondary circuit of CT when current is applied to the load.• Never remove the terminal block when current is applied to the load. <p>Will cause electric shock or CT breakdown!</p>

- Use a CT with a secondary side current of 5 A or 1 A, the rated burden 0.5 VA or more.
- One CT is needed for one unit when measuring 1P2W (2 CTs for 2 circuits, 3 CTs for 3 circuits). Two CTs are needed when measuring 1P3W/3P3W. Three CTs are needed when measuring 3P4W.
- Use the appropriate or it might cause a breakdown, burnout or electric shock.
- When connecting the CT, connect the secondary side to the terminal of the main unit first, then wire the primary side to a load electric wire. Not keeping to this sequence may cause an electric shock or CT breakdown.
- The CT has polarity. Wire correctly in accordance with the K and L marks. **Wiring in the wrong direction will result in incorrect measurement.**
- If harmonic or waveform distortion occurs, measurements may be inaccurate. Please check the current system before adopting it.
- Separate the wiring (strong electric part) of the measured voltage input terminal (operating power supply terminal) from the CT cable. It may not satisfy the accuracy requirements due to noise.

How to connect the CT

- (1) Power off the measured devices.
- (2) Install the appropriate CT.
- (3) Remove terminal block of Power Monitor 51A.
- (4) Connect the CT to the terminal block.
- (5) Insert the terminal stand securely.
- (6) After ensuring that all the wiring is correct, turn on the power of the load and Power Monitor 51A.

(Connection example)



How to set the parameters for the CT

- (1) Select CT type (CT-T) in accordance with the CT to be used.
(Select "5A" if secondary side current of the CT used is 5 A. Select "1A" if secondary side current of the CT used is 1 A.)
- (2) Set the primary current of the measured CT at primary side current of CT setting mode (CT-1).
<ex> If the measured CT is 400 A / 1 A or 400 A / 5 A, set to "400".
- (3) Connect the CT according to the CT direction, power side (K) to load side (L).

6.4 For input connection

- Pulse input

- ◇ Contact input

Use highly reliable metal plated contacts. Since the contact's bounce time results directly in an 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:

$V_{CEO \min} = 20 \text{ V}$, $I_{C \min} = 20 \text{ mA}$, $I_{CBO \max} = 6 \mu\text{A}$

Use transistors with a residual voltage of less than 3 V when the transistor is ON.

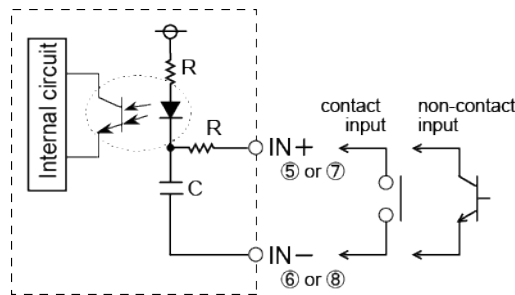
Short-circuit impedance should be less than 1 k Ω .

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

(When the impedance is 0 Ω , drain current is approx. 10 mA.)

- ◇ Input wiring

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

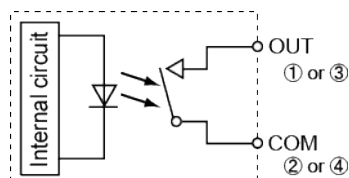


6.5 For output connection

- PhotoMOS relay output

- ◇ It adopts PhotoMOS relay output, there is no polarity.

Output rated capacity 30 V AC/DC, 0.1 A



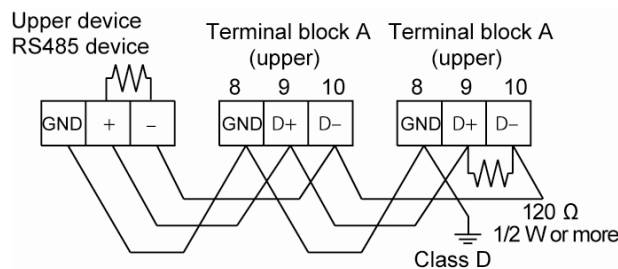
- ◇ Do not connect devices whose voltage or load exceeds the rated capacity (30 V AC/DC, 0.1 A).

- ◇ Please wire less than 100 m for output. If it is longer, it may not work correctly due to floating capacitance.

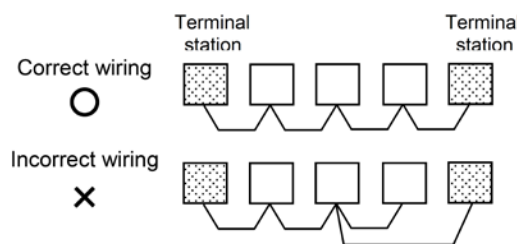
6.6 RS485 communication

- 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).
- For terminal stations of both side including the upper device, termination resistors should be connected. Power Monitor 51A does not have any built-in termination resistors. Connect 120 Ω , 1/2 W or more termination resistor between [D+] and [D-] of the Power Monitor 51A that is connected to the end of RS485 transmission line. The RS485 transmission line shielded cable should be grounded at the end Power Monitor 51A end (Fig. 1).
- Make sure that the RS485 transmission line between each unit is connected using a daisy chain arrangement. Do not use a splitter (Fig. 2).
- To avoid noise, separate the transmission line from the high-voltage line (power supply, voltage line).
- When using the RS485 interface, only those units can be wired together which are installed in the same cabinet. Cabling between multiple cabinets is not permitted (basic insulation).

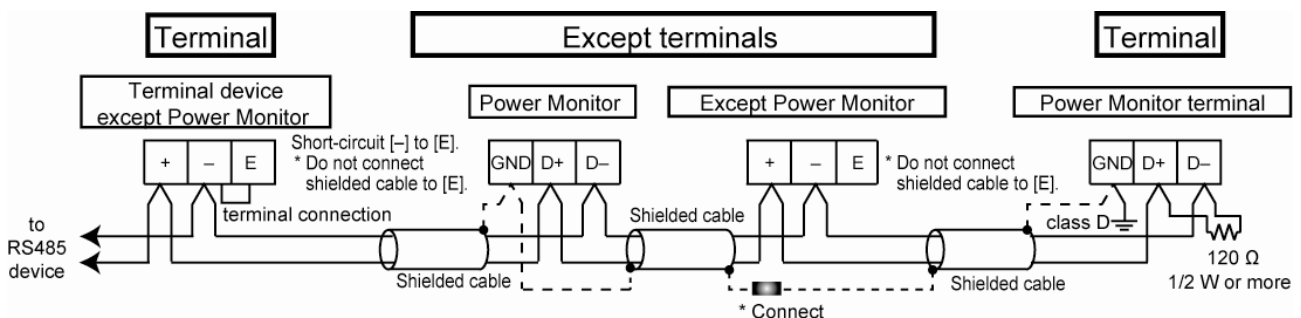
(Fig. 1) only within the same cabinet



(Fig. 2)



How to connect Power Monitor 51A and the other devices with a 2-wire system



Recommended cable

Use the transmission cables shown below for the Power Monitor 51A 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 (AWG 16) or more	Max. 16.8 Ω/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 (AWG 20) or more	Max. 33.4 Ω/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 (AWG 18) or more	Max. 25.1 Ω/km	PVC	Max. 0.6 mm	Approx. 6.6 mm	VCTF 0.75 mm ² x 2C (JIS)

Cable	Section
Twisted pair with shield	
VCTF	

Notes

- 1) Use shielded type twist cables.
- 2) Use only one type of transmission cable.
- 3) Do not mix different types of cables.
- 4) Use twist pair cables in environments exposed to excessive noise.

6.7 Backup battery for clock

It is possible to back up the clock for one month using a backup battery. In order to charge the clock fully, the power must be switched on for 2 days. If it turns off within 2 days from the first installation, it may not back up the clock for a month.

6.8 Low voltage directive

When using in accordance with measurement category III, install varistors between the power supply lines and the measured voltage input. Use varistors which comply with the European standard and specifications to match the power supply and added current.

When using in the application in compliance with EN 61010-1 / IEC 61010-1, ensure that the following conditions are met.

- (1) RS485 communication part and pulse input part ensure only basic insulation. In order to ensure reinforced (double) insulation demanded by EN 61010-1 / IEC 61010-1, ensure basic insulation or more with load side and reinforced (double) insulation with RS485 communication system side.
 - (2) Provide the voltage input part with an EN 60947-1 or EN 60947-3 compliant circuit breaker.
 - (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 -25 to +55 °C
 - ◊ An ambient non-condensing humidity of 30 to 85 % RH (at 20 °C)
 - ◊ Altitude of 2000 m or less
 - Mount the product in a location 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

7. Settings

You can set parameters for measuring and other functions using the keys on Power Monitor 51A.

After wiring Power Monitor 51A and CT, power on and set the parameter for power measurement, Power Monitor 51A can measure the electric power. In order to use the other functions, set other parameters as required.

Key functions in setting mode

<MODE>	Change to setting mode
<SET>	Set the items and values
<SHIFT/▽>, <ITEM/Δ>	Select items and change values

Parameters for power measurement

Item	Range	Initial value
Phase/Wire system	1P2W, 1P3W, 3P3W, 3P4W	1P2W
CT type	1, 5 [A]	5A
Primary side current of CT	1 to 65535 [A]	5A
Rated voltage	100 to 500 [V]	100V
VT ratio	1.00 to 600.00	1.00
Over voltage (ON threshold)	100.0 to 120.0 [%]	105.0 %
Over voltage (OFF threshold)	100.0 to 120.0 [%]	105.0 %
Under voltage (ON threshold)	5.0 to 100.0 [%]	95.0 %
Under voltage (OFF threshold)	5.0 to 100.0 [%]	95.0 %
Over current (ON threshold)	0.1 to 120.0 [%]	100.0 %
Over current (OFF threshold)	0.1 to 120.0 [%]	100.0 %
Under current (ON threshold)	0.0 to 100.0 [%]	0.0 %
Under current (OFF threshold)	0.0 to 100.0 [%]	0.0 %
Conversion rate (P) total	0.00 to 99.99/1 kWh	10.00
Conversion rate (P) time zone 1		
Conversion rate (P) time zone 2		
Conversion rate (P) time zone 3		
Conversion rate (P) time zone 4		
Conversion rate (-P) total		
Conversion rate (-P) time zone 1		
Conversion rate (-P) time zone 2		
Conversion rate (-P) time zone 3		
Conversion rate (-P) time zone 4		

Parameters for demand measurement

Item	Range	Initial value
Power demand type	Peak (Peak demand) Slide (Sliding block) Fixed (Fixed block) 30-min. (30-min. demand)	Peak
Power demand interval 1	1 to 60 [min.]	15
Power demand interval 2	1 to 60 [min.]	1
30-min. demand calculation method	Add (addition), Avg (average)	Add
Power input	CT (CT input), PM (Pulse input)	CT
Pulse unit	kWh (electric power), PLS (pulse constant)	kWh
Pulse rate (convert to electric power)	0.001 to 100.000 [kWh]	1.000
Pulse constant number	50000 [pulse/kWh], 2000 [pulse/kWh]	50000
Current interval	1 to 60 [min.]	15

Parameters for pulse input

Item	Range	Initial value
Pulse input (IN1)	30, Clock (clock correction)	30
Clock correction time	00:00 to 23:59	00:00
Pulse input (IN2)	30, 2000	30
Pre-scale (IN1, IN2)	0.001 to 100.000	1.000
Unit for pulse output (OUT1, OUT2)	0.0001, 0.001, 0.01, 0.1, 1, 10, 100 (kWh/1pulse) AL-S, AL-oV, AL-uV, AL-C, AL-uC, AL-MS, AL-P, AL-Q, AL-S, AL-PF, AL-oF, AL-uF, AL-VH, AL-CH, AL-VT, AL- CT, AL-VU, AL-CU, AL-PD, AL-CD Cnt1, Cnt2, PL-L	0.001
Target phase for pulse output (OUT1, OUT2)	Total, Phase1, Phase2, Phase3	total
Target phase for alarm output (OUT1, OUT2)	electric power	Total, All(ALL) , Phase1, Phase2, Phase3
	current	All(ALL) , Phase1, Phase2, Phase3, N
	power interrup- tion, over voltage, under voltage	All(ALL) , Phase1, Phase2, Phase3, Line1- 2, Line2-3, Line3-1
Integral direction (OUT1, OUT2)	P, -P	P
Stand-by alarm (threshold) (OUT1, OUT2)	0.1 to 100.0 [%]	100.0

Stand-by alarm (start time) (OUT1, OUT2)	0 to 9999 [sec.]	0
Stand-by alarm (phase) (OUT1, OUT2)	Phase1, Phase2, Phase3, All	All
Power alarm (active/reactive/apparent) threshold (ON/OFF) (OUT1, OUT2)	0.0 to 2999999.9 [kW/kvar/kVA]	2999999.9
PF alarm threshold (ON/OFF) (OUT1, OUT2)	0.000 to 1.000	0.000
Over frequency alarm threshold (ON/OFF) (OUT1, OUT2)	0.00 to 100.00 [Hz]	100.00
Under frequency alarm threshold (ON/OFF) (OUT1, OUT2)	0.00 to 100.00 [Hz]	0.00
Voltage harmonics alarm threshold (ON/OFF) (OUT1, OUT2)	0.00 to 400.0 [%]	400.00
Current harmonics alarm threshold (ON/OFF) (OUT1, OUT2)	0.00 to 400.0 [%]	400.00
Current THD alarm threshold (ON/OFF) (OUT1, OUT2)	0.00 to 400.0 [%]	400.00
Voltage THD alarm threshold (ON/OFF) (OUT1, OUT2)	0.00 to 400.0 [%]	400.00
Voltage unbalancing alarm threshold (ON/OFF) (OUT1, OUT2)	0.00 to 999.99 [%]	999.99
Current unbalancing alarm threshold (ON/OFF) (OUT1, OUT2)	0.00 to 999.99 [%]	999.99
Power demand alarm power type (ON/OFF) (OUT1, OUT2)	P, Q, S, -P, -Q	P
Power demand alarm threshold (ON/OFF) (OUT1, OUT2)	0.000 to 99999.999 [kW/kvar/kVA]	0
Power demand alarm hysteresis (OUT1, OUT2)	0 to 100 [%]	0
Power demand alarm start time (OUT1, OUT2)	1 to 30 [min.]	10
Current demand alarm threshold (OUT1, OUT2)	0.0 to 120.0 [%]	0
Preset value (OUT1, OUT2)	0 to 999999	0

Parameters for communication

Item	Range	Initial value
Protocol	MEWTOCOL, MODBUS(RTU), DL/T645-2007	MEWTOCOL
Device number	MEWTOCOL	1
	MODBUS(RTU)	
	DL/T645-2007	
Transmission speed	38400, 19200, 9600, 4800, 2400, 1200 [bps]	19200
Transmission format	8b-o(8bit odd), 8b-n(8bit none), 8bit-E(8bit even)	8b-o
Stop bit	1, 2	1
Response time	1 to 99 [ms]	5

Parameters for optional functions

Item	Range	Initial value
Auto-off	0 to 99 [min.]	1
Luminance	1, 2, 3, 4, 5 (1: dark to 5: light)	3
Alarm flashing	ON, OFF	OFF
Update cycle	100 to 1000 [ms]	100
Auto-display	0 to 99 [min.]	10
Display cycle	1 to 99 [sec.]	5
Temperature correction	-100.0 to 100.0	0.0
Reset all integral value	YES, NO	NO
Reset integral value 1	YES, NO	NO
Reset integral value 2	YES, NO	NO
Reset integral value 3	YES, NO	NO
Reset count value 1	YES, NO	NO
Reset count value 2	YES, NO	NO
Reset logging data	YES, NO	NO
Version		

Parameters for time program

Item	Range		Initial value
Program 1	time zone	T1, T2, T3, T4, OFF	T4
	start time	00:00 to 23:59	00:00
Program 2	time zone	T1, T2, T3, T4, OFF	T3
	start time	00:00 to 23:59	6:00
Program 3	time zone	T1, T2, T3, T4, OFF	T2
	start time	00:00 to 23:59	8:00
Program 4	time zone	T1, T2, T3, T4, OFF	T1
	start time	00:00 to 23:59	10:00
Program 5	time zone	T1, T2, T3, T4, OFF	T2
	start time	00:00 to 23:59	12:00
Program 6	time zone	T1, T2, T3, T4, OFF	T1
	start time	00:00 to 23:59	14:00
Program 7	time zone	T1, T2, T3, T4, OFF	T2
	start time	00:00 to 23:59	16:00
Program 8	time zone	T1, T2, T3, T4, OFF	T3
	start time	00:00 to 23:59	22:00
Program 9	time zone	T1, T2, T3, T4, OFF	OFF
	start time	00:00 to 23:59	—
Program 10	time zone	T1, T2, T3, T4, OFF	OFF
	start time	00:00 to 23:59	—

• Initial setting for time program

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
T1																									
T2																									
T3																									
T4																									

Diagram illustrating the initial setting for the time program (T1, T2, T3, T4) across 24 hours. The terms are defined as follows:

- 1-term(PG-1): 00:00 to 06:00
- 2-term(PG-2): 06:00 to 08:00
- 3-term(PG-3): 08:00 to 12:00
- 4-term(PG-4): 12:00 to 14:00
- 5-term(PG-5): 14:00 to 16:00
- 6-term(PG-6): 16:00 to 18:00
- 7-term(PG-7): 18:00 to 22:00
- 8-term(PG-8): 22:00 to 00:00

Calendar timer

Item	Range	Initial value
Calendar timer	January 1st, 2000 00:00:00 to December 31st, 2099 23:59:59	

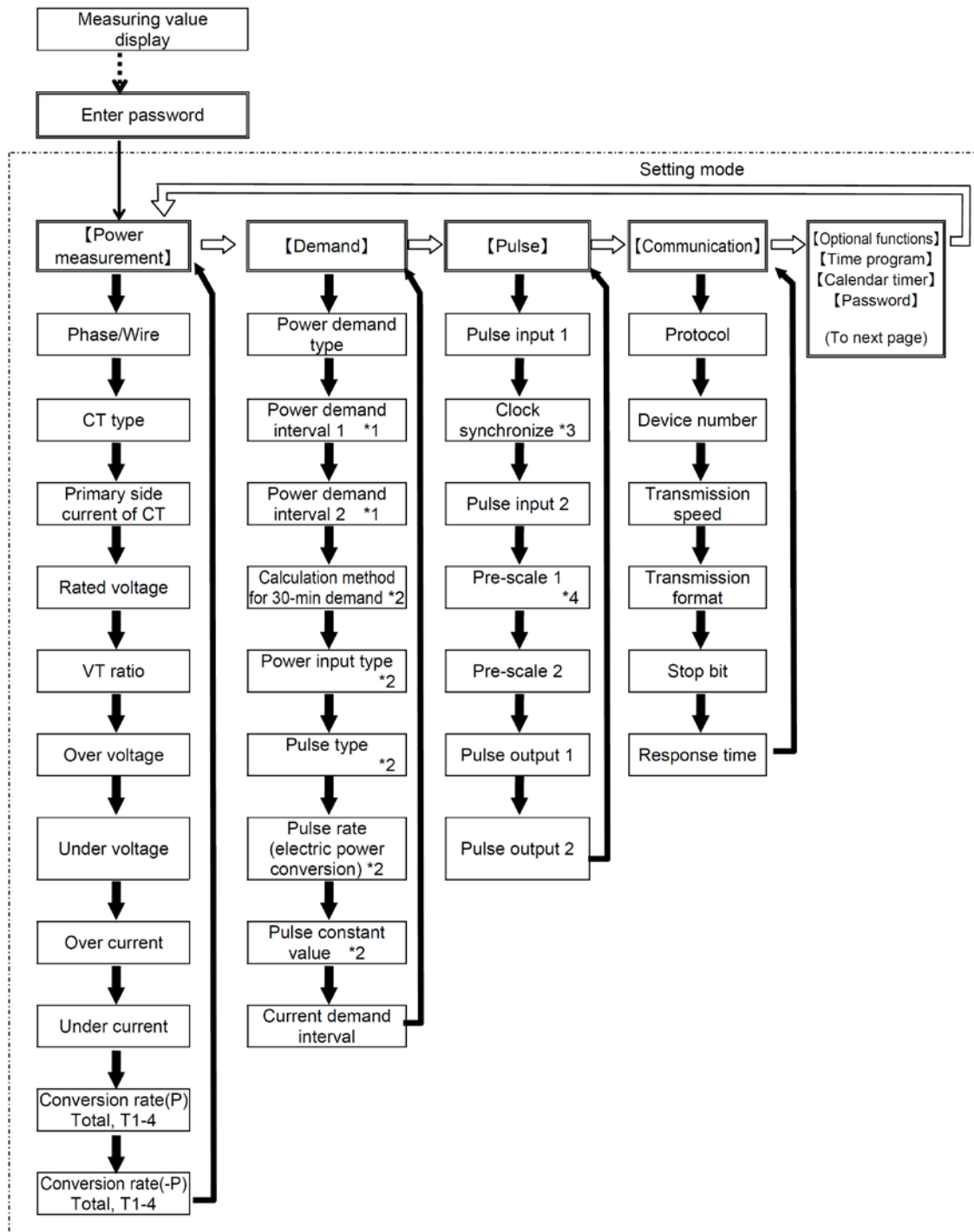
Password

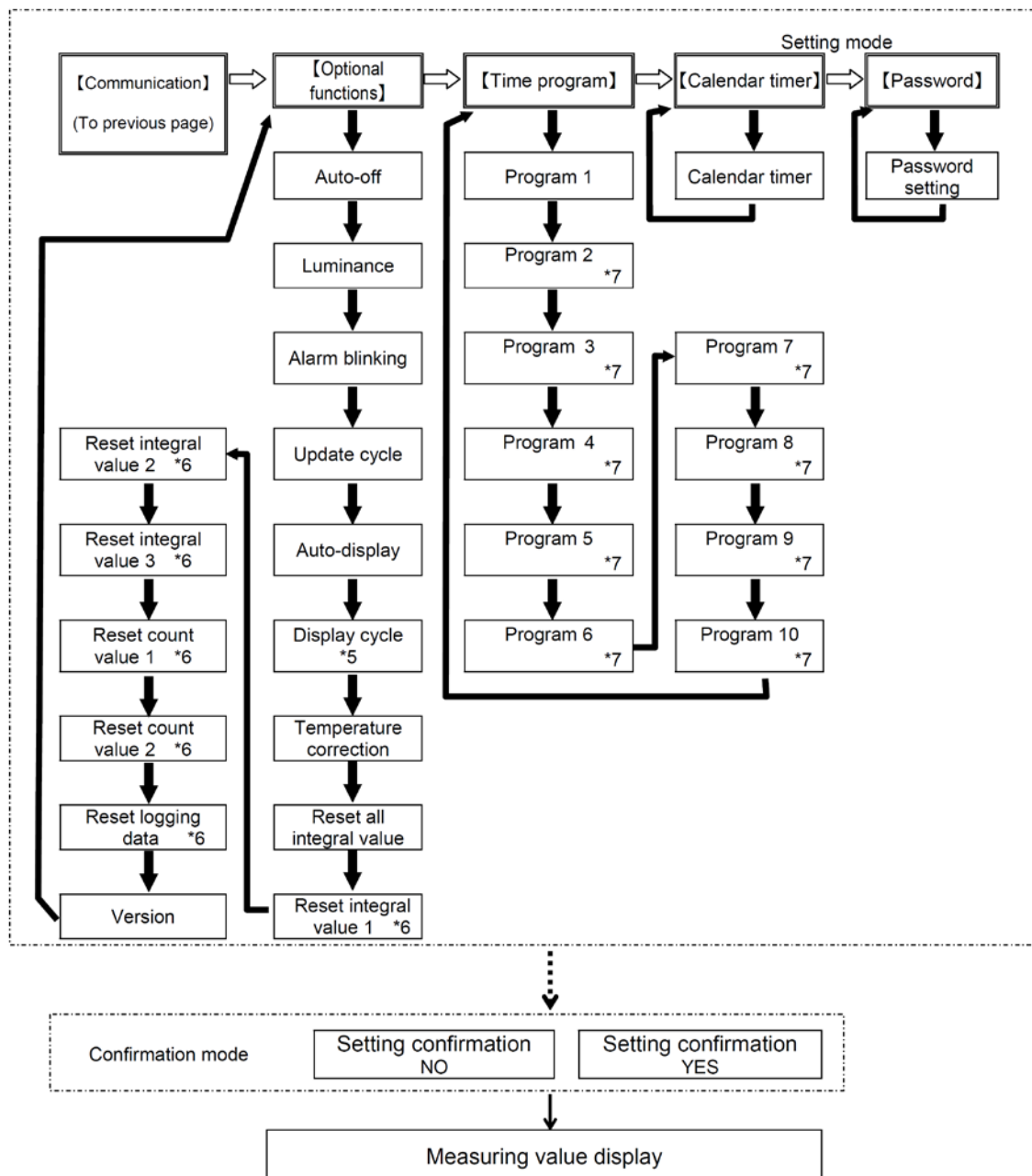
Item	Range	Initial value
Password change	0000 to 9999	0000

7.1 Setting workflow

An arrow mark indicates that each key must be pressed.

.....> <MODE> → <SET> ➡ <ITEM/Δ> ⇨ <SHIFT/▽>





Press <SET> when each item is displayed to change the setting value.

Press <MODE> to display the confirmation window. Select [YES] and press <SET> to define the setting value. However, if no value is changed, the confirmation window is skipped and the measuring value indicator is displayed.

Notes

- 1) It is skipped when [Peak] or [30min] is set for power demand type.
- 2) It is skipped except when [30min] is set for power demand type.
- 3) It is skipped when [30] is set for pulse input 1.

- 4) It is skipped when [Clock] is selected for pulse input 1.
- 5) It is skipped when [0] is set as the auto-display setting.
- 6) It is skipped when [YES] is selected for reset all integral value.
- 7) It is skipped when [OFF] is selected at the previous program.

7.2 Entering a password

You must enter a password to switch to setting mode.

Enter [0000] and change to password setting mode when you set the password at the first time.



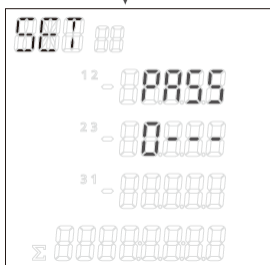
NOTICE

When setting a password, enter it carefully and remember to make a note of it.

Measuring value
display

MODE

Press <MODE> to switch to the password entry window.



Enter the password from left to right using <ITEM/Δ>, <SHIFT/∇>.



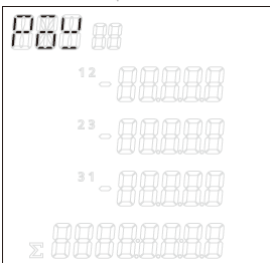
Increase



Moves the digit entered to the right.

SET

Press <SET> after entering the password.



If the password is correct, you switch to the setting mode of power measurement.

If the password is incorrect, [FAIL] is displayed and you return to the password entry window.

**NOTICE**

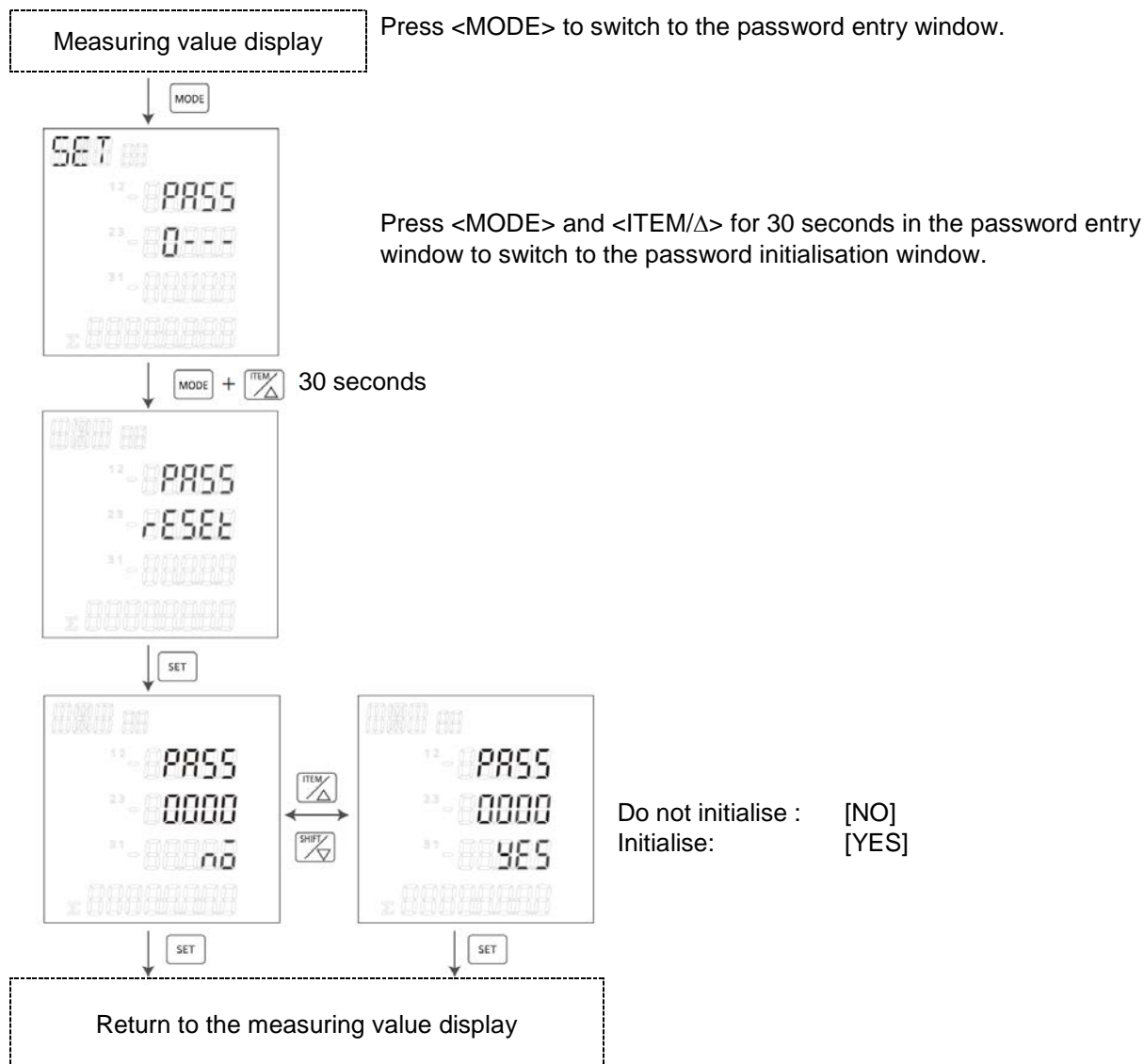
If you enter an incorrect password 5 times, you have to wait one hour before setting it again.



7.3 Initialise password

When you forget the password, initialise it using the following procedure. (Initial: [0000])

It is not possible to decode the set password.



7.4 Settings

Make setting before measuring

Select setting item with <ITEM/Δ> and press <SET>, the value will flash.

Set with <ITEM/Δ> and <SHIFT/▽>.

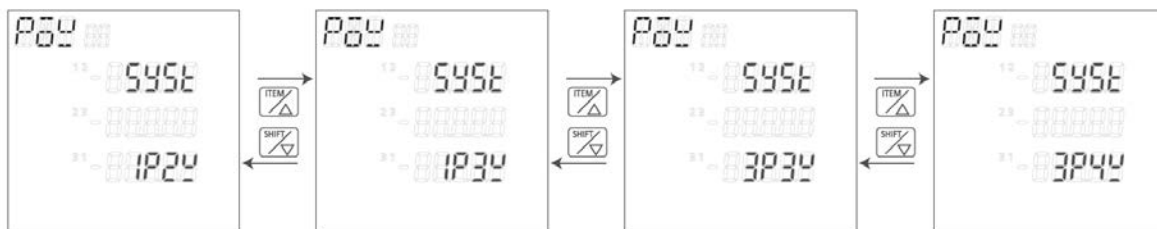
Select [YES] in the confirmation window and press <SET> to confirm the setting values.

7.4.1 Settings for power measurement

Phase/wire system

Select the phase/wire system to be measured.

Press <ITEM/Δ>, <SHIFT/▽> to select the phase/wire system.



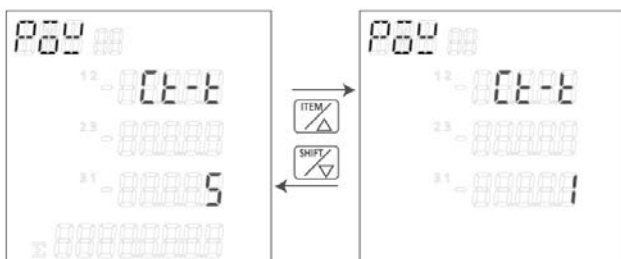
[Set list] 1P2W, 1P3W, 3P3W, 3P4W (initial: 1P2W)

Note

- 1) If the system settings do not match those of the measurement system, measurements will not be accurate.

CT type

Select using CT type (secondary side current).



Press <ITEM/Δ>, <SHIFT/▽> to select CT type.

[Set list] 5 (5 A), 1 (1A) (initial: 5)

To use CT with secondary side current 5 A: [5]

To use CT with secondary side current 1 A: [1]

Primary side current of CT

Set the primary side current of CT used.

Enter the primary side current of CT that is set at CT type setting.



Press <ITEM/Δ>, <SHIFT/▽> to make the setting.

[Set range] 1 to 65535 (initial: 5)



Increase



Decrease

Primary side current of using CT is 400 A: [400]

Rated voltage

Set the rated voltage to be measured.



Press <ITEM/Δ>, <SHIFT/▽> to set the rated voltage.

[Set range] 100 to 500 (initial: 100)



Increase



Decrease

VT ratio

Select the voltage input method, input voltage directly or use a voltage transformer (VT: secondary side rating 110 V) and set VT ratio.



Press <ITEM/Δ>, <SHIFT/▽> to make the setting.

[Set range] 1.00 to 600.00 (initial: 1.00)



Increase



Decrease

Input directly without VT: [1.00]

Use VT: [1.01 to 600.00]

Note

- 1) When the input voltage is under 3 V (VT ratio = 1), [0.0] is displayed and no measurements are made.

Over voltage / Over voltage 2

Set a ratio of voltage for rated voltage used for threshold to determine overvoltage and to clear the over voltage.

At this [over volt] window, set a ratio of voltage to determine overvoltage.



Press <ITEM/Δ>, <SHIFT/▽> to set the ratio.

[Set range] 100.0 to 120.0 % (initial:105.0)



Increase



Decrease

Press <SET> and [over volt2] is displayed. At this window, set a ratio of voltage to clear overvoltage.



Press <ITEM/Δ>, <SHIFT/▽> to set the ratio.

[Set range] 100.0 to 120.0 % (initial:105.0)



Increase



Decrease

Settings: [over volt] 120.0 %, [over volt2] 105.0 %

Note

- 1) When measured voltage is over 120.0 %, it is considered to be over voltage and an alarm is output.
- 2) During output of the alarm, if the measured voltage falls below 105.0 %, the alarm will be cleared.

Under voltage / Under voltage 2

Set a ratio of voltage for rated voltage used for threshold to determine under voltage and to clear the under voltage.

At the [under volt] window set a ratio of voltage to determine under voltage.



Press <ITEM/Δ>, <SHIFT/▽> to set the ratio.

[Set range] 5.0 to 100.0 % (initial: 95.0)



Increase



Decrease

Press <SET> and [under volt2] is displayed. At this window, set a ratio of voltage to clear under voltage.



Press <ITEM/Δ>, <SHIFT/▽> to set the ratio.

[Set range] 5.0 to 100.0 % (initial: 95.0)



Increase



Decrease

Settings: [under volt] 95.0 %, [under volt2]

Note

- 1) When measured voltage is under 95.0 %, under voltage is determined and an alarm is output.
- 2) During output of the alarm, if the measured voltage goes above 100.0 %, this will clear the alarm.

Over current / Over current 2

Set a ratio of current for rated current used for threshold to determine over current and to clear the over current.

At the [over curr] window set a ratio of current to determine over current.



Press <ITEM/Δ>, <SHIFT/▽> to set the ratio.

[Set range] 0.1 to 120.0 % (initial: 100.0)



Increase



Decrease

Press <SET>, and [over curr2] is displayed. At this window, set a ratio of current to clear over current.



Press <ITEM/Δ>, <SHIFT/▽> to set the ratio.

[Set range] 0.1 to 120.0 % (initial: 100.0)



Increase



Decrease

Settings: [over curr] 120.0 %, [over curr2] 105.0 %

Note

- 1) When the measured current is over 120.0 %, over current is determined and an alarm is output.
- 2) During output of the alarm, if the measured current falls below 105.0 %, this will clear the alarm.

Under current / Under current 2

Set a ratio of current for rated current used for threshold to determine under current and to clear the under current.

At the [under curr] window set a ratio of current to determine under current.



Press <ITEM/Δ>, <SHIFT/▽> to set the ratio.

[Set range] 0.0 to 100.0 % (initial: 0.0)



Increase



Decrease

Press <SET>, and [under curr2] is displayed. At this window, set a ratio of current to clear under current.



Press <ITEM/Δ>, <SHIFT/▽> to set the ratio.

[Set range] 0.0 to 100.0 % (initial: 0.0)



Increase



Decrease

Settings: [under curr] 95.0 %, [under curr2] 100.0 %

Note

- 1) When the measured current is under 95.0 %, under current is determined and an alarm is output.
- 2) During output of the alarm, if the measured current reaches 100.0 %, this will clear the alarm.

Conversion rate (P)

Set the conversion rate per integral active power 1 kWh.



Press <ITEM/Δ>, <SHIFT/▽> to make the setting.

[set range] 0.00 to 99.99 / 1 kWh (initial: 10.00)



Increase



Decrease

Conversion rate (-P)

Set the conversion rate per integral export power (-P) 1kWh.



Press <ITEM/Δ>, <SHIFT/▽> to make the setting.

[set range] 0.00 to 99.99 / 1 kWh (initial: 10.00)



Increase



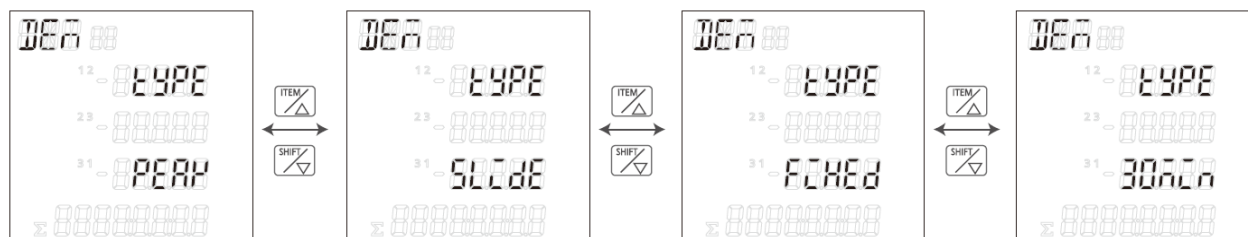
Decrease

7.4.2 Settings for demand measurement

Power demand type

Select type of power demand measurement.

Press <ITEM/Δ>, <SHIFT/▽> to select power demand type.

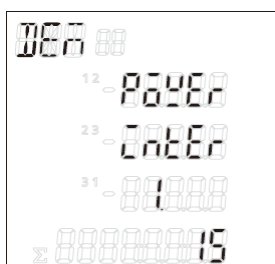


[Set list] Peak (peak demand), Slide (sliding block), Fixed (fixed block), 30-min. (30-min. demand)
(initial: Peak)

Power demand interval 1

* It skips this when [Peak] or [30min] is set for power demand type.

Set interval time to use for sliding block and fixed block for power demand measurement.



Press <ITEM/Δ>, <SHIFT/▽> to make a setting.

[Set range] 1 to 60 min. (initial: 15)



Increase



Decrease

Power demand interval 2

* Only when [Slide] is selected for power demand type.

Set slide time to use for sliding block for power demand measurement.



Press <ITEM/Δ>, <SHIFT/▽> to make a setting.

[Set range] 1 to 60 min. (initial: 1)



Increase

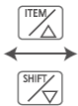


Decrease

Calculation method for 30-min. demand

* Only when [30min] is selected for power demand type.

Select calculation method for 30-min. demand.



Press <ITEM/Δ>, <SHIFT/▽> to select.

[Set list] Add(addition), Avg(average) (initial: Add)

Power input type

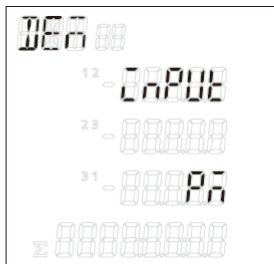
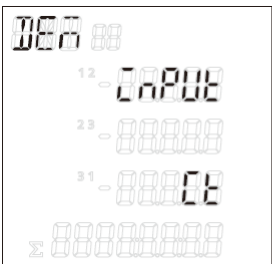
*Only when [30min] is selected for power demand type.

Select input type to use for demand measurement, current measurement or pulse input.

"CT": Use current measurement via CT for demand measurement.

"PM": Use pulse input for demand measurement.

Count value by pulse input2 is used for power input.



Press <ITEM/Δ>, <SHIFT/▽> to select.

[Set list] CT(current measurement),
PM(Pulse input) (initial: CT)

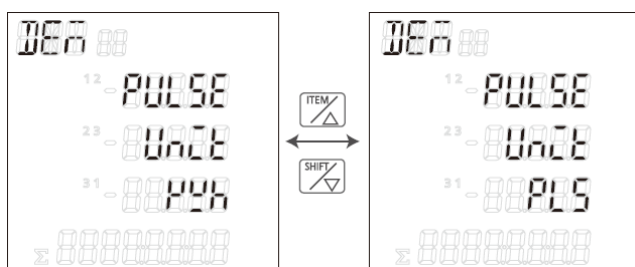
Pulse type

*Only when [PM] is selected for power input type.

Select pulse type to input.

"kWh": Set electric power value per pulse directly.

"PULSE": Use pulse constant value of pulse output device to be used.



Press <ITEM/Δ>, <SHIFT/▽> to select.

[Set list] kWh, PULSE (initial: kWh)

Pulse rate (electric power conversion)

* Only when [kWh] is selected for pulse type.

Set electric power value per pulse.



Press <ITEM/Δ>, <SHIFT/▽> to make a setting.

[Set range] 0.001 to 100.000 [kWh]



Increase



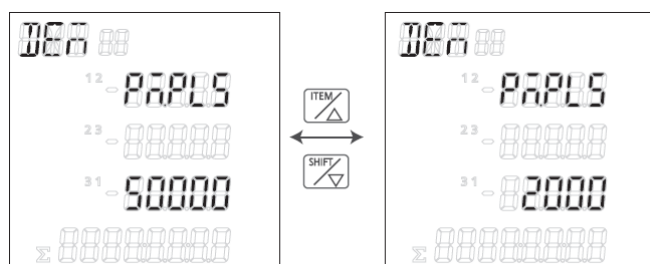
Decrease

Pulse constant value

* Only when [PULSE] is selected for pulse type.

Select pulse constant value input by an outer pulse detector.

Check and select the pulse constant value using a pulse detector.



Press <ITEM/Δ>, <SHIFT/▽> to select.

[Set list] 50000 (pulse/kWh), 2000 (pulse/kWh)
(initial: 50000)

Current demand interval

Set interval to use for current demand calculation.



Press <ITEM/Δ>, <SHIFT/▽> to make a setting.

[Set range] 1 to 60 min. (initial: 15)



Increase

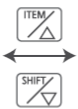


Decrease

7.4.3 Settings for pulse measurement

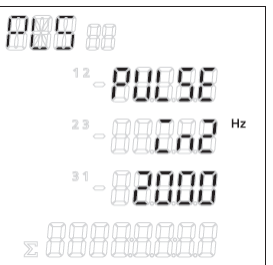
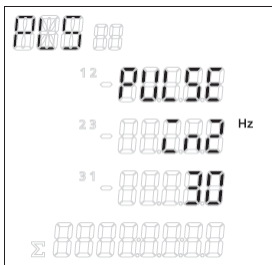
Pulse input IN1 IN2

Select pulse input max. counting speed or select to use pulse input for clock correction.



Press <ITEM/Δ>, <SHIFT/▽> to select.

[Pulse input IN1: Set list]
30(Hz), Clock (clock correction) (initial: 30)



[Pulse input IN2: Set list]
30(Hz), 2000(Hz) (initial: 30)

Clock synchronize

* It is skipped when [30] is selected for Pulse input IN1.

Set time to correct the clock by using pulse input IN1.



Press <ITEM/Δ>, <SHIFT/▽> to make a setting.

[Set range] 00:00 to 23:59 (initial: 00:00)



Increase



Decrease

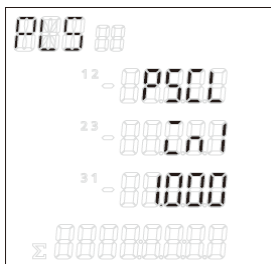
Note

- 1) If the Power Monitor 51A clock is different by one hour or more from the setting time when pulse is input to IN1, the clock is not corrected.

Pre-scale IN1 IN2

* It is skipped when [Clock] is selected for Pulse input IN1.

Set pre-scale value used to convert count value of pulse input.



Press <ITEM/Δ>, <SHIFT/▽> to make a setting.

[Set range] 0.001 to 100.00 (initial: 1.000)



Increase

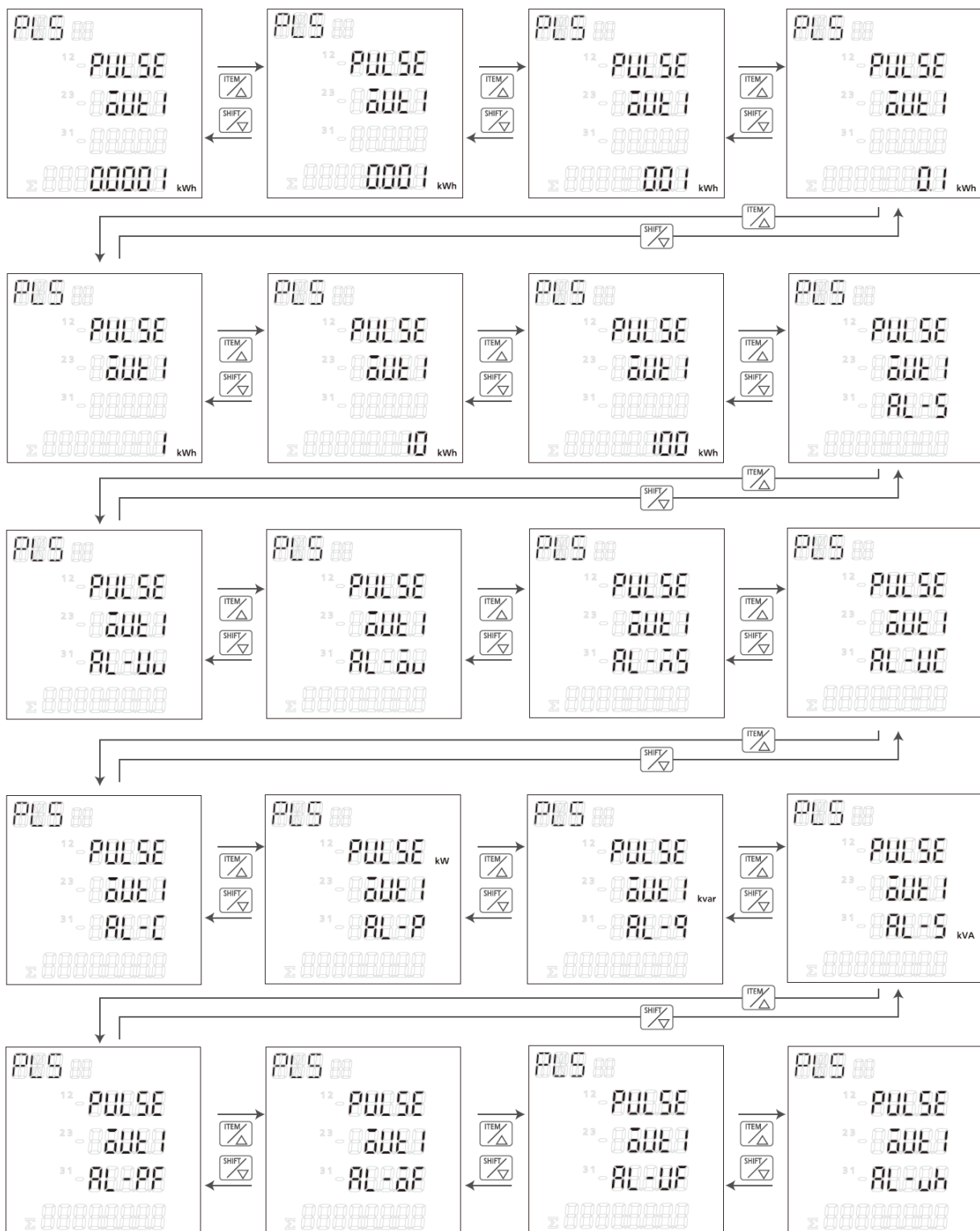


Decrease

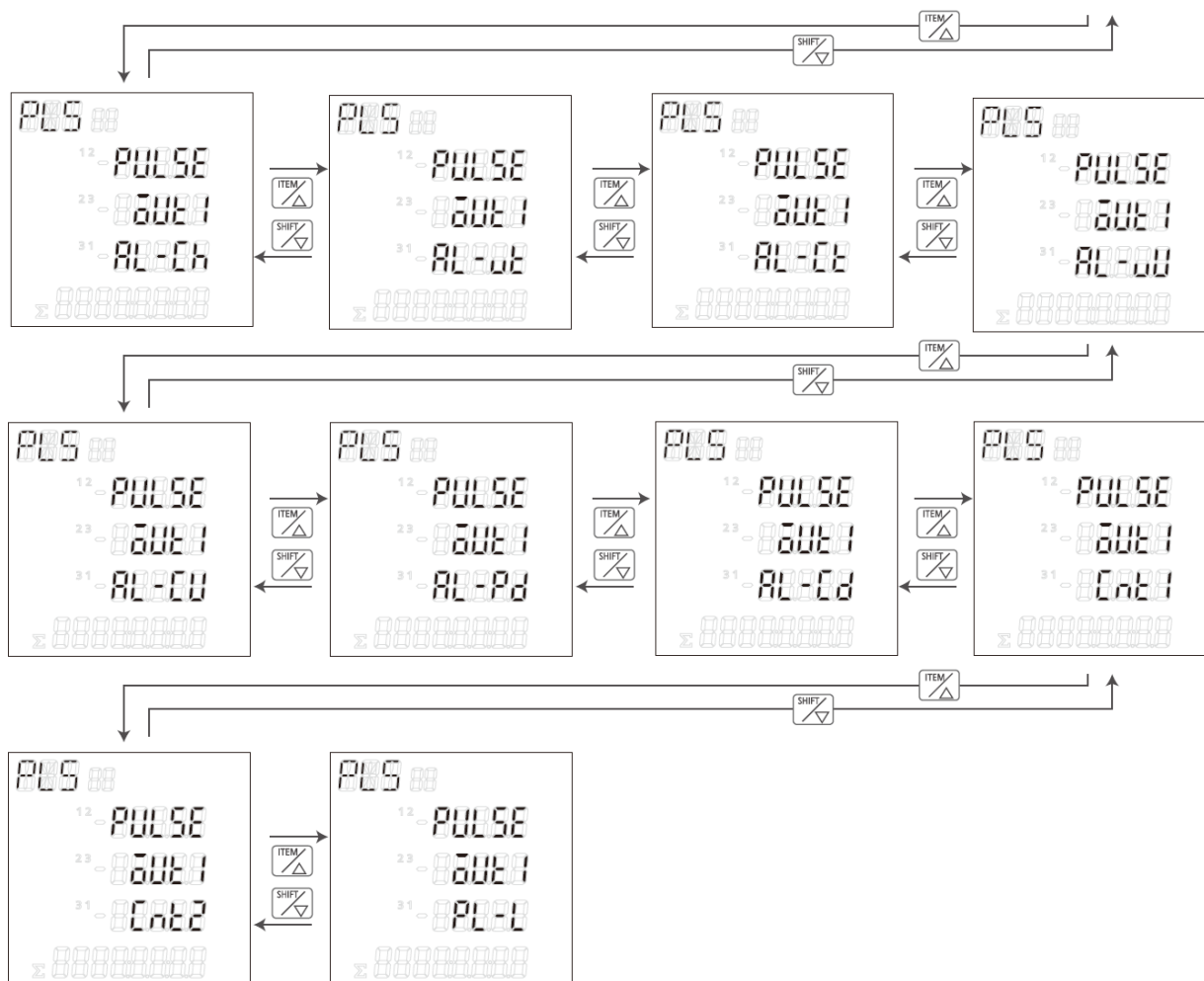
Unit for pulse output OUT1 OUT2

Set unit used for pulse output.

Press <ITEM/Δ>, <SHIFT/▽> to select unit for pulse output.



continued on next page



Note

- 1) [AL-PD] is skipped when [Peak] is selected for Power demand type.

[Set list] integral value (kWh/1pulse): 0.0001, 0.001, 0.01, 0.1, 1, 10, 100,

AL-S (stand-by alarm), AL-uV (under voltage alarm), AL-oV (over voltage alarm),
 AL-MS (power interruption alarm), AL-uC (under current alarm), AL-C (current alarm),
 AL-P (active power alarm), AL-Q (reactive power alarm), AL-S (apparent power alarm),
 AL-PF (power factor alarm), AL-oF (over frequency alarm), AL-uF (under frequency alarm),
 AL-VH (voltage harmonics alarm), AL-CH (current harmonics alarm),
 AL-VT (voltage THD alarm), AL-CT (current THD alarm), AL-VU (voltage unbalancing alarm),
 AL-CU (current unbalancing alarm), AL-PD (power demand alarm),
 AL-CD (current demand alarm), Cnt1 (count output), Cnt2 (count output), PL-L (level output)
 (initial: 0.001)

- When one of AL-uV(under voltage alarm), AL-oV(over voltage alarm), AL-uC (under current alarm), AL-C(current alarm) is set, an alarm is output according to the settings of under voltage, over voltage, under current, over current.

- When AL-MS (power interruption alarm) is set, an alarm is output when it detects voltage under 5% of the rated voltage.
- When PL-L(level output) is set, when the designated data register is 1, an alarm is output.

An external device is required. Write 1 (output ON) or 0 (output OFF) to the designated data register (OUT1: DT00005, OUT2: DT00006).

Note on selecting integral value

- 1) Select unit for pulse output so that the pulse is less than 1 pulse a second.

Target phase for pulse output/ alarm (OUT1 OUT2)

*It is skipped when [AL-VU, AL-CU, AL-PD, Cnt1, Cnt2, PL-L] is selected for unit for pulse output.

Select phase to monitor in order to determine the output.

It differs according to the setting unit and phase/wire systems.

Press <ITEM/Δ>, <SHIFT/▽> to select.

Set unit	Set list
Integral value	total, Phase1, Phase2, Phase3 (initial: total) ◇ For 3P3W, it fixes the total. Setting window is skipped.
AL-P, AL-Q, AL-S (Power alarm)	total, All, Phase1, Phase2, Phase3 (initial: total) ◇ For 3P3W, it fixes the total. Setting window is skipped.
AL-S (Stand-by alarm), AL-UC, AL-uC, AL-CH, AL-CT,AL-CD	All, Phase1, Phase2, Phase3 (initial: All)
AL-PF, AL-oF, AL-uF	All, Phase1, Phase2, Phase3 (initial: All) ◇ For 3P3W, it cannot be selected. Setting window is skipped.
AL-C	All, Phase1, Phase2, Phase3 (initial: All) ◇ For 3P4W: All*, Phase1, Phase2, Phase3, Phase-n (initial: All)* Except Phase-n
AL-uV, AL-oV, AL-MS, AL-VH, AL-VT	All, Phase1, Phase2, Phase3 (initial: All) ◇ For 3P3W: All, Line1-2, Line2-3, Line3-1 (initial: All)

Notes

- 1) Selecting [All], is output when one of the voltages of phase1, phase2 or phase3 exceeds (or falls below) the threshold.
- 2) Selecting [total], is output when the total voltage of phase1, phase2 and 3 exceeds (or falls below) the threshold.

[Setting window display] example of OUT1

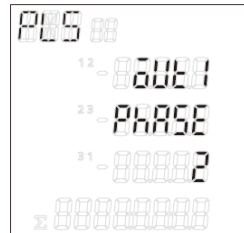
Total



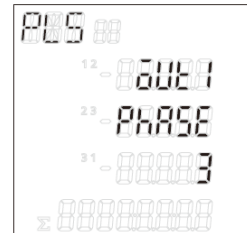
Phase1



Phase2



Phase3



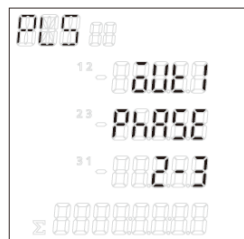
All



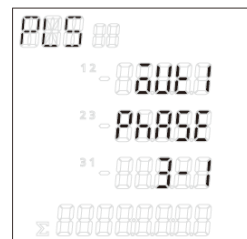
Line1-2



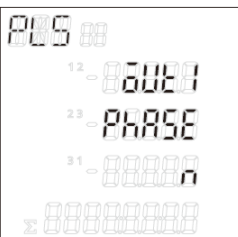
Line2-3



Line3-1

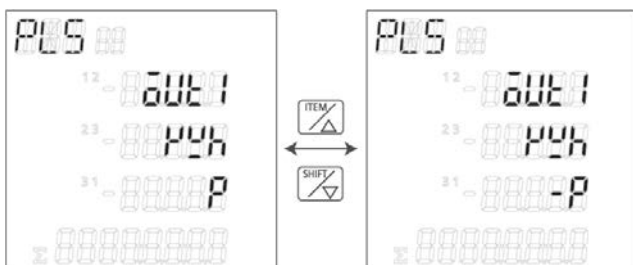


Phase-n



Direction of integral power for pulse output (OUT1 OUT2)

Select the direction of power (import or export) for using as a threshold for pulse output when unit for pulse output is set to "integral value".



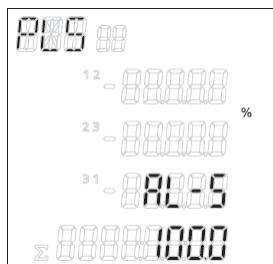
Press <ITEM/Δ>, <SHIFT/▽> to select.

[Set list] P(import), -P(export) (initial: P)

Stand-by power alarm (threshold) (OUT1 OUT2)

* Only when [AL-S] is selected for unit for pulse output.

Set a ratio of current for rated current used for threshold to determine stand-by power.



Press <ITEM/Δ>, <SHIFT/▽> to make a setting.

[Set range] 0.1 to 100.0 % (initial: 100.0)



Increase



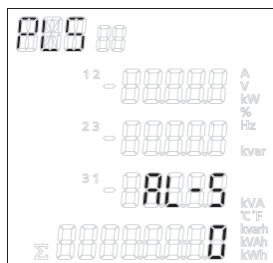
Decrease

Stand-by power alarm (pass time) (OUT1 OUT2)

* Only when [AL-S] is selected for unit for pulse output.

Set pass time used for threshold to determine stand-by power.

When the setting time has elapsed, it will be determined as a stand-by power.



Press <ITEM/Δ>, <SHIFT/▽> to make a setting.

[Set range] 0 to 9999 min. (initial: 0)



Increase

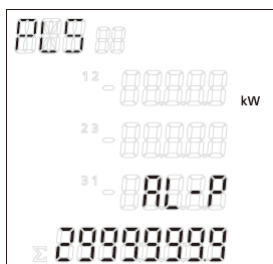


Decrease

Active power alarm threshold (OUT1 OUT2)

* Only when [AL-P] is selected for unit for pulse output.

Set a value of instantaneous active power to use for alarm output.



Press <ITEM/Δ>, <SHIFT/▽> to make a setting.

[Set range] 0.0 to 29999999.9 (initial: 29999999.9)



Increase

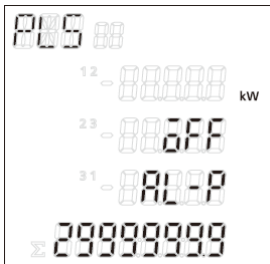


Decrease

Active power alarm OFF threshold (OUT1 OUT2)

* Only when [AL-P] is selected for unit for pulse output.

Set a value of instantaneous active power to use to clear the alarm output.



Press <ITEM/Δ>, <SHIFT/▽> to make a setting.

[Set range] 0.0 to 29999999.9 (initial: 29999999.9)



Increase

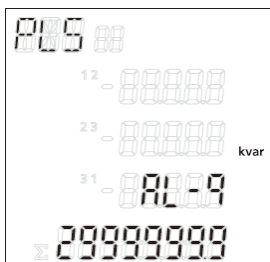


Decrease

Reactive power alarm threshold (OUT1 OUT2)

* Only when [AL-Q] is selected for unit for pulse output.

Set a value of instantaneous reactive power to use for alarm output.



Press <ITEM/Δ>, <SHIFT/▽> to make a setting.

[Set range] 0.0 to 29999999.9 (initial: 29999999.9)



Increase



Decrease

Reactive power alarm OFF threshold (OUT1 OUT2)

* Only when [AL-Q] is selected for unit for pulse output.

Set a value of instantaneous reactive power to clear the alarm output.



Press <ITEM/Δ>, <SHIFT/▽> to make a setting.

[Set range] 0.0 to 29999999.9 (initial: 29999999.9)



Increase

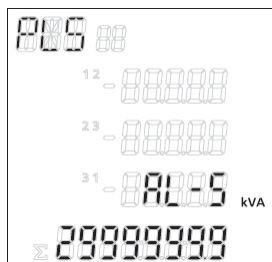


Decrease

Apparent power alarm threshold (OUT1 OUT2)

* Only when [AL-S] is selected for unit for pulse output.

Set a value of instantaneous apparent power to use for alarm output.



Press <ITEM/Δ>, <SHIFT/▽> to make a setting.

[Set range] 0.0 to 2999999.9 (initial: 2999999.9)



Increase



Decrease

Apparent power alarm OFF threshold (OUT1 OUT2)

* Only when [AL-S] is selected for unit for pulse output.

Set a value of instantaneous apparent power to clear the alarm output.



Press <ITEM/Δ>, <SHIFT/▽> to make a setting.

[Set range] 0.0 to 2999999.9 (initial: 2999999.9)



Increase



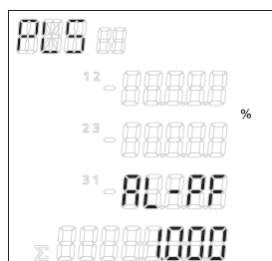
Decrease

PF alarm threshold (OUT1 OUT2)

* Only when [AL-PF] is selected for unit for pulse output.

Set a value for power factor to use for alarm output.

It determines the value by using the absolute value of measured power factor.



Press <ITEM/Δ>, <SHIFT/▽> to make a setting.

[Set range] 0.000 to 1.000 (initial: 0.000)



Increase



Decrease

Note

- 1) When PF is measured to be "0.000", no alarm is output.

PF alarm OFF threshold (OUT1 OUT2)

* Only when [AL-PF] is selected for unit for pulse output.

Set a value for power factor to clear the alarm output.



Press <ITEM/Δ>, <SHIFT/▽> to make a setting.

[Set range] 0.000 to 1.000 (initial: 0.000)



Increase

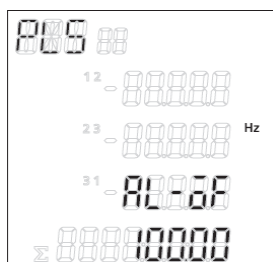


Decrease

Over frequency alarm threshold (OUT1 OUT2)

* Only when [AL-oF] is selected for unit for pulse output.

Set a value for frequency to use for alarm output.



Press <ITEM/Δ>, <SHIFT/▽> to make a setting.

[Set range] 0.00 to 100.00 [Hz] (initial:100.00)



Increase



Decrease

Over frequency alarm OFF threshold (OUT1 OUT2)

* Only when [AL-oF] is selected for unit for pulse output.

Set a value for frequency to clear the alarm output.



Press <ITEM/Δ>, <SHIFT/▽> to make a setting.

[Set range] 0.00 to 100.00 [Hz] (initial:100.00)



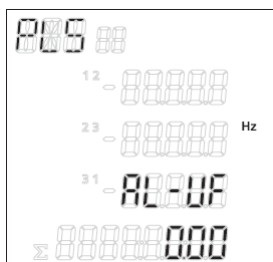
Increase



Decrease

Under frequency alarm threshold (OUT1 OUT2)

* Only when [AL-UF] is selected for unit for pulse output.

Set a value for frequency to use for alarm output.

Press <ITEM/Δ>, <SHIFT/▽> to make a setting.

[Set range] 0.00 to 100.00 [Hz] (initial: 0.00)



Increase



Decrease

Under frequency alarm OFF threshold (OUT1 OUT2)

* Only when [AL-UF] is selected for unit for pulse output.

Set a value for frequency to clear the alarm output.

Press <ITEM/Δ>, <SHIFT/▽> to make a setting.

[Set range] 0.00 to 100.00 [Hz] (initial: 0.00)



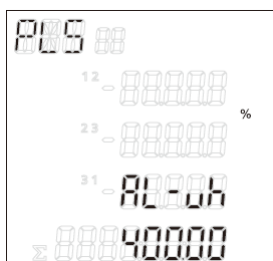
Increase



Decrease

Voltage harmonics alarm threshold (OUT1 OUT2)

* Only when [AL-VH] is selected for unit for pulse output.

Set a value for voltage harmonics to use for alarm output.**When one of 2nd-order to 31st-order harmonics exceeds the setting threshold, an alarm is output.**

Press <ITEM/Δ>, <SHIFT/▽> to make a setting.

[Set range] 0.00 to 400.00 [%] (initial: 400.00)



Increase



Decrease

Voltage harmonics alarm OFF threshold (OUT1 OUT2)

* Only when [AL-VH] is selected for unit for pulse output.

Set a value for voltage harmonics to clear the alarm output.

When all the values of 2nd-order to 31-order harmonics fall below the setting threshold, alarm output is cleared.



Press <ITEM/Δ>, <SHIFT/▽> to make a setting.

[Set range] 0.00 to 400.00 [%] (initial: 400.00)



Increase



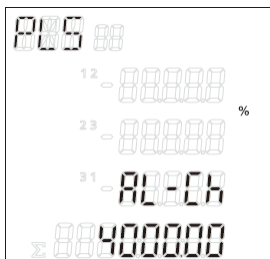
Decrease

Current harmonics alarm threshold (OUT1 OUT2)

* Only when [AL-CH] is selected for unit for pulse output.

Set a value for current harmonics to use for alarm output.

When one of 2nd-order to 31-order harmonics exceeds the setting threshold, an alarm is output.



Press <ITEM/Δ>, <SHIFT/▽> to make a setting.

[Set range] 0.00 to 400.00 [%] (initial: 400.00)



Increase



Decrease

Current harmonics alarm OFF threshold (OUT1 OUT2)

* Only when [AL-CH] is selected for unit for pulse output.

Set a value for current harmonics to clear the alarm output.

When all the values of 2nd to 31st-order harmonics fall below the setting threshold, alarm output is cleared.



Press <ITEM/Δ>, <SHIFT/▽> to make a setting.

[Set range] 0.00 to 400.00 [%] (initial: 400.00)



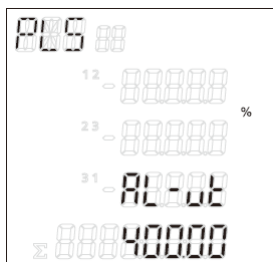
Increase



Decrease

Voltage THD alarm threshold (OUT1 OUT2)

* Only when [AL-VT] is selected for unit for pulse output.

Set a value for voltage THD to use for alarm output.

Press <ITEM/Δ>, <SHIFT/▽> to make a setting.

[Set range] 0.00 to 400.00 [%] (initial: 400.00)



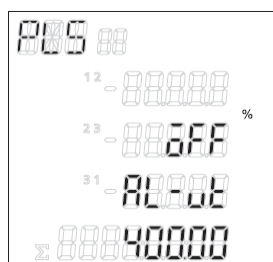
Increase



Decrease

Voltage THD alarm OFF threshold (OUT1 OUT2)

* Only when [AL-VT] is selected for unit for pulse output.

Set a value for voltage THD to clear the alarm output.

Press <ITEM/Δ>, <SHIFT/▽> to make a setting.

[Set range] 0.00 to 400.00 [%] (initial: 400.00)



Increase



Decrease

Current THD alarm threshold (OUT1 OUT2)

* Only when [AL-CT] is selected for unit for pulse output.

Set a value for current THD to use for alarm output.

Press <ITEM/Δ>, <SHIFT/▽> to make a setting.

[Set range] 0.00 to 400.00 [%] (initial: 400.00)



Increase



Decrease

Current THD alarm OFF threshold (OUT1 OUT2)

* Only when [AL-CT] is selected for unit for pulse output.

Set a value for current THD to clear the alarm output.



Press <ITEM/Δ>, <SHIFT/▽> to make a setting.

[Set range] 0.00 to 400.00 [%] (initial: 400.00)



Increase

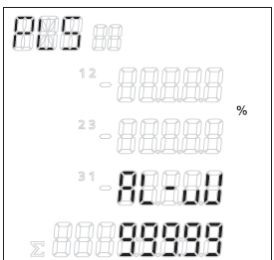


Decrease

Voltage unbalancing alarm threshold (OUT1 OUT2)

* Only when [AL-VU] is selected for unit for pulse output.

Set a value for voltage unbalancing to use for alarm output.



Press <ITEM/Δ>, <SHIFT/▽> to make a setting.

[Set range] 0.00 to 999.99 [%] (initial: 999.99)



Increase



Decrease

Voltage unbalancing alarm OFF threshold (OUT1 OUT2)

* Only when [AL-VU] is selected for unit for pulse output.

Set a value for voltage unbalancing to clear the alarm output.



Press <ITEM/Δ>, <SHIFT/▽> to make a setting.

[Set range] 0.00 to 999.99 [%] (initial: 999.99)



Increase

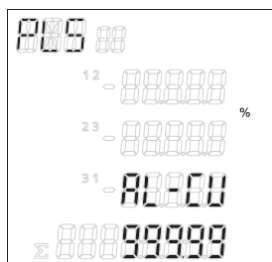


Decrease

Current unbalancing alarm threshold (OUT1 OUT2)

* Only when [AL-CU] is selected for unit for pulse output.

Set a value for current unbalancing to use for alarm output.



Press <ITEM/Δ>, <SHIFT/▽> to make a setting.

[Set range] 0.00 to 999.99 [%] (initial: 999.99)



Increase

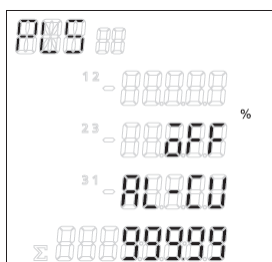


Decrease

Current unbalancing alarm OFF threshold (OUT1 OUT2)

* Only when [AL-CU] is selected for unit for pulse output.

Set a value for current unbalancing to clear the alarm output.



Press <ITEM/Δ>, <SHIFT/▽> to make a setting.

[Set range] 0.00 to 999.99 [%] (initial: 999.99)



Increase



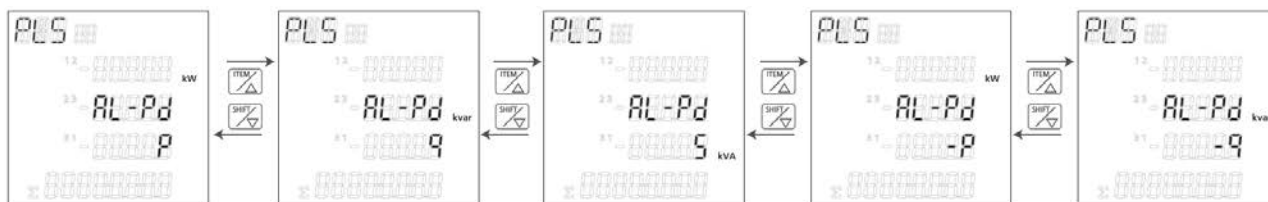
Decrease

Power type for power demand alarm

* Only when [Slide] or [Fixed] is selected for power demand type, and when [AL-PD] is selected for unit for pulse output.

Select power type to use for power demand alarm.

Press <ITEM/Δ>, <SHIFT/▽> to make a setting.



[Set list] P (active power), Q (reactive power), S (apparent power), -P (active power (export)), -Q (reactive power (export)) (initial: P (active power))

Power demand alarm threshold (OUT1 OUT2)

* Only when [Peak] isn't selected for power demand type,
and when [AL-PD] is selected for unit for pulse output.

Set a value for instantaneous power to use for alarm output.

The unit differs according to the selected power type.

P(active power)

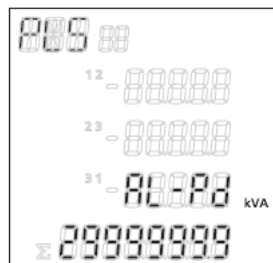
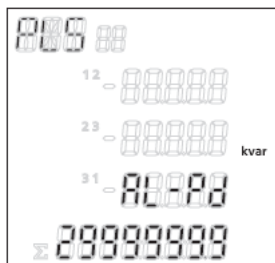
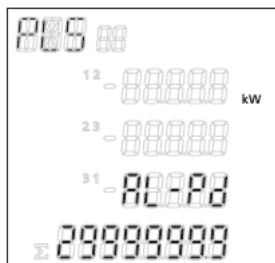
Q(reactive power)

-P(active power (import))

-Q(reactive power (import))

S(apparent power)

Press <ITEM/Δ>, <SHIFT/▽> to set the threshold.



Increase



Decrease

[Set range] 0.000 to 99999.999 [kWh/kvar/kVA] (initial: 0.0)

Power demand alarm OFF threshold (OUT1 OUT2)

* Only when [Slide] or [Fixed] is selected for power demand type,
and when [AL-PD] is selected for unit for pulse output.

Set a value for instantaneous power to clear the alarm output.

The unit differs according to the selected power type.

P(active power)

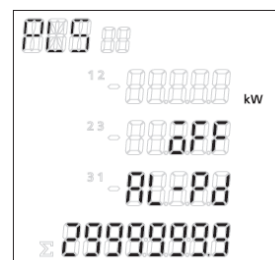
Q(reactive power)

-P(active power (import))

-Q(reactive power (import))

S(apparent power)

Press <ITEM/Δ>, <SHIFT/▽> to select the threshold.



Increase



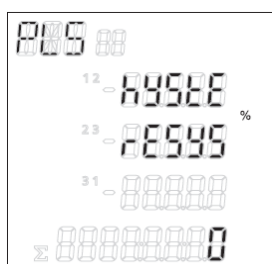
Decrease

[Set range] 0.000 to 99999.999 [kWh/kvar/kVA] (initial: 99999.999)

Power demand alarm hysteresis (OUT1 OUT2)

* Only when [30min] is selected for power demand type, and when [AL-PD] is selected for unit for pulse output.

Set hysteresis to clear timing of power demand alarm.



Press <ITEM/Δ>, <SHIFT/▽> to make a setting.

[Set range] 0 to 100 [%] (initial: 0)



Increase

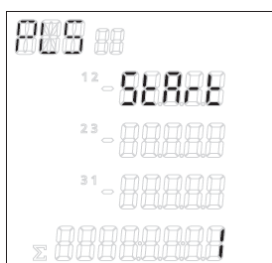


Decrease

Power demand alarm start time (OUT1 OUT2)

* Only when [30min] is selected for power demand type, and when [AL-PD] is selected for unit for pulse output.

Set time in minutes to start monitoring power demand.



Press <ITEM/Δ>, <SHIFT/▽> to make a setting.

[Set range] 1 to 30 [min.] (initial: 10)



Increase

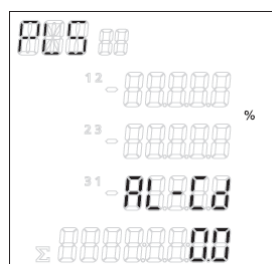


Decrease

Current demand alarm threshold (OUT1 OUT2)

* Only when [AL-CD] is selected for unit for pulse output.

Set ratio of current demand to use for alarm output.



Press <ITEM/Δ>, <SHIFT/▽> to make a setting.

[Set range] 0.0 to 120.0 [%] (initial: 0.0)



Increase



Decrease

Current demand alarm OFF threshold (OUT1 OUT2)

* Only when [AL-CD] is selected for unit for pulse output.

Set ratio of current demand to clear the alarm output.



Press <ITEM/Δ>, <SHIFT/▽> to make a setting.

[Set range] 0.0 to 120.0 [%] (initial: 0.0)



Increase

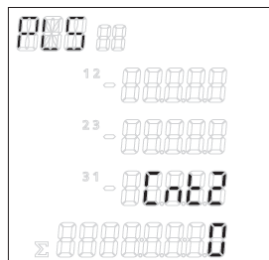
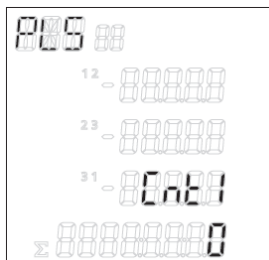


Decrease

Preset value (OUT1 OUT2)

* Only when [Cnt1] or [Cnt2] is selected for unit for pulse output.

Set count value to output pulse.



Press <ITEM/Δ>, <SHIFT/▽> to make a setting.

[Set range] 0(0.000) to 999999(999.999)
(initial: 0)



Increase



Decrease

7.4.4 Settings for communication

Protocol

Select protocol for main unit via serial communication (RS485).

Note

- 1) When the protocol is changed, the device number, transmission speed (Baud rate), transmission format, stop bit and response time will be initialised.

Press <ITEM/Δ>, <SHIFT/▽> to select the protocol.



[Set list] MEWT(MEWTOCOL), MODr (MODBUS(RTU)), 645(DL/T645-2007) (initial: MEWT)



Device number

Set an individual device number for each unit when two or more units are connected for serial communication via RS485.



Press <ITEM/Δ>, <SHIFT/▽> to make the setting.
The setting range differs depending on the protocol.

[Set range] MEWTOCOL: 1 to 99
 MODBUS(RTU): 1 to 247
 DL/T645-2007: 0 to 9999 (initial: 1)

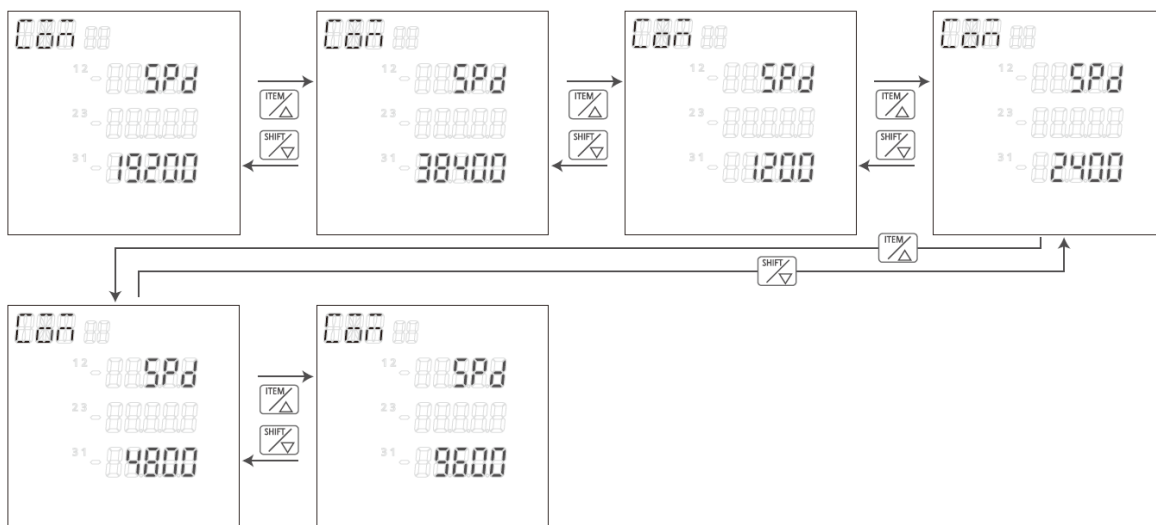
 Increase
 Decrease

Transmission speed (Baud rate)

Select the serial communication (RS485) transmission speed.

Define the transmission speed in accordance with that of the master (PLC etc.).

Press <ITEM/Δ>, <SHIFT/▽> to select.



[Set list] 1200, 2400, 4800, 9600, 19200, 38400 [bps] (initial: 19200)

Transmission format

*Select [8b-E] if [645] is set for the protocol.

Select serial communication (RS485) transmission format (data length, parity).

Define the transmission format in accordance with that of the master (PLC etc.).

Press <ITEM/Δ>, <SHIFT/▽> to select.

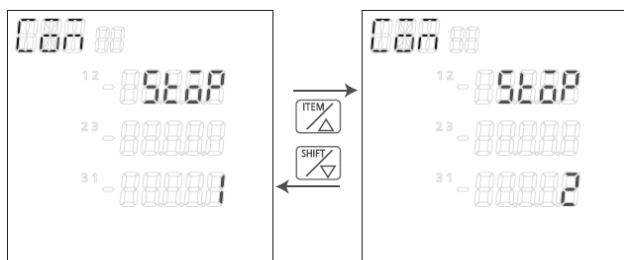


[Set list] b-o (8bit odd), 8b-n (8bit none), 8b-E (8bit even) (initial: 8b-o)

Stop bit

*Select [1] if [645] is set for the protocol.

Select the serial communication (RS485) stop bit.



Press <ITEM/Δ>, <SHIFT/▽> to select.

[Set list] 1, 2 (initial: 1)

Response time

*Select 50 or more if [645] is set for the protocol.

Set the serial communication (RS485) response time of the main unit.

When a command is received, it sends a response after the setting response time has elapsed.



Press <ITEM/Δ>, <SHIFT/▽> to make the setting.

[Set range] 1 to 99 ms (initial: 5)



Increase



Decrease

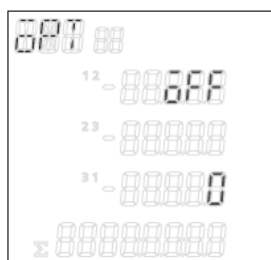
Note

- 1) If Data Logger Unit (DLU) or Data Logger Light (DLL) is used as a master, set the response time to 5ms or more because DLU or DLL sends the response after 1.1 ms or less from receipt of the command when the transmission speed is set to 19200 bps.

7.4.5 Settings for optional functions

Auto-off

The display LCD turns off automatically when there is no key operation for a long time.
When the setting time has elapsed, the backlight will turn off.



Set <ITEM/Δ>, <SHIFT/∇> to make the setting.

[Set range] 0 to 99 min. (initial:1)



Increase



Decrease

Always turn on: [0]

Turn off after setting time: [1 to 99]

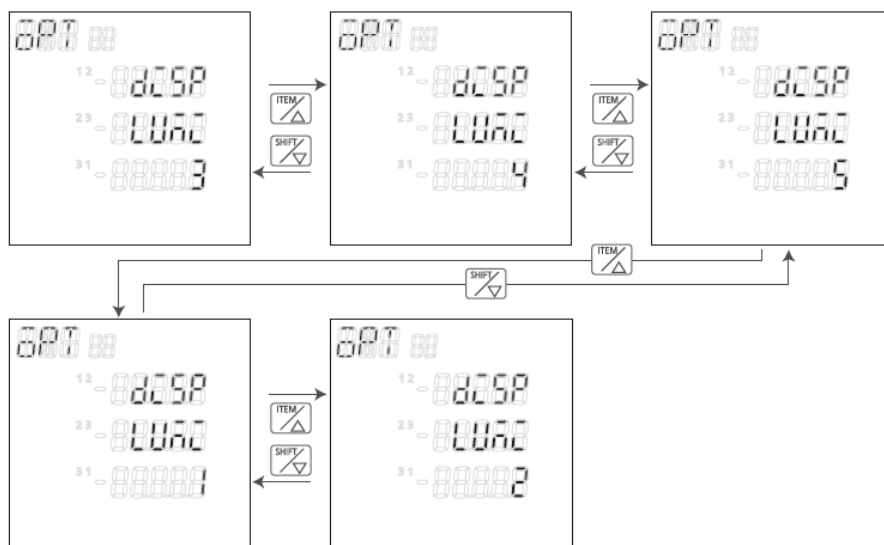
Note

- 1) After the LCD has been turned off, any key operation turns it on again.

Luminance

Adjust the display luminance.

Press <ITEM/Δ>, <SHIFT/∇> to select.

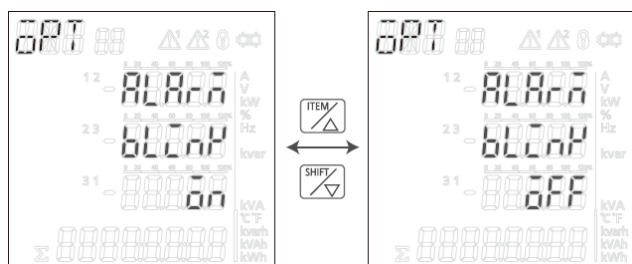


[Set item] 1, 2, 3, 4, 5 (initial: 3)

Dark to light from 1 to 5

Alarm blinking

Select whether the display flashes during alarm output.



Press <ITEM/Δ>, <SHIFT/▽> to select.

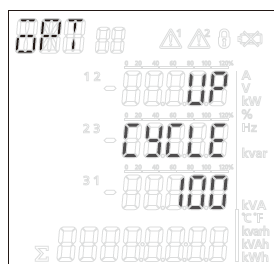
[Set list] ON, OFF (initial: OFF)

Press any key while the display is flashing to stop it flashing.

Update cycle

Set update cycle for measuring window.

It updates the display of measured values for each setting time.



Press <ITEM/Δ>, <SHIFT/▽> to make a setting.

[Set range] 100 to 1000ms (initial: 100)



Increase



Decrease

Auto-display

This automatically changes the items of each integral value.

When the setting time elapses after key operation, the integral value is automatically changed.



Press <ITEM/Δ>, <SHIFT/▽> to make the setting.

[Set range] 0 to 99 min. (initial: 10)



Increase



Decrease

Do not change automatically: [0]

Change automatically after the setting time: [1 to 99]

Note

- Any key operation during auto-display makes the display shift to instantaneous active power.

Display cycle

*It skips this item when [0] is set for auto-display.

Set each display cycle during auto-display.



Press <ITEM/Δ>, <SHIFT/▽> to make the setting.

[Set range] 1 to 99 sec (initial: 5)



Increase



Decrease

Shift every 1 second:

[1]

Note

- Any key operation during auto-display makes the display shift to instantaneous active power.

Temperature correction

The measured temperature can be corrected to display.



Press <ITEM/Δ>, <SHIFT/▽> to make the setting.

[Set range] -100.0 to 100.0 (initial: 0.0)



Increase



Decrease

Reset all integral values

Integral power (active, reactive, apparent) can be reset once.



Press <ITEM/Δ>, <SHIFT/▽> to select.

[Set list] YES, NO (initial: NO)

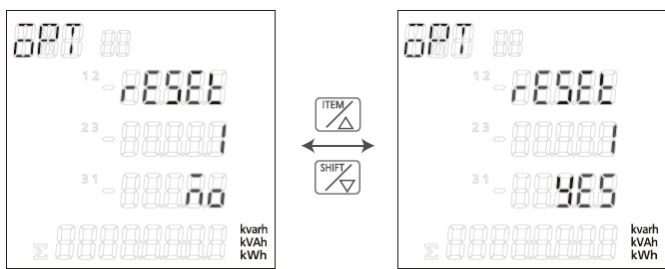
Reset all: [YES]

Do not reset: [NO]

Reset integral value 1

*It skips this item when [YES] is selected to reset all integral values.

Reset the integral power of 1CH/1-phase (active, reactive, apparent) and integral export power of 1CH/1-phase (active, reactive).



Press <ITEM/Δ>, <SHIFT/▽> to select.

[Set list] YES, NO (initial: NO)

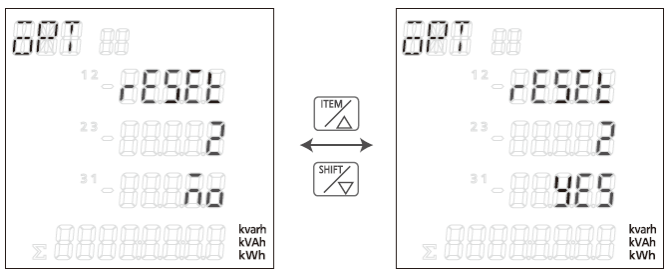
Reset: [YES]

Do not reset: [NO]

Reset integral value 2

*It skips this item when [YES] is selected to reset all integral values.

Reset the integral power of 2CH/2-phase (active, reactive, apparent) and integral export power of 2CH/2-phase (active, reactive).



Press <ITEM/Δ>, <SHIFT/▽> to select.

[Set list] YES, NO (initial: NO)

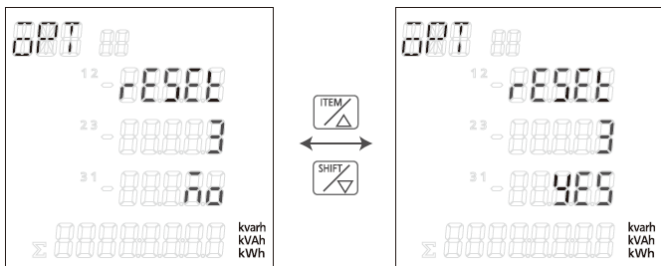
Reset: [YES]

Do not reset: [NO]

Reset integral value 3

*It skips this item when [YES] is selected to reset all integral values.

Reset the integral power of 3CH/3-phase (active, reactive, apparent) and integral export power of 3CH/3-phase (active, reactive).



Press <ITEM/Δ>, <SHIFT/▽> to select.

[Set list] YES, NO (initial: NO)

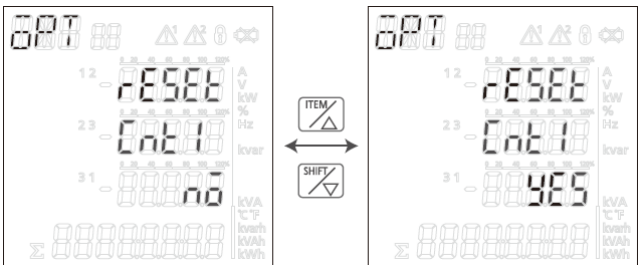
Reset: [YES]

Do not reset: [NO]

Reset count value 1

*It skips this item when [YES] is selected to reset all integral values.

Reset the count value 1.



Press <ITEM/Δ>, <SHIFT/▽> to select.

[Set list] YES, NO (initial: NO)

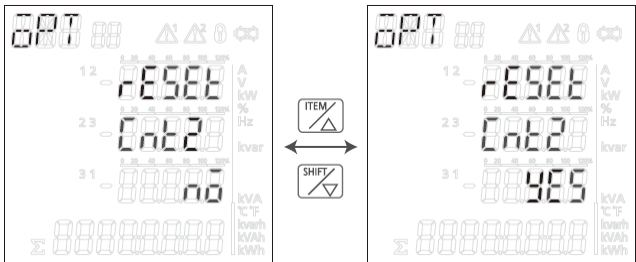
Reset: [YES]

Do not reset: [NO]

Reset count value 2

*It skips this item when [YES] is selected to reset all integral values.

Reset the count value 2.



Press <ITEM/Δ>, <SHIFT/▽> to select.

[Set list] YES, NO (initial: NO)

Reset: [YES]

Do not reset: [NO]

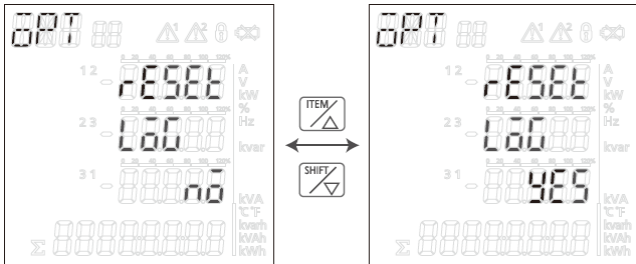
Note

- 1) If [PM] is selected for power input type, this resets the electric power converted by pulse.

Reset log data

*It skips this item when [YES] is selected to reset all integral values.

Reset all log data (monthly max. /min. value of measured value, max. demand, power quality event).



Press <ITEM/Δ>, <SHIFT/▽> to select.

[Set list] YES, NO (initial: NO)

Reset: [YES]

Do not reset: [NO]

Version

You can check the software version.



It displays the software version.

7.4.6 Settings for time program

Time program 1 to 10

You can set 10 types of time program.

Set a start time and end time for each time zone and use it with the setting conversion rate.

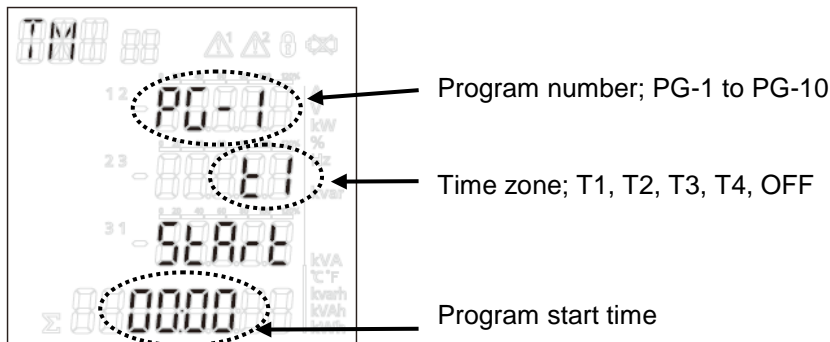
Refer to chapter 7 "Settings", "Parameters for time program" in detail.

- End time

- ◇ Start time of PG-2 is set as the end time of PG-1.

- ◇ This means that the end time of PG-n is the same as the start time of PG-(n+1).

[Display explanation]



Press <SET> and "time zone" will flash.

Press <ITEM/Δ>, <SHIFT/▽> to select the time zone.

After that press <SET>, and "program start time" will flash. Set the hour and minute.

The same time period cannot be set to the different programs.

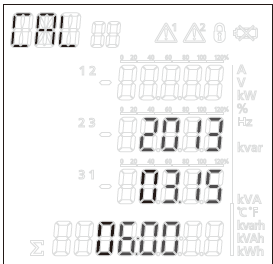
Press <ITEM/Δ> to change the program number.

7.4.7 Settings for calendar timer

Calendar timer

Set the year, month, day and time.

- Setting range is from January 1, 2013, 00:00 to December 31, 2099, 23:59.
Set the date and time to use logging function.



Press <SET> and year, month, date, time will flash in turn.
If the setting item is flashing, press <ITEM/Δ>, <SHIFT/∇>.

	CAUTION!
	The timing when the calendar timer is set to the unit is the timing when you select [YES] in the confirmation window and press <SET>.
	Pressing <SET> in the calendar timer setting window doesn't set the calendar timer to the unit. Pay attention when setting the time in seconds.

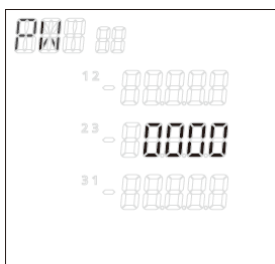
7.4.8 Password setting

Password setting

You can set a password for changing the settings.

The password must be entered before changing the setting mode.

We recommend that you set a password to avoid changes from being made inadvertently.



Press <SET> and [0] on the left will flash.

Set password using <ITEM/Δ>, <SHIFT/∇>.



Increase



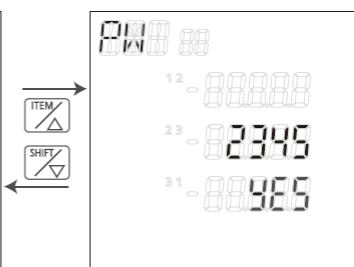
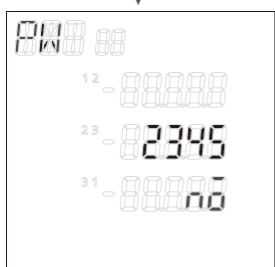
Move the digit entered to the right.

Set from left to right. The digit will flash.

[Set range] 0000 to 9999 (initial: 0000)



Set a 4-digit password and press <SET>
The confirmation window will then be displayed.

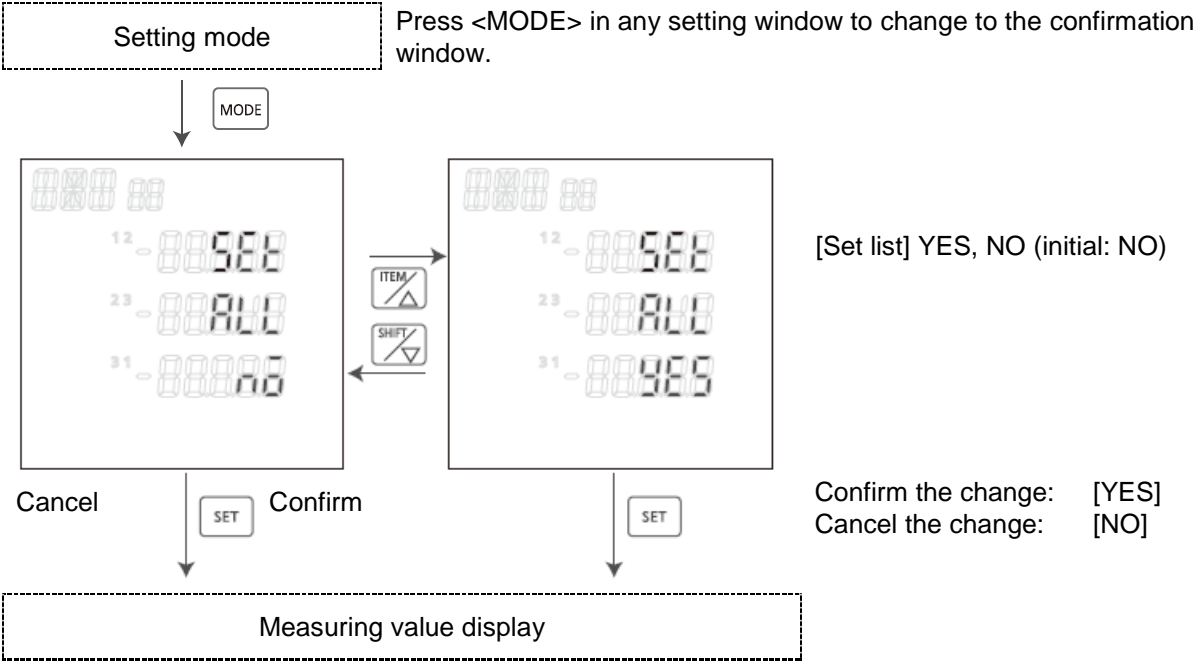


[Set range] YES, NO (initial: NO)

Confirm: [YES]

Do not confirm: [NO]

7.4.9 Confirmation window



8. Various functions

8.1 Pulse output function

You can use 2 types of pulse output, OUT1 and OUT2.

Refer to chapter 7.4.3 "Settings for pulse measurement" for making settings.

[OUT1][OUT2] flash when a pulse is output.

The time and date when a pulse is output are recorded up for up to 10 records for each OUT1 and OUT2.

8.1.1 Output depends on integral electric power

Set the unit for pulse output of integral power value and pulse output is enabled every time the integral electric power reaches the unit. (Pulse width: approx. 100ms)

It judges at the same time of sampling cycle.

8.1.2 Stand-by alarm

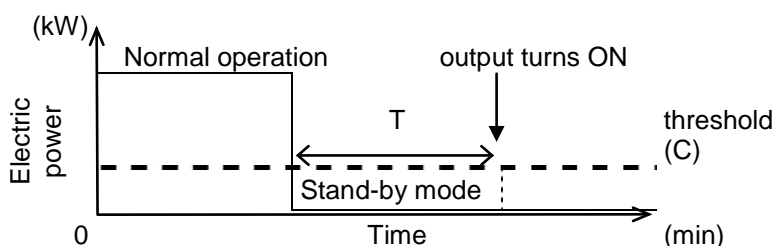
When it detects stand-by power (current) of the measured load, pulse output is enabled.

Set threshold (current) (C) and stand-by time (T) to determine stand-by power.

When the measured load has met the setting conditions, pulse output is enabled.

When it exceeds the setting threshold, it turns off and is reset.

(Working flow chart)



8.1.3 Under voltage alarm

When it falls below the voltage setting, pulse output is enabled.

When it exceeds the setting voltage, output is disabled.

8.1.4 Over voltage alarm

When it exceeds the voltage setting, pulse output is enabled.

When it falls below the voltage setting, output is disabled.

8.1.5 Power interruption alarm

When it detects that the voltage has fallen below 5% of the rated voltage for 100ms or more, pulse output is enabled.

8.1.6 Under current alarm

When it falls below the current setting, pulse output is enabled.

When it exceeds the setting, output is disabled.

8.1.7 Current alarm

When it exceeds the current setting, pulse output is enabled.

When it falls below the setting, output is disabled.

8.1.8 Power alarm

When it exceeds the setting for instantaneous electric power (active, reactive, apparent, active(export), reactive(export)), pulse output is enabled in order to notice.

When it falls below the setting, output is disabled.

8.1.9 Other alarms

Output is enabled or disabled according to each alarm setting.

PF alarm, over frequency alarm, under frequency alarm, voltage harmonics alarm, current harmonics alarm, voltage THD alarm, current THD alarm, voltage unbalancing alarm, current unbalancing alarm, power demand alarm, current demand alarm

8.1.10 Output depends on count value

Set the preset value and pulse output is enabled at the time when the count value reaches the preset value. Refer to the next sections in detail.

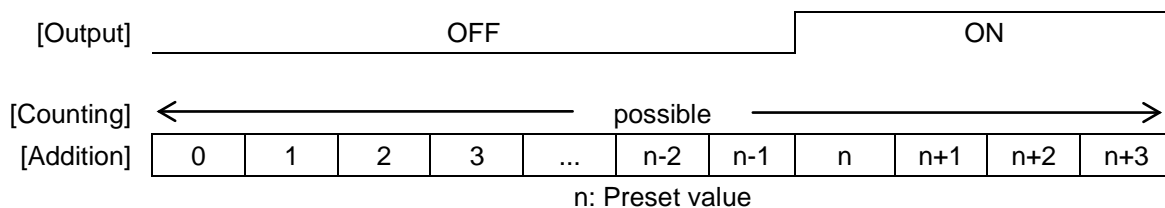
8.1.11 Level output

It runs on or off the output by writing 0 (OFF) or 1 (ON) to the designated data register (OUT1: DT00005, OUT2: DT00006) via communication by external control.

8.2 Counter function

• Operation mode

Maintain output hold count HOLD



- ◇ Output control is maintained after counting up has been completed and until reset. However counting is possible despite completion of count-up .
- ◇ It reverts to "0" after counting up full scale, but output control is maintained. However output is OFF if count value or preset value is changed.

• Change the Preset Value

It is possible to change the preset value even during counting. The following points should be noted however:

- ◇ When the pre-scale value is "1.000". (PSCL = 1.000)
 - If the preset value is changed to a value that is lower than the count value, counting will continue until it reaches full scale, returns to "0" and then reaches the new preset value.
 - If the preset value is changed to "0", it will not count up starting from "0". It counts up when the counting value reverts to "0" again (after reaching full scale). However output is OFF if the count value or preset value is changed.
 - When the count value is fixed, output is changed according to the changing of the preset value as below.
 - If the preset value is changed to a value that is lower than the count value or the same as the count value, output is ON.
Count value \geq Preset value
 - If the preset value is changed to a value that is higher 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.

8.3 Clock correction function


The clock in Power Monitor 51A can be set by pulse input when you set pulse input IN1 to [Clock]. However, if the clock is different by one hour or more from the setting time, it is not corrected.

8.4 Demand function

You can select demand calculation methods for Power Monitor 51A from the bellows.

- Peak demand
- In accordance with IEC 61557-12
 - ◇ Sliding block interval demand
 - ◇ Fixed block interval demand
 - ◇ Current demand
- 30-min. demand

Please use this simple demand function as your standard. The value is not guaranteed.

	CAUTION!
	<ul style="list-style-type: none"> • Definition of demand It is demand measurement in order to use by yourself as your standard. • The time used by this function is the time set up with Power Monitor 51A. Therefore, it is different from the demand meter controlled by an electric power company.

8.4.1 Peak demand

The maximum values of instantaneous power (active, reactive, apparent, active (export), reactive (export)) in one month are recorded as peak demand for 12 months.

8.4.2 Block interval demand

It calculates demand by setting interval and displays.

You can select sliding block or fixed block for the interval.

It outputs a demand alarm according to the setting conditions.

Sliding block

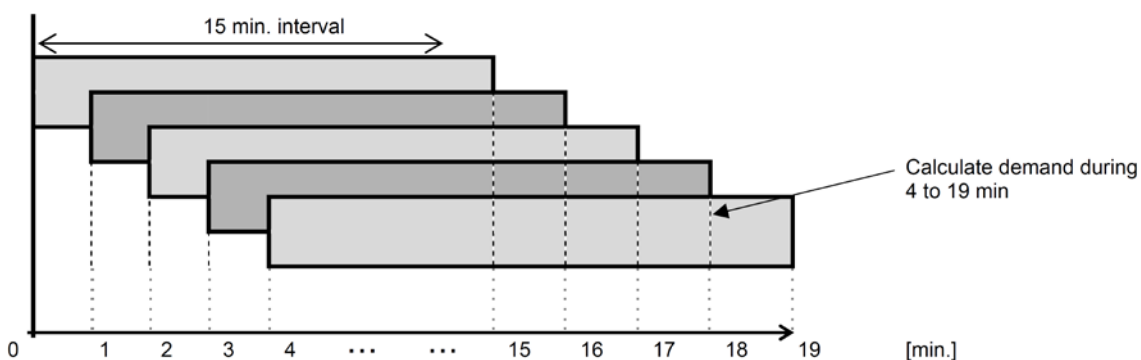
Set power interval by 1 to 60 (min.) (every minute). It calculates demand during latest finished interval and displays.

One interval is started for each time that is set for "power demand interval 2".

Example:

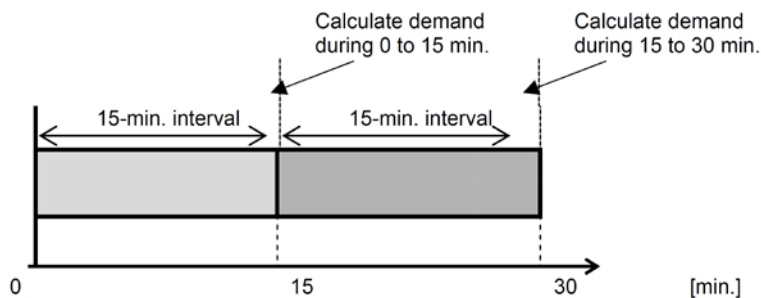
Power demand interval: 15 min.

Power demand interval 2: 1 min.



Fixed block

Set power interval by 1 to 60 (min.) (every minute.) It calculates demand during latest finished interval and displays. After one interval finishes, the next interval starts.



8.4.3 30-min. demand

It estimates an average using electric power and determines it for the setting demand every minute.

This works for demand monitoring for electric power input by CT or pulse.

You can select the demand calculation method, additional or average.

In order to use demand monitoring by pulse input, input a pulse that meet the specifications of 8.5.

A demand alarm is output according to the setting conditions.

Output demand alarm

When present demand or estimated demand exceeds the setting threshold for power demand alarm, an alarm is output.

[present demand or estimated demand \geq threshold for power demand alarm]

Alarm output is kept for 1 minute following this,

[present demand or estimated demand \geq threshold for power demand alarm] \Rightarrow Keep alarm

[present demand or estimated demand \geq threshold for power demand alarm] \Rightarrow Clear alarm

When you set hysteresis for power demand alarm, the timing of clear alarm is as below.

Example:

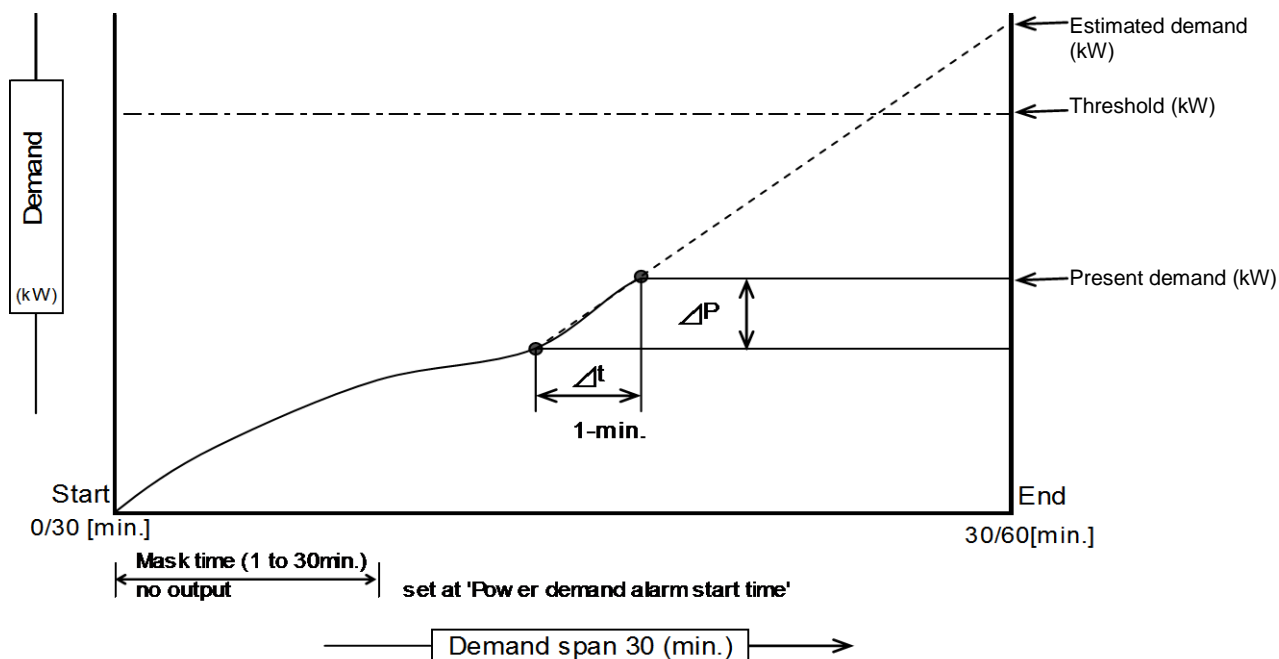
Threshold for power demand alarm: 100 kW

Hysteresis: 10 %

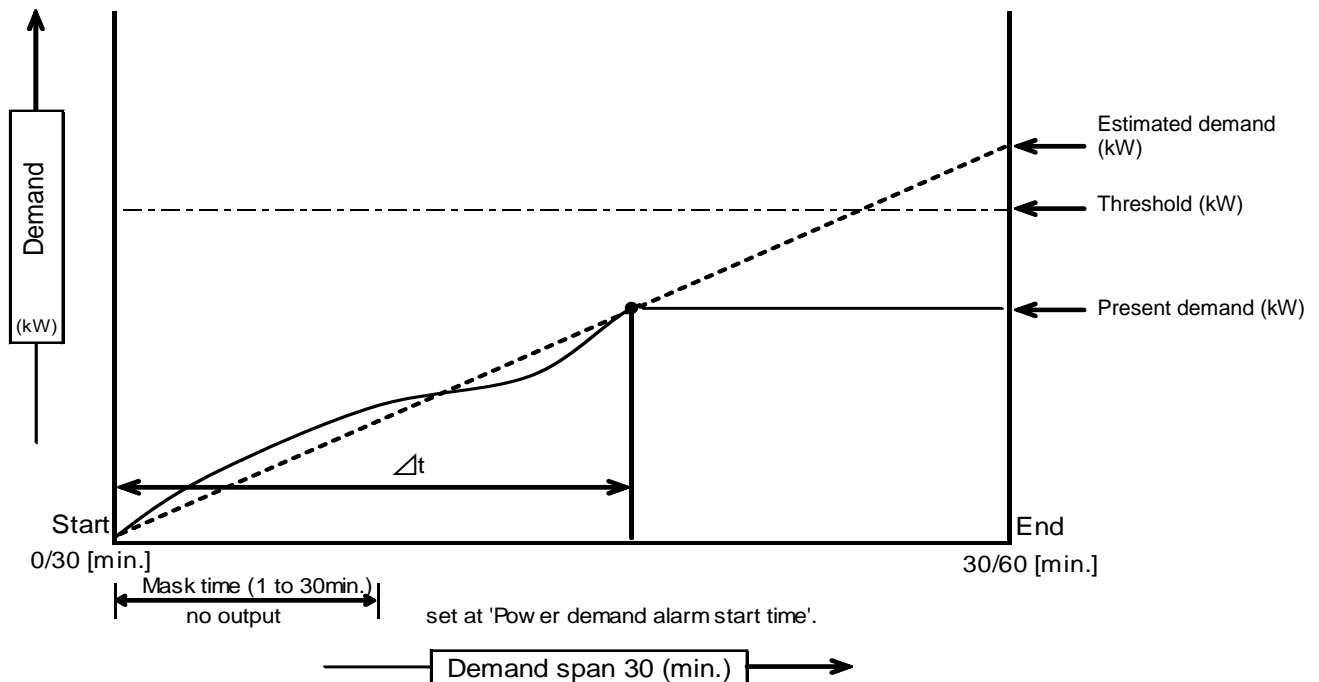
When present demand or estimated demand exceeds 100 kW, an alarm is output and kept for 1 minute. After that, if the present demand or estimated demand exceeds 90 kW, the alarm is kept. If it is below 90 kW, the alarm is cleared.

Setting hysteresis can prevent frequent alarm output ON/OFF near threshold for power demand alarm.

Working outline for additional



Working outline for average



<Present demand (PV)>

It shows demand value from the time when demand span starts to present time.

[Calculation]

CT input (calculated by Power Monitor 51A)

Present demand (kW)	=	Integral electric power until present from the start	×	$\frac{60 \text{ (min.)}}{30 \text{ (min.) demand span}}$
	=	Integral electric power until present from the start	×	2

Pulse input (integral pulse input from a power meter)

Present demand (kW)	=	(Integral electric power until present from the start × pulse rate)	×	$\frac{60 \text{ (min.)}}{30 \text{ (min.) demand span}}$
	=	(Integral electric power until present from the start × pulse rate)	×	2

<Estimated demand (EV)>

It shows the estimated demand value at the end of demand span according to the power used from the time when demand span starts to present time.

[Calculation] (addition)

$$\text{Estimated demand (kW)} = \text{Present demand} \times \frac{\text{Power change amount for } \Delta t \text{ minutes } (\Delta P)}{\text{Sampling cycle } \Delta t \text{ (minute)}} \times \text{Remaining time (minute)}$$

[Calculation] (average)

$$\text{Estimated demand (kW)} = \frac{\text{Present demand}}{\text{Pass time}} \times \text{Remaining time (minute)}$$

<Power demand threshold (SV)>

It shows the threshold for demand alarm output.

<Ratio of estimated demand (SET.R)>

Ratio of estimated demand to power demand alarm threshold.

<Alarm output>

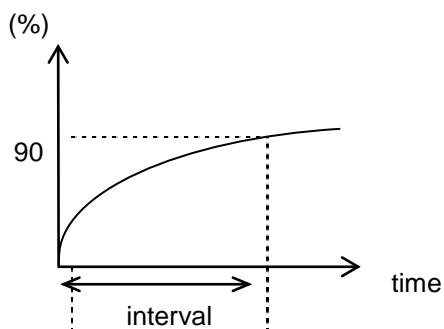
When present demand or estimated demand has satisfied the setting conditions, an alarm is output and an alarm is indicated.

8.4.4 Current demand

Current demand calculates the demand based on a thermal demand meter.

Current demand =
(Average of current – last current demand value) × 90 % (fixed) + last current demand value

In the event that a stable current flows for the interval time, 90% of current value is displayed.



8.4.5 Max. demand value

Maximum value of measured demand value (active, reactive, apparent, active (export), reactive (export), current)) during one month is considered the max. demand value.

It records the max. demand value of each time zone and all time for 12 months.

8.4.6 Demand alarm output

- Is output with pulse output terminal. (open collector)
- Is output only when [AL-PD] is set for unit for pulse output.
- An alarm is not output if power demand alarm threshold is set to "0.000" kW.

8.4.7 Working at power failure and at recovery

<In the event of power failure>

- Demand measurement is stopped.
- Monthly max. demand log, max. demand value is recorded in the internal memory.

<At recovery>

- Demand measuring is stopped until next span starts. When the next span starts, demand measuring is started.

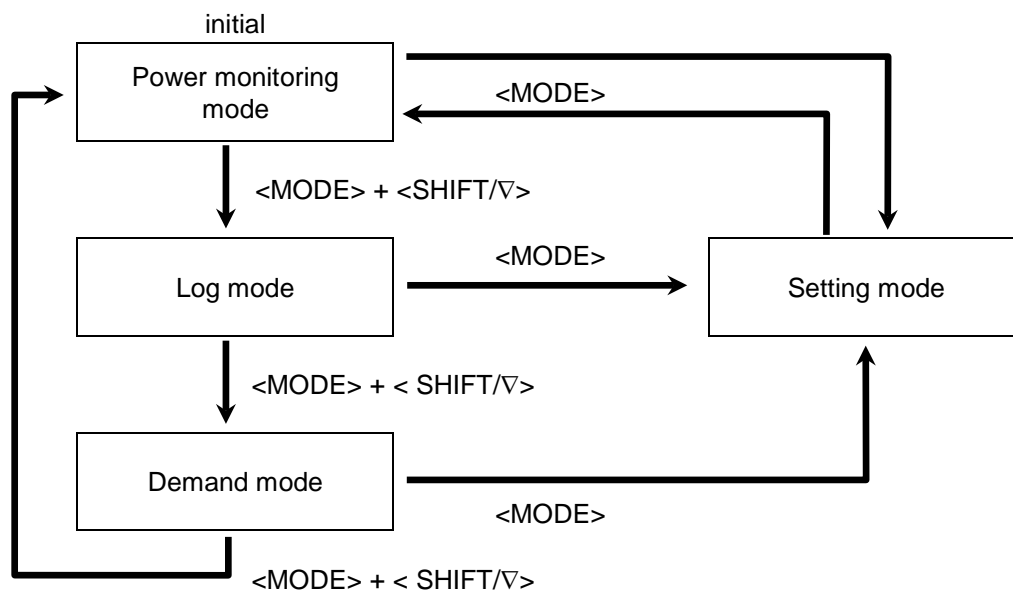
9. Display each value

9.1 Operation of monitor display

[Shift the display mode]

Press <SHIFT/▽> while pressing <MODE>, it changes to measuring mode, logging mode and demand mode.

Press <MODE> to change the setting mode.

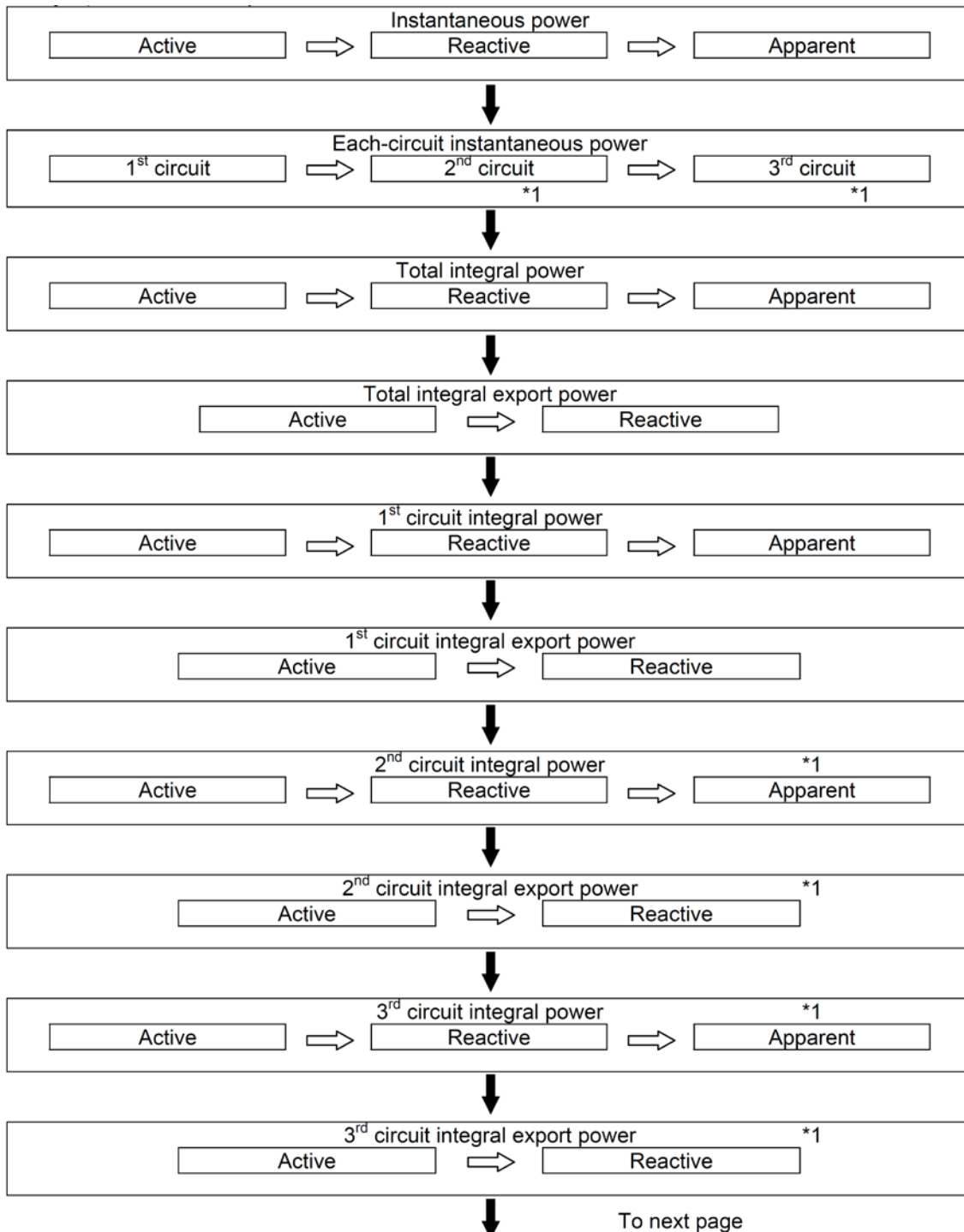


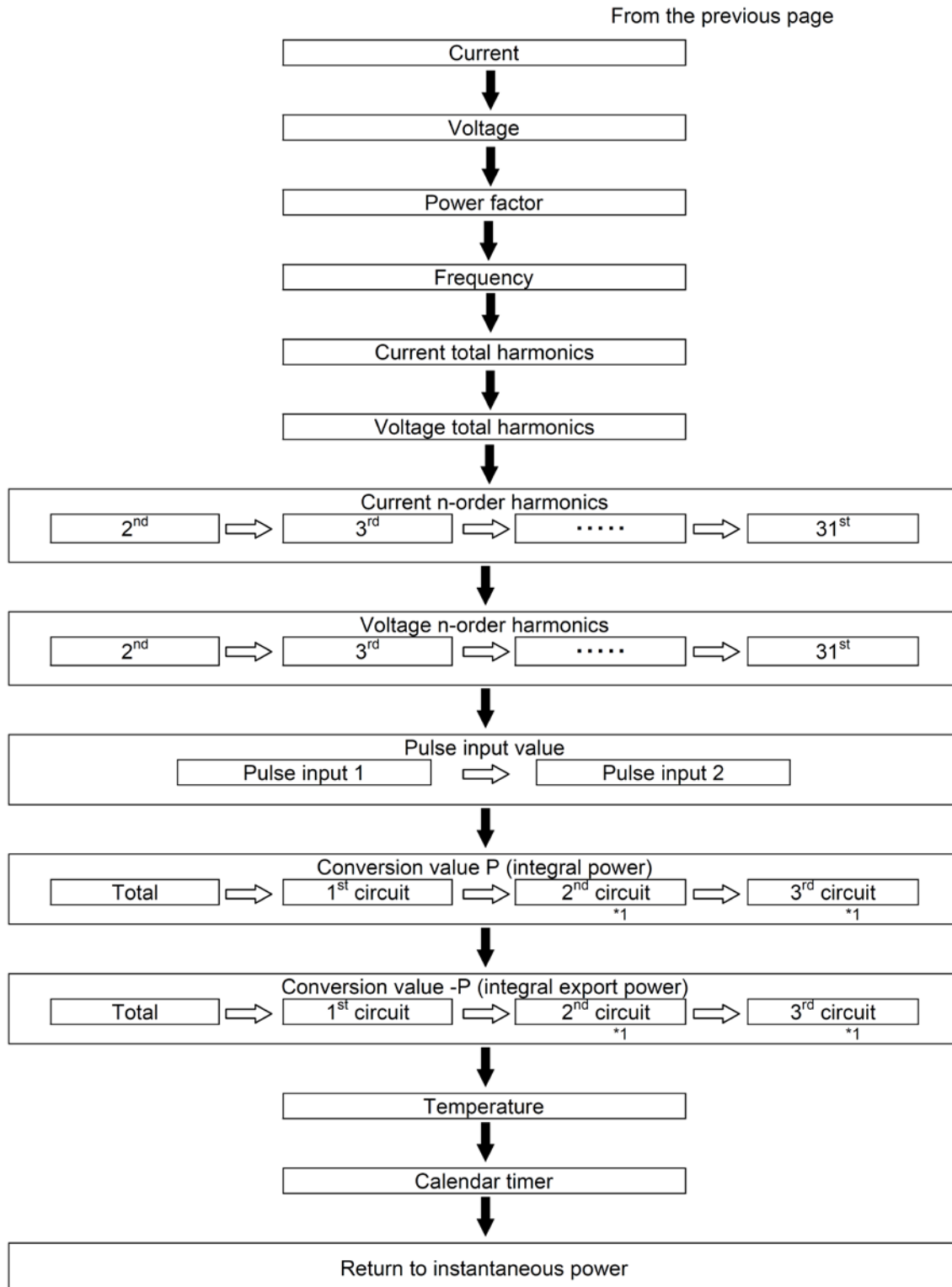
9.2 Operation of monitor display

9.2.1 Single-phase two-wire system

An arrow mark indicates that each key must be pressed:

➡ <ITEM/Δ> ➡ <SHIFT/▽>



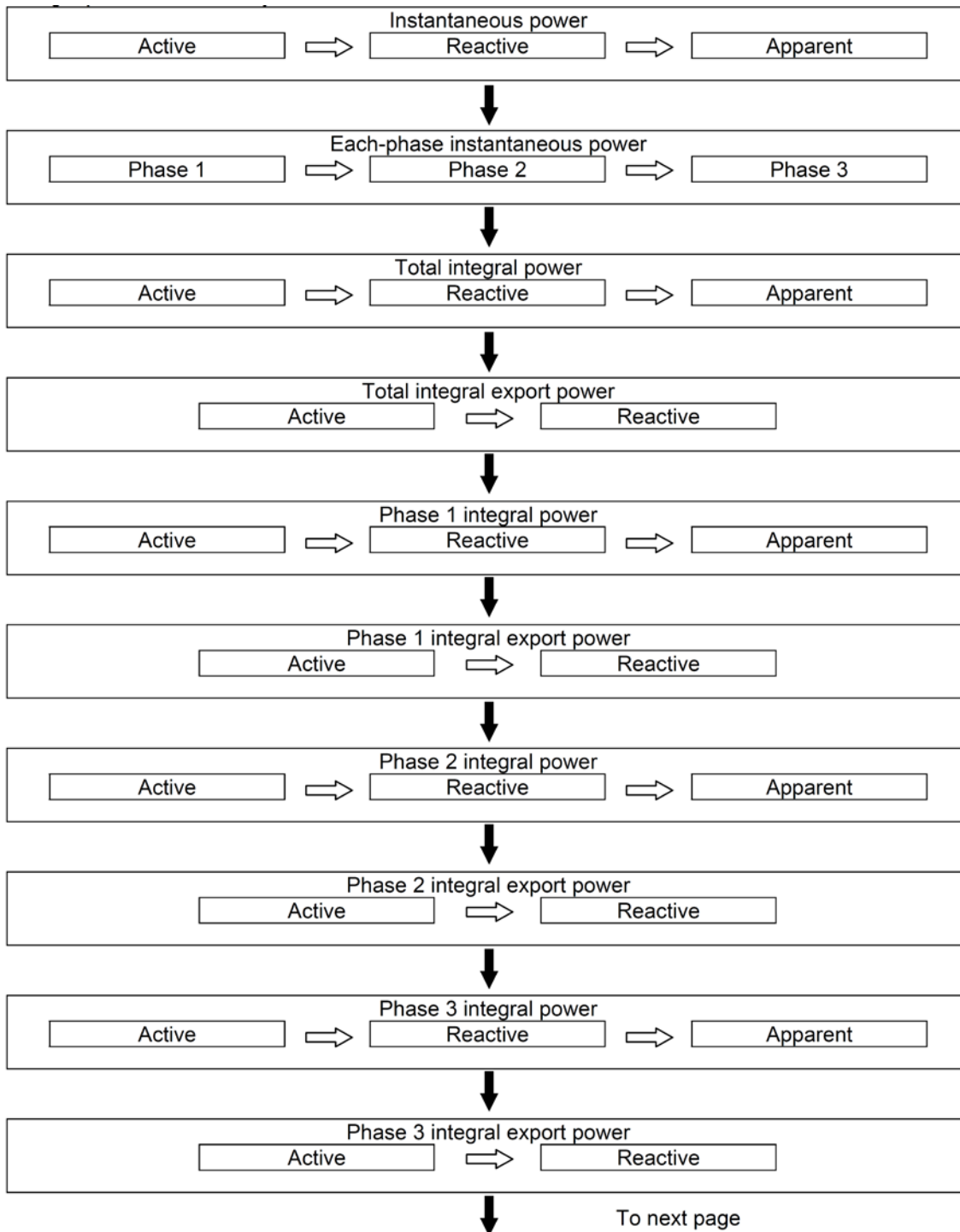


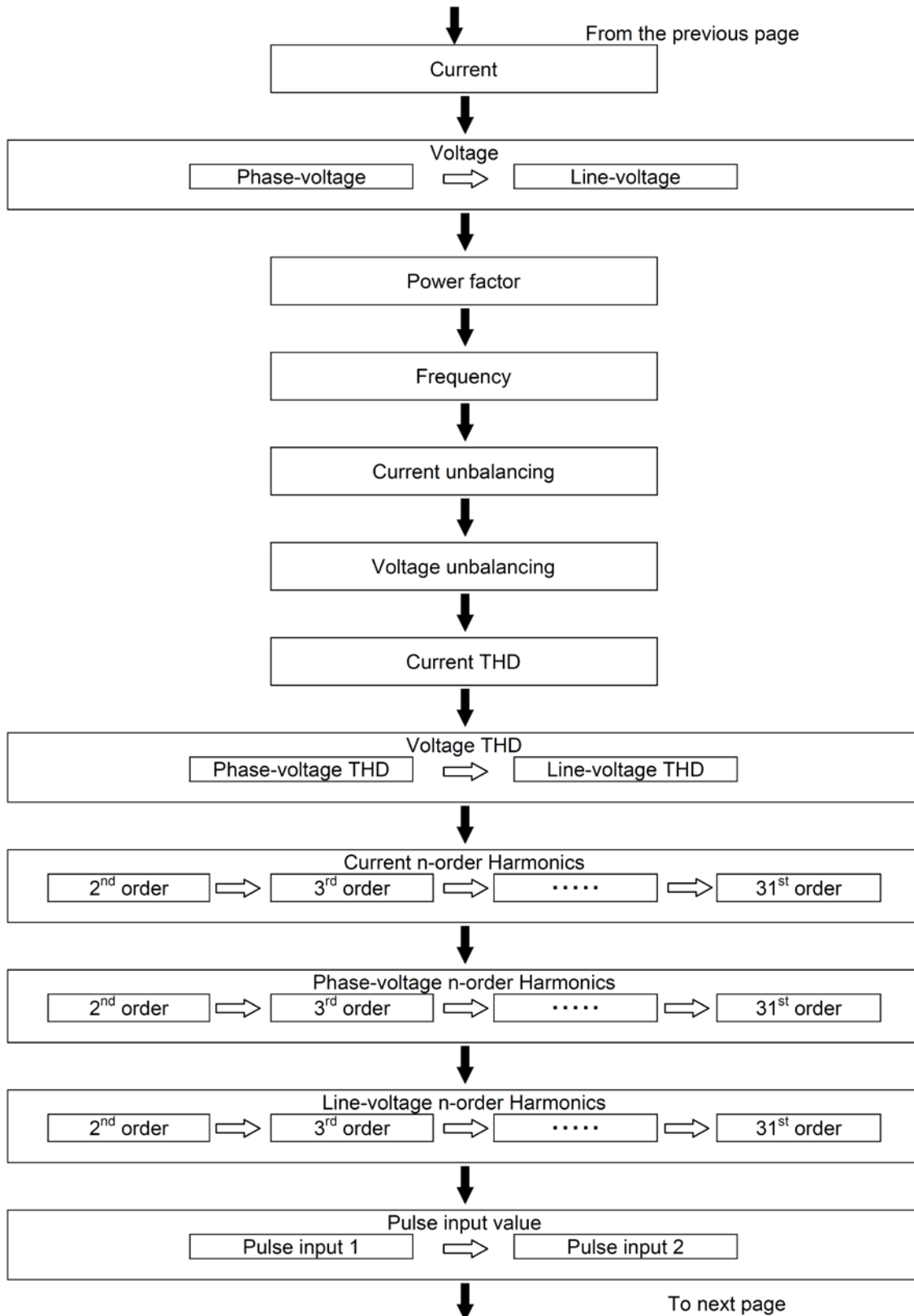
*1 When the 2nd circuit and 3rd circuit are not measured, [0] is displayed.

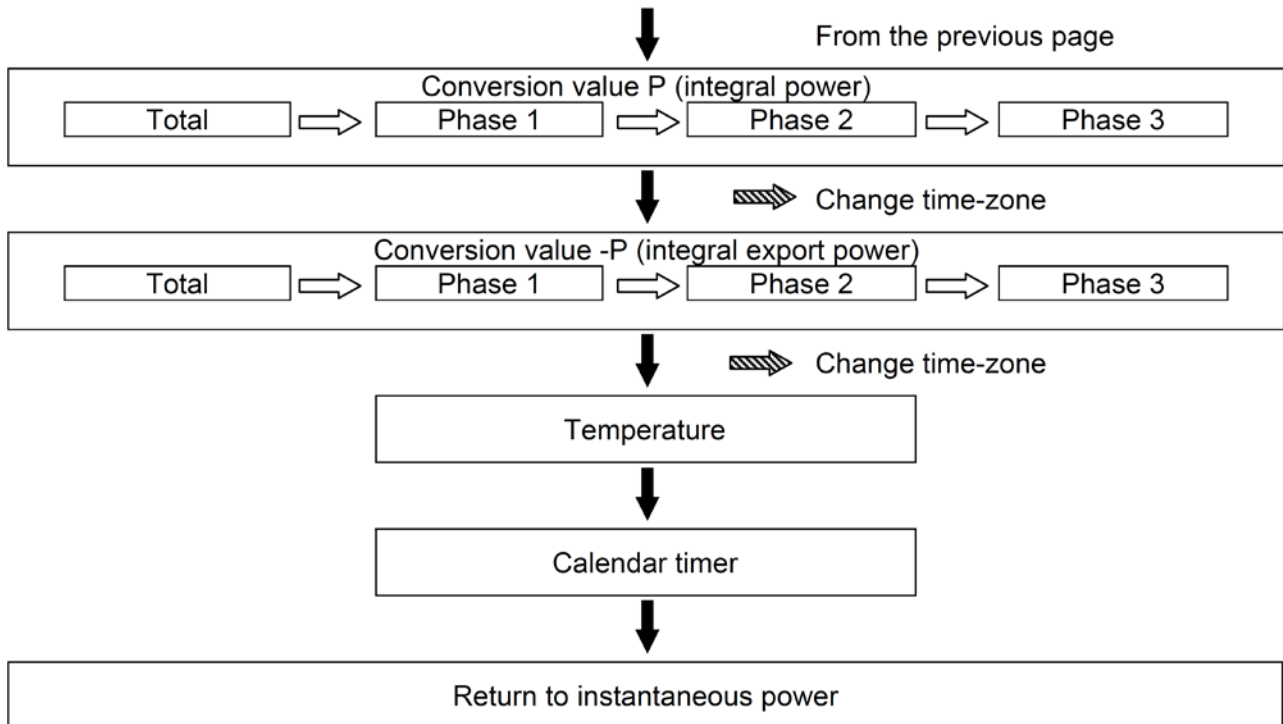
9.2.2 Single-phase three-wire system

An arrow mark indicates that each key must be pressed:

➡ <ITEM/Δ> ➡ <SHIFT/▽>







Display each value

9.2.3 Three-phase three-wire system

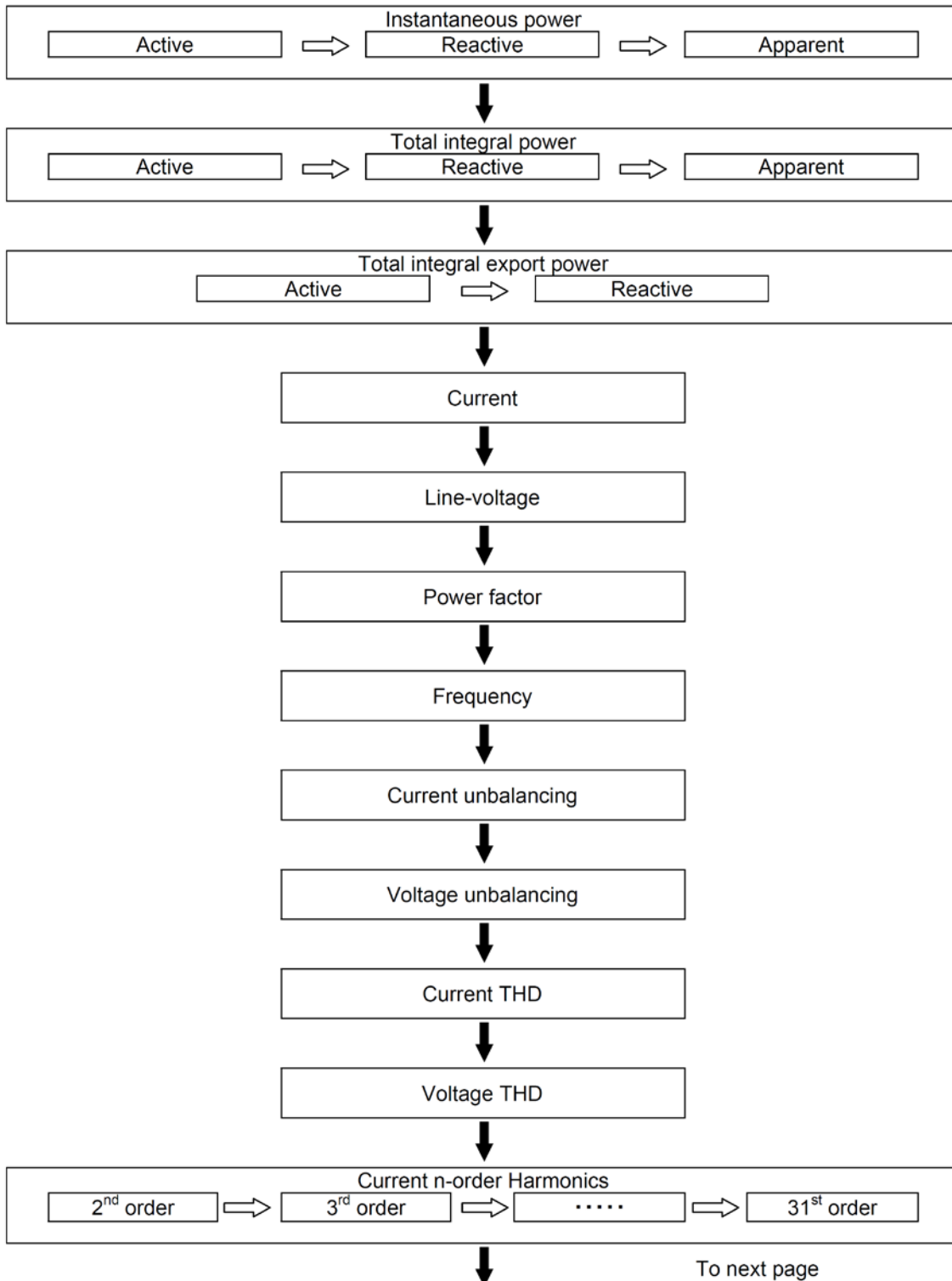
An arrow mark indicates that each key must be pressed:

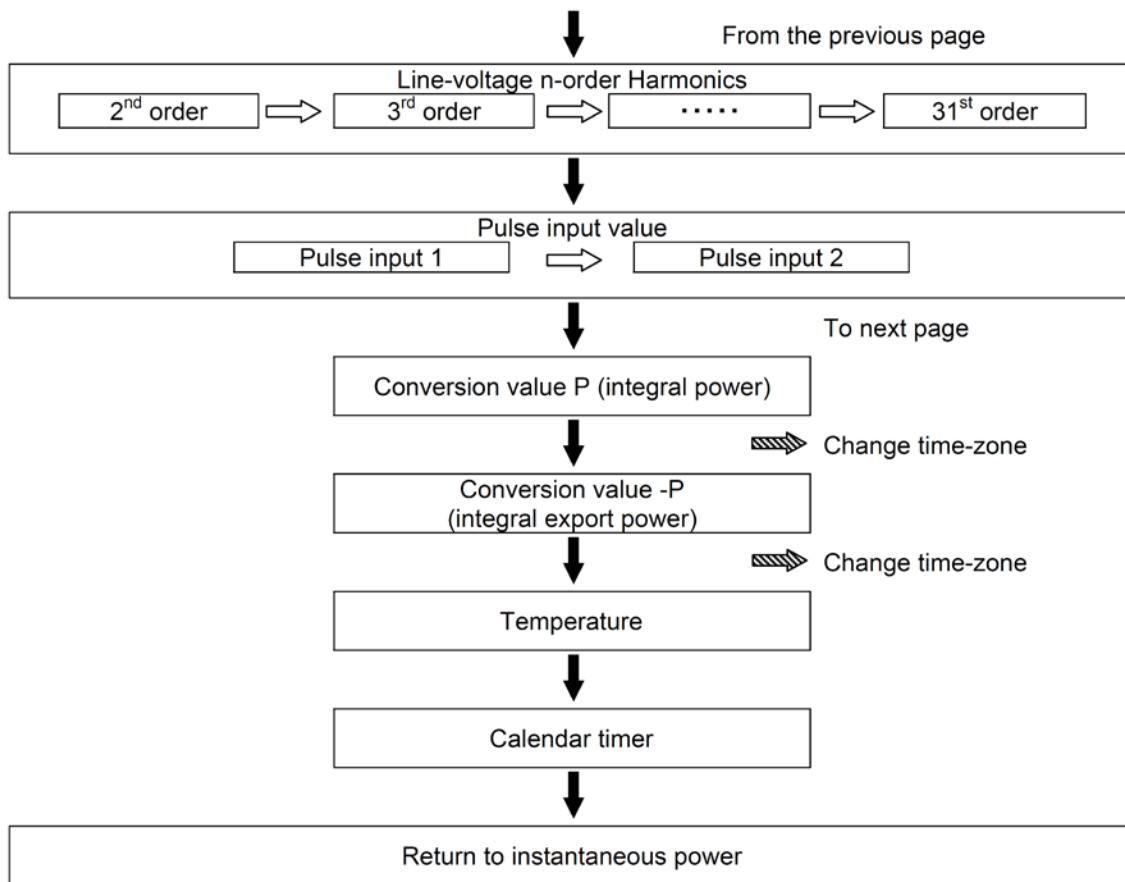


<ITEM/Δ>



<SHIFT/▽>



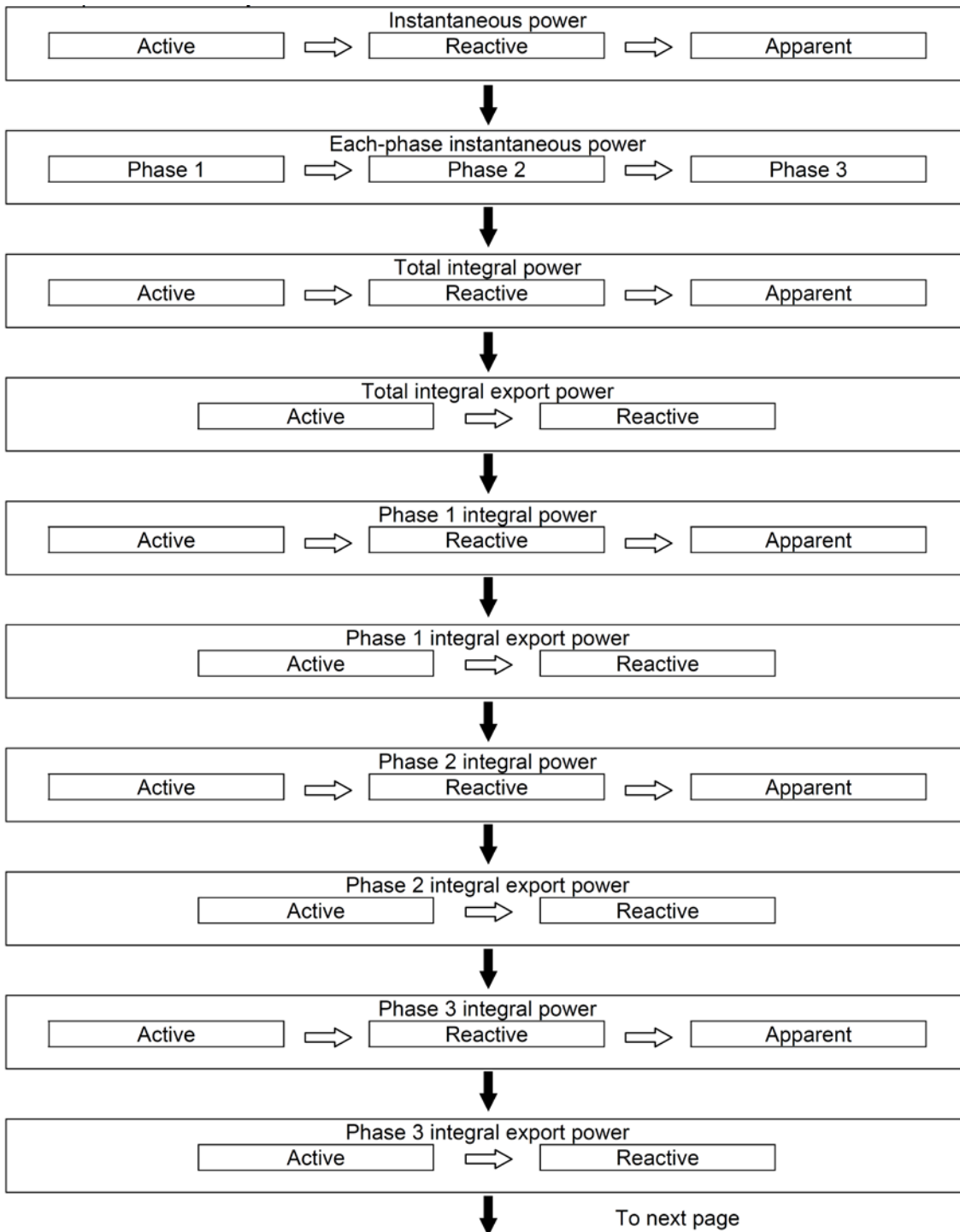


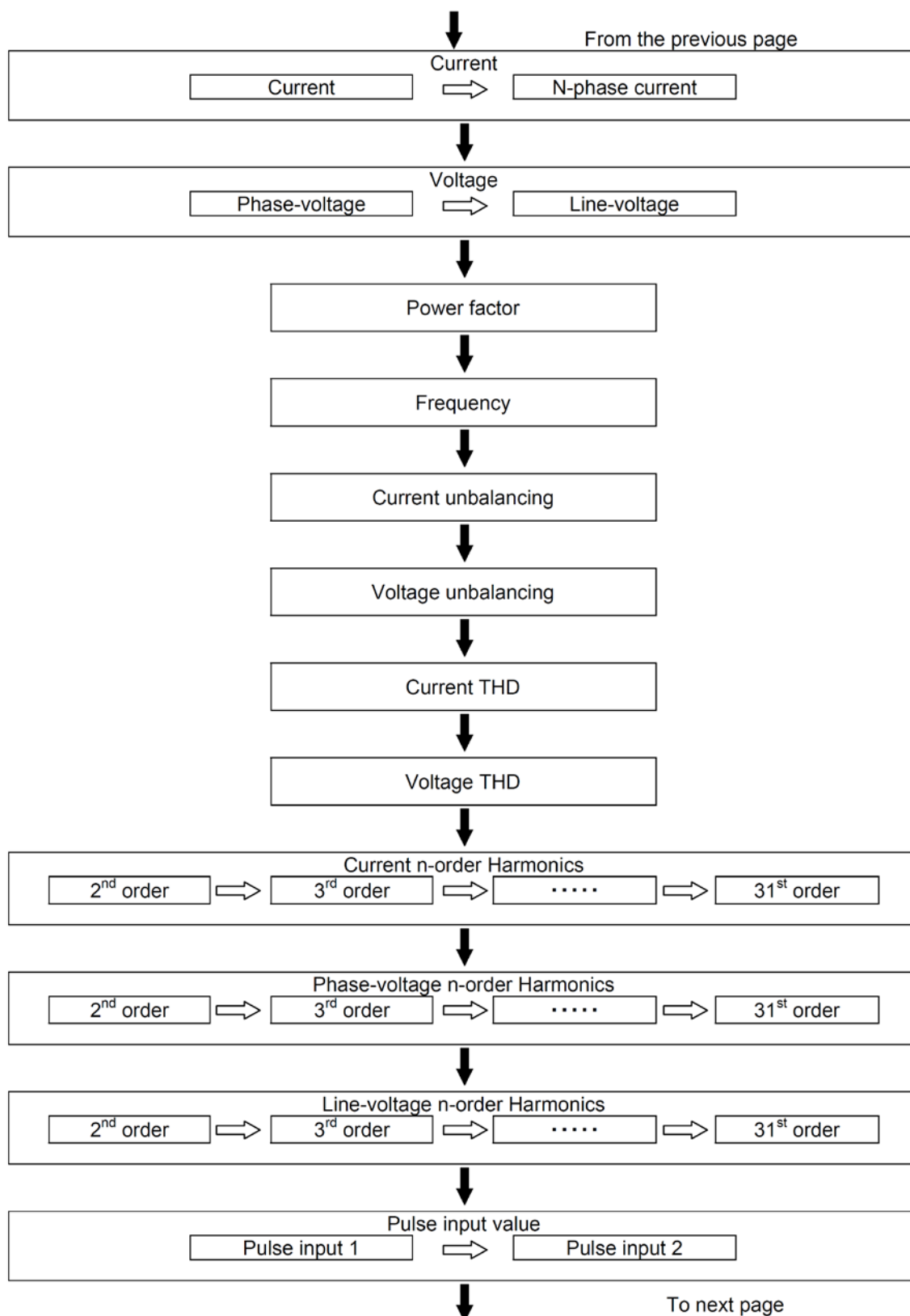
Display each value

9.2.4 Three-phase four-wire system

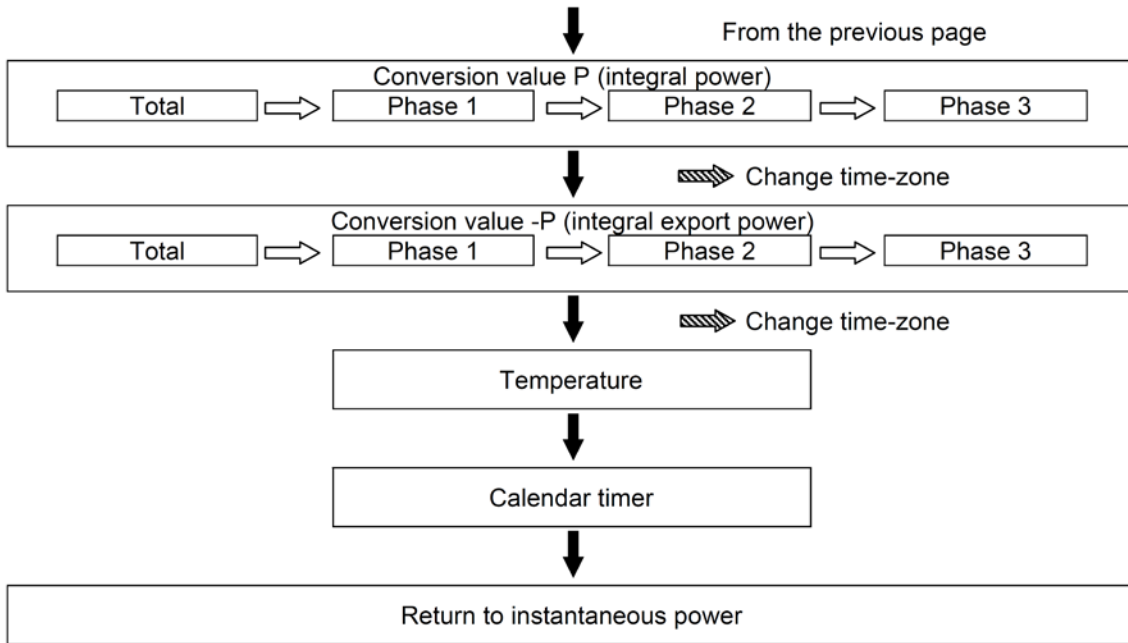
An arrow mark indicates that each key must be pressed:

➡ <ITEM/Δ> ➡ <SHIFT/▽>



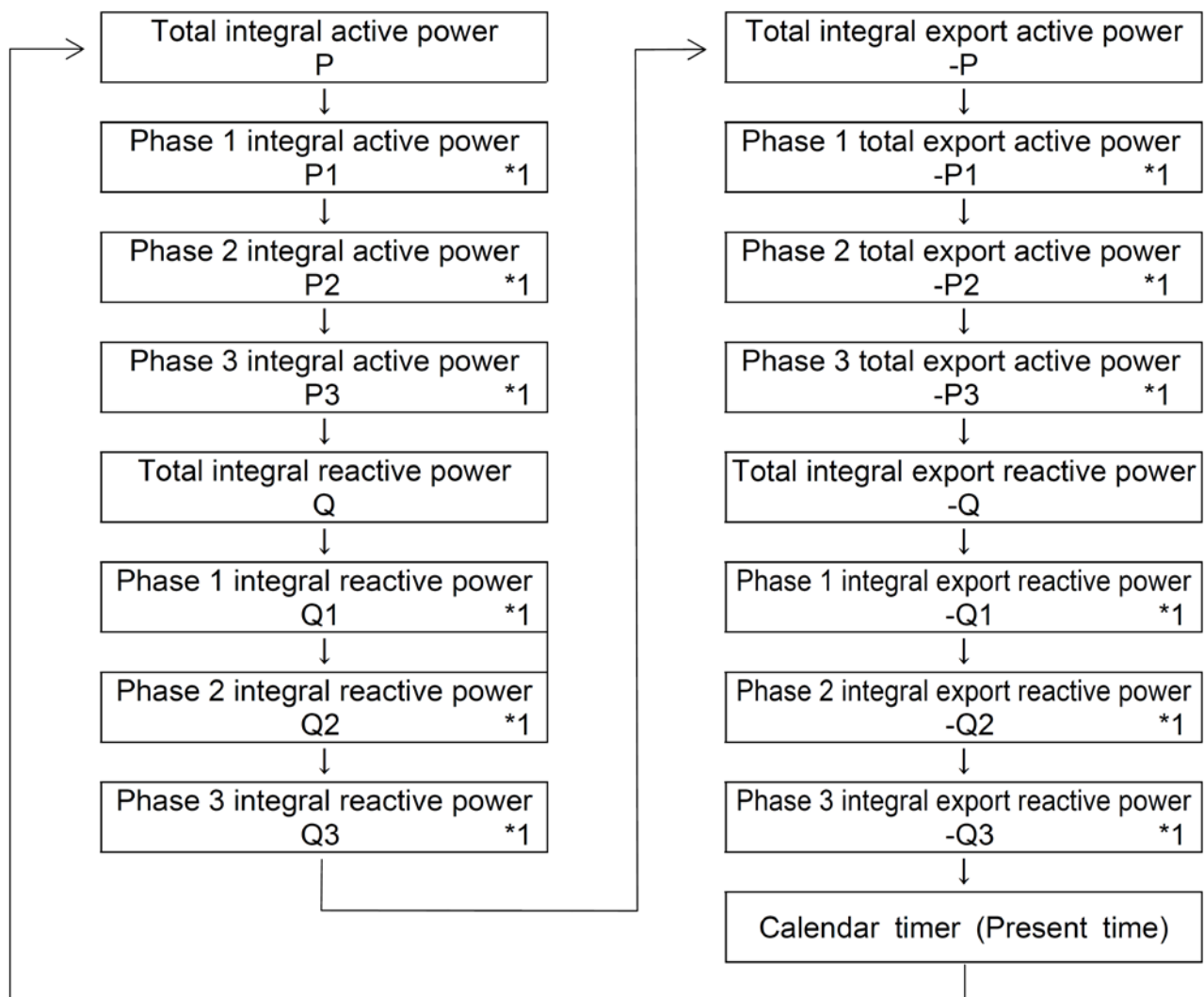


Display each value



Items that are displayed during the auto-display mode

When a value is set for the auto-display setting, each integral value display is automatically changed. If you press any key during auto-display mode, it returns the instantaneous power display. Items that are not displayed according to the phase/wire system are skipped.



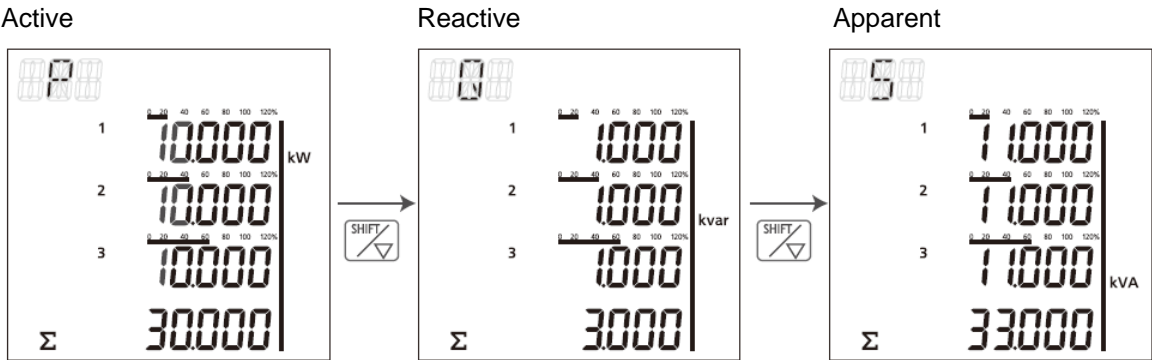
*1 These are skipped when it is set to the three-phase three-wire system.

Display each value

9.2.5 Instantaneous power

- The current instantaneous power of all phases or all circuits is displayed.
- Press <SHIFT/▽> to change active, reactive and apparent.

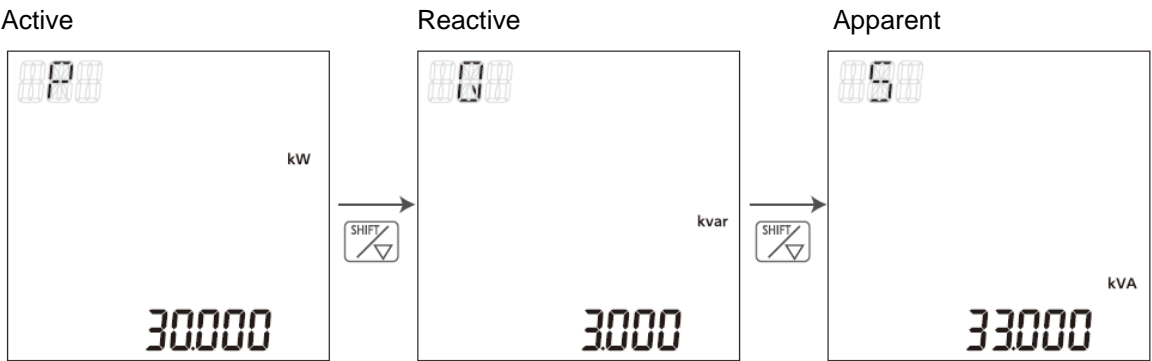
<1P2W/1P3W/3P4W>



Power Monitor 51A displays the power as below.

Display	1P2W	1P3W	3P3W
1	1 st circuit	R-phase	R-phase
2	2 nd circuit	---	S-phase
3	3 rd circuit	T-phase	T-phase
Σ	Total (1+2+3)	Total (R+T)	Total (R+S+T)

<3P3W>

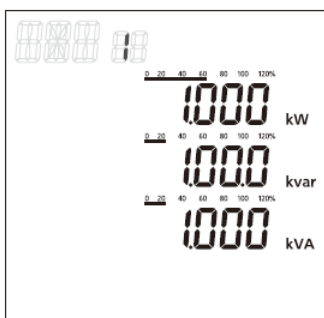


9.2.6 Instantaneous power of each phase / each circuit

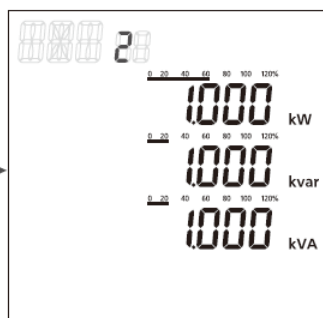
- The current instantaneous power of each phase or each circuit is displayed.
(It does not display for 3P3W system.)
- Press <SHIFT/▽> to change phase 1 (1st circuit), phase 2 (2nd circuit) and phase 3 (3rd circuit).

<1P2W/1P3W/3P4W>

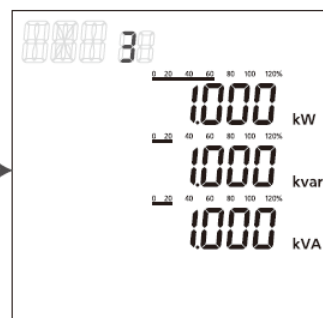
Phase 1 (1st circuit)



Phase 2 (2nd circuit)



Phase 3 (3rd circuit)



9.2.7 Total integral power

- The current total integral power is displayed.
- Press <SHIFT/▽> to change to active, reactive and apparent.
- Press <SET> to change the display with each time zone.

After changing, press <SET> to change the displayed time zone.

Time zone1(T1) → time zone2(T2) → time zone3(T3) → time zone4(T4) → All time zones

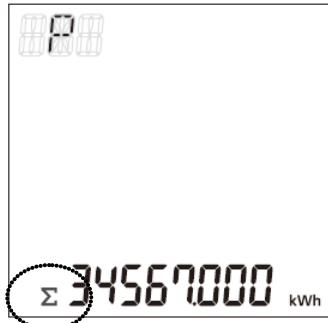
Note

- 1) A time zone without setting for any time program is not displayed.

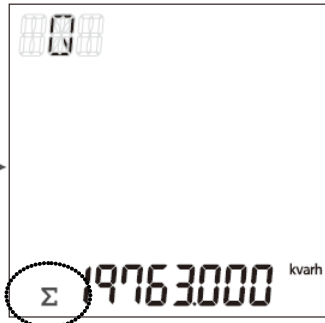
Display each value

All time zones

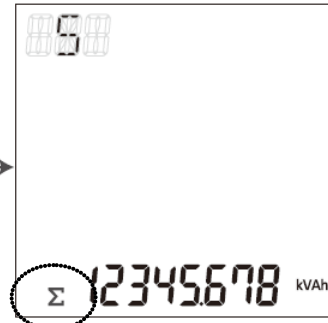
total integral active power



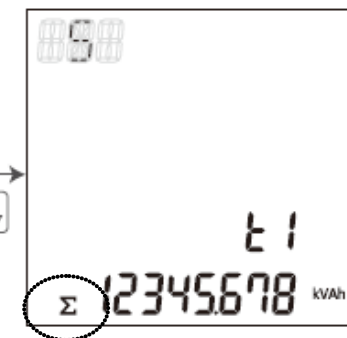
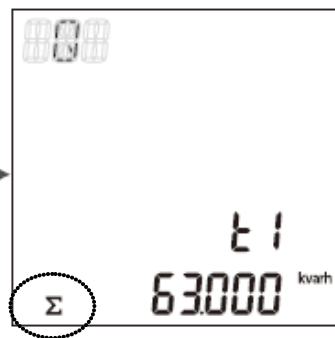
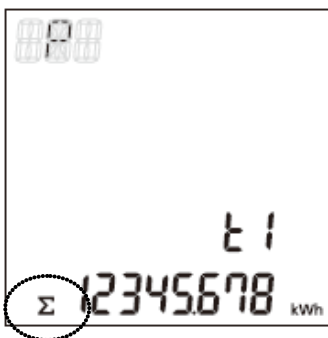
total integral reactive power



total integral apparent power



time zone1



time zone2, time zone3, time zone4 and all time zones are changed in sequence.

Note

1) [Σ] is not lit with the 3P3W system.

- The total integral power is measured and displayed from 0.000 to 29999999 (kWh/kvarh/kVAh).
- The decimal point is changed automatically.

➤ 0.000 ➔ 99999.999 ➔ 100000.00 ➔ 999999.99 ➔ 1000000.0 ➔ 29999999

(When the maximum figure, 29999999, is reached, the value reverts to 0.000 but measuring continues.)

9.2.8 Total integral export power

- The current total integral export power is displayed.
- Press <SHIFT/▽> to change to active, reactive and apparent.
- Press <SET> to change the display with each time zone.

After changing, press <SET> to change the displayed time zone.

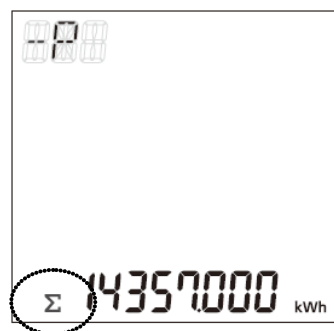
Time zone1(T1) → time zone2(T2) → time zone3(T3) → time zone4(T4) → All time zones

Note

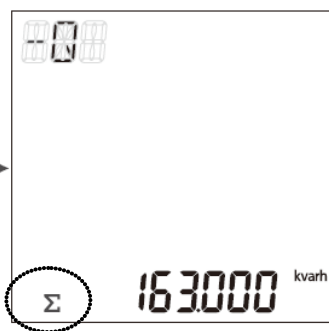
- 1) A time zone without setting for any time program is not displayed.

All time zones

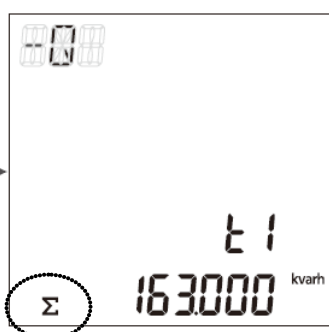
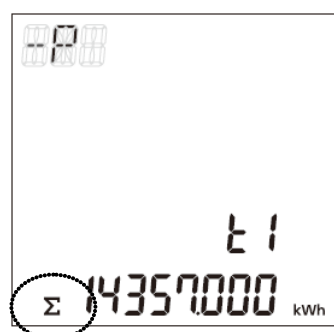
total integral active power
(export)



total integral reactive power
(export)



time zone1



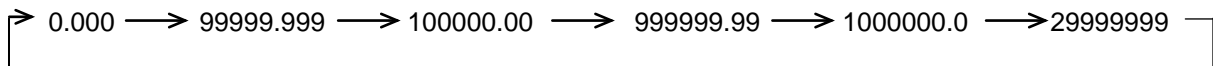
time zone2, time zone3, time zone4 and all time zones are changed in succession.

Note

- 1) [Σ] is not lit with the 3P3W system.

Display each value

- Total integral power is measured and displayed from 0.000 to 29999999 (kWh/kvarh/kVAh).
- The decimal point is changed automatically.



(When the maximum figure, 29999999, is reached, the value reverts to 0.000 but measuring continues.)

9.2.9 Integral power of each phase / each circuit

- The current total integral export power is displayed.
(It is not displayed for the 3P3W system.)
- Press <SHIFT/▽> to change to active, reactive and apparent.
- Press <SET> to change the display with each time zone.

After changing, press <SET> to change the displayed time zone.

Time zone1(T1) → time zone2(T2) → time zone3(T3) → time zone4(T4) → All time zones

Note

- 1) A time zone without setting for any time program is not displayed.

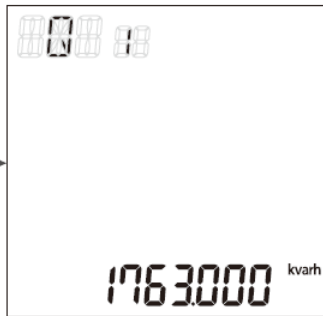
All time zones

Phase 1 (1st circuit)

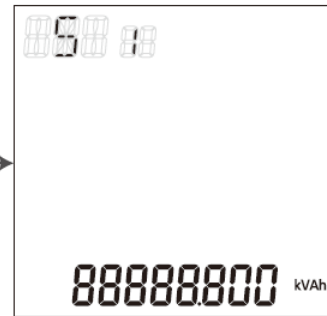
integral active power



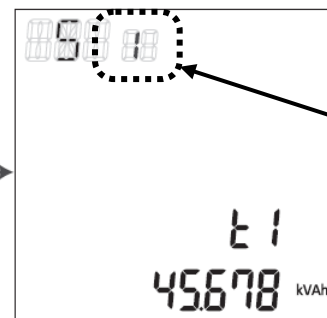
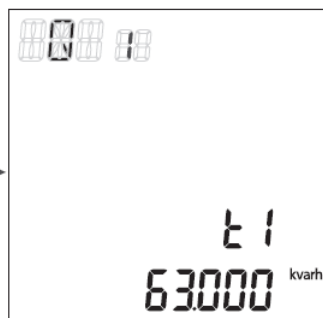
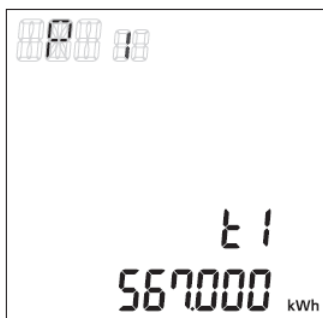
integral reactive power



integral apparent power



time zone1



Phase (CH)

time zone2, time zone3, time zone4 and all time zones are changed in succession.

- Integral power is measured and displayed from 0.000 to 9999999.9 (kWh/kvarh/kVAh).
- The decimal points is changed automatically.

0.000 → 99999.999 → 100000.00 → 999999.99 → 9999999.9

(When the maximum figure, 9999999.9, is reached, the value reverts to 0.000 but measuring continues.)

Display each value

9.2.10 Integral export power of each phase / each circuit

- The current integral export power of each phase or each circuit is displayed.
(It does not display for 3P3W.)
- Press <SHIFT/▽> to change active, reactive and apparent.
- Press <SET> to change the display with each time zone.

After changing, press <SET> to change the displayed time-zone.

Time zone1(T1) → time zone2(T2) → time zone3(T3) → time zone4(T4) → All time zones

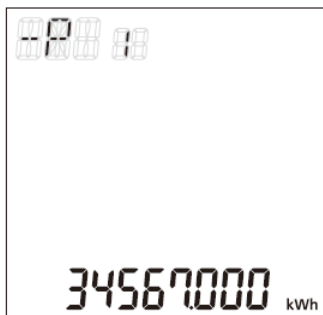
Note

- 1) A time zone without setting for any time program is not displayed.

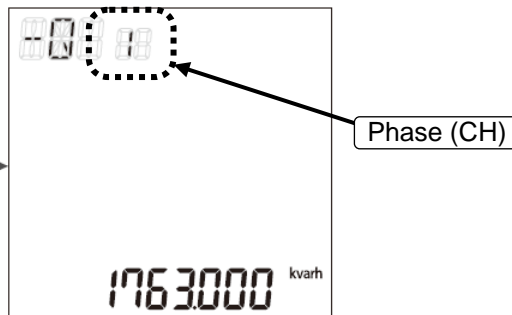
All time zones

Phase 1 (1st circuit)

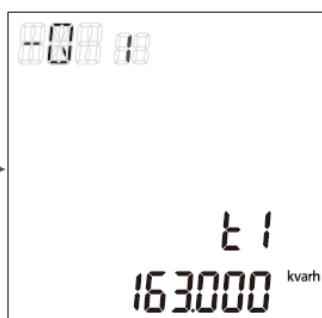
integral active power (export)



integral reactive power (export)

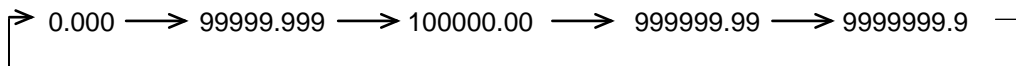


time zone1



time zone2, time zone3, time zone4 and all time zones are changed in succession.

- Integral power is measured and displayed from 0.000 to 9999999.9 (kWh/kvarh).
- The decimal points is changed automatically.

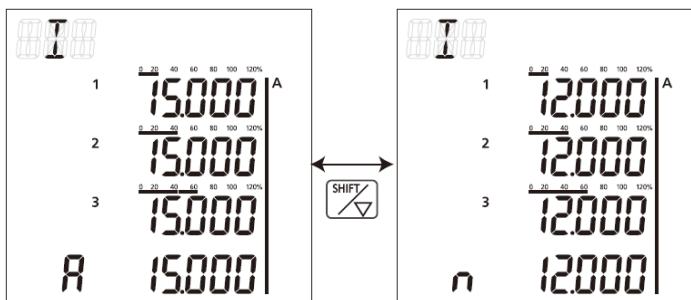


(When the maximum figure, 9999999.9, is reached, the value reverts to 0.000 but measuring continues.)

How to reset integral power (active/reactive/apparent) and integral export power (active/reactive)

- You can reset the value in the optional functions settings.
Refer to chapter 7.4.5 "Settings for optional functions" in detail.

9.2.11 Current



- The present current value is displayed. (N-phase current is displayed for 3P4W)
- It measures from 0.1 % of CT secondary current.
- When the input current exceeds 200 % or the display range, it displays "- - - -".
Check and confirm the measurement environment.
- Current measuring points

Power Monitor 51A measures the current as below.

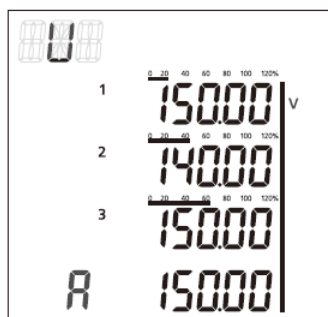
Display	1P2W	1P3W	3P3W / 3P4W
1	1 st circuit R-current	R-current	R-current
2	2 nd circuit R-current	N-current	S-current
3	3 rd circuit R-current	T-current	T-current
A	Average	Average of R and T	Average
N	—	—	N-current (only 3P4W)

Display each value

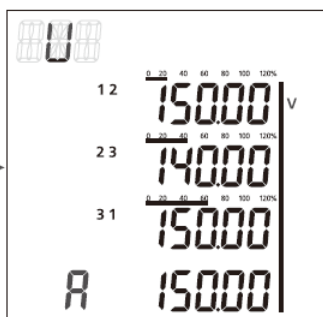
9.2.12 Voltage

- The current voltage is displayed.
- Press <SHIFT/▽> to change the phase voltage and line voltage.
(Line voltage is not displayed for 1P2W. Phase voltage is not displayed for 3P3W).

Phase voltage



Line voltage



- When the input voltage is under 3 V (when VT ratio is 1.), it displays “0.0” and does not measure.
- When the input voltage exceeds 600 V or the display range, it displays “— — — —”.
Check and confirm the measurement environment.
- Voltage measuring points

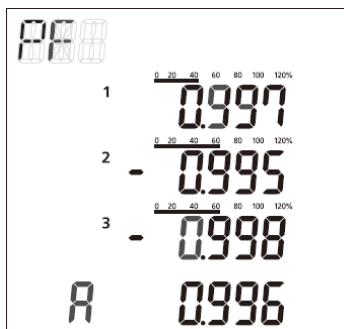
Power Monitor 51A measures the voltage as below.

Display	1P2W	1P3W	3P3W	3P4W
1	R-voltage (L1-N) or 1 st circuit R-voltage	R-voltage (L1-N)	No display	R-voltage (L1-N)
2	None or 2 nd circuit R-voltage	None		S-voltage (L2-N)
3	None or 3 rd circuit R-voltage	T-voltage (L3-N)		T-voltage (L3-N)
A	Average	Average of R and T		Average
1 2	No display	R-voltage (L1-N)	RS-voltage (L1-L2)	RS-voltage (L1-L2)
2 3		T-voltage (L3-N)	ST-voltage (L2-L3)	ST-voltage (L2-L3)
3 1		TR-voltage (L3-L1)	TR-voltage (L3-L1)	TR-voltage (L3-L1)
A		Average of R and T	Average	Average

9.2.13 Power factor

- The current power factor of the load is displayed.

<1P2W/1P3W/3P4W>



<3P3W>



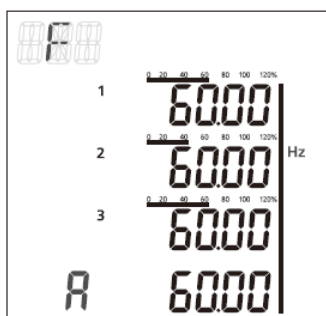
Note

- Power factor operation is a method that requires a balanced load. The error might be considerable when it measures an unbalanced load.

9.2.14 Frequency

- The current frequency is displayed.

<1P2W/1P3W/3P4W>



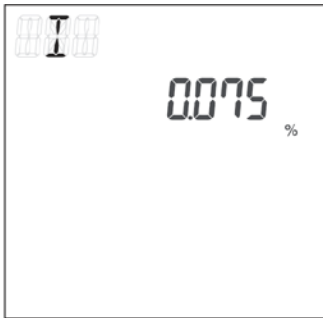
<3P3W>



Display each value

9.2.15 Current unbalance

- The present current unbalance is displayed. (Not displayed for 1P2W)



9.2.16 Voltage unbalancing

- The present voltage unbalancing is displayed. (Not displayed for 1P2W)



9.2.17 Current THD

- The present THD for current is displayed.



9.2.18 Voltage THD

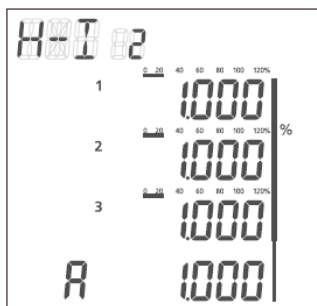
- The present THD for voltage is displayed.



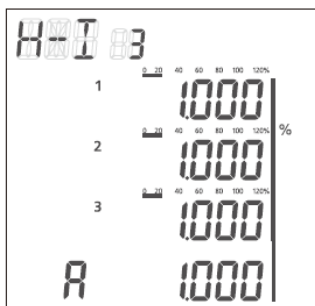
9.2.19 Current n-order harmonics

- The present current n-order harmonics is displayed.
- Press <SHIFT/▽> to change the display.

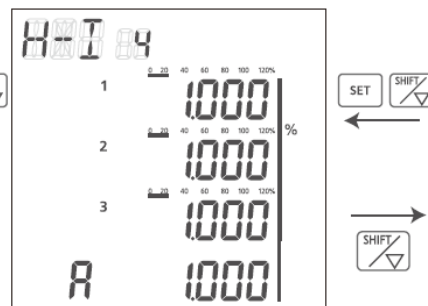
2nd order



3rd order



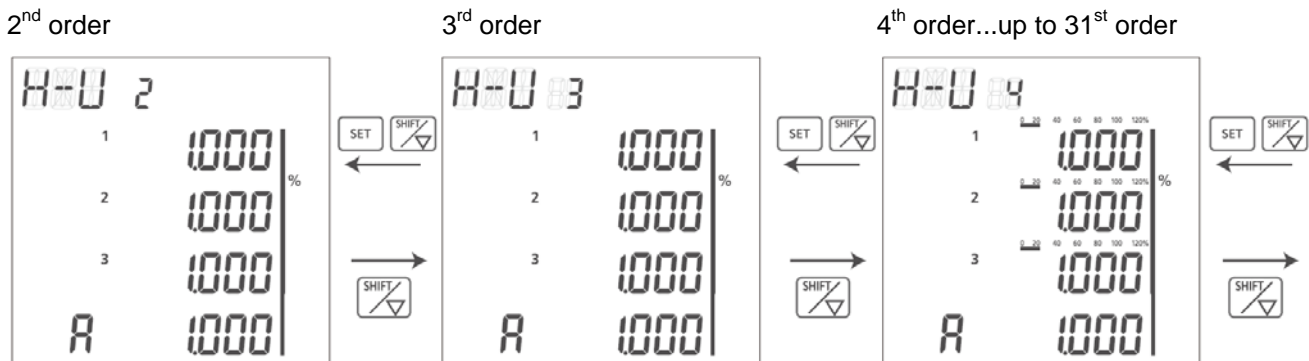
4th order...up to 31st order



Display each value

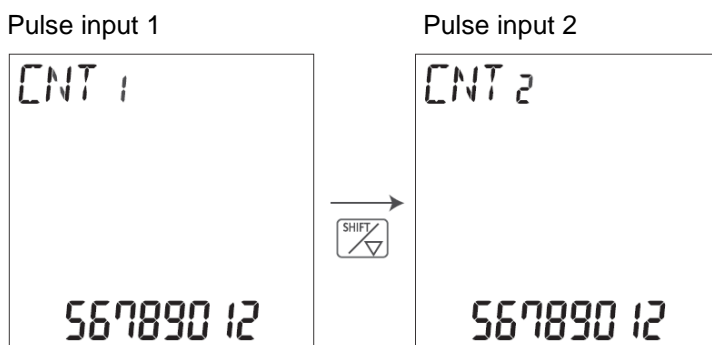
9.2.20 Voltage n-order harmonics

- The present voltage n-order harmonics is displayed.
- Press <SHIFT/▽> to change the display.



9.2.21 Pulse Input Value

- The present pulse input value is displayed.
- Press <SHIFT/▽> to change to CNT1, CNT2.
CNT1 is not displayed when CNT1 is set to [Clock] (clock correction).
- Pulse input status (ON or OFF) is confirmed via communication. (MEWTOCOL and MODBUS)



Note

- 1) Turn on the unit while IN1 or IN2 is shorted, first 1-pulse is not counted and it doesn't light on [IN1] [IN2]. After that, when pulse is input pulse it count the pulse.

9.2.22 Conversion value for integral active power

- The conversion value for the present integral active power (P) is displayed.
(Only total conversion value is displayed for 3P3W.)
- Press <SHIFT/▽> to change total, phase 1 (1st circuit), phase 2 (2nd circuit) and phase 3 (3rd circuit).
- Press <SET> to change the display with each time zone.

After changing, press <SET> to change the displayed time zone.

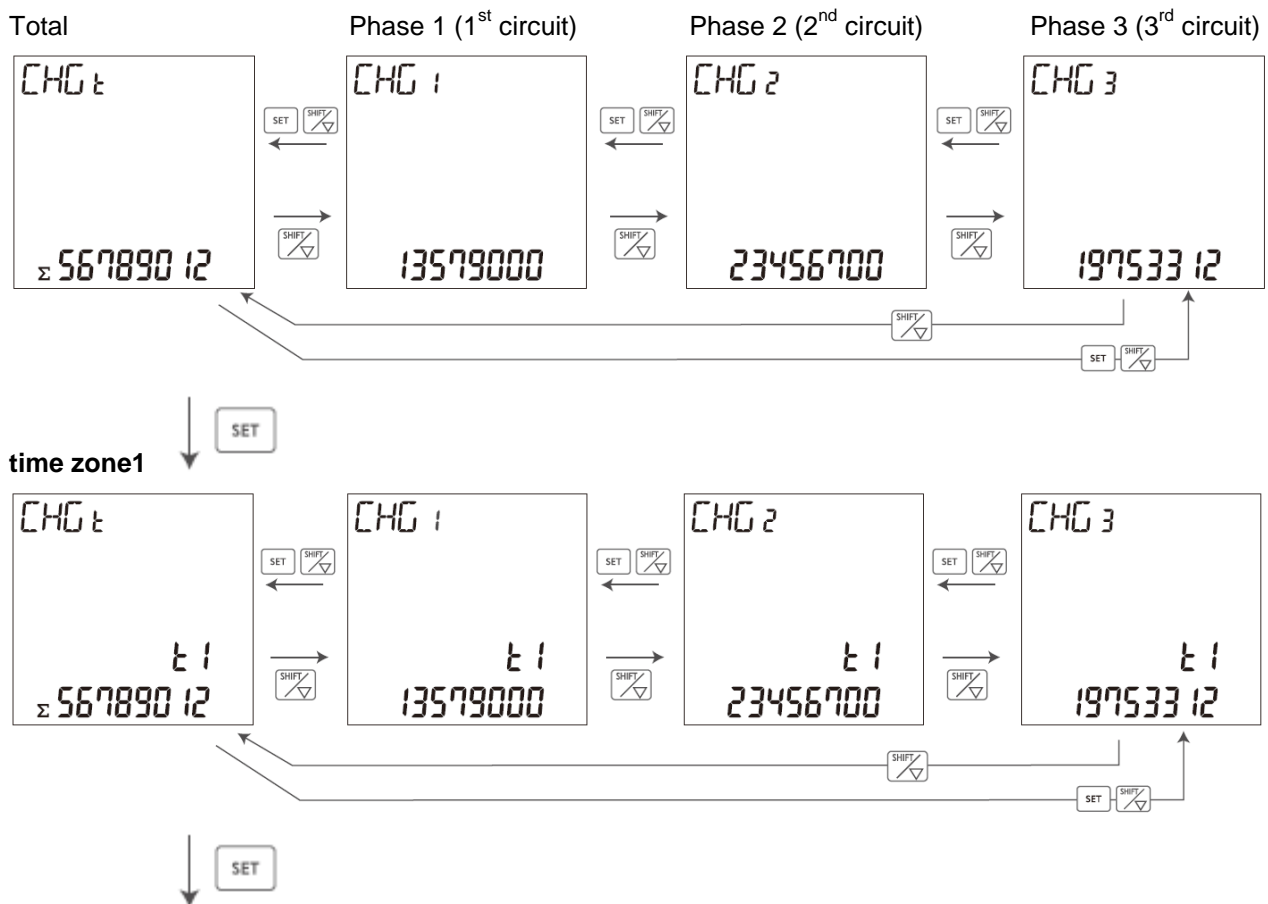
Time zone1(T1) → time zone2(T2) → time zone3(T3) → time zone4(T4) → All time zones

Note

- 1) A time zone without setting for any time program is not displayed.

<1P2W/1P3W/3P4W>

All time zones



Display each value

<3P3W>

Total



Note

- 1) If the conversion value exceeds "99999999", "-----" is displayed.
Check and confirm the measurement environment.

9.2.23 Conversion value for integral export power

- The conversion value for the present integral export active power (-P) is displayed.
(Only total conversion value is displayed for 3P3W.)
- Press <SHIFT/▽> to change total, phase 1 (1st circuit), phase 2 (2nd circuit) and phase 3 (3rd circuit).
- Press <SET> to change the display with each time zone.

After changing, press <SET> to change the displayed time zone.

Time zone1(T1) → time zone2(T2) → time zone3(T3) → time zone4(T4) → All time zones

Note

- 1) A time zone without setting for any time program is not displayed.

<1P2W/1P3W/3P4W>

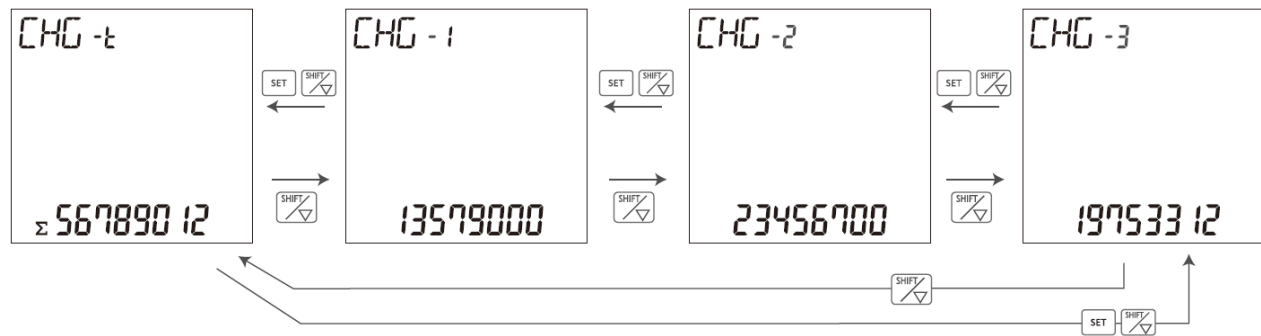
All time zones

Total

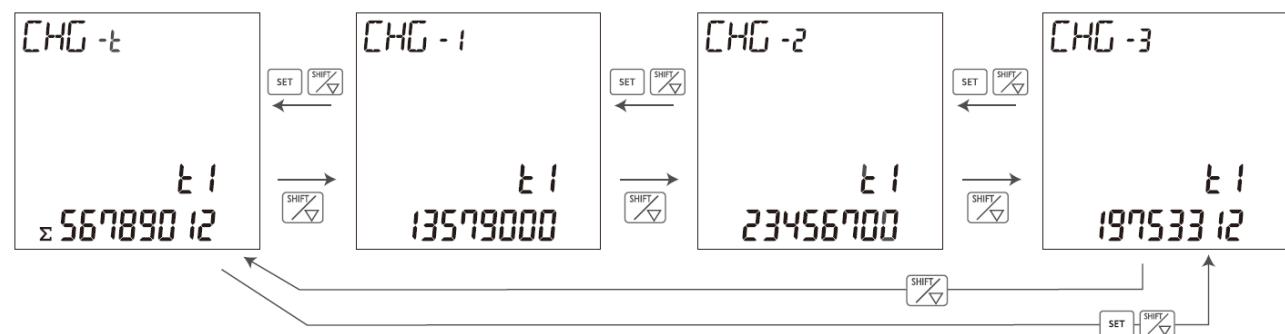
Phase 1 (1st circuit)

Phase 2 (2nd circuit)

Phase 3 (3rd circuit)



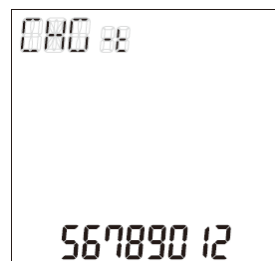
time zone1



time zone2, time zone3, time zone4 and all time zones are changed in succession.

<3P3W>

Total



Note

- 1) If the conversion value exceeds "99999999", "-----" is displayed.
Check and confirm the measurement environment.

Display each value

9.2.24 Temperature

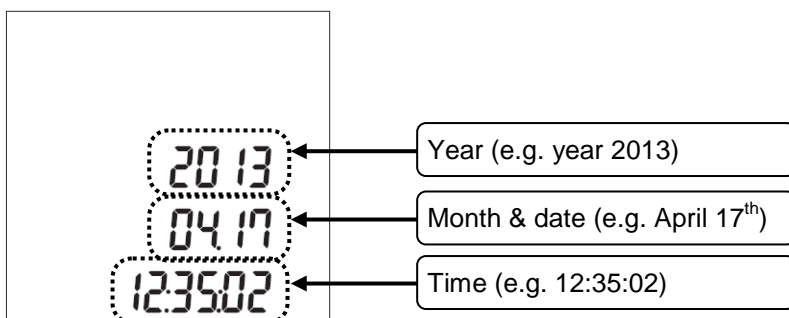
- The current temperature is displayed.



- The temperature measuring function is a basic function. Use this only to check the temperature trend but do not use for control.
- It measures using a built-in thermistor, so the measured value differs depending on the internal circuit conditions (communication, input current). Use it only for reference.
- If the temperature of the front differs significantly from the temperature of the installed panel when it cools inside the panel, it is impossible to measure correctly. Use the temperature correction function to adjust the temperature and use it only to check the temperature trend.

9.2.25 Calendar timer

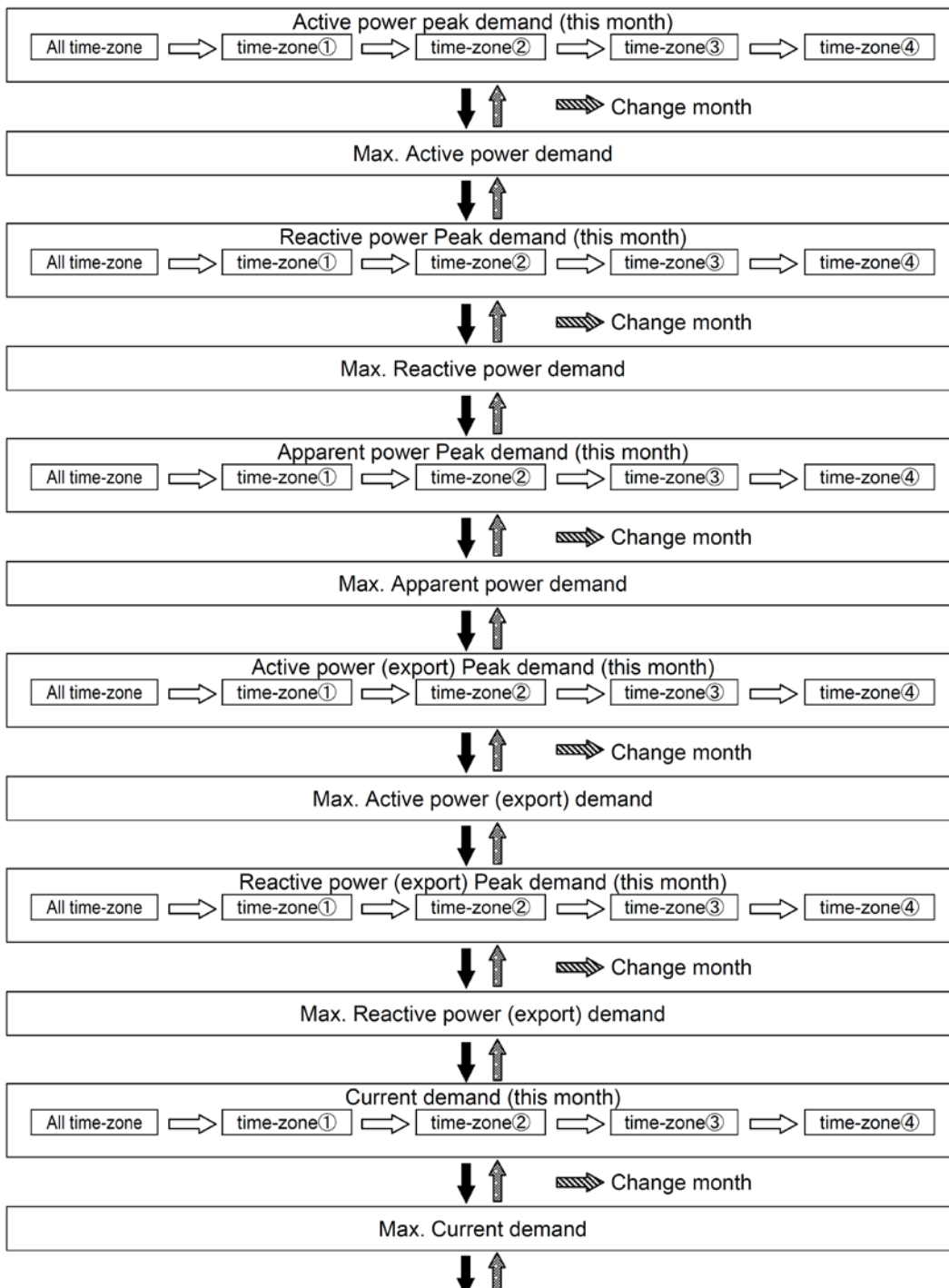
- The present date and time are displayed.

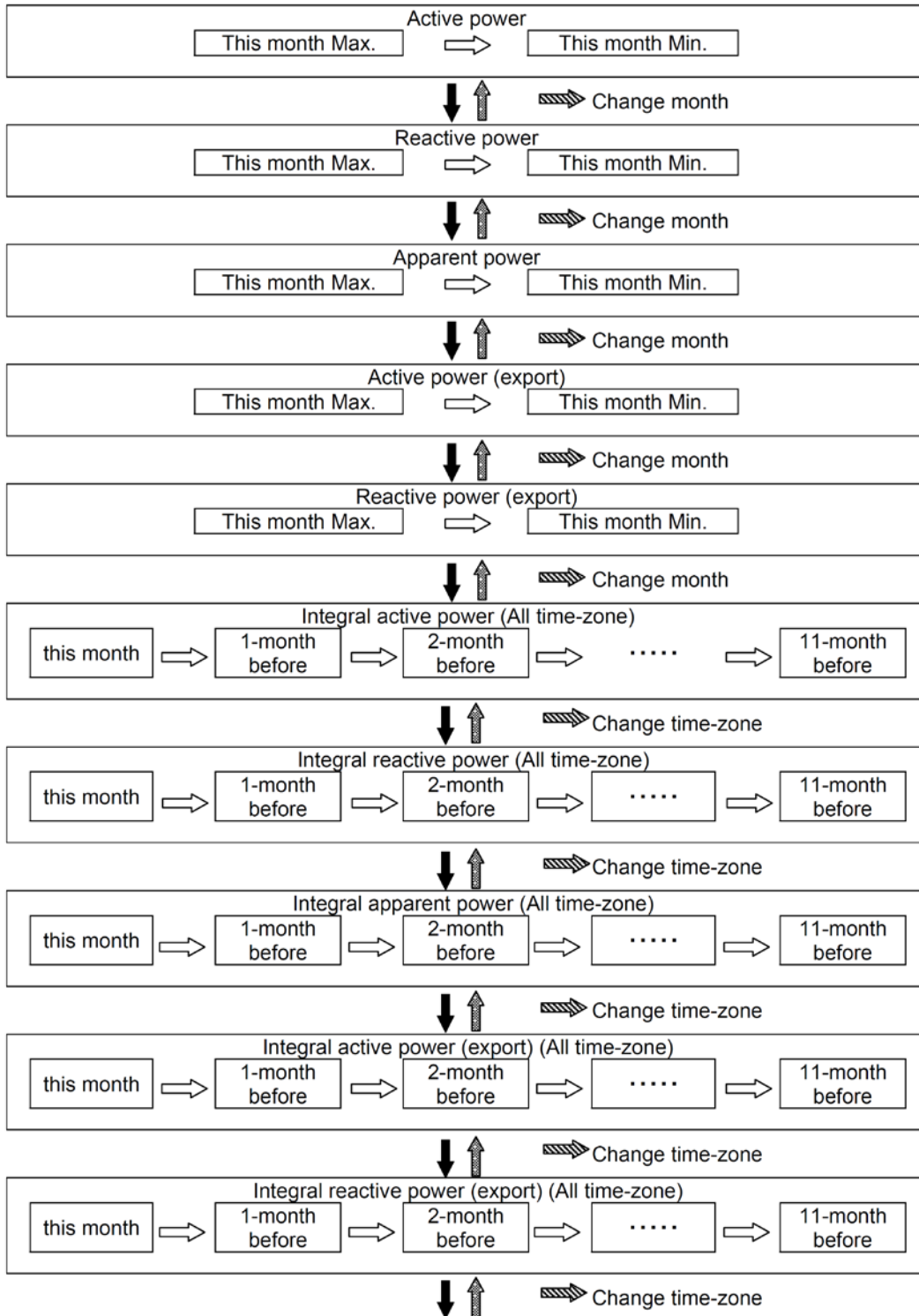


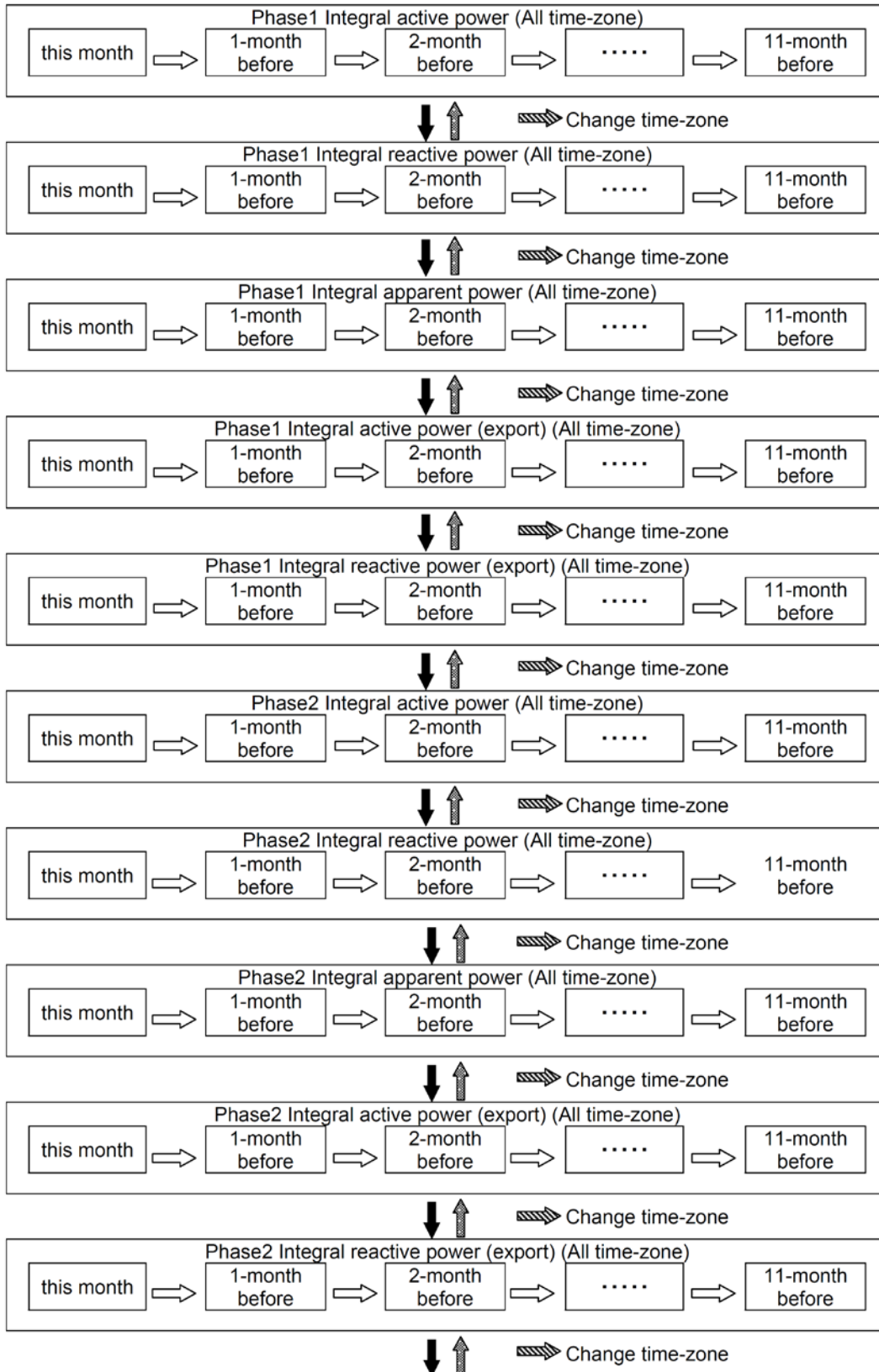
9.3 Working of logging mode

Each measured value is displayed as shown below. It differs according to the selected phase/wire system. An arrow mark indicates that each key must be pressed:

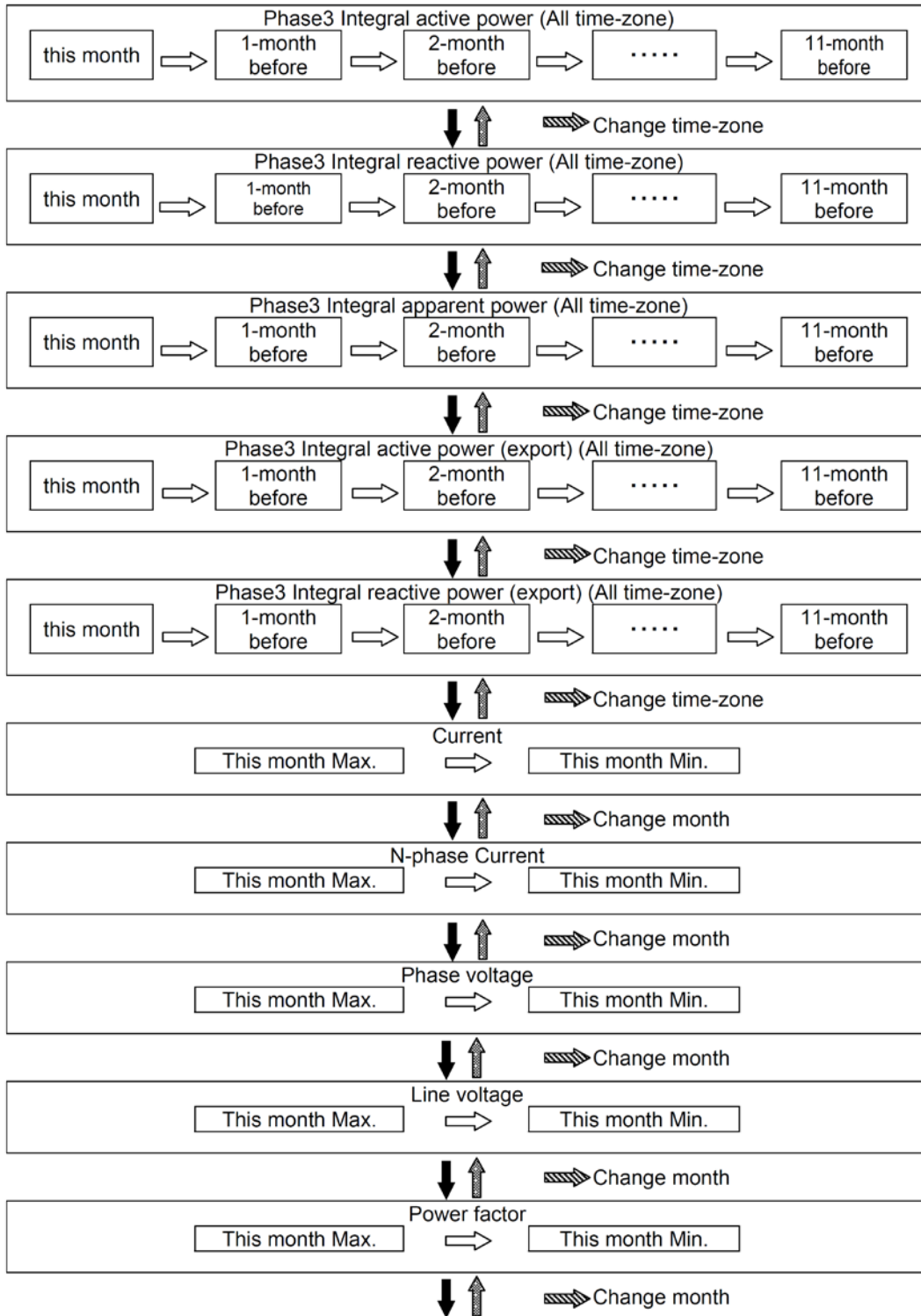
 <ITEM/Δ>
  <SHIFT/▽>
  <SET>
  <SET> + <ITEM/Δ>

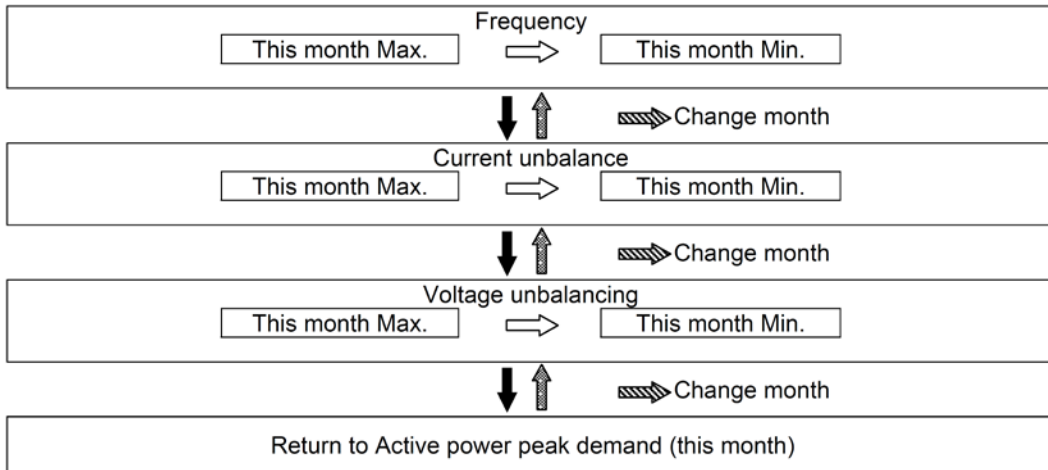






Display each value





Note

- 1) The items displayed differ according to the phase and wire system. Some items are not displayed.

9.3.1 Max. demand value

- The log data of peak demand is displayed.
- Press <SHIFT/▽> to change the displayed time zone.

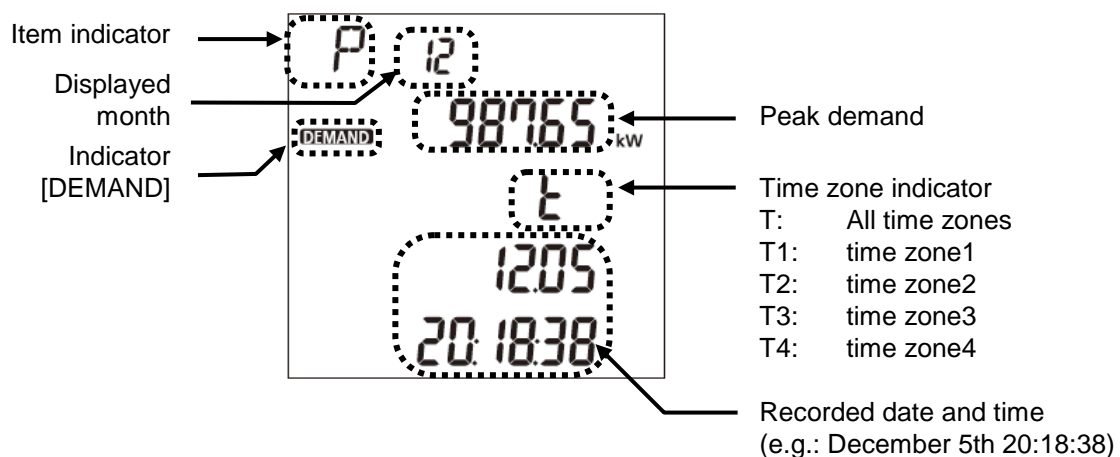
All time zone → time zone1 (T1) → time zone2 (T2) → time zone3 (T3) → time zone4 (T4)

- Press <SET> to change the display with each month.

1 month previously → 2 months previously → 3 months previously → 12 months previously)

Note

- 1) A time zone without setting for any time program is not displayed.



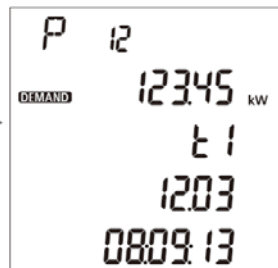
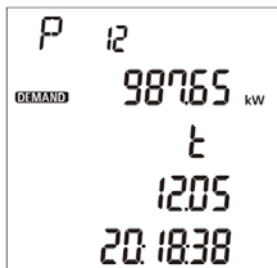
Display each value

Active power display example

- Each time zone

[December All time zones]

[time zone1]

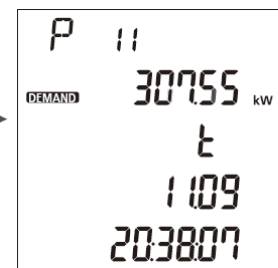
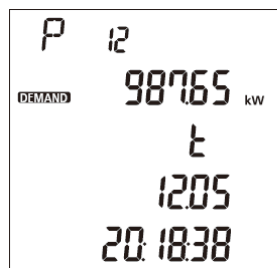


time zone2, time zone3, time zone4 are changed in succession.

- Each month

[December]

[November]



Change to October, September, August.....

- Press <ITEM/Δ> to change the items to be displayed.

Item	Display	
	Indicator	Unit
Active power Peak demand	P	kW
Reactive power Peak demand	Q	kvar
Apparent power Peak demand	S	kVA
Active power (export) Peak demand	-P	kW
Reactive power (export) Peak demand	-Q	kvar
Current Peak demand	I	A

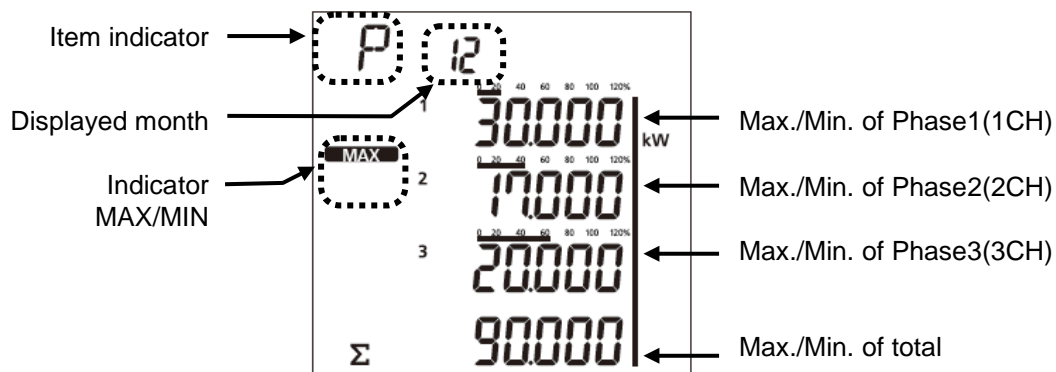
9.3.2 Max. / Min. value of electric power

- The log data of max. and min. value for electric power is displayed.
- Press <SHIFT/▽> to change max. and min.
- Press <SET> to change the displayed month.

1 month previously → 2 months previously → 3 months previously → 12 months previously)

Note

- 1) If the setting of phase and wire system is changed, the log data of max. and min. will be reset.

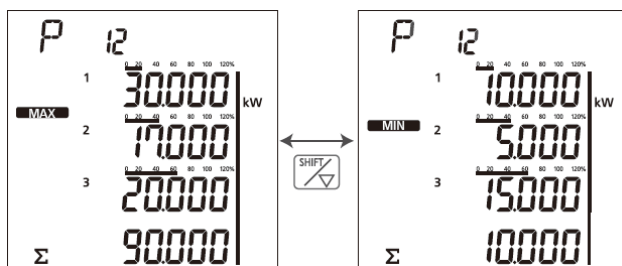


Active power display example

- Max. and Min.

[Max. value in December]

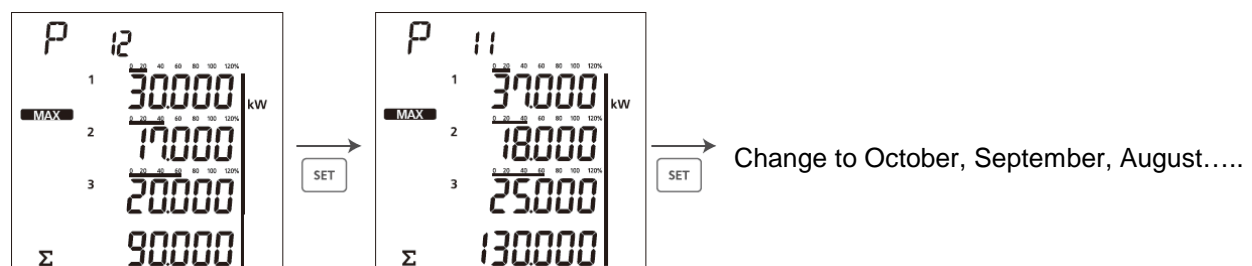
[Min. value in December]



- Each month

[Max. in December]

[Max. in November]



Display each value

- Press <ITEM/Δ> to change the items to be displayed.

Item	Display	
	Indicator	Unit
Active power	P	kW
Reactive power	Q	kvar
Apparent power	S	kVA
Active power (export)	-P	kW
Reactive power (export)	-Q	kvar

9.3.3 Integral power

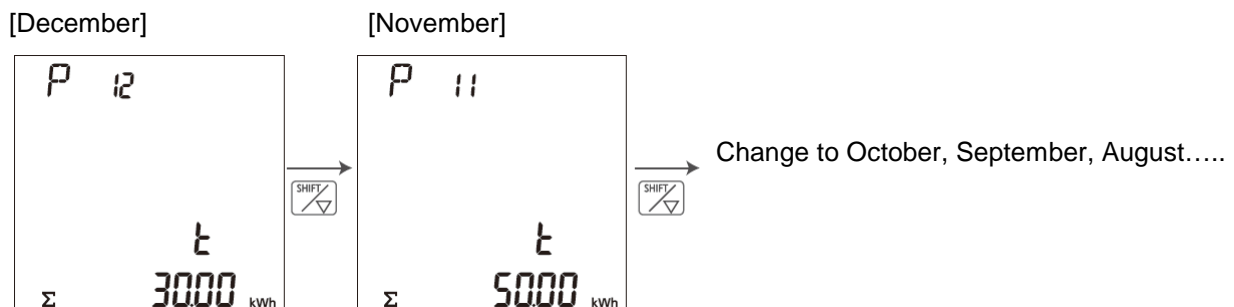
- The log data of integral power is displayed.
- Press <SHIFT/▽> to change the displayed month.
1 month previously → 2 months previously → 3 months previously → 12 months previously)
- Press <SET> to change the displayed time zone.
All time zone → time zone1 (T1) → time zone2 (T2) → time zone3 (T3) → time zone4 (T4)

Note

- 1) If the setting of phase and wire system is changed, the log data of max. and min. will be reset.

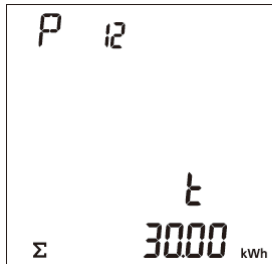
Integral active power

- Each month

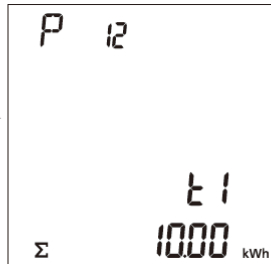


- Each time zone

[All time zone]



[time zone1]



Change to time zone2, time zone3, time zone4

- Press <ITEM/Δ> to change the items to be displayed.

Item	Display	
	Indicator	Unit
Integral active power	P	kWh
Integral reactive power	Q	kvarh
Integral apparent power	S	kVAh
Integral active power (export)	-P	kWh
Integral reactive power (export)	-Q	kvarh
Phase1 Integral active power	P1	kWh
Phase1 Integral reactive power	Q1	kvarh
Phase1 Integral apparent power	S1	kVAh
Phase1 Integral active power (export)	-P1	kWh
Phase1 Integral reactive power (export)	-Q1	kvarh
Phase2 Integral active power	P2	kWh
Phase2 Integral reactive power	Q2	kvarh
Phase2 Integral apparent power	S2	kVAh
Phase2 Integral active power (export)	-P2	kWh
Phase2 Integral reactive power (export)	-Q2	kvarh
Phase3 Integral active power	P3	kWh
Phase3 Integral reactive power	Q3	kvarh
Phase3 Integral apparent power	S3	kVAh
Phase3 Integral active power (export)	-P3	kWh
Phase3 Integral reactive power (export)	-Q3	kvarh

Display each value

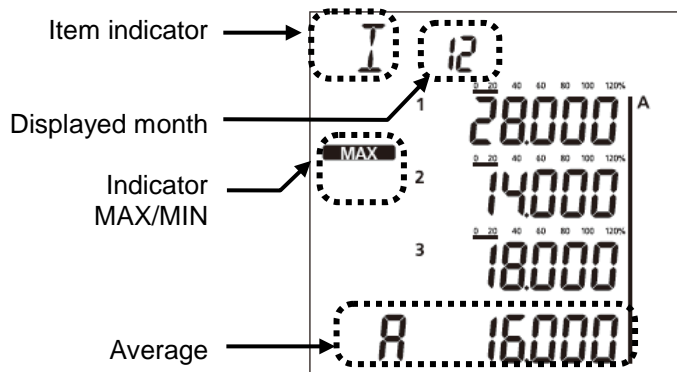
9.3.4 Max. /Min. value of each measured value

- The log data of max. and min. value for current, voltage, power factor frequency, current unbalancing, voltage unbalancing is displayed.
- Press <SHIFT/▽> to change max. and min.
- Press <SET> to change the displayed month.

1 month previously → 2 months previously → 3 months previously → 12 months previously)

Note

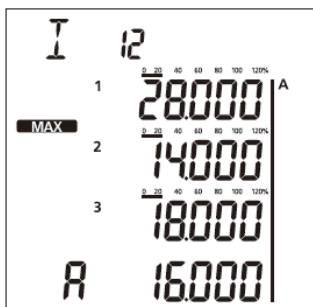
- 1) If the setting of phase and wire system is changed, the log data of max. and min. will be reset.



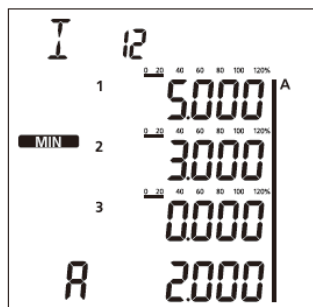
Current display example

- Max. and Min.

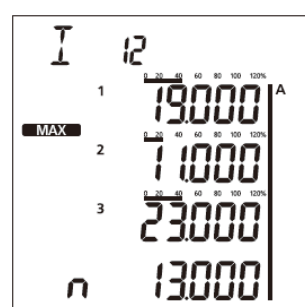
[Max. in December]



[Min. in December]

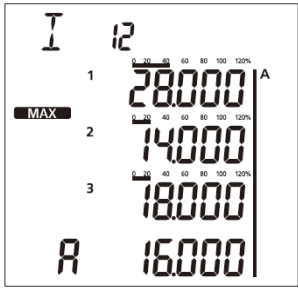


[N-phase]

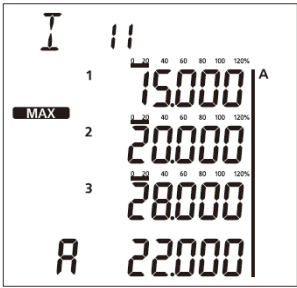


- Each month

[Max. in December]



[Max. in November]

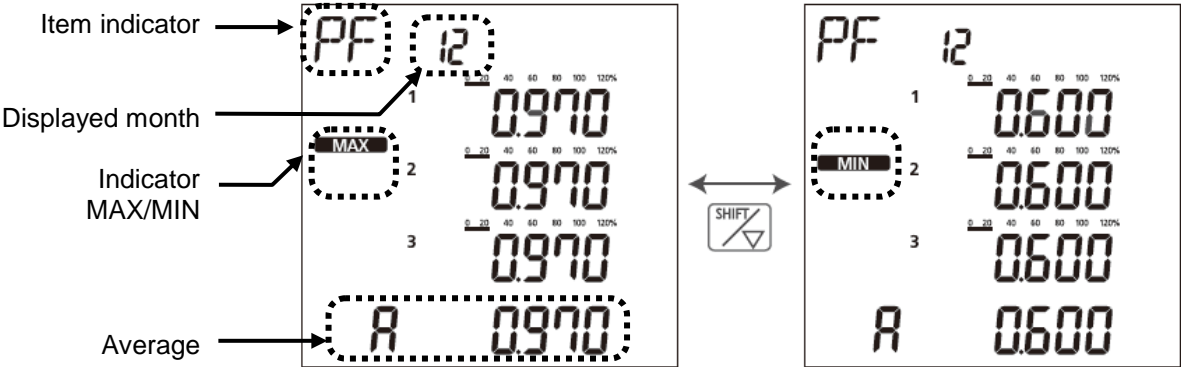


Change to October, September, August...

- Press <ITEM/Δ> to change the items to be displayed.

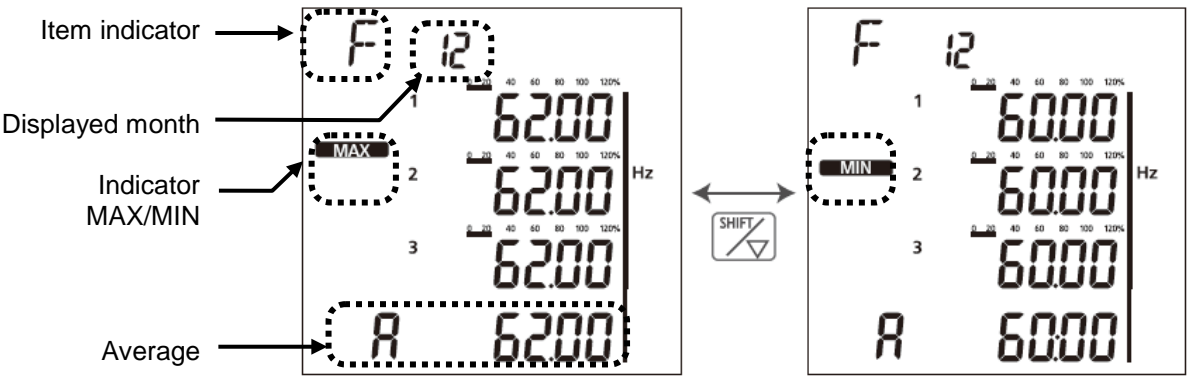
Item	Display	
	Indicator	Unit
Current	I	A
N-phase current	I	A
Phase-voltage	U	V
Line-voltage	U	V

Power factor display

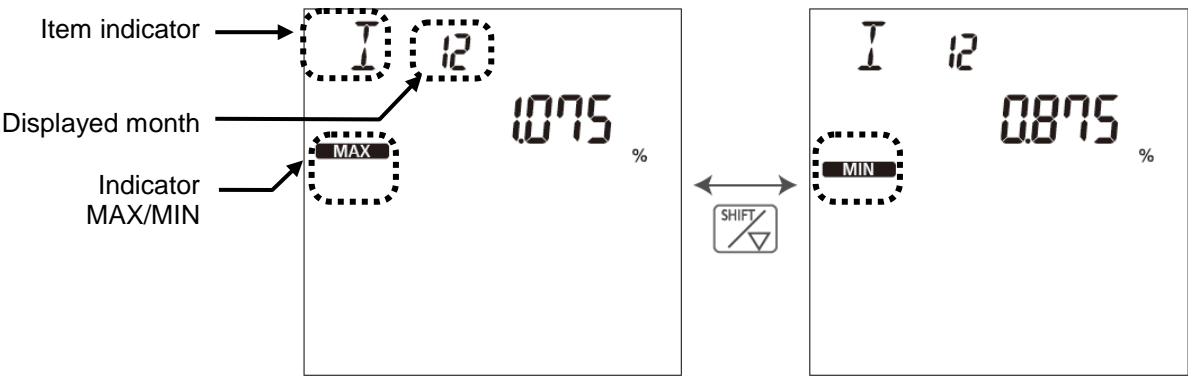


Display each value

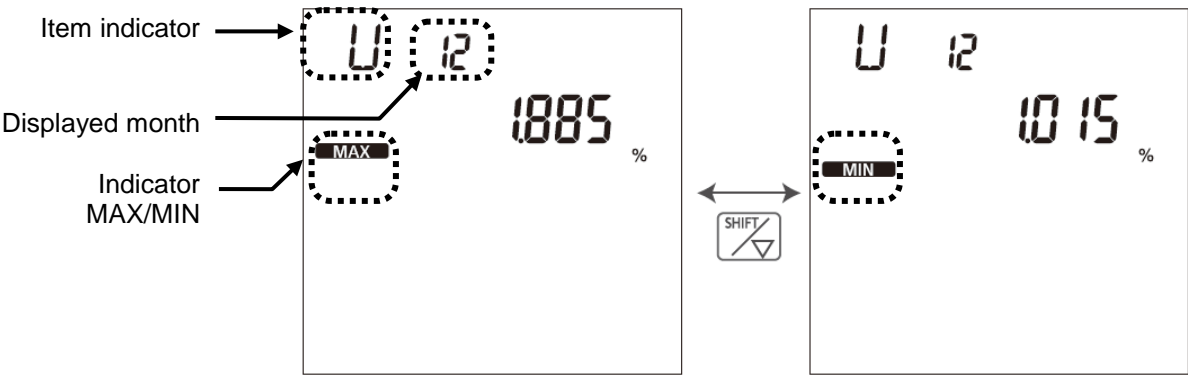
Frequency display



Current unbalancing display



Voltage unbalancing display

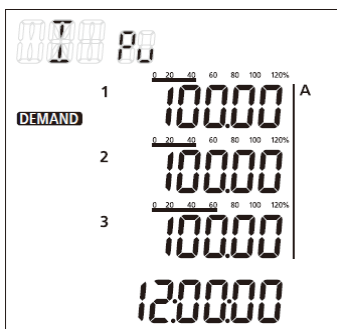


9.4 Working of demand mode

Each measured value is displayed as shown below. It differs according to the selected demand type.

9.4.1 Peak demand

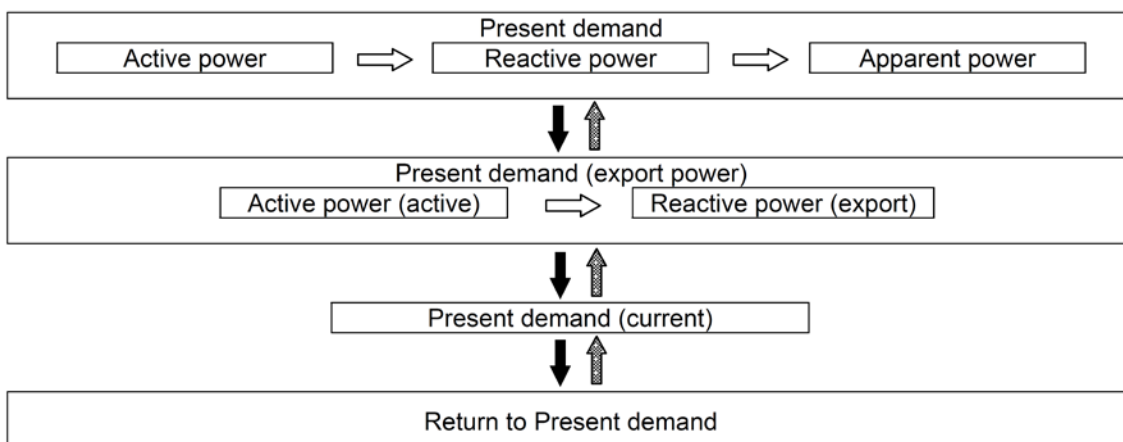
- When peak demand is selected, the present current demand is displayed. Other demand value is not displayed.



9.4.2 Block interval demand (sliding block, fixed block)

An arrow mark indicates that each key must be pressed:

<ITEM/Δ>
 <SHIFT/▽>
 <SET>
 <SET> + <ITEM/Δ>

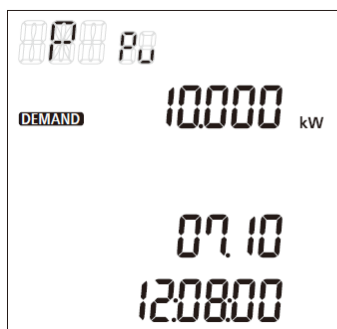


Display each value

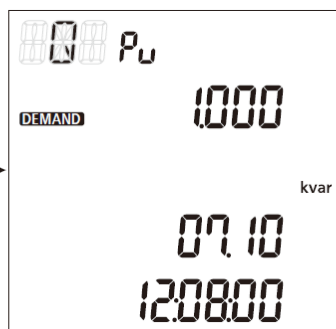
Present power demand

- Each demand value is displayed.
- Press <SHIFT/▽> to change to active power, reactive power, apparent power.
- Date and time when the present demand is measured is displayed in the bottom 2 lines.

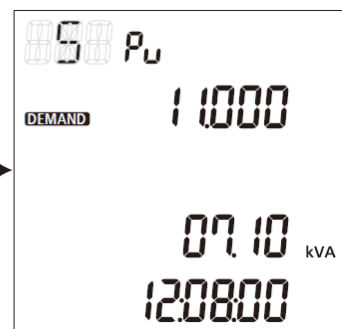
Active power
present demand



Reactive power
present demand



Apparent power
present demand



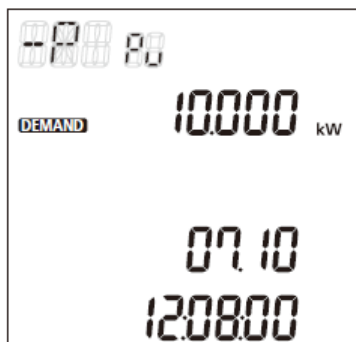
Note

- 1) “-----” is displayed in the following cases.
 - ◇ Until the setting time elapses to start monitoring demand
 - ◇ Demand value exceeds the display range
 - ◇ Clock is changed between demand time span
 - ◇ Until starting next time span at power failure

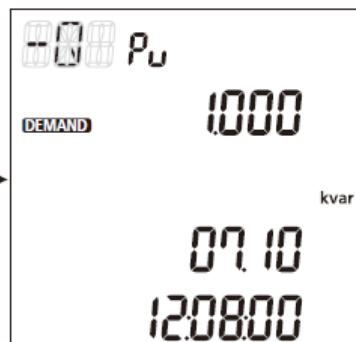
Present export power demand

- Each demand value is displayed.
- Press <SHIFT/▽> to change to active power (export), reactive power (export).
- Date and time when the present demand is measured is displayed in the bottom 2 lines.

Active power (export)
present demand



Reactive power (export)
present demand

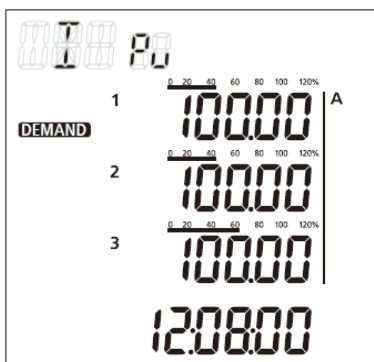


Note

- 1) “-----” is displayed in the following cases.
- ◇ Until the setting time elapses to start monitoring demand
 - ◇ Demand value exceeds the display range
 - ◇ Clock is changed between demand time span
 - ◇ Until starting next time span at power failure

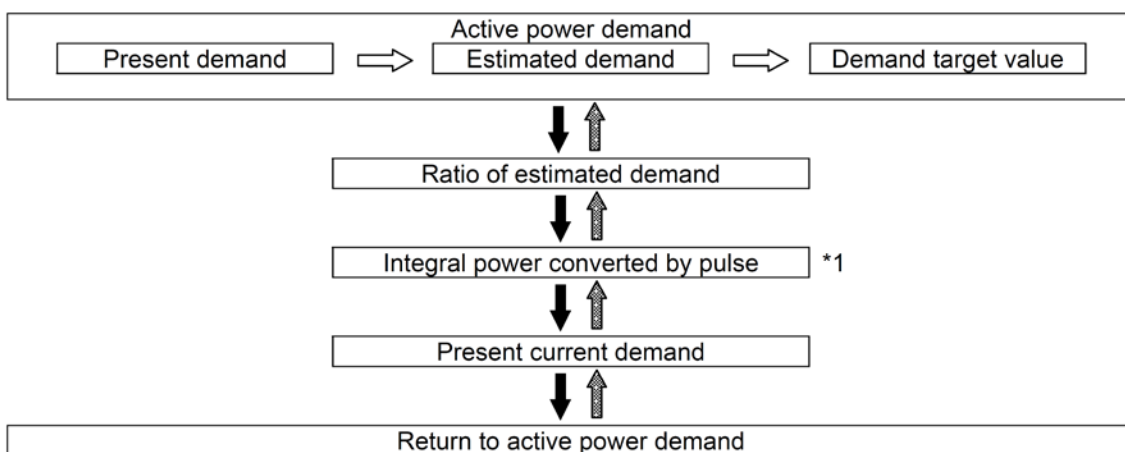
Present current demand

- The present value of current demand is displayed.

**9.4.3 30-min. demand**

An arrow mark indicates that each key must be pressed:

➡ <ITEM/Δ> ➡ <SHIFT/▽> ➡ <SET> ➡ <SET> + <ITEM/Δ>



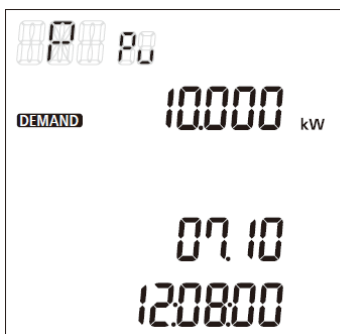
*1 only when [PULSE] is selected for power input type.

Display each value

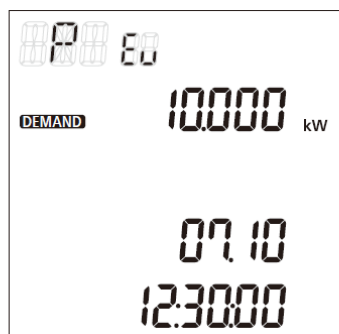
Active power demand

- Each demand value is displayed.
- Press <SHIFT/▽> to change to present demand, estimated demand, demand target value.
- Demand target value is set at "Power demand alarm threshold (OUT1 OUT2)".

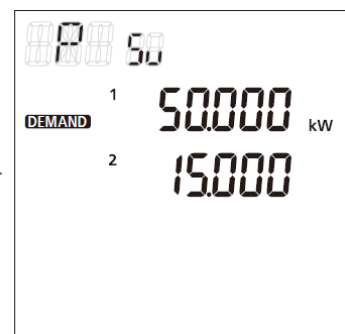
Present date and time



Estimated time



1: OUT1 threshold
2: OUT2 threshold

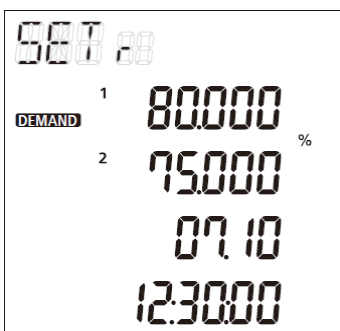


Ratio of estimated demand

- ◇ Ratio of estimated demand is displayed.

Example:

Estimated demand: 2.5 kW
Power demand alarm threshold: 5.0 kW
-> Ratio of estimated demand is 50.0 %

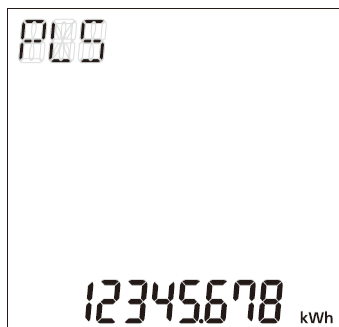


Note

- 1) "-----" is displayed in the following cases.
 - ◇ Until the setting time elapses to start monitoring demand
 - ◇ Demand value exceeds the display range
 - ◇ Clock is changed between demand time span
 - ◇ Until starting next time span at power failure
 - ◇ [AL-PD] is not selected for unit for pulse output.

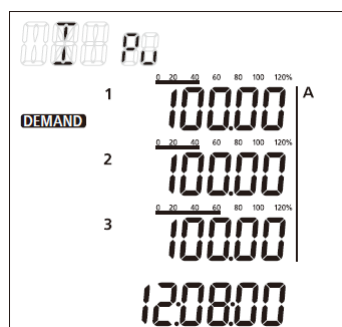
Integral power converted by pulse

- Conversion value that pulse from outer pulse detector is converted to electric power is displayed.



Present value of current demand

- The present value of current demand is displayed.



10. Installing a USB driver

A USB driver (PowerMonitor_USB.inf) must be installed for connecting Power Monitor 51A via USB communication.

- Once a USB driver has been installed, it is not necessary to install it again.
- If you change the port you are using, the driver must be installed again.

Turn on Power Monitor 51A and connect Power Monitor 51A to the PC via a USB cable.
After that, install the USB driver in accordance with your OS.



11. Specifications

11.1 Main unit

Supply voltage range	85 to 264 V AC 100 to 300 V DC	
Rated frequency	50/60 Hz	
Nominal power consumption	Approx. 6 VA Approx. 3 W	(240 V AC at 25 °C) (240 V DC at 25 °C)
Inrush current	30 A or less	(240 V AC/DC at 25 °C)
Allowable supply voltage	85 to 264 V AC (85 to 110 % of rated supply voltage)	
Allowable momentary power-off time	10ms	
Ambient temperature	Accuracy guarantee: -10 to +55 °C Operation: -25 to +55 °C Storage: -25 to +70 °C	
Ambient humidity	30 to 85 % RH (at 20 °C) non-condensing	
Breakdown voltage (initial)	Between the isolated circuits: 1500 V / 1 min	a) enclosure ⇔ all terminals b) between insulated circuits
Insulation resistance (initial)	Between the isolated circuits: 100 MΩ or more	<ul style="list-style-type: none"> • power supply terminals ⇔ other terminals • measured current input terminals ⇔ other terminals • pulse input terminals ⇔ other terminals • pulse output terminals ⇔ other terminals
Vibration resistance	10 to 150 Hz (7.5 minutes/cycle) single amplitude: 0.075 mm (1 h on 3 axes) ----- 10 to 55 Hz (1 minute/cycle) single amplitude: 0.0375 mm (1 h on 3 axes)	
Shock resistance	Min. 294 m/s ² (5 times on 3 axes)	
Display method	LCD with backlight	
Display updated cycle	100 to 1000 ms (set with setting mode)	
Power failure memory method	Internal memory (overwrite 10 ¹⁰ or more)	
Calendar	Range	From January 1, 2000 00:00:00 to December 31, 2099 23:59:59
	Accuracy	±15 seconds/month (at 25 °C)
	Backup	About 1 month (backup with secondary battery) (after 48 hours has elapsed, at 23 °C)
Degree of protection	Front: IP51 Back: IP20	
Sea level altitude	Under 2,000 m	

Overvoltage category	II
Measurement category	II
Pollution degree	2
Dimensions W/H/D	96 x 96 x 56 mm (without terminal block) 96 x 96 x 68 mm (with terminal block)
Weight	Approx. 480 g (with battery)

11.2 Input specifications

Measured data		AC sine		
Phase/wire system		Single-phase two-wire (1P2W) (max.3 circuits) Single-phase three-wire (1P3W) Three-phase three wire (3P3W) Three-phase four-wire (3P4W) (common)		
Applicable power system		100 V system, 200 V system, 400 V system		
Measured frequency		50/60 Hz		
Sampling rate		Sampling	1.024 MHz (approx. 1.0 μs)	
		Data update	100 ms 22.5 s for harmonics (2 nd to 31 st)	
Voltage	Input voltage	1P2W	L-L	0-500 V AC
		1P3W	L-L	0-500 V AC
			L-N	0-250 V AC
		3P3W	L-L	0-500 V AC
	3P4W	L-L	0-500 V AC	
		L-N	0-289 V AC	
	Impedance	2 MΩ or more (L-N; V1/V2/V3 - Vn)		
	Resolution	0.01 V		
	Power consumption	Approx. 0.2 VA (L-N; V1/V2/V3 - Vn)		
Accuracy * ¹	0.5 % *0.5% for 2-phase of 1P3W, 3-1 voltage of 3P3W and line voltage of 3P4W			
VT ratio	1.00 to 600.00 (set with setting mode) *Voltage transformer (VT) is required when you measure a load with voltage over rated voltage. (Rated secondary voltage of VT is 110 V) *When it input direct, VT ratio is set to 1.00.			
Current	Input current (with CT)	Primary current:	65535 A or less	
		Secondary current:	1 A or 5 A (set with setting mode)	
	Max. current	10 A (200 % of the rating)		
	Overload capacity	1000 % of the rating for 3 s		
	Resolution	0.001 A		
	Power consumption	Approx. 0.2 VA		
Accuracy * ¹ * ²	0.2 % *0.5 % for 2(N)-phase of 1P3W and 2(S)-phase of 3P3W.			
	Power	Accuracy * ¹	0.5 % Active power	Class 0.5S (IEC 62053-21)
Reactive power			Class 2 (IEC 62053-23)	

Temperature	Accuracy	$\pm 5.0\%$ (after ambient temperature correction with setting mode) *Passing 2 hours or more after energised.
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*1 Without error of current transformers (CT) and voltage transformers (VT)
It measures from 0.1 % of CT secondary current.

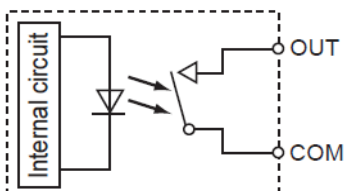
*2 As to the current under 5 % of rating, it may not satisfy the accuracy according to CT setting (max. error: 0.5 %).

11.3 Output specifications

Number of output point		2 points (insulate between output terminals)
Insulation method		PhotoMOS relay
Output type		1a
Output capacity		100 mA, 30 V AC/DC
Output mode (OUT1/OUT2)		<ul style="list-style-type: none"> Pulse by integral power Output by alarm or events (set with setting mode)
Pulse by integral power	Pulse width	Approx. 100 ms
	Pulse output unit	0.0001 kWh / 0.001 kWh / 0.01 kWh / 0.1kWh / 1kWh / 10kWh / 100kWh
Alarm event	Type	Stand-by alarm / Under voltage alarm / Over voltage alarm / Power interruption alarm / Under current alarm / Over current alarm / Active power alarm / Reactive power alarm / Apparent power alarm / PF alarm / Over frequency alarm / Under frequency alarm / Voltage harmonics alarm / Current harmonics alarm / Voltage THD alarm / Current THD alarm / Unbalanced voltage alarm / Unbalanced current alarm / Power demand alarm / Current demand alarm / counter output / level output (external control)
	Alarm reset	Self reset (according to the setting) / manual reset
Protection element		Varistor *1

*1 Varistor is mounted internally as a protection element.
Install a protective device if the place where it is used is effected by surge.

<Internal output circuit>



Calculation

Unit for pulse output > (Max. measurement power [kW]) / (3600[s] × 1[pulse/s])

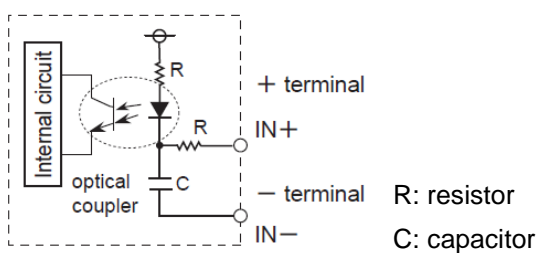
Notes

- 1) An incorrect unit setting may result in a miscount.
- 2) If the OFF time is too short, counting errors may occur.

11.4 Input specifications

Number of input point		2 points (no insulation between input terminals (COM is common))
Insulation method		Designated insulation for input (insulate to the other functions)
Input method		Contact / non-voltage a contact or open collector
Input signal		<div>Non-voltage</div> <ul style="list-style-type: none"> • Impedance: max. 1 kΩ (when short-circuit current: max. 10 mA) • Residual voltage when shorted; max. 3 V • Impedance when open: min. 100 kΩ
Input mode	IN1	Pulse input or synchronised with input from outer device
	IN2	Pulse input
Max. counting speed	IN1	30 Hz (when pulse input)
	IN2	2000 Hz / 30 Hz
Min. input signal width	IN1	16.7 m ON:OFF ratio = 1:1
	IN2	0.25 ms (when 2000 Hz is set) / 16.7 ms (when 30 Hz is set) ON:OFF ratio 1:1
Pre-scale	Decimal point	Under 3-digit
	Range	0.001 to 100.000 (set with setting mode)
Output mode (when pulse output is selected)		HOLD
Protective elements		Zener diode

<Internal input circuit>



11.5 Demand monitor and control specifications (common to 9, 10)

Demand type		<ul style="list-style-type: none"> • Peak demand • IEC61557-12 demand <ul style="list-style-type: none"> ◇ Sliding block interval ◇ Fixed block interval ◇ Current demand • 30-min. demand (set with setting mode)
Power input type		Current transformer input (IEC demand / 30-min. demand)) Integral pulse input (only 30-min. demand) (set with setting mode)
Demand span	IEC demand	1 to 60 min. (set with setting mode)
	30-min. demand	30 min. (fixed)
Measurement item		Present demand, Estimated demand (only 30-min. demand)
Demand calculate method *1		Additional method / Average method (set with setting mode)
Data update cycle		1 min.
Demand stand-by time (mask time) *1		1 to 30 min. (set with setting mode)
Display	IEC demand	Present demand (active / reactive / apparent / active(export) / reactive(export) / current)
	30-min. demand	Power demand (active), Estimated demand, Demand target value, Ratio of estimated demand, Current demand, Monthly max. demand, Max. demand
Saved data		Monthly max. demand 12 records (12-month), max. demand
Time span synchronised method		Clock synchronised (Pulse input to IN1) (set with setting mode)
Synchronised signal input <IN1>	Input terminal	IN1
	Input method	Non-voltage a contact or open collector
	Pulse width	50 ms or more
	Operating voltage / current	5 V DC 10 mA
	Signal common	Common (IN2; common to pulse input)

Pulse input <IN2>	Input terminal		IN2	
	Input method		Non-voltage a contact or open collector	
	Input signal		50000 / 2000 [pulse/kWh]	
		Pulse rate	0.001 to 100.000 kWh/pulse	
	Input pulse	2000Hz	width	0.25 ms or more
			interval	0.5 ms or more (OFF: 0.25 ms or more)
		30 Hz	width	16.7 ms or more
			interval	33.4 ms or more (OFF: 16.7 ms or more)
Operating voltage/ current		5 V DC / 10 mA		
Signal common		Common (IN1; common to clock synchronised input)		
Alarm output <OUT1> <OUT2> *2	Display		Lighting alarm mark / Flashing backlight	
	Output signal		2 points; set each#normal; OFF alarm; ON	
	Output capacity		100 mA, 30 V AC/DC	
	Communi- cation	OUT1	DT00298 (MEWTOCOL), 12Ahex (MODBUS) normal: 0, alarm: 1	
		OUT2	DT00299 (MEWTOCOL), 12Bhex (MODBUS) normal: 0, alarm: 1	

*1 Available when 30-min. demand is selected.

*2 Alarm output cannot be set when peak demand is selected.

11.6 Communication specifications

<RS485>

Interface		Conforming to RS485
Communication method		Half-duplex
Synchronous system		Synchronous communication method
Isolation status		Isolated with the internal circuits (basic insulation)
Protocol		MEWTOCOL, MODBUS(RTU), DL/T645-2007 ^{*1} (select with setting mode)
Number of connected unit		99 (max.) ^{*2}
Transmission distance		1200 m ^{*3}
Transmission speed		38400, 19200, 9600, 4800, 2400, 1200bps (select with setting mode)
Transmission format	Data length	8 bit (fixed)
	Parity	Not available / odd number / even number (select with setting mode)
	Stop bit	1 bit, 2 bit (select with setting mode)

^{*1} MEWTOCOL is the protocol for PLC from Panasonic.
DL/T645 is the Chinese power-meter standard. Only DL/T645-2007 is supported.

^{*2} For a RS485 converter on the computer side, we recommend SI-35 and SI-35USB (from LINE EYE Co.,Ltd.). When using SI-35, SI-35USB or a PLC from our company (which can be connected up to 99 units), up to 99 can be connected. If using this system with other devices, up to 31 can be connected.

^{*3} Please check the current devices when some commercial devices with an RS485 interface are connected. The number of connected devices, transmission distance, and transmission speed may be different depending on the transmission line used.

<USB>

Electric specification	Conform to USB2.0 standard
Connector shape	USB series MiniB
Insulation method	Insulated to internal circuit
Transmission speed	12 Mbps (full speed)
Transmission function	Computer link (MEWTOCOL)

Note

- 1) Install the dedicated USB driver before using the USB port.
- 2) Do not ground the signal wire of USB communication.

11.7 Self-diagnostic function

If an error occurs, the following will be displayed.

When several errors occur, [1] are indicated for the designated digits.

Indicator	Meaning	To recover	After recovery
00000001	Hardware breakdown	Change main unit due to the end of hardware	
00000100	Firmware update failure	Update again	Start with updating firmware
00100000	Internal program error	Power on again	Before the abnormal
10000000	Memory breakdown or crash *	Change main unit due to insufficient internal memory	

* Includes the possibility that the internal memory life has expired.

11.8 Power failure memory

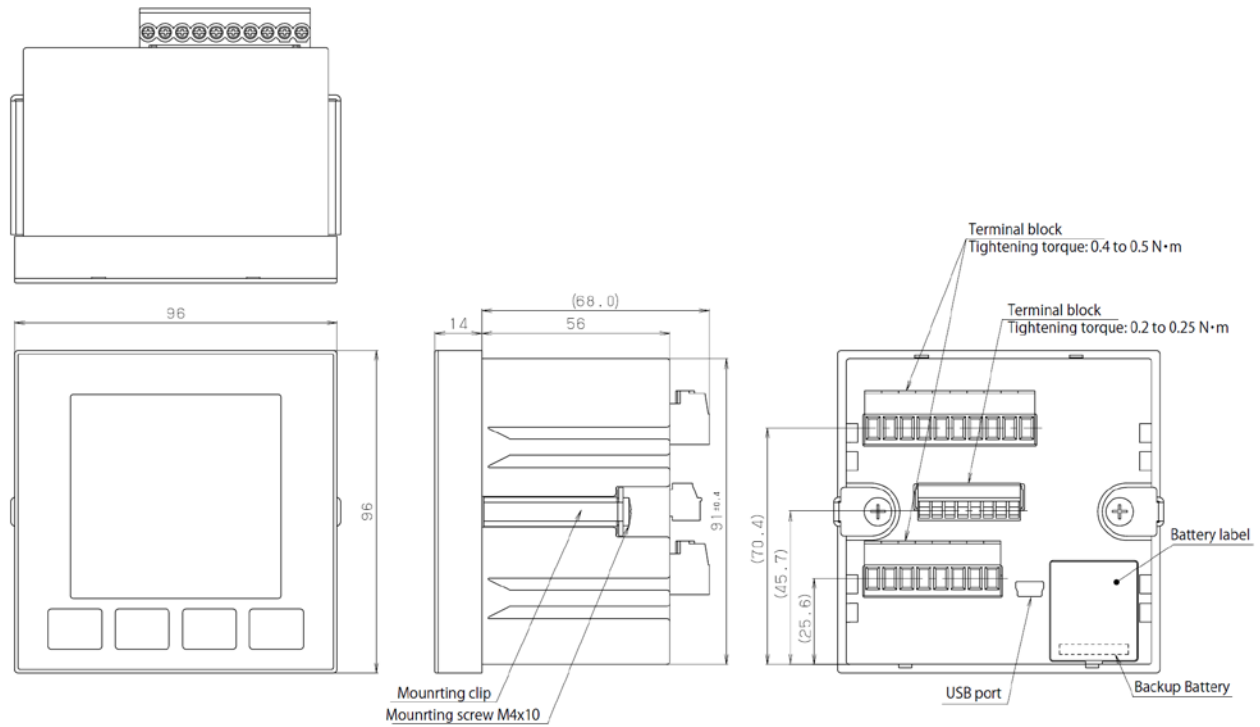
Power Monitor 51A stores the integrated electric power and working status to internal memory until the power supply is off (power failure guarantee).

Each time a setting is changed, each setting value is stored to internal memory at the same time. Rewritable times are limited. Be especially careful when changing settings via communication.

12. Mounting

12.1 Dimensions

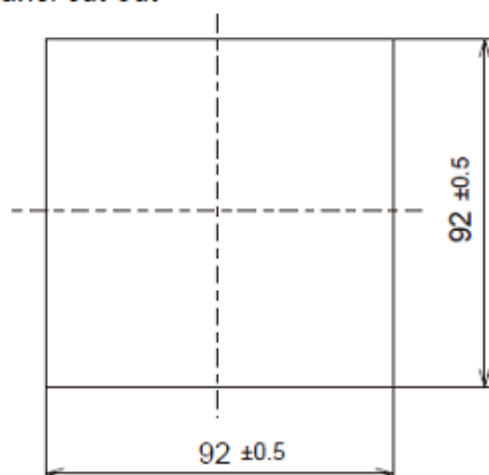
12.1.1 Main unit



12.2 Panel mounting

(Unit: mm)

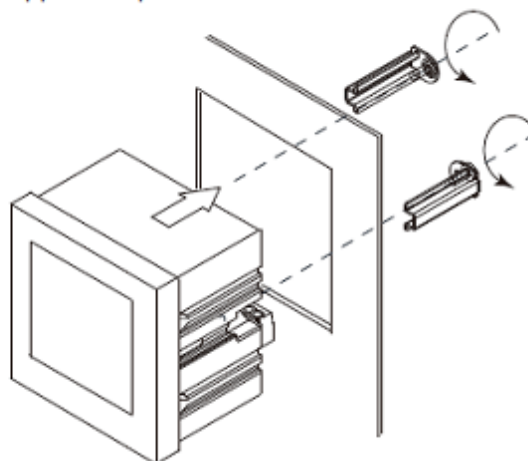
◆ Panel cut-out



Keep enough space for several mountings.
recommended space:
130mm the left, right, top and bottom
from center of the unit

◆ Panel mounting

- 1) Remove the mounting clips from the unit.
 - 2) Insert the unit from the front of the panel.
 - 3) Attach the mounting clips at the both side of the case and secure in place with the screws.
(Tightening torque: approx. 0.2 to $0.3 \text{ N} \cdot \text{m}$)
- Applicable panel thickness: 1 to 5mm



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