

## Clamp-on Power Meter

### Characteristics 1

Electric power analysis and power supply quality control in a single unit.

### Characteristics 2



**V Range** : 150/300/600/1000 V

**A Range** : Minimum 200.0mA (96036)

Maximum 3000A (96034/35)

**Measuring Mode** : All items can be measured at the same time

Instantaneous Value (Wave form) / Electric Energy / Demand / Harmonics / Voltage Fluctuation

**Wiring** : 1 phase 2W, 1 phase 3W, 1 phase 3W3i (Neutral line current)

3 phase 3W2i, 3 phase 3W3i (3-wattmeter method), 3 phase 4W,

3 phase 4W4i (Neutral line current)

**Multiple System Load Measurement** :

1 phase 2W X2/ X3/ X4, 1 phase 3W X2, 3 phase 3W X2,

SCOTT Wiring (1 phase 3W +3 phase 3W)

**Data Saving** : PC Card, Internal Memory (1MB)

**Data Saving Interval** :Standard 1/2/5/10/15/30 sec 1/2/5/10/15/30/60 min

Short time 1 Cycle/0.1/0.2/0.5 sec (Only for Instantaneous Value)

**Function** : Leak Current

Analog I/O

Wiring & Setting Check

Display Hard Copy, Instantaneous Value Data Saving

## Input

Item	Voltage (V)	Current (A)	
Input type	Resistive potential division	Clamp detection	
Rated Value (Range)	150.0/300.0/600.0/1000V	96036 (2A) 96033 (50A) 96030 (200A) 96031 (500A) 96032 (1000A) 96034 3000A range 2000A range 1000A range 96035 3000A range 300A range	200.0/500.0mA/1.000/2.000A 5.000/10.00/20.00/50.00 A 20.00/50.00/100.0/200.0 A 50.00/100.0/200.0/500.0 A 200.0/500.0 A/1.000 kA 300.0/750.0 A/1.500/3.000 kA 200.0/500.0 A/1.000/2.000 kA 100.0/200.0/500.0 A/1.000 kA 300.0/750.0 A/1.500/3.000 kA 30.00/75.00/150.0/300.0 A
Phase/Wiring Measurement	1P2W/1P3W/1P3W3i(Nutral line current)/3P3W2i(2-wattmeter method)/3P3W3i(3-wattmeter method),3P4W/3P4W4i(Nutral line current), SCOTT wiring (1P3W + 3P3W)		
Number on measurement system	Common Voltage 1P2W: 4 system load/ 1P3W: 2 system load/ 3P3W2i: 2 system load		
Input resistance	Approximately 1.3M $\Omega$	Approximately 100k $\Omega$ (CW240)	
Maximum allowed continuous input	1000Vrms	96036 (2A) 96033 (50A) 96030 (200A) 96031 (500A) 96032 (1000A) 96034 3000A range 2000A range 1000A range 96035 3000A range 300A range	20Arms 130Arms 250Arms 625Arms 700Arms 2400Arms 2400Arms 1200Arms 3600Arms 360Arms
AD conversion	Simultaneous inversion of Voltage/Current input, PPL synchronism		

## Measurement function

Parameter	Voltage	Current/Active Power/Reactive Power <sup>1</sup> (Use reactive-power meter method)
Method	Digital sampling	
Frequency range	45Hz to 65Hz (Select measurement element from U1, U2 or U3)	
Crest factor	3 for rated input (1.8 for 1000 range)	
Accuracy	$\pm 0.2\%$ rdg. $\pm 0.1\%$ rng.	96030, 96031, 96033, 96036 $\pm 0.6\%$ rdg. $\pm 0.4\%$ rng. 96032, 96034, 96035 $\pm 1.0\%$ rdg. $\pm 0.8\%$ rng.
Power factor effects	—	96030 $\pm 1.0\%$ rng. (45 to 65Hz, Power factor = $\pm 0.5$ ) $\pm 2.0\%$ rng. (45 to 65Hz, Power factor = $\pm 0.5$ ) Except 96030
Effect of reactive factor	—	96030 $\pm 1.0\%$ rng. (45 to 65Hz, Power factor = $\pm 0.5$ ) $\pm 2.0\%$ rng. (45 to 65Hz, Reactive factor= $\pm 0.5$ ) Except 96030
Valid input range	5 to 110% for each range (Max 100% for 1000 range)	
Display Range	Voltage/Current: 0.4 to 130% for each range (Zero suppress less than 0.4%) Electric Power (Active, Reactive, Apparent) : 0 to 130% for each range (Zero suppress if less than 0.17% of range rating) Harmonics Level: 0 to 130% for each range	
Temperature coefficient	$\pm 0.03\%$ rng/ $^{\circ}\text{C}$	$\pm 0.05\%$ rng/ $^{\circ}\text{C}$
Display update period	Approximately 0.5 second	

rdg: reading rng: range

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## Frequency measurement

Measurement input	: Voltage input: Select from U1,U2 and U3
Measurement frequency range	: 45 to 65 Hz
Display Range	: 40.00 to 70.00 Hz
Accuracy	: $\pm 0.1\% \text{rdg} \pm 1 \text{dgt}$ . When sine wave input is 10 to 130% of voltage range
Low-pass filter function	: Cutoff frequency : 300Hz / On/Off setting

## Electric energy measurement

Measuring element	: Active power, Recursive power, Lag reactive power and Lead reactive power
Measurement accuracy	: Measurement Accuracy is +/- 1dgt for Active Power & Reactive Power
Measuring range	: Active power
(By setting of Range, VT ratio and CT ratio)	Consumption 0.00000 mWh to 999999 GWh Regenerative -0.00000 mWh to -999999 GWh Reactive power Lag 0.00000 mvarh to 999999 GVarh Lead -0.00000 mvarh to -999999 Gvarh"
Display digit setting function	: Auto setting by rated electric energy, Set minimum resolution, Select from minimum resolution movement by integrated value
Integration time accuracy	: $\pm 20 \text{ppm}$ (Typ. , 23 °C)

## Demand mode

Measurement element	: Active Power (consumption) , Reactive Power (Lag) , Power factor (Demand value within each interval time) , Active electric energy (Consumption, Regenerative) , Reactive electric energy (Lag/Lead) (Electric energy within each interval time) Max demand (Electric power consumption demand) value from beginning of logging measurement and its occurrence time
Measurement accuracy	: Active power, each measurement accuracy Reactive power = +/- 1 dgt.

## Harmonics mode

Method	: PLL synchronization
Measurement frequency range	: Fundamental wave frequency 45 to 65
Number of analysis order	: 1st - 50th
Window width	: 1 period
Window function	: Rectangular
Number of data analysis	: 128 points
Analysis rate	: 1 time / every 16 period
Analysis item	: Harmonics level: Each harmonic level of Voltage, Current and Electric power
	Relative harmonic content : Each relative harmonic content of Voltage, Current and Electric power
	Harmonic phase angle: Each harmonic phase angle of Voltage, Current and Electric energy
	Select fundamental wave for Voltage and Current or select fundamental wave against U1
	Total value : Total value up to 50th harmonic of Voltage, Current, Electric energy and Power factor
	Total harmonic content : Voltage and Current (THD-F or THD-R)
Accuracy	: Harmonics level
Current / Electric Power	1 to 20th : $\pm 1.5\%rdg. \pm 1.5\%rng.$
16th or later order for 96031	21 to 30th : $\pm 2.0\%rdg. \pm 1.5\%rng.$
All order for 96032	31 to 50th : $\pm 3.0\%rdg. \pm 1.5\%rng.$
Reference value	: Relative harmonic content
	+/- 2 dgt by computing from the harmonic level
	: Harmonic phase angle
	Accuracy assurance range is more than 5% of the range for both harmonic voltage of each order and current level
	1to 20th order : $\pm 5^\circ$
	20 to 50th order: $\pm 20 (0.3^\circ \times k+1^\circ)$ k : order
Display data	: List, Bar graph (linear or log) and Vector

## Waveform measurement function

Measurement elements	: Voltage/Current waveform at inphase, All voltage waveform, Select from all current waveform
Change of magnification	: 1/3 to 20 times against the rating
Display data	: 1 waveform

## Voltage fluctuation measurement function

Measurement elements	: Voltage Dip/Voltage Swell/Voltage failure
Measurement method	: Detect from voltage RMS value of 1 waveform
Threshold value/ Hysteresis	: Set % against to reference voltage
Accuracy	: Same as voltage RMS accuracy
Detection period	: Period that exceeded threshold value
Display data	: Data, Time, Voltage RMS value and detection period
number of event	: 100

## Display function

Display	: 5.7 inches STN monochrome LCD (320 x 240 pixels) with backlight
Backlight	: Auto off, ON/OFF
Contrast	: Automatic compensation and 8 level setting by ambient temperature
Display digits	: Except electric power: 4 digits Electric energy: 6 digits
Languages	: English/French/German/Italian/Spanish/Korean/Japanese French, German, Italian, Spanish and Korean languages will be added soon.
Averaging function	: Moving average method/ select from 2/5/10/20 times
Display hold function	: Hold/Release

## Save and Print function

Manually or Automatically save/print

Memory	: Internal memory: 1MB or PC card
Print	: Dedicated printer (RS-232 )
Save and print data	: All measurement item, /Set value/Screen
Save and print interval	: Standard interval: 1/2/5/10/15/30sec. /1/2/5/10/15/30/60min.

Less than 30 second interval, it impossible to output/print for harmonics measurement and waveform data.

Short time interval:  
0.1/0.2/0.5second for each waveform  
Data output item is only instantaneous value

Possible for data saving time display : Compute from free area of storage, data saved item and interval time

## File operation

File copy	: File copy from internal memory to PC card
Read set file/ Save	: Internal memory/ Reading of set file in the PC card/ Save
Deletion of file	: Delete internal set file/ Delete file in PC card
Format	: PC card/ Initialize internal memory
File saving format	: Measurement data: CSV format (Binary format when set to short time interval Waveform data : Binary format Display data : BMP format Setting data : text format Voltage dip/Swell/Data for instantaneous power failure : Text format

## Communication function

Electric specification	: EIA RS-232
Synchronism method	: Start-Stop synchronism method
Baud rate	: 1200/2400/9600/19200/38400 bps
Connector	: D-SUB 9 pin

## PC card interface

Slot	: Conforms with PC Card Standard TYPE II × 1
PC card	: Flush ATA card
Data format	: MS-DOS format
Recording contents	: Setting data/Measurement data/Display data

## External control output

Input-output for start/stop control of integrated power measurement

Control input : TTL level or contact

Control output : TTL level

## Analog input-output function (Optional)

### Analog output

Output voltage :  $\pm 1$ VDC for rated value of each range

Electric energy by output rate

Can be set magnification of 10/100 for harmonics

Frequency (0.4 to 0.7V)/ (40 to 70Hz)

Number of output : 4CH

Output data : Instantaneous value

(Select 4 items) Voltage/Current/Ave. Voltage/Ave. Current/Active power/Reactive power/Apparent power/Power factor/Phase angle/Frequency

Electric power

Active electric energy (Consumption/Regenerative) / Reactive electric energy (Lag/Lead)

Harmonic

Harmonics level for each order/ Relative harmonic content of each order/ Relative harmonic phase angle/

Total value/ THD-F/THD-R

Accuracy :  $\pm$  (Measurement accuracy +0.2%f.s.)

Resolution : Polarity + 11 bits

Updating of cycle : Except harmonic measurement: 1 cycle of input signal

Harmonic measurement elements: 16 cycle of input signal

Temperature coefficient : less than  $\pm 0.02\%$ f.s./ $^{\circ}$ C

Output resistance :  $22\ \Omega \pm 5\%$

Electric energy output rate : Select from 1V/1kWh, 1V/5kWh, 1V/10kWh, 1V/50kWh, 1V/100kWh, 1V/500kWh, 1V/1000kWh

### Analog input

Input range : 100mV/1V/5VDC

Number of input : 2CH

Accuracy :  $\pm 0.5\%$  f.s.

Resolution : Polarity + 11 bits

Sampling rate : About 20m sec.

Input resistance : About 100k  $\Omega$

## Clock function

Auto calendar/Leap year auto detection/24 hour clock

Actual time accuracy :  $\pm 20$ ppm (Typ., 23  $^{\circ}$ C)

## Wiring error check function

Voltage/Current input value, Voltage/Current phase difference, Check rightness of frequency measurement

Check single phase load connection for SCOTT wiring

Wiring diagram, Vector diagram display

## Setting confirmation display

Data saving item at integrated power measurement

## Other function

VT/CT ratio setting/ID number setting/NiMH battery charging/Battery power display/Beep sound (Confirmation of key operation)/Key lock/System reset

## General Specification

Environmental requirements	: Indoor usage at an altitude of 2,000 meters or less
Storage temperature and humidity ranges	: -20 to 60 °C, 90 %RH (no condensation)
Usage temperature and humidity ranges	: 5 to 40°C, 5 to 80%RH (no condensation)
Insulating resistance	: DC500V 50M Ω or greater Between voltage input terminals and case Between voltage input terminals and current input terminals/ Terminal for DC power/ Between external interface terminals
Withstand voltage (50/60Hz, 1 minute)	: AC5.55 kVrms/1 min (sensed current 1mA) Between voltage input terminal and main unit case AC3.32 kVrms/1 minute (sensed current 1mA) Between Voltage input terminal to Current input terminal, DC power supply terminal and External interface terminal
Power supply	: AC adapter 100 to 240V 50/60Hz
Alternative power supply	: NiMH battery (Sell separately) Battery: AA size alkaline battery X 6 (batteries included)
MAX rated apparent power	: Main unit: About 10W (Normal operation)/ About 20W (In case of charging NiMH) AC adapter : About 30VA (with normal operation) , About 60VA (when charging NiMH)
Size	: About 206(W)×184(H)×65(D)mm (not including prong)
Weight	: About 1.2kg (without batteries)

## Accuracy assurance condition

Warm up time	: more than 30 minutes / Valid input range, Sine wave input and Power factor = 1 (with PPL synchronization)
Accuracy assurance temperature & RH range	: 23±5 °C 30 to 75%Rh
Accuracy assurance frequency range	: 45 to 65Hz
Accuracy warranty period	: 1 year

## Accessories (supplied with purchase of the main unit)

91007 Voltage probes (Black, Red, Yellow and Blue 1 cable each/ cable length is 3m)
AC adapter x 1
AA size alkaline battery x 6
ToolBox240 . . . CD-ROM
User's Manual x 1, CD-ROM x 1
Quick manual x 1, CD-ROM x 1
Communication function manual (CD-ROM) x 1

## Computing equation

Active power, Reactive power, Apparent power, Power factor and Phase angle (for phase angle, measured value for each phase)

Average value during the integration measurement, Max value and Min value

Voltage RMS value

Voltage RMS value

$$U_{m\,rms} = \sqrt{\frac{1}{T} \int_0^T u_m(t)^2 dt} = \sqrt{\frac{1}{T} \sum_{t=0}^T u_m(t)^2}$$

Current RMS value

$$I_{m\,rms} = \sqrt{\frac{1}{T} \int_0^T i_m(t)^2 dt} = \sqrt{\frac{1}{T} \sum_{t=0}^T i_m(t)^2}$$

Active power

$$P_m = \frac{1}{T} \int_0^T \{u_m(t) \times i_m(t)\} dt = \frac{1}{T} \sum_{t=0}^T \{u_m(t) \times i_m(t)\}$$

Reactive power 1

When using reactive watt meter method

$$Q_m = \frac{1}{T} \int_0^T \left\{ u_m(t) \times i_m\left(t + \frac{T}{4}\right) \right\} dt = \frac{1}{T} \sum_{t=0}^T \left\{ u_m(t) \times i_m\left(t + \frac{T}{4}\right) \right\}$$

u(t) : Input signal for voltage

i(t) : Input value for Current

T : Input signal for 1 cycle

m : Phase

		1P3W	3P3W *6 2-wattmeter method	3P3W 3-wattmeter method	3P4W
Ave. Voltage	U ave.	(U1+U2)/2	(U1+U2+U3)/3 *1		
Ave. Current	I ave.	(I1+I2)/2	(I1+I2+I3)/3 *2		
Active power	$\sum P$	P1+P2	P1+P3	P1+P2+P3 *4	
Reactive power 2 *3	$Q = \sqrt{S^2 - P^2}$	$\sum Q$	Q1+Q2	$\sqrt{\sum S^2 - \sum P^2}$	Q1+Q2+Q3 *4
Apparent power	S=U×I	$\sum S$	S1+S2	$\frac{\sqrt{3}}{2}(S1+S3)$	S1+S2+S3 *4
Power factor	No use of reactive wattmeter method *5	$\sum PF$	$\sum PF = \frac{\sum P}{\sum S}$		
	Use reactive wattmeter method	$\sum PF$	$\sum PF = \frac{\sum P}{\sqrt{\sum P^2 + \sum Q^2}}$		
Phase angle *5	$\sum PA$	$\sum PA = \cos^{-1} \sum PF$			

Note : For distortion wave input: There may be discrepancies between the CW240 and other instruments that operate based on other measurement principals.

\*1 : Line voltage for 3P3W / Phase voltage for 3P4W

\*2 : Result of I2 will be derived from vector computation when using 3P3W (2 wattmeter method)

\*3 : Case of not using reactive watt meter method. In this case, do computation for each phase by multiply polarity of Q at reactive power meter method.

\*4 : Case of using 3P3W, voltage that apply for calculating each phase electric power is the phase voltage from virtual midpoint.

\*5 : Computation for each phase by multiply polarity of Q at reactive power meter method.

\*6 : Case of unbalance input at 3P3W (2 wattmeter method), there may be discrepancies between CW240 and other instruments that operated based on other measurement principals.

P1,P3,Q1,Q3,S1,S3,PF1 and PF3 are value for computing process of 2 wattmeter method, and that value have no physical meaning.



## Data Memory

All general measurement data items, Electric energy/Demand measurement, Voltage fluctuation measurement in case of saving data.

Phase/wiring Measurement		1P2W /4system load	1P3W /2system load	1P3W 3i	3P3W2i/ 2system load	3P3W3i, 3P4W	3P4W 4i	SCOTT wiring
Number of data items		168	196	114	208	138	142	216
Memory	Interval							
PC card (64MB)	1s	9hours	8hours	14hours	8hours	12hours	12hours	7hours
	1min	24days	21days	37days	20days	30days	30days	19days
	60min	1471days	1304days	2223days	1232days	1852days	1802days	1188days
Internal memory (1MB)	1s	8min	7min	12min	7min	10min	10min	6min
	1min	8hours	7hours	12hours	7hours	10hours	10hours	6hours
	60min	21days	18days	32days	17days	26days	26days	17days

All general measurement data items, Electric energy/Demand measurement, Harmonics measurement data (all), Waveform measurement data, Voltage fluctuation measurement in case of saving data.

Phase/wiring Measurement		1P2W /4system load	1P3W /2system load	1P3W3i	3P3W2i /2system load	3P3W3i, 3P4W	3P4W4i	SCOTT wiring
Number of data items		5624	5052	3758	6888	4390	5002	7504
Memory	Interval							
PC card (64MB)	1min	17hours	19hours	26hours	14hours	22hours	19hours	13hours
	60min	44days	49days	65days	35days	56days	49days	32days
Internal memory (1MB)	1min	12min	13min	19min	8min	16min	13min	7min
	60min	12hours	13hours	19hours	8hours	16hours	13hours	7hours

General measurement data items, Frequency measurement, Voltage fluctuation measurement in case of saving data.

Phase/wiring Measurement		1P2W /4system load	1P3W /2system load	1P3W3i	3P3W2i /2system load	3P3W3i, 3P4W	3P4W4i	SCOTT wiring
Number of data items		28	22	15	25	16	17	27
Memory	Interval							
PC card (64MB)	1cycle	2hours	3hours	3hours	2hours	3hours	3hours	2hours
	100ms	12hours	15hours	19hours	13hours	18hours	18hours	12hours
	200ms	25hours	30hours	39hours	27hours	37hours	36hours	25hours
	500ms	62hours	75hours	98hours	68hours	94hours	90hours	64hours
Internal memory (1MB)	1cycle	1min	2min	3min	1min	2min	2min	1min
	100ms	10min	12min	16min	11min	16min	15min	10min
	200ms	21min	25min	34min	23min	32min	31min	22min
	500ms	54min	65min	85min	59min	82min	78min	55min

Subject change without notice.