YOKOGAWA

CW140

CLAMP ON POWER METER

- Easy-to-view LCD screen (5.9 inches, 320×240 pixels)
- Internal memory for storing measurements and settings

A single CW140 power meter can measure the loads on two power systems.

Instant Measure

Electric energy Measure

Demand Measure

Harmonics Measure

CE

Energy-saving equipment

NEW

Support for a variety of connection types

The CW140 has connectors for 4 current sensing clamps.

Useful functions

The CW140 has a variety of useful functions designed for a variety of measurement-site applications.

Data management features(for energy-saving data and harmonics data)

- In addition to internal memory, the CW140 supports a floppy disk drive (sold separately) connection for saving data to 3.5-inch floppy disks.
- The CW140 can be connected to a PC through an RS-232C connection for data transfers. A printer (optional accessorie) can also be connected to print out hard copies.

• The display screens contain some composite photos.

CW140

Yokogawa M&C Corporation

Bulletin CW140-E

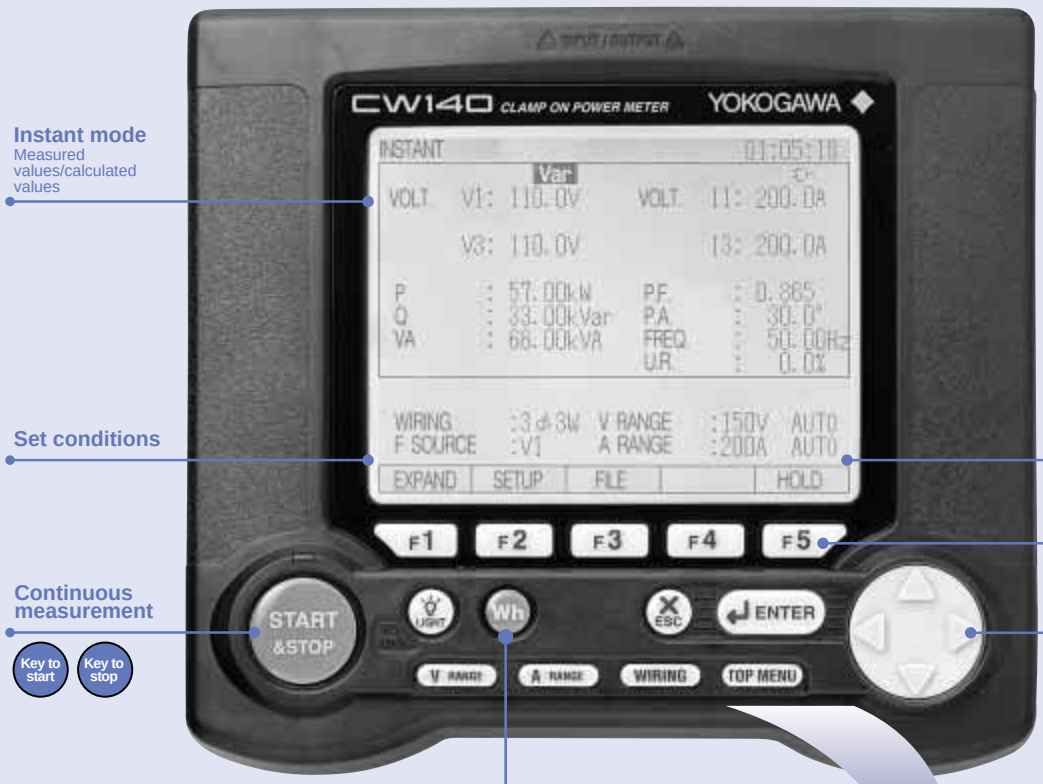
Easy-to-view LCD screen

English-language display

The CW140 has an LCD screen (5.9 inches, 320×240 pixels) and displays values corresponding to displayed (measured) parameters. The values and the scientific units on which they are based are easy to view.

Easy-to-view screen

Function key action and messages relating to procedures are displayed on the screen, making the CW140 easier to use.



Wh Measurements using the watt-hour key

Useful functions

Increased speed

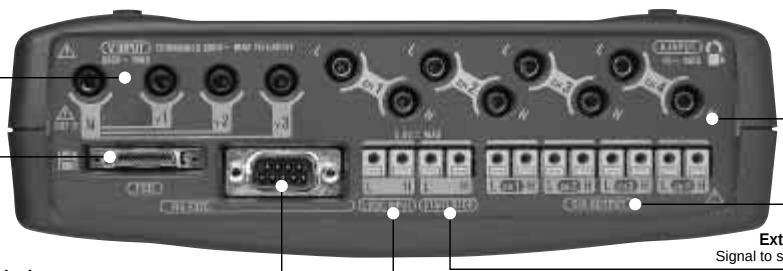
Frequently used actions in electric energy mode are simplified.

Set conditions can be saved to internal memory. (In addition to the conditions which were valid at the end of the previous session, setting conditions 1 through 4 can be saved.) With this capability, even if the power is turned off and measurements are interrupted, the same condition settings will be used the next time the power is turned on. This makes it possible to continue the measurement process without difficulty.

Enlarged display screen

Easy-to-view screen

In instant measure, you can enlarge the display of three desired parameters.



Load measurements on two systems

CW140

A single CW140 power meter can measure the loads on 2 power systems sharing a common supply voltage.

The CW140 has connectors for 4 current sensing clamps.

Useful functions

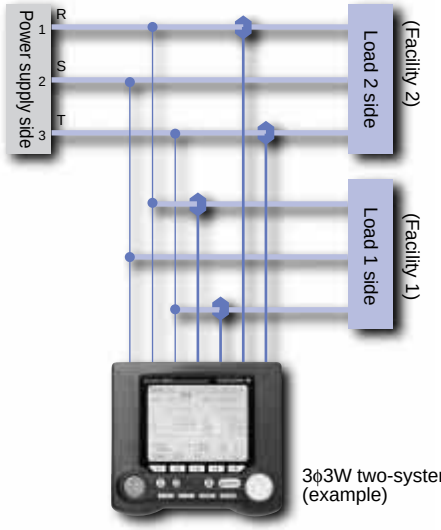
Support for a variety of connection types

2-system load measurement (functions)

In addition to support for a variety of connection types (from 1ϕ2W to 3ϕ4W), the CW140 can simultaneously measure the loads* (facilities, equipment) on two systems sharing a common supply voltage.

- Supported connection types
  1ϕ2W, 1ϕ3W, 3ϕ3W2i, 3ϕ3W3i, 3ϕ4W
- 2-system load measurements
  1ϕ2W×2, 1ϕ3W×2, 3ϕ3W×2
  (2-system load measurements are not supported in harmonics mode.)
- Because the CW140 supports 2 system loads, as many as 4 current sensing clamps can be connected.)

3ϕ3W Two current systems (example)



3ϕ3W two-system load (example)

Four modes for a variety of applications

CW140

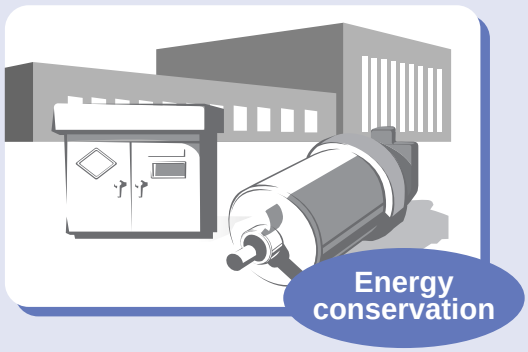
A single CW140 unit can be used for basic power measurement and analysis.

The CW140 has 4 measurement modes to support power-related measurements at a variety of measurement sites.

Useful functions

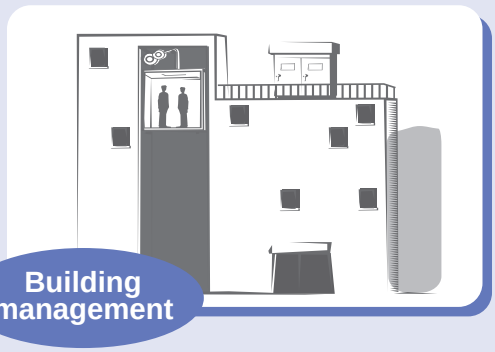
A wide range of applications
Instant mode, electric energy mode, demand mode, harmonics mode

•Factory energy conservation data



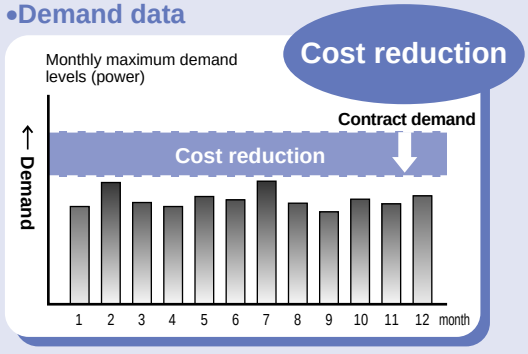
Energy conservation

•Maintenance and periodic check data



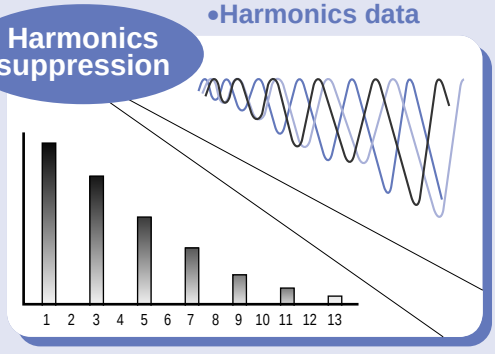
Building management

•Demand data



Cost reduction

•Harmonics data



Harmonics suppression

A variety of application-specific functions

Useful functions for specific applications and measurement sites

Useful functions

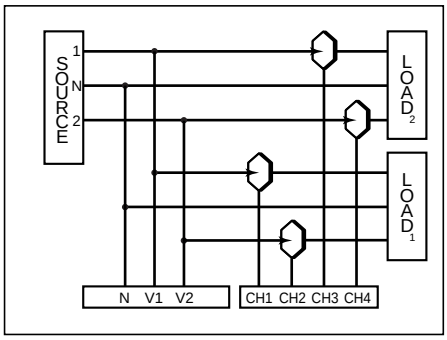
Wiring error check function

Safety design

This function is used to check for wiring errors and select connections using the WIRING key.

- **Five checks**
  - VOLTAGE INPUT
  - CURRENT INPUT
  - VOLT. PHASE SEQUENCE
  - CLAMP DIRECTION ERR.
  - FREQUENCY SOURCE
- **Error message and connection diagram display**
  A function is provided to display an error message or a connection diagram if an error occurs in any of the above five checks.

Wiring error check function
Connection diagram display screen (for 1φ3W×2)



Useful functions

Power supplies

Three power supply types

The CW140 can be powered through an AC adapter, as well as two types of batteries.

The AC adapter is useful for continuous measurements over an extended period of time. Batteries are useful for shorter-length measurements in areas where AC power is not available.

- **AC adapter** **(Standard accessory)**
- **AA alkaline dry cells (6)** **(Standard accessory)**
- **Rechargeable nickel metal-hydride (NiMH) battery** **(Optional accessory)**

Example running times with batteries

For normal operations (LCD backlight off, floppy disk drive not connected)

- AA alkaline dry cells : approx. 3 hours
- NiMH battery : approx. 7 hours

(Actual running times vary depending on usage conditions.)

Useful functions

Continuous measurement

Advanced data management

The CW140 supports continuous measurement, which is useful for data management, in all measurement modes. In addition, the user can select the method for starting and stopping continuous measurement.

- **Instant mode : LOGGING**
- **Electric energy mode : INTEGRATE**
- **Demand mode : DEMAND**
- **Harmonics mode : LOGGING**

User-selectable continuous measurement start/stop method

START	STOP
• TIME	• TIME
	• TIMER
• TRIGGER	• TRIGGER
• MANUAL	• MANUAL

Useful functions

Event input

Advanced data management

The CW140 has a function for receiving a 0-5V signal indicating whether the load (facilities, equipment) is on or off. This is used when measuring (saving) continuous data, such as the power level. This makes it possible to manage load operations in association with the power level and other data.

Useful functions

Functions

Clock, displayed language switch (Japanese, English), displayed value hold, NiMH battery charging, LCD contrast, LCD backlight, beep (key action confirmation), key lock, power saving mode, system reset, low-battery indication.

Advanced data management

Data collected by the CW140 can be used as part of an energy conservation program.

Data management

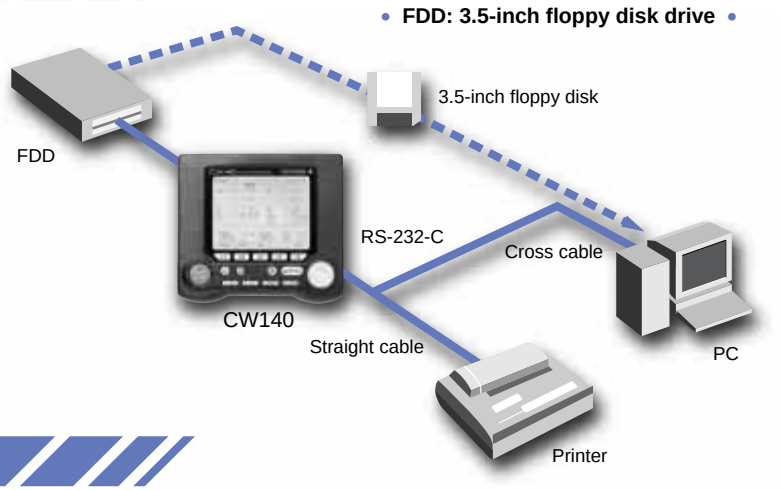
Internal memory, floppy disk drive

- Measurement data can be stored in the internal memory.
- When a floppy disk drive (sold separately) is connected, measurement data can be saved to a 3.5-inch floppy disk.
- The CW140 also has a function for copying internal memory data (files) to a floppy disk.
- Data can also be saved simultaneously to both internal memory and a floppy disk.

Saving data (example)

For electric energy mode (3ϕ3W)

Saved data	: 4 parameters
Output interval	: 30 minutes
Internal memory	: approx. 187 days
Floppy disk (1.44MB)	: approx. 292 days



Data communication (RS-232C)

PC, printer

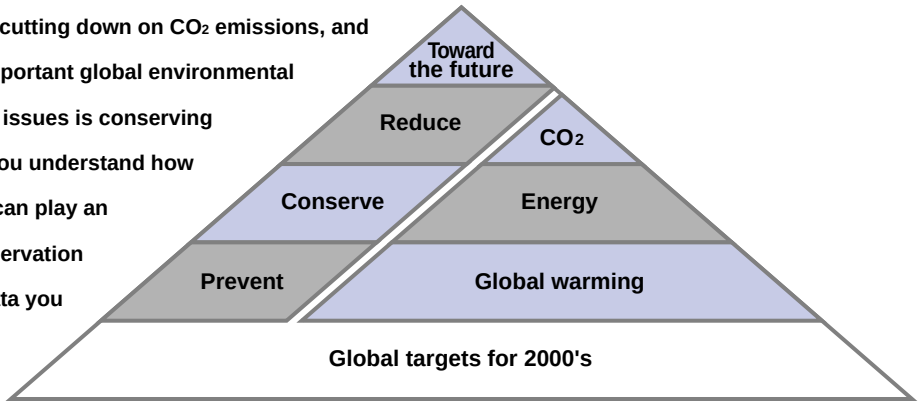
- You can connect the CW140 to a PC through the RS-232C in order to transfer measurement data.
- You can also connect a printer through the RS-232C interface in order to print hard copies of measurement data.

D/A output function (optional)

- The CW140 supports D/A output (1V output voltage) on 4 channels.

Power data → **Energy conservation data**

Conserving limited energy resources, cutting down on CO_2 emissions, and preventing global warming are now important global environmental issues. One important aspect of these issues is conserving electricity. By providing data to help you understand how you currently use energy, the CW140 can play an important role in creating energy conservation programs. The CW140 provides the data you need to find ways to conserve energy.



Energy conservation applications

- Data obtained in electric energy mode and demand mode are based for energy conservation applications.
- Measurement data are saved in CSV format, and can be used to create graphs, etc. using off-the-shelf spreadsheet programs.

Obtaining smoother loads

CW140

Criteria for reviewing contracted power levels

Electric energy mode and demand mode

Electric energy mode

Increased speed

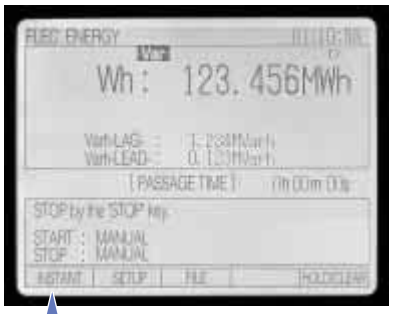
The integrated power level for a set time period (from the start to the end of the integration period) is measured, calculated, and displayed.

Useful functions

Frequently used electric energy mode actions, such as setting conditions, are simplified.

Wh **Simplified actions with the watt-hour key**

(Used to save the settings which were current the last condition and to save setting conditions 1 through 4.)



Electric energy mode

Integrated value screen
Instantaneous value screen — Switch

Demand mode

The demand time limit is the length of time specified for determining the average power.
Demand power is the average power during the demand time limit period.

Useful functions

The CW140 lets you set the demand time limit.

- Demand time limit settings 5, 10, 15, or 30 minutes
  1, 2, 3, 4, 6, 8, 10, or 12 hours

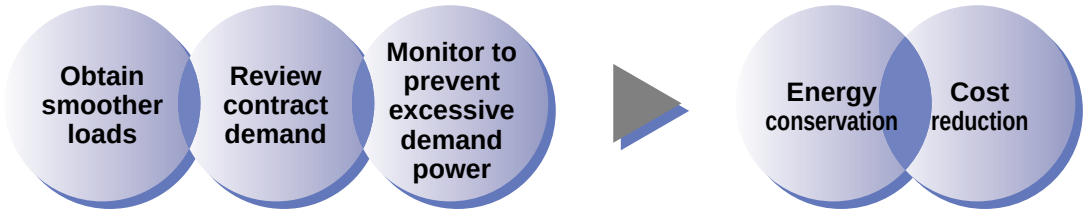
- **Reference power setting**

The reference power can be set in the range of 1 to 1000 kW.
DEM. OVER is displayed if the demand power (demand) exceeds the reference power.

- **Maximum demand power (maximum demand) and the time that maximum demand occurs are displayed.**

Demand screen

Demand screen
Instantaneous value screen — Switch



Instant mode

In this mode, the CW140 measures, calculates, and displays voltage and current RMS values as well as active power, reactive power, apparent power, power factor, phase angle, frequency, and (with 3-phase) unbalanced rate. (Reactive power can be calculated either with or without the reactive power meter method.)

Useful functions

Function keys can be used to switch to the instantaneous value display screen even when measurements are being performed using electric energy mode or demand mode (does not apply to unbalanced rate).

Harmonics mode (standard)

1st through 13th-order graph displays

Harmonics mode is a standard feature with the CW140.

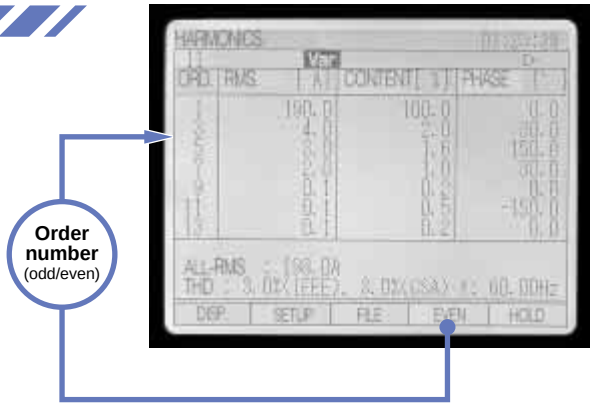
- Phases and wiring : 1φ2W, 1φ3W, 3φ3W, 3φ3W3i, 3φ4W
- Measurement frequency : 45-65 Hz (fundamental wave frequency)
- Analysis orders : 1st through 13th

The CW140 can perform analysis of 1st through 13th orders serving as a basis for harmonics analysis. Such analyses can be used as basic data in controlling harmonics that occur when electrical facilities are used.

Harmonics mode

Table displays

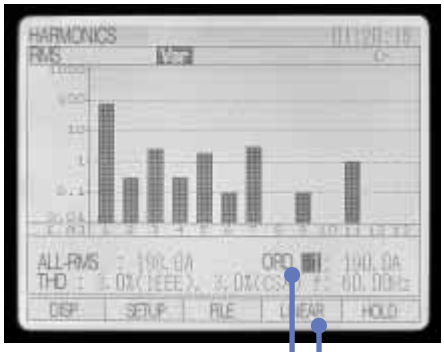
Voltage/current	Power
RMS, contentrate, phase angle	Power level, power content, power phase angle
All-RMS	All-Power
Total harmonic distortion IEEE: Distortion relative to fundamental wave CSA: Distortion relative to All-RMS	All-Power Factor
Fundamental wave frequency	Fundamental wave frequency



Order number (odd/even)

Graph displays

Voltage/current	Power
Any of the following can be displayed in a graph as an analysis parameter: RMS, content, phase angle.	Any of the following can be displayed in a graph as an analysis parameter: power factor, power factor content, power factor phase angle



Vertical axis Linear/log

Easy-to-view screen

First-order through thirteenth-order analysis parameter values can be displayed in a bar graph so that they are easy to understand. In addition, bar graph values can be displayed as numerical values.

Specifications

Harmonics mode

System	PLL synchronization
Measurement frequency range	Fundamental wave frequency 45 ≤ t ≤65 Hz
Number of analysis orders	1st-13th
FFT data length	512
FFT processing word length	32 bits
Window function	Rectangular
Sampling rate	f × 256Hz
Window width	Window width 2 periods off
Display fields	
Voltage and current	RMS, content, phase angle, All-RMS, total harmonic distortion (IEEE/CSA), fundamental wave frequency
Power	Power, power content, power phase angle, All-Power, All-Power Factor, fundamental wave frequency

Graph display	
Voltage and current	All-RMS, content, phase angle
Power	power, power content, power phase angle
Display accuracy	RMS, power ±(1.5% rdg + 1.5% rng) <1>
Content	Value calculated from <1> ±2 dgt
Phase angle	±5 deg
Total harmonic distortion	Value calculated from <1> ±2 dgt
Logging function	The logging function can be used to take continuous measurements.
START setting	MANUAL, TIME, TRIGGER
STOP setting	MANUAL, TIMER, TIME, TRIGGER
Output interval	Setting in range of 2 minutes to 1000 hours (in 1-minute increments).

The harmonic analysis function does not work with two current systems.
See page 9 for the harmonics equation.

CW140 Clamp-On Power Meter

Specifications

Input

Input	Input Voltage (V)	Current (A)
Input type	Resistive potential division	Clamp sensing
Ratings (ranges)	150, 300, 600 (V)	Clamp A: 20, 50, 100, 200 (A)
		Clamp C: 50/100/200/500 A
Input resistance	Approximately 1.3 MΩ	Approximately 100 kΩ (CW140)
Maximum allowed continuous input	600 Vrms	Clamp A: 250 Arms Clamp C: 625 Arms
A/D conversion	Simultaneous voltage/current input conversion, 12-bit resolution	
Range switching	Manual, automatic, and settings entered through PC	
Auto-range functions	Range up: RMS is 110% or more of range rating, or sampled value is approximately 300% or more of rating. Range down: RMS is 30% or less of range rating, or sampled value does not exceed approximately 300% of range rating after range moves down.	

Measurement functions

Parameter	Voltage	Current, active power, reactive power
Method	Digital sampling	
Frequency range	45 Hz to 1 kHz (harmonics mode: 45-65 Hz)	
Crest factor	3 (for rated input)	
Effective input range	10% to 110% of rated voltage/current range	
Temperature coefficient	± 0.03% of rng/°C	± 0.05% of rng/°C (including clamp)
Display update period	Approximately 1 sec (approximately 3 sec in harmonics mode)	

Instant mode

Display fields

Measured parameters	Voltage RMS (V), current RMS (A), active power (W), reactive power 1 (Var), frequency (Hz)
Calculated parameters	Reactive power 2 (Var), apparent power (VA), power factor, phase angle (°), 3φ unbalanced rate (°) Reactive power 1: With reactive power meter method Reactive power 2: Without reactive power meter method
Measurement accuracy	For power factor 1 (including clamp)
Voltage	45 Hz ≤ 66 Hz: ± (0.1% rdg + 0.2% rng) 66 Hz < f ≤ kHz: ± (0.2% rdg + 0.4% rng)
Current, active power, reactive power 1	45 Hz ≤ 66 Hz: ± (0.6% rdg + 0.4% rng) 66 Hz < f ≤ 1 kHz: ± (0.1% rdg + 0.8% rng)
Calculation accuracy	(reactive power 2, power factor, apparent power, phase angle)
	45 Hz to 1 kHz: (value calculated from measurement) Â} 1 dgt
Power factor effects	For 45 Hz ≤ f ≤ 66 Hz
Active power	± 1.0% rng cos φ = ± 0.5 (relative to power factor 1)
Reactive power	± 1.0% rng sin φ = ± 0.5 (relative to reactive power 1)

Logging function
The logging function can be used to take continuous measurements.

Start setting:	Manual, specified time, external trigger (controlled)
End setting:	Manual, timer, specified time, external trigger (controlled)
Output interval:	Setting in range of 2 minutes to 1000 hours (in one-minute increments)

Equations

Voltage RMS

$$Vrms = \sqrt{\frac{1}{T}\int_0^T v(t)^2 dt} = \sqrt{\frac{1}{T}\sum_{t=0}^{T} v(t)^2}$$

Current RMS

$$Arms = \sqrt{\frac{1}{T}\int_0^T i(t)^2 dt} = \sqrt{\frac{1}{T}\sum_{t=0}^{T} i(t)^2}$$

Active power

$$P = \frac{1}{T}\int_0^T v(t)\times i(t)dt = \frac{1}{T}\sum_{t=0}^{T} v(t)\times i(t)$$

Reactive power (with reactive power meter method)

$$Q = \frac{1}{T}\int_0^T v(t)\times i\left(t+\frac{T}{4}\right)dt = \frac{1}{T}\sum_{t=0}^{T} v(t)\times i\left(t+\frac{T}{4}\right)$$

v (t), i (t): Input signals
T: One period of input signal

3φ voltage unbalanced rate

$$\text{Unbalanced rate} = \frac{Vb}{Va}\times 100\%$$

Frequency: 45-440 Hz
Calculation accuracy:
(calculation from measurement) ± 1%

• For 3φ3W

$$Va = \sqrt{\frac{1}{6}(V_{12}{}^2+V_{23}{}^2+V_{31}{}^2)+\frac{2}{\sqrt{3}}\sqrt{V_s(V_s-V_{12})(V_s-V_{23})(V_s-V_{31})}}$$

$$Vb = \sqrt{\frac{1}{6}(V_{12}{}^2+V_{23}{}^2+V_{31}{}^2)-\frac{2}{\sqrt{3}}\sqrt{V_s(V_s-V_{12})(V_s-V_{23})(V_s-V_{31})}}$$

$$Vs = \frac{1}{2}(V_{12}+V_{23}+V_{31}) \qquad V_{12}, V_{23}, V_{31}$$

• For 3φ4W
In the equations, substitute V_{1n}, V_{2n}, V_{3n} or the 3φ3W voltages between wires.

	Reactive power (without reactive power meter method)	Apparent power	Power factor	Phase angle
1φ2W	$Q=\sqrt{(VA)^2-P^2}$	VA = V × A	With reactive power meter $P/\sqrt{P^2+Q^2}$ Without reactive power meter P / VA	With reactive power meter $\cos^{-1}(P/\sqrt{P^2+Q^2})$ Without reactive power meter $\cos^{-1}$ (P / VA)
1φ3W	Q i= $\sqrt{(VAi)^2-Pi^2}$ i=1,2 ΣQ=Q1+Q2	VAi=Vi×Ai i=1,2 ΣVA=VA1+VA2	With reactive power meter $\frac{\Sigma P}{\sqrt{(\Sigma P)^2+(\Sigma Q)^2}}$	With reactive power meter $\cos^{-1}\left(\frac{\Sigma P}{\sqrt{(\Sigma P)^2+(\Sigma Q)^2}}\right)$
3φ3W	Q i= $\sqrt{(VAi)^2-Pi^2}$ i=1,3 ΣQ=Q1+Q3	VAi=Vi×Ai i=1,3 ΣVA= $\sqrt{3}$/2(VA1+VA3)		
3φ3W3i	Q i= $\sqrt{(VAi)^2-Pi^2}$ i=1,3 ΣQ=Q1+Q3	VAi=Vi×Ai i=1,3 ΣVA= $\sqrt{3}$/2(VA1+VA3)	Without reactive power meter ΣP/ΣVA	Without reactive power meter $\cos^{-1}$(ΣP/ΣVA)
3φ4W	Q i= $\sqrt{(VAi)^2-Pi^2}$ i=1,2,3 ΣQ= Q1+Q2+Q3	VAi=Vi×Ai i=1,2,3 ΣVA= VA1+VA2+VA3		
Calculation range	The ratings depend on the ranges for V and A.	The ratings depend on the ranges for V and A.	-1 ～ +1	-180 ～ +180
Display resolution	Same as for active power.	Same as for active powaer	±1.000	±180.0

• For distortion wave input: There may be discrepancies between the CW140 and other instruments that operate based on other measurement principles.
• Power factor and phase angle polarity : Determined by reactive power polarity.
• If either voltage or current input is 0.4% or less of range rating:
0 (zero) is displayed for Reactive power 2* and apparent power.
———(dashes) are displayed for factor and phase angle.
Reactive power 2*: without reactive power meter method.

Frequency measurement

Measurement input	Voltage input: V1, V2, V3	Select one of the parameters on the left.
	Current input: CH1, CH2, CH3, CH4	
Measurement frequency range	45 Hz to 1 kHz (harmonics mode : 45 –65Hz)	
Accuracy	±(0.1% rdg + 1 dgt)	

Low-pass filter function
The low-pass filter function can be set in the system settings.
Cutoff frequency: 300 Hz

Electric energy mode

Display fields	Integrate screen	Active power (Wh), recursive power (Wh), lag reactive power (Varh), lead reactive power (Varh)
	Instant screen	Instantaneous value measurement function measurement/calculated value display screen (does not apply to unbalanced rate)
Display accuracy	Instantaneous value measurement function active power measurement accuracy ±1 dgt	
Integration function settings		
	Start setting	Manual, specified time, external trigger (controlled)
	End setting	Manual, timer, specified time, external trigger
Output interval	Setting in range of 2 minutes to 1000 hours (in 1-minute increments).	
Quick actions using Wh key.		

Demand mode

Display fields	Display during demand	Maximum demand and time of occurrence, previous power demand, power since start of demand, power during current time limit, power factor, load factor, remaining demand time
	Display after demand ends	Maximum demand and time of occurrence, average for each demand type, power from start to end of demand, average load factor
	Instantaneous screen	Instantaneous value measurement function measurement, calculated value display screen (does not apply to unbalanced rate)
Display accuracy	Instantaneous value measurement function active power measurement accuracy ±1 dgt	
Demand function settings	Demand time limit settings (output intervals)	5, 10, 15, or 30 minutes : 1, 2, 3, 4, 6, 8, 10, or 12 hours
Load factor calculation : (demand/reference power) x100%		

Display functions

Display screen	Semitransparent LCD (320x 240 pixels)
Included functions	Backlight ON/OFF, contrast adjustment
Maximum digits	
Other than power	4 digits
Power (active, reactive, recursive)	6 digits
Japanese/English language switching	

Range chart (full scale)

Voltage (V)	Phases and wiring	Current (A) range Clamp A (20-200 A)				
		20.00	50.00	100.0	200.0	500.0
150.0	1φ2W	3.000kW	7.500kW	15.00kW	30.00kW	75.00kW
	1φ3W	6.000kW	15.00kW	30.00kW	60.00kW	150.0kW
	3φ3W	6.000kW	15.00kW	30.00kW	60.00kW	150.0kW
	3φ4W	9.000kW	22.50kW	45.00kW	90.00kW	225.0kW
300.0	1φ2W	6.000kW	15.00kW	30.00kW	60.00kW	150.0kW
	1φ3W	12.00kW	30.00kW	60.00kW	120.0kW	300.0kW
	3φ3W	12.00kW	30.00kW	60.00kW	120.0kW	300.0kW
	3φ4W	18.00kW	45.00 kW	90.00kW	180.0kW	450.0kW
600.0	1φ2W	12.00kW	30.00kW	60.00kW	120.0kW	300.0kW
	1φ3W	24.00kW	60.00kW	120.0kW	240.0kW	600.0kW
	3φ3W	24.00kW	60.00kW	120.0kW	240.0kW	600.0kW
	3φ4W	36.00kW	90.00kW	180.0kW	360.0kW	900.0kW

Current range Clamp A: 20, 50, 100, 200 (A)
Clamp C: 50, 100, 200, 500 (A)

Averaging function

The averaging function can be set through system settings.
Moving average type Number of averages: Set between 2 and 10.

Scaling function

The VT ratio and CT ratio settings can be set through system settings.

Setting range VT ratio: 1-10000
CT ratio: 0.01-10000

Wiring error check function

This function checks the wiring connection status based on five parame ers, and displays the results.

Save and print functions (file functions)

Internal memory	1 MB
Floppy disks	1.2 MB or 1.44 MB (only when using an externally connected floppy disk drive)
Printer	Printing (only when using an externally connected printer)
Reading	Display values, set values
Saving	Display values, set parameters, set values
Printing	Display values, set parameters, set values

Communication functions (RS-232C)

Electrical specifications	As per EIA RS-232C.
Synchronization system	Start-stop synchronization
Baud rate	1200, 2400, 4800, 9600, 19200 bps

Harmonics mode equations

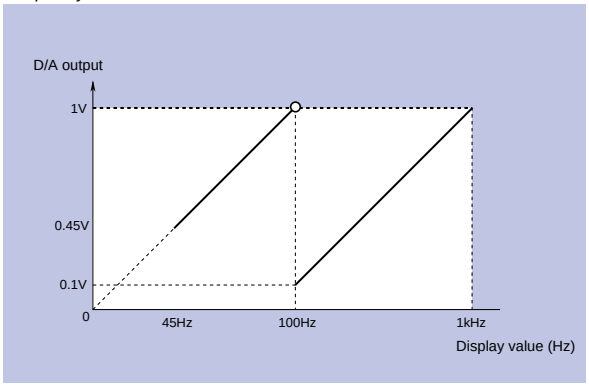
	Equations
Voltage RMS Current RMS	$Vn=\sqrt{\frac{(Vnr)^2+(Vni)^2}{2}}$ $An=\sqrt{\frac{(Anr)^2+(Ani)^2}{2}}$
RMS nth order content	$\frac{n\text{th order RMS}}{\text{fundamental wave RMS}}\times 100\%$
RMS phase angle	$\theta n=$ (nth order harmonic voltage phase) - (fundamental wave phase) $\times n$ $=\tan^{-1}(\frac{Vnr}{Vni})-\{\tan^{-1}(\frac{V1r}{V1i})\}\times n$ $\theta n=$ (nth order harmonic voltage phase) - (fundamental wave phase) $\times n$ $=\tan^{-1}(\frac{Anr}{Ani})-\{\tan^{-1}(\frac{A1r}{V1i})\}\times n$
Total Harmonic Distortion content IEEE:	$THD(IEEE)=\sqrt{\frac{\sum_{n=2}^{13}(n\text{th order harmonic voltage (current) RMS})^2}{(\text{fundamental wave voltage (current) RMS})^2}}$
Total harmonic distortion content (CSA)	$THD(CSA)=\sqrt{\frac{\sum_{n=2}^{13}(n\text{th order harmonic voltage (current) RMS})^2}{\sum_{n=1}^{13}(n\text{th order harmonic voltage (current) RMS})^2}}$
Power	1φ2W Pn=Vnr×Anr+Vni×Ani 1φ3W Pn=P1n+P2n 3φ3W Pn=P1n+P3n 3φ4W Pn=P1n+P2n+P3n
Power nth order content	$\frac{n\text{th order active power}}{\text{fundamental wave active power}}\times 100\%$
Power phase angle	• With reactive power meter method $\theta Pn=\tan^{-1}(\frac{Qn}{Pn})$ 1φ2W Qn=Vnr×Ani-Vni×Anr 1φ3W Qn=Q1n+Q2n 3φ3W Qn=Q1n+Q3n 3φ4W Qn=Q1n+Q2n+Q3n • Without reactive power meter method $\theta Pn=\cos^{-1}(\frac{Pn}{VA})$ 1φ2W VAn=Vn×An 1φ3W VAn=V1n×A1n+V2n×A2n 3φ3W VAn=$\frac{\sqrt{3}}{2}$(V1n×A1n+V3n×A3n) 3φ4W VAn=V1n×A1n+V2n×A2n+V3n×A3n
All-RMS	$\sum_{n=1}^{13}Vn$, $\sum_{n=1}^{13}An$
All-power	$\sum_{n=1}^{13}Pn$
All-power factor	• Without reactive power meter method $\frac{\sum_{n=1}^{13}Pn}{\sqrt{(\sum_{n=1}^{13}Pn)^2+(\sum_{n=1}^{13}Qn)^2}}$ • Without reactive power meter method $\frac{\sum_{n=1}^{13}Pn}{\sum_{n=1}^{13}Pn\ (Vn\times An)}$

Data representing 512 obtained samples are put through FFT calculations to analyze the nth order harmonic components as follows.
nth order harmonic voltage RMS Vn : (Vnr, Vni)
nth order harmonic current RMS An : (Anr, Ani)
n : Number of orders
Vnr, Anr : Real-number components following FFT calculation
Vni, Ani : Imaginary-number components following FFT calculation
n : Number of orders
Vnr,Anr : Real-number components following FFT calculation
Vni,Ani : Imaginary-number components following FFT calculation
P1n–P3n : Active power (element of nthi order)
Q1n–Q3n : Reactive power (element of nthi order)
RMS phase angle: Phase angle of nth order harmonic components relative to fundamental wave component of input signal
Power phase angle: nth order current phase relative to nth order voltage

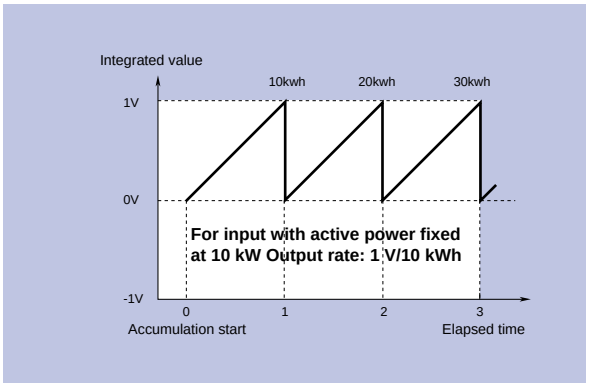
D/A output (optional)

Output voltage	± 1 V relative to rating for each range
Output current	± 1 mA(at load resistance of 1kΩ)
Number of outputs	4
Output data selection	Selected from measurement parameters for each mode.
Accuracy	±(measurement accuracy + 0.5% FS)
Updating period	Same as display updating period

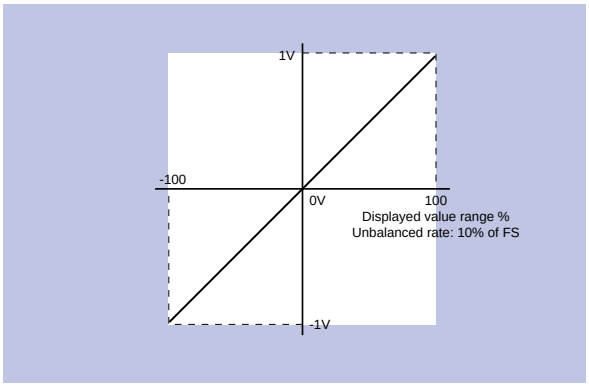
Frequency



Integrate



Other items



Externally controlled input

Inputs can be externally controlled as logging, integration, and demand start/stop signals. 0V/ 5 V

Event input

The CW140 can read a signal indicating whether the load (measured equipment) is on or off. 0V/5 V

Other included functions

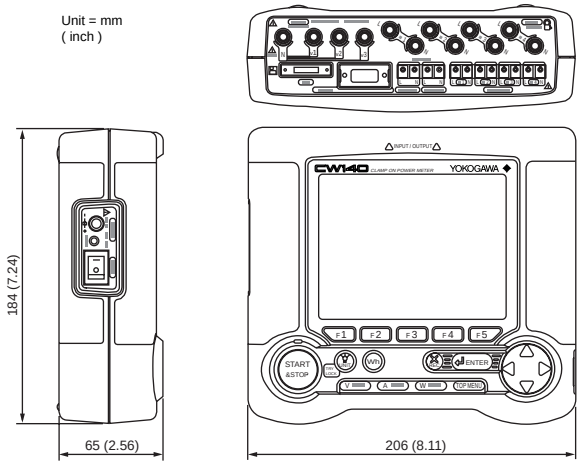
Clock, displayed language switch (Japanese, English), displayed value hold, NiMH battery charging, LCD contrast, LCD backlight, beeps (key action confirmation), key lock, power saving mode, system reset, low-battery indication

General specifications

Ambient temperature and humidity ranges	5 to 40°C, 35 to 80%RH (no condensation)		
Storage temperature and humidity ranges	-20 to 60°C, 90% RH or less (no condensation)		
Insulating resistance	50 MW or more at 500 V DCAcross voltage input • Between voltage input terminals and case • Between voltage input terminals and follouing <1> to <5> terminals <1> Current input terminal <2> Communication terminal <3> Floppy disk drive connector <4> D/A output terminal <5> Control input terminal • Between voltage input terminals and AC adapter power line • Between case and ACadapter power line		
Insulating withstand voltage	3700 V AC for 1 minute • Between voltage input terminals and case • Between voltage input terminals and follouing <1> to <5> terminals 2300 V AC for 1 minute • Between voltage input terminals and AC adapter power line • Between case and ACadapter power line		
Power supply			
AC voltage (Standard accessorie)	AC adapter: 100-240 V (50/60 Hz)		
NiMH battery (Optional accessorie)	NiMH battery pack (rechargeable while installed in CW140) Running time: approx. 7 hours (with LCD backlight off and with no floppy disk drive connected) Recharging time: approx. 1.5 hours		
AA alkaline dry cells (6) (Standard accessorie)	Running time: approx. 3 hours (with LCD backlight off and with no floppy disk drive connected)		
Power consumption	approx. 3 VA (typical) (with LCD backlight off and with no floppy disk drive connected)		
External magnetic field effects	Within precision range at 400 A/m		
External dimensions	Approximately 206 (W) × 65 (H) × 184 (D) mm		
Weight	Approximately 1.2 kg (batteries not included)		
Terminals	Voltage input	4 terminals	Banana terminals (safety terminals)
	Current input H/L	4 terminals	Banana terminals (safety terminals)
	External control input	H/L 2 terminals X2	Screwless terminals
	Event input	H/L 2 terminals X2	Screwless terminals
	D/A output (optional)	H/L 2 terminals X2	Screwless terminals
Accessories :	Voltage input probes(4), AA alkaline dry cells(6), AC adapter(1)		
Safety standard	EN61010-1,EN61010-2-031 (Over voltage Category Ⅱ 600V, Category Ⅲ 300V pollutionDegree2, Indoor use)		
Emission	EN55011-Group1, Class A		
Immunity	EN61000-6-2, EN61326		

External dimensions (CW140)

Unit = mm
(inch)



CW140 current clamp A specifications (for 20, 50, 100, and 200 A)

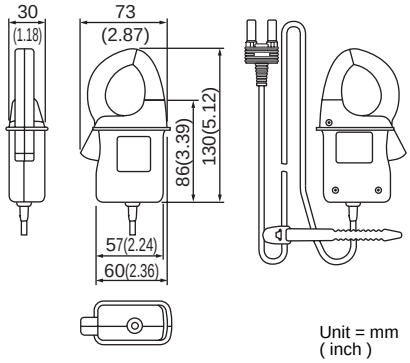
960 30

Measurement range	0-200 Arms AC (300 Apk)	
Output voltage	0-0.5 Vrms AC (2.5 mV/A)	
Accuracy	Amplitude	± 1.5% rdg ± 0.4 mV (20 Hz to 45 Hz) ± 0.5% rdg ± 0.1 mV (45 Hz to 66 Hz) ± 0.8% rdg ± 0.2 mV (66 Hz to 1 kHz) ± 2.0% rdg ± 0.4 mV (1 kHz to 20 kHz)
	Phase	± 0.5° (45 Hz to 1 kHz) (for temperature of 23°C ±5°C, relative humidity of 35-75%, and sinewave input)
Temperature coefficien	±0.05%/°C in ranges of 5-18°C and 18-40°C	
Maximum allowed current	250 Arms AC (45 Hz to 1 kHz)	
Output impedance	Approximately 6 Ω	
External magnetic field effects	0.1 A equivalent or less (at 400 A/m, 50/60 Hz)	
Connector position effects	± 0.5% (at 20-200 A, 45 Hz to 1 kHz)	
Used circuit voltage	600 Vrms AC maximum	
Withstand voltage	3.7 kVrms AC for one minute (across core and casing, and across core and output)	
Measurable connector diameter	ϕ30 mm maximum	
Operating temperature and humidity ranges	5 to 40°C, 35 to 80% RH or less (no condensation)	
Storage temperature and humidity ranges	-20 to 60°C, 90% RH or less (no condensation)	
External dimensions	approx. 73 (W) x 130 (H) x 30 (D) mm	
Weight	approx. 300 g	
Output cable length	approx. 3 meters	
Accessory	Instruction manual (1)	

960 30/960 31

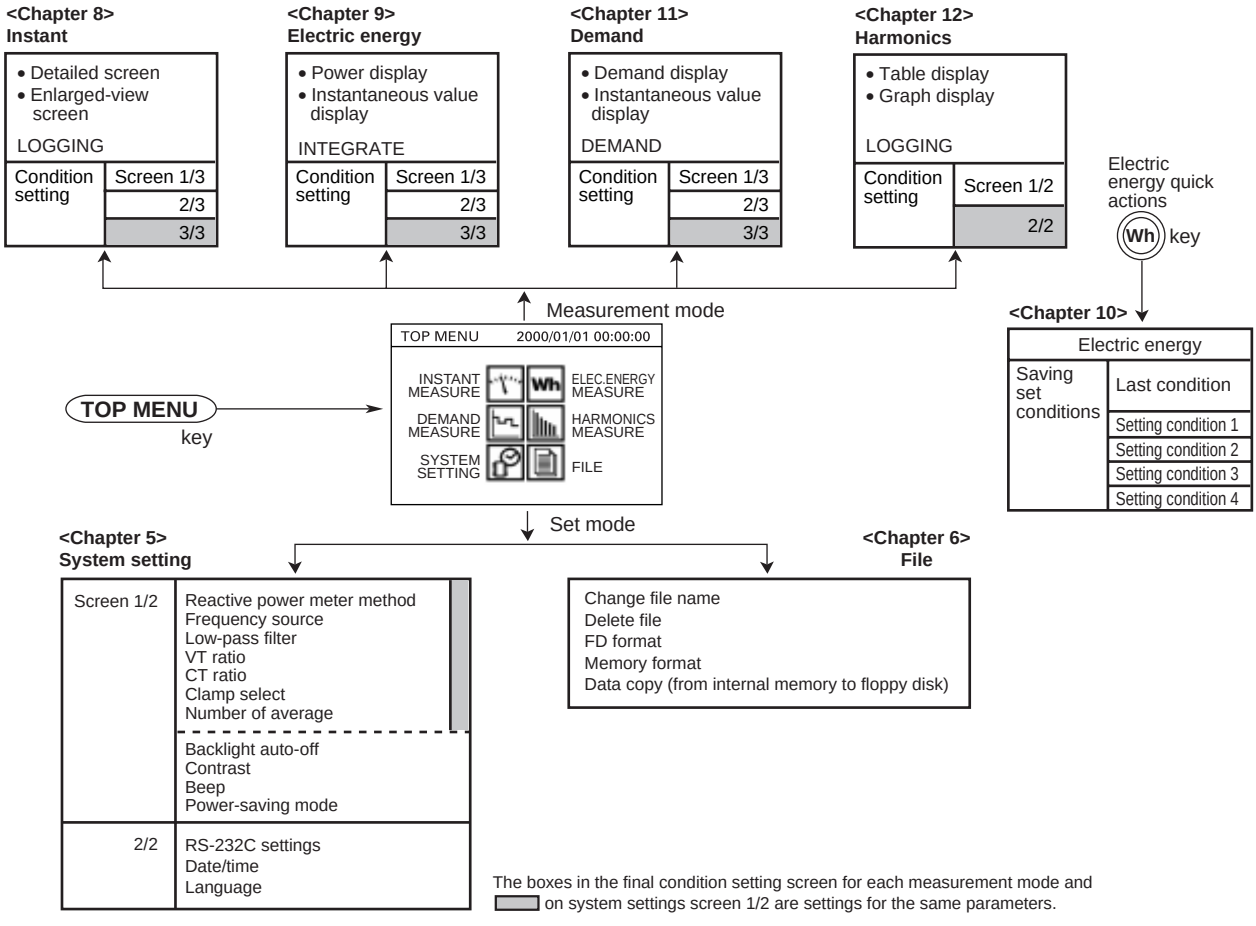
Safety standard: EN61010-1, EN61010-2-032
(Over voltage Category Ⅱ 600V, Category Ⅲ 300V
pollutionDegree2, Indoor use)
Emission: EN55011-Group1, Class A
Immunity: EN61000-6-2, EN61326

External dimensions (Clamp-on Probe)



Unit = mm
(inch)

Operation Displays (CW140)



CW140 Clamp-On Power Meter

Model name and suffix codes

Model	Suffix code	Specifications
CW140		
AC adapter	-D	Power cord : UL/CSA standard
	-F	: VDE standard
	-R	: SAA standard
	-S	: BS standard
	/DA	D/A output
	/C1	Clamp-on probe for 20/200 A (2 pcs/set)
	/C2	Clamp-on probe for 20/200 A (4 pcs/set)
	/C3	Clamp-on probe for 50/500 A (2 pcs/set)
	/C4	Clamp-on probe for 50/500 A (4 pcs/set)
	/PM1	NiMH battery pack and carrying case
	/PM2	PM1 and FDD unit

Optional accessories

Name	Model No.
Clamp-on probe (for 20/200 A)	960 30
Clamp-on probe(for 50/500A)	960 31
Voltage probes (4 pcs/set)	910 07
FDD unit	970 20
Carrying case	930 20
NiMH battery pack	940 04
Printer	970 10
AC adapter (for printer, Europe)	940 06
AC adapter (for printer, USA)	940 07
Thermal paper for printer (10 rolls)	970 80

Standard accessories

Voltage probes (4), AA alkaline dry cells (6), AC adapter (1), instruction manual

Carrying case

- The carrying case lets you carry the current clamp and voltage probes without disconnecting them from the CW140. It also holds the other accessories.

Power supplies (3 types)

- AC adapter
- AA alkaline dry cells (6)
- Rechargeable NiMH battery pack

Current clamp-on probe (for 20/200 A)

Printer

FDD unit

- 3.5-inch floppy disk drive

♦ Related Product ♦

Power monitors/POWERCERT

- For site management : PR201/UZ005
- For centralized management : UPM Series
- Portable : PR801/MCP5000

YOKOGAWA
Yokogawa M&C Corporation

World Wide Web site at
http://www.yokogawa.co.jp/MCC/Welcome_e.htm

⚠NOTICE
● Before using the product, read the instruction manual carefully to ensure proper and safe operation

YOKOGAWA M&C CORPORATION
International Sales Dept.
Kojimachi-Tokyu Bldg. 3F
6-6 Koji-machi, Chiyoda-ku, Tokyo, 102-0083 Japan
Phone: +81-3-3239-0576 Facsimile: +81-3-3239-0585

YOKOGAWA CORPORATION OF AMERICA
2 Dart Road, Newnan, GA. 30265-1094 U.S.A.
Phone: +1-770-253-7000 Facsimile: +1-770-251-2088

YOKOGAWA EUROPE B. V.
Vanadiumweg 11 Amersfoort, 3812PX THE NETHERLANDS
Phone: +31-334-64-1611 Facsimile: +31-334-64-1610

YOKOGAWA ENGINEERING ASIA PTE. LTD.
5 Bedok South Road, Singapore 469270 SINGAPORE
Phone: +65-241-9933 Facsimile: +65-241-2606

YOKOGAWA AMERICA DO SUL S.A.
Praca Acapulco, 31-Jurubatuba, Sao Paulo/SP, 04675-190 BRAZIL
Phone: +55-11-548-2666, ext. 200/320
Facsimile: +55-11-521-4653/522-5231

YOKOGAWA MEASURING INSTRUMENTS KOREA CORPORATION
City Air Tevminel Bldg., 405-9, #159-6, Samsung-dong, Kangnam-ku, Seoul, KOREA
Phone: +82-2-551-0660 to 0664 Facsimile: +82-2-551-0665

YOKOGAWA AUSTRALIA PTY. LTD.
Court D1, 25-27 Paul Street North, North Ryde, NSW 2113, AUSTRALIA
Phone: +61-2-9805-0699 Facsimile: +61-2-9888-1844

YOKOGAWA BLUE STAR LTD.
40/4 Lavelle Road, Bangalore, 560 001 INDIA
Phone: +91-80-227-1513 Facsimile: +91-80-227-4270

YOKOGAWA MIDDLE EAST E.C.
P.O.Box 10070 Diplomatic Area, Building Nos, 161, Road 4304 Area 343, Mina Sulman Industrial Area, STATE OF BAHRAIN
Phone: +973-826644 Facsimile: +973-826633

LTD. YOKOGAWA ELECTRIC
Grokholskiy per. 13, Build. 2, 4th Fioor, Moscow, 129010 RUSSIAN FEDERATION
Phone: +7-095-737-7868 Facsimile: +7-095-737-7869

Represented by:

MCK-EM7

Subject to change without notice.
[Ed: 02/b]
Printed in Japan: Jul. 2000(C)/3,000(YG)