TMU

TOYO KEIKI

Multi-power meter

If you use this “TMU” multi-meter, you can measure 20 elements on the main display, and 17 elements on the sub-display.

TOYOKEIKI CO., LTD.

CAT.No. TMU-01E

Feature

◆Package display (4 elements)
23 elements can be displayed on the screen.
High-speed digital operation system is adopted.
Many elements are displayed on real time 1 screen with the combination by LCD display. Even when there is no lighting, it displays clearly with backlight.
◆The same attachment as 110 wide angle meter.
It possible to replace, since it is the same size. (110type)
◆It possible to measure active energy and reactive energy of out going and in coming.
◆Harmonic measurement.
It possible to measure voltage distortion factor and current distortion factor.
◆It possible to measure 4 times rated current.
Also in consideration of inrush current, it possible to measure up to 4 times of rated input current.
◆Bar graph of possible scaling.
The bar graph can be scaling scaled.

Specification

Measurement item	Input range	Indication	Auxiliary power supply
Current (R,S,T)	0～5A (up to 20A)	Input current ×CT ratio	AC 80～264 V：6VA DC 80～143 V：3.5W (32mA) DC 19 ～ 31 V ： 3.5W (150mA)
Voltage (R-S,S-T,T-R)	0～150V or 0～300V (max 600V)	Input voltage ×VT ratio	
Active power	0～1kW or 0～2kW	Input active power ×CT ratio×VT ratio	
Reactive power	LEAD 1kvar～0～LAG1kvar LEAD 2kvar～0～LAG2kvar	Input reactive power×CT ratio×VT ratio	
Power factor	LEAD 0～1～LAG 0	LEAD 0.0～100.0～LAG0.0 %	**Input rating and power consumption**
Frequency	45Hz～65Hz	45.00～65.00 Hz	Current：5A,50/60Hz,0.5VA Voltage：110V,50／60Hz,0.11VA 220V,50／60Hz,0.22VA
Watt demand	0～1kW or 0～2kW	Input watt demand×CT ratio ×VT ratio	
Amp demand (R,S,T)	0～5A (up to 20A)	Input current × CT ratio	
Active energy		0.000 ～ 999999.999 kWh (MWh)	
Reactive energy		LAG 0.000 ～ 999999.999 kvarh (Mvarh) LEAD 0.000 ～ 999999.999 kvarh (Mvarh)	
Voltage THD	0 ～ 100%, Peak value : 0 ～ 9.9A	0 ～ 100 %	
Current THD	0 ～ 100%, Peak value : 0 ～ 250V (Rated voltage 110V) 0 ～ 500V (Rated voltage 220V)	0 ～ 100 %	
Operating time		0 ～ 999999h	

Total: 23 measurements

Performance

Item	Specification
Tolerance	Current ……………… ±0.5% Voltage ……………… ±0.5% Active power …………… ±0.5% Reactive power ………… ±1.0% Power factor …………… ±0.03 Frequency ……………… ±0.5% Watt demand …………… ±1.0% Amp demand …………… ±1.0% Active energy ………… ±2.0% Reactive energy ……… ±2.5% Voltage THD …………… ±1.0% Current THD …………… ±1.0% Operating time ………… ±1h
Effect of temperature	±0.3% ／10℃
Response time	About 1 second
Insulation resistance	Over 100MΩ 500V DC
Withstand voltage	AC 2000V for 1 minute
Impulse test	6kV 1.2／50 μs
Vibration & shock	Vibration 10～55～10 Hz 0.15mm Shock 490m/S² XYZ positive and negative each 3 times.

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 (M4,M3)
Weight	About 520 g
Display element	LCD
Protection rating	IP 40

Output specification

Analog output with limiter	DC4～20mA 0～550Ω DC1～5 V 600Ω～∞ MAX.4CH
Pulse output	Active energy or reactive energy DC 125V, AC 125V 0.1A MAX.4CH
Communication output	RS-485 2400～38.4kbps (MODBUS)
Relay output	AC 250V 5A MAX.2CH

Control input specification (Remote control of main display)

Impressing voltage from the exterior can change the measurement item of a main display. Please impress the voltage of AC 85~264V, or voltage of DC 80~143V.If it impress once, an item will move to next. Consumption current is about 2 mA.
However, this function is not provided in the specification of analog(4ch), pulse (4ch), analog(2ch)+pulse (2ch) and analog(3ch)+pulse (1ch).

Control input specification (Alarm reset)

The alarm output can be cancelled by impressing voltage from the exterior. Please impress the voltage of AC 85~264V, or voltage of DC 80~143V.
If it impress once, the alarm output is cancelled.
Consumption current is about 2 mA

TYPE NAME and SPEC No.

TMU－□□－□－□□－□

Item	No.	Specification
① Circuit	11	1P2W 100V 5A
	12	1P2W 200V 5A
	13	1P2W 400V 5A
	21	1P3W 2×100V 5A
	22	1P3W 2×200V 5A
	23	1P3W 2×400V 5A
	31	3P3W 110V 5A
	32	3P3W 220V 5A
	33	3P3W 440V 5A
	41	3P4W 110／√3V 5A
	42	3P4W 220／√3V 5A
	43	3P4W 440／√3V 5A
	99	Others (Note 1)
② Auxiliary power supply	1	DC 19~31V
	2	AC 80~264V and DC 80~143V
	9	Others
③ Out put	00	Non
	15	DC 1~5V (3ch)
	16	DC 1~5V (4ch)
	18	DC 4~20mA (3ch)
	19	DC 4~20mA (4ch)
	24	DC 1~5V (3ch) + Pulse (1ch)
	25	DC 1~5V (2ch) + Pulse (1ch)
	26	DC 1~5V (2ch) + Pulse (2ch)
	27	DC 4~20mA (3ch) + Pulse (1ch)
	28	DC 4~20mA (2ch) + Pulse (1ch)
	29	DC 4~20mA (2ch) + Pulse (2ch)
	30	Pulse (4ch)
	31	RS－485
	50	Alarm relay + Reset
	55	DC 1~5 V (1ch) + Alarm relay + Reset
	58	DC 1~5 V (1ch) + Alarm relay + Reset
	60	Alarm relay (2ch) + Reset
④ Viewing direction (Note 2)	Blank	Instrument screen of viewing angle to upper
	D	Instrument screen of viewing angle to lower

Note 1: If you select spec No.99, please consult with our company.
Note 2: "Instrument screen of viewing angle to upper" is an indicator expected to be an installation at a high position easily.
"Instrument screen of viewing angle to lower" is an indicator expected to be an installation at a low position easily.

Order Example

Type name	① Circuit	② Aux power supply	③ Out put	④ Viewing direction
TMU	－ □□	－ □	－ □□	－ □

Internal parameters can also be specified at the time of order. TMU is carried out with the specified parameters.
The setting parameters, which can be specified, are CT ratio, VT ratio, and the demand time.

Example TMU-31-2-25-D

CT 100／5A, VT 3300／110V, Demand time 15 minutes
CH1 – Effective power 4~20 mA
CH2 – Current R phase 4~20 mA
Pulse – Watt-hour 10kWh/1 pulse

Parts name and accessories

Name of each part.

1st sub-display
2 nd sub-display
3 rd sub-display
Main display
Main display bar graph

Switch cover
Display
Fitting bolt
Terminal cover

DISPLAY key : If you push this key, you can see 20 elements on the main

NEXT key: If you push this key, you can see 17 elements on the sub-display

Initialize key

SET key

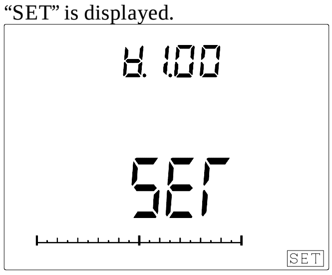
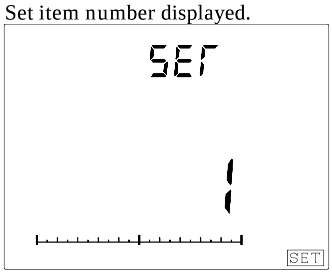
+ key

− key

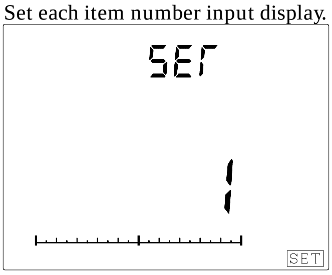
Setting item

Set each item number	Setting item	Setup contents
1	Primary voltage setup	Selection of VT
2	Primary current setup	Selection of CT
3	Main display setup	Selection of main display element
4	Sub-display setup	Display pattern selection and pattern editing of Sub-display
5	Bar graph-display setup	Selection of bar graph-display type
6	Setup of asetting point	Setting point (upper&lower bound value) of each element is setup
7	Setup of demand alarm setting point	Setting of alarm reset mode, alarm value and element of alarm
8	Minimum value setup in range of measurement	The minimum value of the voltage and the current is setup
9	Setup of Watt demand	Setting of demand time.　Maximum and minimum demand value reset. Adjustment of demand start.
10	Setup of analog output	Setting of analog output element and measurement range of output.
11	Setup of pulse output	Setting of　pulse output element and multiplier.
12	Setup of digital output	Setting of baud rate,transmission mode and data format, etc.
13	Setup of back-light output	Selection of back-light mode. (ON,OFF,AUTO OFF)
14	Setup of distribution key	Setting with distribution of display key of main and sub-display.
15	Setup of initial parameter	It returns to the setting at the time of factory shipments.
16	Reset of active energy and operating time	Reset of active energy , reactive energy and operating time.
17	Setup of active energy display	Setting of display multiplier of energy. Selection of outgoing reactive energy or incoming reactive energy.

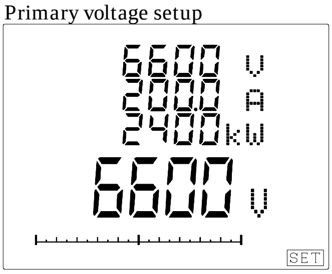
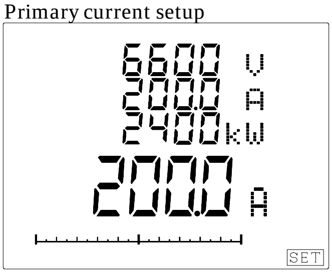
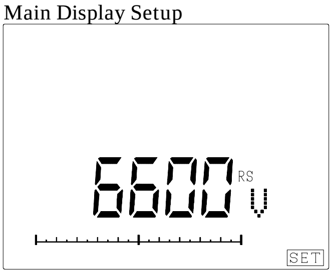
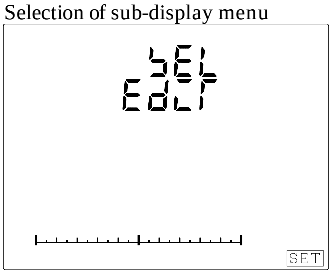
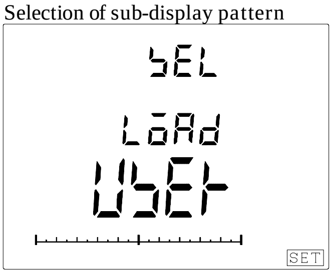
It moves to a set each item

Setting item	Key operation	Explanation	The example of a display
Auxiliary power supply ON ↓ Measurement state	Initial setup Key	The equipment has no power-on switch. ・When voltage is applied to the power supply terminal, the equipment begins to measure. ・Pushing initialize key with tin point such as a mechanical pencil for 5 seconds makes the display change to flushing in measurement state and makes the display appear the character “SET” at the display lower right.	“SET” is displayed. 
	↓ SET Key	・If SET key is pushed for 5 seconds, “SET” character is displayed on a screen and measurement operation is interrupted. ・If DISPLAY key is pushed, it will return to a measurement state.	
↓ Set item number	↓ NEXT Key	・If NEXT key is pushed, set item “1” displayed and it will move to initial setup mode.	Set item number displayed. 
	↓ + or − Key	・Selection of item number is determined by pushing + or − key.	
↓ Each setting	↓ NEXT Key To a setting each display	・If NEXT key is pushed, it will move to each item setting display. ・Please refer to the content of a setting each item.	
↓ Measurement state	↓ DISPLAY Key	・After the setting ends, It returns to the state of the measurement when the DISPLAY key is pushed on displaying each item number.	

Fixation and cancellation of setting

Setting item	Key operation	Explanation	The example of a display
Each setting display	SET Key	・After changing set value, it is fixed by pushing the SET key. And it moves to the set each item number input display. ・After changing set value, a set value is canceled by pushing the DISPLAY key. And it moves to the set each item number input display.	Set each item number input display. 

Setting each item

Setting item	Key operation	Explanation	The example of a display
1.Primary voltage setup	+ or − Key	・Selection of primary voltage is determined by pushing + or − key. 110.0V→110V→220.0V→220V→440.0V→440V→1100V→1.10kV→2200V→2.20kV→3300V→3.30kV→6600V→6.60kV→11.00kV→22.00kV→33.00kV→66.00kV→77.00kV	Primary voltage setup 
2.Primary current setup	+ or − Key	・Selection of primary current is determined by pushing + or − key. 5.00A→6.00A→7.50A→8.00A→10.00A→10.0A→12.00A→12.0A→15.00A→15.0A→20.00A→20.0A→25.00A→25.0A→30.00A→30.0A→40.00A→40.0A→50.00A→60.00A→75.00A→80.00A→100.0A→100A→120.0A→120A→150.0A→150A→200.0A→200A→250.0A→250A→300.0A→300A→400.0A→400A→500.0A→600.0A→750.0A→800.0A→1000A→1.00kA→1200A→1.20kA→1500A→1.50kA→2000A→2.00kA→2500A→2.50kA→3000A→3.00kA→4000A→4.00kA→5000A→5.00kA→6000A→6.00kA→7500A→7.50kA→8000A→8.00kA	Primary current setup 
3.Main Display Setup	+ or − Key	・You can choice the element, what you want to measure on the main display. ・Pushing the + key makes the element appear and pushing the − key makes the element disappear. If + or − key is pushed, next element displayed on the main display. The unit currently displayed shows the element, which you want to set.	Main Display Setup 
4. Sub-Display Setup Selection of menu Selection of pattern	+ or − Key ↓ NEXT Key ↓ + or − Key	・You can select and edit the display pattern of Sub-display is done. ・Either SEL(Pattern selection) or EDIT(Pattern editing) is selected. The selected item blinks. ・It moves to a set up of by selected item pushing NEXT key. ・The pattern to be selected currently is displayed on the main display. ・The display pattern is selected by pushing + or − key. ・There are eight kinds of patterns that can be selected, that is user edit pattern and "0〜6 "display pattern. (There are only user edit pattern and "0" display pattern for 1P2W.) Refer to P13.	Selection of sub-display menu  Selection of sub-display pattern 

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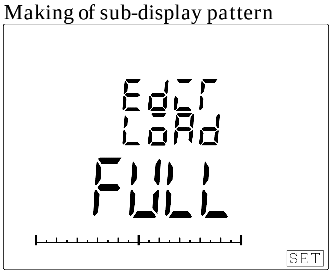
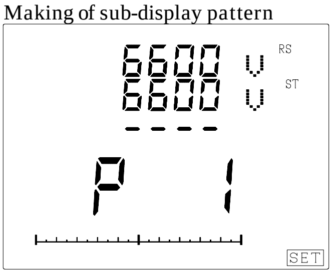
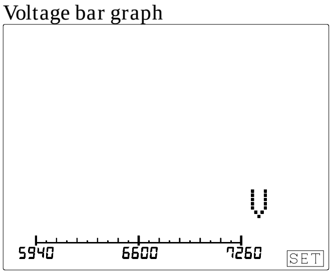
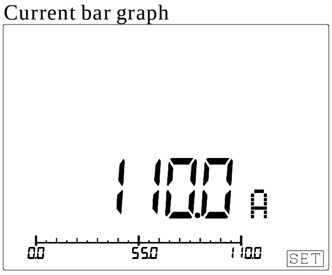
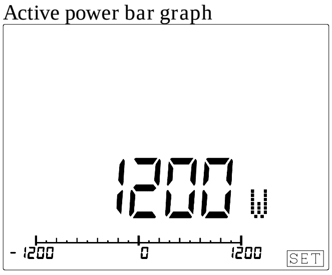
Setting item	Key operation	Explanation	The example of a display
Edit of pattern	+ or − Key	・Setting of user edit pattern. (Refer to P13 as for the display pattern you can select. ・Select the based pattern by pushing + or − key.	
	NEXT Key	・The selected pattern is loaded, and the first page of the pattern is displayed.	Making of sub-display pattern 
	+ or − Key	・Select the element displayed on the 1st sub-display by pushing + or − key.	
	NEXT Key	・It moves to the 2nd sub-display.	
	+ or − Key	・Select the element displayed on the 2nd sub-display by pushing + or − key.	
	NEXT Key	・It moves to the 3rd sub-display.	Making of sub-display pattern 
	+ or − Key	・Select the element displayed on the 3rd sub-display by pushing + or − key.	
	NEXT + + Key	・It moves to the display pattern of next page.	
	+ or − Key	・Select the display element as well as the first page.	
	NEXT + + Key	・Edit to the last page in the same way.	
	DISPLAY + − Key	・If you want to make the page disappear at a time, you push the DISPLAY key and − Key at the same time.	
5.Bar graph display setup		・Selection of the display mode in the bar graph of each element and setup scaling.	Voltage bar graph 
Voltage bar graph	+ or − Key	・Determination of bar graph range for voltage selecting ±10% bar graph display from center or 0～100% graph display for voltage. ・Please select the voltage bar graph by + or − key.(0～100% scale ⇔±10% scale ⇔ V unit ⇔ deviation scale of V unit from a center voltage.)	
	NEXT Key	・If NEXT key is pushed when the deviation scale is selected, it will move to a set up of center value. If NEXT key is pushed when the other scale display is selected, it will move to a setup of the current bar graph.	
	+ or − Key	・A center voltage of bar graph is selected by pushing + or − key . Setting value is equivalent to secondary side conversion, 100,105,110,115V, or 200,210,220,230V.	
	NEXT Key	・If NEXT key is pushed, it will move to a setup of the current bar graph. ・Selection either % scale or real scale on the current bar graph.	
Current bar graph	+ or − Key	・The mode of current bar graph is selected by pushing + or − key. (%-display mode ⇔ real scale mode) %-display becomes a display of 0～100% which 100% is the ratings value.	Current bar graph 
	NEXT Key	・It will move to the input of full-scale value by pushing NEXT key when a real scale mode selected. It will move to a setup of the active power bar graph when % display mode is selected.	
	+ or − Key	・Set the full scale value by pushing + or − key.	
	NEXT Key	・It will moves to a setup of the active power bar graph. ・Selection % scale or real scale on the active power bar graph.	Active power bar graph 
Active power bar graph	+ or − Key	・The display mode of power bar graph is selected by pushing + or − key . (0 ～ 100%, -100 ～ 100%, real scale)	

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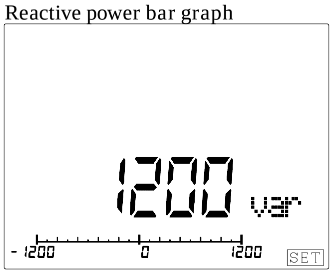
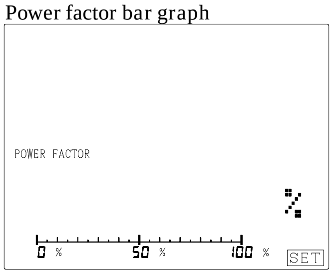
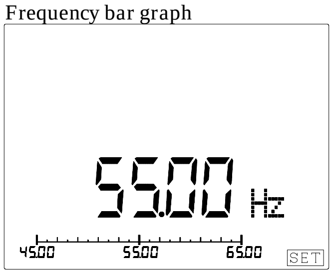
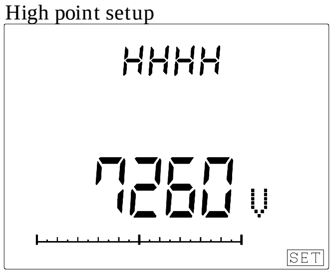
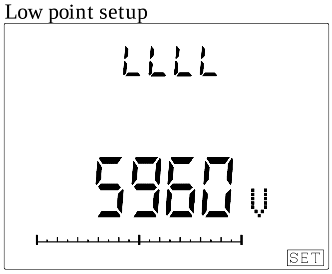
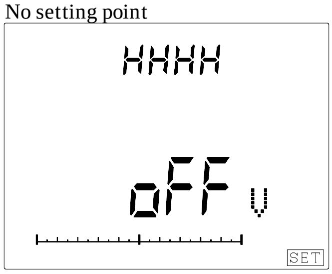
Setting item	Key operation	Explanation	The example of a display
	↓ NEXT Key	・It will move to the input of full-scale value when NEXT key is pushed at real scale mode. It will move to a setup of the reactive power bar graph. When NEXT key is pushed at % display mode.	
	↓ + or − Key	・Set the full scale value by pushing + or − key.	
	↓ NEXT Key	・It will move to a setup of reactive power bar graph. ・Selection % scale or real scale on the reactive power bar graph.	Reactive power bar graph 
Reactive power bar graph	↓ + or − Key	・The display mode of reactive power bar graph is selected by pushing + or − key . (0 ～ 100%, -100 ～ 100%, real scale)	
	↓ NEXT Key	・It will move to a setup of the power factor bar graph when NEXT key is pushed at % display mode.	
	↓ + or − Key	・Set the full scale value by pushing + or − key.	
	↓ NEXT Key	・It moves to a setup of power factor bar graph.	Power factor bar graph 
Power factor bar graph	↓ + or − Key	・The display mode of power factor bar graph is selected by pushing + or − key. (0 ～ 100%, -0 ～ -100% ～ 0%) ・It moves to a setup of frequency bar graph.	
	↓ NEXT Key	・Select the range of frequency bar graph.	Frequency bar graph
Frequency bar graph	↓ + or − Key	・Frequency bar graph is selected by pushing + or − key 50～60Hz ⇔ 45～55Hz ⇔ 55～65Hz	
6.Setup of a setting indicator		・The display is blinked when the input signal exceeds the setting point.	High point setup 
	+ or − Key	・If the mode is high point setting, blinking "HHHH" appears in 1st sub-display. If the mode is low point setting, blinking "LLLL" appears in 1st sub-display. ・Set it as the target value. If the + key is pushed, the point value increase. By pressing − key, the point value decrease. When a setting up point exceeds maximum value of setting range, a set up point is cancelled and "OFF" is displayed on the screen. When a setting bottom point exceed minimum value of setting range, a set bottom point is cancelled and "OFF" is displayed on the screen.	Low point setup 
	↓ NEXT Key	・If the NEXT key is pushed, it will move to next element. Line to line voltage (maximum)→line to line voltage (minimum)→〔line to neutral voltage (maximum)→line to neutral voltage (minimum)〕→current (maximum)→current (minimum) →active power (maximum)→active power (minimum) → reactive power (maximum)→reactive power (minimum)→power factor (maximum)→power factor (minimum)→frequency (maximum)→frequency (minimum)→watt demand (maximum)→watt demand (minimum)→amp demand(maximum)→amp demand (minimum) →current THD(maximum)→current THD(minimum)→voltage THD (maximum)→voltage THD (minimum) ＊ In parentheses 〔 〕, only 3P4W	No setting point 

<table>
<tr><th>Setting item</th><th>Key operation</th><th>Explanation</th><th>The example of a display</th></tr>
<tr><td>7.Setup of alarm output setting</td><td>+ or − Key

NEXT Key

+ or − Key

NEXT Key

+ or − Key

NEXT Key

+ or − Key

NEXT Key</td><td>・Alarm output(relay contact) turned ”ON” when the input signal exceeds alarm setting point(relay point of contact) and ALARM lights appears on the display. And, the display is blinked.
・It displays alarm output CH on the 1st sub-display, and high setting (”H”) or low setting point(”L”) on the 2nd sub-display , and return mode on the 3rd sub-display.

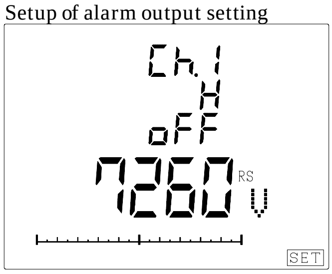
・Select the element of alarm by pushing the + or − key.
(Line to line voltage→line to line voltage OR mode→〔line to neutral voltage→line to neutral voltage OR mode〕→current→current OR mode→active power→reactive power→power factor→frequency→watt demand→amp demand→amp demand OR mode→current THD→current THD OR mode→voltage THD →voltage THD OR mode
(In parentheses 〔 〕,3P4W types.)

・It move to the selection of high setting point or low setting point by pushing NEXT key. The state of the setting point is displayed on the 2nd sub-display.
・Either high setting point(”H”) or low setting point(”L”) is selected by pushing + or − key.

・It moves to set alarm value by pushing NEXT key. A present alarm value is displayed on the main-display.
・Alarm value is sharing with a set value of setting indicator.

・If the + key is pushed, the alarm value increase. By pushing − key, the value decrease.

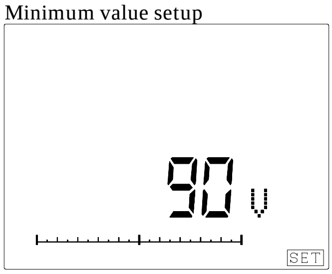
・If the NEXT key is pushed, it will move to a setup of the return time. The state of the return time is displayed on the 3rd sub-display.

・The return time is selected by pushing + or − key. Select the return time value. (OFF,0,5,10,15,20,30,60,90) 0(zero)is instantaneous output,OFF is manual reset.
・At two alarm outputs type, it moves to 2CH alarm setting. The setting method is the above-mentioned and is same.</td><td>Setup of alarm output setting

</td></tr>
<tr><td>8.Minimum value setup</td><td>+ or − Key

NEXT Key

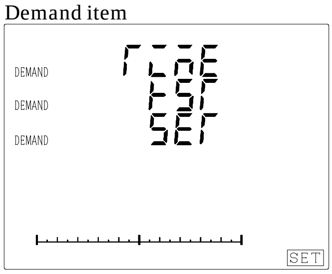
+ or − Key</td><td>・Minimum value setting for voltage and current. The screen displays “0”(ZERO) below with setting value for voltage and current.
・The display of other elements is as specified in the following table.
Example: If you set the point as 90V, “0” is displayed on the screen under 90V.
<table><tr><td>Frequency</td><td>The screen displays 0 below with setting value.</td></tr><tr><td>Effective power</td><td>The screen displays 0.</td></tr><tr><td>Reactive power</td><td>The screen displays 0.</td></tr><tr><td>Power factor</td><td>The screen displays 100.0</td></tr><tr><td>Operating time</td><td>No count below the setting value for current.</td></tr><tr><td>Watt-hour, var-hour</td><td>No count.</td></tr></table>
・If the + key is pushed, the voltage value increase. By pressing − key, the value decrease.

・If NEXT key is pushed, it will move to current value setup.

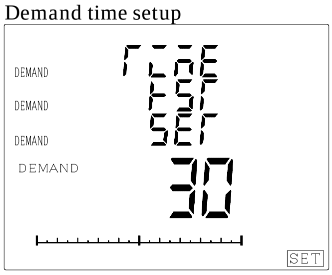
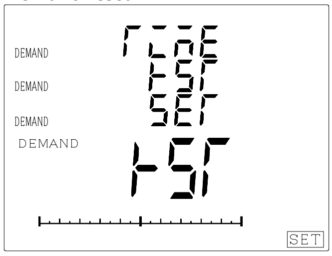
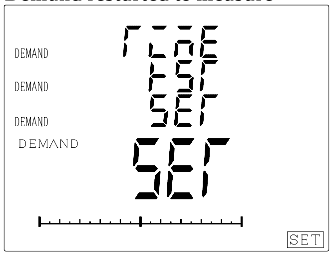
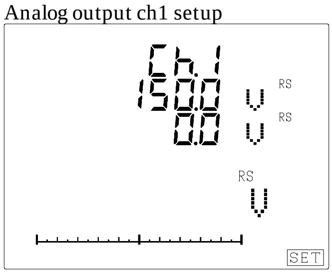
・If the + key is pushed, the voltage value increase. By pressing − key, the value decrease.</td><td>Minimum value setup

</td></tr>
<tr><td>9.Demand setup</td><td>+ or − Key

NEXT Key</td><td>・Demand time setting, reset of a maximum and a minimum demand, and adjusting of demand start.
1st sub-display：demand time
2nd sub-display：demand reset
3rd sub-display：adjustment of demand start.

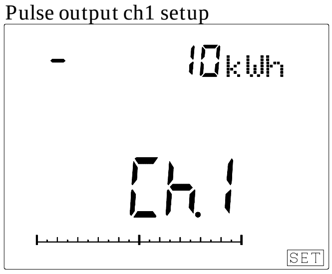
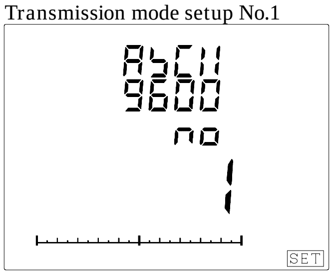
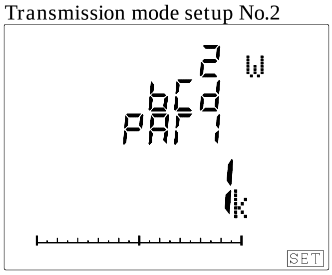
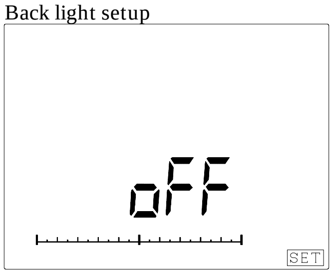
・Please select a setting item by pushing + or − key. Selected item blinks.

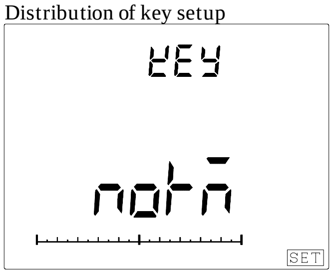
・It moves to the selected set item by pushing NEXT key.
・The present demand time is displayed on the main display.</td><td>Demand item

</td></tr>
</table>

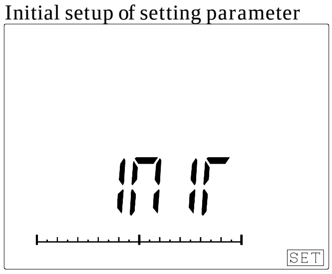
Continues to the next page.

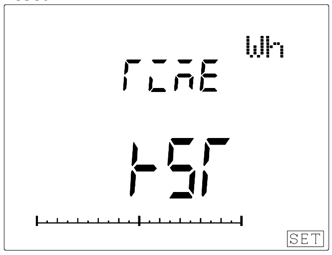
Setting item	Key operation	Explanation	The example of a display
Demand time setup Demand time setup Demand restarted to measure	+ or − Key SET Key (3sec) SET Key (3sec)	・Please set demand time by pushing + or − key. ・It is possible to set up by unit for 1 minute(1 to 60 min) and0.5 minute(30sec). ・The maximum and the minimum demand value are reset to the present demand value. Blinking “RST” is displayed on the main-display “RST”. (If SET key is pushed for three seconds, the maximum and minimum demand value are reset, and it will move to item number input mode. ・Watt demand and Ampdemand are initialized and restarted to measure. Blinking “SET” displayed on the main-display. ・If SET key is pushed for three seconds, the present demand value is initialized to zero, and it will move to item number input mode.	Demand time setup  Demand reset  Demand restarted to measure 
10.Analog Output Setup	+ or − Key NEXT Key + or − Key NEXT Key + or − Key NEXT Key	・Setup the output element, and the input range corresponding to each output. Unit and phase are displayed on main display. A present set value is displayed on 2nd and 3rd of the sub-displays. ・Select the unit and phase. The following element can be selected.(Line to line voltage, Line to line average voltage, Line to line maximum voltage in three phase, Line to line voltage of minimum value in three phase, Line to neutral voltage, Line to neutral average voltage, Line to neutral voltage of maximum value in three phase, Line to neutral minimum voltage in three phase, three phase average current, maximum current in three phase, minimum current in three phase, active power, reactive power, power factor, frequency, watt demand, amp demand, current THD, voltage THD) ・If the NEXT key is pushed, it will move to a setup of maximum value. ・Set the 2nd sub-display value. If the + key is pushed, the value increase. By pressing − key, the value decrease. ・If the NEXT key is pushed, it will move to a setup of minimum value. ・Set the 3rd sub-display value. If the + key is pushed, the value increase. By pressing − key, the value decrease. ・If the NEXT key is pushed, it will move to the next channel. ・Please set only output CH according to the same procedure.	Analog output ch1 setup 
11.Pulse Output Setup	+ or − Key	・Setting up the value of multiplier and the kind for 1 pulse. Output ch is displayed on the main display. Allocated unit and value of multiplier are displayed on the 1st sub-display. ・Please select the output element by pushing + or − key.	

Continues to the next page.

Setting item	Key operation	Explanation	The example of a display
	↓ NEXT Key ↓ + or – Key ↓ NEXT Key ↓	・If the NEXT key is pushed, it will move to selection of multiplier indication mode. Multiplier indication is blinking on the screen. ・Selection of multiplier indication is determined by pushing + or – key. It selects among 0.01kWh, 0.1 kWh, 1 kWh, 10 kWh, 100 kWh, 1 MWh,10 MWh, 100 MWh. ・It moves to a setup of 2ch at more outputs. ・Please set only output ch according to the same procedure. (Note) The same measurement element can be output to more ch. However, multiplier indication becomes common in that case.	Pulse output ch1 setup 
12.Digital Output Setup	+ or – Key ↓ NEXT Key ↓ + or – Key ↓ NEXT Key ↓ + or – Key ↓ NEXT Key ↓ + or – Key ↓ NEXT Key ↓ + or – Key ↓ NEXT Key ↓ + or – Key ↓ NEXT Key ↓ + or – Key ↓ NEXT Key ↓ + or – Key	・Setting of digital output mode(RS-485). ・Selection of transmission mode is determined by pushing + or – key. (RTU mode or ASCII mode) ・If the NEXT key is pushed, it will move to baud rate set-up mode. ・Selection of baud rate is determined by pushing + or – key (2400, 4800, 9600, 19.2k or 38.4k) ・If the NEXT key is pushed, it will move to parity bit set-up mode. ・Setting of parity bit is determined by pushing + or – key. ・If the NEXT key is pushed, it will move to address set-up mode. ・Setting of address is determined by pushing + or – key. Communication address can be set only 1 ～ 247. ・If the NEXT key is pushed, it will move to the transmission data format of watt-hour and var-hour. ・Selection of data size of watt-hour and var-hour by pushing + or – key.(2word,4word) ・If the NEXT key is pushed, it will move to data type setup mode at selection of 2word data length. ・Selection of data type by pushing + or – key.(BCD,HEX) ・If the NEXT key is pushed, it will move to LRC(error check code) type setup mode. LRC:check sum. ・Selection of LRC type by pushing + or – key. Please select either PAT1 or PAT2. PAT1:calculate LRC before converting + 0 ASCⅡcode. PAT2:calculate LRC after converting + 0 ASCⅡcode. ・If the NEXT key is pushed, It will move to the multiplier indication setting of transmission data of Wh and Varh at selection of 2 word data length. At selection of 4 word data length the unit of Wh and Varh is fixed to 0.001kWh(Varh). ・Selection of multiplier indication is determined by pushing + or – key. It selects among 0.001kWh, 0.01kWh, 0.1 kWh, 1 kWh, 10 kWh, 100 kWh, 1 MWh,10 MWh, 100 MWh.	Transmission mode setup No.1  Transmission mode setup No.2 
13.Back Light Setup	+ or – Key	・Setting of back light mode. ・Setting of back-light mode is determined by pushing + or – key. The mode is chosen from 3 kinds. (ON, OFF, AUTO OFF) AUTO OFF: The light is put out after 3 minutes automatically.	Back light setup 

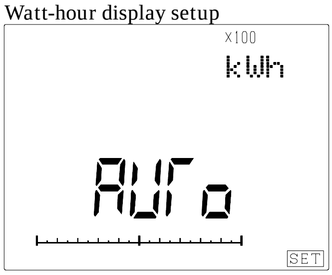
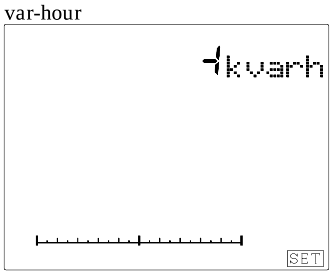
<table>
<tr><th>Setting item</th><th>Key operation</th><th>Explanation</th><th>The example of a display</th></tr>
<tr><td>14.Distribution
Key Setup</td><td>+ or − Key</td><td>・Selection of key allocation by pushing + or − key.
NORM：DISPLAY key：Main display
NEXT key：Sub-display
EXCG：Setting opposite to the above-mentioned case.</td><td>Distribution of key setup
</td></tr>
<tr><td>15.Initial setup of
setting parameter</td><td>SET Key (3sec)

DISPLAY Key</td><td>・All the parameters of an initial setting are returned to the shipment condition. When setting operation gets confused, please initialize by the operation shown below.
・The blinking character (“INIT”) is displayed on the main display.
・If the SET key is pushed for 3 seconds, setup parameters will return to value of shipments. Please set up from the beginning.
・If DISPLAY key is pushed, it will return to a setting item number input display without initializing.</td><td>Initial setup of setting parameter
</td></tr>
<tr><td>16.Watt-hour and
adjusting time are
reset</td><td>+ or − Key
↓
SET Key
↓
SET Key (3sec)</td><td>・Please reset watt-hour and operating time.
・Wh unit is displayed on the 1st sub-display. And “TIME” is displayed on the 2nd sub-display.
・Either watt-hour or operating time is selected by pushing + or − key. The selected item blinks.
・Please decide the reset element.

・If the SET key is pushed for 3 seconds, The selected items is reset. When you reset watt-hour , var-hour is reset at the same time.</td><td>Watt-hour and adjusting time are reset
</td></tr>
<tr><td>17.Watt-hour
display setup</td><td>+ or − Key
↓
NEXT Key
↓
+ or − Key</td><td>・Please setup watt-hour (var-hour) display setup multiplier indication.
・The display multiplier of watt-hour (var-hour) is set and either outgoing var-hour or incoming var-hour is selected.
・The present multiplier of watt-hour (var-hour) is displayed on the 1st sub-display.
・Selection of multiplier indication is determined by pushing + or − key. Select among AUTO, 1 kWh, 10 kWh, 100 kWh, 1 MWh,10 MWh, 100 MWh .

Multiplier for AUTO
<table>
<tr><th>Rated power</th><th>Multiplie</th><th>Displayof multiplier</th><th>Unit display</th></tr>
<tr><td>P＜ 100kW</td><td>1</td><td>No indication</td><td>kWh,kvarh</td></tr>
<tr><td>100kW ≦P＜ 1MW</td><td>10</td><td>X 10</td><td>kWh, kvarh</td></tr>
<tr><td>1 MW ≦P＜ 10 MW</td><td>100</td><td>X 100</td><td>kWh, kvarh</td></tr>
<tr><td>10 MW ≦P＜ 100MW</td><td>1</td><td>No indication</td><td>MWh,Mvarh</td></tr>
<tr><td>100 MW ≦P＜1000MW</td><td>10</td><td>X 10</td><td>MWh,Mvarh</td></tr>
<tr><td>1000MW≦P</td><td>100</td><td>X 100</td><td>MWh,Mvarh</td></tr>
</table>
P: Rated power value.

・It move to the selection of outgoing varh or incoming varh.

・Please select whether to measure var-hour of incomming or outgoing by pushing + or − key. No sign on the 1st sub-display shows incoming. And “—” sign shows outgoing.</td><td>Watt-hour display setup

Setup of in comming and out going of var-hour
</td></tr>
</table>

Manual reset of alarm output

Alarm output is maintained until the operation is performed when (manual) return mode is selected.
Alarm output reset is performed according to the following key operation.

Setting item	Key operation	Explanation
Alarm output reset	SET ＋ + Key	・Pushing SET key and + key simultaneously reset alarm output.

Setting value of factory shipments

Item	Setting value	Item	Setting value	Item	Setting value
VT ratio	3 phase 6600V 1 phase 100V	Setting indicator	Max voltage value: 7260V (3 phase) 110.0V (1 phase) Min voltage value: 5940V (3 phase) 90.0V (1 phase) Others element: OFF	Distribution of key	DISPLAY key: Change for main-display NEXT key: Change for sub-display
				Analog output	CH1 : Current (S) CH2 : Effective Power CH3 : Voltage(RS) CH4 : Frequency
CT ratio	3 phase 100A 1 phase 100A	Alarm output	CH1: Watt demand, setting point 960kW, manual reset CH2: Amp demand, setting point 80.0A, manual reset	Pulse output	CH1 : Incomming / kWh / pulse CH2 : Outgoing / kWh / pulse CH3 : LAG / kvarh / pulse CH4 : LEAD / kvarh / pulse
Main-display element	All element displays	Minimum value of range	1.5% of rated voltage 2% of rated current	Communication parameter	Baud rate : 9600 Parity : Non parity Address : 01 Mode : ASCII Data size : 2word Data type : BCD LRC type : PAT1 Multiplier of active energy: 1kWh
Sub-display element	All element displays	Demand time	30 minutes		
Bar graph-display	Voltage : deviation scale Current : real scale Active power : real scale Reactive power : real scale Power factor : - 0 ～ 100 ～ 0% Frequency : 45～65Hz	Mode of back-light	Auto off mode		
		Active energy-display	Multiplier : AUTO Reactive energy : Incomming		

Operation explanation

Changing of main display

・If the DISPLAY key is pushed, the measurement appears on main display in order.

・If the DISPLAY key and – key are pushed simultaneously, the measurement appears on main display in reverse. The display screen sequences are as follow.

3P4W (23 elements)

→ line to line voltage(RS, ST, TR)→line to neutral voltage(RN,SN,TN)→current (R, S, T)→watt→var→power factor→frequency→Watt demand→Amp demand(R, S, T)→current THD(R, S, T)→voltage THD(RS, ST, TR) →

3P3W (20 elements)

→ line to line voltage(RS, ST, TR)→current (R, S, T)→watt→var→power factor→frequency→Watt demand→Amp demand(R, S, T)→current THD(R, S, T)→ voltage THD(RS, ST, TR) →

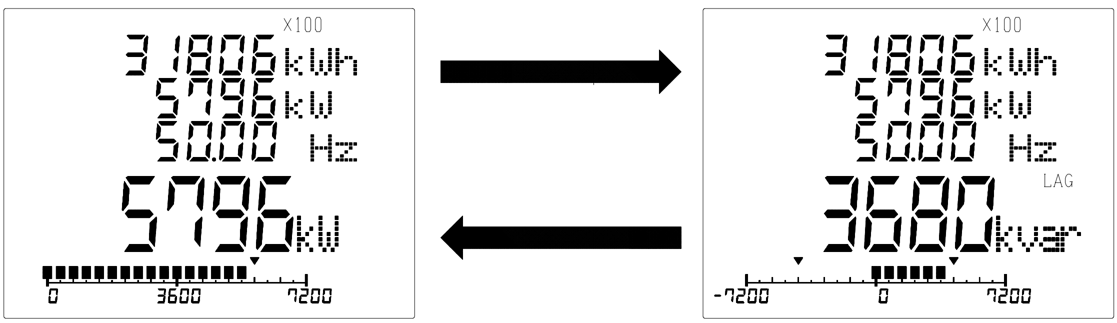
1P3W (20 elements)

→ voltage(RN, TN, RT)→current (R, N, T)→watt→var→power factor→frequency→Watt demand→Amp demand(R, N, T)→current THD(R, N, T)→voltage THD(RN, TN,RT) →

1P2W (10 elements)

→ voltage(RN)→current (R)→watt→var→power factor→frequency→Watt demand→Amp demand(R)→current THD(R)→voltage THD(RN) →

・Measurements on the main display, which are no use, can be disappeared.
Measurements, which are disappeared on the main display, are skipped at the time of a display changing.
Example: Only Wh and varh are selected to display. The elements what you want to indicate on the main display can be selected by method at page 5.



Auto scan of the main display

・If the DISPLAY key is pushed for 3 seconds, the screen displays under the condition of auto scan mode. Measurements change in order for every 1-second. (Measurements by which mask processing were carried out are skipped.)
Auto scan will be stopped if DISPLAY key is pushed once again.

Change of a sub-display

If the NEXT key is pushed, sub-display (from 1 to 3) changes simultaneously. The combination and the change order of sub-display are as follows.
ALSO arbitrary measurements can be displayed on the arbitrary position by method at page 5. If the NEXT key and − key are pushed simultaneously, the measurement change in reverse.

◆3P3W, 3P4W and 1P3W (S phase is exchanged for N phase)

Sub-display 1	Voltage (RS)	→ ←	Voltage (RN)	→ ←	Current (R)	→ ←	Max watt demand	→ ←	Max Amp demand (R→S→T)	→ ←	
Sub-display 2	Voltage (ST)		Voltage (TN)		Current (S)		Min watt demand		Min Amp demand (R→S→T)		
Sub-display 3	Voltage (TR)		Voltage (RT)		Current (T)		Watt		Current (R→S→T)		

Incomming Wh	→ ←	Outgoing Wh	→ ←	LAG reactive energy	→ ←	LEAD reactive energy	→ ←	Operating time
Active power		—		Reactive power		—		—
Frequency		—		Power factor		—		—

The element that is enclosed with the dotted line is adapted to 3P4W.
In the case of other input type.
It is skipped.

◆1P2W

Sub-display 1	Voltage (RN)	→ ←	Max watt demand	→ ←	Max amp demand (R)	→ ←	Incomming Wh	→ ←	
Sub-display 2	Current (R)		Min watt demand		Min amp demand (R)		Active power		
Sub-display 3	Active power		Watt		Current (R)		Frequency		

Outgoing watt	→ ←	LAG reactive energy	→ ←	LEAD reactive energy	→ ←	Operating time
—		Reactive power		—		—
—		Power factor		—		—

If you want to display other pattern and edit arbitrary pattern, please refer to page 5.

【Pattern of sub-display】

It is possible to select it from six patterns besides PAT0(all elements).
Moreover, an arbitrary display pattern can be edited, and be displayed.
＊ Remarks : Only "PAT0" in the case of 1P2W.

・3P3W and 1P3W (S phase is exchanged for N phase)

PAGE	PAT 0	PAT 1	PAT 2	PAT 3	PAT 4	PAT 5	PAT 6	User's pattern
1	Voltage (RS) Voltage (ST) Voltage (TR)	Voltage (RS) Voltage (ST) Voltage (TR)	Voltage (RS) Voltage (ST) Voltage (TR)	Voltage (RS) Voltage (ST) Voltage (TR)	Voltage (RS) Voltage (ST) Voltage (TR)	Voltage (RS) Voltage (ST) Voltage (TR)	Voltage (RS) Voltage (ST) Voltage (TR)	＊1
2	Current (R) Current (S) Current (T)	Current (R) Current (S) Current (T)	Current (R) Current (S) Current (T)	Current (R) Current (S) Current (T)	Current (R) Current (S) Current (T)	Current (R) Current (S) Current (T)	Current (R) Current (S) Current (T)	＊1
3	Max watt demand Min watt demand Watt demand	Reactive power Power factor Frequency	Reactive power Power factor Frequency	Reactive power Power factor Frequency	Max watt demand Min watt demand Watt demand	Reactive power Power factor Frequency	Incomming Wh Active power Reactive power	＊1
4	Max amp demand (R) Max amp demand (R) Amp demand (R)	Incomming Wh Active power —	Incomming Wh Active power —	Incomming Wh Watt demand Active power	Max amp demand (R) Max Amp demand (R) Amp demand (R)	Operating time Reactive power —	LAG var-hour — —	＊1
5	Max amp demand (S) Max amp demand (S) Amp demand (S)		Outgoing Wh — —	LAG var-hour — —	Max amp demand (S) Max Amp demand (S) Amp demand (S)		Operating time — —	＊1
6	Max amp demand (T) Max amp demand (T) Amp demand (T)			LEAD var-hour — —	Max amp demand (T) Max Amp demand (T) Amp demand (T)			＊1
7	Incomming Wh Active power Frequency							＊1
8	Outgoing Wh — —							＊1
9	LAG var-hour Reactive power Power factor							＊1

Continues to the next page.

PAGE	PAT 0	PAT 1	PAT 2	PAT 3	PAT 4	PAT 5	PAT 6	User's pattern
10	LEAD var-hour — —							＊1
11	Operating time — —							＊1

・3P4W

PAGE	PAT 0	PAT 1	PAT 2	PAT 3	PAT 4	PAT 5	PAT 6	User's pattern
1	Voltage (RS) Voltage (ST) Voltage (TR)	Voltage (RS) Voltage (ST) Voltage (TR)	Voltage (RS) Voltage (ST) Voltage (TR)	Voltage (RS) Voltage (ST) Voltage (TR)	Voltage (RS) Voltage (ST) Voltage (TR)	Voltage (RS) Voltage (ST) Voltage (TR)	Voltage (RS) Voltage (ST) Voltage (TR)	＊1
2	Voltage (RN) Voltage (SN) Voltage (TN)	Current (R) Current (S) Current (T)	Current (R) Current (S) Current (T)	Current (R) Current (S) Current (T)	Current (R) Current (S) Current (T)	Current (R) Current (S) Current (T)	Current (R) Current (S) Current (T)	＊1
3	Current (R) Current (S) Current (T)	Reactive power Power factor Frequency	Reactive power Power factor Frequency	Reactive power Power factor Frequency	Max watt demand Min watt demand Watt demand	Reactive power Power factor Frequency	Incomming Wh Active power Reactive power	＊1
4	Max watt demand Min watt demand Watt demand	Incomming Wh Active power —	Incomming Wh Active power —	Incomming Wh Watt demand Active power	Max amp demand (R) Max Amp demand (R) Amp demand (R)	Operating time Reactive power —	LAG var-hour — —	＊1
5	Max amp demand (R) Max amp demand (R) Amp demand (R)		Outgoing Wh — —	LAG var-hour — —	Max amp demand (S) Max Amp demand (S) Amp demand (S)		Operating time — —	＊1
6	Max amp demand (S) Max amp demand (S) Amp demand (S)			LEAD var-hour — —	Max amp demand (T) Max Amp demand (T) Amp demand (T)			＊1
7	Max amp demand (T) Max amp demand (T) Amp demand (T)							
8	Incomming Wh Active power Frequency							＊1
9	Outgoing Wh — —							＊1
10	LAG var-hour Reactive power Power factor							＊1
11	LAED var-hour — —							＊1
12	Operating time — —							＊1

・1P2W

PAGE	PAT 0	PAT 1	PAT 2	PAT 3	PAT 4	PAT 5	PAT 6	User's pattern
1	Voltage (RS) Voltage (ST) Voltage (TR)							＊1
2	Max watt demand Min watt demand Watt demand							＊1
3	Max amp demand (R) Max amp demand (R) Amp demand (R)							＊1
4	Incomming Wh Active power Frequency							＊1
5	Outgoing Wh — —							＊1
6	LAG var-hour Reactive power Power factor							＊1

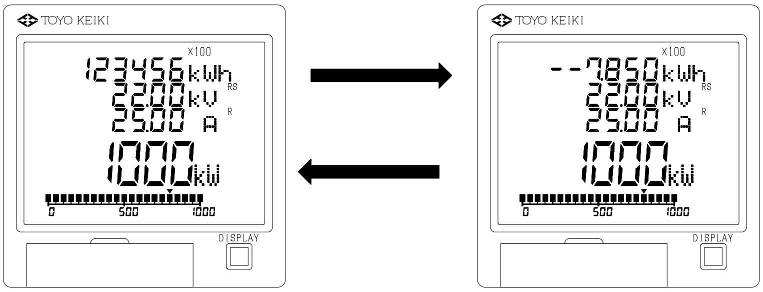
Continues to the next page.

PAGE	PAT 0	PAT 1	PAT 2	PAT 3	PAT 4	PAT 5	PAT 6	User's pattern
7	LEAD var-hour ― ―							＊1
8	Operating time ― ―							＊1

＊　1　An arbitrary element can be set. But there is constrain as follows.
・It is allowed to display watt-hour, var-hour and operatingtime only on 1st sud-display.
・It is allowed to display max demand only 1st sub-display and min demand only 2nd sub-display.
・In the case of 1P2W you select either PAT 0 on user's pattern.

Watt-hour and var-hour digit feeding

(If you want to check the detail (under decimal point) of Watt-hour and var-hour, you can check it by the method as follow.)
① Select the measurement on main display. (watt-hour or var-hour)
② While pushing both + and − keys at the same time allows to feed the digit readout 6 to 9 digit. After detached the key, it will return to a normal display.

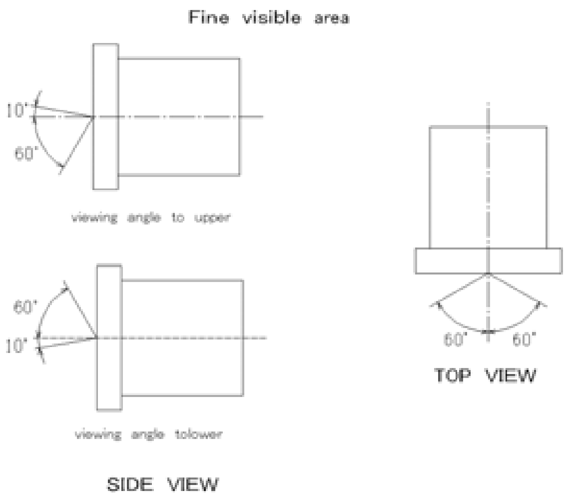


Installation and wiring

Check of aproduct
Specifications of inputs, an auxiliary power supply, and outputs are marked on the product. Please check that it is in agreement with the specification of your demand.

Installation environment
Installation environment influences the performance of a product. Please refer to the following and select installation environment.
① Surrounding temperature, humidity.
Please avoid high temperature, a humind if possible, in any at the time of transportation, storage and use.
② Please avoid a continuous vibration and a shock in the use.
③ When used in a special environment, please contact our.

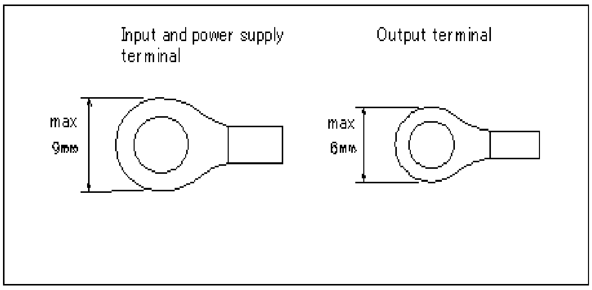
Installation
① Attachment position
The display screen of this product is using the liquid-crystal-display(LCD).
A LCD changes contrast with the angle to see. We prepare the two type LCD with the different angle to see.
Please determine selection of type and an installation position for the right figure as reference.
Instrument screen of viewing angle to upper is advantageous to install in a position a little higher than eye-level in respect of contrast. And instrument screen of viewing angle to lower is advantageous to install in a position a little lower than eye-level in respect of contrast.
② Installation
Please attach by referring to the panel cut of an outside size (＊＊page), and process a hole.
When you attach adjacently, please take 115mm leftward, take the interval of 125mm or more in the vertical direction.
The depth direction should take a margin in consideration of the drawer of a cable.

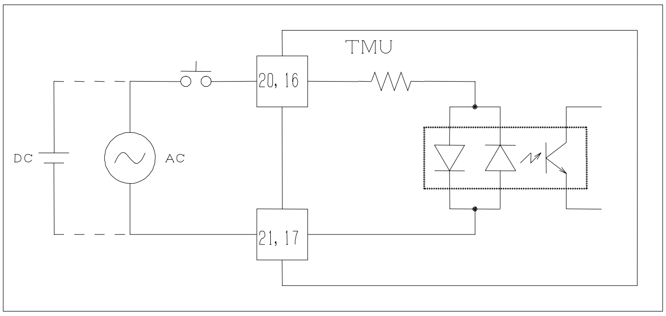


Connection
Please connect correctly according to a connection figure.
① If it is made to rotate counterclockwise, it will separate from a terminal cover.
After a connection end should attach a terminal cover as before.
As for the terminal cover , the vertical direction was decided. Please attach in the direction which can read a terminal number correctly.
② In an input terminal and a power supply terminal, the object for M4 and an output terminal should prepare the object for M3.
③ It is recommended that one of CT's, VT's secondary terminals should ground for safety (refer to wiring fig).
④ Be sure to ground an earth terminal(No.7 terminal) for safety and stability of operation.
⑤ In the case of product with DC 24V power supply, it has polarity in the auxiliary powerterminal. If you are connected on the contrary, it does not power on.
⑥ Please take a margin for cable diameter. You need to select a cable that is permitted for overcurrent.

⑦ In the case of product with outputs, please dissociate output wiring from wiring to inputs, a power supply, a power line, etc., and wiring for output signal should use shielding wire or twisted pair wire if needed.

⑧ External remote(or reset) inputs operate by impressing voltage.
Please prepare the power supply of AC 80-264V or DC 80-143V.
An auxiliary power supply can be used commonly. The internal structure is as follows.
When not using a reset terminal, leave open circuit. The consumption current of the remote input is about 1mA at 100V a.c. or dc..





Terminal number
external remote input : 20, 21
reset input : 16, 17

⑨ An alarm output'circuit is following. Please use it within the rated voltage and current, and if necessary, use surge absorb devices in external.

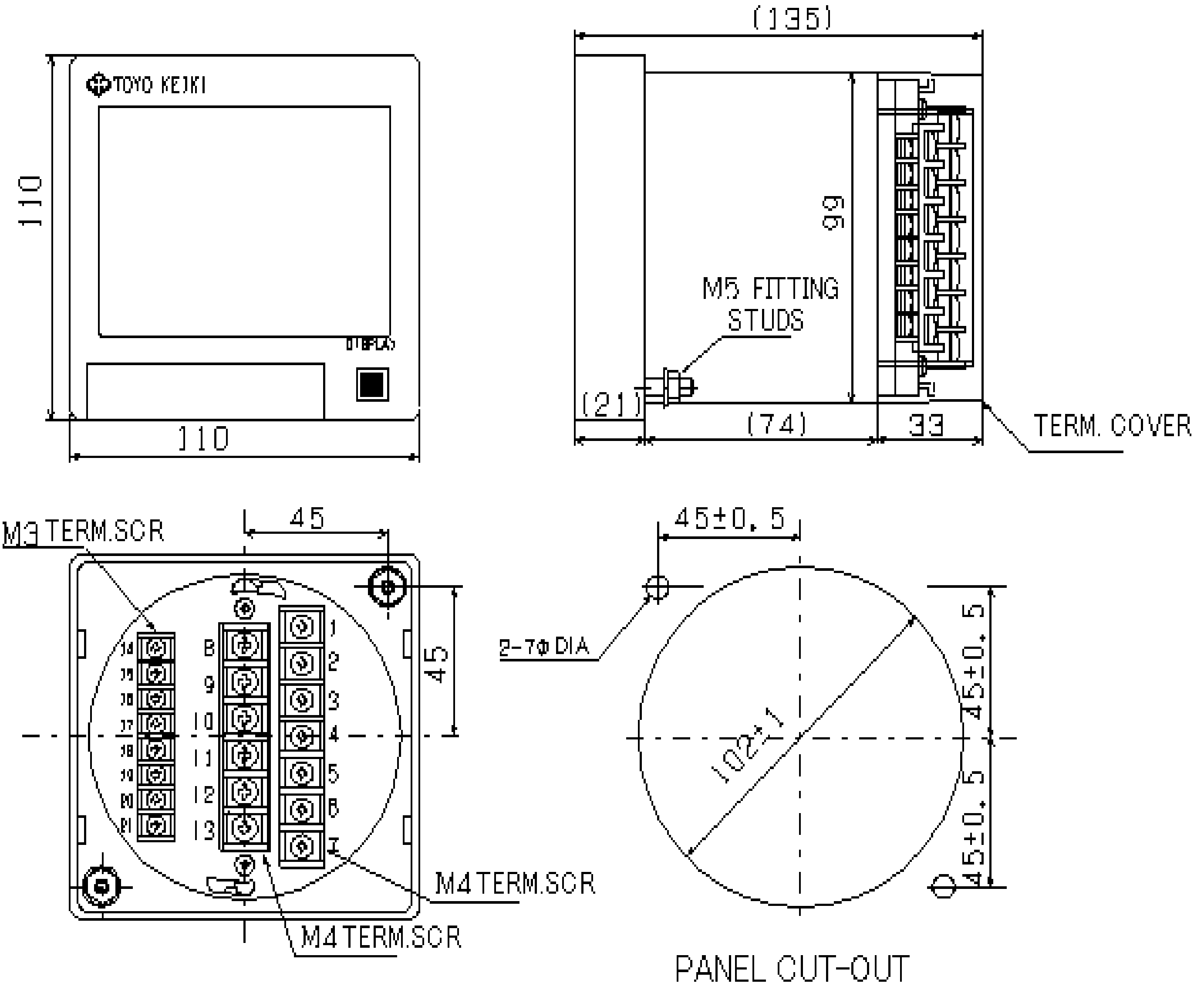
⑩ Please connect nothing to non-connection terminals. When you do not use an output terminal and/or a remote terminal, Please leave to opening. For the product has current output, if you do not use the output, it is not necessary to connect together. When a product with a digital transmission output which does not use, please leave to opening.

⑪ Connection should check having tightened the screw certainly and it should surely a terminal cover.

Troubleshooting information when a trouble occurs, please check the following table to reference.

Condition	Check point
It is hard to see a display.	① The liquid-crystal-display(LCD) is used a display. A LCD has a thing hard to see depending on the direction to see. It is designed so that it may become legible towards looking up at the front of the display. On the contrary, towards looking down, it becomes a little hard to see. ② The contrast of LCD worsens in the environment where temperature is high(45 degrees C or more). I will recover, if temperature falls.
A display blinks.	If an input value exceeds the set point of a setting indicator, a display will blink. Please check the set point.
The back light went off.	If you push the DISPLAY key switch, dose a back light turn on? A back light can be chosen from the following mode by initial setting. ・The light is turned on at all times. ・A back light does not use it. ・The light is switched on for 3 minutes after key operation, and turn off automatically. In setting change, please see the 13.Back light
ERROR01 had been displayed.	Abnormalities were discovered by RAM inside a product. Since you cannot use it is, please contact our.
ERROR02 had been displayed.	Abnormalities were discovered by program inside a product. Since you cannot use it as it is, please contact our.
ERROR03 had been displayed.	Abnormalities were discovered by data of the nonvolatile memory inside a product. Since you cannot use it us it is, please contact our.

Dimensions


TOYO KEIKI
110
110
(135)
99
M5 FITTING STUDS
(21)
(74)
33
TERM. COVER
M3 TERM.SCR
45
45
M4 TERM.SCR
M4 TERM.SCR
45±0.5
2-7Φ DIA
102±1
45±0.5
45±0.5
PANEL CUT-OUT

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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