Eaton Power Xpert Meter 4000/6000/8000 Power Quality and Energy Meters

Power quality and energy metering, diagnostics, trending and performance benchmarking

Product snapshot

- Internet enabled power quality and energy meter with comprehensive power measurement and integrated quality analysis
- Use a standard Web browser to surf to the meter and analyze waveforms, trend, ITIC graphs directly on the meter or LCD Display
- Capture waveforms at a high speed of 6 Mhz (six samples every millionth of a second)
- Embedded information technology performance curve (ITIC) analyzes the power quality events that have occurred and determines the level your sensitive IT equipment can sustain without disruption and damage
- Open protocols allow flexible third-party integration to BMS and other PQ systems

Features

- Embedded Web server – see and analyze waveforms, trends, harmonics directly in your Web browser or LCD meter graphic display
- Automatic power quality analysis and trigger setting with available ITIC performance curve: detect and capture sags, swells, transients, harmonics, flickers
- Accurately detect fast transients by assessing circuit activity at very high sampling rates (up to 100,000 samples per cycle)
- Comprehensive power, energy and demand measurements
  - Voltage, current: per phase minimum, maximum, average, trend graph analysis, export, print
  - Power: power factor, apparent, real, reactive, frequency
  - Energy, demand: forward, reverse, net, sum, TOU, profile, previous month-to-month, week-to-week comparisons, graph analysis, data export, print
- Up to one millisecond time synchronization and event logging capability for sequence of events analysis
- Get an at-a-glance view of power quality with patented power quality index gauge, statistically derived trending and red-yellow-green indicators for overall power health
- Support continuous, non-disruptive monitoring with a permanently installed meter that is continuously on the job, 7x24
- Alarm notifications are also available remotely via email (waveform attached)
- Use industry-standard communication protocols, to support a multitude of configurations and third-party software: HTTP, FTP, Modbus RTU, Modbus TCP, SNMP, SMTP, NTP, COMTRADE
- Supported via Power Xpert® Software and Power Xpert Architecture
- ANSI C12.20 accuracy
- UL and CE certifications
- Industry Canada certification pending

E·A·T·N

Powering Business Worldwide

Power Xpert Architecture

Power Xpert Architecture provides the framework to unify the entire power system. It connects power systems with communication and management systems to provide a holistic approach to the entire power system. This strategic system-level focus is integral to PowerChain Management® solutions. It provides increased reliability, cost efficiencies, enhanced safety and risk mitigation and allows for the more effective use of capital. Power Xpert Architecture is comprised of both software and hardware components including meters, gateways, time servers and connectivity devices.

Eaton Power Xpert Meters 4000/6000/8000

The meters combine state-of-the-art technology with available ITIC diagnostics, waveform capture, data trending and performance benchmarking, along with a "Twist-and-Click" graphic display: a new paradigm for simplicity and ease of use in the market place. The embedded Web server enables users to surf to the meter over the Internet via a standard Web browser. The new platform offers advanced functionality like high-speed impulsive transient capture, 6 Mhz sampling rate (100,000 samples per cycle), anti-aliasing, ITIC analysis and automatic trigger setting, field-upgradeable firmware, and optional digital, relay, solid state I/O.

Applications

Identify power quality problems to help

- Identify harmonics, sags, swells and transients damaging or disrupting sensitive, mission-critical IT equipment
- Boost IT equipment service life to the maximum
- Analyze sequence of events up to one millisecond time resolution
- Protect motors from damage
- Preserve the integrity of processes and batches
- Prevent blown capacitor bank fuses
- Protect transformers and conductors from overheating

Detect and record high speed transients to help

- Avoid equipment damage and disruption
- Identify equipment malfunction

Monitor circuit loading to help

- Avoid overloads and nuisance overload trips
- Maximize equipment utilization
- Manage emergency overloads

Manage energy utilization to help

- Reduce peak demand charges and power factor penalties
- Identify excessive energy consumption

Metered/monitored parameters available

- Comprehensive power metering
- Flicker
- Availability
- Phasors
- Sequence components
- Crest factor
- K-factor
- PQ Index

Accuracy

- Currents: 0.05% reading + 0.025%FS
- Voltage: 0.1% reading + 0.025% FS
- Energy, and demand power: 0.2% in accordance with ANSI C12.20
- Frequency: +/- 0.01 Hertz
- Power factor:
  - 0.10% at Unity PF
  - 0.30% at 0.5 PF
- IEC/EN 60687, classes 0.2 & 0.5 (0.2% min)
- ANSI C12.20 (electricity meters 0.2%)

Physical characteristics

Two-piece design—power quality meter base module and display module

- 320x240 pixel backlit LCD remote graphic display module
- Display mounted with meter base module or up to 2000 feet away
- Meter may be operated without a display
- Graphic display module can support a sub-network of up to 16 remote meter base modules

Meter base unit characteristics

- Height: 8.88 inches (225.6 mm)
  - Top/bottom clearance - three inches minimum
  - Clearance required for proper ventilation
- Width: 9.56 inches (242.8 mm)
  - Side clearance - two inches minimum
  - Clearance required for proper access to termination
- Depth: 6.72 inches (170.8 mm) including optional wall mounting brackets
  - Includes terminals and panel mounting feet
  - Add 1.2 inch depth clearance for terminal plug field cable termination
  - Add 3.2 inch depth clearance for RS232 or fiber optic
- NEMA rating: NEMA 1, IP3Ø
- Shipping weight 7.1 lbs.

Display unit characteristics

- Height: frame 9.02 inches (229.0 mm)
  - Body back 7.22 inches
  - Leave two-inch top/bottom clearance for proper ventilation
- Width: frame 7.80 inches (198.1 mm)
  - Body back 7.22 inches
- Depth:
  - 1.45 inches (36.8 mm) behind panel surface
  - 1.04 (26.3 mm) projection in front of panel surface
- NEMA rating: NEMA 12, IP42 front of panel rating

Listings/certifications

- Safety: EN61010-1, UL/cUL 61010-1
- Accuracy: IEC/EN60687 0.2 class, ANSI C12.20 0.2 Class
- EMC: FCC Part 15 Subpart B Class A EN55011 Class A
- Measurement Canada Approval pending
- Immunity IEC 61326
- CE Mark

Communication interfaces

Standard

- RS-485 remote display port
- RS-485 Modbus RTU slave port
- RJ-45 10/100 BaseT local configuration port (Local Web server connection)

Optional

- Communications Expansion Card (CEC)
    - Selectable 100F fiber-optic or 10/100 BaseT Ethernet network port
    - RS-485 Modbus RTU selectable master/slave port
- CEC
- PXD-MMG

For graphic display module

(To view data from up to 16 Power Xpert Meter 4000/6000/8000s on the same network)

- Graphic Display Module (PXD-MMG)
    - RS-485 meter display network port
    - RJ-45 10/100 BaseT for easy access to local meter configuration and network

Communication protocols supported (including options)

- Modbus RTU
- Modbus TCP
- Ethernet TCP/IP
- HTML
- FTP
- SNMP
- NTP
- COMTRADE (IEEE C37.111-1999)

Time synchronization

- Up to one millisecond time stamping accuracy supported via GPS and IRIG-B time references when used with 3rd party device and I/O option for sequence of events determination in a time synchronized environment
- Time sources traceable to National Institute of Standards and Technology (NIST) atomic time
- DCF-77 protocol support for time synchronization input
- Network Time Protocol (NTP) support (standard)

General description

Power Xpert Meter 4000/6000/8000 power quality and energy instruments monitor, record and analyze critical aspects of an electrical distribution system—so you can optimize energy utilization, process performance and cost. This premier power quality instrument serves several essential functions:

- Highly accurate digital meter, to measure and log current, voltage, power factor and other comprehensive power metering parameters
- Circuit monitoring device, watching for harmonics, voltage transients and other potentially harmful power events
- Automatic trigger settings (6000 and 8000 models)
- Alarm system and sending notifications and emails to selected people and power management software when conditions exceed established tolerance ranges
- Power quality analyzer, capturing waveforms and other information to support in-depth statistical analysis

Power Xpert Meter 4000/6000/8000 series introduced a new level of intuitive user interface design. System information is presented in a way that is simple to understand and navigate:

- A graphic display module presents information from up to 16 Power Xpert 4000/6000/8000 instruments, mounted locally or up to 2000 feet away; a simple "twist-n-click" navigation dial makes it easy to select menus, views and links—and drill down into increasing levels of detail or back up to summary levels or previous views
- An embedded Web server displays complex power quality data on standard Internet browsers, and permits device configuration over the Web

Both the graphic display module and embedded Web server present real-time, historical and event information in a browser-style graphical format. The visual presentation makes it easy to interpret important circuit information, such as current loading, voltage and power levels, power factor, energy usage, I/O status and power quality measurements, as well as harmonic plots, disturbance and transient waveforms and an ITIC disturbance summary screen.

The Web server also provides the energy and demand readings required to help manage the cost of energy, as well as power quality information, such as harmonic distortion, flicker, crest factor, k-factor and more.

Ease-of-use — Power Xpert Meter 4000/6000/8000 graphic display (option)

The Power Xpert Meter 4000/6000/8000 display features a large easy-to-read white backlit graphic LCD. The information presented by the display is organized into an information architecture that is easy-to-navigate and organized for simplicity. Screen navigation is accomplished using a navigation control dial and a "back" button. The user simply twists the knob on the navigation control dial to move between menu selections and drill down links on the screen. When the selection is highlighted, pressing the dial makes the selection. Information is displayed from a single meter or an RS-485 daisychain of up to 16 meters. The display features a rich set of screens including real-time data, trend plots, waveform views and an ITIC Plot. The graphic display allows basic device setup and password protected resets. An audible alarm is available to annunciate alarm conditions.

Power Xpert Meter 4000/6000/8000 embedded Web server

The Power Xpert Meters 4000/6000/8000 embedded Web server offers Eaton customers a new level of accessibility to the critical information required to manage their electrical distribution system. The Web server includes real-time circuit information in both numeric and graphical visual formats to help monitor circuit parameters such as current loading, voltage and power levels, power factor, THD, Flicker and more. The Web server also provides energy and demand readings with graphic usage plots to help analyze energy usage patterns. Energy readings include kWh, kvarh, delivered and received and kVAh with time of use and RTP displays. The interval energy usage plot includes the ability to do week-to-week and month-to-month energy consumption graphical comparisons for benchmarking purposes.

Both the Power Xpert Meters 4000/6000/8000 embedded Web server and the local graphic display support graphical trend charts of key circuit measurements such as current, voltage, power and energy. The trend chart supports a zoom feature that allows the user to view data over a short period of 16 hours up to 4 years. The trend chart includes zoom in/out buttons and a horizontal slider bar control to manage scrolling forward and backward through the data. Trend charts of basic readings include minimum, maximum and average readings. Trend charts of interval by interval energy data also display peak demand.

Note: For remote access and networking capabilities such as connecting to a LAN/WAN, use the optional Commucations Expansion Card (CEC).

Sag/swell/transient capture and recording

60 cycles of waveform are oversampled at 4096 samples per cycle (Power Xpert Meter 4000/6000), filtered through anti-aliasing and recorded at 512 samples per cycle and post event data. The Power Xpert Meter 8000 samples at a rate of 100,000 samples per cycle. Embedded Web server supports viewing of triggered waveforms one channel at a time and includes the ability to zoom and to scroll horizontally using a slider bar. The Power Xpert Meter 6000/8000 Series have preconfigured (600 volts and below) trigger settings for sags, swells and transients, and do not require additional setup by the user. Waveforms are stored in non-volatile flash memory using an industry standard COMTRADE format. Waveforms can be automatically sent out as COMTRADE attachments to an email following an event, or can be retrieved from an FTP (File Transfer Protocol) directory structure in the Power Xpert Meter module's memory.

Historical trend logging

The Power Xpert 4000/6000/8000 Meter records historical data for graphical viewing from the Local display or the embedded Web server. Graphical views of historical data support pan and zoom. 145 standard metering parameters are logged as part of the standard meter functionality including min./max. and average for each parameter. The averages are calculated over the interval period. The minimum and maximum readings are based on 200 ms calculations. Storage capacity for standard trend plots includes all of the following intervals:

- Every 5 minutes for 48 hours (2 days)
- Every 15 minutes for 192 hours (4 days)
- Every hour for 28 days (4 weeks)
- Every 8 hours for 56 weeks
- Every week for 44 months

Note: Trend plot data can be easily exported to third-party applications, such as Microsoft Excel in csv-file format.

In addition, metered parameters are automatically stored on the built-in FTP Servers, where they can be easily copied and imported into third-party applications for benchmarking and analysis. Logs on the FTP Server include the min./max. and average for 145 standard metering parameters at 5-minute intervals.

Storage capacity for trend data:

- 63 days of 5 minute interval trend data.
- Capacity=18144 intervals.

Energy profile data

The Power Xpert Meter 4000/6000/8000 records Real and Reactive energy forward, reverse, net and absolute sum, as well as Apparent energy (kVAH). Up to 8 status inputs can be configured as energy accumulators for counting KYZ pulse inputs (option). These readings are stored over a configurable interval from 1 to 60 minutes, as well as in daily and weekly totals.

With the optional LAN/WAN Ethernet Communication Expansion Card (CEC), users can easily configure the meters to send periodic emails at user-defined intervals of energy consumption and power demand. Emails contain a summary of readings per rate structures and also have the actual measurements attached to the email's body as a CSV file in a ZIP container.

In addition, metered parameters are automatically stored on the built-in FTP Server, where they can be easily copied and imported into third-party applications for benchmarking and analysis. Logs on the FTP Server include energy consumption logs, one for every month in CSV file format, trended measurement logs also in CSV file format and waveform captures in COMTRADE file format.

Storage capacity for energy profile data:

- 62 days of 15 minute interval energy and pulse interval data
- (Fixed interval capacity = 5952 intervals. Configurable intervals from 1 to 60 min)
- 372 days of 1 day accumulated energy and pulse interval data
- 208 weeks of 1 week accumulated energy and pulse interval data

Energy and demand comparisons

Energy and demand usage patterns can be analyzed with the month-to-month, week-to-week comparison chart built into the meter. Raw data can be exported with the "Save Table" option to other applications, such as Excel, for further analysis and graphing.

Event triggers

The Power Xpert Meter 4000/6000/8000 supports five types of configurable event triggers:

- Out of limits (4000/6000/8000)
- Demand overload (4000/6000/8000)
- Sub-cycle disturbance (4000/6000/8000)
- ITIC (6000/8000)
- Fast transient (8000)

These triggers permit pickup, reset and pickup delay to be configured by the user. When a trigger occurs, actions include Performance Monitoring (#9's analysis), Capturing Waveform, Capture Parameters, Send Email and Operate a Relay Output. The Graphic Display flashes an LED to annunciate the alarm condition. An audible alarm is also available.

Trigger options include:

- Out of limits: over 100 triggers
- Demand overload: 10 triggers
- ITIC: 8 triggers
- Fast transient: dV/dT and absolute per phase
- Sub-cycle disturbance — dV/dT and absolute

Event logging

The optional Power Xpert Meter 4000/6000/8000 Local graphic display or the embedded Web server both allow the user to view a list of triggered events along with any captured parameters, event details, and triggered waveforms. In addition, a separate event log includes a variety of activities including acknowledged triggers, new min. and max. events, and system operations such as resets. The size of the event log is virtually unlimited based only on the memory option selected.

Table 1. Power Xpert Meter 4000/6000/8000 months of memory

Model	Memory	Event	File Size (KB)		Occurance Per Month[1]		Memory Usage (MB)		Months of Capacity[2]	
					Typical	Severe	Typical	Severe	Typical	Severe
PXM4000	2GB	Subcycle Disturbance	1260		10	60	12.3	73.8	166	28
PXM6000	4GB	ITIC Event	1260		5	20	6.2	24.6	666	166
		Subcycle Disturbance	1260		10	60	12.3	73.8	333	55
		ITIC + Subcycle Disturbance Combined		Total -->	15	80	18.5	98.4	222	42
PXM8000	8GB	ITIC Event	1260		5	20	6.2	24.6	1332	333
		Subcycle Disturbance	1260		10	60	12.3	73.8	666	111
		Transients	2048		3	30	6.0	60.0	1365	137
		ITIC + Subcycle Disturbance + Transients		Total -->	18	110	24.5	158.4	335	52

[1] The typical and severe power quality event occurrences are estimates and may vary depending on the electrical environment.
[2] Memory is not allocated by event category; memory is used first come, first served.

Email notification

With the optional LAN/WAN Ethernet Communication Expansion Card (CEC) attached to the Power Xpert Meter 4000/6000/8000's, the users can easily configure the meters to send periodic emails at user-defined intervals for energy consumption and power demand. Emails contain a summary of readings per rate structures and also have the actual measurements attached to the email's body as a CSV file in a ZIP container. Prompt alarm emails can also be sent for any event condition either standard in the meter or ones set up by the user based on thresholds, dV/dt triggers or IO status changes with the optional IO Card. Alarm emails can be configured to have the COMTRADE waveform capture attached to the email's body.

Periodic Email Message

ITIC analysis plot

The Power Xpert Meters' graphic display (option) and Web server include a graphic representation of the ITIC plot (Power Xpert Meter 6000/8000) with counts of disturbances and transients that have occurred. The ITIC plot organizes events into 8 distinct disturbance zones corresponding to severity and a 9th zone for transients. A pass/fail count is displayed to indicate how many events are outside the ITIC limits. Clicking on any counter in the ITIC Web page will link the user to the event view and display all triggered events in the selected zone. This makes it simple to view disturbance waveforms associated with the ITIC plot. A separate ITIC graph is available to review individual ITIC events. This graph will show the user the event hit position on the graph and the event duration and magnitude.

Inputs and outputs

Power Xpert Meter 4000/6000/8000 is available with an optional digital I/O card which includes:

• Eight digital inputs — self sourced 24 Vdc
• Three relay outputs — 5 A max. continuous, 240 Vac max., 30 Vdc max.
• Two solid-state outputs — 80 mA max. continuous, 30 Vdc max.

Each of the 8 inputs are interrupt driven, allowing for 1 ms accuracy of digital events time stamps (1 ms accuracy requires local NTP TimeServer). Inputs can also be configured for demand synch, and pulse counting. Inputs selected for pulse counting can be scaled. Interval by interval pulse recordings are maintained in profile memory and can be displayed graphically. Outputs can be used for KYZ, or alarm annunciation.

Ratings

• Application to 500 kV, no PTs to 600 V
• CT ratios selectable from standard 120/600 Vac line
• CT inputs accept 5 amp secondary.
• Power supply:
  ◦ Standard 120/240 Vac or 110/250 Vdc
  ◦ Low voltage 24 – 48 Vdc (Contact Eaton for availability)

Table 2. Power Xpert Meters 4000/6000/8000 features & benefits

Feature	Power Xpert Meter 4000	Power Xpert Meter 6000	Power Xpert Meter 8000
General			
Embedded Web server	•	•	•
TOU metering support	•	•	•
Firmware flash upgrade support	•	•	•
Self-learning capability (characterizes "normal" per circuit)	•	•	•
Power, energy & demand			
Voltage, current: per phase minimum, maximum, average, trend graph analysis, export, print	•	•	•
Energy and demand plot comparisons month-to-month, week-to-week	•	•	•
Power: power factor, apparent, real, reactive, frequency	•	•	•
Energy, demand: forward, reverse, net, sum, TOU, profile, previous month comparison, graph analysis, export, print	•	•	•
Power quality analysis			
Statistical analysis (min, max, average)	•	•	•
Sag and swell monitoring, management and recording	•	•	•
Symmetrical components: zero, negative, positive	•	•	•
Low frequency transient detection and capture	•	•	•
Sampling rate, maximum samples/cycle	4096*	4096*	100,000
"Number of nines" uptime data (e.g. 6 nines=99.9999%)	•	•	•
K-factor	•	•	•
Crest factor	•	•	•
Security			
Secure 5 level user access privileges	•	•	•
Communications & I/O			
Modbus TCP	•	•	•
Modbus RTU	•	•	•
HTML	•	•	•
SNMP (Simple Network Management Protocol)	•	•	•
SMTP (Simple Mail Transfer Protocol)	•	•	•
FTP (File Transfer Protocol)	•	•	•
NTP (Network Time Protocol)	•	•	•
COMTRADE, open IEEE standard file format for waveform capture export	•	•	•
Trend measurements CSV file export	•	•	•
I/O (8 Digital inputs, 3 relay outputs, 2 solid state KYZ outputs)	•	•	•
Time synchronization			
NTP time synchronization up to 1 millisecond accuracy	•	•	•
GPS time synchronization up to 1 millisecond accuracy	•**	•**	•**
Logs			
Trend logging	•	•	•
Load profile	•	•	•
Event logging	•	•	•

Feature	Power Xpert Meter 4000	Power Xpert Meter 6000	Power Xpert Meter 8000
Memory & storage			
Standard memory, GB	2	4	8
Harmonics			
Harmonic levels	127	127	127
Total harmonic distortion (THD)	•	•	•
Delta-Sigma D/A conversion technology	•	•	•
Harmonics over-sampling (4096 samples per cycle)	•	•	•
Anti-alias filtering	•	•	•
Individual harmonics	•	•	•
Total demand distortion (TDD)	•	•	•
Interharmonics		•	•
Highlights			
Sub-cycle disturbance capturing	•	•	•
dV/dt triggers for sub-cycle oscillatory transients	•	•	•
Absolute Threshold and dV/dt triggering	•	•	•
Power Quality Index - Standard (includes dv/dt count, %TDDi and %THDv)	•	•	•
Power Quality Index - Enhanced (includes Standard Index plus Sag level, Swell level and Flicker)		•	•
Flicker calculations		•	•
Automatic trigger setting		•	•
Automatic event severity analysis		•	•
Event Severity counters		•	•
ITIC (Information Technology Industry Council), previously CBEMA performance curve		•	•
Custom ITIC (CBEMA) plot with individual event magnitude and duration		•	•
Event calendar view		•	•
Events timeline view		•	•
Sequence of events and events plot on waveform		•	•
Power Quality Index - Premium (includes Enhanced Index plus counts of impulsive transients)			•
High speed transient capture & detection			
6 MHz capture of impulsive transients			•
Transient capture duration: ~20ms/6MHz ~120ms/1MHz			•
Waveform recorded at 100,000 samples per cycle			•
Three-phase voltage and neutral-to-ground fast transient capture			•

* Delta-Sigma A/D oversampling rate, waveform recorded at 512 samples
** When used with 3rd party device and I/O option

Note: These specifications are subject to change without notice and represent the maximum capabilities of the product with all options installed. This is not a complete feature list. Features and functionality may vary depending on selected options and product model.

Technical highlights

Metered/monitored parameters

- Volts: Absolute—line-to-line, line-to-neutral
- Average—line-to-line, line-to-neutral, line-to-ground
- Phase neutral and ground currents
- Power: real, reactive and apparent
- Frequency
- Power factor: apparent and displacement
- Energy
- Demand
- Percent total harmonic distortion (THD)
- Minimum and maximum values
- Harmonics

Sampling capabilities

- A/D technology, sampling at 4096 oversampling per cycle
- Oversampling and quantizing filtering to eliminate false signal noise
- Waveform recorded at 512 samples per cycle
- ITIC representation of power events (6000/8000 Meters)
- dV/dT triggers for sub-cycle oscillatory transients
- 6 MHz/1MHz capture of impulsive transients*
- Waveform recorded at 100,000 samples per cycle*
- Three-phase voltage and neutral-to-ground fast transient capture*
- Absolute Threshold and dV/dT triggering*

* Power Xpert Meter 8000

Harmonic distortion analysis

- Phase angle and magnitude through the 127th harmonic

Time-of-use metering

- Four rate periods for Time of Use (TOU) revenue metering
- Total rate, independent of time of use
- Up to 64 rate schedules (weekdays and weekends)

Historical trend logging

- On-board data logging
- Intervals from one minute for nine days or 60 minutes for 540 days
- Supports data storage redundancy

Event and trend logging

- ITIC curve display of sag or swell voltage events (6000/8000 Meters)
- Out-of-limit, ANSI alarms, ITIC events (6000/8000 Meters)
- Events trigger parameter capture, waveform capture, and/or email
- Events can trigger a change in state of internal or external I/Os

Inputs and outputs

- Optional, I/O module for auxiliary functions, with eight digital inputs, three relay outputs, two solid-state outputs
- Digital inputs can interface with control sensors and transducers
- Relay outputs can actuate alarms and change the state of control relay contacts

Technical specifications

Safety

EN 61010-1

CNL evaluation to CAN/C22.2 No 1010.1.92

UL 61010-1, 2nd Edition

- Display face
  - UL Validated to NEMA type 12, IP42
- Meter & Display back
  - UL Validated to NEMA type 1, IP30

Electromagnetic compatibility

Emissions

- FCC Part 15, Subpart B, Class A Radiated & Conducted
- EN55011 Class A Radiated & Conducted
- IEC 61000-3-2, EMC - Harmonic Current
- IEC 61000-3-3, EMC - Flicker - Low Voltage

Immunity - EN 61326, Industrial EMC Immunity

- EN 61000-4-2, ESD Level 2
- EN 61000-4-3, Rad. RF Level 3
- EN 61000-4-4, EFT Level 3
- EN 61000-4-5, Surge Level 2/3 (signal/mains)
- EN 61000-4-6, Cond. RF Level 2
- EN 61000-4-11, Voltage Var

Environmental

IEC 60529

- Display face IP42
- Display back IP30
- Meter IP30

IEC 60255-21-1, Vibration, Class 1

IEC 60255-21-2, Shock/Bump, Class 1

IEC 60255-21-3 Seismic, Class 1

IEC 68-2-6, Vibration

Environmental ratings - meter and display

For indoor use only

Operating temperature

- Meter base unit: -20° to 70°C
- Display unit: -20° to 60°C

Storage temperature

- -40° to 85°C (-40° to 185°F)

Humidity

5% - 95% (non-condensing) for all temperatures

Maximum operating altitude

- 2000 meters (6,561 feet)

Pollution degree II for meter and display back

Pollution degree III for display front

- Panel housing must be => NEMA 12 or IP52
- Panel must be flat to accept display gasket
- Display ethernet cover must be closed

Electrical specifications

Display power supply input (DG2)

24 Vdc +/- 10%

8 W maximum draw

Common TVS bonded to ground ~ 300V

Wiring to four-position removable terminal plug

- 12-18 AWG, wire ferrules recommended

Meter power supply input

PXPS-1 Standard (PS1):

- 100 - 240 Vac +/- 20%, 47 - 63 Hz
- 110 - 250 Vdc +/- 20%
- 50W maximum draw
- Minimum ride-through 0.5 Sec
- Neutral (-) TVS bonded to ground ~ 575V
- Wiring to three-position removable terminal plug
  - 12-18 AWG, wire ferrule recommended

Meter PXCM 24VDC outputs (CM4, CM6)

- 24VDC +/-10%
- 10W maximum load
- Output switched off on PS1 power down
- Common to paired RS485 port
  - CM3/CM4
  - CM5/CM6
- Common TVS bonded to ground ~ 300V
- Wiring to three-position removable terminal plug
  - 12-18 AWG, wire ferrule recommended

Meter PXIO discrete inputs (IO1)

- Qty 8 common circuits IO1.1-1.8
- 24V internal source IO1.9
  - To drive external dry contact
- Input impedance ~ 2.2K ohm
- Input current draw ~ 10 mA
- Minimum pulse width 10 millisecond
- Maximum pulse rate 20 Hz
- Common TVS clamped to ground ~ 300V
- Wiring to nine-position removable terminal plug
  - 12-18 AWG, wire ferrule recommended
- Meter PXIO solid-state Outputs (IO2)
- Qty 2 – Form A NO Bidirectional FET
- Isolation circuit to ground 2KV/1 min.
- Isolation SS1 to SS2 2KV/1 min.
- Maximum external source voltage 30Vdc
- Line-to-line TVS clamp at 32Vdc
- Maximum load current 100 mA.
- Minimum pulse width 20 milliseconds
  - Fixed 25 milliseconds for Pulse initiator function
- Maximum pulse rate 25Hz
- Wiring to four-position removable terminal plug
  - 12-18 AWG, wire ferrules recommended

Meter PXIO relay outputs (IO3)

- Qty 3 - Form C relays (both NO=A and NC=B contacts)
- Rated current voltage 5 A/30 Vdc, 100 - 240 Vac
- Isolation circuit-to-ground 2,500 V/1 minute
- Isolation relay-to-relay circuit 2,500 V/1 minute
- Contacts MOV protected at ~300V
- Lifetime 5 A load 1,000,000 cycles
- Response turn-on/off time ~ 20 - 30 msec
- Wiring to nine-position removable terminal plug
  - 12-18 AWG, wire ferrules recommended

Metering inputs

Current inputs CT1-5 (each channel)

- Rating 5 A secondary nominal, 20 A continuous max
- Metering range 0.25 to 20A
- Burden < 10 mohm
- Overload withstand
  - 500 A ac/1 sec, non-repeating
- Accuracy
  - 0.05% of reading + .01% of full scale (50 mA to 20A)
- Wiring to removable terminal plug
  - Screw down cover
  - Range 10 AWG - 18 AWG
- Safety insulation rating
  - 600 V all CT circuits to ground
  - Installation category CAT-III
- Dielectric withstand
  - All inputs to ground 3500 Vac/1 min
- ADC conversion
  - 15.46 ksps through delta-sigma A/D
  - True rms processing at 512 sample/cycle
  - Delta sigma A/D oversampling rate: 4096 samples/cycle

Standard metering voltage inputs VTV1-VR

- Maximum rating
  - 347 Vac rms L:G
  - 600 Vac rms L:L
  - Installation category CAT-III
- Metering range (temporary transitions)
  - 30-700 Vac rms L:G
- Abuse overload rating
  - 1000 Vrms sustained input impedance two megohm
- Accuracy
  - 0.1% of reading + .02% of full scale 63-347 Vac rms L:G
- Wiring to removable terminal plug
  - range 10 AWG - 18 AWG
- ADC conversion
  - 15.46 ksps through delta-sigma A/D
  - True rms processing at 512 sample/cycle
  - Delta sigma A/D oversampling rate: 4096 samples/cycle

Auxiliary voltage inputs VXV6-V8

- Maximum rating
  - 347 Vac rms L:G
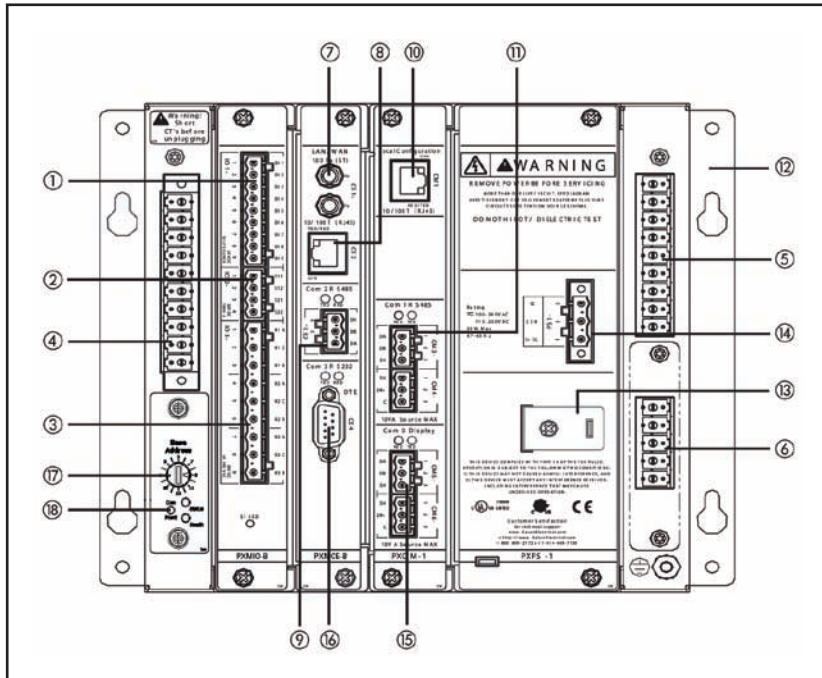 - 600 Vac rms L:L
  - Installation category CAT-III

Figure 1. Power Xpert 4000/6000/8000 Meter rear view

I/O card
① Digital inputs 1-8 (option)
② Solid-state outputs 1-2 (option)
③ Relay outputs 1-3 (option)

CT and voltage connections
④ CT input connections
⑤ Standard 3-phase voltage phase inputs
⑥ Aux channel voltage inputs (option)

Communication expansion card (LAN/WAN ethernet networking)
⑦ 100FX ST-type ethernet (multi-mode) (option)
⑧ 10/100Base-T ethernet (option)
⑨ RS-485 (2-wire w/shield) — 24 V accessory power (Com 2)

Standard features
⑩ Local RJ-45 config port (non-networkable ethernet)
⑪ RS-485 (2-wire w/shield) Modbus RTU (Com 1)
⑫ Meter mounting brackets
⑬ Sealable mode switch cover
⑭ Control power (100 – 240 Vac & 110 – 250 Vdc) (+/-20%)
⑮ Display RS-485 network port (up to 15 meters) — 24 V accessory power (Com 0)
⑯ RS-232 (Tx Rx) Modbus RTU (Com 3) (option)
⑰ Meter base address
⑱ Ethernet communication reset button

- Metering range (temporary transitions)
  - 30-700 Vac rms L:G
- Abuse overload rating
  - 1000 Vrms sustained input impedance two megohm
- Accuracy
  - 0.1% of reading + .02% of full scale 63-347 Vac rms L:G
- Wiring to removable terminal plug
  - range 10 AWG - 18 AWG
- ADC conversion
  - 15.46 ksps through delta-sigma A/D
  - True rms processing at 512 sample/cycle
  - All samples used in all rms calculations
  - Delta sigma A/D oversampling rate: 4096 samples/cycle

High speed transient voltage inputs VTV1-VR

(Parallel circuit to standard metering using the same terminal block.)

- Maximum rating
  - 347 Vac rms L:G
  - 600 Vac rms L:L
  - Installation category CAT-III
- Metering range (temporary transitions- surge/transients)
  - +/- 40-8000 Vpk L:G
- Abuse overload rating
  - 1000 Vrms sustained input impedance two mega ohm
- Accuracy
  - +/-40V
- Wiring to removable terminal plug
  - range 10 AWG - 18 AWG
- ADC conversion
  - 1 or 6 MHz

VT standard/high speed inputs
PT potential transformers requirements

Single-phase

No PT required:

- 120 Vac L:N or 240 Vac L:L
- 277 Vac L:N or 554 Vac L:L

PT required:

- Over 277 L:N or 554 Vac L:L

Wye

No PT required:

- 120 Vac L:N or 208 Vac L:L
- 277 Vac L:N or 480 Vac L:L
- 347 Vac L:N or 600 Vac L:L

PT required:

- Over 347 Vac L:N or 600 Vac L:L

Delta

PT recommended:

- Up to 480 Vac L:L

PT required:

- Over 480 Vac L:L

Optional VX auxiliary input
PT potential transformers requirements

Delta

PT recommended:

- Up to 480 Vac L:L

PT required:

- Over 480 Vac L:L

Relay outputs

The optional PXMIO-B card includes three 5 A form C relay outputs rated for 240 Vac or 30 Vdc. These outputs can be used for applications such as:

• Alarm annunciation

• KYZ pulse output

Alarm outputs can be driven from triggers based on metering values.

Output modes include:

• Normal — relay energized during alarm condition

• Latched — relay energized by event trigger, de-energized by acknowledgement

• Timed — relay energized by event trigger, maintained for a programmed interval

Communications expansion card (CEC)

• The optional CEC Card offers two Ethernet connection options, 10/100Base-T and a fiber-optic port that can be used for the following applications:

• Monitoring, managing and configuring the meter remotely using a standard Web Browser interface like Microsoft Internet Explorer

• Alarm notifications via email, SMTP

• Enabling remote access to the meter's FTP server (energy, trend and waveform logs)

• Providing Modbus TCP/IP or RTU communications to BMS systems

• Providing SNMP communications to NMS systems

• Synchronizing with an NTP server for 1ms time-stamping resolution

• Asset management via SNMP to Network Management Systems

• Updating firmware on the meter remotely

Technical application data

Current inputs (each channel)

• Conversion: 4096 samples per cycle delta-sigma converter digitally filtered down to 512 samples per cycle

• CT Input: 4096 rms samples per cycle delta-sigma converter digitally filtered down to 512 samples per cycle for anti-aliasing

• Burden: less than 10 milliohms

• Overload withstand: 500 A for 1 second, non-repeating

• Range: 0.005 – 20 amperes continuous

• Accuracy: 0.05% or reading plus 0.01% of full scale (from 50 milliamps to 20 amperes)

Voltage inputs (each channel)

• Conversion: 4096 rms samples per cycle delta-sigma converter digitally filtered down to 512 samples per cycle for anti-aliasing

• PT input: 120 V – 500,000 V primary

• Input range: 600 V L-L, 347 L-N direct connect

• Nominal full scale: 1000 V rms

• Input impedance: 2 mega ohms

Frequency range

• 47 – 63 hertz

Harmonic response (voltage, current)

• 127th harmonic

Discrete inputs

• Self sourced: 24 Vdc

Relay output contacts

• 5A maximum, 240 Vac maximum, 30 Vdc maximum

• Lifetime: 1,000,000 no load operations

• 100,000 under rated voltage and load

Solid-state outputs

• Maximum load: 100 milliamps

• Max. voltage: 30 V (externally sourced)

Control power input

• Input range ac: 100 – 240 Vac (+/- 20%)

• Frequency range: 47 – 63 hertz.

• Input range dc: 110 – 250 Vdc +/- 20%

• Burden 50 VA

• Ride-through: 1 – 5s

## Power Xpert Meter 4000/6000/8000 graphic display (option) features

A menu-driven graphical display with information organized into a user-friendly information architecture. The Homepage (see below) offers:

• Graphical level indicator based on a statistical analysis for 3-phase Line-to-Line and Line-to-Neutral Voltage and per phase currents to quickly indicate out of normal readings.

• Large easy-to-read average L-L voltage average Phase currents and System Frequency can be highlighted and selected using the navigation control dial to drill down for additional detail.

• Menu selections for Meter, Power, Quality, Events and Setup are shown for ease of navigation into display for more detail, or basic device setup.
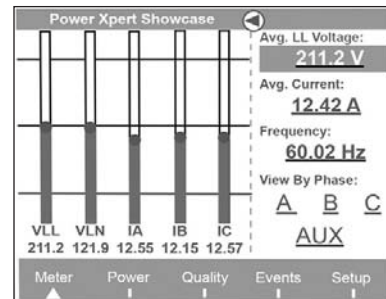

Homepage

Highlighting a field such as the Avg. Current value and pressing the navigation control dial brings up a detail screen like the one below.
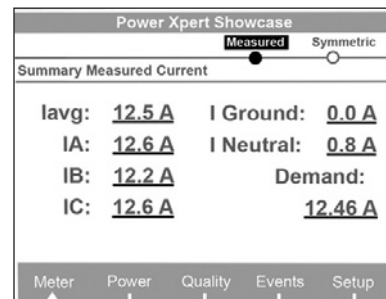

Current Summary

Highlighting an individual reading on the detail summary level screen and selecting it drills down to a level including links to Min./Max., Historical Trend Plots, Triggers, Harmonic spectral data, and waveform viewing. Selecting the trend plot for a given parameter displays a historical graph of the selected parameter over the last 16 hours. The zoom buttons change the time scale to one of several data views based on historical averages with Min./Max. The Pan button allows scrolling within the selected view.
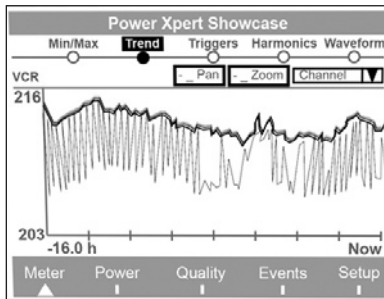
Trend Plot

Waveforms can be displayed for currents and voltages. The waveforms can be viewed on demand for steadystate conditions. Triggered waveforms can also be displayed to view sag/swell or transient data.
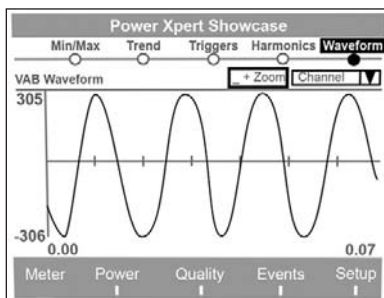
Waveform Viewer
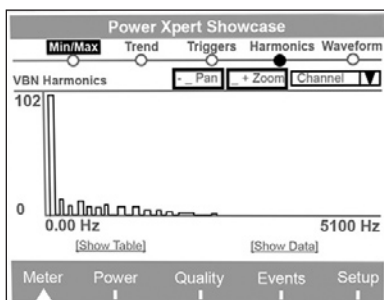
Harmonic Spectrum

The harmonic spectral plot displays both harmonics and interharmonics up to the 85th order. A detailed table also includes individual magnitudes and angles of current and voltage harmonics as well as a harmonic power calculation at each frequency.

The Power Xpert Meter classifies disturbances and summarizes the results graphically using the ITIC plot.
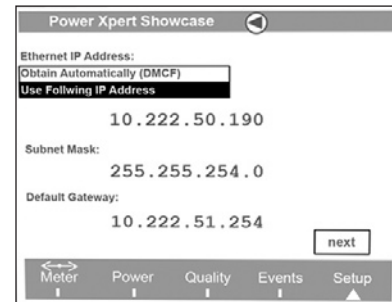
Ethernet Settings

Ethernet and other settings can be input or verified via the Power Xpert LCD Display.

Note: Some of the other settings are specific only to the Web Browser GUI.
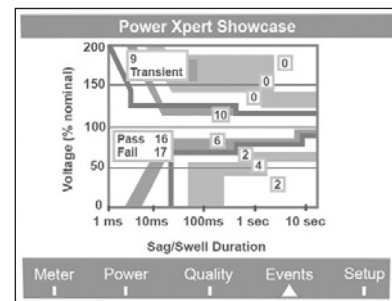
ITIC Plot (Power Xpert Meter 6000/8000)

The number of ITIC Sags and Swells are indicated for each of 9 severity levels. A Pass/Fail summary is shown to indicate how many events are outside the ITIC pass zone.

Power Xpert Meter 4000/6000/8000 graphic display (option) screens

Meter top level screen

V-LL avg, V-LN avg, IA, IB, IC, Iavg, Freq.

Meter detail screens

Per phase detail L-L, L-N, Symmetrical Comp, Aux. Channels, Min./Max. with date/time of occurrence, Trend Plots, Triggers, Phasors.

Power top level screen

3-Phase Power Factor, kWh, kWd, Real-Time kW, kvar, kVA, Load Profile Link.

Power detail screens

Per phase detail, kVA, kvar, kW, Min./Max. with date/time of occurrence, Trend Plots, Triggers.

Quality top level screen

10 min. & 24 hr. PQIndex, THDI, THDV, K-factor, Crest Factor, Flicker Pst, %9's of Reliability.

Quality detail screens

Per phase detail L-L, L-N,V aux, Odd, Even, Interharmonics, Present, Min./Max., Trend Plots, Harmonic spectrum plots, waveform plots.

Events top level screen

Active/Acknowledged Event list, Trigger List, System Log, ITIC Curve Link.

Event detail screens

Event List, Condition, Acknowledge Button, Trigger Date/Time,
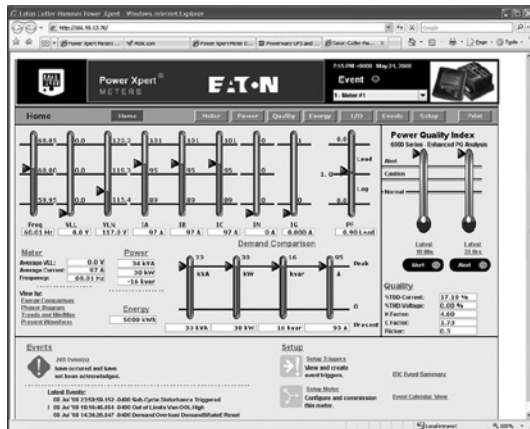Trigger description.

Setup top level screen

View setup, Edit setup, Login, Logout.

Setup detail screens

Quick Setup, Trigger setup, Detail setting.

Power Xpert Meter 4000/6000/8000 Web browser views


Power Xpert 4000/6000/8000 Web Browser Homepage

Note: 4000 does not include flicker, ITIC.

Power Xpert Meter 4000/6000/8000's embedded Web server offers
Eaton customers a new level of accessibility to the critical infor-
mation required to manage the electrical distribution system. The
embedded Web server includes real time circuit information in both
numeric and graphical formats to help monitor circuit parameters
such as current loading, voltage and power levels, power factor.

The Web server also provides the energy and demand readings
required to help manage the cost of energy. Readings include
kWh, kvarh, delivered and received and kVAh with time-of-use and
separate status input controlled energy accumulation to account for
energy during special times such as rate alert periods or stand-by
generator times of operation.

The Web server also includes critical information regarding Power
Quality such as harmonic distortion, flicker (Power Xpert 6000/8000),
crest factor, K-Factor and more.

The Web server allows the user to view waveforms of the voltage
and current to spot power quality problems such as notching.
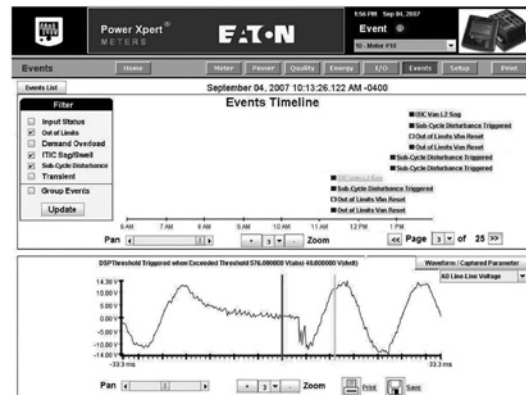
Events Timeline (Power Xpert Meter 6000/8000)

View and understand the sequence of events that have occurred
during a period of time. Plot color-coded events on captured wave-
forms to gain insight into the sequence of events from one single
cycle to the next one. This provides the user an excellent vantage
point to review and compare multiple events at an unprecedented
resolution.
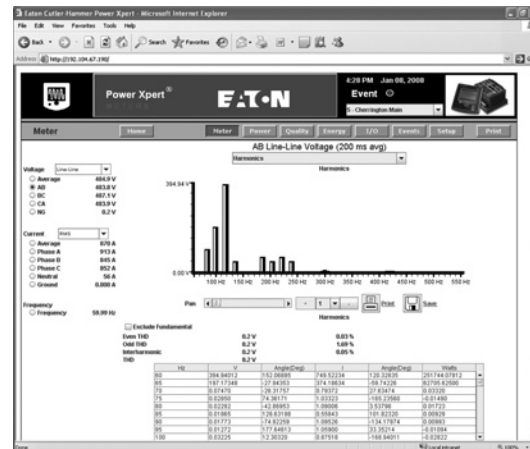
Harmonic Spectral Plot

The harmonic spectral plot displays both harmonics and interharmon-
ics up to the 85th order. A detailed table also includes individual
magnitudes and angles of current and voltage harmonics, as well as
a harmonic power calculation at each frequency. Even, odd and total
THD are displayed for diagnostic purposes. In addition, the Power
Xpert Meter 6000/8000 provides interharmonics, which allow users
to see what is going on between the integer multiples of the funda-
mental.

Historical Trend Plot

Graphical trending of data

The Power Xpert Meter 4000/6000/8000's embedded Web server supports graphical trend charts of key circuit measurements such as current, voltage, power and energy. The trend chart supports a zoom feature that allows the user to view data over a short period of 16 hours or a longer period of 48 months. The trend chart has a horizontal slider bar control to manage scrolling forward and backward through the data. Trend charts of basic readings include minimum, maximum and average readings. Trend charts of energy data also display demand values.
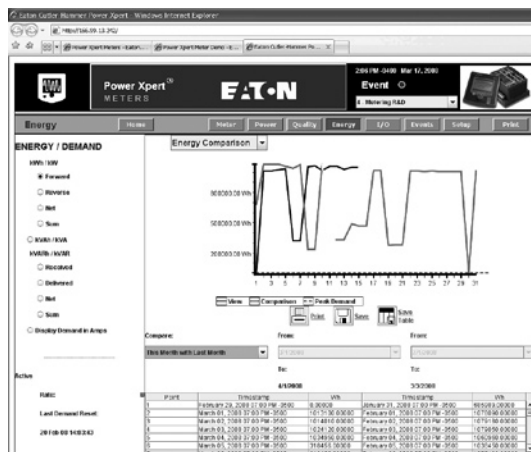
Energy Comparison

Energy usage patterns can be effortlessly analyzed with the month-to-month, week-to-week comparison chart. Raw data can be easily exported with the "Save Table" option to other applications such as Excel for further analysis or graphing.

Note: All data logging for trend plotting is automatically preconfigured in all of the Power Xpert Meter 4000/6000/8000. In addition, the 6000 and 8000 Series Meters have sag, swell and transient triggers builtin according to the ITIC (CBEMA) standard.

Demand Comparison

Demand comparison compares power consumption day-to-day, month-to-month or week-to-week. Power Xpert Meters can set to measure demand at 1 to 60 minute intervals. Both sliding and fixed interval windows are supported for maximum flexibility.
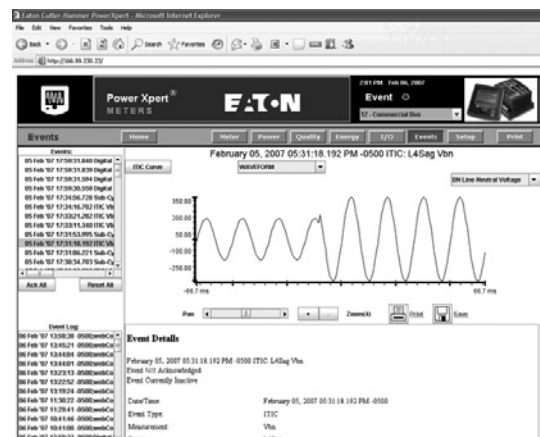
Disturbance Recording

Sag/swell recording

60 cycles of waveform are recorded at 512 samples per cycle including 30 cycles of pre and post trigger data. The Power Xpert Meter 4000/6000/8000's embedded Web server supports viewing of triggered waveforms one channel at a time including the ability to zoom and to scroll horizontally using a slider bar. Waveforms are stored in Power Xpert Meter 4000/6000/8000's nonvolatile flash memory using an industry standard Comtrade format. Waveforms can be automatically sent out by email following an event, or can be retrieved from an FTP directory structure in the meter's memory.

Events Calendar (Power Xpert Meter 6000/8000)

The Events Timeline calendar view provides instant insight to the frequency of power events and helps detect reoccurring problems. Colorcoded events can be filtered to detect specific issues.

Web server device configuration

Special software is not required to configure a Power Xpert Meter 4000/6000/8000. The embedded Web server includes comprehensive device set-up capability.

Quick Setup (Power Xpert Meter 4000/6000/8000)

Discrete contact inputs

The optional I/O expansion card offers 8 digital inputs that are useful for a variety of applications such as:

- Status indication with time stamping of transitions (1 ms precision).
- Pulse Counting of KYZ or other utility pulses such as air, water or gas.

Additional features include:

- High-speed triggering of waveforms based on events such as breaker trips or static transfers.
- Demand interval timing taken from a master utility meter end of interval pulse.

Status inputs are self sourced providing a nominal 24 Vdc (20 – 30 Vdc) across the circuit. Names can be configured for each input for ease of use.

ITIC (formerly CBEMA) analysis (Power Xpert Meter 6000/8000)

The ITIC (Information Technology Industry Council) Web page includes counters to track the occurrence of disturbances and a pass/fail summary. In addition, selecting any disturbance counter links to a detailed event view of the disturbances in that ITIC category. Disturbance waveforms can be viewed from the browser.
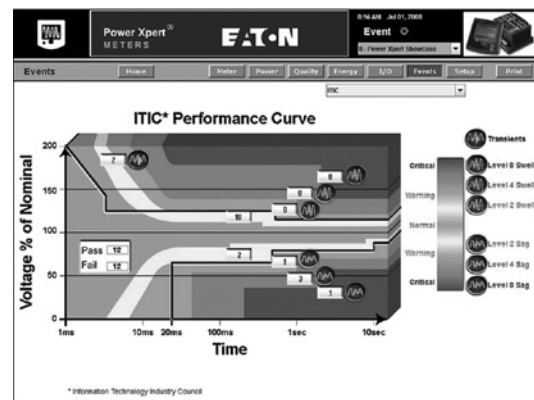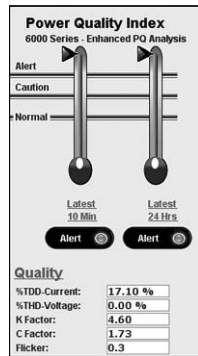

ITIC Analysis Plot (Power Xpert Meter 6000/8000)
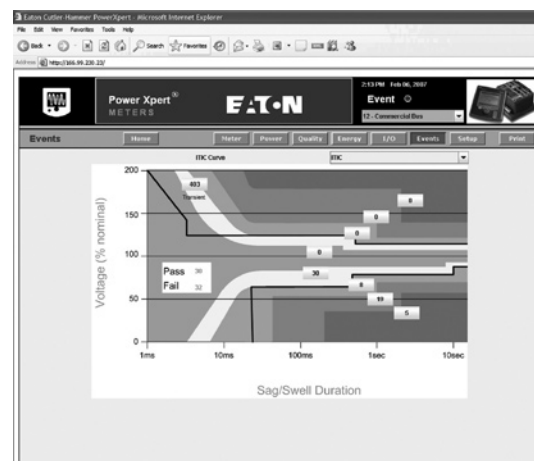
ITIC Individual Event Plot with Duration and Magnitude
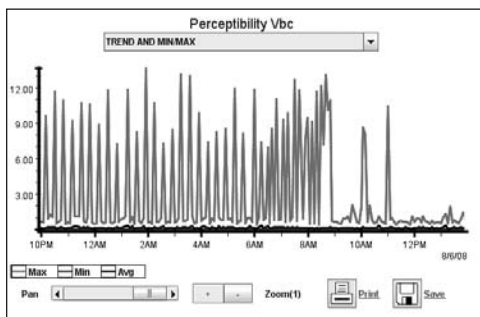(Power Xpert Meter 6000/8000)

PQ Index

A statistical analysis comparing the last 10 minute and 24 hour periods' Power Quality to the historical norm for the circuit. The PQ Index score results in a Power Quality rating of Normal, Caution and Alert for the period.
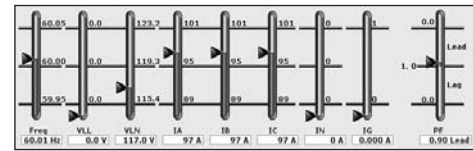

PQ Index

Flicker (EN61000-4-15; Power Xpert Meter 6000/8000)

Flicker

Flicker values for Perceptibility, PST and PLT are calculated based on EN61000-4-15 guidelines.

Health Monitor

Health Monitor

Easily upgrade your Power Xpert Meter 4000 to a 6000

Eaton understands that our customers' needs change over time. That's why we've developed meters that can grow with you. Once a Power Xpert Meter 4000 is purchased, you have the ability to upgrade to a Power Xpert Meter 6000, with no intervention from Eaton, when needed. All the features of the Power Xpert Meter 4000 that you have been using and depend on remain, however, once updated, all the additional features of the Power Xpert Meter 6000 are available. The self-upgrade is available on Eaton's Web site. You'll need a credit card, your Power Xpert Meter 4000 serial number and date code (you will be presented with this information if you are using the upgrade link directly from your Power Xpert Meter) and your e-mail address. Once you have completed the purchase, we will send you your new license key information via e-mail that will allow you to complete the upgrade.
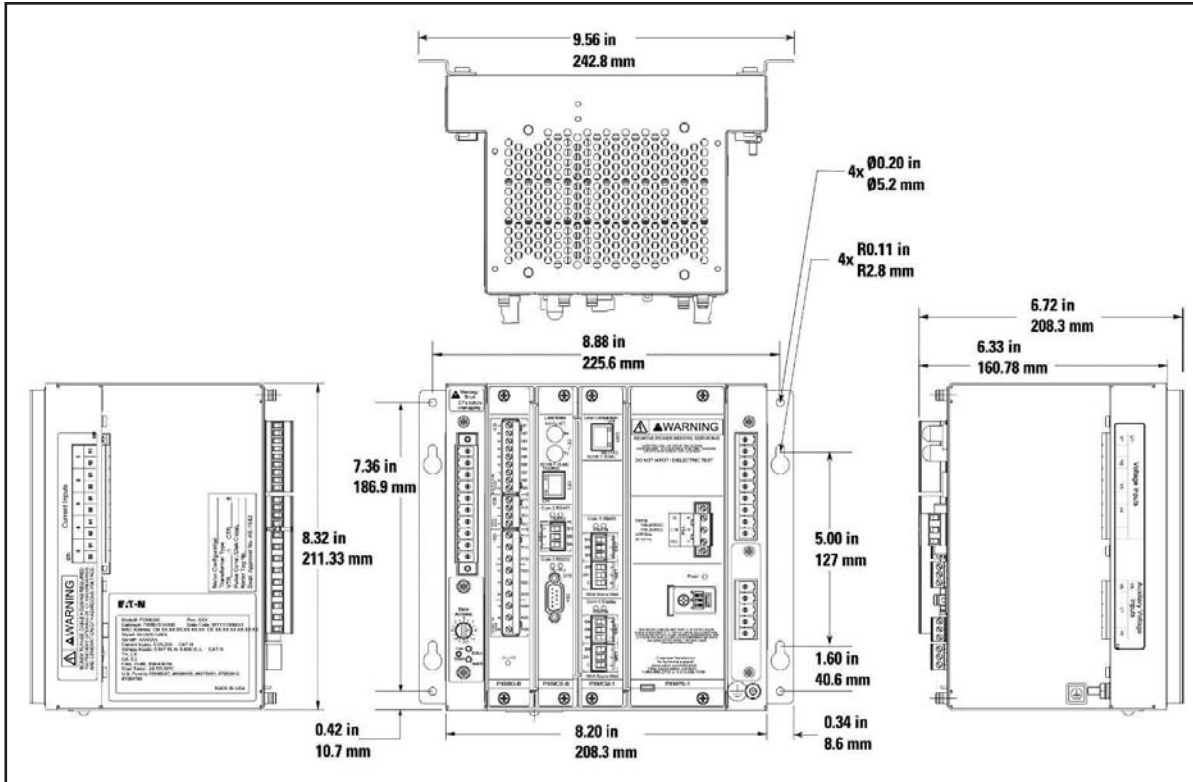
Figure 2. Power Xpert 4000/6000/8000 Meter Module physical characteristics
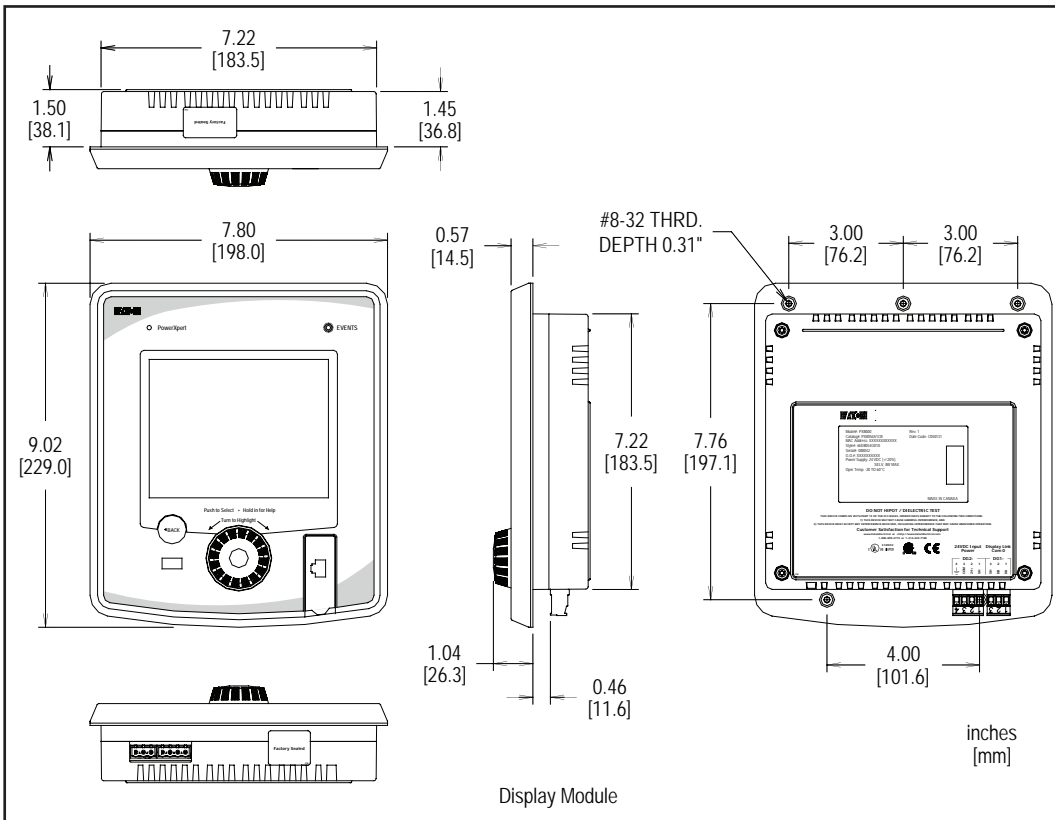

Figure 3. Power Xpert 4000/6000/8000 Graphic Display Module (PXD-MMG) physical characteristics
- Sold separately - supports a sub-network of a total of 16 meter modules
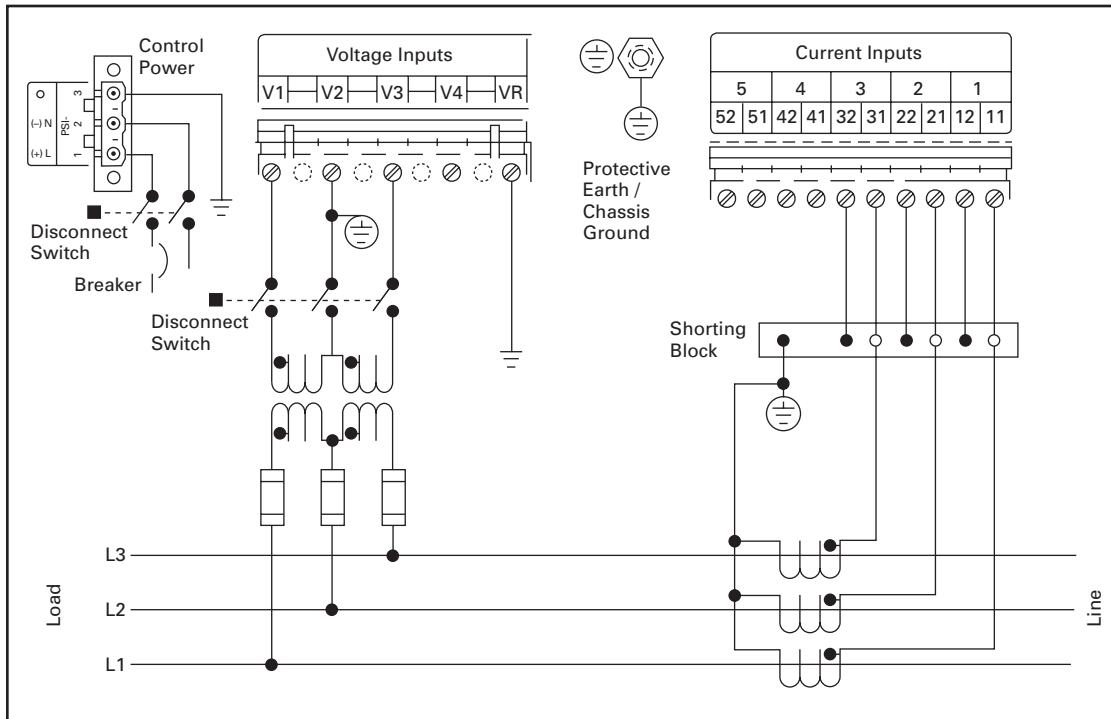
Figure 4. 3-Phase 3-Wire Delta (Up to 600 Volts)
Note: Based upon the voltage rating, you may need a control power transformer for the control power.
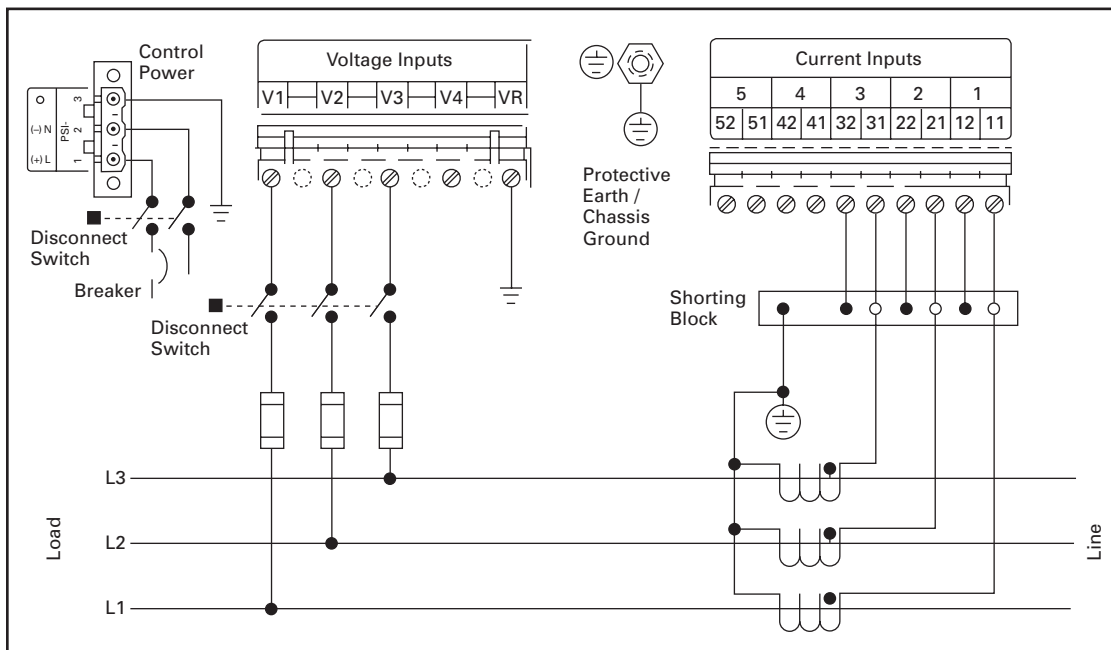

Figure 5. 3-Phase 3-Wire Delta (Above 600 Volts)
Note: Based upon the voltage rating, you may need a control power transformer for the control power.

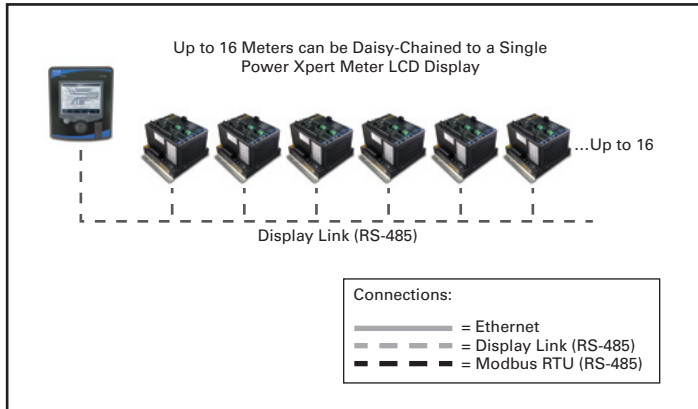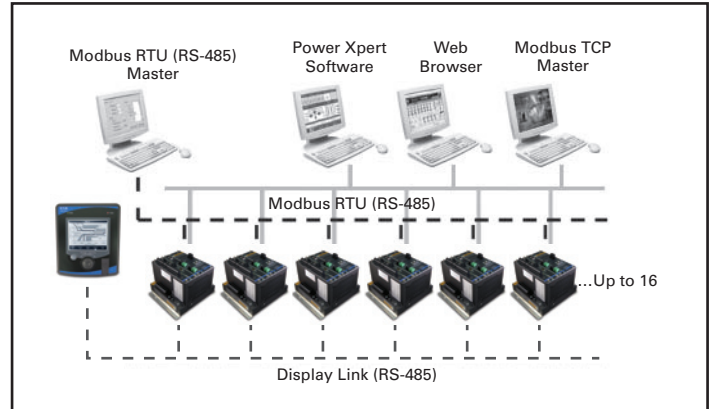## Power Xpert Meters configuration and wiring examples

Figure 6. Display Link

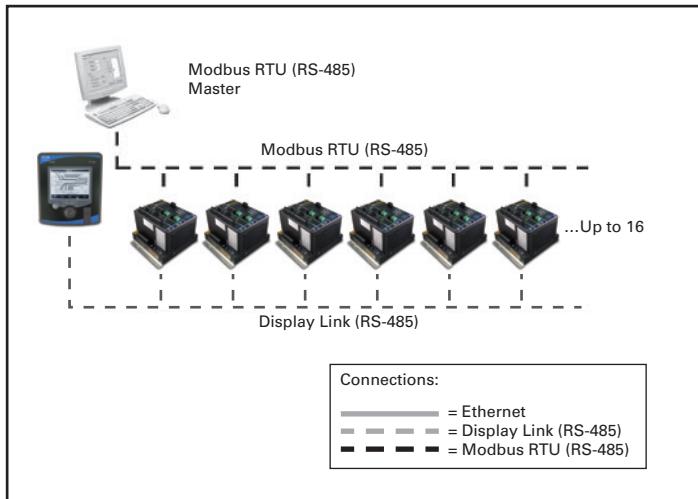**Figure 7. Web Enabled — Advanced System Functionality**

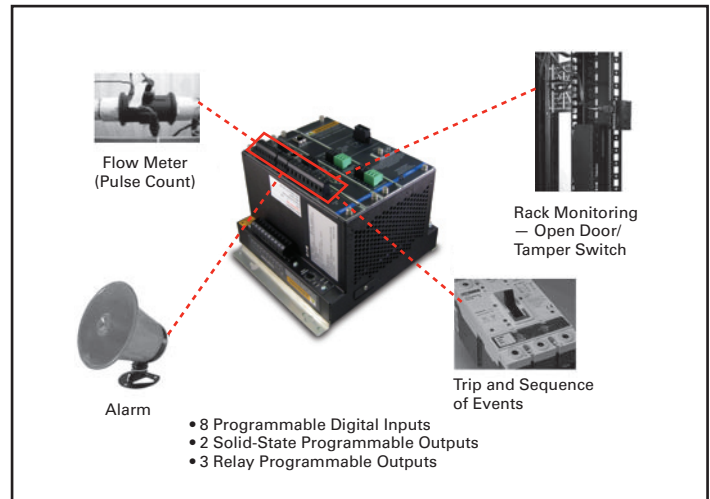**Figure 8. Modbus RTU (RS-485) — Non-Web Enabled**

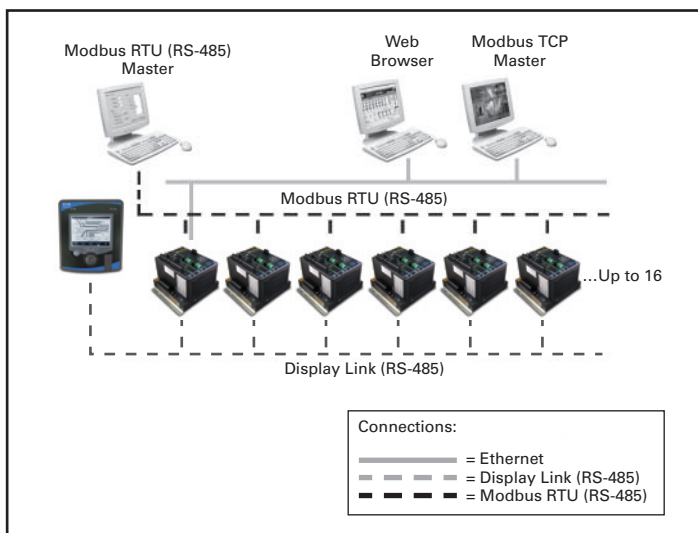**Figure 9. Accessories — I/O Card (option)**

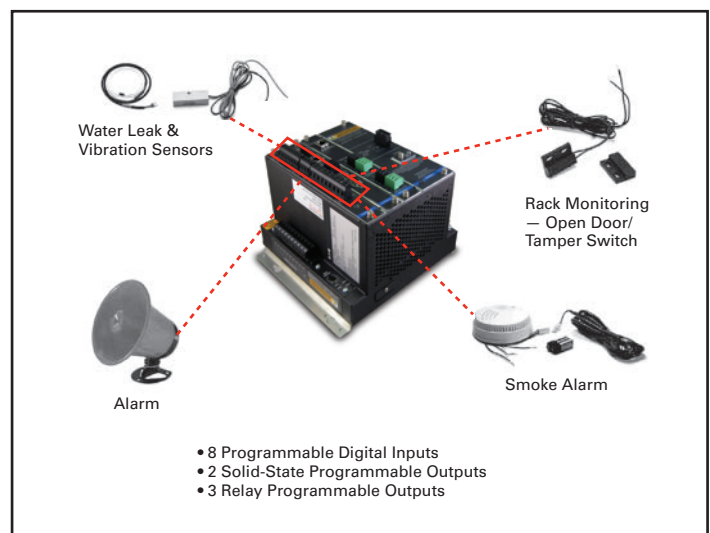**Figure 10. Web Enabled — Browser and Modbus TCP**

**Figure 11. IT Configuration Examples — Accessories —
I/O Card (option)**

To order a Power Xpert Meter 4000/6000/8000, the catalog number should be determined using the chart shown in **Table 3**. The chart illustrates how to include the desired factory options as part of a catalog number. Option cards that are selected at time of order entry will be installed at the factory.

Option cards are also field installable for field upgrades.

If a display is required, it should be ordered separately. The Multi-Meter Graphic Display is capable of displaying data from an RS-485 daisychain of up to 16 Power Xpert Meter 4000/6000/ 8000 meter modules over a distance of up to 1000 ft. Power Xpert Meter modules include panel mounting brackets. The Multi-Meter Graphic Display is designed to mount separately. If back-to-back meter to display panel mounting is desired, a mounting bracket kit is available (**PX-PMBA**).

Example 1: **PXM8251A1BB** (PXM 8000 Meter, w/ VAUX, Std. Pwr, Com. Exp. & I/O Cards)
Example 2: **PXM6251A1BA** (PXM 6000 Meter, w/ VAUX, Std. Pwr, Com. Exp. Card)

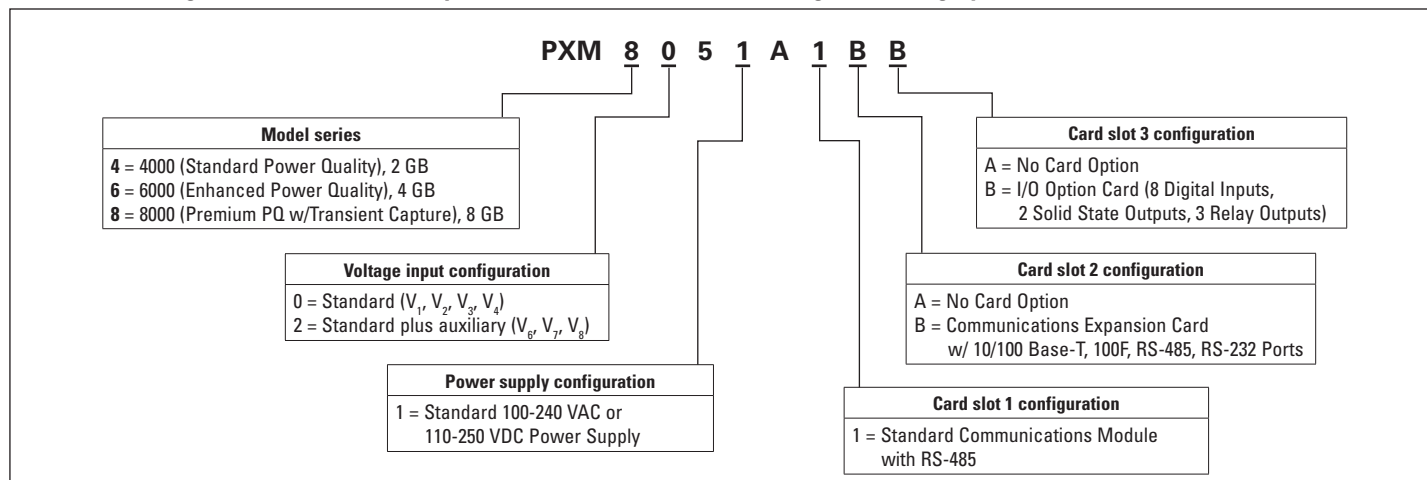**Table 3. Ordering information—Power Xpert Meter 4000/6000/8000 catalog numbering system**

PXM 8 0 5 1 A 1 B B

Model series
4 = 4000 (Standard Power Quality), 2 GB
6 = 6000 (Enhanced Power Quality), 4 GB
8 = 8000 (Premium PQ w/Transient Capture), 8 GB

Voltage input configuration
0 = Standard (V_1, V_2, V_3, V_4)
2 = Standard plus auxiliary (V_6, V_7, V_8)

Power supply configuration
1 = Standard 100-240 VAC or
110-250 VDC Power Supply

Card slot 1 configuration
1 = Standard Communications Module
with RS-485

Card slot 2 configuration
A = No Card Option
B = Communications Expansion Card
w/ 10/100 Base-T, 100F, RS-485, RS-232 Ports

Card slot 3 configuration
A = No Card Option
B = I/O Option Card (8 Digital Inputs,
2 Solid State Outputs, 3 Relay Outputs)

Table 4. Power Xpert Meter 4000/6000/8000 accessories

Description	Catalog number
Graphic display module	PXD-MMG
Communications expansion card: Ethernet 100FX, 10/100T, RS-485, RS-232	PXMCE-B*
Digital I/O card: 8 digital input, 2 solid-state output, 3 relay output	PXMIO-B*
Panel mounting bracket assembly for back-to-back meter to graphic display mounting	PX-PMBA
Panel mounting bracket assembly for retrofitting a graphic display to an IQ analyzer cutout	PX-PMBB
Panel mounting bracket assembly required for reduced graphic display rear clearance	PX-PMBC
Power Xpert Meter 4000 to 6000 License Upgrade Key	PXM-4KUPG

* These items can be ordered separately or preinstalled in the meter by selecting option B in the model number.
Note: These specifications are subject to change without notice and represent the maximum capabilities of the product with all options installed. This is not a complete feature list. Features and functionality may vary depending on selected options and product model.

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