Advanced Power Quality Analyzer

For Utility, Industrial and Commercial Power Quality Monitoring

www.cet-global.com

Cost Effective PMC-680i & PMC-670 High Performance

Power Quality (PQ) is an important issue for many electricity consumers at all levels due to the recent proliferation of sensitive power electronic equipment and non-linear loads in industrial, commercial and domestic applications, which cause them to be much more sensitive to voltage dips and transients. At the same time, these loads are highly harmonic and would potentially pollute the supply networks, cause safety concerns, reduce supply reliability and above all result in damages to capital-intensive appliances and significant economic losses. Utilities have recently raised their alert levels and started to invest heavily on power quality monitoring and reporting to obtain the much needed information to validate compliance, improve system stability as well as supply reliability. Further, the large-scale deployment of renewable energy generation as well as high penetration of solar inverters would cause additional PQ concerns and destabilize public electricity supply networks.

PMC-680i & PMC-670 are advanced power quality monitoring products that have been certified for IEC 61000-4-30 Class A compliance and therefore can provide a complete picture of PQ Compliance Level at any critical points in a power transmission or distribution network. This allows both the suppliers and the consumers to understand power quality related issues as well as make decisions quickly and effectively to address any potential problems. CET's PMC-680i & PMC-670 provide complete IEC 61000-4-30 compliance measurements, generate EN 50160 reports and capture power quality events such as Dips, Swells, Transients and Interruptions with high-resolution Voltage and Current waveforms and extended duration.

Typical Applications

Utility

- PQ monitoring at HV, MV and LV Utility Substations
- Benchmarking for Supply Reliability and PQ performance
- Identify the improvement areas on Power System
- Fault location and PQ Event investigation
- Substation Automation

Industrial and Commercial

- PQ monitoring at Mains and Critical feeders
- Harmonic and Disturbance Monitoring
- EN 50160 & IEC 61000-4-30 Class A Compliance Verification
- Energy Efficiency improvement

International Standards

- IEC 61000-4-30 Class A Certified
- IEC 61000-4-15 Flicker
- IEC 61000-4-7 Harmonics
- IEC 62053-22 Class 0.2S Compliant
- IEC 61850 for Smart Grid (optional)

Industrial Grade Components

- Extended Temperature Range
- Standard Tropicalization
- Extended Warranty

Comm. & I/Os

- 2xRS-485
- 2xEthernet Ports (PMC-680i)
  1xEthernet Port (PMC-670)
- 8xDIs, 4xROs
- 4xDOs (PMC-680i)
  2xDOs (PMC-670)
- Modbus RTU/TCP, HTTP, SNTP, SMTP

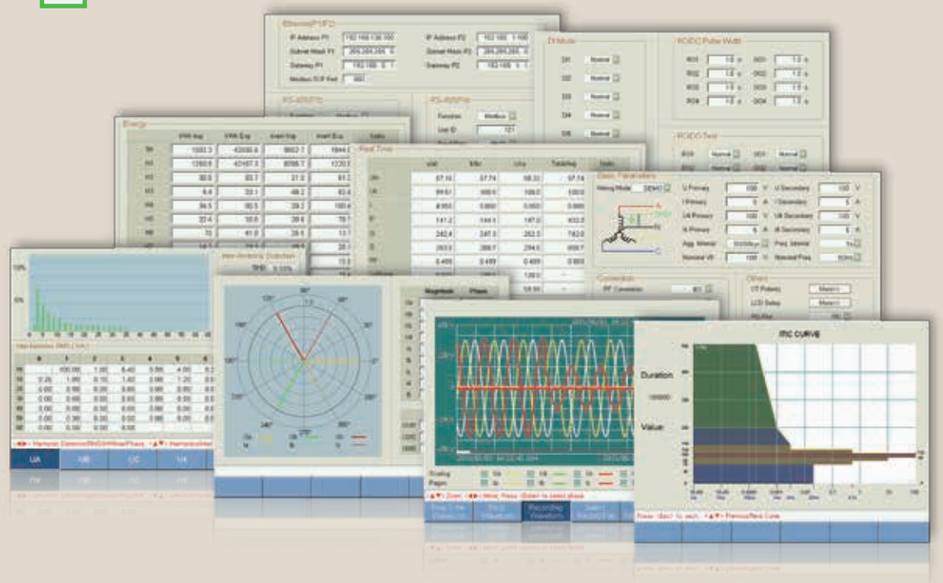
Features Summary

PMC-680i

- DIN 192 (186x186 Cutout)
- 4GB Log Memory
- Optional Split-Core CT

PMC-670

- DIN 144 (138x138 Cutout)
- 2GB Log Memory



Comprehensive Data Recording

- Statistical Data Recorders
- Real-Time / HS Data Recorders
- Interval Energy Log
- Max/Min Log
- SOE Log
- PQ Log

Enhanced Monitoring, Alarming & Control

- PQ Setpoints
- Control Setpoints
- DI Setpoints
- Trigger DO, SOE Log, Data Recording, Waveform Recording or Alarm Email

Front Panel & Built-in Web Interface

- 5.7" Color LCD Display @ 640x480
- EN 50160 Report
- PQ Event with ITIC/SEMI F47 Plot
- High-resolution waveform, WFR and DWR
- Real-time Waveform Capture
- Harmonic & Interharmonic Histogram
- Harmonic Power and Energy
- Phasor Diagrams
- SOE & PQ Log
- I/O status
- Device configuration
- Diagnostics

Time Synchronization

- Battery-backed real-time clock @ 6ppm
- Time Sync. via Modbus RTU protocol, SNTP and GPS @ 1PPS
- Optional IRIG-B input

Advanced Power Quality Features

- Dips/Swells, Transients, Flickers & Harmonics Monitoring
- Disturbance Waveform Recording (DWR) and Waveform Recording (WFR) @ 512 Samples/Cycle for Power Quality events
- Disturbance Direction Indicator (PMC-680i)
- COMTRADE Compatible
- EN 50160 Compliance Reporting
- PQDIF Support for PMC-680i
- Optional 1024 Samples/Cycle for PMC-680i

PQ Monitoring PMC-680i & PMC-670 Multifunction

Metering

PMC-680i and PMC-670 perform basic measurements at 1-second update rate and high-speed measurements for event detection at ½ cycle update rate.

Basic Measurements (1-second update)

- 3-phase V&I, Power, PF, V4, I4, (I5 for PMC-680i only)
- Frequency and Phase Angles
- kWh, kvarh Import/Export/Net/Total and kVAh Total

High-speed Measurements (½ cycle update)

- 3-phase V&I, Power, PF, V4, I4, (I5 for PMC-680i only)
- High-speed Frequency detection
  - 1 cycle for PMC-680i
  - 5 cycles for PMC-670

Demands

- Demand is defined as the average power consumption over a fixed interval
- Sliding Window Demands with programmable interval (1 to 60 minutes) and No. of Demand Intervals
- Optional Demand Synchronization through DI
- PQ Demands for THD/TOHD/TEHD, ...etc.
- Max. Demands for This Month and Last Month

Multi-Tariff TOU Capability

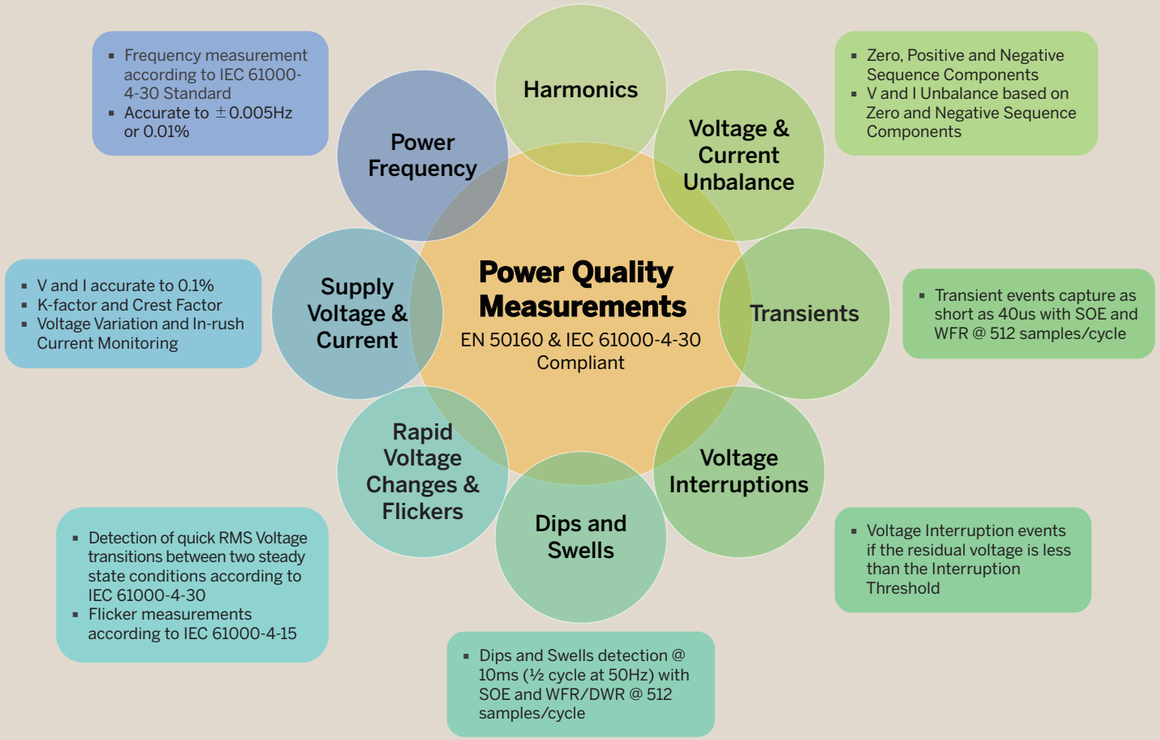
Two independent sets of TOU Schedules, each supporting

- Up to 12 Seasons
- 90 Holidays or Alternate Days and 3 Weekdays
- 20 Daily Profiles, each with 12 Periods in 1-minute interval
- 8 Tariffs, each providing the following information:
  - kWh/kvarh Import/Export and kVAh
  - kW/kvar Import/Export Peak Demands
  - Register rollover at 100,000,000,000 kXh

Power Quality (PQ) Metering

Both PMC-680i and PMC-670 comply with IEC 61000-4-30 Class A, IEC 61000-4-15, IEC 61000-4-7 and EN 50160, offering accurate harmonic measurements up to the 63rd order and capable of capturing disturbance events such as Transients, Dips, Swells and Interruptions. In addition, the PMC-680i provides high-end fault recorder feature with its Disturbance Waveform Recorder (DWR), capable of capturing events that last over 300 seconds in duration in varying resolutions. This feature likely gives the PMC-680i the highest Performance/Cost ratio of any panel-mount PQ Analyzers for the utility market today.

- IEC 61000-4-7 Compliance
- V & I THD. TOHD, TEHD, Harmonics & Inter-Harmonics up to 63rd
- Harmonic kW, kvar, kVA and PF from Fundamental to 63rd
- Total harmonic kWh, kvarh Import/Export/Net/Total
- Individual harmonic Total kWh, kvarh Import/Export/Net/Total



Data and Event Recorders

PMC-680i and PMC-670 offer 4GB and 2GB, respectively, of extended non-volatile memory for data and event recording. Data Recorders support programmable Sources, Recording Intervals, Depths and Offsets in FIFO or Stop-When-Full mode.

Interval Energy Recorder (IER)

- kWh, kvarh Import/Export and kVAh Total, Total Harmonic kWh, kvarh Import/Export
- Recording interval from 1 to 65,535 minutes
- FIFO and Stop-When-Full mode

Real-Time and High-Speed (HS) Data Recorder

- Recording interval
  - 1s to 40 days for Real-Time Data Recorder
  - ½ cycle to 60 cycles for HS Data Recorder
- Max. Depth @ 65,535

No. of Data Recorders	PMC-680i	PMC-670
Real-Time	8 (32 Parameters/Recorder)	16 (16 Parameters/Recorder)
High-Speed (HS)	4 (16 Parameters/Recorder)	4 (16 Parameters/Recorder)

Max/Min Recorder (MMR)

Logging of Max/Min values for real-time measurements of V, I, kW, kvar, kVA, PF, Freq., Unbalance, K-factor, THD.

PQ Log

Recording the time and characteristic data of the captured PQ events such as Transients, Dips/Swells, Interruptions, Rapid Voltage Changes and all PQ related parameters with maximum 1024 FIFO entries time-stamped to ±1ms resolution.

SOE Log

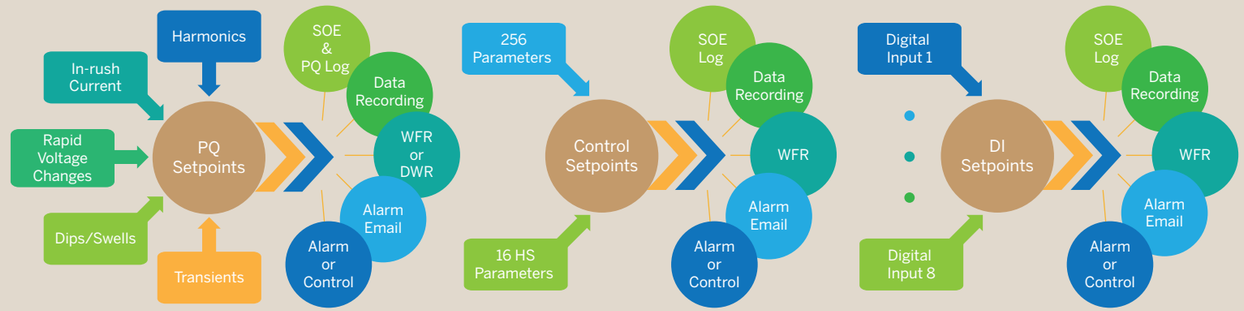
- Setup changes, System events, Setpoint events and I/O operations
- 1024 FIFO events time-stamped to ±1ms resolution

Statistical Data Recorder (SDR) Log (PMC-680i only)

- Recording of the Max, Min, Avg. and 95th percentile for real-time measurements including V, I, Freq., Flicker, Harmonics and Unbalances in 16 different recorders of 64 parameters each
- Recording interval from 1 minute to 60 minutes
- 30 days @ 1-minute, 300 days @ 10-minute, 450 days @ 15-minute
- On-board trending via Front Panel display
- PQDIF file format, downloadable from the on-board FTP Server

Setpoints

PMC-680i and PMC-670 provide extensive control by allowing users to initiate an action in response to a specific condition from PQ events, Control parameters or Digital Input status. Typical applications include SOE or PQ Log reporting, Waveform and Data Recording as well as DO Triggering for Alarm or Control Actions.



PQ Setpoints | Control Setpoints | DI Setpoints

Inputs and Outputs

Digital Inputs

PMC-680i and PMC-670 are equipped with 8 self-excited Digital Inputs for external status monitoring, Demand Synchronization or pulse counting with programmable weight for collecting WAGES (Water, Air, Gas, Electricity, Steam) information.

- Internally wetted at 24 VDC with programmable debounce
- 1,000Hz sampling
- Time Sync. via GPS's 1PPS output

Digital Outputs

PMC-680i and PMC-670 come standard with Mechanical Relay Outputs (RO) for setpoint alarming and control as well as Solid State Digital Outputs (DO) for energy pulsing.

	PMC-680i	PMC-670
RO	2 Form A Mechanical Relays 2 Form C Mechanical Relays	4 Form A Mechanical Relays
DO	4 Solid State Digital Outputs (Optically Isolated)	2 Solid State Digital Outputs (Optically Isolated)

High Accuracy PMC-680i & PMC-670 Substation Automation

Communications

RS-485

Both PMC-680i and PMC-670 are equipped with 2 RS-485 ports for serial communications

- Optically isolated with baud rate from 1.2 to 115.2 kbps
- Modbus RTU protocol

Ethernet Port

100BaseT for High-speed data connection supporting the following Protocols

- Modbus TCP
- HTTP, SNTP, SMTP, FTP
- Ethernet Gateway
- Optional IEC 61850

	PMC-680i	PMC-670
Ethernet port (RJ45 connector)	Two Ethernet ports (one of which is an optional 100BaseFX port)	One Ethernet port
Simultaneous Client Connections	10 Modbus TCP 12 IEC 61850 (optional)	10 Modbus TCP 8 IEC 61850 (optional)

Time Synchronization

- Battery-backed real-time clock @ 6ppm (⩽ 0.5s/day)
- Time Synchronization via Modbus RTU protocol, SNTP, GPS @ 1PPS or optional IRIG-B input

System Integration

PecStar® iEMS

The PMC-680i is supported by CET's PecStar® iEMS software. In addition, the PMC-680i can be easily integrated into other 3rd party systems because of its support of multiple communications ports as well as different industry standard protocols such as Modbus and optional IEC 61850.

3rd Party System Integration

Easy integration into Substation Automation or Utility SCADA systems via Modbus RTU, Modbus TCP or IEC 61850.

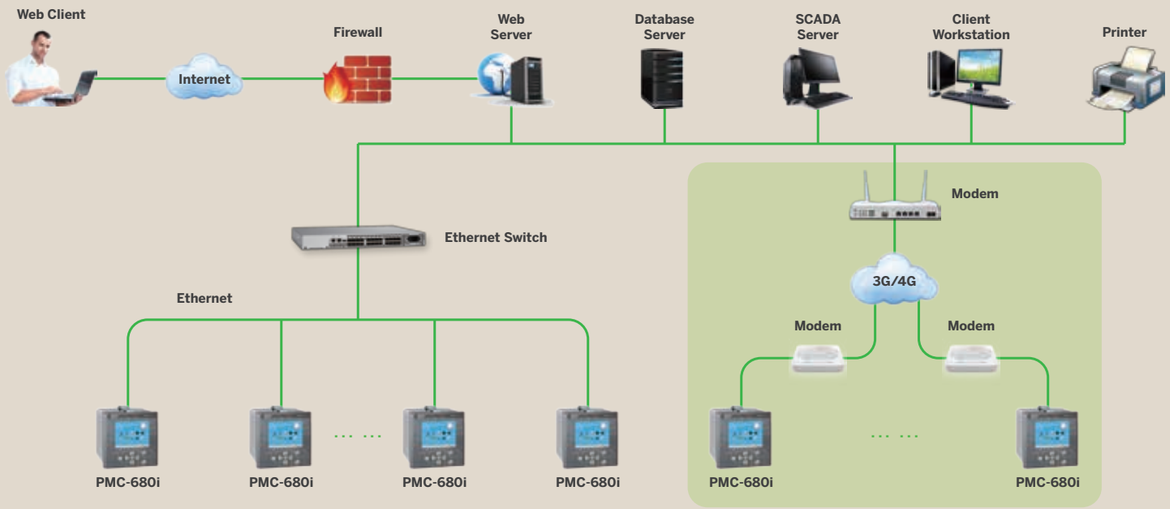
Web Interface

The on-board Web Server allows complete access to its data and supports the configuration for most Setup parameters via a web browser without using any proprietary software. The on-board, password protected FTP Server allows logged data in PQDIF or COMTRADE format to be downloaded and then subsequently viewed using any 3rd-party software that supports the industry standard PQDIF and COMTRADE file formats.

CT Clamp Selections

Model No.	Specification	Output Voltage	Accuracy	Diameter	Cable Length	Appearance
PMC-SCCP-50A-500mV-B-A-B	5A (50A Imax)	AC 10mV/A	±0.3% rdg. ±0.02% f.s.	15mm	3m	
PMC-SCCP-200A-200mV-B-B-B	20A/200A (200A Imax)	AC 10mV/A (20A) AC 1mV/A (200A)	±0.3% rdg. ±0.02% f.s.	24mm	3m	
PMC-SCCP-500A-500mV-B-B-B	500A (500A Imax)	AC 1mV/A	±0.5% rdg. ±0.02% f.s.	50mm	3m	
PMC-SCCP-9667	500A/5000A (5500A Imax)	AC 1mV/A (500A) AC 0.1mV/A (5000A)	±2.0% rdg. ±1.5mV	254mm	3m	

Typical Network Application



Accuracy

Parameters	Accuracy		Resolution
	PMC-680i	PMC-670	
Voltage (V)	±0.1%		0.01V
Current (I)	±0.1%		0.001A
kW, kVA	±0.2%		0.001kX
kvar	±0.2%		0.001kvar
kWh, kVAh	IEC 62053-22 Class 0.2S		0.1kXh
kvarh	IEC 62053-23 Class 2		0.1kvarh
Power Factor	±0.2%	±0.5%	0.001
Frequency	±0.005Hz		0.001Hz
Harmonics	IEC 61000-4-7 Class A		0.01%
Phase Angles	±0.2°	±1°	0.1°
Voltage Deviation	±0.1%		0.01%
Voltage Unbalance	±0.1%		0.01%
Current Unbalance	±0.5%		0.01%

Technical Specifications

Voltage Inputs (V1, V2, V3, V4, VN)

		PMC-680i	PMC-670
Standard (Vn)		240VLN/415VLL	400VLN/690VLL
Optional (Vn)		400VLN/690VLL	-
Range	Standard	1V-150% of Vn	10V-120% of Vn
	Optional	1V-200% of Vn	-
Overload		2xVn continuous, 4xVn for 1s	1.2xVn continuous, 4xVn for 1s
Burden		<0.1VA/phase	
PT Ratio	Primary	1-1,000,000V	
	Secondary	100-690V	
	V4 Primary	1-1,000,000V	
	V4 Secondary	100-690V	1-400V
Frequency		42Hz-58Hz @ 50Hz 50Hz-70Hz @ 60Hz	

Current Inputs (I11, I12, I21, I22, I31, I32, I41, I42, I51, I52)

		PMC-680i	PMC-670
Standard (In)		5A	
Optional (In)		1A	
Range		0.1%-1,000% In (I1-I3) 0.1%-300% (I4-I5)	0.1%-400% In (I1-I4)
Starting Current		0.1% In	
Overload		4xIn continuous, 20xIn for 1s	4xIn continuous, 10xIn for 1s
Burden		<0.5VA/phase	
Optional SCCP50		5A/50A (In/Imax) Split-Core Current Probe	-
CT Ratio	Primary	1-30,000A	
	Secondary	1-5A	
	I4 Primary	1-30,000A	
	I4 Secondary	1-5A	

Power Supply (L+, N-, G)

	PMC-680i	PMC-670
Standard	95-250VAC/VDC ± 10%, 47-440 Hz	
Optional	20-60VDC	
Burden	<10W	<8W

Digital Inputs (COM, DI1, DI2, ..., DI7, DI8)

Standard	Dry contact, 24VDC internally wetted
Sampling	1,000Hz
Hysteresis	1ms minimum

Relay Outputs (RO1, RO2, RO3, RO4)

	PMC-680i	PMC-670
Type	Form A Mechanical Relay	
Loading	5A @ 250VAC / 30VDC	5A @ 250VAC / DC
Type	Form C Mechanical Relay	
Loading	8A @ 250VAC / 24VDC	-

Digital Outputs (COM, DO1, DO2, DO3, DO4)

Type	Form A Solid State Relay
Isolation	Optical
Max. Load Voltage	80V
Max. Forward Current	50mA

GPS/IRIG-B (Optional)

	PMC-680i	PMC-670
Hardware Interface	D+, D-, SH (via COM2)	D+, D-, SH (via COM1)

LCD Display

Type	Color TFT LCD, Industrial Grade
Resolution	640x480
View Area	115x86mm (5.7")

Safety Standards

Safety Requirements

		PMC-680i	PMC-670
LVD Directive 2006/95/EC		EN 61010-1-1: 2001	
Insulation		IEC 60255-5: 2000	
Dielectric Test	Between Power, AC Circuits, and GND	2kV @ 1 minute	
	Between I/O, GPS and GND	500V @ 1 minute	
Insulation Resistance	Between Power, AC Circuits, and GND	>100MΩ	
	Between GPS and GND	>100MΩ	>10MΩ
	Between Voltage and GND	>5MΩ	
Impulse Voltage	Rated input voltage > 60V	6kV, 1.2/50μs	
	Rated input voltage ⩽ 60V	1kV, 1.2/50μs	

EMC Compatibility

EMC Directive 2004/108/EC (EN 61326: 2006)

Immunity Tests

Electrostatic Discharge	EN 61000-4-2: 2009
Radiated Fields	EN 61000-4-3: 2006+A1: 2008+A2: 2010
Fast Transients	EN 61000-4-4: 2004+A1: 2010
Surges	EN 61000-4-5: 2006
Conducted Disturbances	EN 61000-4-6: 2009
Magnetic Fields	EN 61000-4-8: 2010
Oscillatory Waves	EN 61000-4-12: 2006
Electromagnetic Emission	EN 60255-25: 2000

Emission Tests

Limits and methods of measurement of electromagnetic disturbance characteristics of industrial, scientific and medical (ISM) radio-frequency equipment	EN 55011: 2009+A1: 2010 (CISPR 11)
Limits and methods of measurement of radio disturbance characteristics of information technology equipment	EN 55022: 2010/AC: 2011 (CISPR 22)
Limits for harmonic current emissions for equipment with rated current ⩽16 A	EN 61000-3-2: 2006+ A1: 2009+A2: 2009
Limitation of voltage fluctuations and flicker in low-voltage supply systems for equipment with rated current ⩽16 A	EN 61000-3-3: 2008
Emission standard for industrial environments	EN 61000-6-4: 2007+A1: 2011
Testing and measurement techniques - Ring wave immunity test	EN 61000-4-12: 2006

Environmental and Mechanical Specifications

Mechanical Characteristics

	PMC-680i	PMC-670
Panel Cutout	186x186mm	138x138mm
Unit Dimensions	192x192x187mm	144x144x129mm
IP Rating	52	

Mechanical Tests

Vibration Test	Response	IEC 60255-21-1: 1988 Level II
	Endurance	IEC 60255-21-1: 1988 Level I
Shock Test	Response	IEC 60255-21-2: 1988 Level I
	Endurance	IEC 60255-21-2: 1988 Level I
Bump Test		IEC 60255-21-2: 1988 Level I

Environmental Conditions

	PMC-680i	PMC-670
Operating Temp.	-25°C to 70°C	
Storage Temp.	-40°C to 85°C	
Humidity	5% to 95% non-condensing	
Atmospheric Pressure	70kPa to 106kPa	
Pollution Degree	2	
Measurement Category	CAT IV	CAT III

Power Quality

Voltage characteristics of electricity supplied by public distribution systems	EN 50160
General guide on harmonics and interharmonics measurements and instrumentation, for power supply systems and equipment connected thereto	IEC 61000-4-7
Flicker meter - Functional and design specifications	IEC 61000-4-15
Testing and measurement techniques Power quality measurement methods	IEC 61000-4-30 (Certified by PSL)

Ordering Information

Product Code		Description
PMC-680i		Advanced Power Quality Analyzer
Sample/Cycle	A	512 Samples/Cycle
	B*	1024 Samples/Cycle
On-board Memory	4	4GB
Input Current	5	5A
	1	1A
	SCCP50*	50A Split-Core Current Probe Option Include 3x50A Split-Core Current Probes
Input Voltage	3	240VLN/415VLL
	9*	400VLN/690VLL
Power Supply	2	95-250VAC/DC, 47-440Hz
	3	20-60VDC
System Frequency	5	50Hz
	6#	60Hz
I/O	A	8 DI + 4 RO + 4DO
Communications	A	2 Ethernet Ports
	B*	2 Ethernet Ports + 2 RS-485 Ports
	C*	1 Ethernet Port + 1 Fiber Port + 2 RS-485 Ports
IEC 61850	X	None
	A*	IEC 61850 Protocol Support
Language	E	English
PMC-680i	A 4 5 3 2 5 A A X E	PMC-680i-A45325AAXE (Standard Model)

Product Code		Description
PMC-670		C&I Advanced Power Quality Monitor
Input Current	5	5A
	1	1A
Input Voltage	3	57V-400VLN
Power Supply	2	95-250VAC/DC, 47-440Hz
	3	20-60VDC
System Frequency	5	50Hz
	6*	60Hz
I/O	A	8DI + 4RO + 2DO
Communications	A	1 Ethernet Port + 2 RS-485 Ports
IEC 61850	X	None
	A*	Support IEC 61850 Protocol
Language	E	English
PMC-670	5 3 2 5 A A X E	PMC-670-5325AAXE (Standard Model)

* Additional charges apply
\# Please consult Factory for availability

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