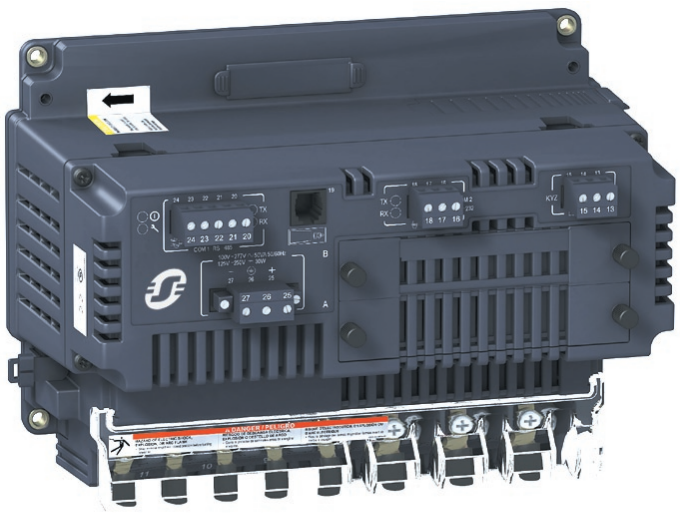
PowerLogic power-monitoring units

Circuit monitor series 4000

Technical data sheet

2009



Schneider Electric

Circuit Monitor Series 4000
Functions and characteristics

DB119008

Transparent Ready

PE86140

CM4000 + vacuum fluorescent display (VFD).

The PowerLogic Circuit Monitor Series 4000 offers high-performance digital instrumentation, data acquisition and control capabilities. The products can integrate easily in power monitoring and control systems due to their optional Ethernet connections and embedded web server. They are Transparent Ready.
These devices are designed for applications where power quality and availability are critical factors. They are generally used at service entrances and interconnection points or on circuits feeding sensitive equipment. Due to their very wide range of features, including transient detection (CM4000T only), it is possible to rapidly solve problems related to poor power quality. EN 50160 compliance checking capability makes these products ideal to meet new needs related to market deregulation.
The Circuit Monitor Series 4000 is available in two versions:
- CM4250, with detection of voltage sags, swells and other power quality indices
- CM4000T, with detection of voltage sags and swells together with transient detection and flicker measurements.

Applications
Panel instrumentation.
Sub-billing / cost allocation.
Remote monitoring of an electrical installation.
Extensive power-quality monitoring.
Contract and load curve optimisation.
EN 50160 electrical supply compliance checking.
Metering of other utilities.

Main characteristics
Disturbance direction detection
Indication of whether the source of a specific power quality event is upstream or downstream from the meter.

Power quality summary
Consolidation of all the power quality characteristics into a single trendable index.

Adaptive waveform capture
Capture of long-duration events.

Shift energy summary
Indication of energy usage per shift up to three shifts a day.

Detection and capture of voltage sags and swells
Fast identification of problems causing production shutdown.

Detection and capture of short transients less than 1 µs (optional, CM4000T only)
Identification of problems due to short disturbances, e.g. switching of capacitors, etc.

Flicker evaluation based on IEC 61000-4-15 and IEEE 1453 (CM4000T only)
Measurement of rapid voltage variations.

Electrical quality checking in compliance with EN 50160
Fast standardised check on the quality of the electricity supplied.

Detection of major waveform changes
Detection of phase switching phenomena (for example during the transfer of a high-speed static switch) not detected by classical threshold-based alarms.

Ultra-fast recording of electrical parameters every 100 ms or every cycle
Preventive maintenance: acquisition of a motor startup curve, etc.

Trend curves and short-term forecasting
Rapid trending and forecasting of upcoming values for better decision making.

Automatic alarm setting
Alarm setpoint learning feature for optimum threshold settings.

Up to 32 Mbytes of memory (16 Mbytes standard)
For archiving of data and waveforms.

Ethernet 10/100 Mbits/s card and server for HTML pages (with optional Ethernet card)
Rapid data transfers over an intranet or the internet, simply using a web browser.

Alarm notification via email
High-priority alarms sent directly to the user's PC.
Instant notification of power quality events by email.

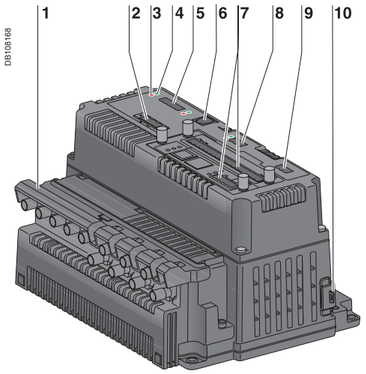
Up to 25 inputs/outputs to monitor the electrical installation (with optional I/O cards)
Status of circuit breakers, as well as metering of other commodities, e.g. gas, water, etc.

IEC 62053-22 and ANSI C12.20 Class 0.2S for energy
Verification of consumption and load curves.

Circuit Monitor Series 4000
Functions and characteristics (cont.)

Square D brand	
Circuit Monitor CM4250	**CM4250**
Circuit Monitor CM4000T	**CM4000T**

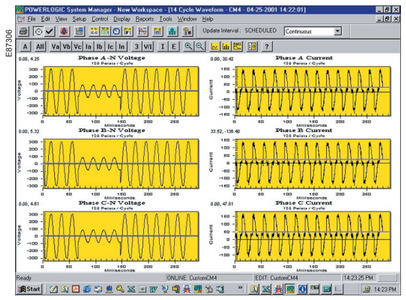
DB108168



CM4000.

1 *Current/voltage module.*
2 *Control power-supply connector.*
3 *Maintenance LED indicator.*
4 *Power LED indicator.*
5 *RS 485 port with transmit and receive LED indicators.*
6 *Display communication port.*
7 *Slots for optional cards.*
8 *RS 232 port with transmit and receive LED indicators.*
9 *KYZ pulse output.*
10 *Sealable access door.*

E87306



Disturbance waveform capture: detection of a voltage sag.

Part numbers

Circuit Monitor Series 4000	
Merlin Gerin brand	
Circuit Monitor CM4250	**CM4250MG**
Circuit Monitor CM4000T	**CM4000TMG**
Options	
See page 432E2010.indd/4	

Selection guide		CM4250	CM4000T
General			
Use on LV and HV systems		■	■
Current and voltage accuracy		0.07 %	0.07 %
Energy and power accuracy		0.2 %	0.2 %
Nbr of samples/cycle or sample frequency		512	5 MHz
Instantaneous rms values			
Current, voltage, frequency		■	■
Active, reactive, apparent power	Total and per phase	■	■
Power factor	Total and per phase	■	■
Energy values			
Active, reactive, apparent energy		■	■
Settable accumulation modes		■	■
Demand values			
Current	Present and max. values	■	■
Active, reactive, apparent power	Present and max. values	■	■
Predicted active, reactive, apparent power		■	■
Synchronisation of the measurement window		■	■
Setting of calculation mode	Block, sliding	■	■
Power quality measurements			
Interharmonics		■	-
Harmonic distortion	Current and voltage	■	■
Individual harmonics	Via monitor	63	63
	Via SMS	255	255
Waveform capture		■	■
Detection of voltage swells and sags		■	■
Adaptive waveform capture (up to 64 s)		■	■
Detection and capture of transients (< 1 µs)		-	■
Flicker		-	■
Fast acquisition of 100 ms or cycle by cycle data		■	■
EN 50160 compliance checking (1)		■	■
Programmable (logic and math functions)		■	■
Data recording			
Min/max of instantaneous values		■	■
Data logs		■	■
Event logs		■	■
Trending/forecasting		■	■
Alarms (optional automatic alarm setting)		■	■
Alarm notification via email		ECC21 option	
SER (Sequence of Event Recording)		■	■
Time stamping		■	■
GPS synchronisation (1 ms)		IOC44 option	
Memory expandable up to		32 Mbytes	32 Mbytes
Display and I/O			
Display		CMDLC or CMDVF option	
Multilingual: English, French, Spanish, German, Italian, Polish		■	■
Wiring self-test		■	■
Pulse output		■	■
Maximum number of I/Os		25	25
Input metering capability (number of channels)		10	10
Direct voltage connection		690 V	600 V
Communication			
RS 485 port		2/4 wires	2/4 wires
RS 232 port		■	■
Modbus protocol		■	■
Ethernet card (Modbus/TCP/IP protocol)		ECC21 option	
HTML-page web server		ECC21 option	
Ethernet gateway for third-party products		ECC21 option	

(1) *Except for interharmonics, signalling voltages, flicker and transients.*

Circuit Monitor Series 4000
Functions and characteristics (cont.)

The Circuit Monitor has two optional display units, an LCD display and a vacuum fluorescent display (VFD). They may be used for local circuit-monitor setup and operation.

PE86143

CMDLC display

Back-lit LCD display with four lines and 20 characters per line. The display unit has four navigation buttons, a contrast button and a red alarm LED.
It connects to the Circuit Monitor via a CAB12 cable, 4.2 metres long, supplied with the display.

Part numbers

		Merlin Gerin brand	Square D brand
LCD display supplied with the CAB12 cable		**CMDLCMG**	**CMDLC**
Connection cables: Circuit Monitor <-> display	1.25 m (4 ft)	**CAB4**	**CAB4**
	3.65 m (12 ft)	**CAB12**	**CAB12**
	9.14 m (30 ft)	**CAB30**	**CAB30**

PE86142

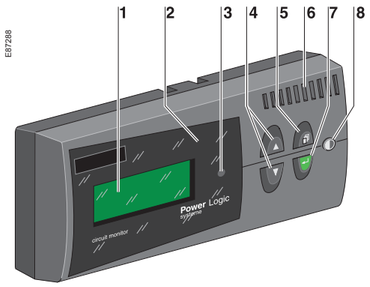
CMDVF display

Vacuum fluorescent display (VFD) with four lines and 20 characters per line.
The display unit has four navigation buttons, a contrast button, a red alarm LED.
The display comes with a cable for connection to the Circuit Monitor (CAB12 cable, 4.2 m long).

Part numbers

		Merlin Gerin brand	Square D brand
VFD supplied with the CAB12 cable		**CMDVFMG**	**CMDVF**
Connection cables: Circuit Monitor <-> display	1.25 m (4 ft)	**CAB4**	**CAB4**
	3.65 m (12 ft)	**CAB12**	**CAB12**
	9.14 m (30 ft)	**CAB30**	**CAB30**

E87268



Display.

1 *Display screen.*
2 *Alarm LED.*
3 *Arrow buttons.*
4 *Menu button.*
5 *Proximity sensor (VFD display only).*
6 *Enter button.*
7 *Contrast button.*

Circuit Monitor Series 4000
Functions and characteristics (cont.)

059141

Ethernet ECC21 communication card

The ECC21 is an optional Ethernet communication card. It may be installed in the slot in the Circuit Monitor intended for options. It has two main functions:
- equip the Circuit Monitor with a fast Ethernet connection over a 10/100 Mbits/s copper link or a 100 Mbits/s fiber-optic link
- serve as an Ethernet gateway for devices daisy chained to its RS 485 ModBus port.

The ECC21 card also includes a server for six HTML pages that may be consulted by a standard web browser. These pages can be customised using WPG software and display information from the host Circuit Monitor and/or devices connected to its ModBus port.

Part number

Ethernet communication card	**ECC21**

059217

CVM42 current/voltage module

This is the CM4250 acquisition module for currents and voltages. It is supplied already installed on the CM4250. If the Circuit Monitor must be recalibrated, this is the only module requiring recalibration. It may be installed and removed in the field. This module may also be replaced in the field by a CVMT module to transform a CM4250 into a CM4000T.

Part number

Current/voltage module for CM4250	**CVM42**

CVMT current-voltage module

This is the CM4000T acquisition module for currents and voltages, i.e. it is suitable for the detection of transient phenomena with a 5 MHz voltage-sampling rate. Similar to the CVM42, it may be installed and removed in the field. It is supplied already installed on the CM4000T.

Part number

CM4000T current/voltage module	**CVMT**

Memory extension kit

These kits make it possible to extend the Circuit Monitor memory to 16 MB or 32 MB.

Part numbers

32 MB kit	**CM4MEM32M**

Circuit Monitor Series 4000
Functions and characteristics (cont.)

Input/output blocks may be added to the Circuit Monitor to:
- monitor the electrical installation, notably the status of the circuit breakers, and check discrimination between protection devices
- measure the consumption of other commodities by counting the pulses sent by water or gas meters
- measure the temperature of the transformers
- transmit parameters over analog channels to other systems
- etc.

The Circuit Monitor may be equipped with a total of 25 optional digital or analog input/outputs.
These input/outputs may be added in two different manners:
- either using an IOC44 card
- or the IOX input/output extender module and individual input/output modules that connect to the extender.

All these options may be installed in the field. Status changes on the digital inputs are time-stamped to within the millisecond.

IOC44 card

This is an input/output card equipped with:
- 4 digital inputs 20 - 138 V AC/DC
- 4 digital outputs, including 3 relay outputs and a static output that may be programmed as a pulse output. It may be installed in the option-card slots of the Circuit Monitor.

There are three possible configurations:
- 1 IOC44 card
- 2 IOC44 cards
- 1 IOC44 card and 1 Ethernet ECC21 card.

Part number

IOC44 card	**IOC44**

IOX extender equipped with two input/output modules.

IOX2411 pre-equipped extender module.

IOX input/output extender

The IOX input/output extender may be equipped with up to eight plug-in input or output modules. The entire unit connects to the side of the Circuit Monitor.
The input/output modules may be digital or analog.
Three pre-equipped versions may be ordered directly, the IOX08, IOX0404 and IOX2411. Other versions may be user prepared by ordering an empty IOX extender and separate I/O modules (see the section on I/O Modules for selection). In this case, the IOX extender may be equipped with up to a maximum of four analog modules.

Description	
IOX extender	Empty extender with eight slots for separate input and/or output modules, digital or analog, with however a maximum of four analog modules.
IOX08 extender	IOX extender equipped with: 8 digital input modules 120 V AC
IOX0404 extender	IOX extender equipped with: 4 digital input modules 120 V AC 4 analog input modules 4-20 mA
IOX2411 extender	IOX extender equipped with: 2 digital output modules 60 V DC 4 digital input modules 32 V DC 1 analog output module 4-20 mA 1 analog input module 0-5 V

Part numbers

IOX extender	**IOX**
IOX08 extender	**IOX08**
IOX0404 extender	**IOX0404**
IOX2411 extender	**IOX2411**

Circuit Monitor Series 4000
Functions and characteristics (cont.)

Input/output modules

The input/output modules are installed in the slots of the IOX extender. One module corresponds to either one input or one output. A number of versions are available, digital and analog inputs and outputs, and different voltage levels.

Description	
DI120AC module	One digital input 120 V AC
DI240AC module	One digital input 240 V AC
DI32DC module	One polarised digital input 32 V DC, switching time 0.2 ms
DO120AC module	One digital output 120 V AC, 3.5 A max
DO240AC module	One digital output 240 V AC, 3.5 A max
DO200DC module	One digital output 200 V DC, 3.5 A max
DO60DC module	One digital output 60 V DC, 3.5 A max
AI05 module	One analog input 0-5 V DC
AI420 module	One analog input 4-20 mA
AO420 module	One analog output 4-20 mA, max. load 250 W

Part numbers

DI120AC module	**DI120AC**
DI240AC module	**DI240AC**
DI32DC module	**DI32DC**
DO120AC module	**DO120AC**
DO240AC module	**DO240AC**
DO200DC module	**DO200DC**
DO60DC module	**DO60DC**
AI05 module	**AI05**
AI420 module	**AI420**
AO420 module	**AO420**

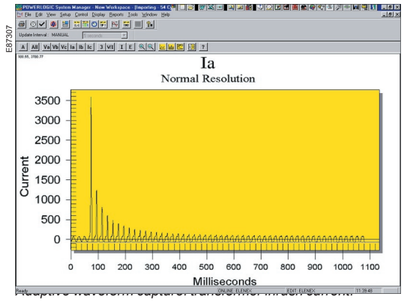
Circuit Monitor Series 4000
Functions and characteristics (cont.)

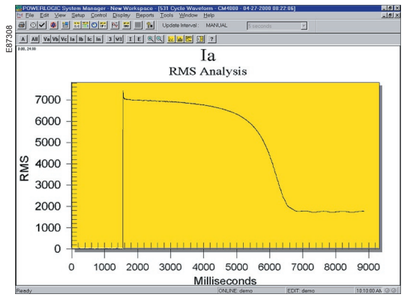
CM4000 + options: ECC21, IOC44 and IOX2411.

Electrical characteristics		
Type of measurement		True rms up to the 255th harmonic On three-phase AC system (3P, 3P + N) Up to 512 samples per cycle Up to 5 MHz for transient events (CM4000T only)
Measurement accuracy	Current and voltage	±0.04 % of reading + ±0.025 % of full scale
	Power	±0.075 % of reading + ±0.025 % of full scale
	Frequency	±0.01 Hz from 45 to 67 Hz ±0.1 Hz from 350 to 450 Hz
	Power factor	±0.002 from 0.5 leading to 0.5 lagging
	Energy: CM4250/CM4000T	IEC 62053-22 and ANSI C12.20 Class 0.2S
Data update rate		1 s in normal mode
Input-voltage characteristics	Measured voltage	0 to 600 V AC on CM4000T (direct) 0 to 690 V AC on CM4250 (direct) 0 to 1200 kV AC (with external VT)
	Measurement range	0 to 1.5 Un
	Impedance	> 2 MΩ
	Frequency measurement range	45 to 67 Hz and 350 to 450 Hz
Input-current characteristics	CT ratings	Adjustable from 5 A to 30 000 A
	Measurement range CM4250/CM4000T	5 mA to 10 A
	Permissible overload	15 A continuous 50 A for 10 seconds per hour 500 A for 1 second per hour
	Impedance	< 0.1 Ω
	Load	< 0.15 VA
Power supply	AC	100 to 275 V AC (±10 %), 50 VA
	DC	125 to 250 V DC (±20 %), 30 W
	Ride-through time	100 ms at 120 V DC
Input/outputs	Pulse output	Static output (240 V AC max, 96 mA max)
	IOC44 card (optional)	4 digital inputs (20-138 V AC/DC), 3 relay outputs (5 A to 240 V AC) 1 static output (96 mA max to 240 V AC)
	IOX extender (optional)	Slots for 8 I/Os
	IOX08 (optional)	8 digital inputs 120 V AC
	IOX0404 (optional) (1)	4 dig. inputs 120 V AC, 4 analog outputs 4-20 mA
	IOX2411 (optional) (1)	2 dig. outputs 120 V AC, 4 dig. inputs 32 V DC, 1 analog input 0-5 V, 1 analog output 4-20 mA
Mechanical characteristics		
Weight		1.9 kg
IP degree of protection (IEC 60529)		IP52
Dimensions CM4250/ CM4000T	Without IOX accessory	235.5 x 165.6 x 133.1 mm
	With IOX accessory	235.5 x 216.3 x 133.1 mm
Environmental conditions		
Operating temperature	Circuit Monitor	-25 °C to +70 °C
	CMDLC display	-20 °C to +60 °C
	CMDVF display	-20 °C to +70 °C
Storage temperature	CM + displays	-40 °C to +85 °C
Humidity rating		5 to 95 % RH at 40 °C
Pollution degree		2
Installation category	CVM42	IV
	CVMT	II
Dielectric withstand		As per EN 61010, UL508, CSA C22.2-2-4-M1987
Electromagnetic compatibility		
Electrostatic discharge		Level 3 (IEC 61000-4-2)
Immunity to radiated fields		Level 3 (IEC 61000-4-3)
Immunity to fast transients		Level 3 (IEC 61000-4-4)
Immunity to impulse waves		Level 4 (IEC 61000-4-5)
Conducted and radiated emissions		CE industrial envir./FCC part 15 class A
Safety		
Europe		CE, as per CEI 61010
USA and Canada		UL508 and CSA C22.2-2-2-4-M1987

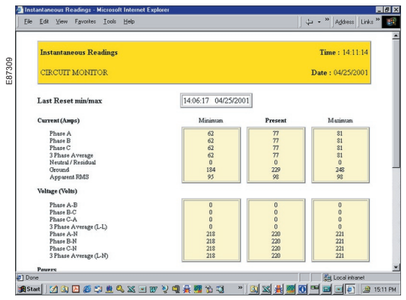
(1) *Operating limits: 0° C to +60 °C. Storage limits: -25 °C to +85 °C.*

Circuit Monitor Series 4000
Functions and characteristics (cont.)





Adaptive waveform capture: motor start, rms value.



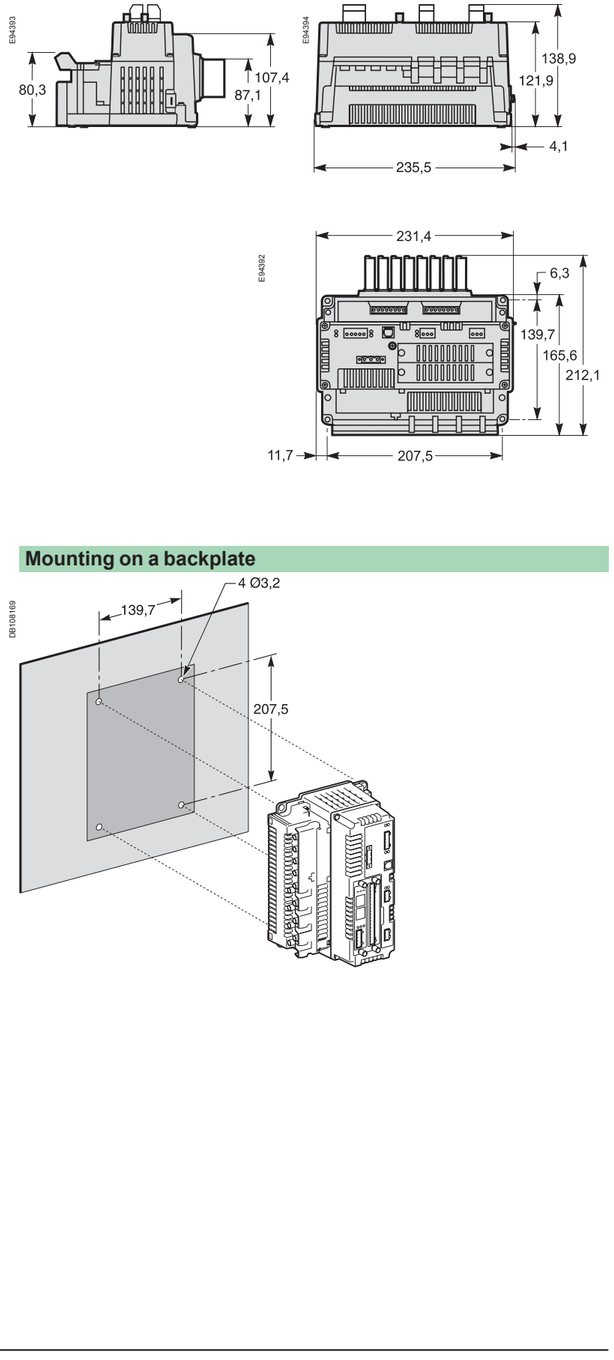
Example CM4250 HTML page showing instantaneous values.

Communication	
RS 485 port (1)	2/4 wires, up to 38400 bauds, Modbus
RS 232 port (1)	Up to 38400 bauds, Modbus, direct connection to a PC or modem
Ethernet ECC21 card with HTML server (optional) (1)	
Copper Ethernet link	10/100 BaseTX, RJ45 connector, 100 m link
Fiber-optic Ethernet link	100 Base FX, LC duplex connector, 1300 nm, FO multimode with gradient index 62.5/125 µm or 50/125 µm, 2000 m link
Protocol	Modbus/TCP/IP
Gateway function for products connected to the ECC21	Master Modbus port, 31 daisy-chained slaves, 63 with repeater, 2/4 wires, 1200 to 38400 bauds, also compatible with the PowerLogic protocol
HTML server	1 standard page, 5 customisable pages
Firmware characteristics	
14 data logs	Up to 96 different parameters, factory-set logs ready to use
One 100 ms data log	Parameters recorded every 100 ms for events
One 20 ms (50 Hz) or 16 ms (60 Hz) data log	Parameters recorded every 20 ms or 16 ms for events
One min/max log	-
One min/max/avg. log	Min/max/avg. values recorded for 23 parameters at regular intervals from 1 to 1440 minutes
One event log	Time stamping to 1 ms, synchro. 1 ms by GPS
Trend curves	Four trend curves: 1 minute, 1 hour, 1 day and 1 month. Min./max./avg. values recorded for eight parameters: - every second for one minute for the 1-minute curve - every minute for one hour for the 1-hour curve - every hour for one day for the 1-day curve - every day for one month for the 1-month curve
Forecasting	Forecasting of the values for the eight parameters for the next four hours and next four days
Waveform captures	Standard: manual launch, 1 cycle, 512 samples, 255th harmonic Disturbance: manual launch or by alarm, adjustable from 512 samples/cycle over 28 cycles to 16 samples/cycle over 915 cycles, response time less than 0.5 cycle, number of cycles before alarm settable from 2 to 10 Adaptive: manual launch or by alarm, adjustable from 512 samples/cycle over 8 seconds to 16 samples/cycle over 264 seconds, capture takes place during a set duration or as long as an alarm is active (to save memory), number of cycles before alarm settable from 2 to 10 Transient: voltage sampling at 5 MHz (83 333 samples/ cycle) over 2 ms to capture transient peaks < 1 µs
Alarms	Threshold alarms: - adjustable pickup and dropout setpoints and time delays, numerous activation levels possible for a given type of alarm - 4 priority levels - 4 response times: standard 1 s, fast 100 ms, disturbance < 1/2 cycle, transient < 1µs - boolean combination of four alarms is possible using the operators NAND, OR, NOR and XOR Automatic alarm setting: after a learning phase, the alarm thresholds are set automatically. The alarms will trip in the event of drift with respect to reference values determined during the learning period. Digital alarms: logic input transitions Waveform alarms: alarm tripping by a special algorithm when the current or voltage waveform is distorted beyond an adjustable level. Makes it possible to detect disturbances that cannot be detected by classical threshold alarms (e.g. phase switching).
Memory	8 Mbytes standard, expandable up to 32 Mbytes
Firmware update	Update via the communication ports
Display characteristics	
CMDLC (optional)	Back lit LCD
CMDVF (optional)	Vacuum fluorescent display (VFD) with IR port
Languages	English, French, Spanish, German, Italian, Polish

(1) *All the communication ports may be used simultaneously.*

Circuit Monitor Series 4000
Installation and connection

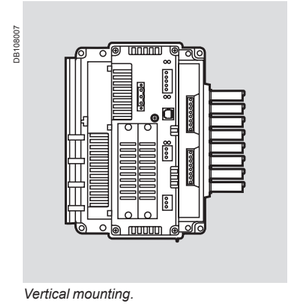
CM4250 / CM4000T dimensions



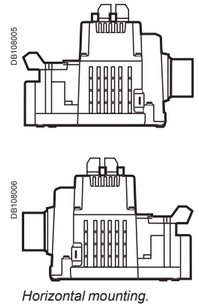
Mounting on a backplate

Circuit Monitor Series 4000
Installation and connection (cont.)

Mounting possibilities

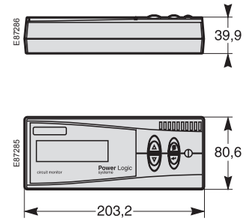


Vertical mounting.

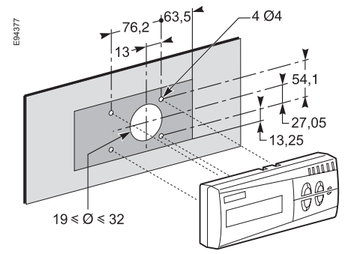


Horizontal mounting.

CMDLC/CMDVF dimensions

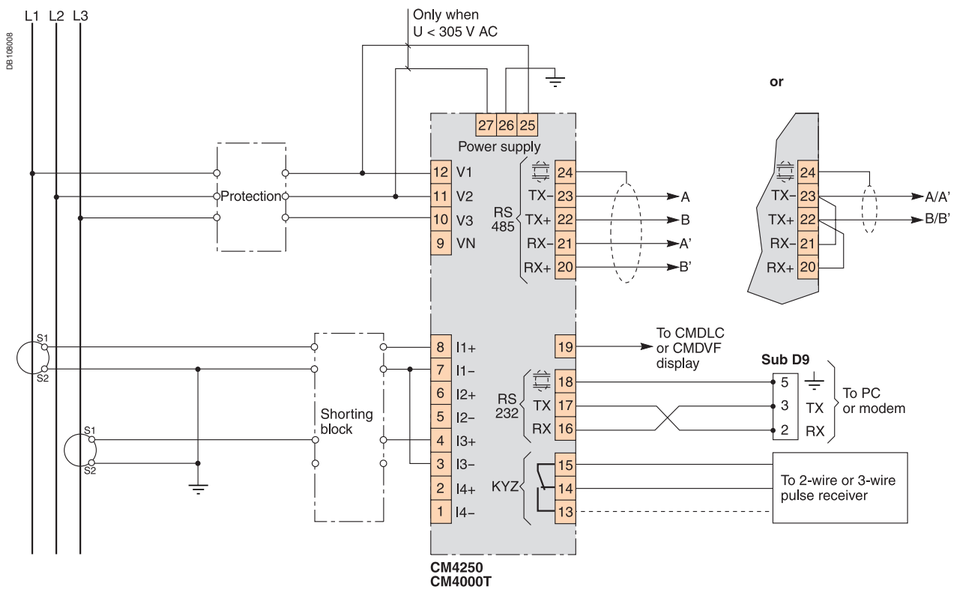


Mounting on a backplate

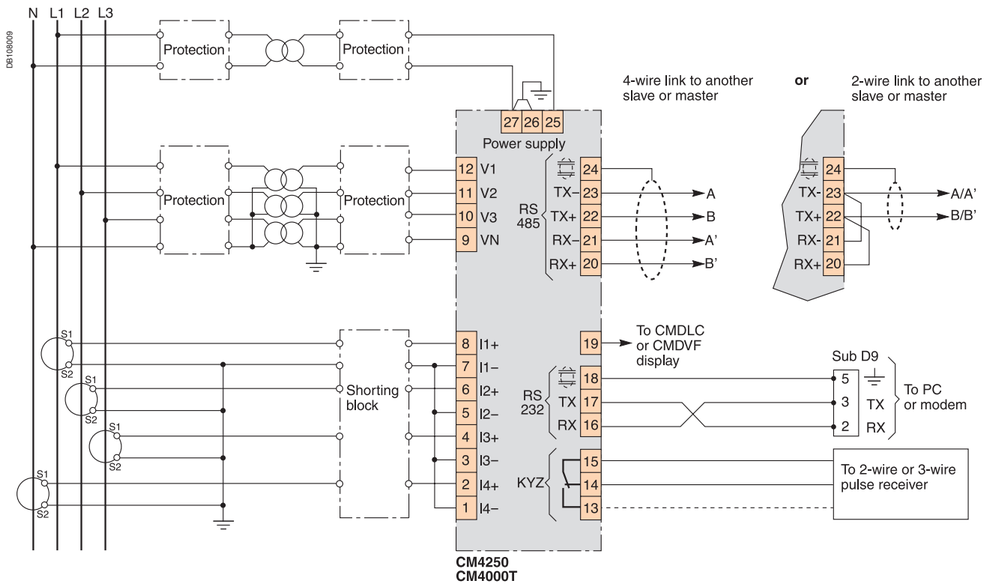


Circuit Monitor Series 4000
Installation and connection (cont.)

3-wire connection with 2 CTs and no PT

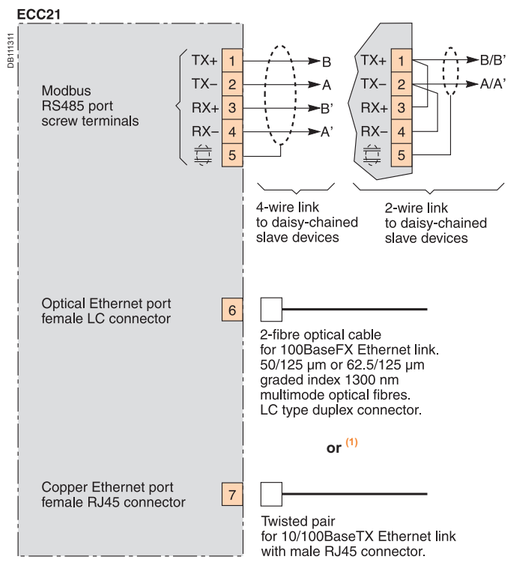


4-wire connection with 4 CTs and 3PTs

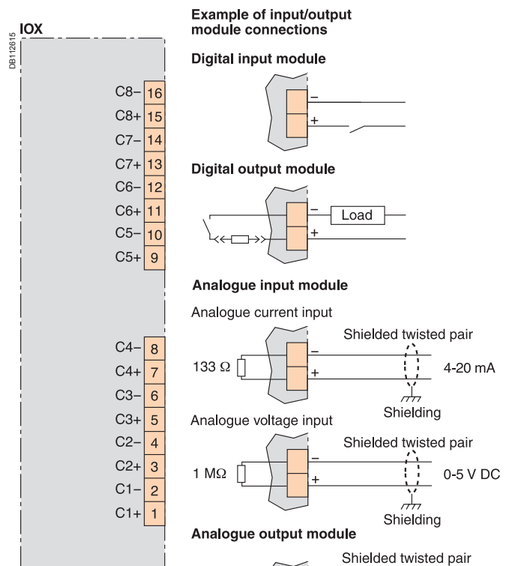


Circuit Monitor Series 4000
Installation and connection (cont.)

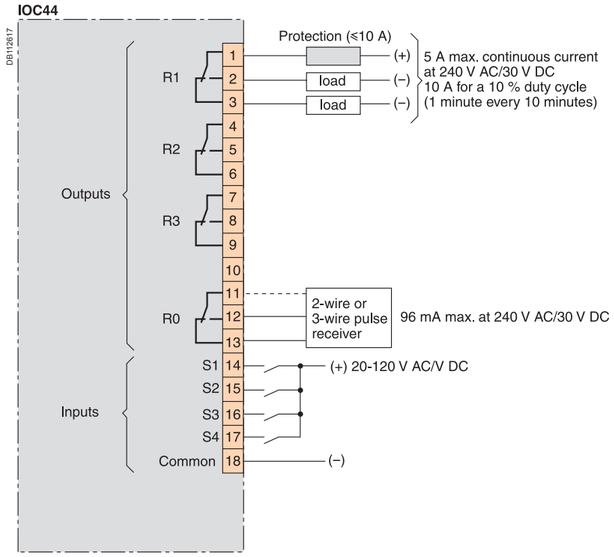
Ethernet ECC21 communication card



IOX input/output extender



IOC44 input/output card



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