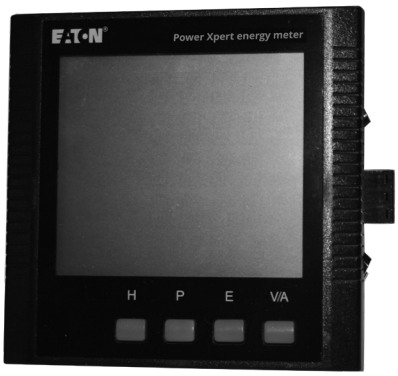
Power Xpert energy meter series



General description

The Power Xpert® energy meter series power and energy meters monitor the most critical aspects of an electrical distribution system. This premier metering instrument uses the latest in advanced technology to make it simple to use, powerful, scalable, and highly flexible.

Applications

Identify power quality problems to help:

- Protect motors from damage
- Preserve the integrity of processes and batches
- Prevent blown capacitor bank fuses
- Protect transformers and conductors from overheating

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

Features

- 20ms refresh, true rms measurement
- ANSI C12.20 (0.1 Class) and IEC61000-4-30 Class S
- Up to 8 GB memory
- 4th CT input, non-ring terminal only
- Eaton cloud connectivity for ETHMULTI
- Power quality analysis
- Over/under limit alarm
- RS-485 communication port
- BACnet MSTP
- Switch status monitoring
- Waveform capture up to 512 samples/cycle
- NTP time synchronization up to 1 millisecond accuracy
- Measure individual harmonics from 2nd to 63rd
- 50/60 Hz rated frequency metering
- Modular design
- Data logging
- TOU (time of use), 4 tariffs, 12 seasons, 14 schedules
- Optional multi-protocol communications module supporting - Modbus TCP/IP, BACnet/IP, EtherNet/IP, IEC 61850, DNP 3.0 over IP, MQTT, PROFINET, HTTP/HTTPs Post, FTP, sFTP, SNMP V3, SMTP and NTP time synchronization

Powering Business Worldwide

Metering

- Voltage V1, V2, V3, VLnavg, V12, V23, V31, VLlavg
- Current I1, I2, I3, In, Iavg
- Power P1, P2, P3, Psum
- Reactive power Q1, Q2, Q3, Qsum
- Apparent power S1, S2, S3, Ssum
- Frequency F
- Power factor PF1, PF2, PF3, PF
- Energy Ep_imp, Ep_exp, Ep_total, Ep_net, Epa_imp, Epa_exp, Epb_imp_Epb_exp, Epc_imp, Epc_exp
- Reactive energy Eq_imp, Eq_exp, Eq_total, Eq_net, Eqa_imp, Eqa_exp, Eqb_imp, Eqb_exp, Eqc_imp, Eqc_exp
- Apparent energy Es, Esa, Esb, Esc
- Demand Dmd_P, Dmd_Q, Dmd_S, Dmd_I1, Dmd_I2, Dmd_I3
- Load features
- Four quadrant power

Features

Monitoring

- Power quality
- Voltage harmonics 2nd to 63rd and THD
- Current harmonics 2nd to 63rd and THD
- Voltage crest factor
- Telephone Interference Factor (TIF)
- Current K factor
- Voltage unbalance factor U_unbl
- Current unbalance factor I_unbl
- Max./min. statistics with time stamps

Alarms

Limits can be set for up to 16 indicated parameters and can be set with a specified time interval. If any input of the indicated parameters is over or under its setting limit and persists over the specified time interval, the event will be recorded with time stamps and trigger the alarm DO output. The 16 indicated parameters can be selected from any of the 80 parameters available.

I/O option module

A maximum of three modules can be used for one meter. Digital input, digital output, pulse output, relay output, analog input and analog output are provided by I/O option module.

Anti-tampering seal

Users can physically seal the meter similar to a utility meter in order to provide anti-tampering protection. All metrological programming and user-defined parameters are protected with a physical seal.

Data logging

PXE2 offers three assignable historical logs where the majority of the metering parameters can be recorded. The onboard memory is 16 MB and each log size is adjustable. A real-time clock allows for any logged events to be accurately time stamped.

With the addition of the PXE-ETHMULTI communication module, the memory size expands to an industry-leading 8 GB memory with 1-second interval datalogging.

Time of use Users can assign up to four different tariffs (sharp, peak, valley, and normal) to different time periods within a day according to the billing requirements. The PXE meter will calculate and accumulate energy to different tariffs according to the meter's internal clock timing and TOU settings.

Waveform capture

PXE2 can record 100 groups of voltage and current waveforms. It provides the waveform record of 10 cycles before and after the triggering point. It also supports a settable triggering condition. COMTRADE waveform file format is available for waveform capture with optional communication module (PXE-ETHMULTI).

Power quality event logging

When a power quality event happens, such as voltage sag and swell, etc., PXE2 will record the timestamp and the triggering condition of the event. It can save up to 50,000 power quality events.

Automatic frequency adaptation

Rated frequency is adjusted automatically to local frequency such as 50 Hz or 60 Hz. The same meter can be used in countries with different electrical frequencies.

Flexible current input

Compatible with different current transformers such as 5 A, 1 A, 333 mV and Rogowski coils all available from Eaton.

Communications Standard

- RS-485

Communication protocols supported

- Modbus RTU
- Modbus TCP option
- BACnet MSTP
- BACnet/IP option
- HTTP/HTTPS option
- Ethernet/IP option
- WiFi option
- IPv6 option
- SMTP (Simple Mail Transfer Protocol) option
- SNMP (Simple Network Management Protocol), V2, V3 option
- Ability to connect to Eaton's Power Xpert Gateway 900 option
- IEC61850 option
- DNP 3.0 over IP option
- MQTT option
- PROFINET option

Display

- Clear and large character LCD screen display with white backlight
- Wide environmental temperature endurance
- Display load percentage, four quadrant power, and load nature outline
- Small size 96 × 96 DIN or 4-inch ANSI round
- Optional 7" color HMI, utilizing the same 96x96 DIN mounting
- Optional IP66 / N4X cover. See TD150045EN

Features

Category		Item	Parameters	PXE1	PXE2
Metering	Real-time metering	Phase voltage	V1, V2, V3, VLnavg	■	■
		Line voltage	V12, V23, V31, Vllavg	■	■
		Current	I1, I2, I3, In, Iavg	■	■
		Power	P1, P2, P3, Psum	■	■
		Reactive power	Q1, Q2, Q3, Qsum	■	■
		Apparent power	S1, S2, S3, Ssum	■	■
		Power factor	PF1, PF2, PF3, PF	■	■
		Frequency	F	■	■
	Energy and demand	Energy	Ep_imp, Ep_exp, Ep_total, Ep_net, Epa_imp,Epa_exp, Epb_imp, Epb_exp, Epc_imp, Epc_exp	■	■
		Reactive energy	Eq_imp, Eq_exp, Eq_total, Eq_net, Eqa_imp,Eqa_exp, Eqb_imp, Eqb_exp, Eqc_imp, Eqc_exp	■	■
		Apparent energy	Es, Esa, Esb, Esc	■	■
		Demand	Dmd_P, Dmd_Q, Dmd_S, Dmd_I1, Dmd_I2, Dmd_I3	■	■
TOU	Time of use	Energy/max. demand	TOU, 4 tariffs, 12 seasons, 14 schedules	■	■
	Daylight saving time	Two adjustable formats	Month/day/hour/minute Month/week/first few weeks/hour/minute	■	■
Time synchronization		NTP time synchronization up to 1 millisecond accuracy	Network Time Protocol support enables the meter to synchronize time over the network up to 1 millisecond resolution	■	■
Monitoring	Waveform capture	Voltage and current waveform*	Trigger, manual, DI change, sag/dips, swell, overcurrent	■	■
	Power quality	Voltage unbalance factor	U_unbl	■	■
		Current unbalance factor	I_unbl	■	■
		Voltage THD	THD_V1,THD_V2,THD_V3, THD_Vavg	■	■
		Current THD	THD_I1, THD_I2, THD_I, THD_Iavg	■	■
		Individual harmonics	Harmonics 2nd to 63rd (50 Hz or 60 Hz) Harmonics 2nd to 15th (400 Hz)	■	■
		Voltage crest factor	Crest factor	■	■
		TIF	Telephone Interference Factor	■	■
		Current K factor	K factor	■	■
	Statistics	MAX with time stamp MIN with time stamp	Each phase of V & I; Total of P, Q, S, PF & F; demand of I1, I2, I3, P, Q&S; each phase THD of V & I; unbalance factor of V and I	■	■
Others	Alarm	Over/under limit alarm	V, I, P, Q, S, PF, V_THD and I_THD each phase and total or average; unbalance factor of V and I; load type; analog input of each channel; demand of I1, I2, I3, P, Q&S; reverse phase sequence; DI1~DI28	■	■
	Power quality event logging	Sag/dips, swell	Voltage	—	■
	Data logging	Data logging 1 Data logging 2 Data logging 3	F, V1/2/3/avg, V12/23/13/avg, I1/2/3/n/avg, P1/2/3/ sum, Q1/2/3/sum, S1/2/3/sum, PF1/2/3, PF, U_unbl, I_unbl, Load Type, Ep_imp, Ep_exp, Ep_total, Ep_net, Eq_imp, Eq_exp, Eq_total, Eq_net, Es, Epa_imp, Epa_exp, Epb_imp,Epb_exp, Epc_imp, Epc_exp, Eqa_imp, Eqa_exp, Eqb_imp, Eqb_exp, Eqc_imp, Eqc_exp, Esa, Esb, Esc, THD_V1/2/3/avg, THD_I1/2/3/avg, harmonics 2nd to 63rd, crest factor, THFF, K factor, sequence and phase angles, DI counter, AI, AO, Dmd P/Q/S, Dmd I1/2/3	—	■
	Onboard memory size	Memory	Bytes	—	16 MB
		Optional Communication modules	PXM1K-ETHMULTI 8GB	■	■
		Optional Communication modules	PXM1K-ETHMULT-NW 8GB (non Wi-Fi)	■	■
	Communication	RS-485 port, half duplex, optical isolated	BACnet MS/TP, Modbus-RTU protocol	■	■
	Time	Real-time clock	Year, month, date, hour, minute, second	■	■

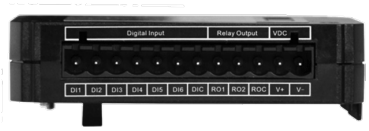
* The PXE2 uses 512 samples per cycle. For the waveform capture function on the PXE2 the sample rate is 64, 128 or 512 samples.

Accessories

Digital/analog I/O

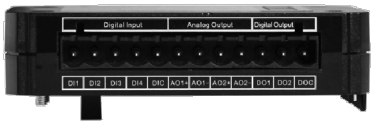
Integrate data to/from other devices with field expandable plug-in I/O modules.

PXE-I01



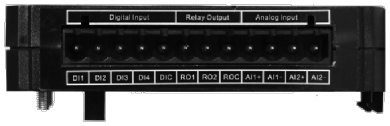
- 6x digital inputs
- 24 Vdc power for digital inputs
- 2x relay outputs

PXE-I02



- 4x digital inputs
- 2x digital outputs
- 2x analog outputs

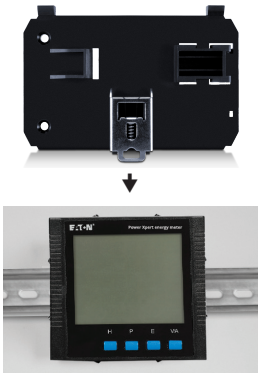
PXE-I03



- 4x digital inputs
- 2x relay outputs
- 2x analog inputs

Din-Rail mounting adapter

PXM1K-DINADAPT is a din rail mounting adapter that provides an easy way to din rail mount the PXE meter with an integrated display. It will not work with a remote display or a transducer version.



Panel mount remote display

PXE panel mount remote display for DIN rail mount transducer version (T designation in catalog number). Includes one 6 ft cable. Optional 7" color HMI, utilizing the same 96x96 DIN mounting.

Communications modules

A standard RS-485 port and optional communication modules support a wide array of protocols.

PXM1K-ETHMULT-NW

PXM1K-ETHMULTI

Communication protocols	Communication modules	
	PXM1K-ETHMULT-NW*	PXM1K-ETHMULTI*
MODBUS-TCP	X	X
HTTP/HTTPs webserver	X	X
SMTP email	X	X
SNMP V	X, V3	X, V3
HTTP/HTTPs push	X	X
FTP post	X	X
sFTP server	X	X
Datalogging	8GB	8GB
Datalogging interval	1 sec	1 sec
BACnet-IP	X	X
WiFi		X
EtherNet/IP	X	X
IPv6	X	X
Dual RJ45 ports	X	X
COMTRADE	X	X
Waveform display	X	X

** Additional details on the module are available in the user manual MN150017EN.*

Meter input wiring for 3 CT input

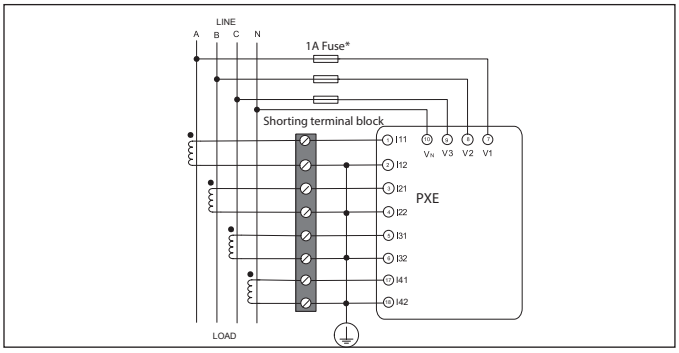


Figure 1. Three-phase, four-wire (3LN, 3CT)

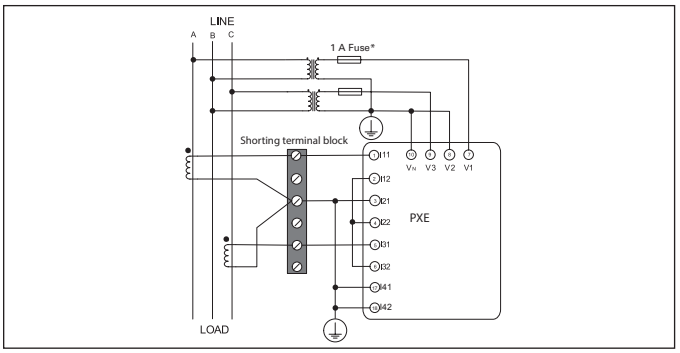


Figure 4. Three-phase, three-wire with PT and 2CT (2LL, 3CT)

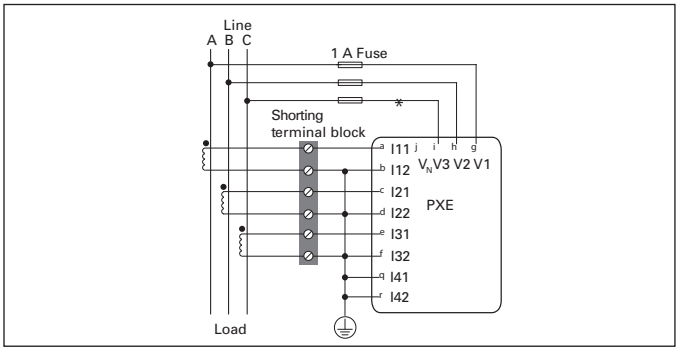


Figure 2. Three-phase, three-wire (3LL, 3CT)

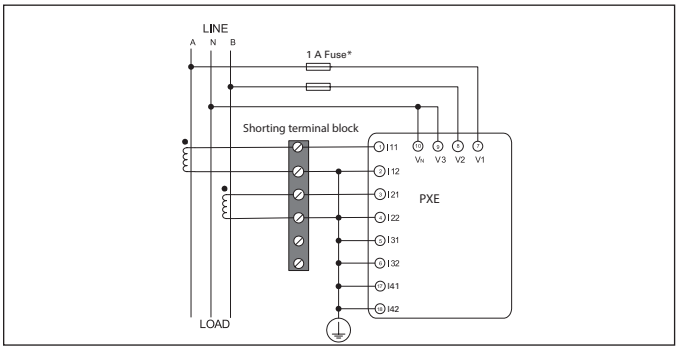


Figure 5. Single-phase, three-wire (1LL, 2CT)

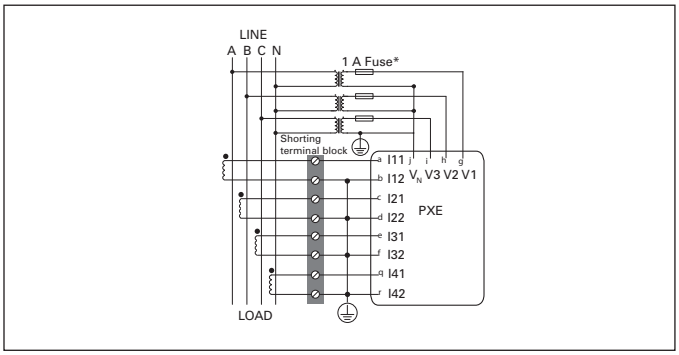


Figure 3. Three-phase, four-wire with PT (3LN, 3CT)

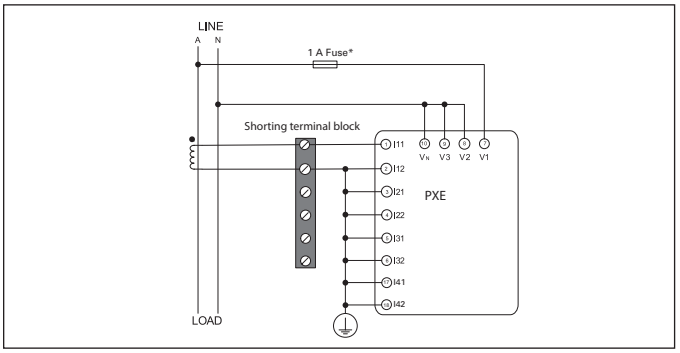


Figure 6. Single-phase, two-wire (1LN, 1CT)

* 1A fuse typical

Note 1: Shorting terminal block not required when used with voltage input current sensors

Note 2: For meters used with voltage input current sensors, unused channels need to be tied to ground as shown in the figures. If meters are used with amperage input current sensors, then the unused channels do not need to be tied to ground.

Note 3: I41 and I42 are only available on non-ring terminal versions.

I/O cards wiring

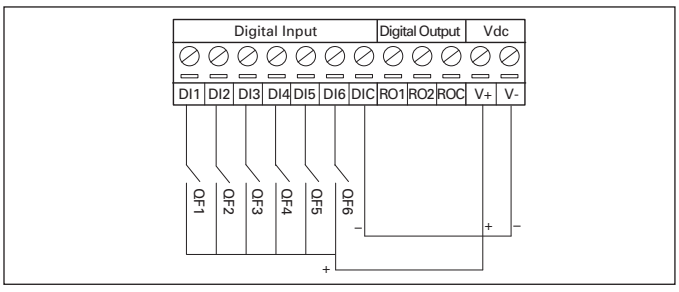


Figure 7. PXE-IO1

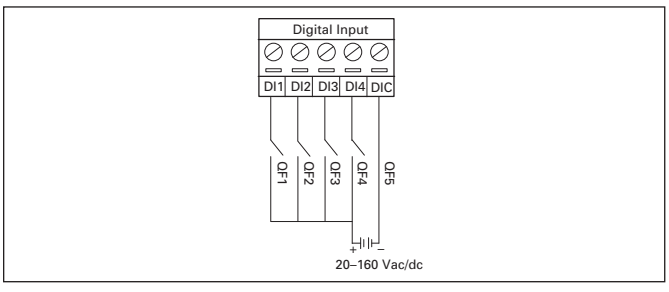


Figure 8. PXE-IO2 / PXE-IO3

Dimensions in inches (mm)

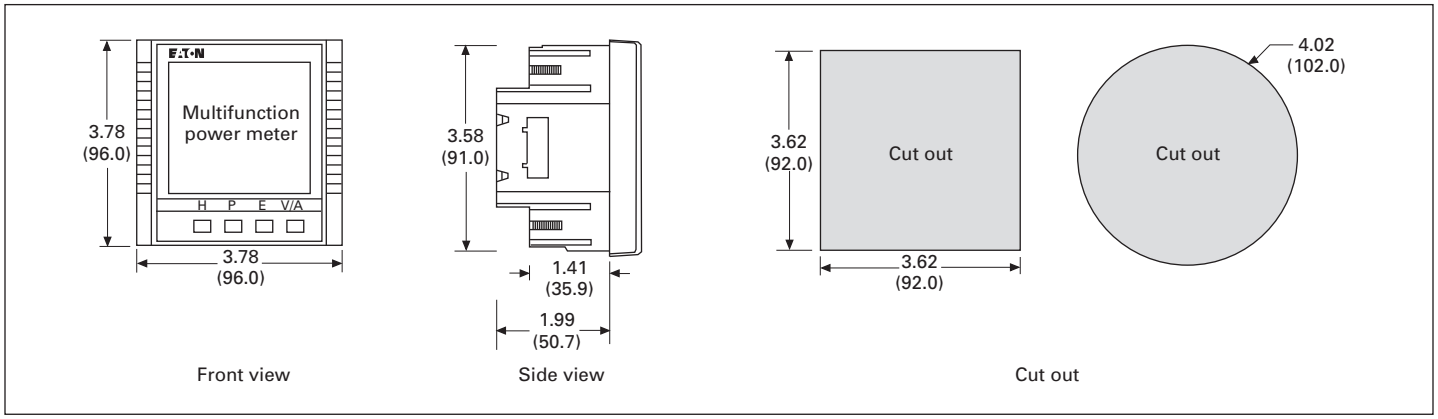


Figure 9. PXE

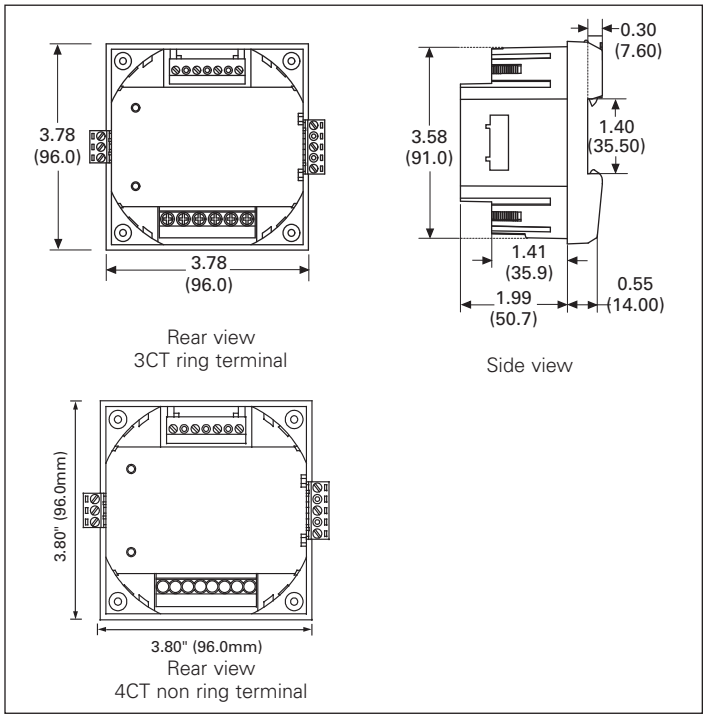


Figure 10. DIN mount meter

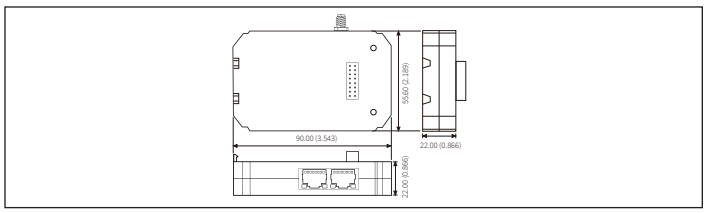


Figure 11. PXM1K-ETHMULTI

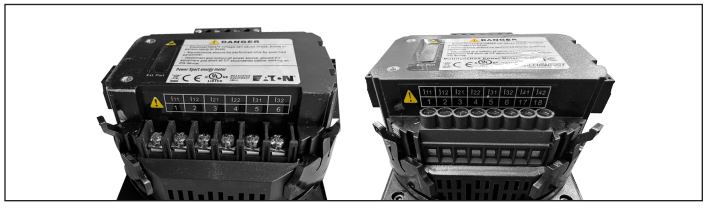
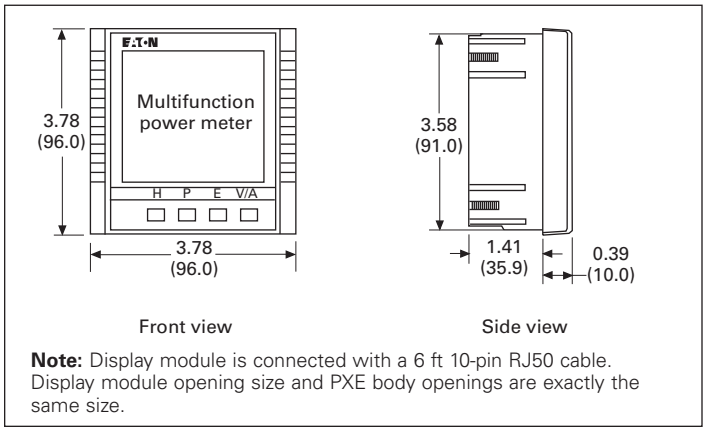


Figure 12. Ring (left) versus Non-ring (right) terminals



Note: Display module is connected with a 6 ft 10-pin RJ50 cable. Display module opening size and PXE body openings are exactly the same size.

Figure 13. External display module

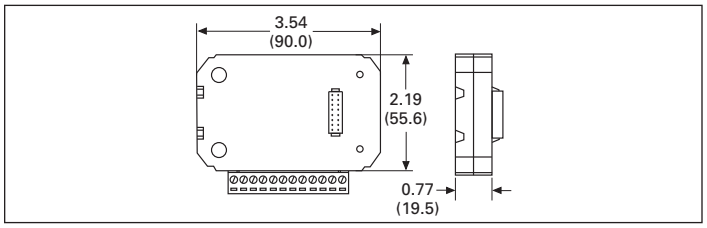


Figure 14. I/O module

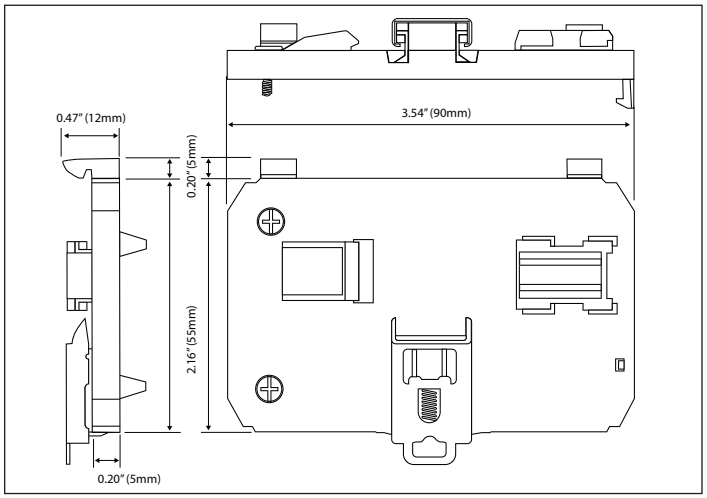


Figure 15. PXM1K-DINADAPT rail mounting adapter

Ordering information

To order a Power Xpert energy meter, the catalog number should be determined using **Table 1**. The table illustrates how to include the desired factory options as part of a catalog number. I/O and communication option modules are separate and field installable. A maximum of three (3) option modules can be added to a meter. A maximum of two (2) optional I/O modules can be added per meter, and a maximum of one (1) optional communication module can be added per meter.

Power Xpert energy meter modules include panel mounting brackets.

Example 1: PXE1MB1A3 (PXE multifunctional meter/integral display, 100–415 Vac (or 100–300 Vdc), 1A or 5A secondary, 3 CT inputs with ring terminals

Example 2: PXE2TB4V4 (PXE multifunctional meter plus/transducer only (no display), 20–60 Vdc, 333 mV secondary or Rogowski coil, 4 CT inputs without ring terminal

Table 1. Power Xpert energy meter catalog numbering system

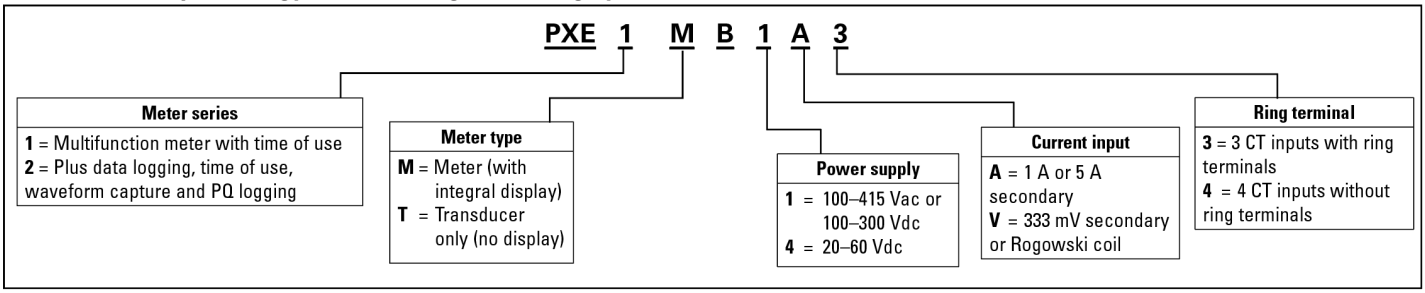


Table 2. PXE1 I/O module

Description	Catalog number
PXE I/O module, logic address configurable (1, 2) 2 RO, 6 DI, with DI power supply 24 Vdc	**PXE-IO1**
PXE I/O module, logic address configurable (1, 2) 4 DI, 2 DO, 2 AO configurable (0–20 mA, 4–20 mA, 0–5 V, 1–5 V)	**PXE-IO2**
PXE I/O module, logic address configurable (1, 2) 4 DI, 2 RO, 2 AI configurable (0–20 mA, 4–20 mA, 0–5 V, 1–5 V)	**PXE-IO3**

Table 3. Power Xpert energy meter accessories

Description	Catalog number
PXE panel mount remote display for DIN rail mount transducer version; include one 6 ft cable	**PXE-DISPLAY**
PXE din rail mounting adapter	**PXM1K-DINADAPT**
PXE replacement terminal plug kit	**PXM1K-TPK**
PXE DISPLAY CABLE (15FT)	**PXM1K-DISPCBL-15**
7-inch enhanced color touchscreen	**PX-ENHANCED-DISP**

Table 4. Power Xpert energy meter communications modules

Description	Catalog number
PXE Dual-port ethernet accessory module*	**PXM1K-ETHMULT-NW**
PXE Dual-port ethernet accessory module*	**PXM1K-ETHMULTI**

Table 5. Related Documents

Description	Document number
PXE Manual	**MN150017EN**
Rogowski coil TD	**TD150039EN**
Dual Ethernet Module PA	**PA150007EN**
5A CT TD	**TD02601002E**
Alternate 5A CT TD	**TD049001EN**
IP66/N4X Cover TD	**TD150045EN**

Table 6. Rogowski coils

Description	Catalog number
PXE 16-inch long Rogowski coil CT with 4-inch window calibrated for 5–1200 A	**CS-16-4-1000-RC**
PXE 16-inch long Rogowski coil CT with 4-inch window calibrated for 12.5–3000 A	**CS-16-4-2500-RC**
PXE 16-inch long Rogowski coil CT with 4-inch window calibrated for 25–6000 A	**CS-16-4-5000-RC**
PXE 16-inch long Rogowski coil CT with 4-inch window calibrated for 50–12,000 A	**CS-16-4-12000-RC**
PXE 16-inch long Rogowski coil CT with 4-inch window calibrated for 250–50,000 A	**CS-16-4-50000-RC**
PXE 24-inch long Rogowski coil CT with 7-inch window calibrated for 5–1200 A	**CS-24-7-1000-RC**
PXE 24-inch long Rogowski coil CT with 7-inch window calibrated for 12.5–3000 A	**CS-24-7-2500-RC**
PXE 24-inch long Rogowski coil CT with 7-inch window calibrated for 25–6000 A	**CS-24-7-5000-RC**
PXE 24-inch long Rogowski coil CT with 7-inch window calibrated for 50–12,000 A	**CS-24-7-12000-RC**
PXE 24-inch long Rogowski coil CT with 7-inch window calibrated for 250–50,000 A	**CS-24-7-50000-RC**
PXE 36-inch long Rogowski coil CT with 10-inch window calibrated for 5–1200 A	**CS-36-10-1000-RC**
PXE 36-inch long Rogowski coil CT with 10-inch window calibrated for 12.5–3000 A	**CS-36-10-2500-RC**
PXE 36-inch long Rogowski coil CT with 10-inch window calibrated for 25–6000 A	**CS-36-10-5000-RC**
PXE 36-inch long Rogowski coil CT with 10-inch window calibrated for 50–12,000 A	**CS-36-10-12000-RC**
PXE 36-inch long Rogowski coil CT with 10-inch window calibrated for 250–50,000 A	**CS-36-10-50000-RC**
PXE 47-inch long Rogowski coil CT with 14-inch window calibrated for 5–1200 A	**CS-47-14-1000-RC**
PXE 47-inch long Rogowski coil CT with 14-inch window calibrated for 12.5–3000 A	**CS-47-14-2500-RC**
PXE 47-inch long Rogowski coil CT with 14-inch window calibrated for 25–6000 A	**CS-47-14-5000-RC**
PXE 47-inch long Rogowski coil CT with 14-inch window calibrated for 50–12,000 A	**CS-47-14-12000-RC**
PXE 47-inch long Rogowski coil CT with 14-inch window calibrated for 250–50,000 A	**CS-47-14-50000-RC**

Reference

* Antenna is not included with the module. An antenna with RP-SMA(f) connector and supporting 2.4 GHz will work
* Additional details on the module are available in the user manual (MN150017EN)

Technical information

Input

Current inputs (each channel)

Nominal secondary sensor settings:

Current Sensor Input Options	5A	1A	333mV	100mV Rogowski
Nominal Configuration Selection	5A	1A	1A	1A
Metering range (%of nominal)	200%	200%	120%	120%
Pickup current(%of nominal)	0.1%	0.1%	0.5%	0.5%

Withstand: 20 A rms continuous, 100 A rms for 1 second, non-recurring

Burden: 0.05 VA (typical) at 5 A rms

Accuracy: 0.1% full scale ANSI C12.20 .1 Class, IEC61000-4-30 Class S

Voltage inputs (each channel)

Nominal full scale: 400 Vac L-N, 690 Vac L-L (+20%)

Withstand: 1500 Vac continuous, 2500 Vac, 50/60 Hz for 1 minute

Input impedance: 2 mohm per phase

Metering frequency: 45–65 Hz, 300–500 Hz

Pickup voltage: 10 Vac

Accuracy: 0.1% full scale

Energy accuracy

Active: Class 0.1s (according to IEC 62053-22), Class 0.1 (according to ANSI C12.20), IEC61000-4-30 (Class S)

Reactive: Class 0.5s (according to IEC 62053-24)

Harmonic resolution

Metered value: 63rd harmonic (50 Hz or 60 Hz type)

Communication

RS-485 (standard)

Modbus RTU, BACnet MSTP

Two-wire shielded twisted pair cable connection

Baud rate: 1200–38,400 bps

Ethernet (optional)

Modbus TCP/IP

BACnet/IP

EtherNet/IP

IEC 61850

DNP 3.0 over IP

MQTT

PROFINET

HTTP/HTTPs Post

FTP

sFTP

SNMP V3

SMTP

NTP time synchronization

Standard compliance

Measurement standard: IEC 62053-22; ANSI C12.20

Environmental standard: IEC 60068-2

Safety standard: IEC 61010-1, UL 61010-1, IEC 61557-12

EMC standard: IEC 61000-4/-2-3-4-5-6-8-11, CISPR 22, IEC 61000-3-2, IEC 61000-6-2/4

Outlines standard: DIN 43700, ANSI C39.1

Operating environment

Operation temperature: –25 °C to +70 °C

Storage temperature: –40 °C to +85 °C

Relative humidity: 5% to 95% noncondensing

Protection level: IP54 (display), IP30 (meter body)

Optional IP66 / N4X cover

I/O option

Digital input

Input voltage range: 20–160 Vac/Vdc

Input current (max.): 2 mA

Start voltage: 15 V

Stop voltage: 5 V

Pulse frequency (max.): 100 Hz, 50% duty ratio (5 ms ON and 5 ms OFF)

SOE resolution: 2 ms

Digital output (DO) (photo-MOS)

Voltage range: 0–250 Vac/Vdc

Load current: 100 mA (max.)

Output frequency: 25 Hz, 50% duty ratio (20 ms ON, 20 ms OFF)

Isolation voltage: 2500 Vac

Relay output (RO)

Switching voltage (max.): 250 Vac, 30 Vdc

Load current: 5 A (resistive), 2 A (inductive)

Set time: 10 ms (max.)

Contact resistance 30 mohm (max.)

Isolation voltage: 2500 Vac

Mechanical life: 1.5 x 10^7

Analog output (AO)

Output range: 0–5 V / 1–5 V, 0–20 mA / 4–20 mA (optional)

Accuracy: 0.5%

Temperature drift: 50 ppm / °C typical

Isolation voltage: 500 Vdc

Open circuit voltage: 15 V

Analog input (AI)

Input range: 0–5 V / 1–5 V, 0–20 mA / 4–20 mA (optional)

Accuracy: 0.1%

Temperature drift: 50 ppm / °C typical

Isolation voltage: 500 Vdc

Power supply for DI (24 Vdc)

Output voltage: 24 Vdc

Output current: 42 mA

Load (max.): 21 DIs

Control power

Universal: AC or DC

AC/DC control power

Operating range: 100–415 Vac, 50/60 Hz; 100–300 Vdc

Burden: 5 W

Frequency: 50/60 Hz

Withstand: 3250 Vac, 50/60 Hz for 1 minute

Installation Category III (distribution)

Low voltage DC control power (optional)

Operating range: 20–60 Vdc

Burden: 5 W

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