Class 3020

POWERLOGIC® Circuit Monitor—Series 2000

Features

• True rms metering
• Certified ANSI C12.16 revenue accuracy
• High accuracy—0.2% current and voltage
• Power quality readings—THD, k-factor, crest factor
• Over 50 displayed meter values
• Current and voltage sag/swell detection and recording
• Min/max displays for metered data
• On-board clock/calendar
• 1 ms time stamping of status inputs for sequence-of-events recording
• Real time harmonic magnitudes and angles
• Programming language for application specific solutions
• RS-485 communications standard
• Easy front panel setup (password protected)
• Waveform and event captures, user-selectable for 4, 12, 36, 48, or 60 cycles
• 64 and 128 points/cycle waveform captures
• High-speed, triggered event capture
• Pre-configured data and alarms
• Setpoint controlled alarm/relay functions
• On-board event and data logging
• Downloadable firmware
• System connections
  –3-phase, 3-wire delta
  –3-phase, 4-wire wye
  –Metered or calculated neutral
  –Other metering connections
• Accepts standard CT and PT inputs
• Optional voltage/power module for direct connection to 480 Y/277 V
• Optional control power module for connecting to 18–60 Vdc control power
• Modular, field installable analog and digital I/O
• I/O modules support configurable KYZ pulse output
• Front panel, RS-232 optical communications port standard
• Wide operating temperature range (–25 to 70° C)
• UL Listed, CSA certified, and CE marked
• MV-90™ billing compatible

Revenue Accurate Comprehensive Metering
The POWERLOGIC Circuit Monitor installs on a 3-phase circuit like a conventional watthour meter, but it delivers far more information. In fact, the circuit monitor can replace more than 100 conventional indicating meters. All circuit monitors perform highly accurate, true rms metering and are certified by an independent test lab to meet ANSI C12.16 revenue accuracy. Models CM-2150 and higher provide 0.2% accuracy on current and voltage, and 0.4% accuracy on power and energy.

Power Quality Readings
Total Harmonic Distortion (THD) for current, voltage, and k-factor readings indicate potential power quality problems which, unchecked, could disrupt critical processes or damage equipment.

Pre-Configured Logs and Alarms
Each circuit monitor (Model 2150 and above) is shipped to you pre-configured at the factory, ready to log data right out of the box. Important information about your electrical system is recorded as soon as the circuit monitor is installed. Event logs, waveform capture, and several alarm conditions are included in the factory configuration.

Easy Setup
Basic circuit monitor setup can be performed from either the front of the circuit monitor, or a personal computer running POWERLOGIC application software. The PC connects to the circuit monitor using either the system network or an optical communications interface. No thumbwheel or DIP switches are involved; therefore, after installation, setup parameters such as the unit address, CT ratio, PT ratio, and baud rate can be configured without exposing personnel to live conductors. For security, all setup information is password protected.
Flexible Communications

Communications ports come standard on all circuit monitors, allowing them to be tied onto communications networks up to 19.2K baud without additional cards or modules. For higher speeds, circuit monitors can be tied into industrially hardened local area networks and high speed Ethernet (TCP/IP) networks. The networks can include a virtually unlimited number of devices, including circuit monitors, POWERLOGIC power meters, protective relays, trip units for low voltage power circuit breakers, MICROLOGIC® solid-state circuit breakers, multiple personal computers, and other compatible devices.

Extended Memory Options

Circuit monitors provide a standard level of non-volatile memory for each model. The memory can be allocated among an event log, a waveform capture log, or an energy log, and up to 14 data logs. The Typical Memory Configuration table shows an example of how the user might configure the available standard memory for various models. Extended memory is also available for models above the standard memory levels.

Instrumentation Summary

Real-Time Readings
- Current (per phase, N, G, 3Ø)
- Voltage (L-L, L-N)
- Real Power (per phase, 3Ø)
- Reactive Power (per phase, 3Ø)
- Apparent Power (per phase, 3Ø)
- Power Factor (per phase, 3Ø)
- Frequency
- Temperature (internal ambient)*
- THD (current and voltage)
- K-Factor (per phase)

Demand Readings
- Demand Current (per phase present, peak)
- Average Power Factor (3Ø total)
- Demand Real Power (3Ø total)
- Demand Reactive Power (3Ø total)*
- Demand Apparent Power (3Ø total)
- Coincident Readings*
- Predicted Demands*

Energy Readings
- Accumulated Energy, Real
- Accumulated Energy, Reactive
- Accumulated Energy, Apparent*
- Bi-directional Readings*

Power Analysis Values*
- Crest Factor (per phase)
- K-Factor Demand (per phase)
- Displacement Power Factor (per phase, 3Ø)
- Fundamental Voltages (per phase)
- Fundamental Currents (per phase)
- Fundamental Real Power (per phase)
- Fundamental Reactive Power (per phase)
- Harmonic Power
- Unbalance (current and voltage)
- Phase Rotation

* Available via communications only.
† CM-2150 = 100K.

Typical Memory Configuration

<table>
<thead>
<tr>
<th>Model</th>
<th>Event Log</th>
<th>1 Data Log</th>
<th>Waveform Captures</th>
<th>Event Captures</th>
</tr>
</thead>
<tbody>
<tr>
<td>CM-2150</td>
<td>500 Events</td>
<td>40 Days</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>CM-2250</td>
<td>500 Events</td>
<td>40 Days</td>
<td>1</td>
<td>N/A</td>
</tr>
<tr>
<td>CM-2350/2450</td>
<td>500 Events</td>
<td>40 Days</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

This table illustrates a typical memory configuration for a standard circuit monitor, with one data log storing the following data hourly: 3Ø avg. amps, volts (L-L, L-N), PF, kW, kW, freq., 3Ø demand for amps, kW, kVA, kW, and kVAR.

The standard CM-2150, -2250, -2350, and -2450 can store up to 51200 values (100K). Waveform and event captures are stored in non-volatile memory in the CM-2350 and CM-2450. The exact number of waveforms and event captures that can be stored depends on how much memory is allocated to event and data logs.

The CM-2350 and CM-2450 can store up to 20 waveform captures or 8 twelve-cycle event captures.
Alarm/Relay Functions
Circuit monitors can detect over 100 alarm situations, including over/under conditions, status input changes, and phase unbalance conditions. Each alarm condition can be set to automatically operate one or more circuit monitor relays. Multiple alarms can be assigned to each relay. Up to three form-C, 10 A mechanical relays and one solid-state output are available.

Protective Functions
A circuit monitor equipped with an I/O module can perform certain motor protective functions. These include phase loss, phase reversal, under voltage, and more. Once the circuit monitor detects the abnormal condition, the output relay switches within 1–3 seconds. Each protective function can operate one or more form-C, 10 ampere relays. Each relay can be activated by multiple protective functions. These functions are password protected.

On-Board Alarm/Event Logging
When an alarm occurs, the circuit monitor can log the event type, date and time, and the most extreme reading during the pickup delay. When the alarm condition drops out, the dropout date/time and the most extreme reading during the entire event is logged. The size of the event log can be user configured.

Data Logging
Circuit monitors are available with nonvolatile memory for storing meter readings. A user can configure the size and structure of up to 14 independent data logs to record metered data at intervals from 1 minute to 24 hours. Data logs can be used to record at regular intervals or report by exception. Each data log can record up to 100 electrical parameters (including date and time). The number of stored readings for each of the parameters is based on the amount of memory available in the circuit monitor. Models CM-2150 and up are available with up to 1.1 megabytes of extended memory.

Downloadable Firmware
The circuit monitor is designed to take advantage of technological advances. As Square D introduces more powerful versions of each circuit monitor, upgrade kits allow the user to install the new capabilities without changing wiring or hardware. This is possible because the circuit monitor has

System Highlights
- Supports multiple PCs
- Powerful software solutions
- Easily retrofit
- Programmable controller support
- Fiber-optic, radio, and modern communications
- Ethernet connectivity
- Building automation system compatible

Devices in a typical POWERLOGIC system.

PC in Plant Engineers Office for power quality analysis
PC in Maintenance Department for load monitoring
PC in Accounting Department for cost allocation
Remote PC off site

- PowerLogic Circuit Monitors
- PowerLogic Power Meters
- MicroLogic® Molded Case Circuit Breakers
- PowerLink® AS Panels
- Digital Relay
- Digitrip 810D Trip Units
- Programmable Controllers
- Other Intelligent Devices
- 2 and 4-Wire Modbus® RTU Devices
- Altivar Drives
- Momentum I/O
- Model 98 Transformer Temperature Controller
downloadable firmware. The new firmware is transmitted from a PC into the circuit monitor, using the front optical communications port or the rear RS-485 port. The equipment containing the monitor does not have to be de-energized. This allows you to keep your circuit monitors up to date with the latest enhancements, minimizing fear of obsolescence.

**Sag/Swell Detection**

The circuit monitor can continuously monitor for sags and swells on any metered voltage or current. This feature can help detect and analyze troublesome voltage disturbances that can cause costly equipment down time. The circuit monitor detects sags and swells based on user-defined setpoints and delays (in cycles). When the circuit monitor detects a voltage or current disturbance, it performs an event capture to record the disturbance. This capture is configurable for 12, 24, 36, 48, or 60 cycles at 64 samples per cycle. It is performed using the patented waveform capture sampling technique that samples all current and voltage signals simultaneously. The user selects the number of pre-event cycles, ranging from 2 to 10 cycles. Thus, the event capture shows the circuit both before and after the disturbance. The event can be date and time stamped to the millisecond, and recorded in the event log.

**Waveform Capture**

Square D pioneered and patented the concept of “waveform capture,” to sample, record, and display current and voltage signals. The captured waveforms are stored in the circuit monitor memory for retrieval and display by POWERLOGIC application software. The waveform captures are used for harmonic analysis and event recording. High resolution waveform captures for 63rd harmonic analysis at 128 samples per cycle are triggered via the network from a PC. These can be up to 30 cycles in duration. Waveform captures for event recording can be triggered by internal alarm conditions or from external signals, such as an overcurrent relay. These 64 samples per cycle event recordings can be up to 60 cycles in duration.

**Programming Capabilities**

The CM-2450 Circuit Monitor is programmed using simple math functions, timers, and compare statements to customize data logging, control functions, and more. Application program examples include tracking disturbances onto CBEMA curves, time-of-use metering, and IEEE 519 compliance. Meter values can be analyzed in the circuit monitor and summarized in daily, weekly, and monthly reports.

This event lasted only a quarter of a second, yet its effect shut down a production process for four hours. Square D power quality experts showed that the event should not have caused an interruption to the plant, exposing a coordination problem on the electric utility distribution circuit.

POWERLOGIC software can show all phase voltage and current waveforms simultaneously, or a frequency spectrum containing harmonics through the 63rd.
Mounting Options
In addition to the standard flush mounting, several other mounting options are available. For applications requiring an indoor general purpose surface mounted (NEMA 1) enclosure, a 3090 SMA-220 is used. The circuit monitor mounts through the door of the enclosure, providing easy access to the rear of the monitor. The enclosure is deep enough to accommodate options, including I/O modules and voltage power modules.

For applications where depth in the equipment enclosure is critical, POWERLOGIC provides the 3090 CMA-100 and 3090 CMA-110 adapters. The CMA-100 reduces the depth requirements by extending the circuit monitor beyond the front of the equipment. The CMA-110 allows the voltage/power module and some I/O modules to be mounted off of the back of the circuit monitor.

Control Power Options
In addition to CT and PT inputs, the circuit monitor requires control power. The circuit monitor accepts a wide range of voltages, including 120/240 Vac nominal or 125/250 Vdc nominal. When the system voltage is 480 Y/277 V, an optional 3090 VPM-277-C1 Voltage/Power Module can be used. This add-on module eliminates the need for PTs and provides control power. The optional 3090 CPM 48 Control Power Module is used when 18–60 Vdc is available. A 3090 RTM-317 Ride Through Module is also available which provides backup control power for up to 8 seconds, depending on the presence of I/O modules. These modules can be conveniently mounted on the back of a circuit monitor or on a nearby flat surface. To complete the offering, Square D manufactures a complete line of control power transformers.

Field Installable I/O Modules
Field installable input/output modules provide maximum flexibility, while keeping the costs for an application at a minimum. An I/O module can be easily installed on the back of the circuit monitor. Seven different I/O modules are available. The modules provide various combinations of digital and analog I/O, ranging from 1 digital input and 1 digital output to 4 digital inputs, 4 digital outputs, 4 analog inputs, and 4 analog outputs.

Two inputs and one output perform special functions. Status input S1 can be configured to accept a demand synch pulse from a utility demand meter. Status input S2 is a high-speed input; it can be connected to an external relay to trigger the circuit monitor’s event capture. The KYZ solid-state output is ideal for pulse initiator applications. The form C, 10 amp mechanical relay outputs are extremely flexible—each can be configured for remote (external) or circuit monitor (internal) control. In addition, each output can be configured for normal, latched, timed, or one of six different pulse initiator modes. The analog inputs are field convertible from 0–5 Vdc to 4–20 mA.

Optical Communications Interface
The circuit monitor has an optical communications port built into the front panel as a standard feature. Using this port, a portable computer with an optical communications interface (OCI-2000) can retrieve data from the circuit monitor. The OCI-2000 mounts magnetically to the circuit monitor and provides a standard RS-232 interface. This interface can be used by engineers and maintenance personnel to retrieve captured waveforms, event and data logs, and other information without connecting to the network.
**Technical Specifications**

**Metering Specifications**

Current Inputs (each channel)
- Current Range: 0–7.4 A ac
- Nominal Current: 5 A ac

Voltage Inputs (each channel)
- Voltage Range: 0–180 Vac
- Nominal Voltage (typical): 120 Vac

Freq. Range (50/60 Hz): 45–65 Hz
Freq. Range (400 Hz): 350–440 Hz

Harmonic Response—Voltage, Current
- Freq. 45 Hz–65 Hz: 31st Harmonic
- Freq. 350 Hz–440 Hz: 3rd Harmonic

Accuracy:
- Current: +/- 0.15% reading + 0.05% full scale
- Voltage: +/- 0.15% reading + 0.05% full scale
- Power: +/- 0.30% reading + 0.05% full scale
- True Power Factor: +/- 1% (0.5 lag to 0.5 lead)
- Displacement Pwr. Fac.: +/- 1% (0.5 lag to 0.5 lead)
- Energy: +/- 0.30%
- Demand: +/- 0.30%
- Frequency: 50/60 Hz: +/- 0.01 Hz

**Control Power Input Specifications**

- Input Range, ac: 100–264 Vac
- Frequency Range: 47–440 Hz
- Input Range, dc: 100–350 Vdc

**Temp. Range (operating):** 25 to 70°C

Accuracies apply to CM-2150, CM-2250, CM-2350, CM-2450.

Ordering Information

<table>
<thead>
<tr>
<th>Class</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3020</td>
<td>CM2150</td>
<td>Circuit monitor with full instrumentation (0.2% accuracy), on-board data logging, 102K memory</td>
</tr>
<tr>
<td>3020</td>
<td>CM2250</td>
<td>Circuit monitor with full instrumentation, CM2150 features, and waveform capture</td>
</tr>
<tr>
<td>3020</td>
<td>CM2350</td>
<td>Circuit monitor with full instrumentation, CM2250 features, and disturbance monitoring</td>
</tr>
<tr>
<td>3020</td>
<td>CM2450</td>
<td>Circuit monitor with full instrumentation, CM2350 features, and programmable logic</td>
</tr>
<tr>
<td>3020</td>
<td>CM2150-512K</td>
<td>Circuit monitor with full instrumentation (0.2% accuracy), on-board data logging, and 512K memory</td>
</tr>
<tr>
<td>3020</td>
<td>CM2250-512K</td>
<td>Circuit monitor with full instrumentation, CM2150 features, waveform capture, and 512K memory</td>
</tr>
<tr>
<td>3020</td>
<td>CM2350-512K</td>
<td>Circuit monitor with full instrumentation, CM2250 features, disturbance monitoring, and 512K memory</td>
</tr>
<tr>
<td>3020</td>
<td>CM2450-512K</td>
<td>Circuit monitor with full instrumentation, CM2350 features, programmable logic, and 512K memory</td>
</tr>
<tr>
<td>3020</td>
<td>CM2150-1024K</td>
<td>Circuit monitor with full instrumentation (0.2% accuracy) on-board data logging, and 1024K memory</td>
</tr>
<tr>
<td>3020</td>
<td>CM2250-1024K</td>
<td>Circuit monitor with full instrumentation, CM2150 features, waveform capture, and 1024K memory</td>
</tr>
<tr>
<td>3020</td>
<td>CM2350-1024K</td>
<td>Circuit monitor with full instrumentation, CM2250 features, disturbance monitoring, and 1024K memory</td>
</tr>
<tr>
<td>3020</td>
<td>CM2450-1024K</td>
<td>Circuit monitor with full instrumentation, CM2350 features, programmable logic, and 1024K memory</td>
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<tr>
<td>3020</td>
<td>CM-2000U</td>
<td>Circuit monitor firmware upgrade kit</td>
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<tr>
<td>3020</td>
<td>CM-MEM-512K</td>
<td>Circuit monitor 512K memory upgrade kit</td>
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<tr>
<td>3020</td>
<td>CM-MEM-1024K</td>
<td>Circuit monitor 1024K memory upgrade kit</td>
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<tr>
<td>3020</td>
<td>IOM11</td>
<td>I/O module with 1 input and 1 pulse output</td>
</tr>
<tr>
<td>3020</td>
<td>IOM18</td>
<td>I/O module with 8 inputs and 1 pulse output</td>
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<tr>
<td>3020</td>
<td>IOM44</td>
<td>I/O module with 4 digital inputs and 4 digital outputs</td>
</tr>
<tr>
<td>3020</td>
<td>IOM444-01</td>
<td>I/O module with 4 digital inputs, 4 digital outputs, 1 analog input, and 1 analog output (1 mA)</td>
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<tr>
<td>3020</td>
<td>IOM444-120</td>
<td>I/O module with 4 digital inputs, 4 digital outputs, 1 analog input, and 1 analog output (20 mA)</td>
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<tr>
<td>3020</td>
<td>IOM4444-01</td>
<td>I/O module with 4 digital inputs, 4 digital outputs, 1 analog input, and 1 analog output (1 mA)</td>
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<tr>
<td>3020</td>
<td>IOM4444-20</td>
<td>I/O module with 4 digital inputs, 4 digital outputs, 4 analog inputs, and 4 analog outputs (20 mA)</td>
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<tr>
<td>3020</td>
<td>ECM-2000</td>
<td>Ethernet communications module, supports up to 8 devices</td>
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<tr>
<td>3020</td>
<td>ECM-RM</td>
<td>Ethernet communications module, remote mounted, supports up to 8 devices</td>
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<tr>
<td>3090</td>
<td>VPA00127/C1</td>
<td>Voltage power module for circuit monitor (Series 2000), 480/127VAC</td>
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<tr>
<td>3090</td>
<td>DPM58</td>
<td>Control power module for circuit monitor (Series 2000), 18–60 Vac</td>
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<tr>
<td>3090</td>
<td>RMT17</td>
<td>Ride through module for circuit monitor (Series 2000)</td>
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<tr>
<td>3090</td>
<td>SMA220</td>
<td>Surface Mounting Adapter with Hinged Cover for Circuit Monitor (CM2000)</td>
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<tr>
<td>3090</td>
<td>CM1006</td>
<td>Mounting Collar for Circuit Monitor (CM2000)</td>
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<tr>
<td>3090</td>
<td>CMA110</td>
<td>CM2000 Mounting Adapter with Accessory Compartment</td>
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<tr>
<td>3090</td>
<td>RO110</td>
<td>2 I/O shielded ribbon cable extension with mounting hardware</td>
</tr>
<tr>
<td>3090</td>
<td>OC2000</td>
<td>Front Panel Optical Communications Interface for Circuit Monitor (CM2000)</td>
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