TOYO KEIKI

TMW

Multi Power Meter

- Industry first in adopting "graphic LCD"
- Display of "time siries" using trend graph
- Various measurement displays
- Up to 10 elements are displayed collectively
- Arbitrary VT, CT settings are possible
- "Easy setting" (Setting support function provided)

TOYO KEIKI CO.,LTD

CAT. NO. TMW_E-01

Contents

TMW Multi power meter

Feature

◆Industry first in adopting "Graphic LCD"

Adoption of graphic LCD makes the measurement display screen different from conventional types.

◆"Display of time series" using trend graph

Previous measurements (power, etc) are displayed on a trend graph in time series.
This shows the variation trend of the measurements at a glance.

◆Various measurement displays

Not only the conventional straight bar graph, but also an arc-shaped bar graph are available. They can be switched.

◆Up to 10 elements are displayed collectively

The display screen can be switched among one-element, four-element, and ten-element screens in real time. (See page 6.)
On the ten-element screen, the measurement items of up to 35 elements can be displayed by scrolling the screen (3P4W specification).

◆Arbitrary VT and CT settings are possible

The VT and CT values on the primary side can be set arbitrarily to support special VT and CT.

◆"Easy setting" (Setting support function provided)

In the setting mode, the operation instruction is displayed on the bottom of the display screen. Therefore, setting is possible without the manual.

Specifications

①Measurement spec.

Item	Input range	Display
Current (R, S, T)	0～5A(20A extension)	Input current × CT ratio
Voltage (R-S, S-T, T-R)	0～150V or 0～300V Note 1)	Input voltage × VT ratio
Active Power	0～1kW or 0～2kW Note 1)	Input Power × CT ratio×VT ratio
Reactive Power	LEAD 1kvar～LAG 1kvar or LEAD 2kvar～LAG 2kvar Note 1)	Input × CT ratio × VT ratio
Apparent Power	0～1kVA or 0～2kVA Note 1)	Input × CT ratio × VT ratio
Power factor	LEAD 0～1.0～LAG 0 Note 1)	LEAD 0.0～100.0～LAG 0.0%
Frequency	45Hz～65Hz Note 1)	45.00Hz～65.00Hz
Watt demand	0～1kW or 0～2kW Note 1)	Input × CT ratio × VT ratio
Amp demand	0～5A or (20A extension)	Input curnent × CT ratio
Active energy	——— Note 1)	0.000～999999.999kWh(MWh) Incomming Wh : sign +Wh outgoing Wh : sign −Wh
Reactiv energy	——— Note 1)	0.000～999999.999kvarh(Mvarh) LAG 0.000～999999.999kvarh(Mvarh) LEAD 0.000～999999.999kvarh(Mvarh)
Operating time	———	0～999999h
Current THD	0～100% Peak Value : 0～9.9A	0～100%
Voltage THD	0～100%,Peak Value 0～250V(Rated Voltage 110V) Note 1) 0～500V(Rated Voltage 220V)	0～100%

note 1) Invalid for current specifications.

②Aux. Power

Spec	Voltage range	Consumption
Worldwide power	AC80～264V DC80～143V	5VA 3W(27mA)
DC24V	DC19～ 31V	3W(123mA)

③Input specifications

Spec	Rating	Input range	Consumption
1P2W / 1P3W / 3P3W	110V/220V, 100V/200V 5A	0～150V／0～300V 0～5A(extension to 20A)	0.11VA/0.22VA 0.5 VA
	440V 5A	0～600V 0～5A(extension to 20A)	0.44VA 0.5 VA
3P4W	110/$\sqrt{3}$V／220/$\sqrt{3}$V 5A	0～150/$\sqrt{3}$V／0～300/$\sqrt{3}$V 0～5A(extension to 20A)	0.04VA/0.08VA 0.5 VA
	440/$\sqrt{3}$V 5A	0～600V/$\sqrt{3}$V 0～5A(extension to 20A)	0.16VA 0.5 VA

Note) exchange 1P2W, 1P3W, 3P3W spec and 110V, 220V input each other by setting

④Output specifications

Output type	Specification
Analog output	DC4～20mA 0～550Ω DC1～5V 600Ω～∞ MAX.4CH
Pulse output	Active energy or Reactive energy DC125V, AC125V 0.1A MAX.2CH
Relay output	Upper alarm or Lower alarm AC250V 5A DC100V 0.3A, DC30V 5A MAX.2CH
Transmission output	RS-485 Protocol : MODBUS Baudrate : 2400, 4800, 9600, 19.2k, 38.4kbps

(Note) Up to two point outputs are available for pulse output and alarm output.
Either of transmission output and pulse output (alarm output) is to be selected (see type name system).
Pulse output is output asynchronously with the display update interval.
Note that a time difference may be generated between the indicated value and the pulse number.

⑤ Remote input specification

The measurement items of the main display can be changed by applying a voltage from outside (Display screen 1 or Display screen 2).

Apply a voltage of 80 to 264 VAC or 80 to 143 VDC to the external input terminal (for 0.5 seconds or more). Each time a voltage is applied, the next item is selected.

(See page 11.)

⑥Display specifications

	Specification
LCD	Dot matrix monochrome LCD 240×160Dots Back light : white
Digital	one element(with trend-graph) 4 elements(with bar-graph) 10 elements
Bar-graph	20dots Bar-graph type:straight line or arc-shaped type
Trend-graph	time series display of each elements(160sampling points) Vertical: 50dots Horizontal: 1h、3h、6h、12h、24h demand time × 2 for demand Watt and demand Amp

Performance

Item	Specification
Tolerance	Current ±0.5% Nphase Current ±3.0%(only 3P4W) Voltage ±0.5% Active power ±0.5% Reactive power ±1.0% Apparent power ±1.0% Power factor ±3% Frequency ±0.5% Watt demand ±1.0% Amp demand ±1.0% Active energy ±2.0% Reactive energy ±2.5% Operating time ±1h Current THD ±1.0% Voltage THD ±1.0% Residual current ±1.0%(Option)
Effect of Temperature	±0.3% / 10℃
Response time	About 1second ※1)
Insulation resistance	Over 100MΩ 500VDC
Withstand voltage	AC2000V for 1minute
Impulse test	6kV 1.2 / 50μs
Vibration & Shock	Vibration 10～55～10Hz 0.15㎜ Shock 490m/s^2 XYZ positive and negative each 3times

※1) The response time of volfage THD and Current THD is : about 4seconds

Environment and Structure

Item	Specification
Operating temp	−10～55℃
Storage temp	−20～70℃
humidity	Under 85%RH
Structure	case Flame resisting ABS
	cover Flame resisting ABS
	Terminal cover polycarbonate
	Terminal screw brass(M3.5、M3)
Weight	About 580g
Display element	LCD
Protecion rating	IP40

Type Name And Spec No.

TMW—□□—□—□□—□

Input

No.	Specification
31	1P2W / 1P3W / 3P3W 110/220V, 5A
32	1P2W / 1P3W / 3P3W 440V, 5A
33	1P2W / 1P3W / 3P3W 110/220V, 5A with a residual current input
34	1P2W / 1P3W / 3P3W 440V, 5A with a residual current input
35	1P2W / 1P3W / 3P3W current input only
41	3P4W $110/\sqrt{3}/220/\sqrt{3}$V, 5A
42	3P4W 440/$\sqrt{3}$V, 5A
45	3P4W current input only
99	Other

Auxiliary power supply

No.	Specification
1	DC19～31V
2	AC80～264V, DC80～143V
9	Other

Out put

No.	Specification
00	None
11	1-5V 4ch Analog output
12	4-20mA 4ch Analog output
21	1-5V 4ch Analog output + 2ch Pulse output
22	4-20mA 4ch Analog output + 2ch Pulse output
31	1-5V 4ch Analog output + 2ch Alarm output
32	4-20mA 4ch Analog output + 2ch Alarm output
41	1-5V 4ch Analog output + Pulse output + Alarm output
42	4-20mA 4ch Analog output + Pulse output + Alarm output
51	1-5V 4ch Analog output +RS-485
52	4-20mA 4ch Analog output +RS-485
61	RS-485

Viewing direction

No.	Specification
E	Instrument screen of viewing angle to 6 o'clock
ED	Instrument screen of viewing angle to 12 o'clock

Plase consult with our company for detailed spec.

Items to be specified at the time of order

1. Type name	2. Input	3. Auxiliary power supply	4. Output	5. Viewing direction
TMW	—□□	—□	—□□	—□

【Example】TMW-31-2-22

CT100A, VT3300V, Demand time 15minutes
CH1 … Active power
CH2 … Current R phase
CH3 … Voltage RS phase
CH4 … Frequency
Pulse CH1 … Watt-hour / 10kWh / 1Pulse
Pulse CH2 … Lag Varh / 10kvarh / 1Pulse
Input 3P3W, 110V, 5A

(Note) The internal parameters can also be specified at the time of order. The unit is shipped with the specified values set.
The setting items that can be specified are CT ratio, VT ratio, and Demand time limit.
For the specifications with analog output, the elements of each output can be specified. For the specifications with pulse, the pulse elements and multiplying factor can be specified.

Parts name and accessories

Measurement/display operation procedure

The operation of the switch used in measurement mode and the operation procedure are described below.
The measurement display screen can be selected from the following three types of screens according to the number of display elements.

	Number of display element	Graph display	Key operation
Display1	1	Trend graph	GRAPH Key
Display2	4	Bar graph	GRAPH Key
Display3	10	———	GRAPH Key

Use GRAPH key to switch the display screen.

①Display screen 1

An arbitrary one of the measurement elements is displayed.
The most recent 160 points are indicated on the trend graph with the digital representation of the measurements.
The display time of the trend graph can be selected from 1h, 3h, 6h, 12h, and 24h.
(During demand display, the display time is twice the demand time limit.)
For measurement scaling, the scaling set for the bar graph is applied.
Note 1: If VT, CT, the trend graph display time, or the bar graph scaling is changed, the trend graph is cleared once and the display starts again from 0h.
Note 2: The trend graphs displaying active energy, reactive energy, and operating time are "Active power", "Reactive power", and "S phase current", respectively.
Note 3: The trend graph is not the four-quadrant type.
Pressing the W/V/A etc. key displays the element list on the bottom of the screen. Also, the measurement element currently displayed is highlighted.
The display elements are switched using the + key and − key.
The + key is used for switching the elements in the forward direction. The − key is for switching the elements in the reverse direction.
Pressing the W/V/A etc. key again deletes the element list.

【Change of measurement element】

3P4W

Line-line voltage (RS、ST、TR) →Phase voltage (R、S、T) →Current (R、S、T、N) →Active power→Reactive power→Apparent power→Power-factor→Frequency→Watt demand (Inst、Max、Min) →Amp demand (Inst、Max、Min) →Voltage THD (RS、ST、TR) →Current THD (R、S、T) →Incomming Wh→Out going Wh→LAG varh→LEAD varh→operating time ·····

3P3W

Line-line voltage (RS、ST、TR) →Current (R、S、T) →Active power→Reactive power→Apparent power→Power-factor→Frequency→Watt demand (Inst、Max、Min) →Amp demand (Inst、Max、Min) →Voltage THD (RS、ST、TR) →Current THD (R、S、T) →Incomming Wh→Out going Wh→LAG varh→LEAD varh→operating time ·····

1P3W

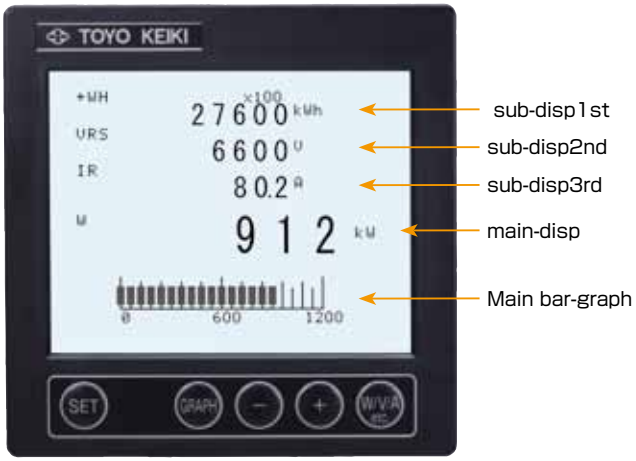
Line-line voltage (RN、TN、RT) →Current (R、N、T) →Active power→Reactive power→Apparent power→Power-factor→Frequency→Watt demand (Inst、Max、Min) →Amp demand (Inst、Max、Min) →Voltage THD (RN、TN、RT) →Current THD (R、N、T) →Incomming Wh→Out going Wh→LAG varh→LEAD varh→operating time ·····

1P2W

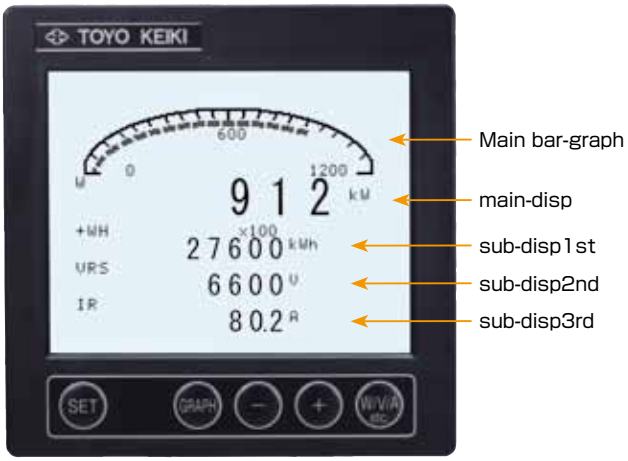
Voltage (RN) →Current (R) →Active power→Reactive power→Apparent power→Power factor→Frequency→Watt demand (Inst、Max、Min) →Amp demand (Inst、Max、Min) →Voltage THD (RN) →Current THD (R) →Incomming Wh→Out going Wh→LAG varh→LEAD varh→operating time ·····

②Display screen 2

An arbitrary four of the measurement elements are displayed. Also, the elements of the main display are displayed on a bar graph at the same time.
The bar graph can be selected from the straight type and arc-shaped type.
(The elements to be displayed on the subdisplay and type of the bar graph can be selected in the setting mode.)



Straight bar-graph

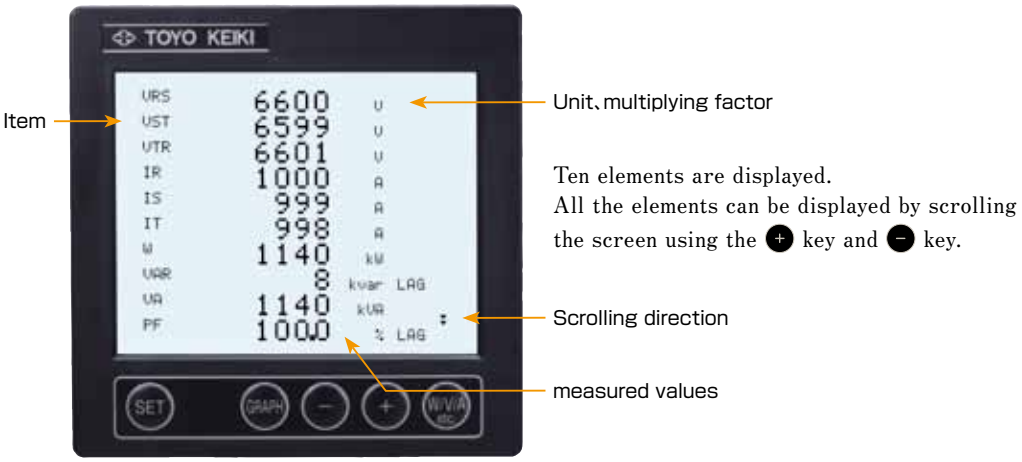


Arc-shaped bar-graph

【Switching elements】

Pressing the W/V/A key displays the element list on the bottom of the screen. Also, the elements currently displayed are highlighted.
The display elements are switched using the + key and − key.
The + key is for switching the elements in the forward direction. The − key is for switching the elements in the reverse direction.
The order of switching the elements is the same as that of the Display screen 1.
Pressing the W/V/A key again deletes the key operation screen.
The elements displayed on the subdisplay are fixed. However, the elements to be displayed can be selected arbitrarily in the setting mode.
(See setting item 2 "Display measurement item setup.")
The bar graph can also be selected from the straight type and arc-shaped type in the setting mode.
(See setting item 3 "Bar graph setup.")
Note: The bar graph is not the four-quadrant type.

③Display screen 3



All the measurement elements are displayed. However, only ten elements are displayed at one time.
The elements not displayed can be displayed by pressing the + key or − key to scroll the screen.

④Mask of main display elements

On the Display screen 2, elements that need not be mainly displayed can be masked by setting.
The masked elements are skipped when switching the display.
On the Display screens 1 and 3, all the elements are displayed regardless of the mask setting.

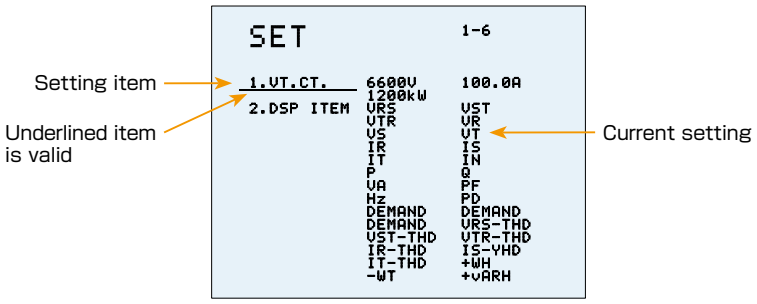
⑤Display of lower digits of active energy, reactive energy, and operation time

The digits lower than the normal display are displayed for active energy, reactive energy, and operation time.
This function is used to quickly check the operation of the unit.

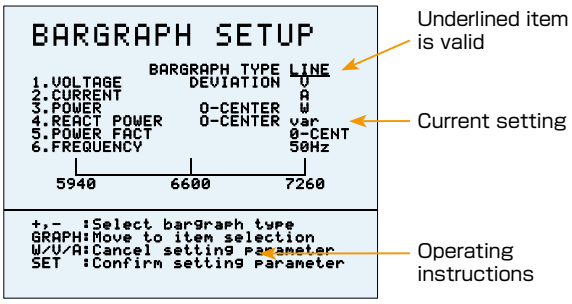
①Display active energy, reactive energy, and operation time.
②Press the + key and − key together. While the keys are pressed, the lowest digit of the normal display and the further lower three digits are displayed.
When the keys are released, the normal display appears again.

Setting item

No.	setting item	Explanation
1	The setup of VT or CT	Setup of standard VT,CT ratio or arbitrary VT,CT ratio.
2	Display measurement item setup	Mask of measurement item on the main display and select of measurement item on subdisplay.
3	Bar-graph setup	Selection of bar-graph type and setting bar-graph scale.
4	Setup of setting point	The display is blinked when the input signal exceeds setting point.
5	Minimum value setup	Setting minimum range of voltage and current.
6	Demand setup	Selection of demand calculation type, setting demand time reset and adjustment of demand.
7	Setting of alarm output	Setting alarm output item, alarm value, and return time.
8	Setting of analog output	Setting analog output item and output range.
9	Setting of pulse output	Setting pulse output item and multiplier.
10	Setting of digital output	Selection of mode, baudrate, parity and address.
11	Display setup	Setting the interval of display, wh multiplier and the phase display.
12	Setup of dead band	Setting of the dead band of each items.
13	Back-light setup	Selection of back-light off mode.
14	Trend-graph setup	Setting the display time range.
15	Wh reset	Resetting wh,varh,operating time.
16	initial setup	It returns to the setting when it is shipped at the factory.
17	Setup of input specification	Selection of input circuit and input voltage.



Set menu display



Example of setting item (Bar-graph setup)

Setting value of factory shipments (Without Current Spec)

Item	Setting value
Display screen	Disp screen No. 1 (Trend-graph) Measuring item : Active power
VT ratio	3 phase : 6600V 1 phase : 100V
CT ratio	3 phase : 100A 1 phase : 100A
Main-display element	All element displays
Sub-display element	1st : Active energy 2nd : Active power 3rd : S Phase current
Bar-graph	Voltage : deviation scale of V unit Current : real scale (A) Active power : real scale(W) Reactive power : real scale(var) Power factor : -0%~100%~0% Frequency : 45~65Hz
Dead band	0.2% of the rated
Setting point	Max voltage value : 7260V(3phase), 110.0V(1phase) Min voltage value : 5940V(3phase), 90.0V(1phase) Other elements : OFF
Minimum value of range	Voltage : 1.0% of max rated Current : 2.0% of rated
Demand	Demand type : thermal instrument Demand time : 30 minutes

Item	Setting value
Alarm output	CH1 : Watt demand 960kW、manual reset CH2 : Amp demand 80.0A、manual reset
Back-light	Auto off mode Bright : max (6) Contrast : 140
Analog output	CH1 : S phase current CH2 : Active power CH3 : RS phase voltage CH4 : Frequency
Pulse outoput	CH1 : Incoming 1kWh/pulse CH2 : LAG 1kvarh/pulse
Communication paramenter	Baudrate : 9600 Parity : None Address : 01 Mode : ASCII Data size : 2word Date type : BCD LRC type : Type1 Multiplier of Wh : 1kWh
Display	Display interval : 0.5S Phase : R、S、T Wh multiplier : Auto Reactive energy : Valid on incomming Trend-graph time:12h

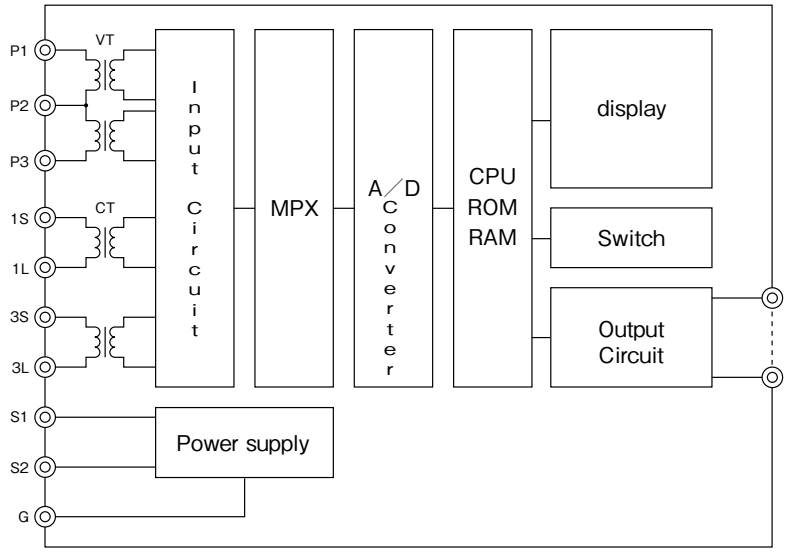
Manual alarm reset

If manual recovery is selected as the alarm output setting recovery mode, the alarm continues until the alarm reset operation is performed. The alarm reset operation can be performed by using the keys as described below.

Item	key operation	Explanation
Alarm reset	SET ↓ GRAPH	・On pushing SET key operation guide is displayed on the screen. ・Pushing GRAPH key reset alarm output and return to measurement mode.

Description of internal operation

①Internal block diagram



Note: The diagram above indicates the structure of 3P3W. In 3P4W, the number of input VT and CT is different.

②Overview of operation

①A voltage input and current input are insulated by the small VT and CT in TMW respectively and detected as signals proportional to each input in the input circuit.
②The input signals are sampled respectively by the MPX (multiplexer) and A/D converter at a high speed and provided for the CPU as digital values.
③The measured quantities are computed respectively in the operation part that consists of the CPU, ROM, and RAM, and the results are displayed on the LCD display.
In some specifications, they are output to the outside as analog output and digital output.

③Measurement principle

①Voltage and current

The values sampled at a high speed in eight input periods are squared and integrated. Then the square root of the result is extracted. This allows correct measurement of effective values even when the input waveform is distorted.

②Active power

The power value is obtained by multiplying the values obtained by sampling the voltage input and current input at a high speed and integrating them for the eight input periods.
The total power value is obtained by adding up the active power of each phase according to the two-wattmeter method for 3P3W and the three-wattmeter method for 3P4W.

③Reactive power

As with power value measurement, the sampling values of the voltage input and current input are multiplied. At this time, the values are multiplied after shifting the current input period by 90° .
As a result, the reactive power value is obtained. As with active power, the total reactive power value is obtained by adding up the reactive power of two phases for 3P3W, and the reactive power of each phase for 3P4W.

④Apparent power

The apparent power is calculated from the active power and reactive power value by using the following formula.

$$VA=\sqrt{W^2+var^2}$$

⑤Power factor

The power factor is calculated from the active power and reactive power value by using the following formula.

$$PF=W/\sqrt{W^2+var^2}$$

Note that the power factor value may vary with measuring instruments having different operating principles.

⑥Frequency

The period of the voltage input waveform is detected by the counter and the frequency is computed.

⑦Watt demand Amp demand

For Watt demand and Amp demand, two types of demand values, thermal demand and arithmetic mean type demand, are provided. The thermal demand value is obtained by taking an index moving average of the power or current value described above.
The arithmetic mean type demand value is obtained by calculating the arithmetic mean of the power or current value within the demand time.
Also, for the arithmetic mean type demand, the demand value is automatically reset to 0 after the demand time has passed and then integrated again.
(The maximum and minimum demand values are reset to 0 after the power is turned off.)

⑧Active energy and reactive energy

Active energy and reactive energy are obtained by integrating the active power value or reactive power value described above at a constant time interval.
Also, power transmission and power reception are integrated separately for corresponding to the power flow. For reactive energy, LAG and LEAD are integrated separately.
Active energy and reactive energy are stored in the internal nonvolatile memory and held even after the power is turned off.
(The internal nonvolatile memory ensures that data is held for ten years or more after power outage.)

⑨Operating time

If a current exceeding the value set as the minimum current is input to any of the phases, the energizing time is integrated.
The integration unit is h (hour). The operating time is stored in the internal nonvolatile memory and held even after the power is turned off. (The internal nonvolatile memory ensures that data is held for ten years or more after power outage.)
Integration of the energizing time by phase voltage input is possible if specified. Please consult us.

⑩Current distortion rate and voltage distortion rate

The values are obtained by conducting DFT processing for the values sampled at a high speed in eight periods, calculating the effective values of the entire harmonics of the orders from 2 to 15, dividing them by the effective value of the fundamental, and expressing them as a percentage.

Installation method and precautions for use

①Installation method and precautions for use

Checking product to be used

The specifications of input, auxiliary power, and output are indicated on the product. Check that they conform to the specifications required.

②Installation environment

The installation environment directly affects the performance and life of the product. Refer to the following when selecting the installation environment.

①Ambient temperature and humidity

Avoid high temperature, high humidity, and their sudden changes as much as possible when storing, transporting, and using the product.。

②Avoid places where corrosive gases such as sulfidizing gas and ammonia gas are generated and places where oil, water, etc. is splashed.

③Avoid continuous vibration and shock when using the product.

④Consult us in advance when using the product in other special environments.

③Installation

①Installation position

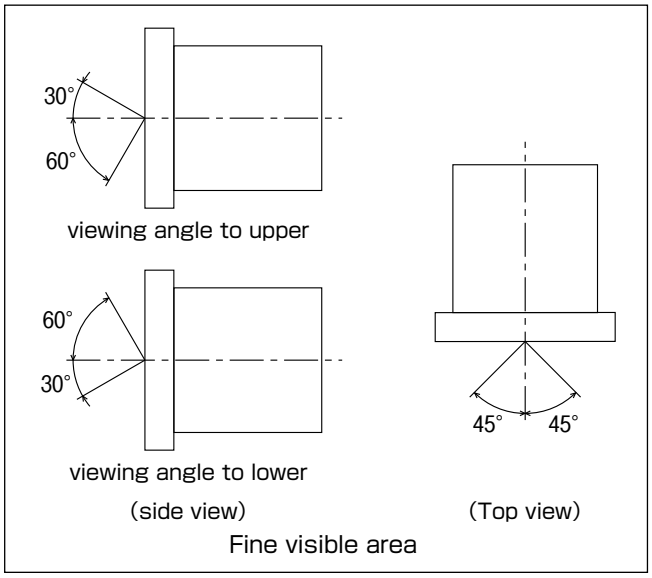
This product is equipped with a liquid crystal display.

On the liquid crystal display, the contrast changes depending on the viewing angle. Therefore, two types of liquid crystal displays are prepared for this product.

Refer to the figure on the right when selecting the display and installation position.

The installation position "High" type should be installed at a position slightly higher than your eye level to obtain a good contrast. The installation position "Low" type should be installed at a position slightly lower than your eye level.

Leave a clearance in the depth direction for pulling the cable.

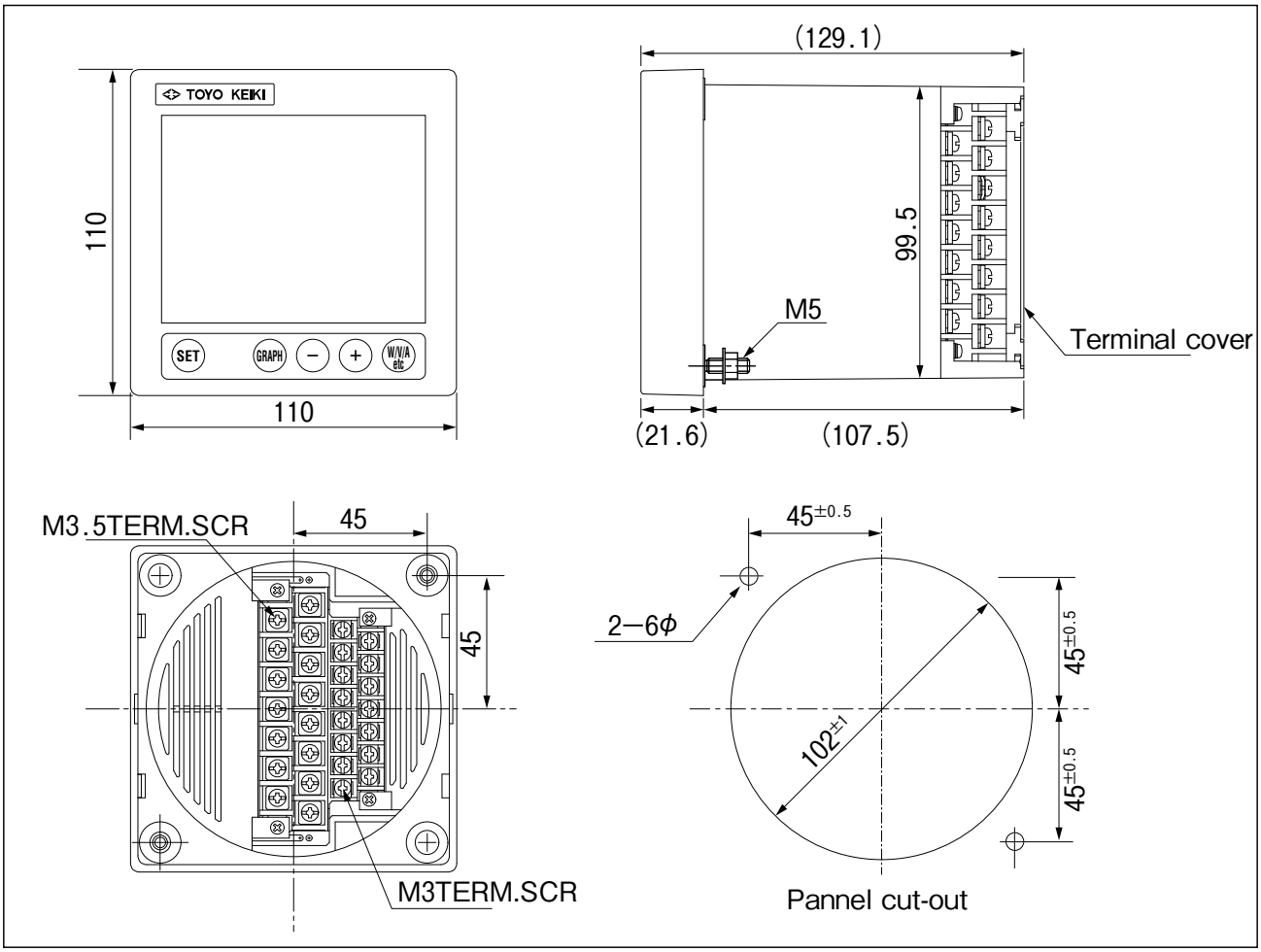


②Installation

Refer to the panel cut on the dimensional outline drawing when forming the installation hole. This product is designed to be installed with two screws on the diagonal line.

When installing the product adjacently to another, arrange them with a clearance of 115 mm or more in the left direction and 125 mm or more in the vertical direction.

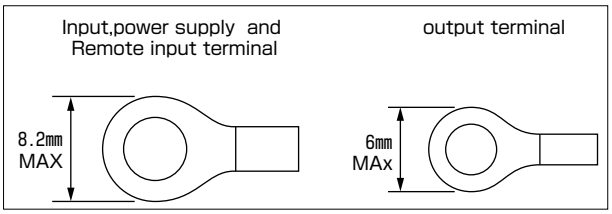
③Dimensional outline drawing



④Connection

Connect the product correctly according to the connecting diagram. Precautions for connection are described below:

①Slide the terminal cover in the direction of the arrow to remove. On completion of connecting work, mount the terminal cover again.



②Prepare M4 terminals for the input terminal and power terminal, and M3 terminals for the output terminal.

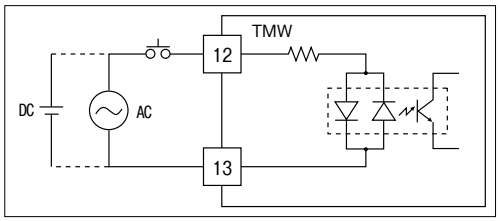
③Especially in the high voltage circuit, ground one side of input-side CT and VT for safety (see the connecting diagram).

④Be sure to ground the grounding terminal (11th terminal) for safety and stable operation.

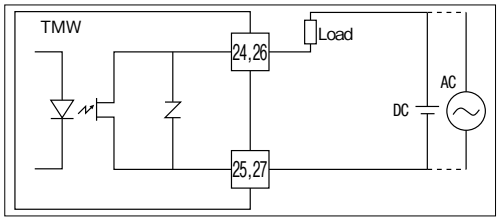
⑤For the product with 24 VDC auxiliary power, the auxiliary power terminal has polarity.
If it is connected with polarity reversed, the product cannot operate.
・For the products with the power specifications 19 to 31 VDC, the 9th terminal is (+) and 10th terminal is (-) (see the connecting diagram).
・For the products with the power specifications 80 to 264 VAC and 80 to 143 VDC, the power terminal does not have polarity. The products operate normally regardless of the connecting position.

⑥Use a cable with a wire diameter having sufficient capacity.
It is necessary to select the cable by taking excess current into consideration, especially connecting it to the current input.

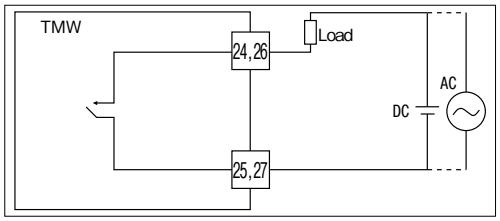
⑦For the specifications with output, separate the wiring to the output signal from the input-side wiring, wiring to the power source, power line, etc., and use shielding wire and twisted pair wire as necessary.



⑧The external switching input is activated by applying a voltage.
Prepare an 80 to 264 VAC or 80 to 143 VDC power source.
It can be shared with the supply power source to the auxiliary power.
The internal structure is as shown in the left figure.
The external switching input can be left open if it is not used.
The consumption current at the switching input is about 1 mA for 100 VAC/100 VDC, and about 2 mA for 200 VAC.



⑨The structure of the pulse output is as shown in the left figure. Use at a voltage and current within the rating.
When driving an inductor, relay, etc., be sure to take measures to prevent excessive voltage, such as a surge absorber.



⑩The structure of the alarm output is as shown in the figure on the left.
Use at a voltage and current within the rating.
When driving an inductor, relay, etc., be sure to take measures to prevent excessive current.

⑪Do not use unused terminals as relay terminals. If the output terminal is not used, leave it open and do not connect anything.
For the specifications with current output, it is not necessary to short-circuit the output when it is not used. Leave it open.
Also for the products with digital transmission output, leave the output open if it is not used.

⑫When connecting the terminals, be sure to check that the screws are tightened securely and mount the terminal cover again.
Slide the terminal cover into the main body.

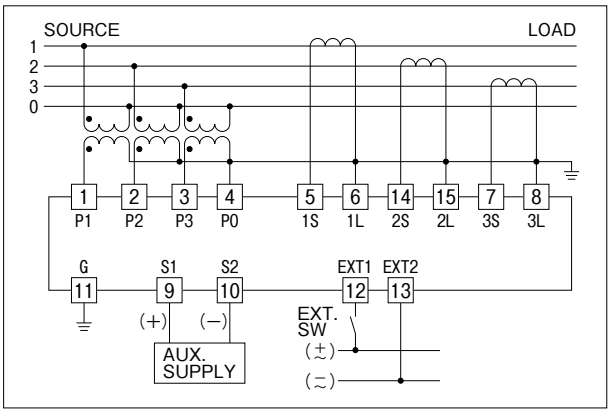
⑤Troubleshooting

Problem	Cause/Solution
The display is difficult to see.	①This product is equipped with a liquid crystal display. The liquid crystal display may be hard to see depending on the viewing direction. It is designed so that it can be seen easily when viewed from the front of the display or in the direction of looking up the display. Note that, on the other hand, the display is a little bit difficult to see when viewed in the direction of looking down on the product. ②The contrast of the liquid crystal becomes poor in an environment with high ambient temperature (exceeding 45℃). It is recovered when the temperature falls. ③When the front cover is dirty, wipe it with a soft cloth. Do not wipe with a chemical cloth, benzine, thinner, etc. Deformation or discoloration may occur.
The display flashes.	If the input exceeds the setting point of the setting guideline, the display flashes. Check the setting point.
The backlight went off.	Is the backlight turned on when the W/V/A etc. key is pressed? If so, there is no problem. The lighting type of the backlight can be selected from the following at the initial setting: ・It is on at all times. ・It is not used. ・It is on for three minutes after key operation and then turned off automatically. When the backlight is dim, the brightness can be adjusted. See setting item 13 **Backlight** when changing the setting.
A message "ERR01" appears on the display and the unit does not operate.	An error is found in the RAM in the unit. It cannot be used in this state. Arrange for repair.
A message "ERR02" appears on the display and the unit does not operate.	An error is found in the program in the unit. It cannot be used in this state. Arrange for repair.
A message "ERR03" appears on the display and the unit does not operate.	An error is found in the internal nonvolatile memory data in the unit. Resetting is required. Please contact us.

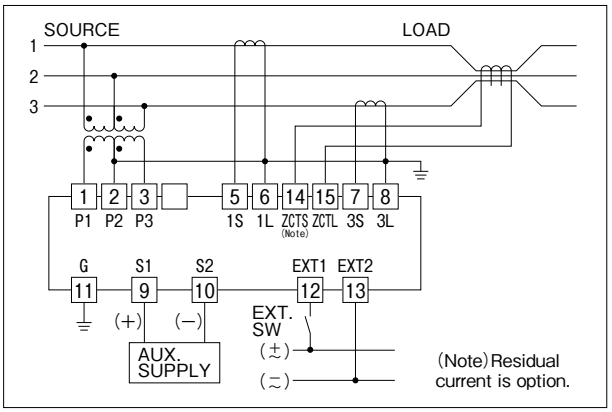
Connection diagram

Input connection diagram

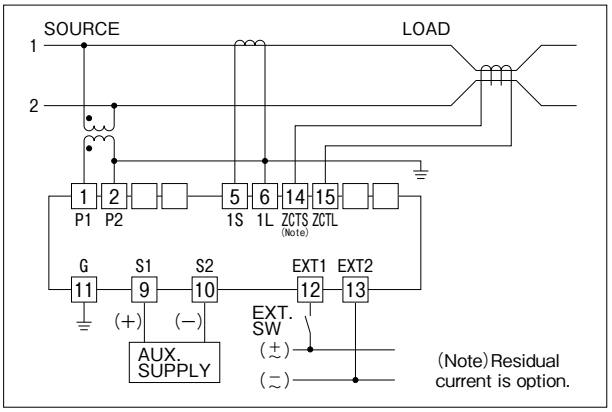
3P4W



3P3W, 1P3W

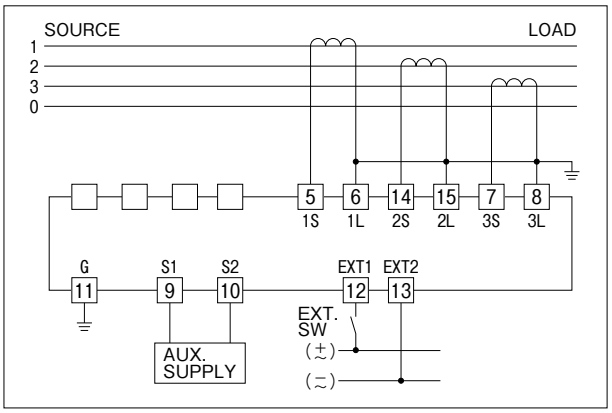


1P2W

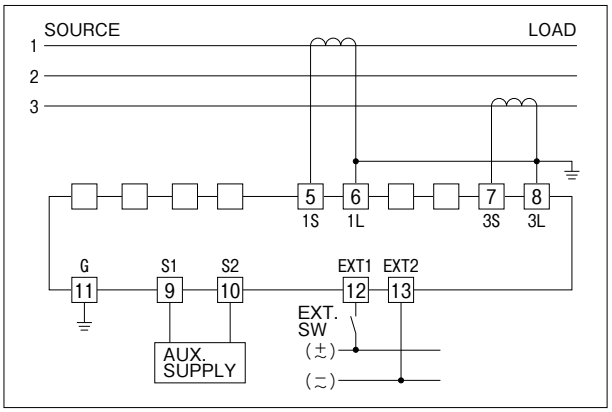


Input connection diagram for current spec.

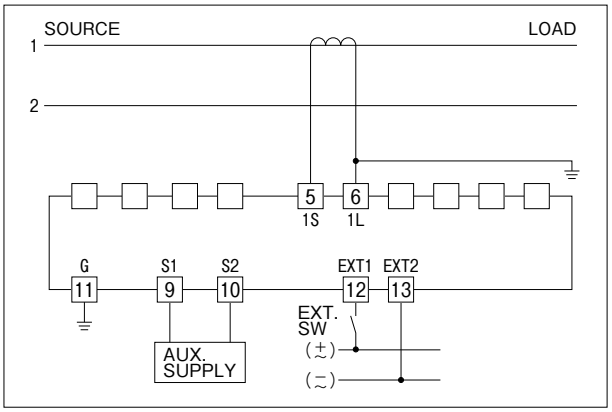
3P4W



3P3W, 1P3W

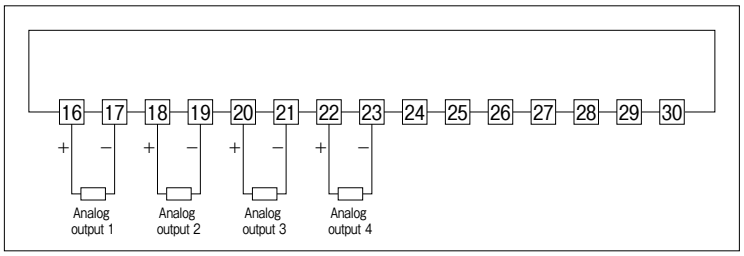


1P2W

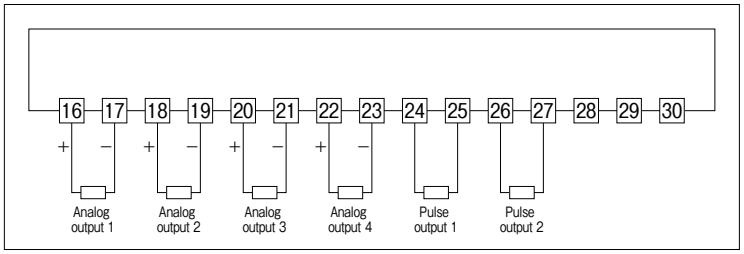


Output connection diagram

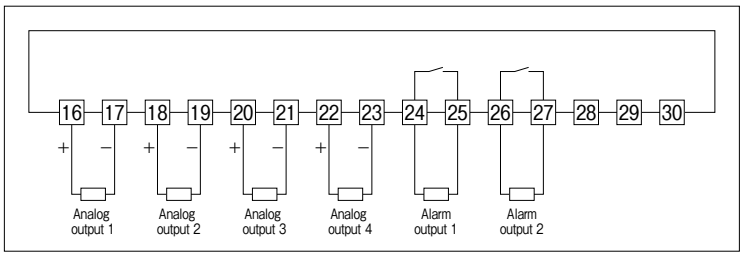
Analog output 4CH



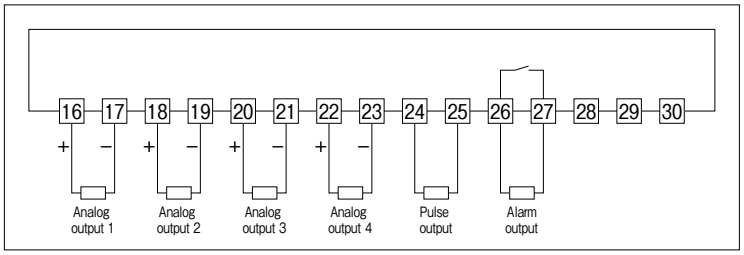
Analog output 4CH + Pulse output 2CH



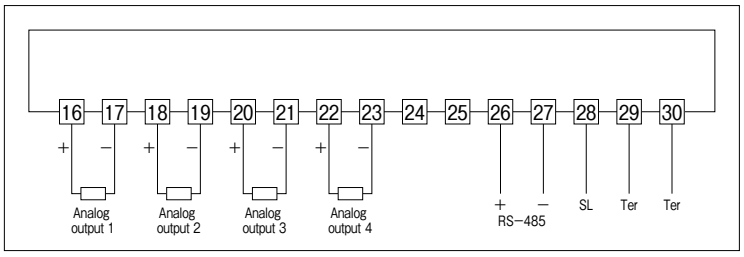
Analog output 4CH + Alarm output 2CH



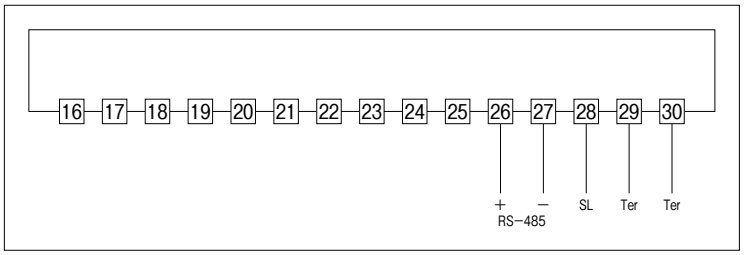
Analog output 4CH + Pulse output + Alarm output



Analog output 4CH + RS−485

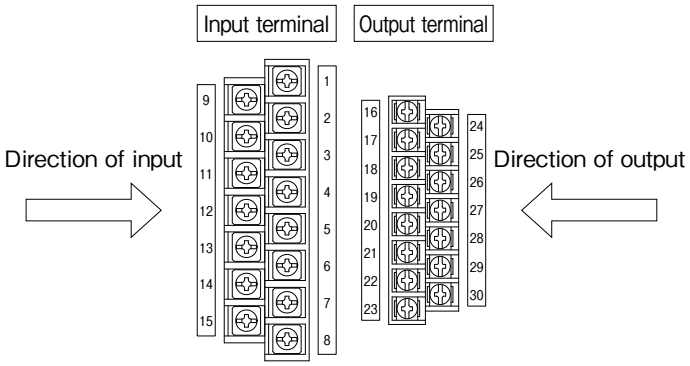


RS−485



Direction of connection

Assign of terminal



Input is connected from left side.
Output is connected from right side.

	Input term		output term
No.	Function	No.	Function
1	R phase voltage	16	CH1 analog output(+)
2	S phase voltage	17	(−)
3	T phase voltage	18	CH2 analog output(+)
4	N phase voltage	19	(−)
5	R phase current	20	CH3 analog output(+)
6		21	(−)
7	T phase current	22	CH4 analog output(+)
8		23	(−)
9	Auxiliary power supply	24	Pulse output or alarm output
10		25	
11	GND	26	Pulse output,alarm output or RS-485(+),(−)
12	Remote input	27	
13		28	SL
14	S phase current or Residual current	29	Ter (RS-485terminal register (internal))
15		30	

Symbol table of measurment items

Item's symbol for measurment mode

Symbol	Item	Unit
VRS	RS phase voltage	V
VST	ST phase voltage	V
VTR	TR phase voltage	V
VRN	RN phase voltage (for 1P3W)	V
VTN	TN phase voltage (for 1P3W)	V
VR	R phase voltage (for 3P4W)	V
VS	S phase voltage (for 3P4W)	V
VT	T phase voltage (for 3P4W)	V
IR	R phase current	A
IS	S phase current	A
IT	T phase current	A
IN	N phase current (for 3P4W)	A
W	Active power	W
VAR	Reactive power	var
VA	Apparent power	VA
PF	Power factor	%
Hz	Frequency	Hz
P−DEMAND or P−DEM	Watt demand	W
P−D MAX	Maximum Watt demand	W
P−D MIN	Minimum Watt demand	W
IR−DEMAND or IR−DEM	R phase Amp demand	A

Symbol	Item	Unit
IR−D MAX	Maximum R phase Amp demand	A
IR−D MIN	Minimum R phase Amp demand	A
IS−DEMAND or IS−DEM	Sphase Amp demand	A
IS−D MAX	Maximum Sphase Amp demand	A
IS−D MIN	Minimum Sphase Amp demand	A
IT−DEMAND or IT−DEM	Tphase Amp demand	A
IT−D MAX	Maximum Tphase Amp demand	A
IT−D MIN	Minimum Tphase Amp demand	A
VRS−THD	RS phase voltage THD	%
VST−THD	ST phase voltage THD	%
VTR−THD	TR phase voltage THD	%
IR−THD	R phase current THD	%
IS−THD	S phase current THD	%
IT−THD	T phase current THD	%
+WH	Incomming active energy	Wh
−WH	Outgoing active energy	Wh
LAG or LAG VARH	LAG reactive energy	varh
LEAD or LEAD VARH	LEAD reactive energy	varh
LOAD	Operation time	h

Item's symbol for setting mode

Symbol	Item	Ref.
V−all	All L-L voltage	Alarm
Vn−all	All L-N voltage	Alarm
I−all	All phase current (without N phase current)	Alarm
Id−all	All phase demand current	Alarm
Vthd−al	All phase voltage THD	Alarm
Ithd−al	All phase current THD	Alarm

Symbol	Item	Ref.
Vavg	L-L average voltage	Analog
Vmax	L-L maximum voltage	Analog
Vmin	L-L minimum voltage	Analog
Vnavg	L-N average voltage	Analog
Vnmax	L-N maximum voltage	Analog
Vnmin	L-N minimum voltage	Analog
Iavg	Average all phase current	Analog
Imax	Maximum all phase current	Analog
Imin	Minimum all phase current	Analog

⚠ Precautions	Precautions in safety

· The handling of this product shall be carried out persons who have sufficient knowledge and skill to correctly use this.
· Connect all wiring's without any wrong connection after sufficiently identifying this connection diagram.
· Tighten screws surely. Slackening of screws may cause to generate heat and burning.
· Do not use this at any value exceeding the rated specification. It may cause a failure and an accident.
· Do not touch to the live part. Always cut out the circuit when maintained and inspected it.

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