

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	Input rating and power consumption Current : 5A,50/60Hz,0.5VA Voltage : 110V,50 / 60Hz,0.11VA 220V,50 / 60Hz,0.22VA
Power factor	LEAD 0 ~ 1 ~ LAG 0	LEAD 0.0 ~ 100.0 ~ LAG0.0 %	
Frequency	45Hz ~ 65Hz	45.00 ~ 65.00 Hz	
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/S ² 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
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)
Auxiliary power supply	1	DC 19~31V
	2	AC 80~264V and DC 80~143V
	9	Others
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
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	Circuit	Aux power supply	Out put	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

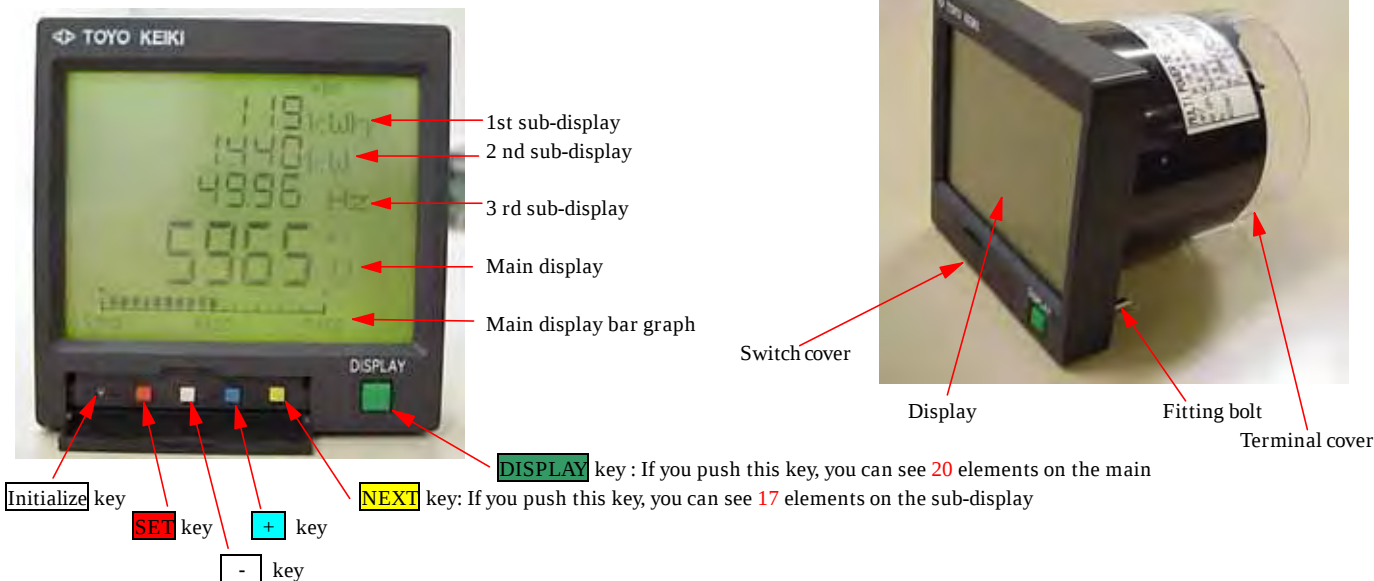
CH1 – Effective power 4~20 mA

CH2 – Current R phase 4~20 mA

Pulse – Watt-hour 10kWh/1 pulse

Parts name and accessories

Name of each part.



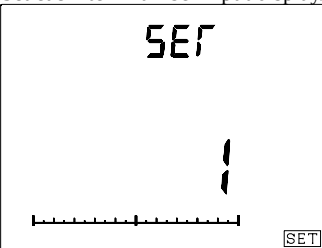
Setting item

Set each item numbe	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.

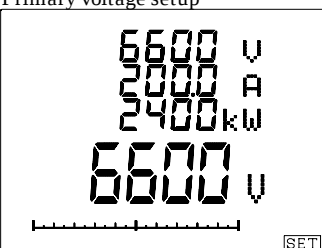
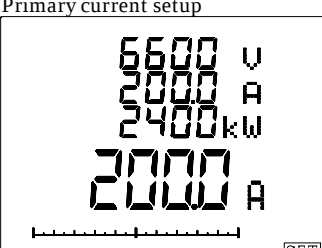
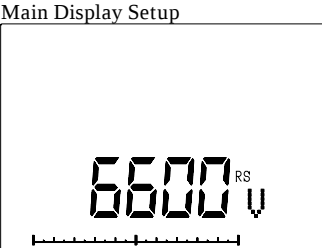
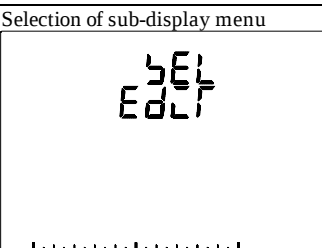
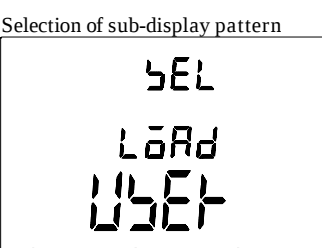
It moves to a set each item

Setting item	Key operation	Explanation	The example of a display
Auxiliary power supply ON Measurement state Set item number Each setting Measurement state	Initial setup Key SET Key NEXT Key + or - Key NEXT Key To a setting each display DISPLAY 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. - 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. - If NEXT key is pushed, set item "1" displayed and it will move to initial setup mode. - Selection of item number is determined by pushing + or - key. - If NEXT key is pushed, it will move to each item setting display. - Please refer to the content of a setting each item. - After the setting ends, It returns to the state of the measurement when the DISPLAY key is pushed on displaying each item number.	"SET" is displayed. Set item number displayed.

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 choose 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 + or - Key ↓ NEXT Key ↓ Selection of pattern + 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 

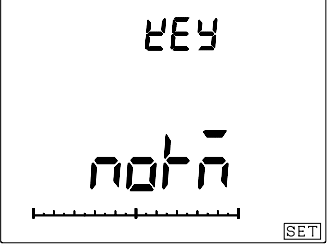
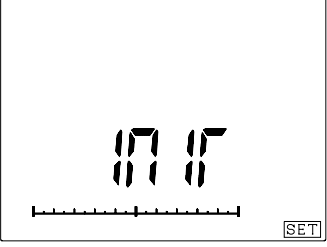
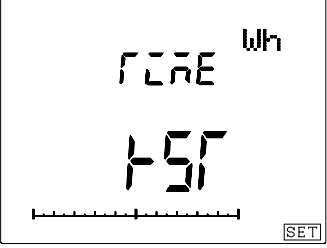
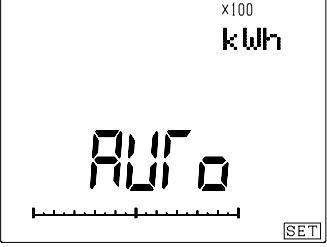
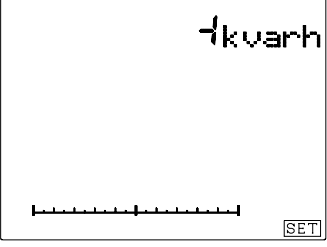
Continues to the next page.

Setting item	Key operation	Explanation	The example of a display
7.Setup of alarm output setting	+ or - Key ↓ NEXT Key ↓ + or - Key		

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	<pre> graph TD A[+] or [-] Key --> B[SET] Key (3sec) B --> C[SET] Key (3sec) </pre>	• Please set demand time by pushing or key. • It is possible to set up by unit for 1 minute(1 to 60 min) and 0.5 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 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 Amp demand are initialized and restarted to measure. Blinking “SET” displayed on the main-display. • If 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	<pre> graph TD A[+] or [-] Key --> B[NEXT] Key B --> C[+] or [-] Key C --> D[NEXT] Key D --> E[+] or [-] Key E --> F[NEXT] Key </pre>	• 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 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 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 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	<pre> graph TD A[+] or [-] Key --> B[] </pre>	• 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																																
14.Distribution Key Setup	 or  Key	- Selection of key allocation by pushing  or  key. - NORM :  key : Main display  key : Sub-display - EXCG : Setting opposite to the above-mentioned case.	Distribution of key setup 																																
15.Initial setup of setting parameter	 Key (3sec)  Key	- 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  key is pushed for 3 seconds, setup parameters will return to value of shipments. Please set up from the beginning. - If  key is pushed, it will return to a setting item number input display without initializing.	Initial setup of setting parameter 																																
16.Watt-hour and adjusting time are reset	 or  Key ↓  Key ↓  Key (3sec)	- 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  key is pushed for 3 seconds, The selected items is reset. When you reset watt-hour , var-hour is reset at the same time.	Watt-hour and adjusting time are reset 																																
17.Watt-hour display setup	 or  Key ↓  Key ↓  or  Key	- 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 . <table border="1"> <thead> <tr> <th colspan="4">Multiplier for AUTO</th></tr> <tr> <th>Rated power</th><th>Multiplie</th><th>Displayof multiplier</th><th>Unit displa</th></tr> </thead> <tbody> <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> </tbody> </table> P: Rated power value. - It move to the selection of outgoing varh or incoming varh. - Please select whether to measure var-hour of incoming or outgoing by pushing  or  key. No sign on the 1st sub-display shows incoming. And " - " sign shows outgoing.	Multiplier for AUTO				Rated power	Multiplie	Displayof multiplier	Unit displa	P < 100kW	1	No indication	kWh,kvarh	100kW P < 1MW	10	X 10	kWh, kvarh	1 MW P < 10 MW	100	X 100	kWh, kvarh	10 MW P < 100MW	1	No indication	MWh,Mvarh	100 MW P < 1000MW	10	X 10	MWh,Mvarh	1000MW P	100	X 100	MWh,Mvarh	Watt-hour display setup  Setup of in coming and out going of var-hour 
Multiplier for AUTO																																			
Rated power	Multiplie	Displayof multiplier	Unit displa																																
P < 100kW	1	No indication	kWh,kvarh																																
100kW P < 1MW	10	X 10	kWh, kvarh																																
1 MW P < 10 MW	100	X 100	kWh, kvarh																																
10 MW P < 100MW	1	No indication	MWh,Mvarh																																
100 MW P < 1000MW	10	X 10	MWh,Mvarh																																
1000MW P	100	X 100	MWh,Mvarh																																

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	 +  Key	Pushing  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 : Incoming / 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 : Incoming		

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)→

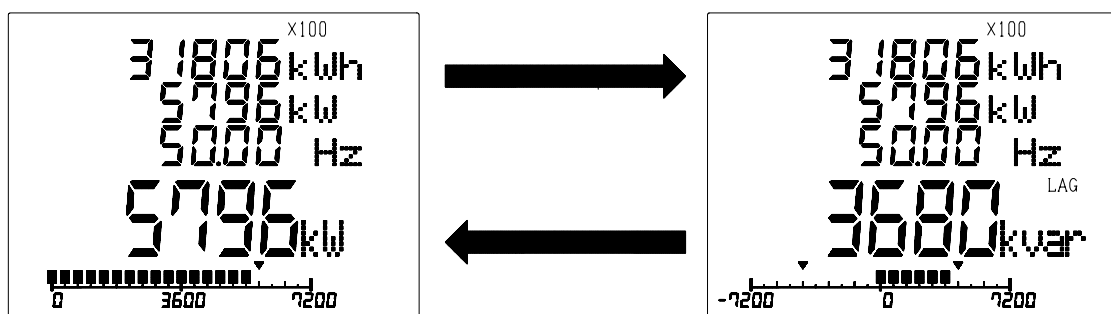
1P2W (10 elements)

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

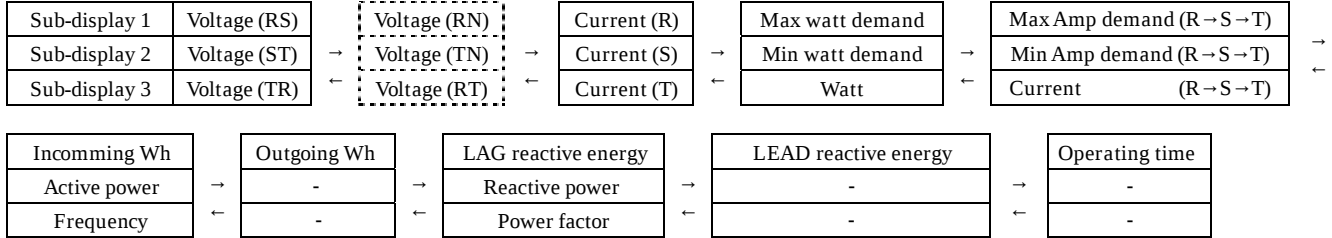
- If the **DISPLAY** key is pushed for 3 seconds, the screen displays under the condition of auto scan mode. Measurements change in order for every 1-second. (Measurements by which mask processing were carried out are skipped.)
- Auto scan will be stopped if **DISPLAY** key is pushed once again.

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)

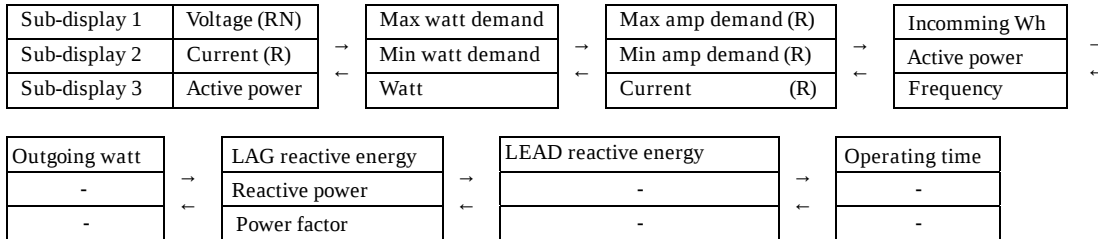


The element that is enclosed with the dotted line is adapted to 3P4W.

In the case of other input type.

It is skipped.

1P2W



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

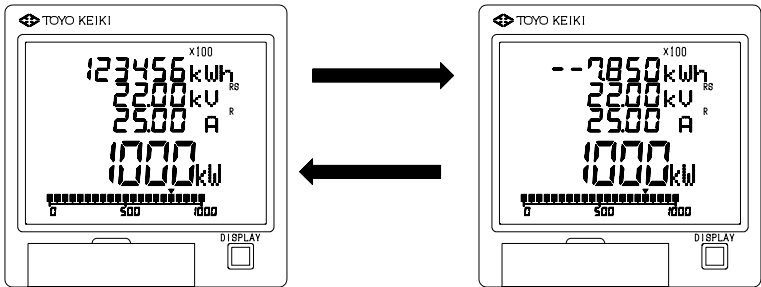
Continues to the next page.

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.)
 Select the measurement on main display. (watt-hour or var-hour)
 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.

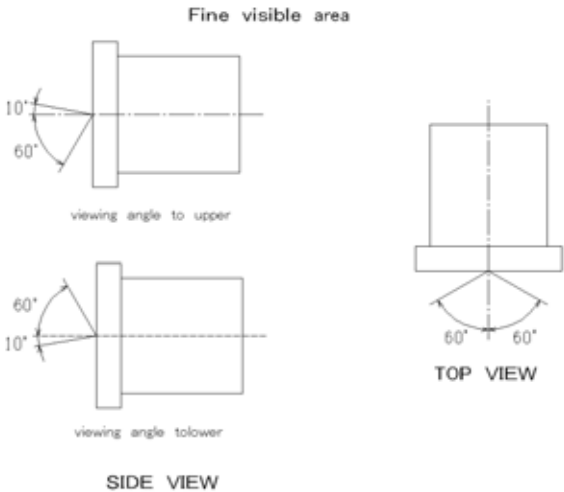


Installation and wiring

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.

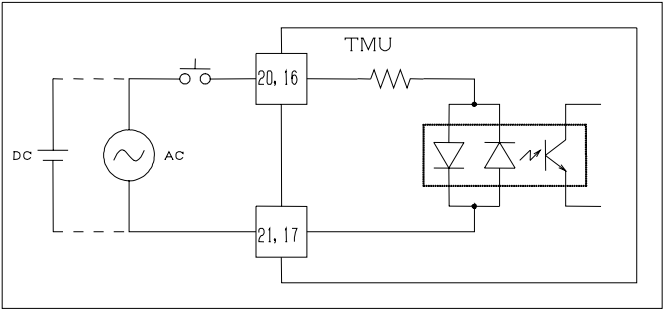
Installation environment
 Installation environment influences the performance of a product. Please refer to the following and select installation environment.
 Surrounding temperature, humidity.
 Please avoid high temperature, a humind if possible, in any at the time of transportation, storage and use.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

Installation
 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.
 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.

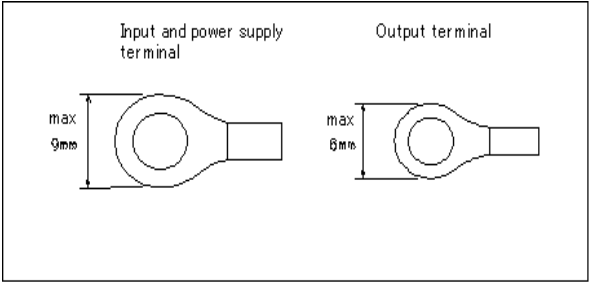


Connection
 Please connect correctly according to a connection figure.
 If it is made to rotate counterclockwise, it will separate from a terminal cover.
 After a connection end should attach a terminal cover as before.
 As for the terminal cover , the vertical direction was decided. Please attach in the direction which can read a terminal number correctly.
 In an input terminal and a power supply terminal, the object for M4 and an output terminal should prepare the object for M3.
 It is recommended that one of CT's, VT's secondary terminals should ground for safety (refer to wiring fig).
 Be sure to ground an earth terminal(No.7 terminal) for safety and stability of operation.
 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.
 Please take a margin for cable diameter. You need to select a cable that is permitted for overcurrent.

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.
 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

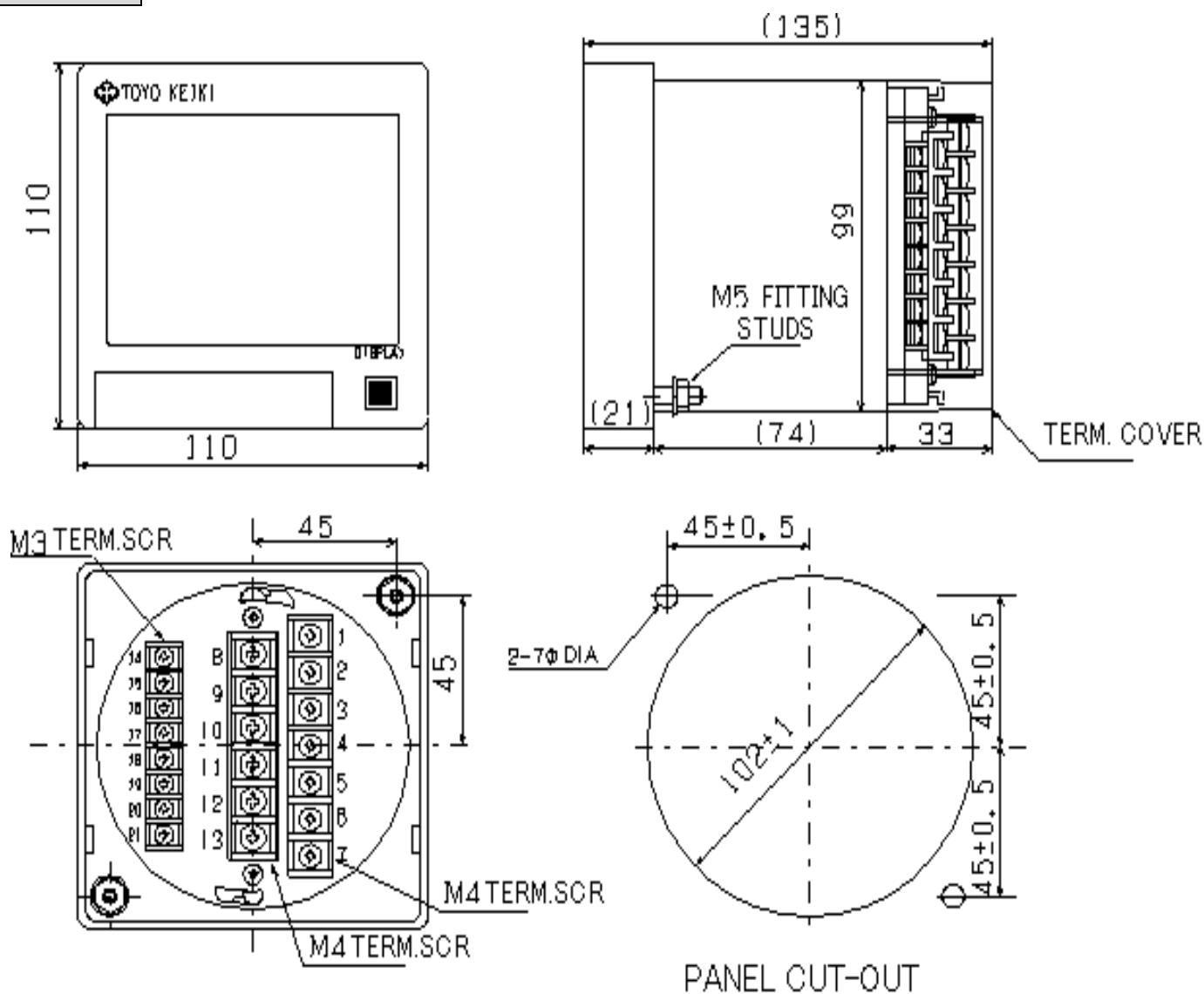


An alarm output circuit is following. Please use it within the rated voltage and current, and if necessary, use surge absorb devices in external.
 Please connect nothing to non-connection terminals. When you do not use an output terminal and/or a remote terminal, Please leave to opening. For the product 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.
 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.	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. 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



普得企業股份有限公司

總公司：台北市內湖區行愛路 68 號 6 樓
 電話：(02)8791-8588 傳真：(02)8791-9588
 電子郵件：toyotech@ms37.hinet.net
 網址：www.toyotech.com.tw

台中辦事處：台中市文心路四段 200 號 10 樓之 2
 電話：(04)2296-9388 傳真：(04)2296-9386
 高雄辦事處：高雄市民生一路 56 號 15 樓之 6
 電話：(07)227-2133 傳真：(07)227-2173



Precautions

P r e c a u t i o n s i n s a f e t y

- 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.

TOYO KEIKI CO.,LTD.

Head Office

17-10-3, Shimosinjou, Higashiyodogawa-Ku, Osaka, Japan.
〒533-0021 TEL. 06(6329) 2441 FAX 06(6328) 4112

Tokyo Office.

8-47-27, Shin-Yoshidahigashi, Kohhoku-Ku, Yokohama.
〒223-0058 TEL. 045(542) 8201 FAX.045 (541)3989

Nagoya Office

SI Bldg.6F, 1-7-32, Nishiki, Naka-Ku, Nagoya.
〒460-0003 TEL. 052(219) 7780 FAX. 052(219) 7781

Osaka Factory

17-10-3, Shimosinjou, Higashiyodogawa-Ku, Osaka, Japan.
〒533-0021 TEL. 06(6328) 1700-5 FAX 06(6328) 4112

Toyama Factory

1-6-2, Yasuuchi, Yatsuo-machi, Nei-gun, Toyama.
〒939-2366 TEL. 0764(55) 2008 FAX 0764(55) 2005

Tokyo Factory.

8-47-27, Shin-Yoshidahigashi, Kohhoku-Ku, Yokohama.
〒223-0058 TEL. 045(542) 3453 FAX.045 (541)9989

Please consult with our Foreign Trade Dept.

TEL 81+6-6329-2441

FAX 81+6-6328-4112