Realization of Power & Power Quality Management using a CW240

CASE1: Get a view of energy consumption!
It is essential to measure energy and manage consumption of each sector such as facility and production line for your energy saving activities and to minimize loss.

CASE2: Contribute for improving productivity!
Constantly analyze productivity by managing unit consumption. Managing voltage, current, electric power and power factor makes for good maintenance of production facility. Moreover, you can check operation management loss and enhance productivity.

CASE3: Discover of electric power waste!
Measure and collect data of electric power consumption by short period. The CW240 can figure out load of production process, and has the ability to check wasteful time and current flow of standby load current.

CASE4: Detect voltage fluctuation!
When trouble occurs on supply side of electric power, instantaneous voltage drop can affect quality of produced goods at the factory. The CW240 is useful for collecting data such as voltage fluctuation to prevent such problems.

Characteristics of CW240
- Simultaneous measurement of instantaneous value, electric energy, demand, harmonics and voltage fluctuation.
- Simultaneous measurement of loads in 4 systems of up to 1P2W
- Simultaneous measurement of loads in 2 systems of up to 1P3P3W
- Data saving interval can be set from 1 waveform (for instantaneous measurement) to 1 hour.
- Measure up to 50th order harmonics
- 4ch leakage current measurement using newly released clamp probe 96036
- Long time data logging by using compact flash memory
- Multi language for the display (English, German, French, Italian, Spanish, Korean and Chinese)
- 2ch analog input (Optional)
  Equipped with 4ch analog output (recorder output)
- AC adaptor for power supply. NiMH rechargeable battery and alkaline battery for backup

System Configuration Block Diagram

- CW240: Simultaneous measurement using two or more CW240 units
- MV series Recorder
- MV series Recorder and JUXTA Temperature converter
- Analog input (2 channels)
- 4ch output (4 channels)
- Voltage input
- Current input (clamp)
- External contact signal
- Summarize integration measurement.
- Start or stop the measurement.
- Switches the voltage/current range to another.
- Returns to the TOP MENU.
- Turns ON/OFF the backlight (locked when held down for a while).
- Card ejection button
- PC card slot
- Battery holder
**Energy saving & Reduce electricity bill**

**Investigation into Energy Saving at Factories and Buildings**

**Food processing plant**

- **Facility investigated:** Pumps

**Purpose:** To review the current power equipment, and replace it if necessary but with low investment cost.

**Solution 1:** Calculation of the amount of used water based on power consumption since flow motors are expensive.

**Solution 2:** Introduction of invert pump control

**Power comparison before and after implementation of the solution**

- **Power measurement**
- **Clamp-on power meter**

**AP240 Suitable for Data Analysis!**

**Energy Saving and Maintenance for Electric Equipment at Factories and Buildings**

**Power Quantity Measurement:** For Power-Saving Diagnosis and Data Collection for ISO14001

The CW240 can measure and display the power quantity consumed up to the specified time (from the start of integration until the end).

- **Measurement elements:** Active power quantity, regenerative power quantity, reactive power quantity (leading/lagging).
- **Data collection time:** 1/2/5/10/15/30/60 minutes, 12/5/10/15/30/600 minutes

**Convenient functions**

- The number of display digits and display units can be selected.
- Standard (Voltage/current range is selected according to the phase)
- Auto (Decimal point position and display unit can be specified)
- Arbitrary (Decimal point position and display unit are selected automatically according to the integration result)

**Demand Measurement:** For Review and Investigation on Contract Demand

- **Measurement elements:** Maximum demand power required since the start of logging measurement and the time it occurs.
  - Active power, reactive power (lag), power factor
  - Active power quantity (consumption, regeneration), reactive power quantity (lagging/lagging)

**Convenient functions**

- Normally, the demand time limit is set to 30 minutes in the contract with a power company. However, the CW240 allows you to set the desired demand time limit in units of seconds/minutes.
- Demand time setting: 1/2/5/10/15/30/60 minutes
- Demand power: Average power during the demand time limit

**Measurement of Instantaneous Value:** For investigation of power consumption, maximum load factor and peak power

The CW240 can be used to carry out investigation regarding renewal of electric equipment such as transformers in building, check load factors and demand factors, and to check current/voltage fluctuation at motor start-up.

- **Measurement elements:** Voltage/current/electric power (active, reactive, apparent)/power factor/phase angle of each phase, average/minimum/maximum values of each measurement element.
- **Data collection time:** 1/2/5/10/30 seconds, 12/5/10/15/30/60 minutes
  - One cycle (waveform), 100/200/500 ms (short time interval)

**Convenient functions**

- Use of the 3-wattmeter method enables display of instantaneous value of each measurement element.
- Allows switching data from one to another and saving data.

**Data Analysis!**

**Investigation at offices**

- For power investigation/monitoring for each application and floor
- For detailed investigation for each shop and tenant
- For detailed investigation of operational status of each electric equipment such as elevator and air conditioner
- For diagnosis regarding renewal of electric equipment

**Investigation at production departments**

- For investigation of operational status of each electrical power equipment and air conditioning
- For investigation of electric power consumption rate for each production line
- For energy investigation/control for primarily-entitled electrical power facilities
- For control of monthly/target energy consumption

**Investigation at production departments**

- For investigation of operational status of each electric equipment such as production line equipment and air conditioning
- For investigation of electric power consumption rate for each production line
- For energy investigation/control for primarily-entitled electrical power facilities
- For control of monthly/target energy consumption

**CW240 Solution (building)**

- For power investigation/control for each application and floor
- For detailed investigation for each shop and tenant
- For detailed investigation of operational status of equipment such as elevator and air conditioner
- For diagnosis regarding renewal of electric equipment

**CW240 Solution (factory)**

- For diagnosis of operational status of equipment such as production line equipment and air conditioning
- For investigation of electric power consumption rate for each production line
- For energy investigation/control for primarily-entitled electrical power facilities
- For control of monthly/target energy consumption
Power Supply Quality Control

Discovering Failures in Power Supply Lines.

Harmonic Measurement

In many cases, inverter power supplies are used to drive air-conditioners and compressors. These power supplies cause distortions in voltages and currents, leading to malfunctions and power loss. Therefore, investigation and control of influences on the main power supplies by harmonics is necessary.

- **Harmonics for analysis**: Up to 50th
- **Display data**: Graph (linear/log), vector (inflow/outflow judgment)
- **Measurement elements**: Voltage, current, electric power, power factor, aggregate harmonic distortion factors (THD-F or THD-R) of voltage/current
- **THD-F**: Distortion factor for the fundamental wave, THD-R: Distortion factor for all rms values voltage/current
- **Data collection time**: 1/15/1/5/15/30 minutes

Convenient functions

- The harmonic whose data is required to be saved can be selected. Inflow/outflow of harmonics can be checked.

- THD-F: Distortion factor for the fundamental wave, THD-R: Distortion factor for all rms values

(Effects of harmonics)

- Voltage distortion (voltage drop, voltage swell, waveform distortion)
- Current distortion (current drop, current swell, waveform distortion)
- Shock, breaker due to overcurrent
- Detection zone: Overload, overvoltage, overcurrent, overheat
- Vector diagram display
  - Explain vector diagram
    - Vector length indicates the apparent power of each harmonic
    - Proportion to that of the fundamental
  - Vector diagram: Outflow of harmonic

Waveform Measurement

- **Measurement elements**: Voltage and current of each phase
- **Data saving format**: Binary (can be converted to CSV format using a standard application program)

Voltage Fluctuation Measurement

The CW240 detects datetimes of when fluctuations occur, fluctuation type, channels where they occur, rms values, and periods between start and end. The voltage threshold is set, and fluctuations exceeding the threshold are detected.

- **Measurement element**: Voltage dip (voltage drop), voltage swell (voltage rise), instantaneous power failure
- **Data saving**: Detected based on the voltage rms value of one waveform. Up to 100 data sets can be saved.

Convenient functions

- It is possible to provide a voltage difference between start and end by setting a hysteresis.

Power Supply Quality Check at Various Places

Quality check for power supplies used in semiconductor manufacturing equipment in accordance with the SEMI guidelines

SEMI: Semiconductor Equipment and Materials International. SEMI guidelines are used at the time the contract is made, to evaluate the safety of semiconductor manufacturing equipment. If a sag (default: within 2%) occurs, the water is removed from the line for inspection or daily quality check for power supplies in necessary.

- **Adverse conditions**: Voltage drop, voltage swell, etc.
- **Solution**: Installation of transformer filter for 5th and 7th harmonics

Improve Harmonic Measurement and Diagnosis

- **Printed plant**: Occurrence of harmonics in 5th and 7th was discovered!
- **Purpose**: To investigate the cause for periodic breakdown of printing machine
- **Measurement**: Advantages obtained by using the CW240
  - Long-term data collection, Vector diagram display
- **Result**: The cause of harmonic was discovered due to loads inside the factory. In particular, the 5th harmonic causes adverse effects such as burn-out of the serial reactor in the capacitor to improve the power factor.

Quality check for power supplies used in semiconductor manufacturing equipment in accordance with the SEMI guidelines

- **Solution**: CW240 detects failures in power supply lines. CW240 can provide a voltage difference between start and end by setting a hysteresis.

Other:

- Verification of instantaneous power failure preventive measures implemented in semiconductor manufacturing equipment

SEMI: Semiconductor Equipment and Materials International. SEMI guidelines are used at the time the contract is made, to evaluate the safety of semiconductor manufacturing equipment when exporting it from Japan to the USA.
Measures Loads in Four Systems Simultaneously.

The CW240 enables simultaneous measurement of loads in four systems in the case of the single-phase 2-wire system, and in two systems in the case of the single/three-phase 3-wire system (common to voltage).

Current clamp/probe range can be set for each system.

This allows measurement according to the current flowing in each load.

Reduces Operation Errors at Work Site.

Wiring check function

Prior to start of measurement, the CW240 checks whether wiring is correct. Wired errors, return connection of current clamps, and phases to be checked can be displayed in a vector diagram.

Setting check function

Settings made for data-saving can be checked in the screen. This prevents data acquisition errors that may occur due to mistakes in voltage range setting, current clamp selection or data save item selection.

Saving a Large Amount of Data

Use of an external memory card (compact flash) makes it possible to save a large amount of data. A memory card (1) of up to 512 MB can be used, and the data is saved in CSV format. 1

4. Data shorter than one second is saved in binary format.

5. Screen copies can be made in bitmap format. Voltage fluctuation data is saved in text format.

Leakage Current Measurement

- External magnetic field effect is 0.002A or less, at 400A/m - Yokogawa’s proprietary technology has achieved a magnetic field impact amount of 30 ppm even in adjacent power lines. (At 100A)

6. Use of the 1A current clamp probe (94030) enables measurements with 300 nA range.

Analog Input/Output

- Besides power data - Analog data such as temperature and illuminance data can be saved simultaneously with power data by using the analog input function (2 channels).

1. The available input ranges are 100 mV/1 V/5 V. In addition, the measured harmonics data, waveform data and measured voltage fluctuation data are saved simultaneously with power data by using the analog input function (2 channels).

2. Data shorter than one second is saved in binary format.

Other Convenient Functions

- Power supply backup
- Multi-lingual support
- Manual data saving
- Screen hard copy
- Zoom function

*1: Memory cards purchased from Yokogawa should be used.

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### Specifications

#### Equations

Active power, reactive power, apparent power, power factor and phase angle are calculated for each phase.

- **Voltage range:** 50 Hz
- **Current range:** 100 A

#### Equations for Each Phase

- **Voltage range:** 50 Hz
- **Current range:** 100 A

#### Measurement Functions

<table>
<thead>
<tr>
<th>Type</th>
<th>Voltage</th>
<th>Current</th>
<th>Function</th>
<th>Range</th>
<th>Performance</th>
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#### Range Configuration for Active Power

For single-phase 2-wire systems (2L: single-phase 3-wire systems, 3L: three-phase 4-wire systems)

- **Voltage range:** 50 Hz
- **Current range:** 100 A

#### Specifications of Each Function

**Frequency Measurement Function**

- **Voltage input:** Selectable from 12, 13, and 15 kV
- **Display range:** 40 Hz to 76 Hz

**Power Quantity Measurement Function**

- **Accuracy:** True power (rms) accuracy
- **Accuracy class:** 1.0

**Display Function**

- **Display range:** 45 Hz to 65 Hz

**Data Storage**

- **Data storage capacity:** 3 Msamples

**Communication Function**

- **RS-232:** 9600 baud (Data in hexadecimal format)

**Printer**

- **Printer type:** Dedicated printer

**Power Supply**

- **AC adaptor:** Approx. 30VA (normal operation), approx. 60VA (maximum)

**Display**

- **Display type:** 5.7-inch STN monochrome LCD display (320 dots x 240 dots)

**Contrast**

- **Automatically adjusted according to the ambient temperature / humidity**

**Language**

- **Languages supported:** English, Japanese, German, French, Spanish, Italian, Korean and Chinese

**Input Type**

- **Analog input:** Input ranges 100mV/1V/5VDC
- **Number of inputs:** 2 channels

**Digital Input**

- **Control input:** TTL level or contact

**Analog Output**

- **DA output:** 0.0 to 5.0 VDC

**Connector**

- **D-sub 9-pin connector

**Dimensions**

- **External dimensions:** 206 (W) x 150.0 (H) x 65 (D) mm
- **Weight:** Approx. 1.2 kg (without batteries)

**Accuracy**

- **Accuracy guarantee frequency range:** 45 to 65 Hz
- **Waveform data:** Binary format
- **Warm-up time:** 30 minutes or more (within active input range, sine wave input)
- **Saving format:** Measured data: CSV format, setting data
- **Weight:** Approx. 1.2 kg

**Power**

- **AC adaptor:** Approx. 30VA (normal operation), approx. 60VA (maximum)
- **Supply voltage:** 100 to 240 V, 50/60 Hz
- **Output voltage:** 12 VDC

**Internal power measurement**

- **Output power:** 0.0 to 5.0 VA

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