

# 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 watt-hour 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.



# POWERLOGIC Circuit Monitor

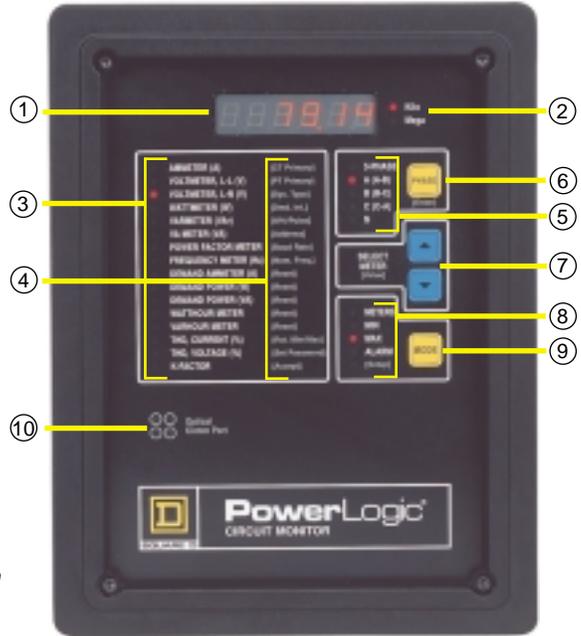
## Feature Comparison

	CM-2150	CM-2250	CM-2350	CM-2450
Full Instrumentation	●	●	●	●
RS-485 Comm Port	●	●	●	●
Front Panel Optical Comm Port	●	●	●	●
0.2% Accuracy Class	●	●	●	●
Alarm/Relay Functions	●	●	●	●
On-board Data Logging	●	●	●	●
Downloadable Firmware	●	●	●	●
Date/Time for Each Min/Max	●	●	●	●
Extended Memory (up to 1.1 Meg)†	●	●	●	●
Waveform Capture		●	●	●
12-Cycle Event Capture		●	●	●
Sag/Swell Detection			●	●
Programmable for Custom Applications				●

† Standard memory: CM-2150, CM-2250, CM-2350, and CM-2450 = 100K.

## Front Panel Features

- ① Six-Digit LED Display
- ② Kilo/Mega Units LEDs
- ③ Meter Indication LEDs
- ④ Setup/Reset Parameters
- ⑤ Phase Indication LEDs
- ⑥ Phase Select Button
- ⑦ Select Meter Buttons
- ⑧ Mode Indication LEDs
- ⑨ Mode Select Button
- ⑩ Optical Communications Port



More than 50 metered values plus extensive minimum and maximum data can be viewed from the large 6-digit LED display.

## 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.

## 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, an event capture 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 2150 and above in units of 512K or 1024K which can be ordered directly from the factory. Extended memory kits are also available for field installation.

### Typical Memory Configuration<sup>①</sup>

	CM-2150 <sup>③</sup>	CM-2250 <sup>③</sup>	CM-2350/2450 <sup>③</sup>
Event Log	500 Events	500 Events	500 Events
1 Data Log	40 Days	40 Days	40 Days
Waveform Captures <sup>②</sup>	N/A	1	3 <sup>④</sup>
Event Captures <sup>②</sup>	N/A	1	3 <sup>④</sup>

① 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, kVAR, freq., 3Ø demand for amps, kW, kVA, kWh, and kVARh.

② Waveform & 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.

③ The standard CM-2150, -2250, -2350, and -2450 can store up to 51,200 values (100K).

④ 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

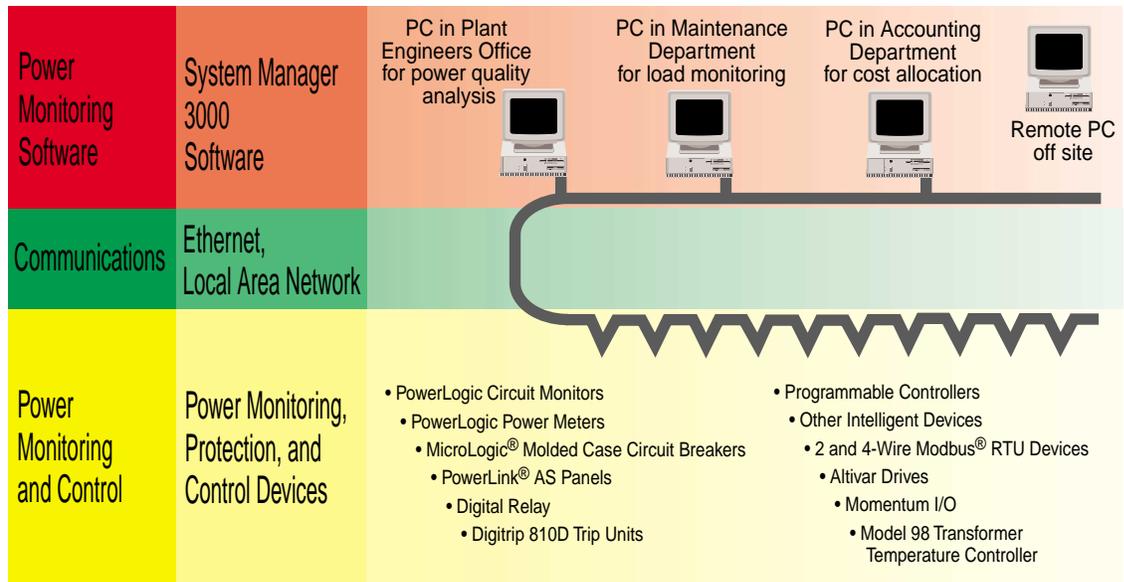
Circuit monitors are available with nonvolatile memory for storing meter readings. A user can configure the size and structure of up to 14 independent data logs to record metered data at intervals from 1 minute to 24 hours. Data logs can be used to record at regular intervals or report by exception. 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 modem communications
- Ethernet connectivity
- Building automation system compatible



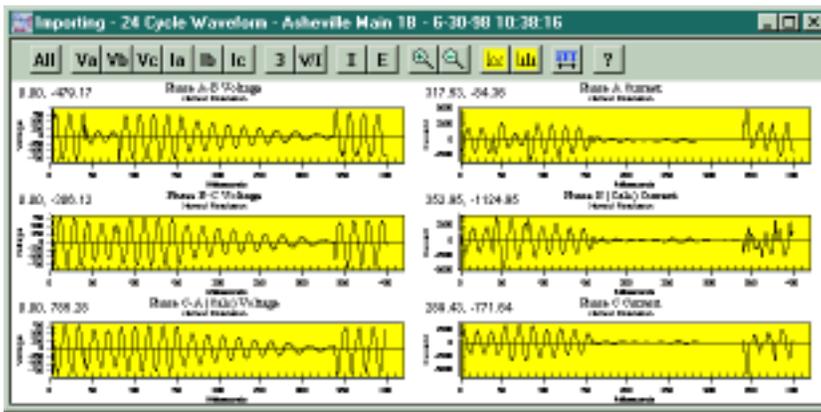
Devices in a typical POWERLOGIC system.

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.



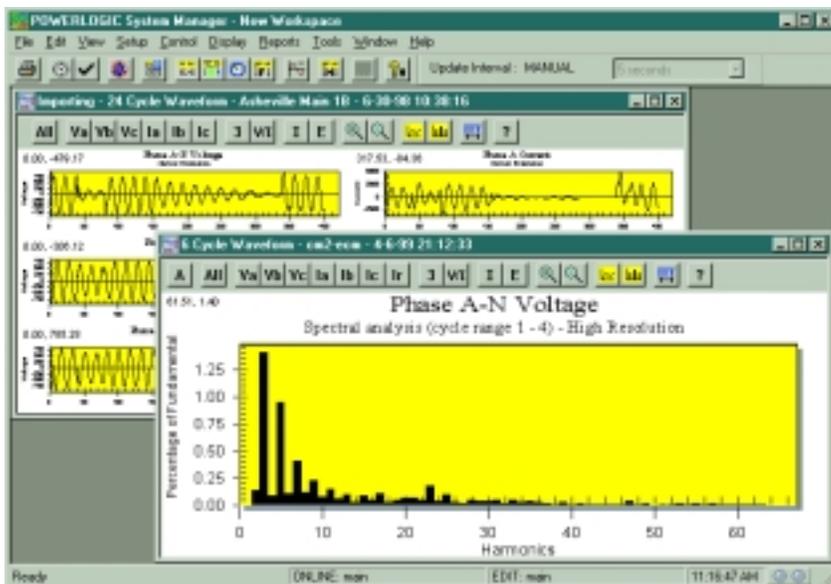
*This event lasted only a quarter of a second, yet its effect shut down a production process for four hours. Square D power quality experts showed that the event should not have caused an interruption to the plant, exposing a coordination problem on the electric utility distribution circuit.*

### 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 63<sup>rd</sup> 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.



*POWERLOGIC software can show all phase voltage and current waveforms simultaneously, or a frequency spectrum containing harmonics through the 63<sup>rd</sup>.*



The 3090 SMA-220 (left) and the 3090 CMA-100 provide convenient alternatives to flush panel mounting.

### 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

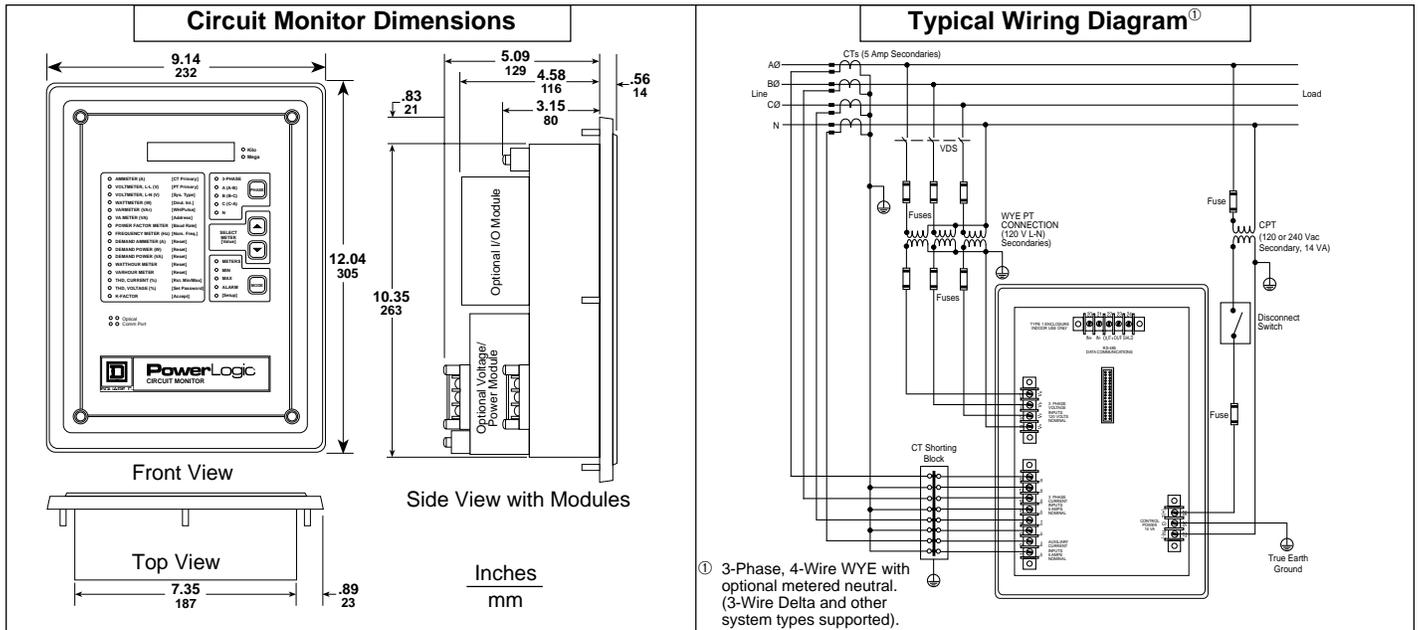
The circuit monitor has an optical communications port built into the front panel as a standard feature. Using this port, a portable computer with an optical communications interface (OCI-2000) can retrieve data from the circuit monitor. The OCI-2000 mounts magnetically to the circuit monitor and provides 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.



An I/O module and either a voltage/power module, or a control power module can mount on the back of the circuit monitor.

It's easy to tap into a circuit monitor using a PC and an optical communications interface.

# POWERLOGIC Circuit Monitor



## 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<sup>②</sup>

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  
Burden<sup>③</sup> (typical) ..... 14–19 VA

Temp. Range (operating) ..... -25 to 70° C

<sup>②</sup> Accuracies apply to CM-2150, CM-2250, CM-2350, CM-2450.

<sup>③</sup> Up to 27 VA, depending on I/O module option.

## Ordering Information

Class	Type	Description
3020	CM2150	Circuit monitor with full instrumentation (0.2% accuracy), on-board data logging, 100K memory
3020	CM2250	Circuit monitor with full instrumentation, CM2150 features, and waveform capture
3020	CM2350	Circuit monitor with full instrumentation, CM2250 features, and disturbance monitoring
3020	CM2450	Circuit monitor with full instrumentation, CM2350 features, and programmable logic
3020	CM2150-512K	Circuit monitor with full instrumentation (0.2% accuracy), on-board data logging, and 612K memory
3020	CM2250-512K	Circuit monitor with full instrumentation, CM2150 features, waveform capture, and 612K memory
3020	CM2350-512K	Circuit monitor with full instrumentation, CM2250 features, disturbance monitoring, and 612K memory
3020	CM2450-512K	Circuit monitor with full instrumentation, CM2350 features, programmable logic, and 612K memory
3020	CM2150-1024K	Circuit monitor with full instrumentation (0.2% accuracy) on-board data logging, and 1124K memory
3020	CM2250-1024K	Circuit monitor with full instrumentation, CM2150 features, waveform capture, and 1124K memory
3020	CM2350-1024K	Circuit monitor with full instrumentation, CM2250 features, disturbance monitoring, and 1124K memory
3020	CM2450-1024K	Circuit monitor with full instrumentation, CM2350 features, programmable logic, and 1124K memory
3020	CM-2000U	Circuit monitor firmware upgrade kit
3020	CM-MEM-512K	Circuit monitor 512K memory upgrade kit
3020	CM-MEM-1024K	Circuit monitor 1024K memory upgrade kit
3020	IOM11	I/O module with 1 input and 1 pulse output
3020	IOM18	I/O module with 8 inputs and 1 pulse output
3020	IOM44	I/O module with 4 inputs and 4 outputs
3020	IOM4411-01	I/O module with 4 digital inputs, 4 digital outputs, 1 analog input, and 1 analog output (1 mA)
3020	IOM4411-20	I/O module with 4 digital inputs, 4 digital outputs, 1 analog input, and 1 analog output (20 mA)
3020	IOM4444-01	I/O module with 4 digital inputs, 4 digital outputs, 4 analog inputs, and 4 analog outputs (1 mA)
3020	IOM4444-20	I/O module with 4 digital inputs, 4 digital outputs, 4 analog inputs, and 4 analog outputs (20 mA)
3020	ECM-2000	Ethernet communications module, supports up to 8 devices
3020	ECM-RM	Ethernet communications module, remote mounted, supports up to 8 devices
3090	VPM277C1	Voltage power module for circuit monitor (Series 2000), 480Y/277V
3090	CPM48	Control power module for circuit monitor (Series 2000), 18-60 Vdc
3090	RTM317	Ride through module for circuit monitor (Series 2000)
3090	SMA220	Surface-Mounting Adapter with Hinged Cover for Circuit Monitor (CM2000)
3090	CMA100	Mounting Collar for Circuit Monitor (CM2000)
3090	CMA110	CM2000 Mounting Adapter with Accessory Compartment
3020	RIO110	2' I/O shielded ribbon cable extension with mounting hardware
3090	OCL2000	Front Panel Optical Communications Interface for Circuit Monitor (CM2000)

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