# Energy Monitoring Modules (PLC Based for Monitoring Process or Machine Energy)

## Energy Monitoring Modules, Single-Circuit

Energy measuring modules add energy management capability to a Q Series system. Mount the module on a Q base unit to measure a variety of energy usage, such as current, voltage, power, frequency, etc. for a single circuit.

<table>
<tr><th colspan="3">Model Number</th><th>QE81WH</th><th>QE81WH4W</th></tr>
<tr><td colspan="3">Stocked Item</td><td>S</td><td>-</td></tr>
<tr><td colspan="3">Certification</td><td colspan="2">UL • cUL • CE</td></tr>
<tr><td colspan="3">Phase Wire System</td><td>1-phase, 2-wire / 1-phase, 3-wire / 3-phase, 3-wire</td><td>3-phase, 4-wire</td></tr>
<tr><td rowspan="5">Instrument Ratings</td><td rowspan="3">Voltage Circuit</td><td>1-Phase, 2-Wire; 3-Phase, 3-Wire (*1)</td><td>110VAC, 220VAC common use</td><td>-</td></tr>
<tr><td>1-Phase, 3-Wire</td><td>110VAC (between wires 1-2, between wires 2-3), 220VAC (between wires 1-3)</td><td>-</td></tr>
<tr><td>3-Phase, 4-Wire</td><td>-</td><td>63.5/110 ~ 277/480VAC (select from 63.5/110, 100/173, 105/182, 110/190, 115/199, 120/208, 127/220, 200/346, 220/380, 230/400, 240/415, 242/420, 250/430, 254/440, 265/460 and 277/480V [all values indicate primary-side voltage of voltage converter](*3) QE8WH4VT is needed for a 4-wire WYE system.</td></tr>
<tr><td colspan="2" rowspan="2">Current Circuit</td><td>AC50A, 100A, 250A, 400A, 600A (Dedicated split-type current sensor is used. In all cases, the current sensor's primary current is indicated.)</td><td rowspan="2">50, 100, 250, 400, 600AAC (use of special split current sensor; all values indicate current values for primary side of current sensor)<br>5AAC (use of special 5A current sensor (EMU2-CT5-4W);<br>5A current sensor can be used in combination with current transformer in a two-level configuration, and primary-side current value can be set to a maximum of 6,000A)</td></tr>
<tr><td>AC5A (Dedicated split-type current sensor is used. The 5A current sensor is used in combination with a current transformer (CT) in a two-step configuration. In this case, the maximum primary current setting is 6000A.)</td></tr>
<tr><td colspan="2">Frequency</td><td colspan="2">50-60Hz (automatic frequency selection)</td></tr>
<tr><td>Tolerance</td><td colspan="2">Main Unit</td><td>
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<tr><th>Measurement Items</th><th>Main Unit Permissible Tolerance</th></tr>
<tr><td>Current, Demand Current</td><td>±1.0% (relative to 100% rating) (*2)</td></tr>
<tr><td>Voltage</td><td>±1.0% (relative to 100% rating)</td></tr>
<tr><td>Energy, Demand Energy</td><td>±1.0% (relative to 100% rating) (*2)</td></tr>
<tr><td>Reactive Power</td><td>±2.5% (5-120% of rating, power factor = 0)</td></tr>
<tr><td>Frequency</td><td>±1.0% (45-65Hz range)</td></tr>
<tr><td>Power Level</td><td>±2.0% (5-120% of rating, power factor = 1)</td></tr>
<tr><td>Power Factor</td><td>±3.0% (relative to electrical angle of 90°)</td></tr>
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<tr><td>Frequency</td><td>±1.0% (in 45 to 65Hz range)</td></tr>
<tr><td>Power Factor</td><td>±3.0% (relative to electrical angle of 90°)</td></tr>
<tr><td>Energy Use</td><td>± 2.0% (in 5-100% range of rated value, power factor=1)</td></tr>
<tr><td>Reactive Energy Use</td><td>±2.5% (in 10-100% range of rated value, power factor=0)</td></tr>
</table>
</td></tr>
<tr><td colspan="3">Number of Measurement Circuits</td><td colspan="2">1</td></tr>
<tr><td colspan="3">Data Refresh Period</td><td>250ms (fixed) Note: Constant cumulative count of power level and reactive power level (also includes short-cycle load changes)</td><td>250ms</td></tr>
<tr><td colspan="3">Response Time</td><td>Backup to non-volatile memory (Saved items: Setting values, max./min. values and their occurrence times, power level (regenerative, consumption), reactive power level, period power level)</td><td>2s or less</td></tr>
<tr><td colspan="3">Measurable Items</td><td colspan="2">Current, current demand, voltage, power, demand power, power factor, frequency, electric energy, reactive energy, periodic energy</td></tr>
<tr><td colspan="3">Number of Occupied Points</td><td colspan="2">16 points (I/O assignment: intelligent 16 points)</td></tr>
<tr><td colspan="3">Internal Current Consumption (A)</td><td colspan="2">0.17</td></tr>
</table>

**Notes:**
1. The module can be connected directly to 100 to 220 V circuits. When the voltage exceeds 220 VAC, an external voltage transformer (VT) is required. (It is possible to arbitrarily set the primary voltage of VT to up to 6,600 V and the secondary voltage to up to 220 V.)
2. "Demand" is the moving average over the specified time period.
3. QE81WH4W is applicable to the standards when combined with voltage converter (QE8WH4VT)

**Energy Measuring Modules, Multi-Circuit**

Energy measuring modules can be slotted directly into a Q Series rack to enable easy measurement of various energy data. These modules are multi-circuit models.

The three-phase/three-wire module (QE84WH) can measure up to 4 circuits, and the three-phase/four-wire module (QE83WH4W) can measure up to 3 circuits. These models provide energy management in a smaller space and at a lower cost than the single-circuit models (QE81WH and QE81WH4W).

When used to measure only the current*, the module can measure up to 8 circuits at 100ms intervals. It requires a small space and is suitable for current value management linked with production equipment.

**Key Features:**

- Saves more space
- Upper and lower limits can be monitored
- Measurement on up to 8 circuits
- Data updating cycle of 100 ms

***Note:** In the current measurement mode, items other than current cannot be measured.

| Model Number | | | QE84WH | QE83WH4W |
|---|---|---|---|---|
| Stocked Item | | | - | - |
| Certification | | | UL • cUL • CE | |
| Phase/Wire | | | 1-phase, 2-wire / 1-phase, 3-wire / 3-phase, 3-wire shared | 3-phase, 4-wire |
| Instrument Ratings | Voltage Circuit | 1-Phase, Two-Wire; 3-Phase, 3-Wire (*1) | 100V~220VAC (If the voltage exceeds 220 VAC, an external voltage transformer is required.) | - |
| | | 1-Phase, 3-Wire | 110VAC (between wires 1 and 2 and between wires 2 and 3), 220VAC (between wires 1 and 3) | - |
| | | 3-Phase, 4-Wire (*2) (*3) | - | 63.5/110~277/480VAC (When the voltage exceeds 277/480 VAC, a voltage transformer is required. The primary voltage values of the voltage transducer (QE8WH4VT) are shown. QE8WH4VT is required for a 4-wire WYE system. |
| | Current Circuit (*4) | | 50, 100, 250, 400, 600AAC (use of special split current sensor; all values indicate current values for primary side of current sensor); 5AAC (use of special 5A current sensor; 5A current sensor can be used in combination with current transformer in a two-level configuration, and primary-side current value can be set to a maximum of 6,000A) | |
| | Frequency | | 50 to 60Hz (frequency determined automatically) | |
| Main Unit Tolerances (Excluding Current Sensor) | Normal Operation Mode | | Current, demand current: ± 1.0% (relative to 100% of rated value) (*5) | |
| | | | Voltage: ± 1.0% (relative to 100% of rated value) | |
| | | | Energy, demand energy: ± 1.0% (relative to 100% of rated value) (*5) | |
| | | | Reactive power: ± 1.0% (relative to 100% of rated value) | |
| | | | - | Apparent power: ± 1.0% (relative to 100% of rated value) |
| | | | Frequency: ± 1.0% (in 45 to 65Hz range) | |
| | | | Power factor: ± 3.0% (relative to electrical angle of 90°) | |
| | | | Energy use: ± 2.0% (in 5 to 100% range of rated value, power factor=1) | |
| | | | Reactive energy use: ± 2.5% (in 10 to 100% range of rated value, power factor=0) | |
| | Current Measurement Mode | | Current, demand current (*5): ± 1.0% (relative to 100% of rated value) | |
| Number of Measurement Circuits | Normal Operation Mode | | 4 circuits in a same voltage system (4 channels) | 3 circuits in a same voltage system (3 channels) |
| | Current Measurement Mode | | 8 circuits (8 channels) | |
| Data Update Cycle | Normal Operation Mode | | 500ms (*6) | |
| | Current Measurement Mode | | 100ms | |
| Response Time | | | 2s or less | |
| Power Interruption Backup | | | Backup in non-volatile memory (stored items: setting values, max./min. values and time and date they occurred, energy use (regenerative, consumption), reactive energy use, time-based energy use) | |
| Number of Required Slots | | | 1 | |
| Number of Input/Output Points | | | 32 (I/O allocation: Intelligent, 32 points) | |
| DC Consumption Current | | | 0.46A | 0.39A |
| Applicable Wires | Voltage Input Terminal | Solid Wire | AWG24-AWG16 | |
| | | Stranded Wire | AWG20-AWG16 | |
| | Current Input Terminal | Stranded Wire | AWG20-AWG18 Applicable crimp-style terminal: R1.25-3 (crimp-style terminal with sleeve is not allowed) | |
| Weight (kg) | | | 0.19 | 0.19 |

**Notes:**

1. The module can be connected directly to 100 to 220 V circuits. When the voltage exceeds 220 V AC, an external voltage transformer (VT) is required. (It is possible to arbitrarily set the primary voltage of VT to up to 6,600 V and the secondary voltage to up to 220 V.)
2. For a 277/480V WYE system" after "For Voltage input, a voltage converter (QE8WH4VT) is required. When the primary voltage of the voltage transducer exceeds 277/480 V AC, an external voltage transformer (VT) is required. (It is possible to arbitrarily set the primary voltage of VT to up to 6,600 V as phase voltage.)
3. The ratio error of the voltage converter is ±1.0% (of the rated primary voltage).
4. The ratio error of the current sensor is ± 1% (5 to 100% of the rating).
5. The demand values are moving average deviations within the specified time limit.
6. The energy use and reactive energy use are constantly measured. Load variation in a short cycle of 500 ms or less is followed.

## Insulation Monitoring Module

Constant measurement of leakage current (I0 or I0r) can prevent sudden trouble and reduce production loss due to equipment stoppage. Insulation monitoring pinpoints the problematic equipment, making it possible to recognize deteriorated insulation location early on.

| Model Number | | | QE82LG |
|---|---|---|---|
| Stocked Item | | | - |
| Certification | | | UL • cUL • CE |
| Phase Wire System | | | 1-phase, 2-wire / 1-phase, 3-wire and 3-phase, 3-wire systems common use |
| Instrument Rating | Voltage Circuit (*1, *2) | 1-Phase, 2-Wire, 3-Phase, 3-Wire | 110VAC, 220VAC common use |
| | | 1-Phase, 3-Wire | 110VAC (between wires 1-2, between wires 2-3), 220VAC (between wires 1-3) |
| | Current Circuit | | AC50A, 100A, 250A, 400A, 600A (Dedicated split-type current sensor is used and the current sensor's primary current is always indicated) |
| | | | AC5A (Dedicated split-type current sensor is used. The 5A current sensor is used in combination with a current transformer (CT) in a two-step configuration. In this case, the maximum primary current setting is 6000A). |
| | Frequency | | 50-60Hz (automatic frequency selection) |
| Tolerance | Main Unit | | Leakage current ±2.5% (10% to 100% of rating)<br>Resistive-component leakage current ±2.5mA (≤10% of rating)<br>(The resistive-component leakage current does not include electrostatic capacity) |
| Number of Measurement Circuits | | | 2 circuits (*3) |
| Data Refresh Period | | | Leakage current: 2 sec or less; Resistive-component leakage current: 10 sec or less |
| Response Time | | | Leakage current: 4 sec or less; Resistive-component leakage current: 30 sec or less |
| | | | Backup to non-volatile memory (Saved items: Setting values, max. value and its occurrence date/time, alarm occurrence times) |
| Measuring Items | Leakage Current | | Current value, max. value, occurrence date/time of max. value, number of first stage alarm occurrences, number of second stage alarm occurrences |
| | Resistive-Component Leakage Current | | Current value, max. value, occurrence date/time of max. value, number of first stage alarm occurrences, number of second stage alarm occurrences |
| Number of Occupied Points | | | 16 points (I/O assignment: intelligent 16 points) |
| Internal Current Consumption (A) | | | 0.17 |
| Weight (kg) | | | 0.10 |

**Notes:**
1. The module can be connected directly to 110V and 220V. To connect to 440V, an external voltage transformer (VT) is necessary. Leakage current (I0, I0r) cannot be measured without voltage input.
2. I0r can be measured on a 1-phase, 3-wire or 3-phase, 3-wire delta circuit. On special grounded circuits, such as 3-phase, 3-wire star circuits, high-resistance grounded circuits and capacitor grounded circuits, only I0 can be measured.*
3. Leakage current (I0 and I0r) of CH1 and CH2 can be measured only on circuits when the voltage input was on the same system.

## Voltage Converter

Use only with QE81WH4W or QE83WH4W module when metering a 277V/480V 4-wire WYE system.

| Model Number | | QE8WH4VT |
|---|---|---|
| Stocked Item | | - |
| Certification | | UL • cUL • CE |
| Phase Wire System | | 3-phase, 4-wire |
| Input Voltage Range | | 63.5/110 to 277/480VAC (The product does not operate on the voltage below 55/95VAC) |
| Frequency | | 50 Hz/60 Hz |
| Voltage Output Tolerance | | ±1.0% (against the rated primary voltage) |
| Measurement Category | | CATIII |
| Pollution Degree | | II |
| Maximum Number of Connections | | 5 units |
| Operating Condition | Operating Temperature | 0ºC to +55ºC (Average daily temperature 35ºC or below) |
| | Operating Humidity | 5% to 95% RH (without condensation) |
| | Storage Temperature | -25ºC to +75ºC |
| | Altitude | 2000 m or lower |
| Commercial Frequency Withstand Voltage | | Between voltage input terminals (P1, P2, P3, P0) and FG terminal: 2210VAC for 3 seconds; Between voltage input terminals (P1, P2, P3, P0) and secondary output terminals (PA, PB, PC, PD) (except for SLD terminal) 2210VAC for 3 seconds |
| Insulation Resistance | | 10 MΩ or more (500VDC) at the same locations as above |
| Consumption VA | | P1-P0: 2VA, P2-P0: 0.3VA, P3-P0: 0.3VA (when inputting 277/480VAC) |
| Current Consumption mA | | 30 |
| Installation Location | | Inside the control panel |
| Secondary Wire Length (m) | | 5 |
| Installation Method | | Installation on IEC rails, installation with screws |
| Product Life Expectancy | | 10 years (used under the operating conditions above) |
| Weight (kg) | | 0.3 |

### Current Input Module

Predictive maintenance of devices by detecting the current in real-time. Changes in the alternating current signal are detected allowing the device state to be checked at real-time. The device can be serviced and troubleshooting performed by detecting the peak current. Take a motor for example. The load applied on the motor because of gear wear and damage changes and causes the load current to suddenly fluctuate.

| Model Number | | Q68CT |
|---|---|---|
| Stocked Item | | - |
| Number of Input Points | | 8 points (8 channels) |
| Operation Method | | Effective value operation |
| Input Range | | 0 to 5A AC, 0 to 50A AC, 0 to 100A AC, 0 to 200A AC, 0 to 400A AC, 0 to 600A AC |
| Digital Output | Converted Current Value | 0 to 12000 |
| | Scaling Value | -32768 to 32767 |
| Input Frequency | | 50/60Hz |
| Excessive Input | | 200% for 1 minute, 150% for continuous time |
| I/O Characteristics | | See table below |
| Accuracy | Ambient Temperature 25 ± 5°C | Within ±0.5% (±50 digits) |
| | Ambient Temperature 0 to 55°C | Within ±1.0% (±100 digits) |
| Sampling Cycle | | 10ms/8CH, 20ms/8CH, 50ms/8CH, 100ms/8CH |
| Response Time | | 0.4s or less |
| Number of Access to Non-Volatile Memory | | Up to $10^{12}$ times |
| Isolation Method | | Between input terminals and the programmable controller power supply: Transformer; Between input channels: No isolation |
| Dielectric Withstand Voltage | | Between I/O terminals and the programmable controller power supply: 1500 VAC rms for 1 minute |
| Insulation Resistance | | Between I/O terminals and the programmable controller power supply: 500V DC 10MΩ or higher |
| Number of Occupied I/O Points | | 16 points (I/O assignment: 16 points for intelligent) |
| External Connection System | | 18-point terminal block |
| Applicable Wire Size | | 0.3 to 0.75mm² |
| Applicable Solderless Terminal | | R1.25-3 (Do not use a solderless terminal with an insulation sleeve) |
| Internal Current Consumption (5 VDC) | | 0.35A |
| Weight (kg) | | 0.19 |

| Input Range | Digital Output Value | Maximum Resolution |
|---|---|---|
| 0 to 5A AC | 0 to 10000 | 0.5mA |
| 0 to 50A AC | | 5mA |
| 0 to 100A AC | | 10mA |
| 0 to 200A AC | | 20mA |
| 0 to 400A AC | | 40mA |
| 0 to 600A AC | | 60mA |

### EMU-CT Model Split Current Sensor

EMU-CTs are used with QE81WH, QE81WH4W, QE83WH4W, QE84WH, Q68CT and EMU4 products.

| Model Number (*1) | EMU-CT50 | EMU-CT100 | EMU-CT250 | EMU-CT400 | EMU-CT600 |
|---|---|---|---|---|---|
| Stocked Item | S | S | - | - | - |
| Certification | CE | | | | |
| Rated Primary Current | 50A AC | 100A AC | 250A AC | 400A AC | 600A AC |
| Rated Secondary Current | 16.66mA | 33.33mA | 66.66mA | 66.66mA | 66.66mA |
| Rated Burden | 0.1VA | | | | |
| Maximum Voltage (Voltage to Ground/Line Voltage) | 266V/460VAC (*1) | | | | |
| Ratio Error | ±1% (5% to 100% of rating, RL≤10Ω) | | | | |
| Phase Displacement | ±0.9 c rad (5% to 100% of rating, RL≤10Ω) | | | | |
| Measurement (Installation) Category | III | | | | |
| Pollution Degree | II | | | | |
| Working Temperature Range | –5°C to +55°C (daily mean temperature: 35°C or less) | | | | |
| Working Humidity Range | 5% to 95%RH (no condensation) | | | | |
| Weight (kg) | 0.1 | | | 0.7 | |

**Note 1:** EMU-CTs can also be used for a 480V systems.

### EMU2-CT Model 5A Current Sensor

Typically used when using existing conventional CTs. Monitors the secondary side of the CT.

| Model Number | EMU2-CT5 | EMU2-CT5-4W |
|---|---|---|
| Stocked Item | S | S |
| Certification | CE | |
| Phase Wire System | 1-phase, 2-wire / 1-phase, 3-wire / 3-phase 3-wire | 3-phase, 4-wire |
| Rated Primary Current | 5A AC | |
| Rated Secondary Current | 1.66mA | |
| Rated Burden | 0.1VA | |
| Maximum Voltage (Voltage to Ground/Line Voltage) | 150V/260VAC | |
| Ratio Error | ±1% (5% to 100% of rating, $R_L$ ≤10Ω) | |
| Phase Displacement | ±0.9 c rad (5% to 100% of rating, $R_L$ ≤10Ω) | |
| Measurement (Installation) Category | III | |
| Pollution Degree | II | |
| Working Temperature Range | –5°C to +55°C (daily mean temperature: 35°C or less) | |
| Working Humidity Range | 5% to 95%RH (no condensation) | |
| 5A Current Sensor Cable (500mm) | EMU2-CB-Q5B | |
| Weight (kg) | 0.1 | |

### 5A Current Sensor Cable

| Model | EMU2-CB-Q5A | EMU2-CB-Q5A-4W | EMU2-CB-Q5B-4W |
|---|---|---|---|
| Stocked Item | S | - | S |
| Cable Length (m) | 0.5 | 0.5 | 0.5 |
| Use With Module | QE81WH | QE81WH4W | QE83WH4W |

### Split Current Sensor Cable

| Model | EMU2-CB-T1M | EMU2-CB-T5M | EMU2-CB-T10M | EMU2-CB-T1MS | EMU2-CB-T5MS | EMU2-CB-T10MS |
|---|---|---|---|---|---|---|
| Stocked Item | - | - | - | - | - | - |
| Cable Length (mm) | 1000 | 5000 | 10000 | 1000 | 5000 | 10000 |
| Note | Standard extension cable | | | Separate extension cable | | |