SQLC-110L POWER LINE SUPER MULTI-METER

Technology

- Adopt High-performance 16 bits microcomputer.
- Highly precise harmonics analysis by fast Fourier transforms processing.
- Brand-new design for 4-digital measuring display simultaneously.
- Environment-considering parts on full-scale, support RoHS order.
- Igr method for current leakage measurement.

Product Concept

- Pursue easiness of product choice

Measure Voltage, current, power, power factor, frequency, watt-hour, var-hour, demand current, max. demand current, demand power, max. demand power, harmonics voltage, harmonics current, and leak current by one unit.
Common use for 3φ 3W, 1φ 3W and 1φ 2W input specifications, 110V and 220V auxibility supply.

- Adopt white backlight

High-reliability, high-contrast LC display and high reliability high-intensity backlight ensures the distinguished visibility.

- High-visibility, easy-operability design

New screen design makes visibility improved by four digital simultaneous measurements. In addition, measurement switching is improved by increasing operation switches. Harmonics voltage / current and max./min. value can be confirmed by easy operation.

- Support various systems

4 analog output, 2-pulse output and 2-alarm output are realized; support various system flexibly.

- Open network correspondence

Intelligent measuring by equipping the communication functions to Modbus RTU mode and CC-Link.

- Support AnyWire wiring save system

It's possible to construct free layout and strong in noise data-collecting system.

History of SQ

Q: In 1982, we DAIICHI developed an aggregate type transducer ahead of the world. By that time, alphabet that imitates a measurement element to a model name as a sign conventionally and make it easy to know what the transducer measures. This all-in-one type transducer assumed the entire normal electricity measurement elements. We take "Q" of "Quality", which declared a high quality, and they were born as the QT2 series.

Later, we improved the QT2 series as the current QT2-93A series: more compact, lightweight and multifunction.

In 1997, Multi-meter: QLC-110, in a meaning of Q (high quality) and multi-(many functions) was developed; it has the indication function of both transducer and electric indicator. Afterwards, according to the functions, demand measurement (DLC-110), harmonics measurement (HLC-110), max. & min. measurements (MLC-110) etc. were born, too. They are LC series.

SQ: In 2006, to summarize these technology and various LC series in 1 (one), we developed the SUPER high quality, multifunction meter. We named it SQLC-110L. Another reason to use "SQ" is from the name of a hairy giant: an unconfirmed animal known for BigFoot / Sasquation in Native American words, which means strong.

Support Broadband CT

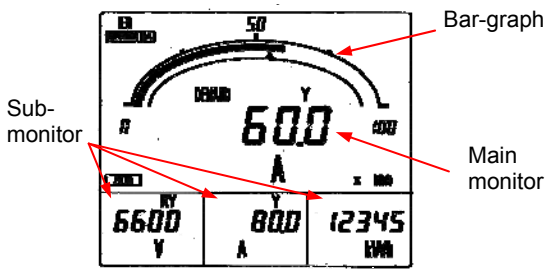
- It combines with broad band CT and support from 40A to 600A.
  According to the load increase and decrease etc. the substitution of CT is unnecessary; it corresponds easily only by changing the CT ratio.
  3 ϕ 3W (2VT, 2CT) method.
- Measuring display is including one main monitoring, 3 sub-monitoring and bar-graph display. It supports harmonic monitoring (distortion rate, RMS value, content rate), too.
- 4 analog circuits outputs and 2 contact circuit outputs (pulse, alarm, CPU in abnormal).

SQLC-110L POWER LINE SUPER MULTI-METER

■OUTLINE & FEATURES

4-measurement display+ bar-graph display

●**One** main monitor, **Three** sub-monitors
Fore measurements + **one** bar-graph display



● Display element list (○: displayable)

No.	Measuring factor	Main-monitor	Sub-Monitor (Left)	Sub-Monitor (Center)	Sub-Monitor (Right)	Bar-graph
1	Voltage (V) (RY-YB-BR)	○	○	○	○	○
2	Current (A) (R-Y-B)	○	○	○	○	○
3	Demand current (DA) (R-Y-B)	○	-	○	○	○
4	Power (W)	○	○	○	○	○
5	Demand power (DW)	○	-	○	○	○
6	Reactive power (var)	○	○	○	-	○
7	Apparent power(3φ4W only)	○	○	-	-	○
8	Power factor (PF) (cosφ)	○	○	-	○	○
9	Frequency(Hz)	○	-	-	○	○
10	Io/Igr(leakage current)	○	○	-	-	○
11	Wh(incoming/outgoing)	○	-	-	○	-
12	var(LAG/LEAD) -var(LAG/LEAD)	○	-	○	-	-
13	Distortion factor (A,V)	○	-	-	-	○
14	Harmonic 5th Conversion content (A,V)	-	-	○	-	○
15	Harmonic nth content (A,V)	-	-	○	○	○
16	Fundamental-wave RMS (A,V)	-	-	-	○	○
17	Harmonic 5th conversion RMS (A,V)	-	-	-	○	○
18	Harmonic nth RMS (A,V)	-	-	-	○	○

Note) when at 3φ4w display, phase W is added

Back light

●**Automatic turn-off**
Back light will turn-off automatically if unoperated in 5 minutes
●**Lightness setting**
There are 5 levels of lightness for selection.

Analog output 4 circuits + 2 contact outputs

●**4 analog outputs**
4 analog outputs simultaneously.
●**Arbitrary setting for output elements**
Any display elements can output by random setting. No matter with main monitor or sub monitor.
●**2 contact outputs**
2 outputs can be chosen by option from output of pulse, alarm and CPU abnormal. Combine them as pulse +alarm, alarm×2, pulse×2, pulse +CPU abnormal, alarm +CPU abnormal

Output test is possible

●**Alarm output**
ON-OFF of alarm output is confirmable.

Compliant with CE marking

●**SAFE standard** 73/23/EEC
EN61010-1:2001
CAT Ⅲ (max. circuit voltage: 300V);
Pollution lever: 2
●**EMC compliant standard** 2004/108/EC
EMI (emission) EN61000-6-4:2001
EN55011:1998+A1:1999+A2:2002
(Group1 Class A)
EMS (immunity) EN61000-6-2:2005
EN61000-4-2:1995+A1:1998+A2:2001
EN61000-4-3:2006
EN61000-4-4:2004
EN61000-4-5:2006
EN61000-4-6:1996+A1:2001
EN61000-4-8:1993+A1:2001
EN61000-4-11:2004

Support wide range of current & voltage

●**Voltage range**
There are 34 ranges of voltage measurement.
Support from 150V to 750kV.
●**Current range**
There are 76 ranges of current measurement.
Support from 5A to 30kA.
●**Full-scale setting**
(1) Ammeter full-scale setting is possible.
Setting range is from 40% to 120% of CT ratio. Refer to the right table.
(2) Watt-meter full-scale setting is possible.
Setting range is from 40% to 115% of VT ratio×CT ratio. Refer to the right table.
(3) Var-meter full-scale setting is possible.
Setting range is from 30% to 115% of VT ratio×CT ratio. Refer to the right table.

Settable of A, W and var measuring range(×10ⁿ)		Example
1. ☐	1.0/1.2/1.4/1.5/1.6/1.8	1000A,1600kW
2. ☐	2.0/2.4/2.5/2.8	2400kW,2500A
3. ☐	3.0/3.2/3.6	300A,3600kW
4. ☐	4.0/4.2/4.5/4.8	40.0kW,480A
5. ☐	5.0/5.6	500A,560A
6. ☐	6.0/6.4	60.0kW,640A
7. ☐	7.2/7.5	720kW,75.0A
8. ☐	8.0/8.4	800A
9. ☐	9.0/9.6	900kw,960A

SQLC-110L POWER LINE SUPER MULTI-METER

Power monitoring (A, V, W, var, cosφ, Hz)

●Measuring element

Voltage (RY-YB-BR), current (R-Y-B), demand current (R-Y-B), active power, demand power, reactive power, apparent power, distortion, power factor, frequency, max. value (max. demand current and so on), min. value etc. can be measured.

●Measuring circuit

3φ3w，1φ3w，1φ2w are common use; 3φ4w is up to 2VT3CT and 3VT3CT by setting.

●Alarm display & alarm output

Alarm contact can be added by option.
Alarm element：voltage（detect at max./min phase）
Setting accuracy：±1.0％（against full-scale）
Setting arrange：30% -150% against 150% of full-scale (1% step)

Harmonic monitoring (distortion rate, RMS, content rate)

●Measuring element（each phase of current and voltage）

Distortion (A, V), fundamental-wave RMS (A, V), Harmonic nth RMS (A, V), Harmonic 5th conversion RMS (A, V), Harmonic nth content (A, V), Harmonic 5th conversion content (A, V), Max. value measuring.

●Alarm display & alarm output

Alarm contact is optional.
Alarm element：distortion, harmonic nth content, harmonic 5th conversion content
Detection：when measuring value≧ setting upper value, alarm display and alarm output (detect at max. phase)
Setting accuracy：current：±2.5%; voltage：±1.0% (% against 100% content)

Preventive maintenance (monitoring and detecting constantly of circuit leakage by insulation deterioration)

●Leak current measurement

Leakage measuring can be added to 3φ3w，1φ3w，1φ2w by option.
Max. value can be measured.

●Leakage detection method

Current leakage measuring by both Io and Igr methods.

●Corresponding ZCT

ZCT option	Combination corresponding ZCT	
Omron Corporation zero-phase converter OTG-LA□	Hitachi Industrial Machine System window type ZCT (ZR series) ZR-□	Taiwa Industrial Electronics low- voltage Zero-phase converter (window type) ZB-□

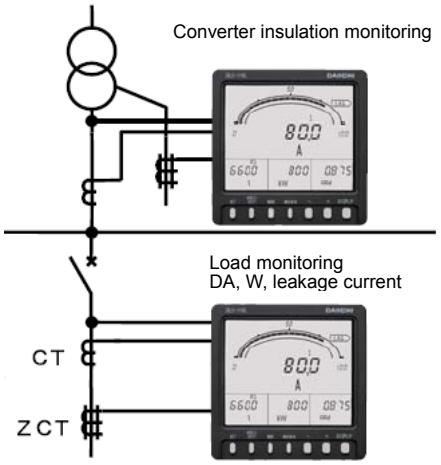
●Measurement accuracy

Measurement accuracy：±2.5％（not include error of ZCT combination）.

●Alarm display and alarm detection

Alarm contact can be added by option

Sensed current	＞50% and ≦100%（against rating sensed current value）
Rating sensed current	0.03A/0.05A/0.1A/0.2A/0.4A/0.8A
Operation time	Time-delay（＞0.1sec. and □2sec.）



Demand monitoring (A, W)

●Measuring element

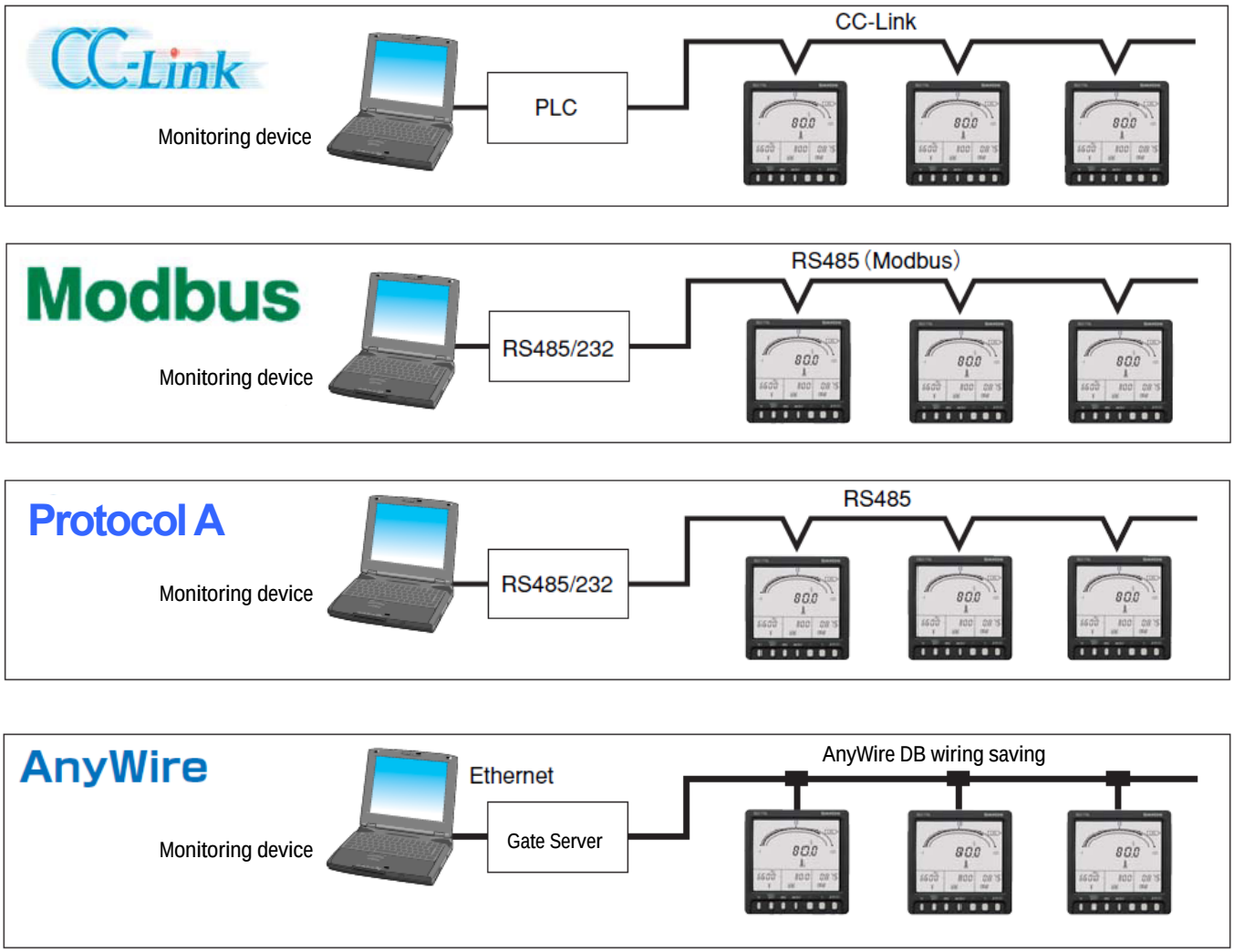
Demand current (R-Y-B), Demand power measurement function is equipped.

●Alarm display & alarm output

Alarm contact can be added by option.
1) Demand current (upper limit setting)
Setting accuracy: ±1.0% (% against full-scale)
Setting range: 5% -100% against max. scale (1% step)
2) Demand power (upper limit setting)
Setting accuracy: ±1.0% (% against full-scale)
Setting range: 5%-100% against max. scale (1% step)

Support various communication protocols

Any communication output field bus is optional.



Except the above T-branch wiring, no limit for multi-drop wiring, tree-wiring and star-wiring etc.

Setting operation (display change-over, setting)

●Easy setting for 8 modes

Man-machine interface makes easy to understand.
8 modes: measurement mode, max./min. mode, harmonic (A) mode, harmonic (V) mode, display related setting mode 1, measurement related setting mode 2, special setting related mode, setting value confirmation mode.

●Return operation

Quick display confirmation without making loop back is possible.

●Max. /min. value can be confirmed quickly.

Max. /min. value can be measured quickly at max. /min. mode.

■ SPECIFICATIONS CODE

Type: ①SQLC-110L

Specification code: ② - ③ ④ ⑤ ⑥ - ⑦ ⑧ ⑨

② Hard model		③ Input circuit common *1/detail setting *2		④ Input range common *1/detail setting *2	
A	R-S-T-N display / Japanese / Backlight GREEN	F	1φ2W,1φ3W,3φ3W common	F	150V,300V common 5A [3φ3W 2VT 2CT]
		1	1φ2W	1	150V,5A(150-300V,5A 1φ3W) [3φ3W 2VT 2CT]
		2	1φ3W	3	300V,5A [3φ3W 2VT 2CT]
B	R-Y-B-W display / English / Backlight GREEN	3	3φ3W	5	5A
		G	1φ2W,1φ3W,3φ3W+leakage *5	9	150V(150-300V, 1φ3W)
		5	1φ2W+ leakage	A	300V
		6	1φ3W+leakage	D	150V, 300V common
		7	3φ3W +leakage	G	150V,300V common 1A [3φ3W 2VT 2CT]
D	R-S-T-N display / Japanese / Backlight WHITE			2	150V,1A(150-300V,1A 1φ3W) [3φ3W 2VT 2CT]
E	R-Y-B-W display / English / Backlight WHITE			4	300V,1A[3φ3W 2VT 2CT]
				6	1A
				7	5A[3φ3W 3CT] *3
F	U-V-W-N display / English / Backlight WHITE			8	1A[3φ3W 3CT] *3
				P	150V,5A[3φ3W 2VT3CT] *3
				Q	150V,1A[3φ3W 2VT3CT] *3
G	L1-L2-L3-N display / English / Backlight WHITE			R	300V,5A[3φ3W 2VT3CT] *3
New!				S	300V,1A[3φ3W 2VT3CT] *3
		4	3φ4W *4	F	150/√3V,300/√3V common 5A
				1	150/√3V,5A
				3	300/√3V,5A
				5	5A
				9	150/√3V
				A	300/√3V
				D	150/√3V,300/√3V common
				G	150/√3V,300/√3V common 1A
				2	150/√3V,1A
				4	300/√3V,1A
				6	1A
				B	440/√3V,5A
				C	440/√3V,1A
				Z	other than those above

⑤Auxiliary supply	
1	AC85-264V & DC80-143V dual use
2	DC20-56V
3	AC85-264V & DC80-143V dual use (CE marking) *6
4	DC20-56V (CE marking) *6
Z	other than those above

⑥External operation input	
0	none
1	2 circuits
Z	other than those above

⑦Analog or communication output	
0	none
	analog output 4 circuits
1	4-20mA
2	0-1mA
3	1-5V
4	0-5V
5	0-10V
	communication output
M	Modbus RTU
L	CC-Link
A	Protocol A
W	AnyWire
Z	other than those above

⑧Contact output (2circuits)	
0	none
1	pulse+alarm
2	alarm×2
3	pulse×2
4	pulse+CPU abnormality
5	alarm+CPU abnormality
Z	other than those above

⑨LCD view angel	
1	Upper installation
2	Lower installation

Upper installation is standard

■ZCT option for electric leakage measuring

ZCT Type and Specification			
Type	Maker	Primary circuit current	Inside diameter(use)
unwanted	-	-	-
OTG-LA21	Omron	50A	21φ (indoor)
OTG-LA30	Omron	100A	30φ (indoor)
OTG-LA42	Omron	200A	42φ (indoor)
OTG-LA68	Omron	400A	68φ (indoor)
OTG-LA82	Omron	600A	82φ (indoor)
OTG-LA30W	Omron	100A	30φ (outdoor)

Note:
*1 It's possible to change the setting after purchase in the case of choosing the code symbol of F, G in the list of ③input circuit and ④input rang.
*2 Setting adherence to the specified detail in the case of choosing the code no. which is classified in detail and it's possible to change the setting after purchase
*3 In the case of choosing [3φ3W 3CT] or [3φ3W 2VT 3CT], please select the code no. of 3 in the list of ③input circuit.
*4 It's possible to make switch-over between 2VT3CT and 3VT3CT by setting.
*5 Please choose the ZCT for leakage measurig and note "unwanted" if you prefer to purchase s
*6 Except the ones with communication input and 3φ4W 440/√3V directly input specifications.

●ZCT option

OMRON option
Produced by Omron Corporation Zero-phase converter Indoor window type: OTG-LA☐ Outdoor window type: OTG-LA30W

●ZCT available

Supportable for combination	
Produced by Taiwa Industrial Electronics Zero-phase converter for low-voltage (window type) ZB-☐	Produced by Hitachi Industrial Machine System Window type ZCT (ZR series) ZR-☐

■ SPECIFICATIONS

Full name		Power Line Super Multi-Meter	
Model type		SQLC-110L	
Input circuits		3-phase 3-wire, single phase 3-wire, Single phase 2-wire common use (2VT, 2CT)	Please specify.
		3-phase 3-wire (2VT, 3CT)	
		3-phase 4-wire (2VT, 3CT/3VT, 3CT changeover by setting)	
Input rating	3-phase 3-wire, Single phase 3-wire, Single phase 2-wire	AC110V, 220V common use (Single phase 3-wire: AC100-200V) AC5A or 1A 50/60Hz	Please specify.
	3-phase 4-wire	AC110/√3V, 220/√3V common use or 440/√3V AC5A or 1A 50/60Hz	Please specify
Auxiliary power	Power range & Consumption VA	(1)AC85-264V 10VA (Rating voltage: AC100/110V, 200/220V) DC80-143V 6W (Rating voltage: DC100/ 110V) Use for both DC and AC (2)DC20-56V 6W (Rating voltage: DC24/48V)	Either (1) or (2). Please specify.
	Rush current (Time constant)	Rating voltage: AC110V 2.2A or less (approx. 3.6ms)	
		Rating voltage: AC220V 4.4A or less (approx. 3.6ms)	
		Rating voltage: DC110V 1.6A or less (approx. 3.6ms)	
		Rating voltage: DC24V 5.0A or less (approx. 2.0ms)	
		Rating voltage: DC48V 9.9A or less (approx. 2.0ms)	

■ SPECIFICATIONS

Measuring item	Measuring range/ Display specification		Intrinsic error(1) Digital display	Intrinsic error(1) Option Analog output Pulse output	Max. measuring (9)	Min. measuring (9)	Notes
Voltage	AC150V-750.0kV (34 ranges)		±1.0%	±0.5%	○	○	Switching between lines RY-YB-BR (2)
Current	Max. demand (9), demand, instant AC5.00A-30.0kA (76 ranges)		±1.0%	±0.5%	○	○	R-Y-B (3) phase switch and CT ratio display separately; Output range setting is possible.
Power	Max. demand (9), Demand, Instant 200W-1000MW (Range selection) peak/peak-to-peak oscillation setting is possible.		±1.0%	±0.5%	○	○	Analog output range is displayable; Setting independently is possible.
Reactive power	LEAD, LAG150var-1000Mvar (Range selection) depend on voltage/current range		±1.0%	±0.5%	○	○	
Apparent power (4)	400VA-1000MVA (range selection)		±1.0%	±0.5%	○	○	Same scale with power range (display/output)
Power factor	LEAD0.500-1.000-LAG0.500 or LEAD0.000-1.000-LAG0.000 range selection		±2.0%	±2.0%	○	○	In the case of under 20% of voltage range or 2% of current range, input is cosφ=1(output is equivalent to cosφ=1)
Frequency	45-55Hz or 55-65Hz or 45-65Hz range selection		±0.5%	±0.5%	○	○	In the case of under 20% of voltage range, input is 0.0Hz; output is a bottom limit value (bottom value -1%:% against output span)
Leak current (5) Io mode, Igr mode		AC0.03A-0.8A (6 ranges)	±2.5% (6)	±2.5% (6)	○		% against rating sensitive current value. Display is 0 when input under 3mA.
Distortion ratio	Voltage	0.0-20.0% (2nd-15th harmonic wave) RY-YB(8)	±1.0%	±2.5%	○		Digital display: % against of 100% distortion ratio.
	Current	0.0-100.0% (2nd-15th harmonic wave) R-B(8)	±2.5%	±2.5%	○		
Harmonic nth RMS value Fundamental wave RMS value	Voltage	AC150V-750.0kV (34 range); n=3,4,5,7,9,11,13,15 and fundamental wave RY-YB(7)	±1.5%	±1.5%	○		Digital display: % against voltage range.
	Current	AC5.00A-30.0kA (76 range); n=3,4,5,7,9,11,13,15 and fundamental wave R-B(8)	±1.5%	±1.5%	○		Digital display: % against current range.
Relative harmonic content (nth)	Voltage	0.0-20.0%; n=3,4,5,7,9,11,13,15; RY-YB (7)	±1.0%	±2.5%	○		Digital display: % against of 100% distortion ratio.
	Current	0.0-100.0%; n=3,4,5,7,9,11,13,15; R-B (8)	±2.5%	±2.5%	○		
Relative harmonic 5th RMS value	Voltage	AC150V-750.0kV (34 range); RY-YB (7)	±1.5%	±1.5%	○		Digital display: % against voltage range.
	Current	AC5.00A-30.0kA (76 range); R-B (8)	±1.5%	±1.5%	○		Digital display: % against current range.
Relative harmonic content (5th)	Voltage	0.0-20.0%; RY-YB (7)	±1.0%	±2.5%	○		Digital display: % against 100% of content ratio.
	Current	0.0-100.0%; R-B (8)	±2.5%	±2.5%	○		
Watt-hour	Display: 5-digit integer Multiplying factor: 10n(n: integer) Enlarged indication is possible to decimal the 3rd place. Power multiplication (incoming/outgoing)		Power factor 1: ±2.0% Power factor 0.5: ±2.5%	Power factor 1: ±2.0% Power factor 0.5: ±2.5%			Based on general watt-hour meters; Setting range of pulse output unit (kWh/pulse): Refer to specification for option.
Var-hour	Display: 5-digit integer Multiplying factor: 10n(n: integer) Enlarged indication is possible to decimal the 3rd place. Incoming reactive power multiplication (LAG/LEAD) Outgoing reactive power multiplication (LAG/LEAD)		Power factor 0: ±2.5% Power factor 0.87: ±2.5%	Power factor 0: ±2.5% Power factor 0.87: ±2.5%			Setting range of pulse output unit (kvarh/pulse): Refer to specification for option.
Operation method	Current, voltage: RMS operation method Demand ammeter: operation method according with thermal type. Demand wattmeter: operation method according with thermal type or averaging arithmetic in demand time limited. (Choose either by setting.) Power, reactive power, Watt-hour, var-hour: time-sharing multiplication method. Power factor: instant measuring or averaging arithmetic in demand time limited (Choose either by setting.) wording-out by power, var-hour. Frequency: zero cross time cycle operation method. Leak current: fundamental wave RMS operation method Harmonic: FFT operation method						
Time limit setting	Demand A	0sec./5sec./10sec./20sec./30sec./40sec./50sec./1min./2min./3min./4min./5min./6min./7min./8min. 9min./10min/15min./20min./25min./30min.(95% time limit)					
	Demand W						
	Harmonic measuring	Average time limited: 0min./1min./2min./5min./10min./15min./30min. (average measuring)					

Notes:
(1) According to this meter's performance principle, its error comes bigger in case of measuring next inverter output directly. In case of cycle control, SCR phase angle control and PWM control, intrinsic error (display) can be measured, except harmonic measurement.
(2) Single phase 3-wire: RW-BW-RB, 3-phase 4-wire: RW-YW-BW-RY-YB-BR, single phase 2-wire: no phase and line display
(3) Single phase 3-wire: R-B-W, 3-phase 4-wire: R-Y-B-W, single phase 2-wire: no phase and line display.
(4) Specification of 3-phase 4-wire only.
(5) Option for 3-phase 3-wire/single phase 3-wire/single phase 2-wire only. But, lo method is for current output measuring only.
(6) Not including the error of ZCT. But, it is ±0.0025A (ZCT primary) when short circuit detectives electric current is under 0.1A.
(7) Single phase 3-wire: RW-BW, 3-phase 4-wire 2VT: RW-BW, 3-phase 4-wire 3VT: RW-YW-BW, single phase: no phase and line display.
(8) Single phase 3-wire: R-B, 3-phase 4-wire: R-Y-B, single phase: no phase display.
(9) Max. value (max. demand current, others) Min. value can be confirmed by Max./Min. measuring mode.

■ PERFORMANCE

Item	Specification			
Intrinsic error	Measuring specification, refer to intrinsic error.			
Bar-graph intrinsic error	±10% (% against span)			
Temperature influence	Within intrinsic error at 23±10˚C			
compliant standard	JIS C 1102-1,-2,-3,-4,-5,-7 (1997), JIS C 1111(1989), JIS C1216(1995), JIS C 1263(1995), JIS C 8374(1991), EIA standard RS-485			
Display update time	Apporx.1 sec. (bar-graph: 0.25 sec.) (Leak measuring: digital/bar-graph 2 sec. or less.; Harmonic measuring: Digital/bar-graph 10 sec. or less.			
Display elements / composition	LCD	Main-monitor	Character height: 11mm 5 digits	
		Sub-monitor (left)	Character height: 6mm 4 digits	
		Sub-monitor (center, right)	Character height: 6mm 5 digits	
		Bar-graph	20 dots	
LCD vision angle	Standard	Upper installation: upper 10˚, lower 60˚, right and left 60˚		
	Special	Lower installation: upper 60˚, lower 10˚, right and left 60˚		
Bar-graph	LED backlight: green or white (Specify, please). Always ON, OFF automatically (in 5 minutes), normally OFF settings are possible. Lightness setting is possible for white backlight only.			
Input consumption VA	Voltage circuit	≦0.1VA (110V), ≦0.2VA (220V), ≦0.05VA (110/√3V), ≦0.1VA (220/√3V), ≦0.2VA (440/√3V)		
	Current circuit	≦0.1VA (5A, 1A)		
Overload withstand	Voltage circuit	2 times of rating voltage for 10 sec., 1.2 times for continuous		
	Current circuit	40 times of rating current for 1 sec., 20 times for 4 sec., 10 times for 16 sec., 1.2 times for continuous		
	Aux. supply	1.5 times of rating voltage for 10 sec., 1.2 times for continuous; In the case of DC110V: 1.5 times of rating voltage for 10 sec. 1.3 times for continuous.		
Insulation resistance(1) JIS C 1102-1 JIS C 1111	Between the electric circuit and the outside box (earth)	DC500V mega 50MΩ or more		
	Between input, output and auxiliary power			
	Between output (analog or communication/pulse/alarm)			
	Between pulse outputs			
	Between alarm outputs			
	Non-insulation between analog outputs (minus common)			
Voltage test(1) JIS C 1102-1 JIS C 1111	Between the electric circuit and the outside box (earth)	AC2000V (50/60Hz),1 min.		
	Between input, output and auxiliary power			
	Between output (analog or communication/pulse/alarm)	AC1500V (50/60Hz), 1 min.		
	Between pulse outputs			
	Between alarm outputs			
	Non-insulation between analog outputs (minus common)			
Impulse voltage test JIS C 1111	Between auxiliary power and the outside box (earth) (only for w/ leakage measuring)	7kV 1.2/50μs plus/minus polarity each 3 times		
	Between the electric circuit (except analog or communication output) and the outside box (earth)	6kV 1.2/50μs plus/minus polarity each 3 times		
	Between analog output or communication output and the outside box (earth)	5kV 1.2/50μs plus/minus polarity each 3 times		
Noise capacity ANSI C37.90a Power standard B-402 IEC801-2	1) Oscillatory surge voltage 1-1.5MHz, peak voltage: when attenuated oscillatory waveform of 2.5-3kV is applied repeatedly, measured error: within 10%, no communication halts. Voltage input circuit (normal/common), current input circuit (common), power supply circuit (normal/common) 2) Square-wave impulse noise (1μs, 100ns width) is repeatedly applied for 5 minutes, measured error: within 10%, no communication halts. Power supply circuit (normal/common): 1500V or more; Alarm output (common): 1000V or more Voltage input circuit (normal/common): 1500V or more; Operation input (common): 1000V or more Current input circuit (common): 1500V or more; Analog or communication output circuit (inductive): 1000V or more Pulse output (common): 1000V or more 3) Radio noise: when radio wave of 150,400,900MHz is applied by 5W, 1m intermittently, measured error is within 10%, no communication halt. 4) Electrostatic noise: when energized by 8kV, measured error is within 10%. At no passage of electric current 10kV, no damage (condenser charge system).			
Vibration/shock JIS C 1102-1	Vibration: 1/2 peak-peak is 0.15mm, 10-55Hz, 1 octave/min., 5 times sweep Shock: 490m/s^2, X,Y, Z direction 3 times for each			
Operating temperature/ humidity range	-10-+55˚C, 30-85% RH, no condensation			
Storage temperature range	-25-+70˚C			
Structure	Dimension: length × height × width 110×110×104mm, diameter: 99mmΦ Material of case for terminal cover: ABS (V-0); Exterior color: black (Munsell N1.5) Mass: approx.600g			
Power outage guarantee	Max. value, min. value, integrated value, respective setting-values are data-saved by non-volatilized memory.			

Note (1): Voltage input and leakage input is non-isolated. Please use with ZCT together.

■ OPTION

Item		Specification
Analog output	Output circuit	4 circuits
	Output specifications	DC4-20mA (550Ω or less); DC0-5V/1-5V (600Ω or more) DC0-10V (2kΩ or more); DC0-1mA (10kΩ or less) Please specify one with the same rating.
	Output elements	Voltage (RY-YB-BR), current (R-Y-B), demand current (R-Y-B), power, demand power, reactive power, apparent power (3φ4w only), power factor, frequency, leak current (with leak current meter only),distortion ratio, Fundamental wave RMS value (Automatic switch to the max. value phase of A, V.), relative harmonic (5th) content (Automatic switch to the max. value phase of A, V.), relative harmonic 5th RMS value (Automatic switch to the max. value phase of A, V.), harmonic (nth) content (Automatic switch to the max. value phase of A, V.), harmonic (nth) RMS value (Automatic switch to the max. value phase of A, V.)
	Response time	1 second or less (Time to be within ±1% of final constant value.) Leak current measuring is 2 sec. or less. Harmonic measuring is 10 sec. or less.
	Output ripple	Within 2 times of fix error (% against output span)
	Non-insulation between output (minus common)	

Pulse output (2)							
Watt-hour or var-hour Output system: photo MOS-FET relay 1a contact (N.O. contact) Contact capacity: AC, DC125V, 70mA (resistance load, inductive load) Pulse width: 250±10ms (According to the setting of voltage measuring range, current measuring range, output pulse unit, when the output pulse cycle becomes 2 pulse/sec. or more at the rating power, output pulse width becomes 100-130ms.) Output pulse unit setting is possible as the followings: ■3-phase 3-wire, 3-phase 4-wire: all load power (kW, kvar) = √3 × rating voltage(V) × rating current(A) × 10^{-3} ■single phase 3-wire: all load power (kW, kvar) = 2 × rating voltage(V) × rating current(A) × 10^{-3} ■single phase: all load power (kW, kvar) = rating voltage(V) × rating current(A) × 10^{-3}							
All load power (kW, kvar)		Output pulse unit kWh (kvarh)/pulse					Multiply factor
	＜1	0.1	0.01	0.001	0.0001		0.01(1)
1≦	＜10	1	0.1	0.01	0.001		0.1
10≦	＜100	10	1	0.1	0.01		1
100≦	＜1,000	100	10	1	0.1		10
1,000≦	＜10,000	1,000	100	10	1		100
10,000≦	＜100,000	10,000	1,000	100	10		1,000
100,000≦	＜1,000,000	100,000	10,000	1,000	100		10,000

Alarm output (2)				
Alarm elements: demand current, demand power, leak current, relative harmonic (5th) content, harmonic (nth) content, distortion ratio, voltage, and alarm OFF, whichever can be setting. Reset method: automatic or manual (by setting) Contact time-delay: 0-300sec. (1 sec. step) Output contact: none-voltage a contact (each phase detective OR) Contact capacity: AC250V 8A, DC125V 0.3A (resistance load) AC250V 2A, DC125V 0.1A (induction load)				
Alarm elements	Item	Specification		
Demand current	Function	When demand measuring value□upper-limit setting value, alarm display/alarm output		
	Setting accuracy	±1.0% (% against full scale)		
	Setting range	5-100% against max. scale value (1% step)		
Demand power	Setting accuracy	±1.0% (% against full scale)		
	Setting range	5-100% against max. scale value (1% step)		
Leak current (for w/ leak current measuring only)	Sensed current	More than 50%, 100% or less (% against rating sensed current value)		
	Rating sensed current value	0.03A/0.05A/0.1A/0.2A/0.4A/0.8A		
	Operating time	Time-delay type (＞0.1 sec, ≦2 sec.)		
	Test function	Function test of leak current at test mode is possible.		
Relative harmonic (5th) content Harmonic nth content Distortion ratio	Function	When measuring value≧upper-limit setting value, alarm display/alarm output (detecting by max. phase)		
	Setting accuracy	Current: ±2.5%, voltage: ±1.0%, % against 100% content ratio.		
	Setting range	Current	Relative harmonic (5th) content, harmonic nth content (n=3, 4, 5. 7, 9, 11, 13, 15) Distortion ratio: 5-100% (1% step)	
		Voltage	Relative harmonic (5th) content, harmonic nth content (n=3, 4, 5, 7, 9, 11, 13, 15) Distortion ratio: 1-20% (0.1% step)	
	Detecting characteristics	Average value mode: detect when average value is over the above setting value. Anti Time-delay mode: detect by anti- time-delay property of instantaneous value. (relative harmonic (5th) content only.)		
Voltage	Function	When measurement value ≧ upper-limit setting value, alarm display/ alarm output. When measurement value ≦ lower-limit setting value, alarm display/ alarm output.		
	Setting accuracy	±1.0% (% against full-scale)		
	Setting arrange	30-150% (1% step), when full-scale value is assumed to be 150%.		

CPU abnormal output (2)			
Detecting item (self-checking item)		Contact construction	Capacity
1. Watch-dog timer (internal/external) 2. RAM check error 3. A/D exchange error ON when abnormal detected or audibility power is implied. OR output of detective item.		b contact (N.C. contact)	AC250V 5A, DC125V 0.2A (Resistance load) AC250V 1.5A, DC125V 0.1A (Induction load)

External operating input		
Circuits	2 circuits , Switching by setting of function (4 kinds)	
External reset	It's possible to reset max. /min. value or alarm output by adding voltage signal outside. Its switch able between alarm output reset and max. /min. value reset. Rating of input and auxiliary power are the same.	
External display switching	It's possible to switch the display by adding voltage signal outside. It's possible to switch the measuring element and phase. Rating of input and auxiliary power are the same.	
It's possible to impress min. operating pulse width 300ms continuously. (1) AC100/110V 0.4VA, AC200/220V 1.4VA, DC100/110V 0.4W (universal) Capacity of contact point: approx. 3mA (AC; DC100/110V), approx. 6mA (AC200/220V) (2) DC24V 0.3W, DC48V 1.2W Contact point capacity: approx. 10mA (DC24V), approx. 20mA (DC48V)		

Note (1): Though multiply factor is 0.01, display is 0.1(4-digit integer display, expansion display becomes 4-digit below the decimal point).
Note (2): 2 outputs combination of pulse output, alarm output and CPU abnormal output is possible (for CPU abnormal output: one only, 2 CPU abnormal outputs are impossible.).

■COMMUNICATION SPECIFICATIONS

Protocol A	EIA RS-485 2 half duplex wires start-stop synchronization type			
	Transmission speed	1200/2400/4800/9600/19200bps	Stop bit	1 bit/2 bit
	Transmission code	NRZ	Cable length	1000m (total extended length)
	Start bit	1 bit	Address	1-254 (connect number: max.31)
	Data length	7 bit/8 bit	Transmission character	ASC Ⅱ code
	Parity bit	None/Odd/Even		
Protocol Modbus RTU mode	EIA RS-485 2 half duplex wires start-stop synchronization type			
	Transmission speed	4800/9600/19200/38400bps	Stop bit	1 bit/2 bit
	Transmission code	NRZ	Transmission code	Binary
	Start bit	1 bit	Cable length	1000m (total extension)
	Data length	8bit	Address	1-247 (connect number: max.31)
	Parity bit	None/Odd/Even	Error detecting	CRC-16 ($X^{16}+X^{15}+X^2+1$)
CC-Link Ver.1.10	Transmission speed	156k/625k/2.5M/5M/10Mbps	Connect number	42 (when composing only of this unit)
	Number of monopoly bureaus	Remote device bureau: One bureau occupied		
	Max. transmission distance	1200m (156kbps) /900m (625kbps) /400m (2.5Mbps) /160m (5Mbps) /100m (10Mbps)		
AnyWire	4 duplex/ 2 full duplex total flame cyclic method			
	Synchronizing method	Flame/Bit synchronous	Transmission cable	Cable free, common2/4 line cable (0.75-1.25mm²)
	Connection figure	Bus topology (multi-drop, T-branched, tree)	Transmit speed	4 full duplex: 7.8kHz(1km), 15.6kHz(500m) 31.3kHz(200m), 62.5kHz(100m) 2 full duplex: 7.8kHz(1km), 31.3kHz(200m) ( ) in total extension
	Protocol	AnyWireBus protocol		
	Error control	Double Duplex	Address setting	0-63 (4 full duplex), 0-15 (2 full duplex)
	RAS function	Transmission line disconnection/short-circuit	Max. connection no.	4 full duplex: 64, 2 full duplex: 16

■ RANGE SETTING

●Voltage measuring range (34)

150.0V (110V)
150V (110V)
300.0V (220V,220V/110V)
300V (220V,220V/110V)
500V (380V/110V)
600V (440V/110V)
600V (460V/110V)
600V (480V/110V)
1200V (880V/110V)
1500V (1100V/110V)
2400V (1650V/110V)
3000V (2200V/110V)
3.00kV (2200V/110V)
4500V (3300V/110V)
4.50kV (3300V/110V)
9000V (6600V/110V)
9.00kV (6600V/110V)
15.00kV (11kV/110V)
18.00kV (13.2kV/110V)
18.00kV (13.8kV/110V)
24.00kV (16.5kV/110V)
25.00kV (18.4kV/110V)
30.0kV (22kV/110V)
45.0kV (33kV/110V)
90.0kV (66kV/110V)
120.0kV (77kV/110V)
150.0kV (110kV/110V)
180.0kV (132kV/110V)
210.0kV (154kV/110V)
270.0kV (187kV/110V)
300.0kV (220kV/110V)
400.0kV (275kV/110V)
500.0kV (380kV/110V)
750.0kV (550kV/110V)

●Current measuring range (76)

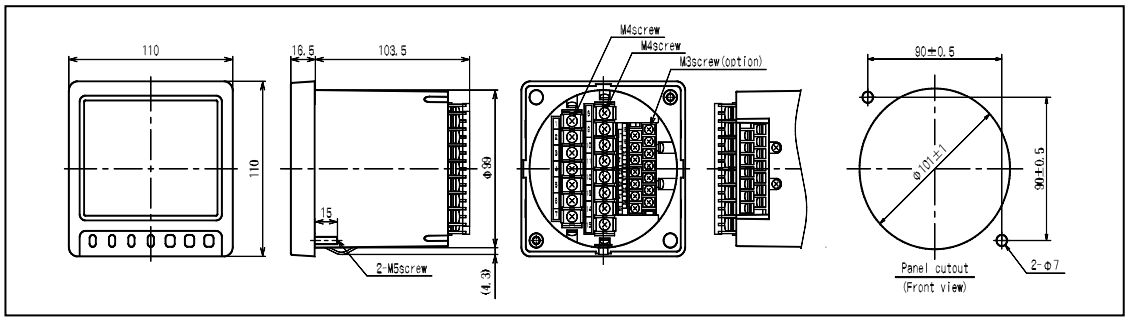
5.00A
6.00A
7.50A
8.00A
10.00A
10.0A
12.00A
12.0A
15.00A
15.0A
20.00A
20.0A
25.00A
25.0A
30.00A
30.0A
40.0A
50.0A
60.0A
75.0A
80.0A
100.0A
100A
120.0A
120A
150.0A
150A
200.0A
200A
250.0A
250A
300.0A
300A
400A
500A
600A
750A
800A
900A
1000A
1.00kA
1200A
1.20kA
1500A
1.50kA
1600A
1.60kA
1800A
1.80kA
2000A
2.00kA
2500A
2.50kA
3000A
3.00kA
4000A
4.00kA
5000A
5.00kA
6000A
6.00kA
7500A
7.5kA
8000A
8.00kA
9.00kA
10.00kA
10.0kA
12.00kA
12.0kA
15.00kA
15.0kA
20.00kA
20.0kA
30.00kA
30.0kA

●Power/ reactive power measuring range

(1)Current meter's full-scale setting is possible.
Setting range can be set from 40 to 120% of CT ratio
(2)Power meter's full-scale setting is possible.
Setting range can be set from 40 to 115% of VT ratio×CT ratio.
(3)Var-hour meter's full-scale setting is possible.
Setting range can be set from 30 to 115% of VT ratio×CT ratio.

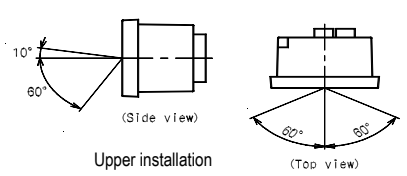
Full-scale which under 4000 displays by 4-digit, while 4000 or more displays by 3-digit.
E.g. 4800kW → 4.80MW
40kvar → 40.0kvar
20kW → 20.00kW

■ DIMENSIONS

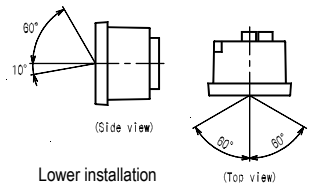


■ HANDLING

Since the contrast changes according to the monitoring angle, please mount the LCD to obtain and optimum angle.

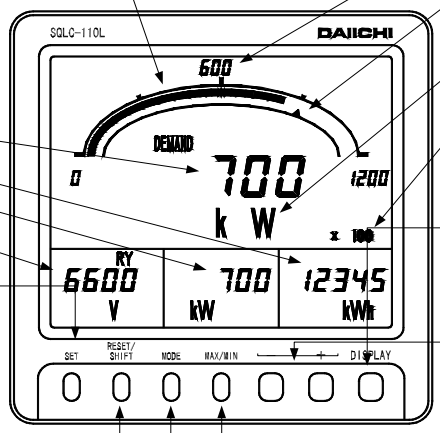


Upper installation



Lower installation

■PARTS NAME & FUNCTIONS



Bar graph display
Indicates main monitoring measuring values by analog.
Sub-monitoring measuring values also can be set to display by bar graph.

Digital display
Measurement monitor can watch 4 elements at the same time.

- ·Main monitor
- ·Sub monitor (Right)
- ·Sub monitor (Center)
- ·Sub monitor (Left)

Scale number
Set automatically by measurement-range setting.

Flicker setting index
To manage index when flicker OFF.

Unit display
Set automatically by measurement-range setting.

Multiplying factor display
Display on the lower right of the main monitor when display electric energy and a reactive energy.

DISPLAY
Phase current or line voltage switch changeover.
Return to the original phase (line) display if no operation for 10 minutes after a display change, At setting mode, it is used as a switch to terminates setting mode.

SET
This switch is used to change the integrated value of various electric energy to a normal display (5 digits of integer) and expansion indication (2 digits of integer+ 3 digits below decimal point). It is also used as a switch which changes to setting mode if continues to push 3 seconds. At setting mode, it is used as a switch to determines a set value.

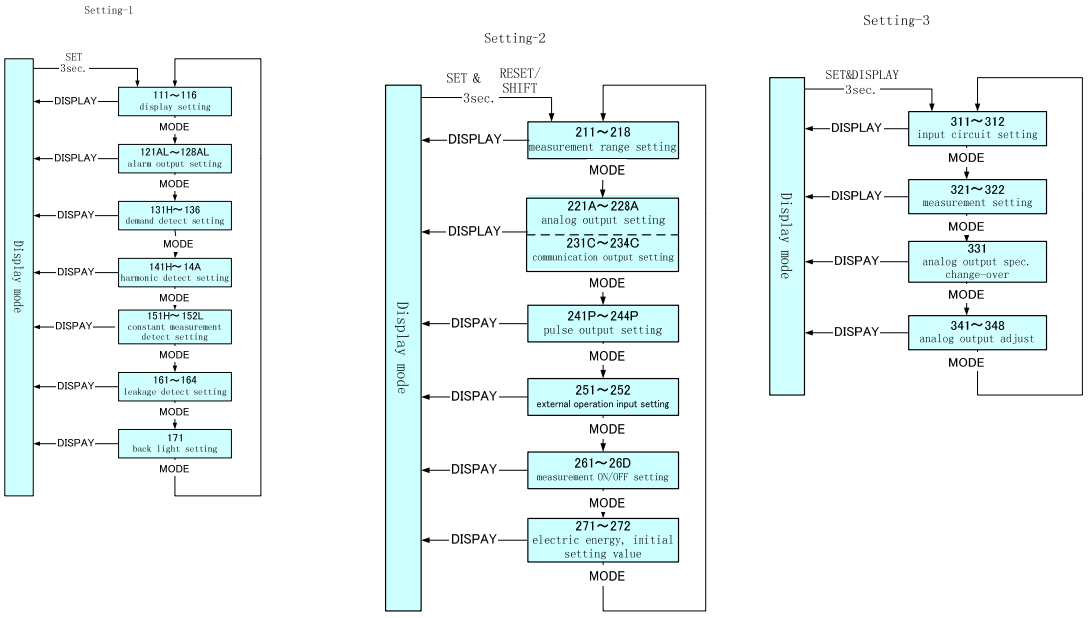
− +
Switch to change the measuring display elements of main monitoring.
It returns to the original measurement display factor if no operation for 10 minutes after a display change.
At setting mode, it is used as a switch to change a setting value.

RESET/ SHIFT
Switch to reset various alarms.
At the maximum and the minimum measurement display, it is used as a switch to reset the maximum and the minimum value.
At setting mode, it is used as a switch to shift a setting item.

MAX/MIN
Change the general measurement display (usually) and the maximum/ minimum measurement display.

MODE
Change the general measurement display (usually) and the harmonic measurement (voltage & current).
At setting mode, it is used to change a setting item.

■ SETTINGS



■ CONNECTING DIAGRAMS

●Single phase 2-wire/ Single phase 3-wire/ 3-phase 3-wire ([4])

Voltage/ Current input

Fig.1. 1φ2 W

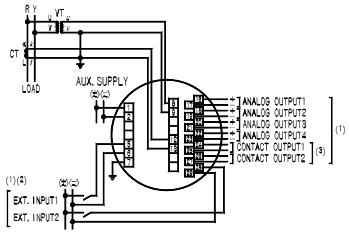


Fig.2. 1φ3 W

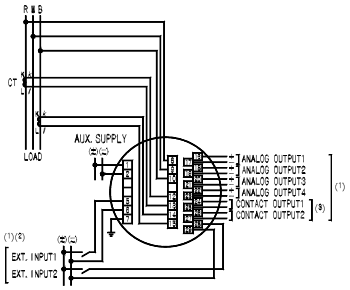
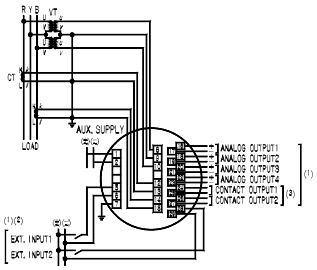
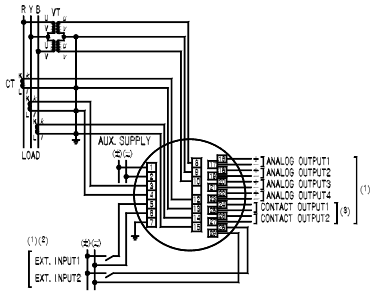


Fig.3. 3φ3 W （2VT,2CT）



Voltage/ Current input

Fig.4. 3φ3 W（2VT,3CT）



Current input

Fig.5. 1φ2 W

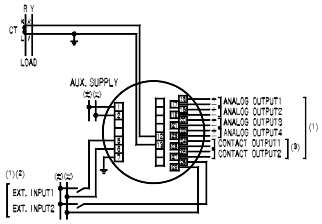
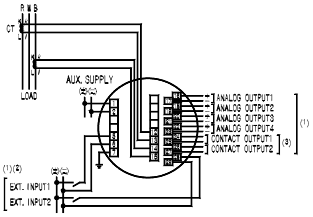


Fig.6. 1φ3 W



Current input

Fig.7. 3φ3 W（2CT）

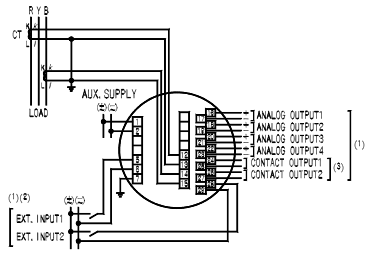
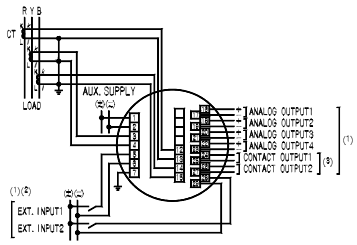
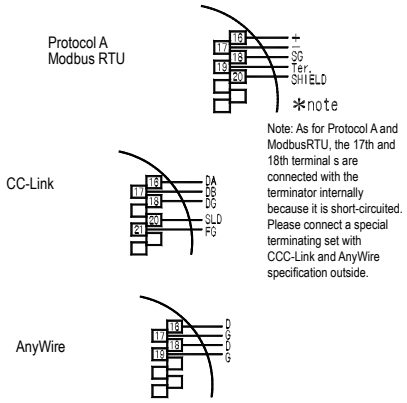


Fig.8. 3φ3 W （3CT）



Communication output

Fig.9.



Note: As for Protocol A and ModbusRTU, the 17th and 18th terminal s are connected with the terminator internally because it is short-circuited. Please connect a special terminating set with CCC-Link and AnyWire specification outside.

Voltage input

Fig.10. 1φ2 W

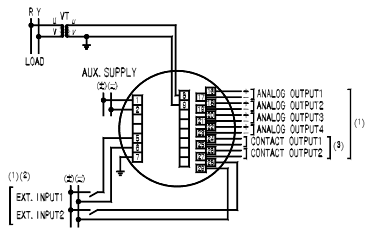


Fig.11. 1φ3 W

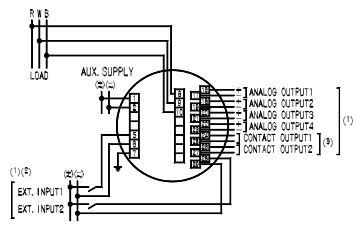
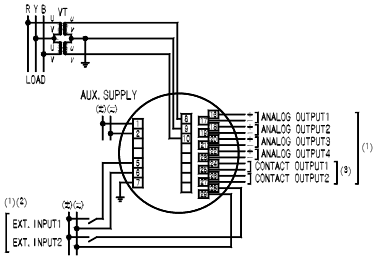


Fig.12. 3φ3 W



■ Connecting diagram

●Single phase 2-wire/ Single phase 3-wire/ 3-phase 3-wire + leakage monitoring

Low-voltage circuit leakage monitoring

Fig.13. 1φ2 W (W phase grounding)

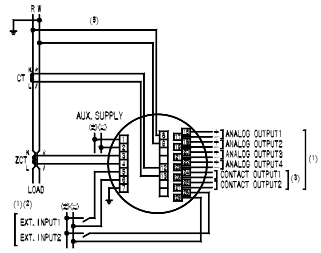


Fig.14. 1φ3 W (W phase grounding)

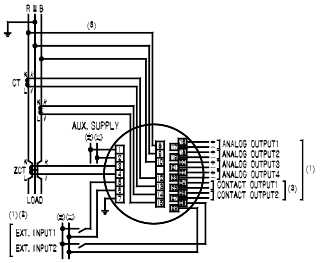


Fig.15. 3φ3 W (Y phase grounding)

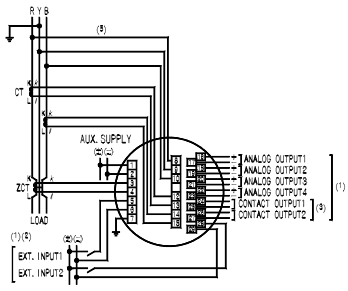


Fig.16. 3φ3 W (Not grounding)

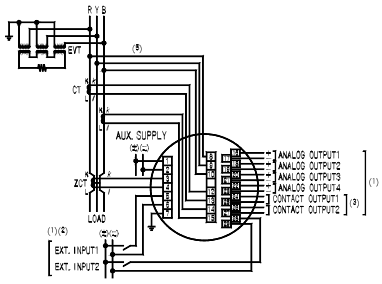


Fig.17. 1φ3 W (W phase grounding)
* in the case ZCT connect grounding
(pay attention to the polar of ZCT)

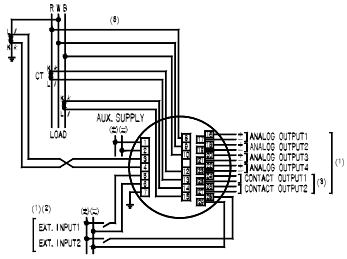
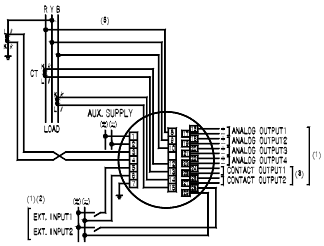


Fig.18. 3φ3 W (Y phase grounding)
* in the case ZCT connect grounding
(pay attention to the polar of ZCT)



●3-phase 4-wire(4)

Voltage/ Current input

Fig.19. 3φ4 W (2VT,3CT)

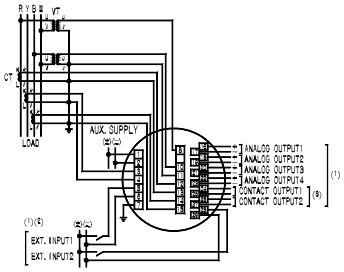
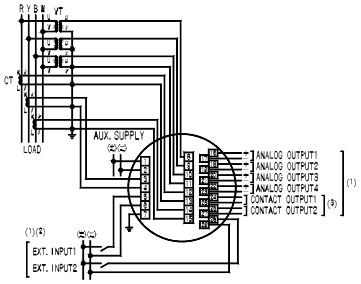
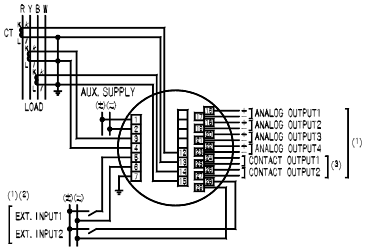


Fig.20. 3φ4 W (3VT,3CT)



Current input

Fig.21. 3φ4 W (3CT)



Voltage input

Fig.22. 3φ4 W (2VT)

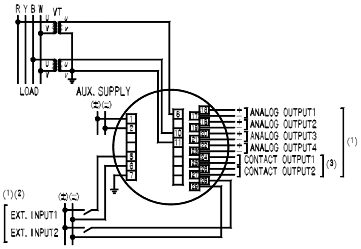
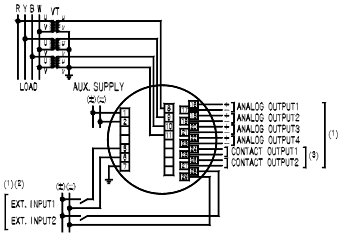


Fig.23. 3φ4 W (3VT)



Note:

(1) Analog output/ Contact output/ External operation input is option.
(2) External operation input can realize either external reset or display changer-over function by setting.
(3) Contact output can be selected from pulse output, alarm output or CPU abnormal output. (Please Specify)

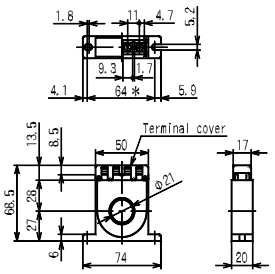
・combination of contact outputs

	Contact 1	Contact 2
Pulse + alarm	Pulse	Alarm
Alarm×2	Alarm 1	Alarm 2
Pulse×2	Pulse 1	Pulse 2
Pulse + CPU abnormal	Pulse	CPU abnormal
Alarm + CPU abnormal	Alarm	CPU abnormal

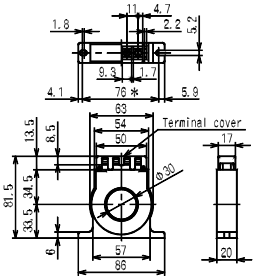
(4) No need secondary grounding for VT & CT when low voltage circuit. Input directly for 110V or 220V or 400V without V
(5) Voltage input is necessary for leak current Igr measuring
(6) Voltage input & leakage input are non-insulate, please combine with ZCT for use.

■ ZCT OUTLINE DIMENSIONS

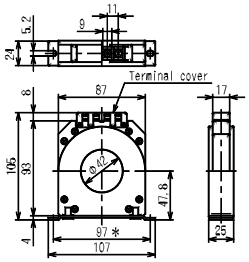
50A (OMRON : OTG-LA21)



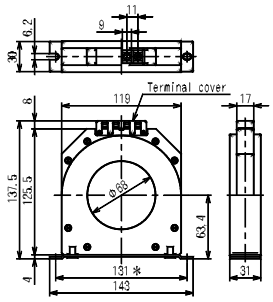
100A (OMRON : OTG-LA30)



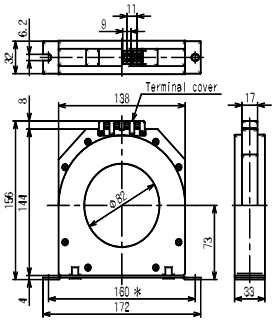
200A (OMRON : OTG-LA42)



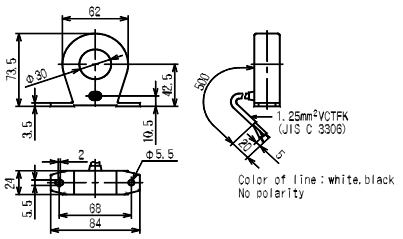
400A (OMRON : OTG-LA68)



600A (OMRON : OTG-LA82)



100A Outdoor type (OMRON : OTG-LA30W)



■ DISPLAY PATTERN

Pattern No.	(1) 3- phase 3-wire/3- phase 4-wire (voltage/ current input)					(2) Single phase 3 wire (voltage/ current input)					(3) Single phase 2 wire (voltage/ current input)					Note
	Main-monitoring	Sub-monitoring			Bar-graph	Main-monitoring	Sub-monitoring			Bar-graph	Main-monitoring	Sub-monitoring			Bar-graph	
		(Left)	(Center)	(Right)			(Left)	(Center)	(Right)			(Left)	(Center)	(Right)		
Pattern 1	A_Y	V_{RY}	W	Wh	A_Y	A_R	V_{RW}	W	Wh	A_R	A	V	W	Wh	A	Standard
Pattern 2	A_Y	V_{RY}	W	cosφ	A_Y	A_R	V_{RW}	W	cosφ	A_R	A	V	W	cosφ	A	
Pattern 3	A_Y	V_{RY}	W	Hz	A_Y	A_R	V_{RW}	W	Hz	A_R	A	V	W	Hz	A	
Pattern 4	DA_Y	A_Y	V_{RY}	W	DA_Y	DA_R	A_R	V_{RW}	W	DA_R	DA	A	V	W	DA	
Pattern 5	DA_Y	A_Y	V_{RY}	Wh	DA_Y	DA_R	A_R	V_{RW}	Wh	DA_R	DA	A	V	Wh	DA	
Pattern 6	DA_Y	V_{RY}	W	cosφ	DA_Y	DA_R	V_{RW}	W	cosφ	DA_R	DA	V	W	cosφ	DA	
Pattern 7	W	V_{RY}	A_Y	Wh	W	W	V_{RW}	A_R	Wh	W	W	V	A	Wh	W	
Pattern 8	W	V_{RY}	A_Y	cosφ	W	W	V_{RW}	A_R	cosφ	W	W	V	A	cosφ	W	
Pattern 9	W	V_{RY}	A_Y	Hz	W	W	V_{RW}	A_R	Hz	W	W	V	A	Hz	W	
Pattern 10	DW	V_{RY}	W	Wh	DW	DW	V_{RW}	W	Wh	DW	DW	V	W	Wh	DW	Specify, please.
Pattern 11	DW	V_{RY}	A_S	cosφ	DW	DW	V_{RW}	A_R	cosφ	DW	DW	V	A	cosφ	DW	
Pattern 12	A_Y	cosφ	W	Wh	A_Y	A_R	cosφ	W	Wh	A_R	A	cosφ	W	Wh	A	
Pattern 13	A_Y	var	W	Wh	A_Y	A_R	var	W	Wh	A_R	A	var	W	Wh	A	
Pattern 14	W	cosφ	var	Wh	W	W	cosφ	var	Wh	W	W	cosφ	var	Wh	W	
Pattern 15(1)	A_Y	A_R	A_B	Wh	A_Y	A_R	A_B	A_W	Wh	A_R	A	-	-	Wh	A	
Pattern 16(2)	V_{RY}	V_{YB}	V_{TR}	Hz	V_{RY}	V_{RW}	V_{BW}	V_{RB}	Hz	V_{RW}	V	-	-	Hz	V	
Pattern 17(3)	A_R	Io/Igr	V_{RY}	W	A_R	A_R	Io/Igr	V_{RW}	W	A_R	A	Io/Igr	V	W	A	
Pattern 18(3)	A_R	Io/Igr	V_{RY}	Wh	A_R	A_R	Io/Igr	V_{RW}	Wh	A_R	A	Io/Igr	V	Wh	A	

Combination beyond above-mentioned pattern can be set with front switch.
Note: (1) Voltage input product: Only pattern 16. (2) Current input product: Only pattern 15 (but, right sub-monitoring is blank display).
(3) Io/ Igr: Only for product with leak current measuring.