

# Power Xpert Meter 2000 Series



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# 1 INTRODUCTION

## About This Manual

This document is the user manual for the installation, operation, and maintenance of the Eaton Power Xpert® Meter 2000 Series. It is intended for authorized and qualified personnel who use the PXM 2250/2260/2270/2280/2290 meters. Please refer to the specific WARNINGS and CAUTIONS in this section before proceeding.

For Technical Support and after hour emergencies, contact our Customer Integrity team at 1-844-435-8982, or by e-mail at [mrsupport@eaton.com](mailto:mrsupport@eaton.com). You can also visit us on the web at [www.eaton.com/monitor](http://www.eaton.com/monitor).

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## Safety Precautions

All safety codes, safety standards, and/or regulations must be strictly observed in the installation, operation, and maintenance of this device.

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**WARNINGS** refer to instructions that, if not followed, can result in death or injury.



**CAUTIONS** refer to instructions that, if not followed, can result in equipment damage.

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**WARNINGS**

### **SHOCK HAZARDS:**

**IMPROPER INSTALLATION CAN CAUSE DEATH, INJURY, AND/OR EQUIPMENT DAMAGE.**

Follow all Warnings and Cautions. Completely read and understand the information in this document before attempting to install or operate the equipment. Improper wiring could cause death, injury, or equipment damage. Only qualified personnel are to service the PXM 2000 Series.

**TROUBLESHOOTING PROCEDURES MAY REQUIRE PROXIMITY TO EXPOSED ENERGIZED (LIVE) ELECTRICAL WIRING AND/OR PARTS WHERE THE HAZARD OF FATAL ELECTRIC SHOCK IS PRESENT.** Exercise extreme care to avoid injury or death. Always disconnect, lock-out, and tag the current and voltage sources and the control power supply circuit before touching the connections or components on the rear face of the meter base unit.

**FAILURE TO GROUND THE PXM 2250/2260/2270/2280/2290 METER MAY RESULT IN INJURY, DEATH, OR EQUIPMENT DAMAGE.** Properly ground the meter during installation.

**Covered by one or more of the following patents:**

**US Patent Numbers D526920, D525893, 6751563, 6735535, 6636030.**

# 2 OVERVIEW AND SPECIFICATIONS

## Power Xpert Meter 2000 Series Overview

The PXM 2250/2260/2270/2280/2290 is a multifunction power and energy meter designed to be used in electrical substations, panel boards, and as a primary revenue meter, due to its high performance measurement capability. The unit provides multifunction measurement of all electrical parameters and makes the data available in multiple formats via display, communication systems, and through analog signal transmission.



Figure 2.1: PXM 2000 Meter

The PXM 2000 Series meter is designed with advanced measurement capabilities, allowing it to achieve high performance accuracy. It is specified as a 0.2% class energy meter for billing applications as well as a highly accurate panel indication meter.

The PXM 2000 Series meter provides additional capabilities, including standard RS485, Ethernet capability, Modbus, SNMP, Modbus TCP, BACnet/IP, and DNP 3.0 Protocols, and Option cards that can be added at any time.

Features of the PXM 2000 Series include:

- 0.2% Class revenue certifiable energy and demand metering
- Meets ANSI C12.20 (0.2%) and IEC 687 (0.2%) classes
- Multifunction measurement including voltage, current, power, frequency, energy, power factor, etc.
- Power quality measurements (%THD and Alarm Limits)
- Percentage of Load Bar for analog meter reading
- Easy to use faceplate programming
- Standard RS485 communication
- Standard Ethernet communication
- Optional I/O Cards - field upgradeable without removing installed meter

In addition to the PXM 2000 Series meter with integral display/transducer configuration, a transducer-only (without a display) configuration is available. The PXM 2000 Series Transducer provides RS485 communication via Modbus RTU, Modbus ASCII or DNP 3.0 protocols, SNMP, Modbus TCP, and BACnet/IP, as well as standard Ethernet communication.



The PXM 2000 Series Transducer is designed to install using DIN Rail mounting. (See Chapter 3 of this manual for mounting information.)

Figure 2.2: Transducer-Only

### Voltage and Current Inputs

#### Universal Voltage Inputs

Voltage Inputs allow measurement up to 576 VAC (Phase to Reference) and 721 VAC (Phase to Phase). This insures proper meter safety when wiring directly to high voltage systems. One unit will perform to specification on 69 volt, 120 volt, 230 volt, 277 volt, and 347 volt power systems.

**Note:** Higher voltages require the use of potential transformers (PTs).

#### Current Inputs

The unit supports a 5 amp or a 1 amp secondary for current measurements.

**Note:** The secondary current must be specified and ordered with the meter.

The PXM 2000 Series Current Inputs use a unique dual input method:

##### Method 1: CT Pass Through

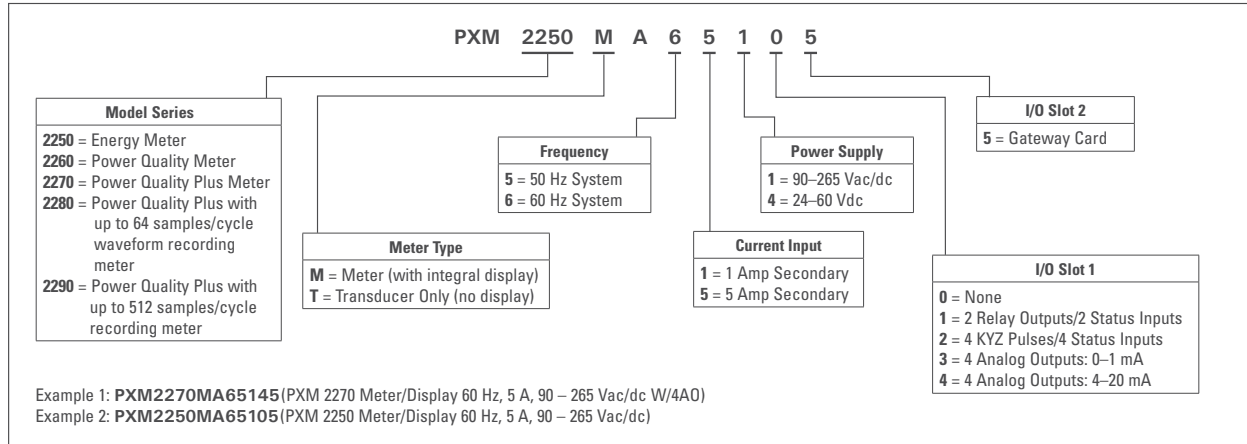
The CT passes directly through the meter without any physical termination on the meter. This insures that the meter cannot be a point of failure on the CT circuit. This is preferable for utility users when sharing relay class CTs. No Burden is added to the secondary CT circuit.

##### Method 2: Current "Gills"

This unit additionally provides ultra-rugged Termination Pass Through Bars that allow CT leads to be terminated on the meter. This eliminates any possible point of failure at the meter. This is a preferred technique for insuring that relay class CT integrity is not compromised (the CT will not open in a fault condition).



## Ordering Information



## Measured Values

The PXM 2000 Series provides the following measured values as Average, Maximum and Minimum values. Only 5, 15, and 60 minute Average Minimum and Maximum values are available.

Voltage provides an Instantaneous Max and Min reading which displays the highest surge and lowest sag seen by the meter. All other parameters offer Max and Min capability averaged over the demand period (meter) or true Min and Max (Gateway Card).

**PXM 2000 Series Measured Values**

Parameter	Min	Max	Avg	Actual
mTotalVARh				X
mVAtotal	X	X	X	
mVarC	X	X	X	
mFreq	X	X	X	
mVcnPerTHD	X	X	X	
mNetEnergy				X
mVAB	X	X	X	
mWtotal	X	X	X	
mACIN	X	X	X	
mLaggingVARh				X
mDemandNetWatts			X	X
mACVavgLL3Sigma				X
mPFapparentA	X	X	X	
mDemandNetVARs			X	X
mWB	X	X	X	
mPosSeqV	X	X	X	
mDemandLeadingVARs			X	X
mDemandSumWatts			X	X
mACVavgLN3Sigma				X
mPFapparentTotal	X	X	X	
mVarB	X	X	X	
mDemandlb		X	X	
mACIC	X	X	X	
mIntDemandNetVARs		X	X	
mTotalEnergy			X	
mACVAN	X	X	X	
mPercentUnbalance	X	X	X	
mIntDemandSumVARs			X	X
mLeadingVARh				X
mVAh				X
mPFapparentTotal5MinIntAvg				X
mDemandlc			X	X
mACIB	X	X	X	
mIaPerTHD	X	X	X	
mACVBC	X	X	X	
mZeroSeqV	X	X	X	
mIntDemandVAs			X	X

**PXM 2000 Series Measured Values (Continued)**

Parameter	Min	Max	Avg	Actual
mVanPerTHD	X	X	X	
mIntDemandForwardWatts			X	X
mNegSeqV	X	X	X	
mReverseEnergy				X
mACIavg	X	X	X	
mACIA	X	X	X	
mACVAB	X	X	X	
mDemandReverseWatts			X	X
mACVavgLN	X	X	X	
mACVavgLLLongtermAvg				X
mDemandla			X	X
mVAA	X	X	X	
mACVBN	X	X	X	
mVbnPerTHD	X	X	X	
mIntDemandLaggingVARs			X	X
mIbPerTHD	X	X	X	
mIntDemandReverseWatts			X	X
mWA	X	X	X	
mNetVARh				X
mACVCA	X	X	X	
mVarA	X	X	X	
mDemandIn			X	X
mDemandSumVARs			X	X
mIntDemandSumWatts			X	X
mDemandVAs			X	X
mForwardEnergy				X
mPFapparentC	X	X	X	
mPercentVoltageUnbalance	X	X	X	
mIcPerTHD	X	X	X	
mACVavgLL	X	X	X	
mVAC	X	X	X	
mDemandAmpsAvg			X	X
mVARtotal	X	X	X	
mDemandLaggingVARs			X	X
mIntDemandNetWatts			X	X
mPFapparentB	X	X	X	
mWC	X	X	X	
mACVavgLNLongtermAvg				X
mIntDemandLeadingVARs			X	X
mDemandForwardWatts			X	X
mACVCN	X	X	X	

## Utility Peak Demand

The PXM 2000 Series provides user-configured Fixed Window or Sliding Window Demand modes. This feature enables you to set up a customized Demand profile. Fixed Window Demand mode records the average demand for time intervals that you define (usually 5, 15, 30, or 60 minutes). Sliding Window Demand mode functions like multiple, overlapping Fixed Window Demands. You define the subintervals at which an average of demand is calculated. An example of Sliding Window Demand mode would be a 15-minute Demand block using 5-minute subintervals, thus providing a new demand reading every 5 minutes, based on the last 15 minutes.

Demand is the power consumption (Amp, Watt, VAR, VA, and PF) averaged over a specific interval of time (Window). The PXM2000 is capable of measuring demand by two internally triggered methods:

1. Fixed Demand Window (5, 15, 30, or 60 min.);
2. Sliding Demand Window (10, 15, 20, 30, 45, 60 with pre-defined subintervals of 5, 15, and 30).

### Sliding Demand Window

Total Interval	Sub Interval	
10	5	Minutes
15	5	Minutes
20	5	Minutes
30	15	Minutes
45	15	Minutes
60	15 30	Minutes

As an example of a Fixed Demand Window, setting the Demand Interval to 15 minutes would provide an average value for the past 15 minutes and update that value every 15 minutes thereafter. As an example of a Sliding Demand Window, setting the Demand Interval to 15 minutes would provide a 15 minute average every 5 minutes (based on the previous 15 minutes).

## Specifications

### Power Supply

Range: 1 Option: Universal, (90 - 265) VAC @50/60 Hz or (100-370) VDC  
 Option 4: (18 - 60) VDC  
 Power Consumption: (5 to 10) VA, (3.5 to 7) W - depending on the meter's hardware configuration

### Voltage Inputs (Measurement Category III) (See Accuracy Specifications, later in this chapter.)

Range: Universal, Auto-ranging:  
 Phase to Reference (Va, Vb, Vc to Vref): (20 to 576) VAC  
 Phase to Phase (Va to Vb, Vb to Vc, Vc to Va): (0 to 721) VAC  
 Supported Hookups: 3 Element Wye, 2.5 Element Wye, 2 Element Delta, 4 Wire Delta

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Input Impedance:	1M Ohm/Phase
Burden:	0.36 VA/Phase Max at 600 Volts; 0.014 VA at 120 Volts
Pickup Voltage:	20 VAC
Connection:	7 Pin 0.400" Pluggable Terminal Block AWG#12 -26 / (0.129 -3.31) mm <sup>2</sup>
Fault Withstand:	Meets IEEE C37.90.1
Reading:	Programmable Full Scale to any PT Ratio

**Current Inputs**(See Accuracy Specifications, later in this chapter.)

Class 10:	5 A Nominal, 10 A Maximum
Class 2:	1 A Nominal, 2 A Maximum
Burden:	0.005 VA Per Phase Max at 11 Amps
Pickup Current:	0.1% of nominal
Connections:	O Lug or U Lug Electrical Connection (Diagram 4.1) Pass-through Wire, 0.177" / 4.5mm Maximum Diameter (Diagram 4.2) Quick Connect, 0.25" Male Tab (Diagram 4.3)
Fault Withstand:	100 A/10 sec., 300 A/3 sec., 500 A/1 sec.
Reading:	Programmable Full Scale to any CT Ratio
Continuous Current Withstand:	20 Amps for Screw Terminated or Pass Through Connections

**KYZ/RS485 Port Specifications**

RS485 Transceiver; meets or exceeds EIA/TIA-485 Standard:

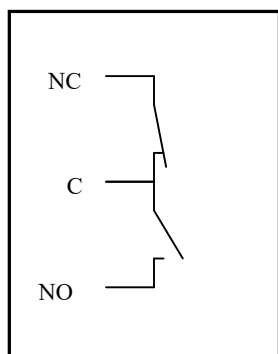
Type:	Two-wire, half duplex
Min. Input Impedance:	96 kΩ
Max. Output Current:	±60 mA

**Wh Pulse**

KYZ output contacts (and infrared LED light pulses through face plate) (see Chapter 6 for Kh values.)

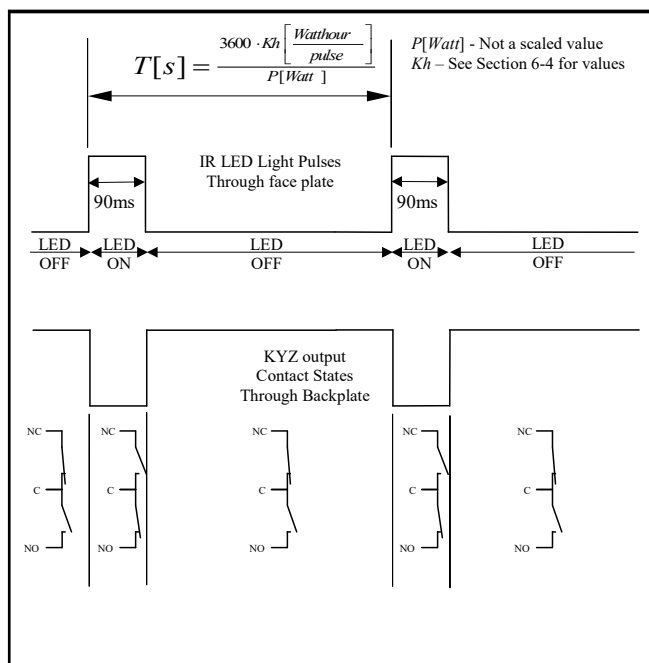
Pulse Width:	90 ms
Full Scale Frequency:	~3 Hz
Contact type:	Solid State - SPDT (NO - C - NC)
Relay type:	Solid state
Peak switching voltage:	DC ±350 V
Continuous load current:	120 mA
Peak load current:	350 mA for 10 ms
On resistance, max.:	35 Ω
Leakage current:	1 μA @ 350 V
Isolation:	AC 3750 V
Reset State:	(NC - C) Closed; (NO - C) Open
Infrared LED:	
Peak Spectral Wavelength:	940 nm
Reset State:	Off

Internal Schematic:



(De-energized State)

Output Timing:



**Isolation**

All Inputs and Outputs are galvanically isolated to 2500 Vac

**Environmental Rating**

Storage: (-20 to +70) °C  
 Operating: (-20 to +70) °C  
 Humidity: to 95% RH Non-condensing  
 Faceplate Rating: NEMA12 (Water Resistant), Mounting Gasket Included

**Measurement Methods**

Voltage, Current: True RMS  
 Power: Sampling at over 400 Samples per Cycle on All Channels

**Update Rate**

Watts, VAR, and VA: Every 6 cycles (e.g., 100 ms @ 60 Hz)  
 All other parameters: Every 60 cycles (e.g., 1 s @ 60 Hz)  
 1 second for current only measurement, if reference voltage is not available

### Communication

Serial Communications Format:

1. RS485 Port through Back Plate
2. Energy Pulse Output through Back Plate

Protocols:	Modbus RTU, Modbus ASCII, DNP 3.0
Com Port Baud Rate:	9,600 to 57,600 bps
Com Port Address:	001-247
Data Format:	8 Bit, No Parity, 1 Stop Bit
PXM 2000 Series Transducer Only Option	Default Initial Communication Baud 9600 (See Chapter 5)

Network Communications Format:

Connection Type:	RJ45, 10/100BaseT Ethernet Network Port
Protocols:	Ethernet TCP/IP, Modbus TCP, HTTP, HTTPS, NTP, SMTP, SNMP, BACnet/IP

### Mechanical Parameters

Dimensions: (see Chapter 3)

Weight: 2 lbs (0.9 kg) (ships in a 6" [152.4 mm] cube container)  
(Without Option Card)

### Compliance

- UL Listing: USL/CNL E185559
- CE (EN61326-1, FCC Part 15, Subpart B, Class A)
- IEC 687 (0.2% Accuracy)
- ANSI C12.20 (0.2% Accuracy)
- ANSI C62.41 (Burst)
- IEC 1000-4-2 - ESD

## Overview and Specifications

### Accuracy (See full Range specifications earlier in this chapter.)

For 23°C, 3-Phase balanced Wye or Delta load, at 50 or 60 Hz (as per order), 5 A (Class 10) nominal unit:

Parameter	Accuracy	Accuracy Input Range <sup>1</sup>
Voltage L-N [V]	0.1% of reading	(69 to 480) V
Voltage L-L [V]	0.2% of reading <sup>2</sup>	(120 to 600) V
Current Phase [A]	0.1% of reading <sup>3</sup>	(0.15 to 5) A
Current Neutral (calculated) [A]	2% of Full Scale	(0.15 to 5) A @ (45 to 65) Hz
Active Power Total [W]	0.2% of reading <sup>1, 2</sup>	(0.15 to 5) A @ (69 to 480) V @ +/- (0.5 to 1) lag/lead PF
Active Energy Total [Wh]	0.2% of reading <sup>1, 2</sup>	(0.15 to 5) A @ (69 to 480) V @ +/- (0.5 to 1) lag/lead PF
Reactive Power Total [VAR]	0.2% of reading <sup>1, 2</sup>	(0.15 to 5) A @ (69 to 480) V @ +/- (0 to 0.8) lag/lead PF
Reactive Energy Total [VARh]	0.2% of reading <sup>1, 2</sup>	(0.15 to 5) A @ (69 to 480) V @ +/- (0 to 0.8) lag/lead PF
Apparent Power Total [VA]	0.2% of reading <sup>1, 2</sup>	(0.15 to 5) A @ (69 to 480) V @ +/- (0.5 to 1) lag/lead PF
Apparent Energy Total [VAh]	0.2% of reading <sup>1, 2</sup>	(0.15 to 5) A @ (69 to 480) V @ +/- (0.5 to 1) lag/lead PF
Power Factor	0.2% of reading <sup>1, 2</sup>	(0.15 to 5) A @ (69 to 480) V @ +/- (0.5 to 1) lag/lead PF
Frequency [Hz]	+/- 0.03 Hz	(45 to 65) Hz
Total Harmonic Distortion [%]	+/- 2%	(0.5 to 10) A <sup>4</sup> or (69 to 480) V, measurement range (1 to 99.99)%
Load Bar	+/- 1 segment	(0.005 to 6) A

- 1 • For 2.5 element programmed units, degrade accuracy by an additional 0.5% of reading.
  - For 1A (Class 2) Nominal, degrade accuracy by an additional 0.5% of reading.
  - For 1A (Class 2) Nominal, the input current range for accuracy specification is 20% of the values listed in the table.
- 2 For unbalanced voltage inputs where at least one crosses the 150V autoscale threshold (for example, 120 V/120 V/208 V system), degrade the accuracy to 0.4% of reading.
- 3 With reference voltage applied (VA, VB, or VC). Otherwise, degrade accuracy to 0.2%. See hookup diagrams 8, 9, and 10 in Chapter 4.
- 4 At least one voltage input (minimum 20 Vac) must be connected for THD measurement on current channels.



# 3 MECHANICAL INSTALLATION

## Introduction

The PXM 2000 Series can be installed using a standard ANSI C39.1 (4" round) or an IEC 92mm DIN (square) form. In new installations, simply use DIN or ANSI punches. For existing panels, pull out old analog meters and replace them with the PXM Series meter. The various models use the same installation. See Chapter 4 for wiring diagrams.

**Note:** The drawings shown below and on the next page give you the meter dimensions in inches and millimeters (mm shown in brackets). Tolerance is +/- 0.1" [2.54 mm].

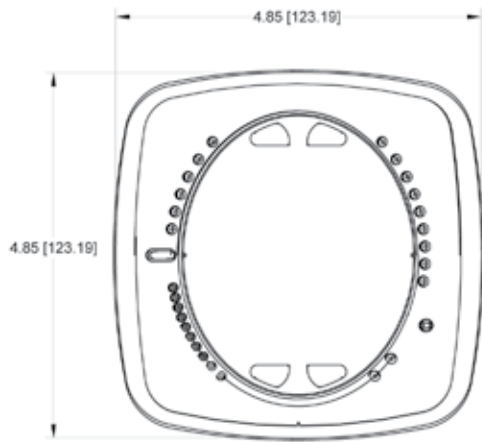


Figure 3.1: Meter Face

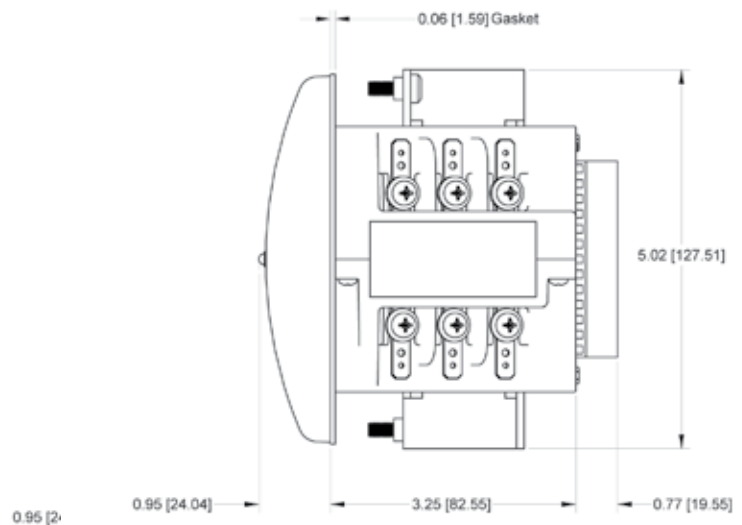


Figure 3.2: Meter Dimensions

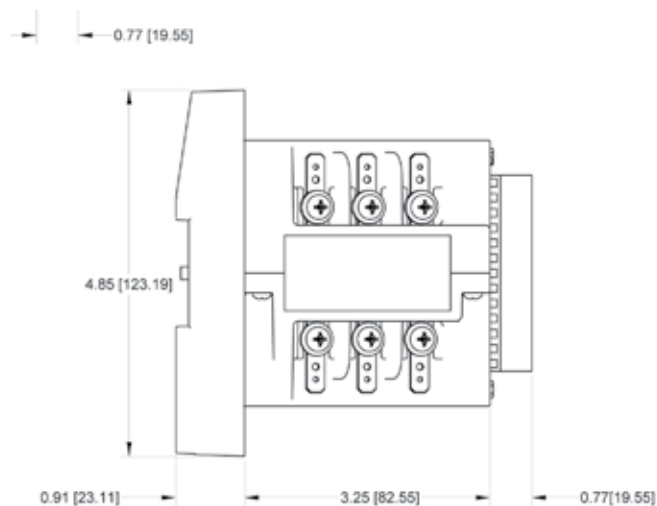


Figure 3.3: Transducer Dimensions

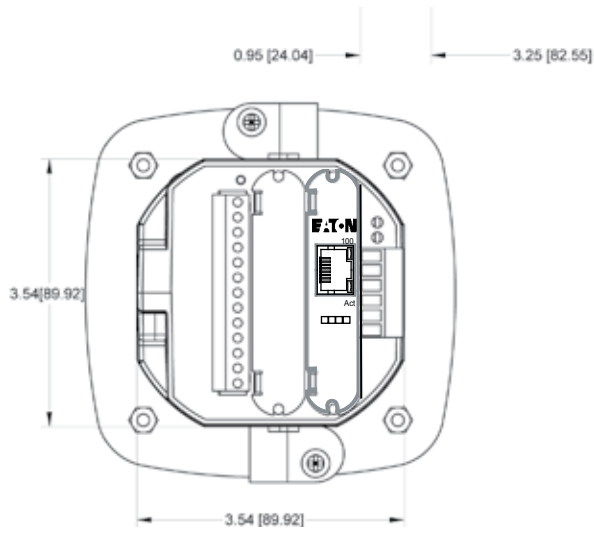


Figure 3.4: Meter Back

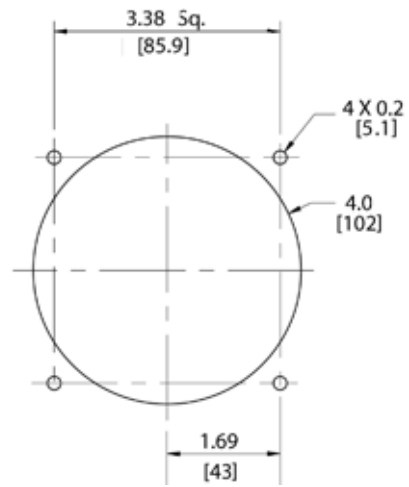


Figure 3.5: ANSI Mounting Panel Cutout

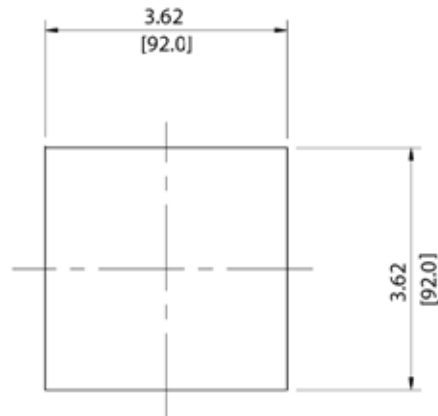


Figure 3.6: DIN Mounting Cutout

**Recommended Tools for PXM 2000 Series Installation:** #2 Phillips screwdriver, small adjustable wrench, and wire cutters.

The meter is designed to withstand harsh environmental conditions; however **it is recommended** you install it in a dry location, free from dirt and corrosive substances. (See Environmental Specifications in Chapter 2.)

## ANSI Installation Steps

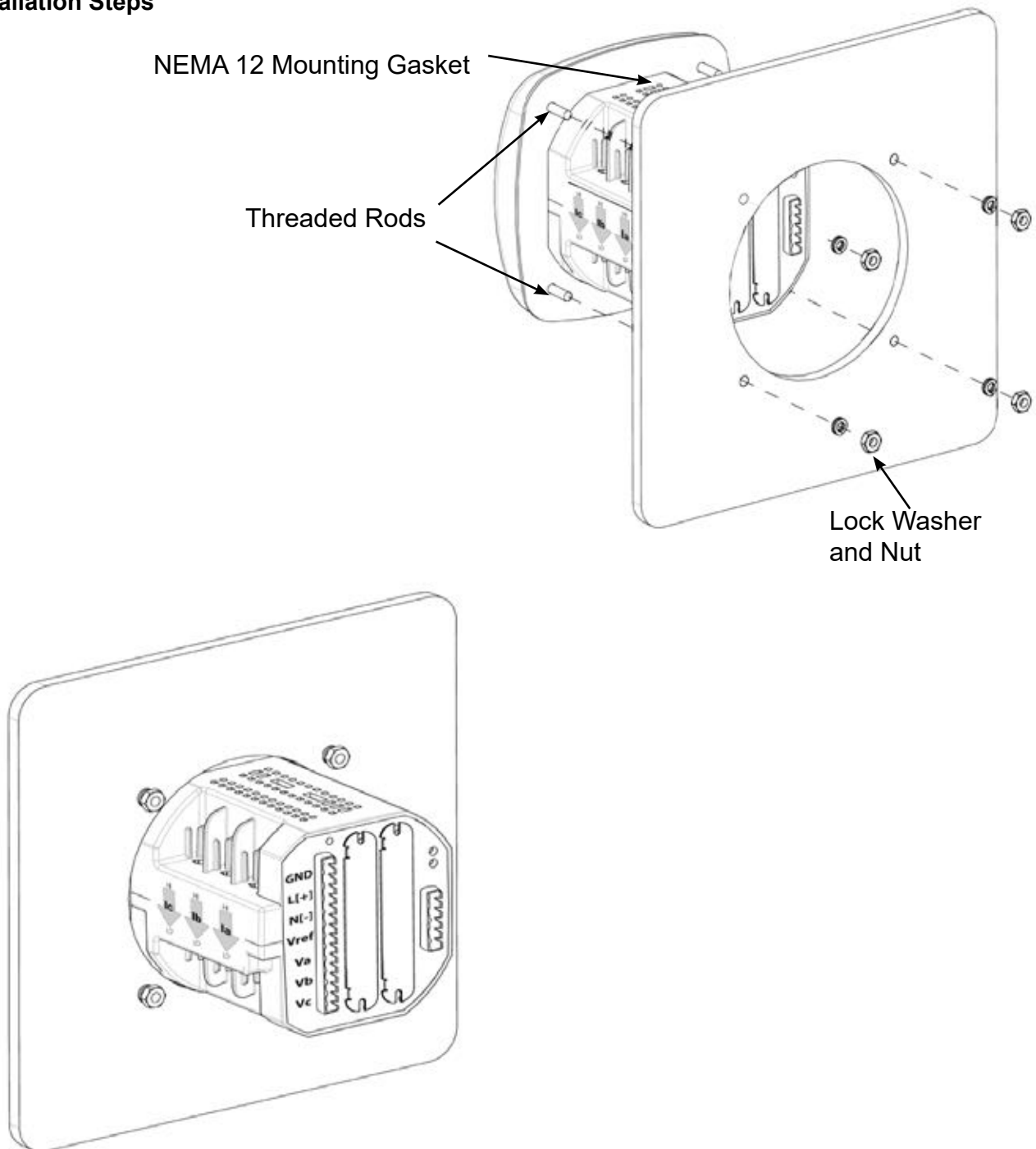


Figure 3.7: ANSI Mounting Procedure

1. Insert 4 threaded rods by hand into the back of meter. Twist until secure.
2. Slide NEMA 12 Mounting Gasket onto back of meter with rods in place.
3. Slide meter with Mounting Gasket into panel.
4. Secure from back of panel with lock washer and nut on each threaded rod. Use a small wrench to tighten. Do not overtighten; slightly more than finger tight is sufficient. The maximum installation torque is 3.5 in./lb (0.4 N·M).

**DIN Installation Steps for Optional DIN Mounting Bracket**

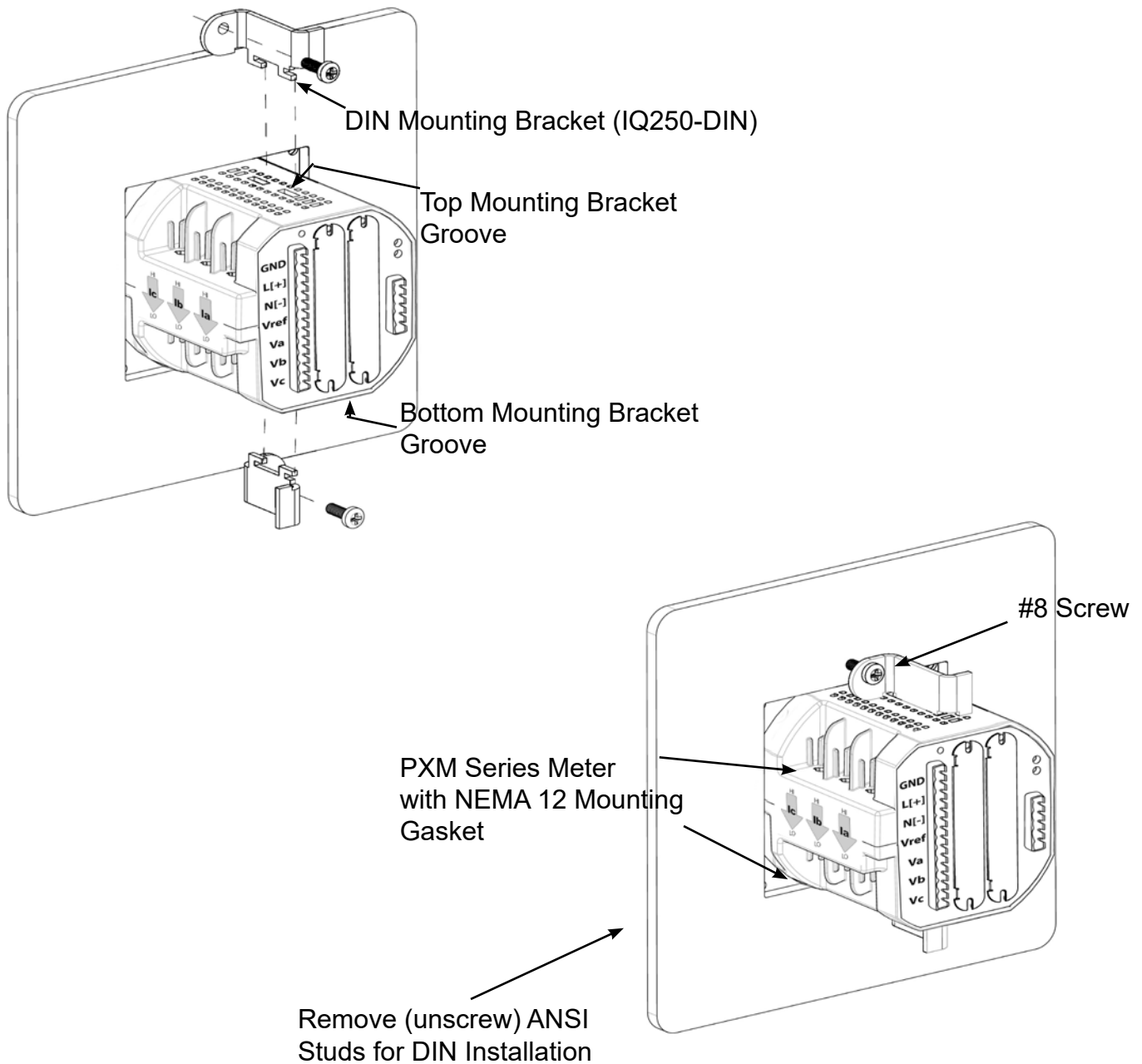


Figure 3.8: DIN Mounting Procedure

1. Slide meter with NEMA 12 Mounting Gasket into panel. (Remove ANSI Studs, if in place.)
2. From back of panel, slide 2 DIN Mounting Brackets into grooves in top and bottom of meter housing. Snap into place.
3. Secure meter to panel with lock washer and a #8 screw through each of the 2 mounting brackets. Tighten with a #2 Phillips screwdriver. Do not overtighten. The maximum installation torque is 3.5 in./lb (0.4 N·M).

## PXM 2000 Series Transducer Installation

The PXM 2000 Series Transducer model is installed using DIN Rail Mounting.

Specs for DIN Rail Mounting: International Standards DIN 46277/3  
 DIN Rail (Slotted) Dimensions: 0.297244" x 1.377953" x 3" (inches)  
 7.55 mm x 35 mm x 76.2 mm (millimeters)

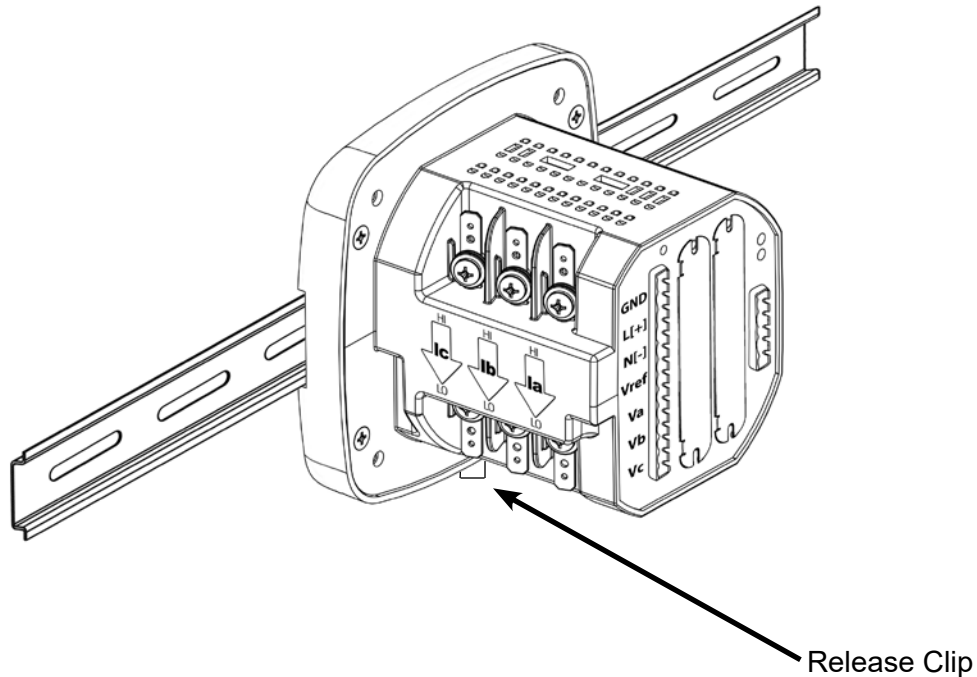
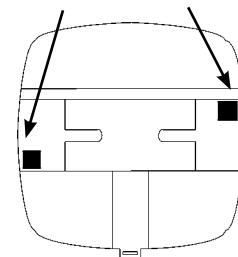


Figure 3.9: DIN Rail Mounting Procedure

1. Slide top groove of meter onto the DIN Rail.
2. Press gently until the meter clicks into place.

### Notes:

- To remove the meter from the DIN Rail, pull down on the Release Clip to detach the unit from the rail.
- If mounting with the DIN Rail provided, use the Black Rubber Stoppers (also provided). See figure to the right.



### Note on DIN Rails:

DIN Rails are commonly used as a mounting channel for most terminal blocks, control devices, circuit protection devices and PLCs. DIN Rails are made of cold rolled steel electrolytically plated and are also available in aluminum, PVC, stainless steel, and copper.



# 4 ELECTRICAL INSTALLATION

## Considerations When Installing Meters



Installation of the PXM 2000 Series must be performed **only by** qualified personnel who follow standard safety precautions during all procedures. Those personnel should have appropriate training and experience with high voltage devices. Appropriate safety gloves, safety glasses and protective clothing is recommended.

During normal operation of the PXM 2000 Series, dangerous voltages flow through many parts of the meter, including: Terminals and any connected CTs (Current Transformers) and PTs (Potential Transformers), all I/O Modules (Inputs and Outputs) and their circuits. All Primary and Secondary circuits can, at times, produce lethal voltages and currents. Avoid contact with any current-carrying surfaces.

Do not use the meter or any I/O Output Device for primary protection or in an energy-limiting capacity. The meter can only be used as secondary protection. Do not use the meter for applications where failure of the meter may cause harm or death. Do not use the meter for any application where there may be a risk of fire.

All meter terminals should be inaccessible after installation.

Do not apply more than the maximum voltage the meter or any attached device can withstand. Refer to meter and/or device labels and to the Specifications for all devices before applying voltages. Do not HIPOT/Dielectric test any Outputs, Inputs, or Communications terminals.

Eaton recommends the use of Shorting Blocks and Fuses for voltage leads and power supply to prevent hazardous voltage conditions or damage to CTs, if the meter needs to be removed from service. CT grounding is optional.

### Notes:



- IF THE EQUIPMENT IS USED IN A MANNER NOT SPECIFIED BY THE MANUFACTURER, THE PROTECTION PROVIDED BY THE EQUIPMENT MAY BE IMPAIRED.
- THERE IS NO REQUIRED PREVENTIVE MAINTENANCE OR INSPECTION NECESSARY FOR SAFETY. HOWEVER, ANY REPAIR OR MAINTENANCE SHOULD BE PERFORMED BY THE FACTORY.



**DISCONNECT DEVICE:** The following part is considered the equipment disconnect device. A SWITCH OR CIRCUIT-BREAKER SHALL BE INCLUDED IN THE END-USE EQUIPMENT OR BUILDING INSTALLATION. THE SWITCH SHALL BE IN CLOSE PROXIMITY TO THE EQUIPMENT AND WITHIN EASY REACH OF THE OPERATOR. THE SWITCH SHALL BE MARKED AS THE DISCONNECTING DEVICE FOR THE EQUIPMENT.

## CT Leads Terminated to Meter

The PXM 2000 Series is designed to have Current Inputs wired in one of three ways. Figure 4.1 shows the most typical connection where CT Leads are terminated to the meter at the Current Gills. This connection uses Nickel-Plated Brass Studs (Current Gills) with screws at each end. This connection allows the CT wires to be terminated using either an “O” or a “U” lug. Tighten the screws with a #2 Phillips screwdriver. The maximum installation torque is 8.5 in./lb (1.0 N·M).

Other current connections are shown in Figures 4.2 and 4.3. Voltage and RS485/KYZ connection is shown in Figure 4.4.

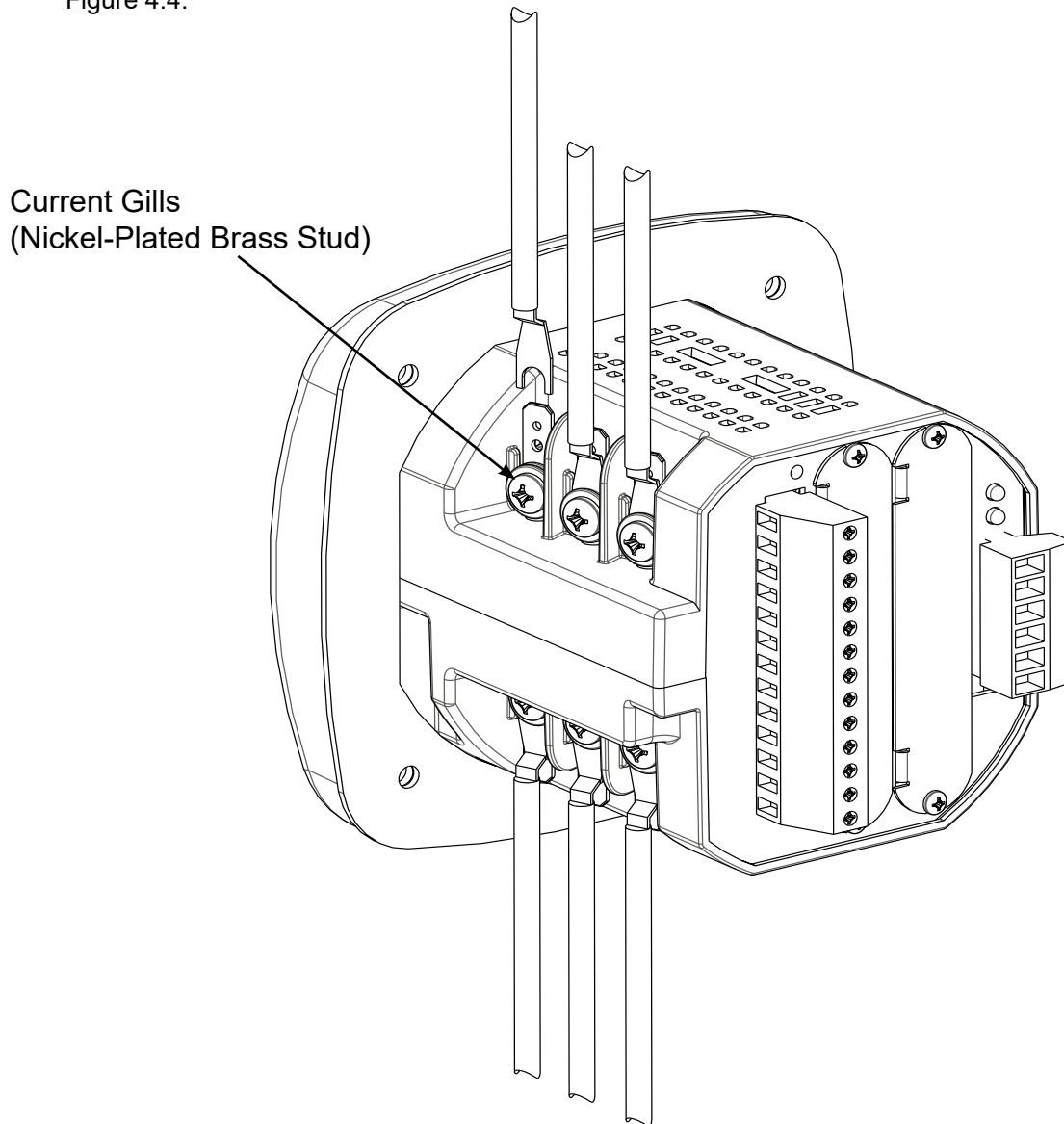


Figure 4.1: CT Leads terminated to Meter, #8 Screw for Lug Connection

Wiring Diagrams are shown later in this chapter.

Communications Connections are detailed in Chapter 5.



### CT Leads Pass Through (No Meter Termination)

The second method allows the CT wires to pass through the CT Inputs without terminating at the meter. In this case, remove the Current Gills and place the CT wire directly through the CT opening. The opening will accommodate up to 0.177" (4.5 mm) maximum diameter CT wire.

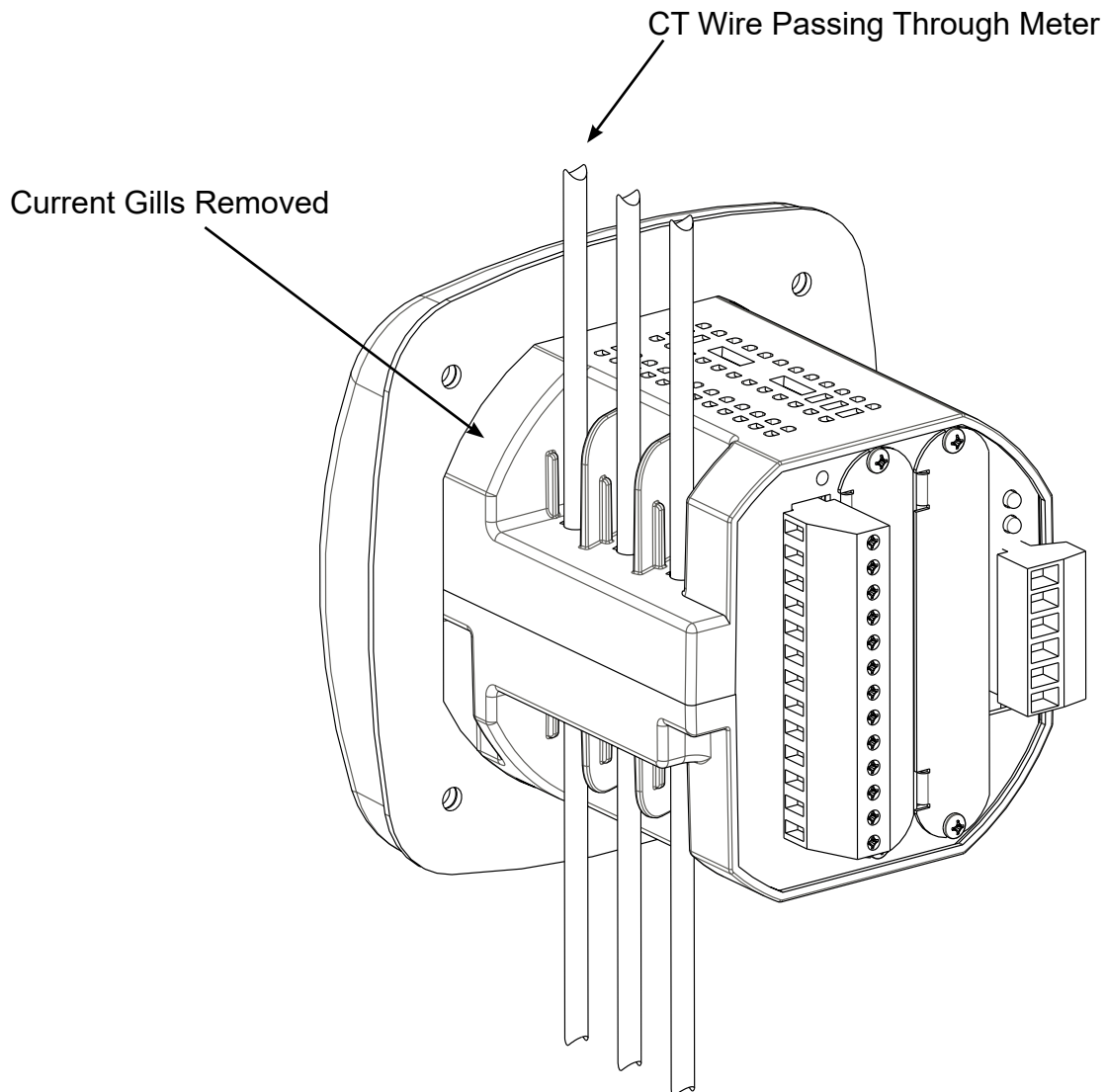


Figure 4.2: Pass-Through Wire Electrical Connection

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## Quick Connect Crimp-on Terminations

For Quick Termination or for Portable Applications, a 0.25" Quick Connect Crimp-on Connectors can also be used.

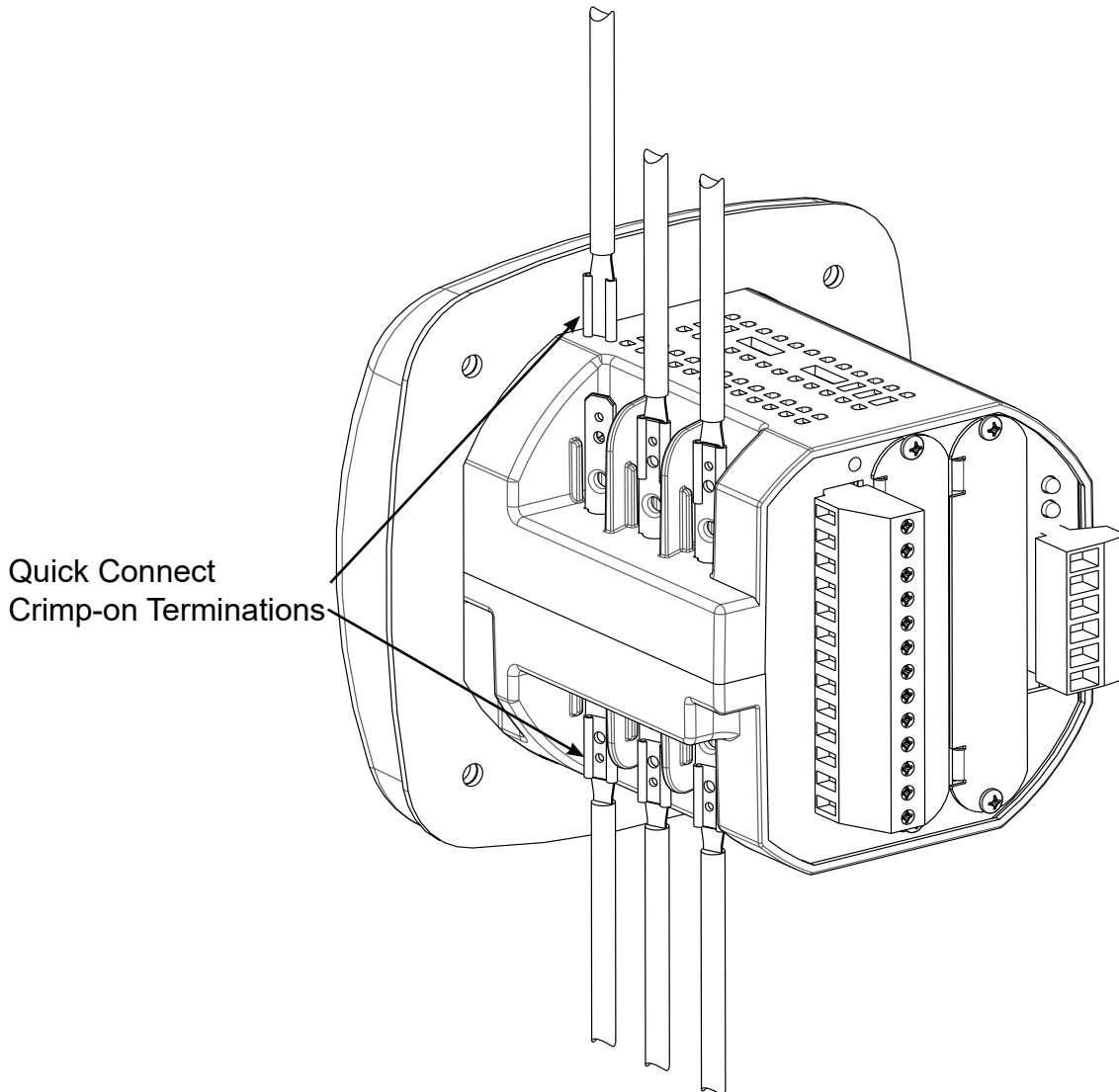


Figure 4.3: Quick Connect Electrical Connection

## Voltage and Power Supply Connections

Voltage Inputs are connected to the back of the unit via a optional wire connectors. The connectors accommodate AWG# 12 -26 / (0.129 - 3.31 mm<sup>2</sup>).

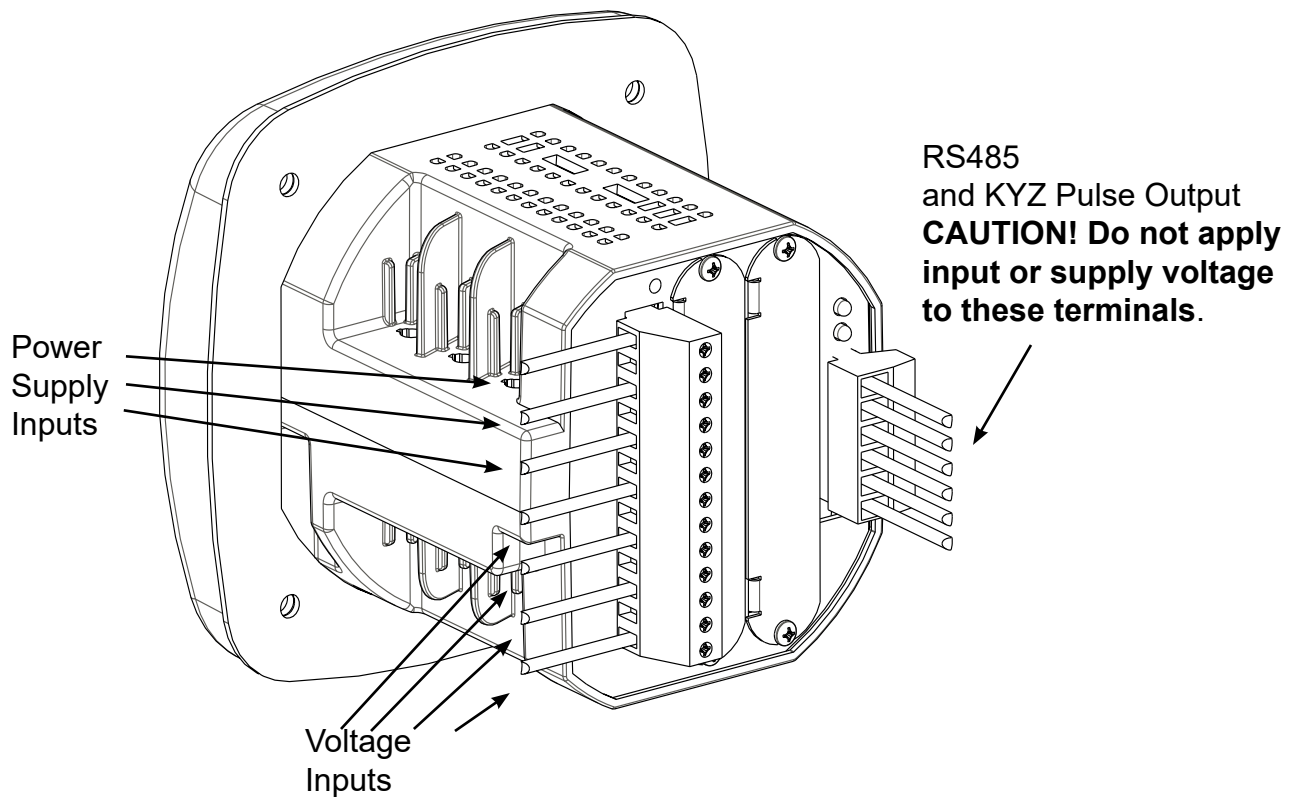


Figure 4.4: Voltage Connection

## Ground Connections

The meter's ground terminals should be connected directly to the installation's protective earth ground. Use AWG# 12/2.5 mm<sup>2</sup> wire for this connection.

## Voltage Fuses

Eaton recommends the use of fuses on each of the sense voltages and on the control power, even though the wiring diagrams in this chapter do not show them.

Use a 0.1 Amp fuse on each voltage input.  
Use a 3 Amp slow blow fuse on the power supply.

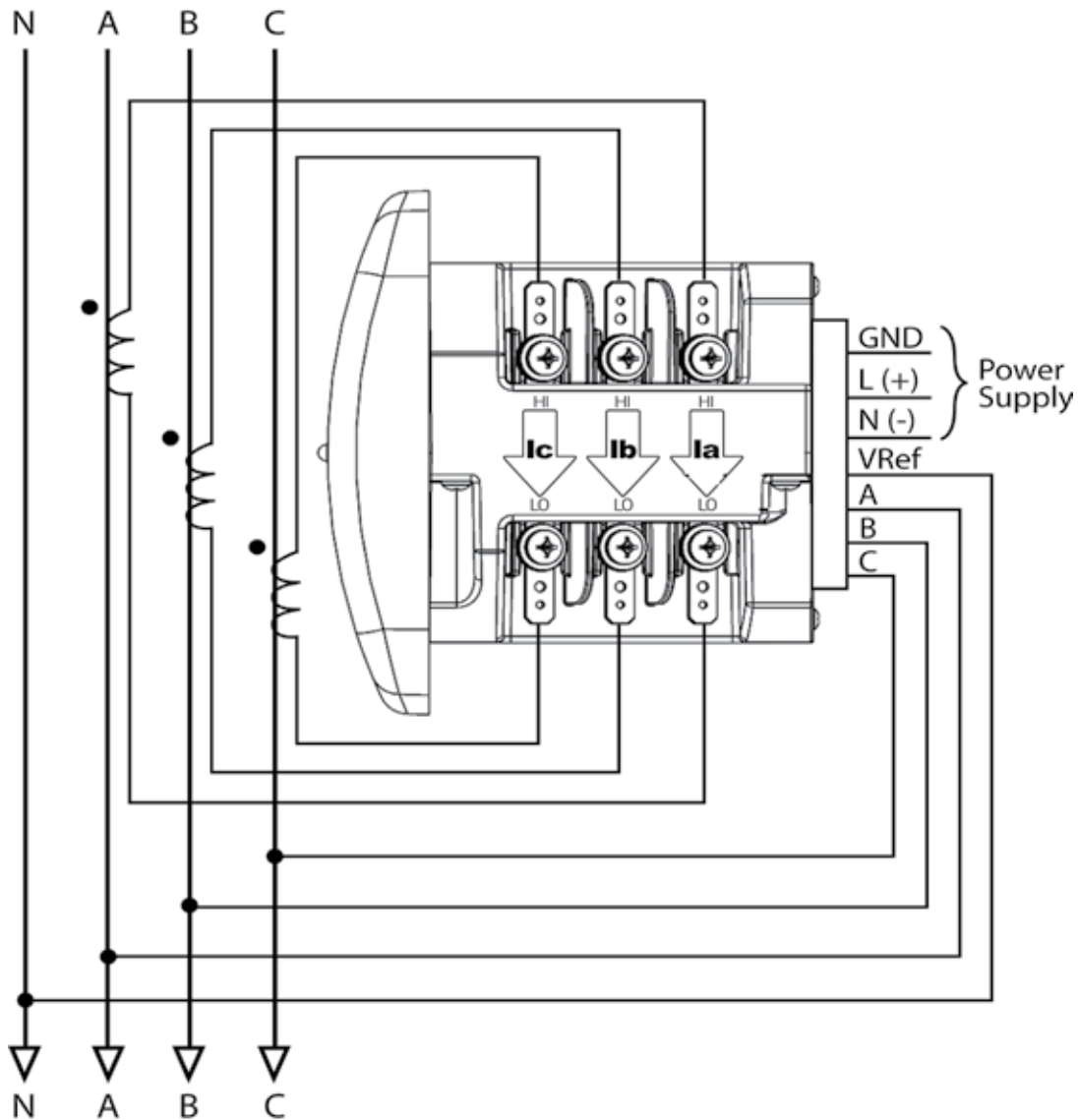
## Electrical Connection Diagrams

The following pages contain electrical connection diagrams for the PXM 2000 Series. Choose the diagram that best suits your application. Be sure to maintain the CT polarity when wiring.

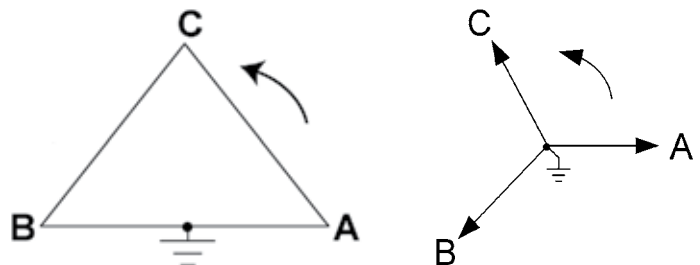
The diagrams are presented in the following order:

1. 3-Phase, 4-Wire System Wye/Delta with Direct Voltage, 3 Element
  - a. Example of Dual Phase Hookup
  - b. Example of Single Phase Hookup
2. 3-Phase, 4r-Wire System Wye with Direct Voltage, 2.5 Element
3. 3-Phase, 4-Wire Wye/Delta with PTs, 3 Element
4. 3-Phase, 4-Wire Wye with PTs, 2.5 Element
5. 3-Phase, 3-Wire Delta with Direct Voltage
6. 3-Phase, 3-Wire Delta with 2 PTs
7. 3-Phase, 3-Wire Delta with 3 PTs
8. Current Only Measurement (3-Phase)
9. Current Only Measurement (Dual Phase)
10. Current Only Measurement (Single Phase)

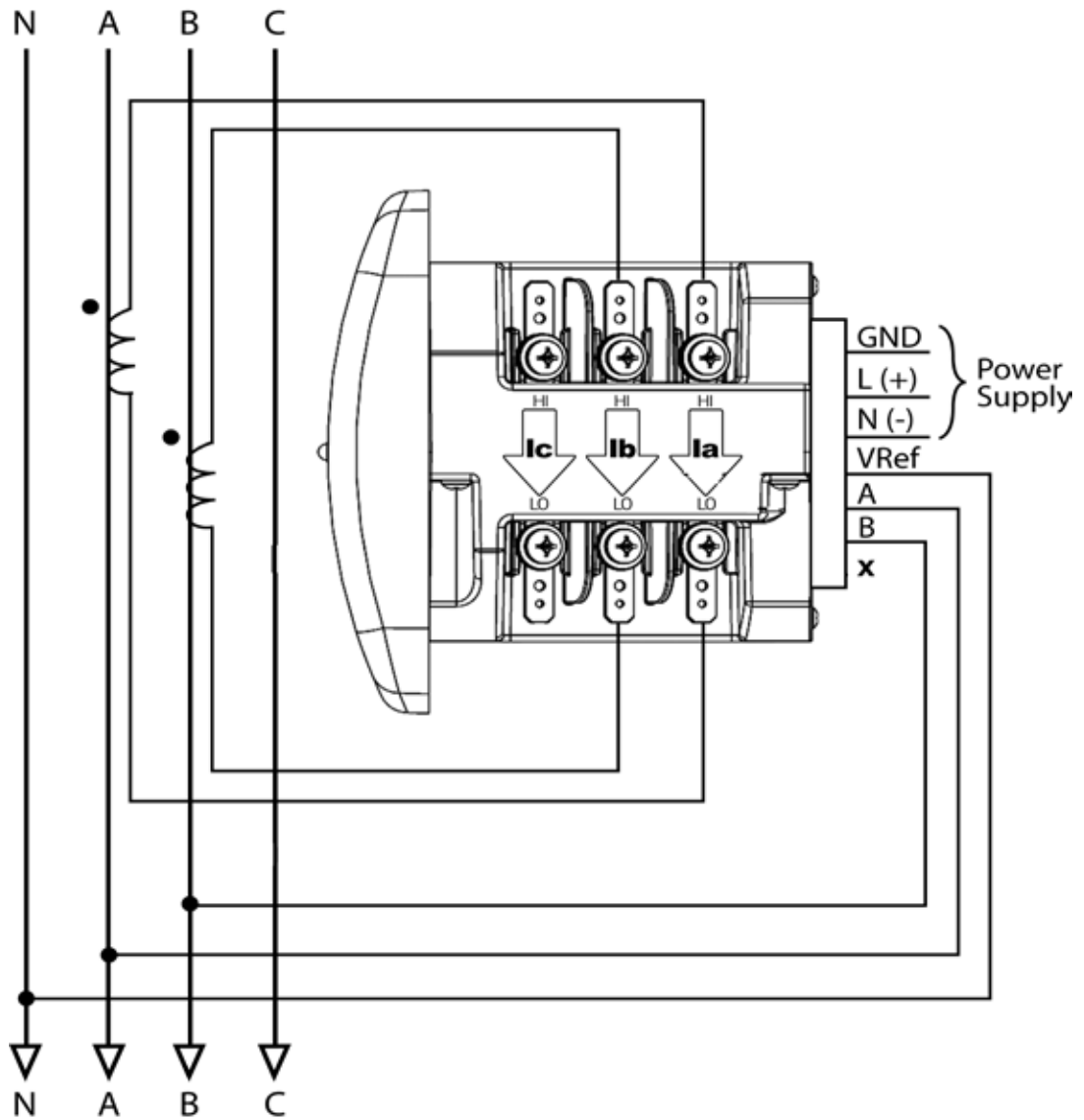
1. Service: WYE/Delta, 4-Wire with No PTs, 3 CTs.



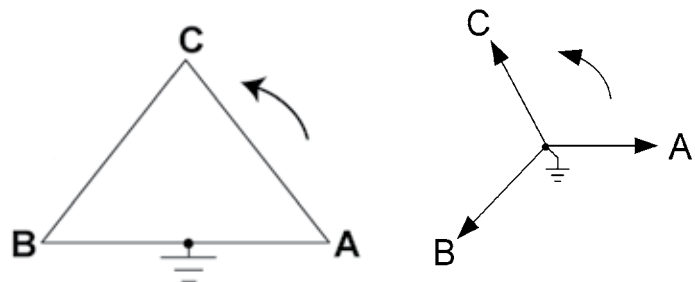
Select: " 3 EL WYE " (3 Element Wye) from the Meter's front panel display. (See Chapter 6.)



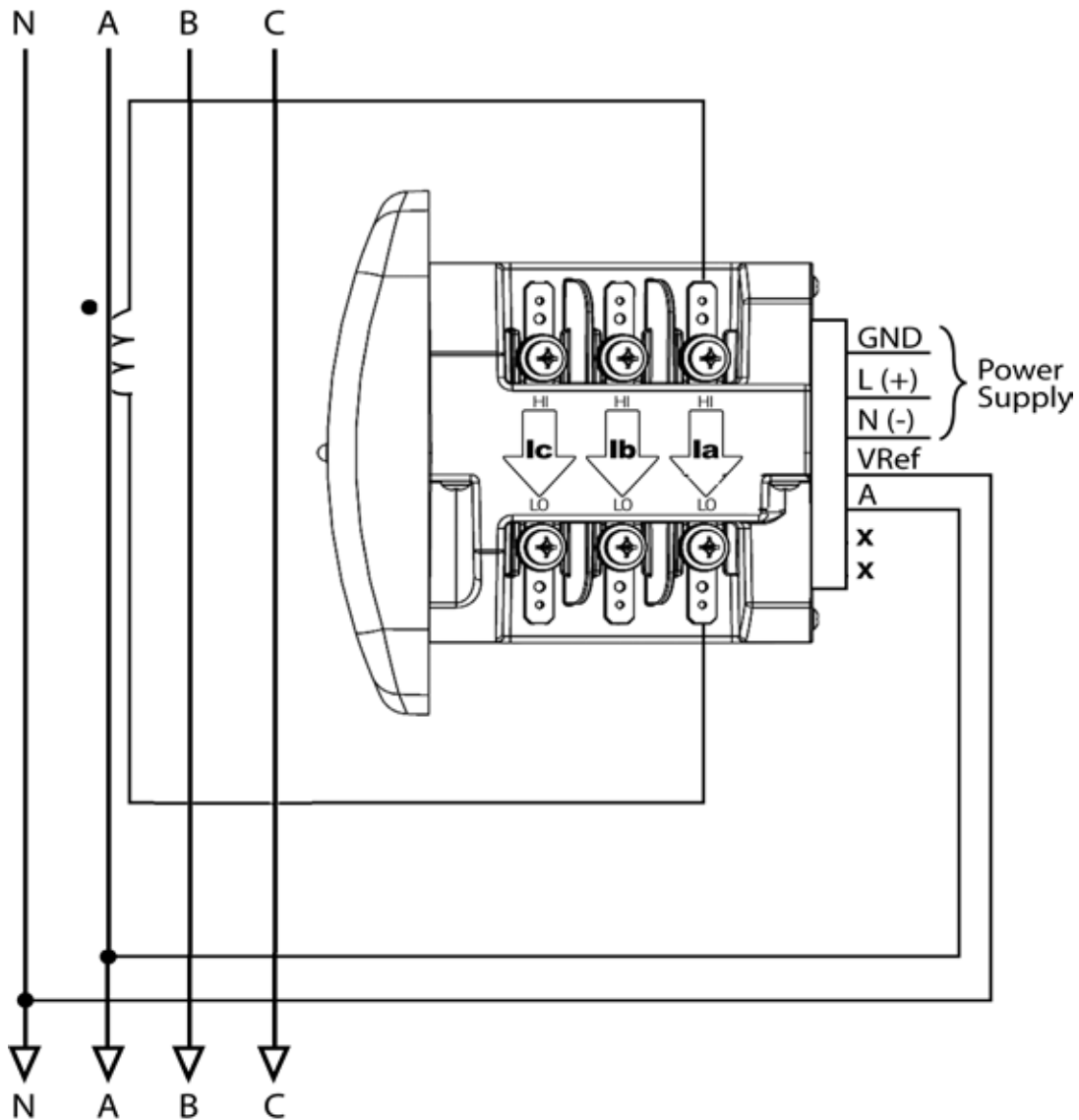
1a. Example of Dual Phase Hookup.



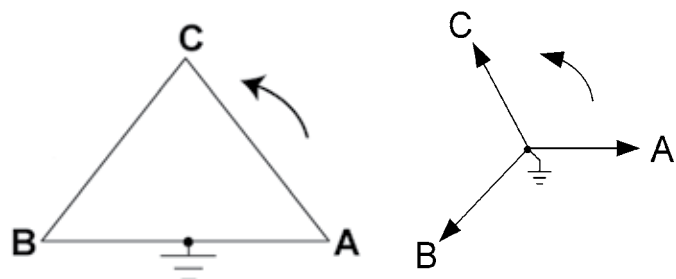
Select: " 3 EL WYE " (3 Element Wye) from the Meter's front panel display. (See Chapter 6.)



1b. Example of Single Phase Hookup.

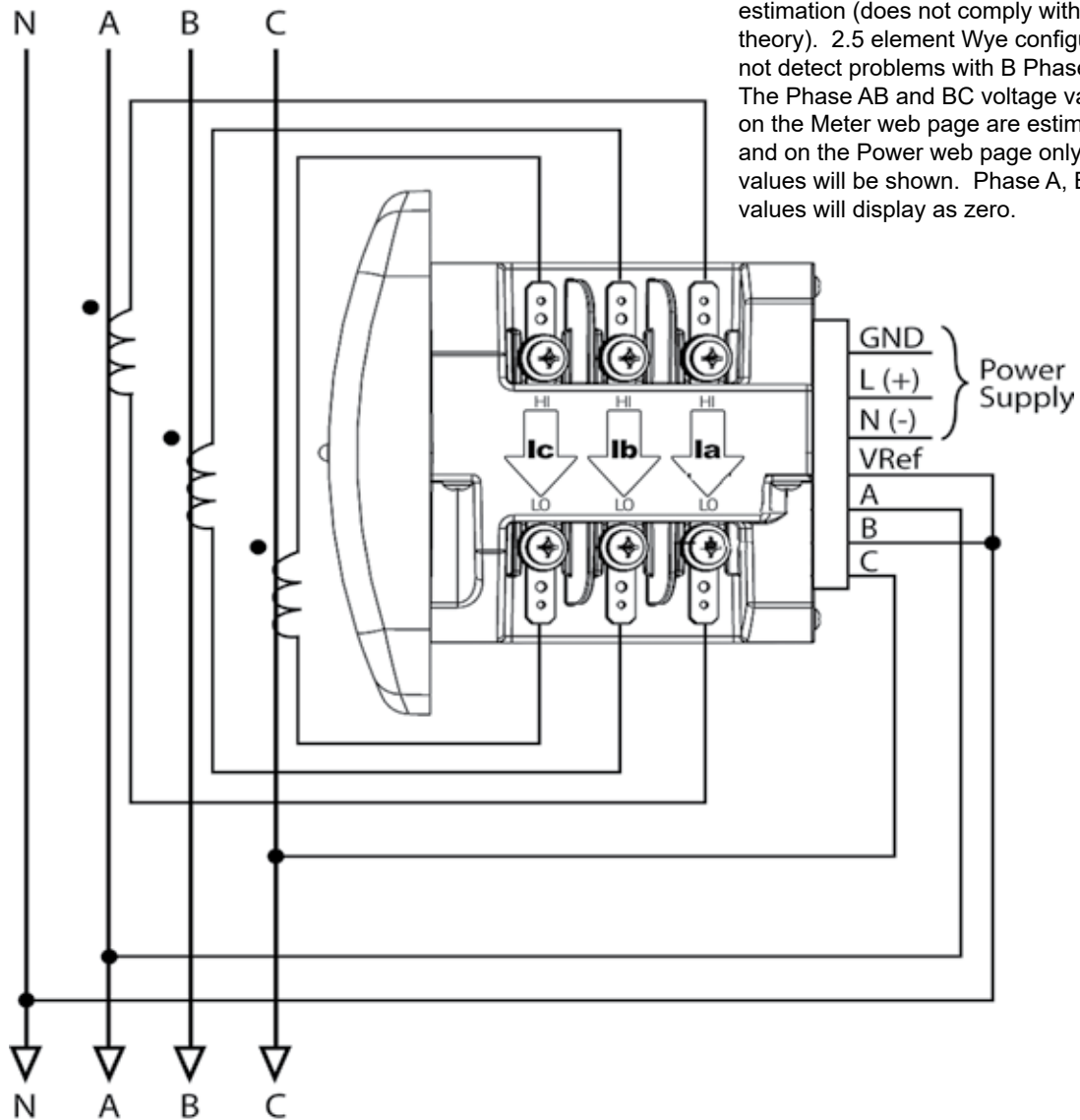


Select: " 3 EL WYE " (3 Element Wye) from the Meter's front panel display. (See Chapter 6.)

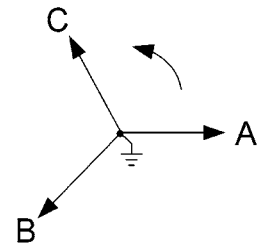


2. Service: 2.5 Element WYE, 4-Wire with No PTs, 3 CTs.

This configuration is **not** recommended. In this configuration, the B Phase voltage is not measured to save the cost of a B Phase voltage transformer. A balanced 3-Phase voltage is assumed to estimate B Phase voltage for the purpose of 3-Phase power and energy estimation (does not comply with Blondel's theory). 2.5 element Wye configuration cannot detect problems with B Phase voltage. The Phase AB and BC voltage values shown on the Meter web page are estimates only, and on the Power web page only the System values will be shown. Phase A, B, and C values will display as zero.

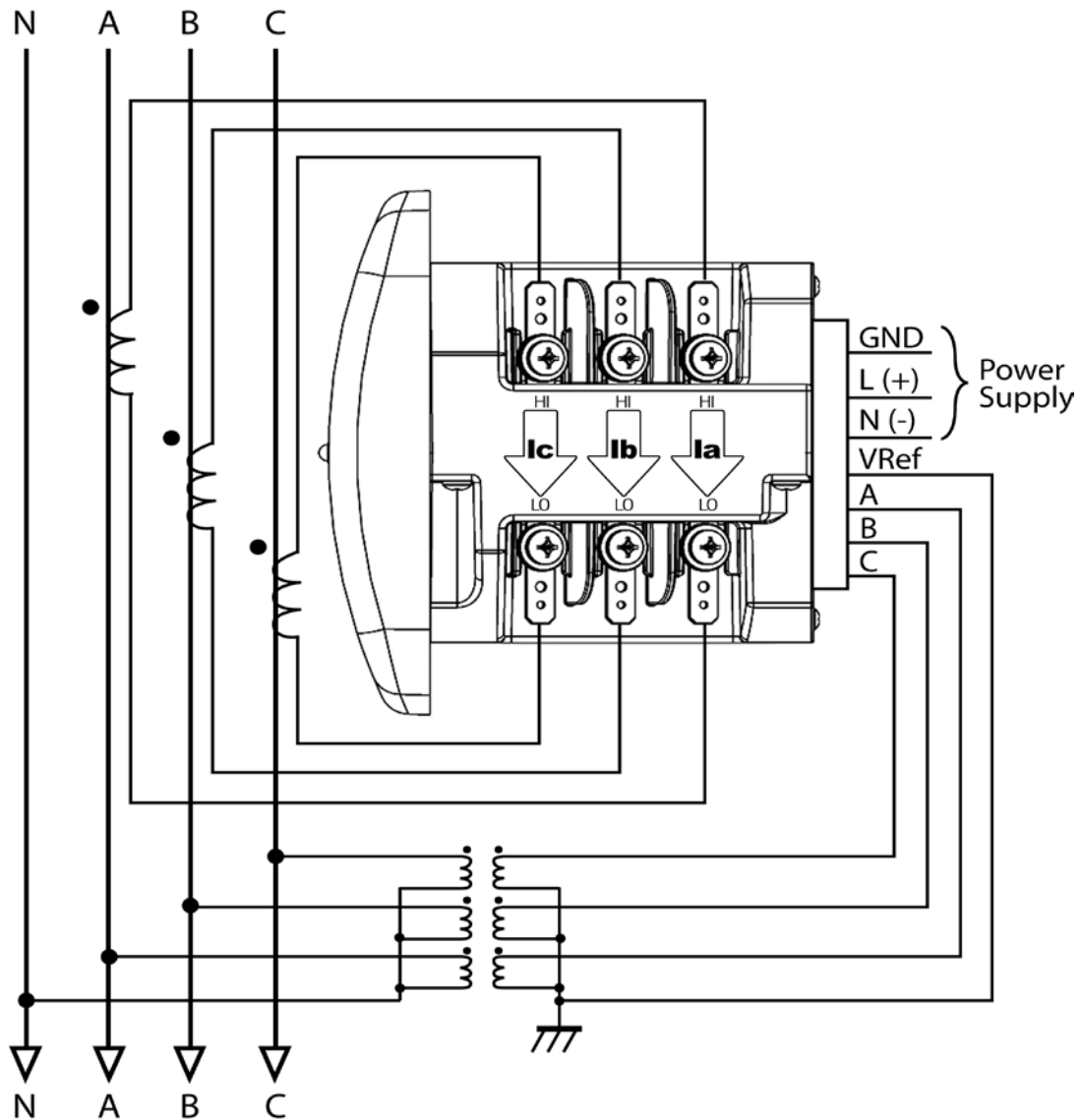


Select: " 2.5 EL WYE " (2.5 Element Wye) from the Meter's front panel display. (See Chapter 6.)

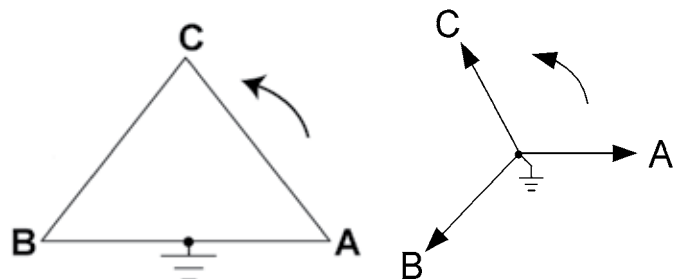




3. Service: WYE/Delta, 4-Wire with 3 PTs, 3 CTs.

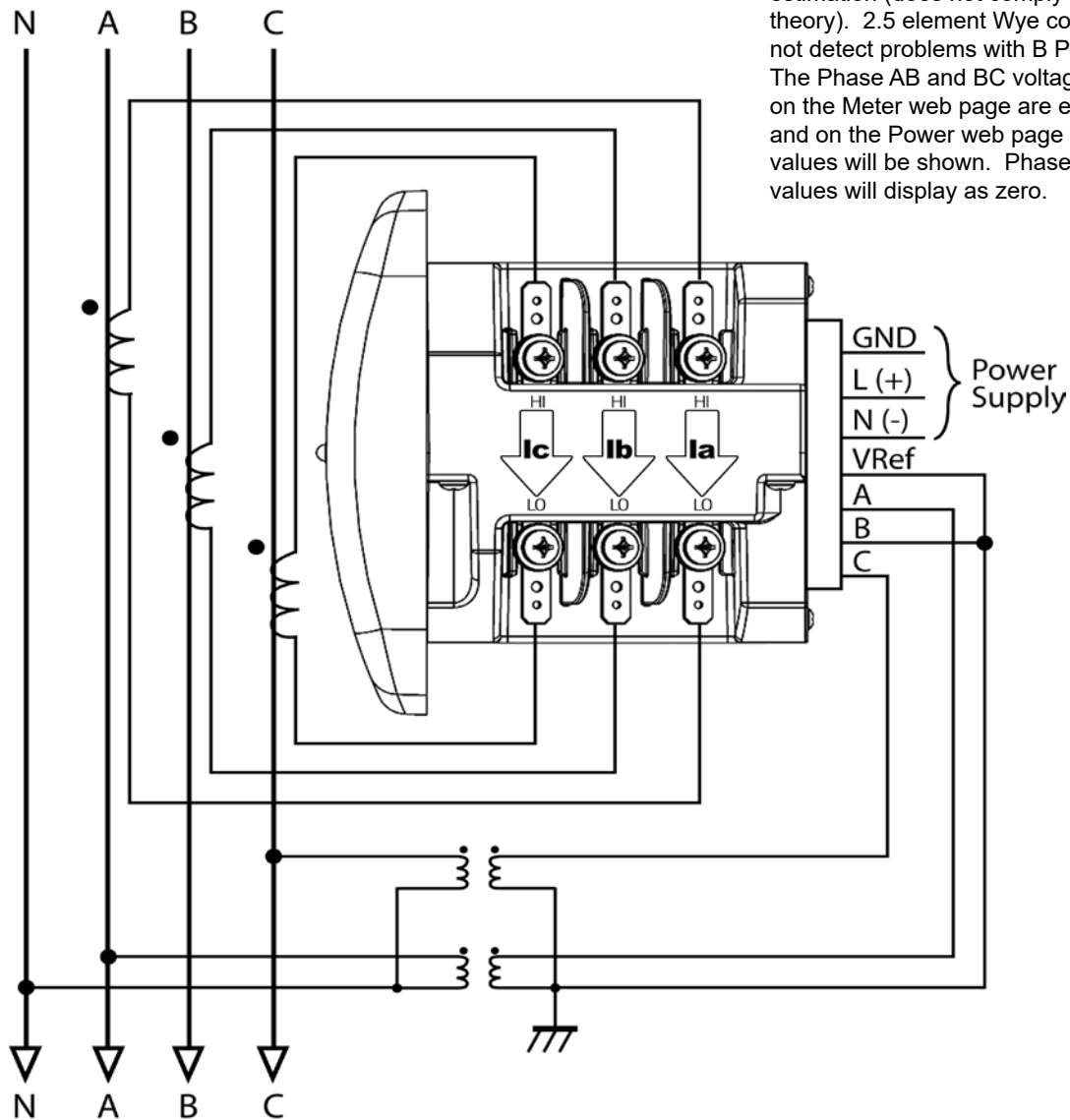


Select: " 3 EL WYE " (3 Element Wye) from the Meter's front panel display. (See Chapter 6.)

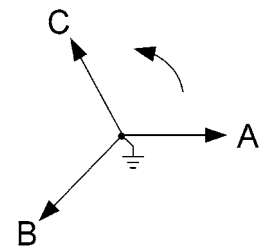


4. Service: 2.5 Element WYE, 4-Wire with 2 PTs, 3 CTs.

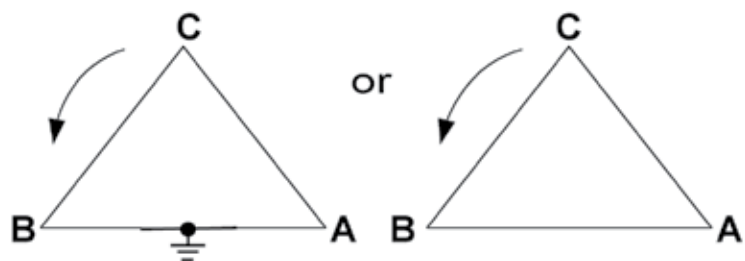
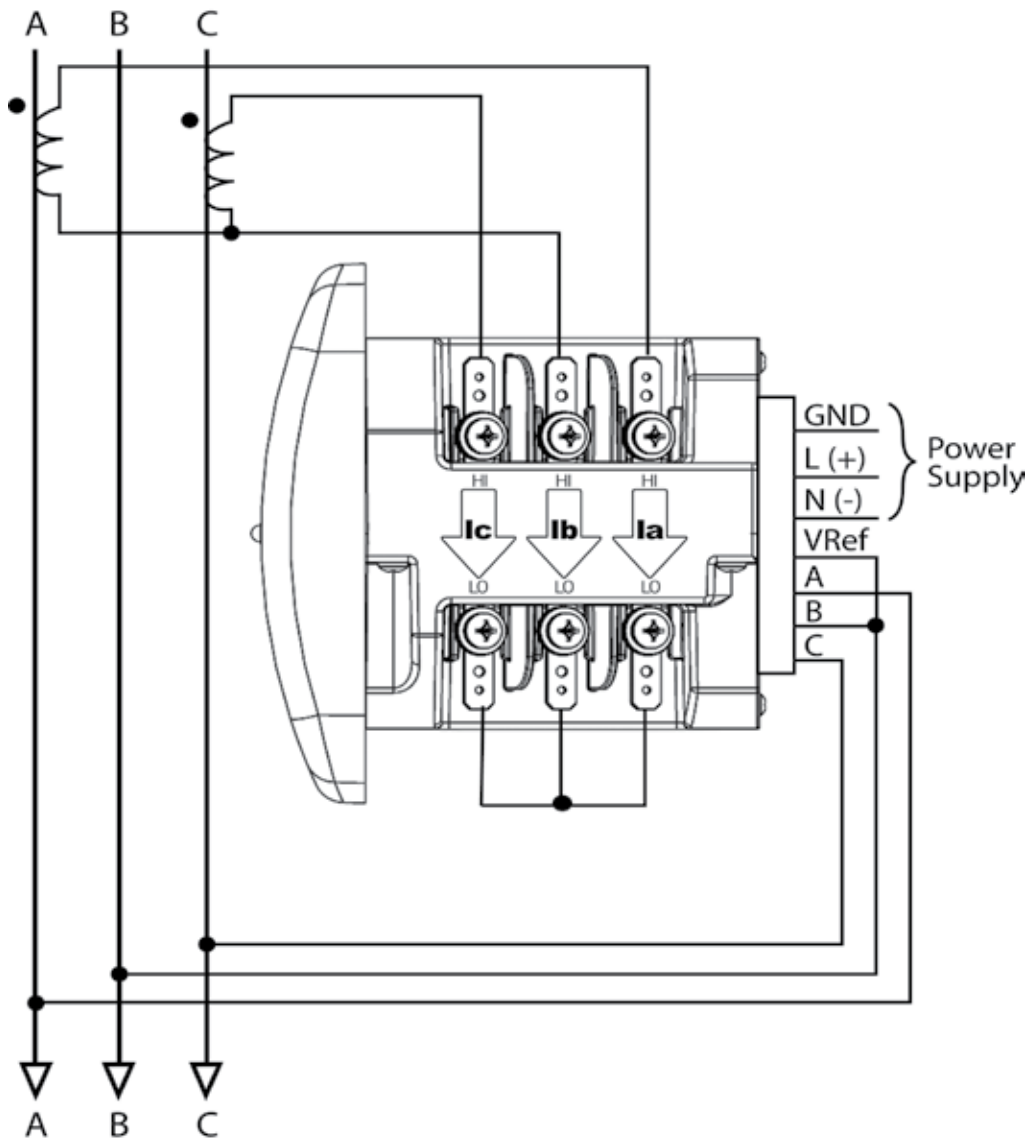
This configuration is **not** recommended. In this configuration, the B Phase voltage is not measured to save the cost of a B Phase voltage transformer. A balanced 3-Phase voltage is assumed to estimate B Phase voltage for the purpose of 3-Phase power and energy estimation (does not comply with Blondel's theory). 2.5 element Wye configuration cannot detect problems with B Phase voltage. The Phase AB and BC voltage values shown on the Meter web page are estimates only, and on the Power web page only the System values will be shown. Phase A, B, and C values will display as zero.



Select: " 2.5 EL WYE " (2.5 Element Wye) from the Meter's front panel display. (See Chapter 6.)



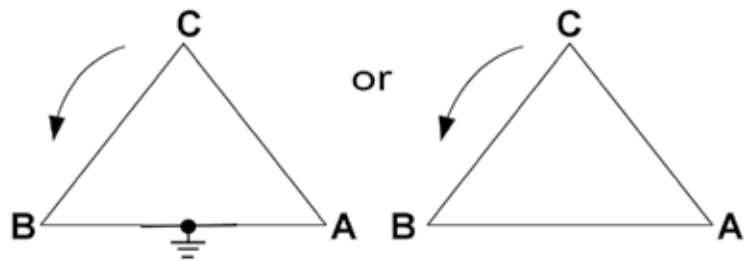
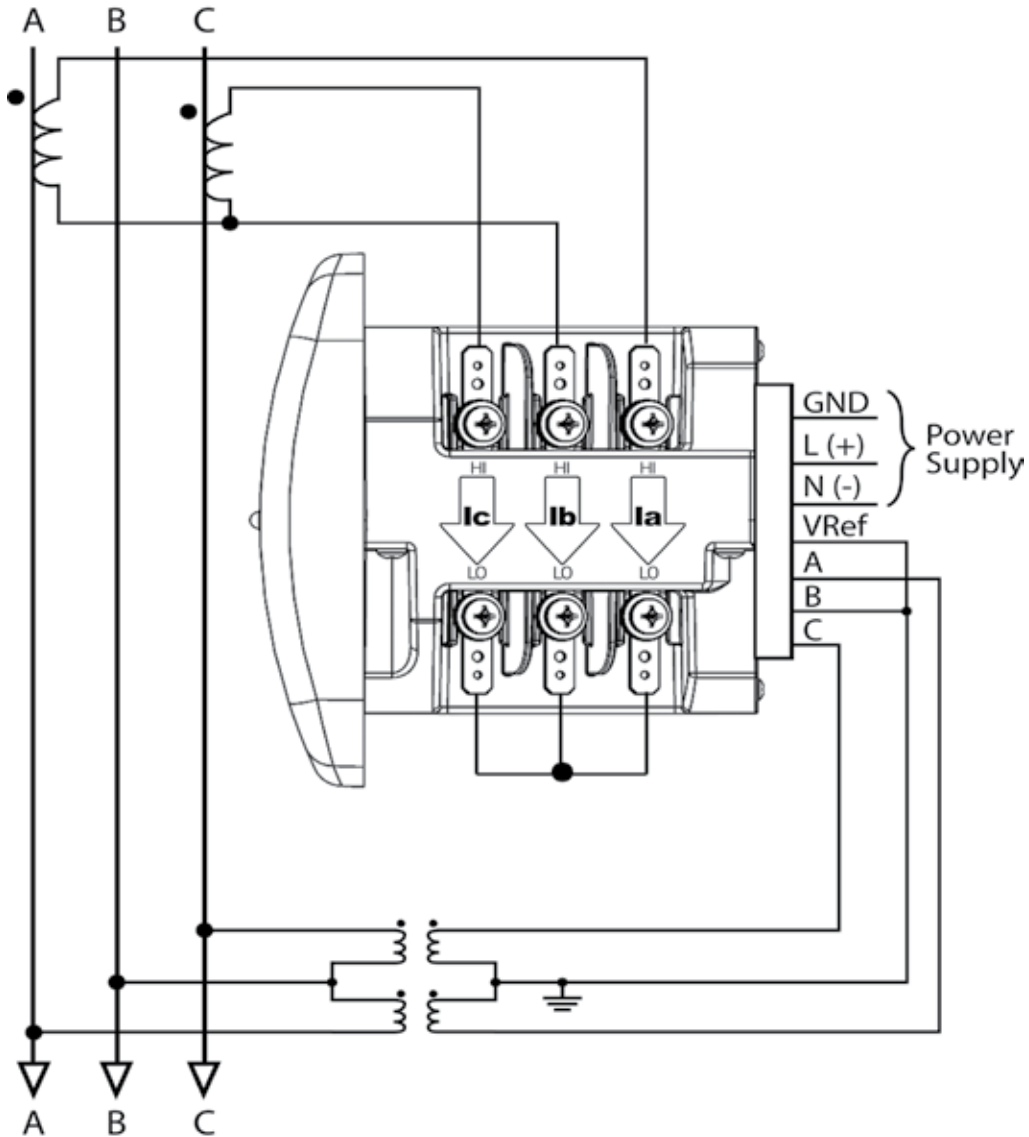
5. Service: Delta, 3-Wire with No PTs, 2 CTs.



Select: " 2 CT DEL " (2 CT Delta) from the Meter's front panel display. (See Chapter 6.)

Not Connected to Meter.

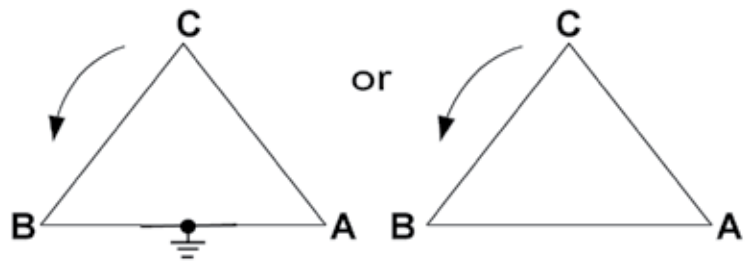
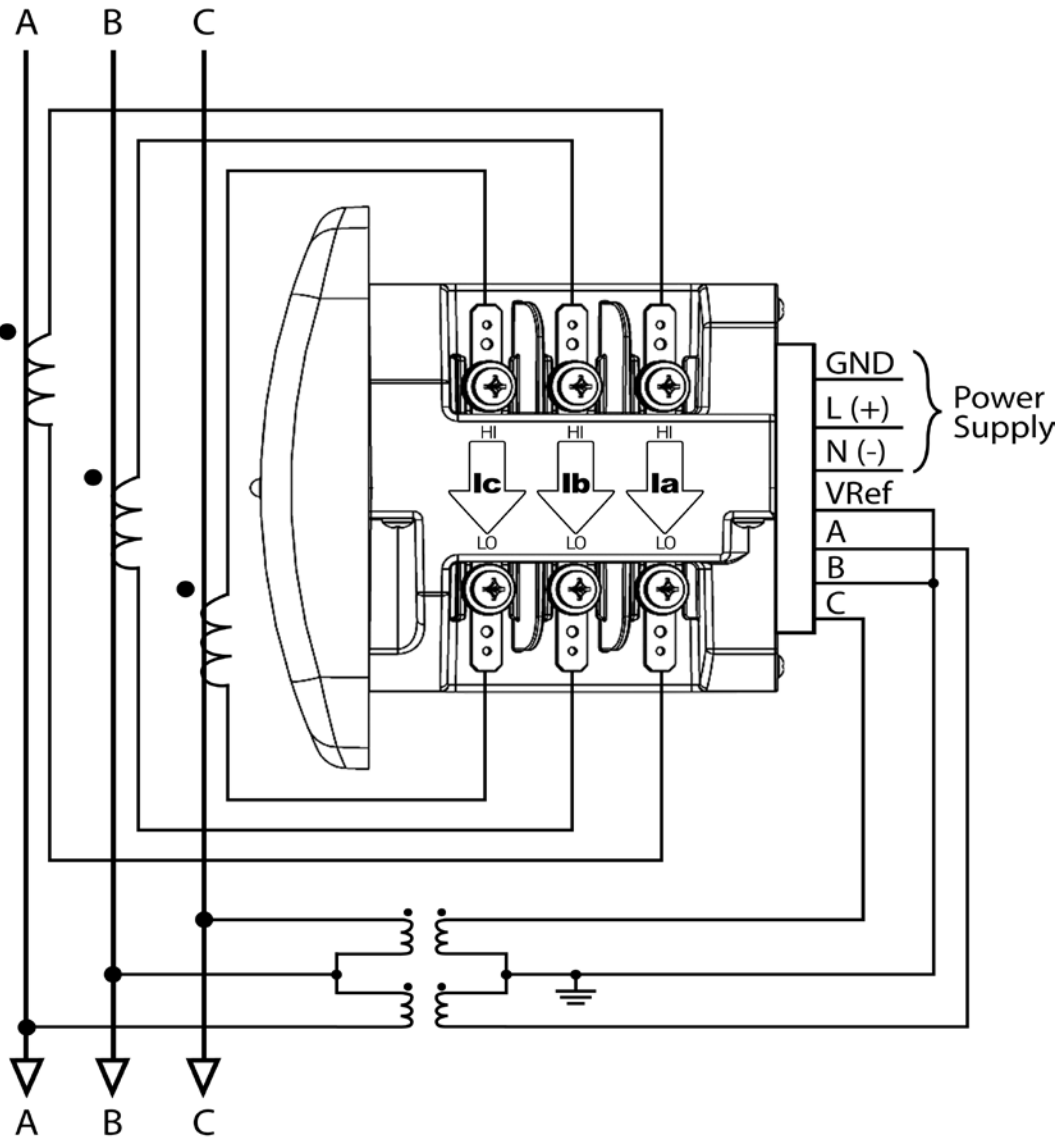
6. Service: Delta, 3-Wire with 2 PTs, 2 CTs.



Select: " 2 CT DEL " (2 CT Delta) from the Meter's front panel display. (See Chapter 6.)

Not Connected to Meter.

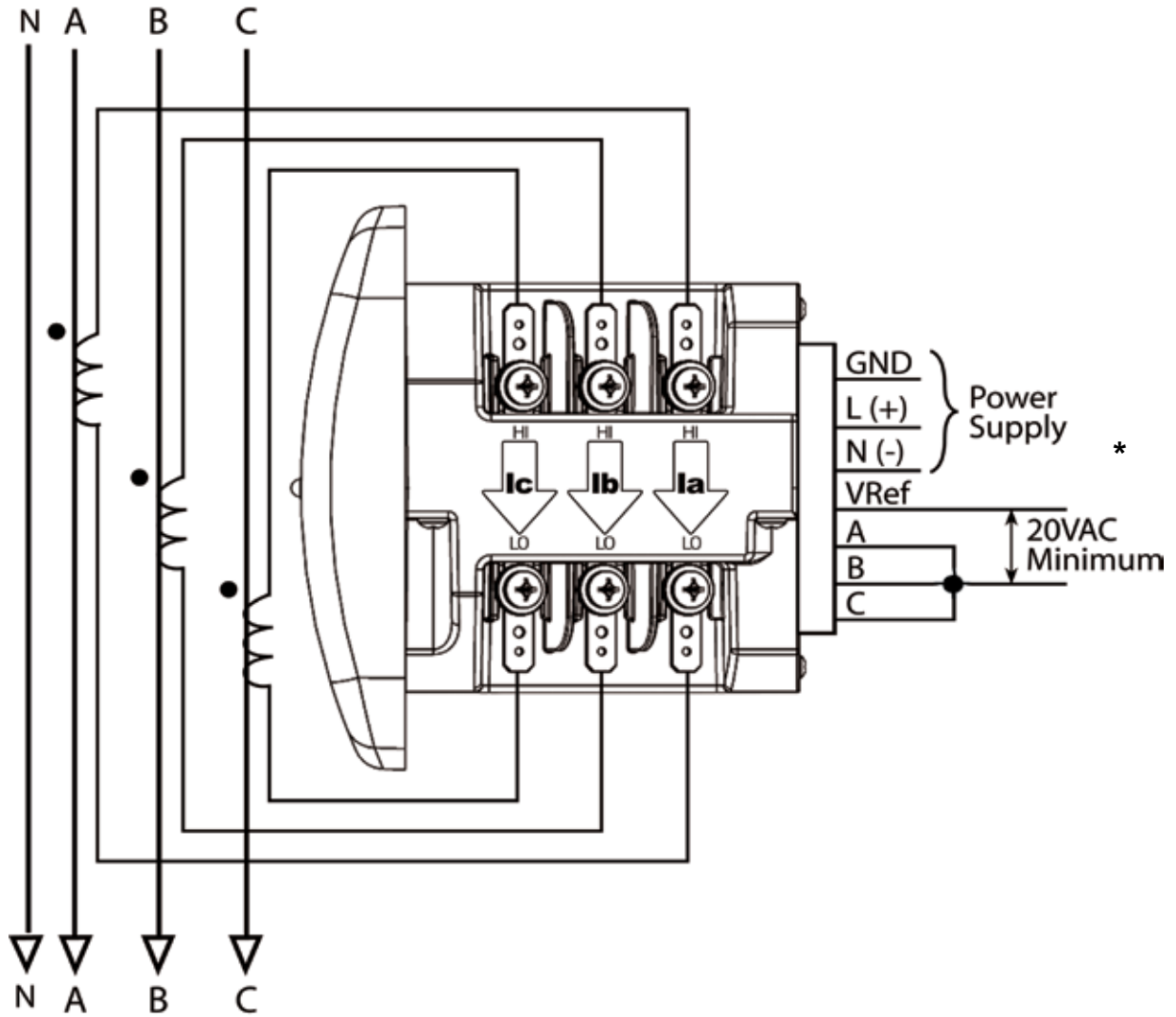
7. Service: Delta, 3-Wire with 2 PTs, 3 CTs.



Select: "2 CT DEL" (2 CT Delta) from the Meter's front panel display. (See Chapter 6.)

**Note:** The third CT for hookup is optional and is for Current Measurement only.

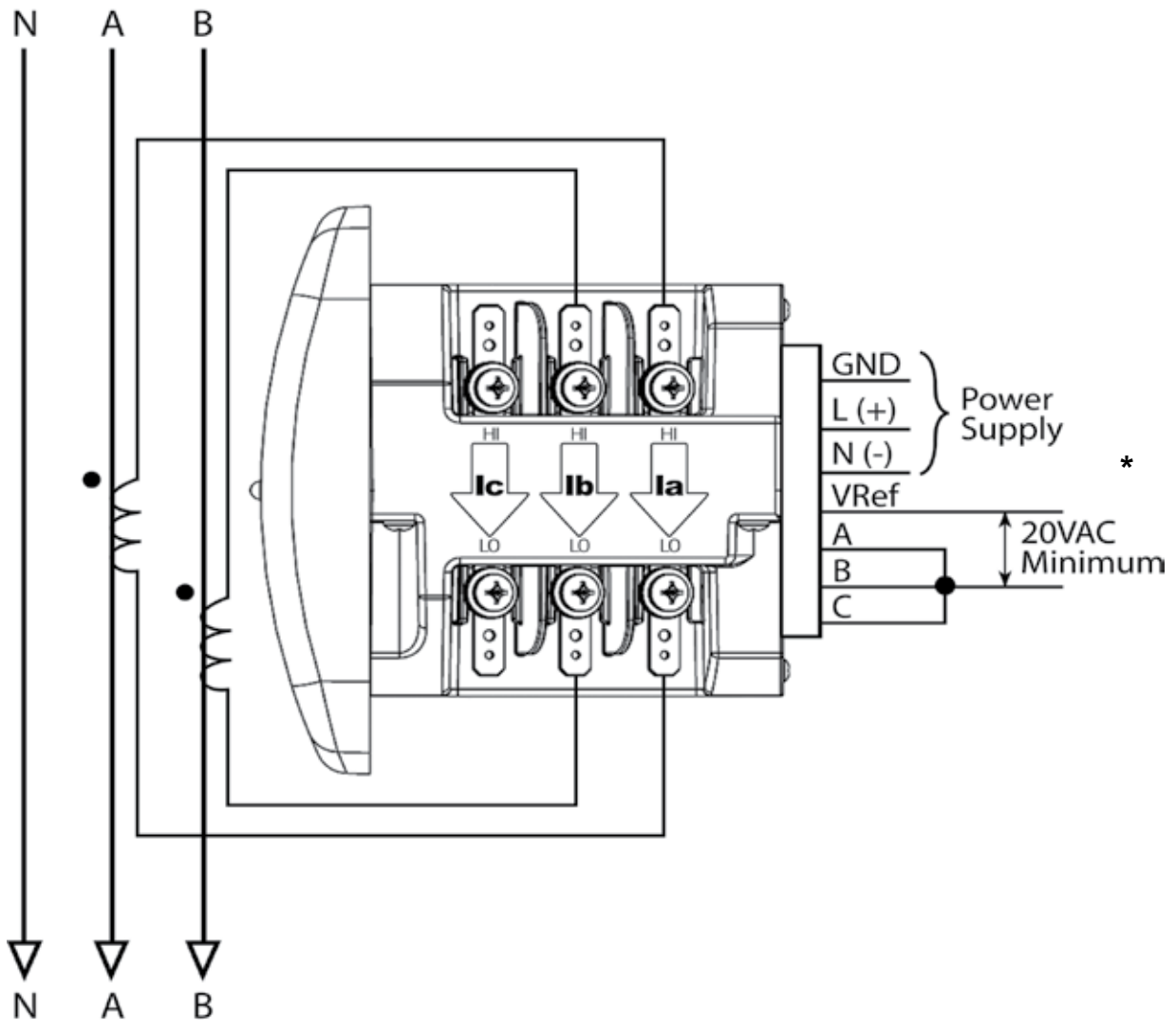
8. Service: Current Only Measurement (3-Phase).



Select: “ 3 EL WYE ” (3 Element Wye) from the Meter’s front panel display. (See Chapter 6.)

\* For improved accuracy, this connection is recommended, but not required.

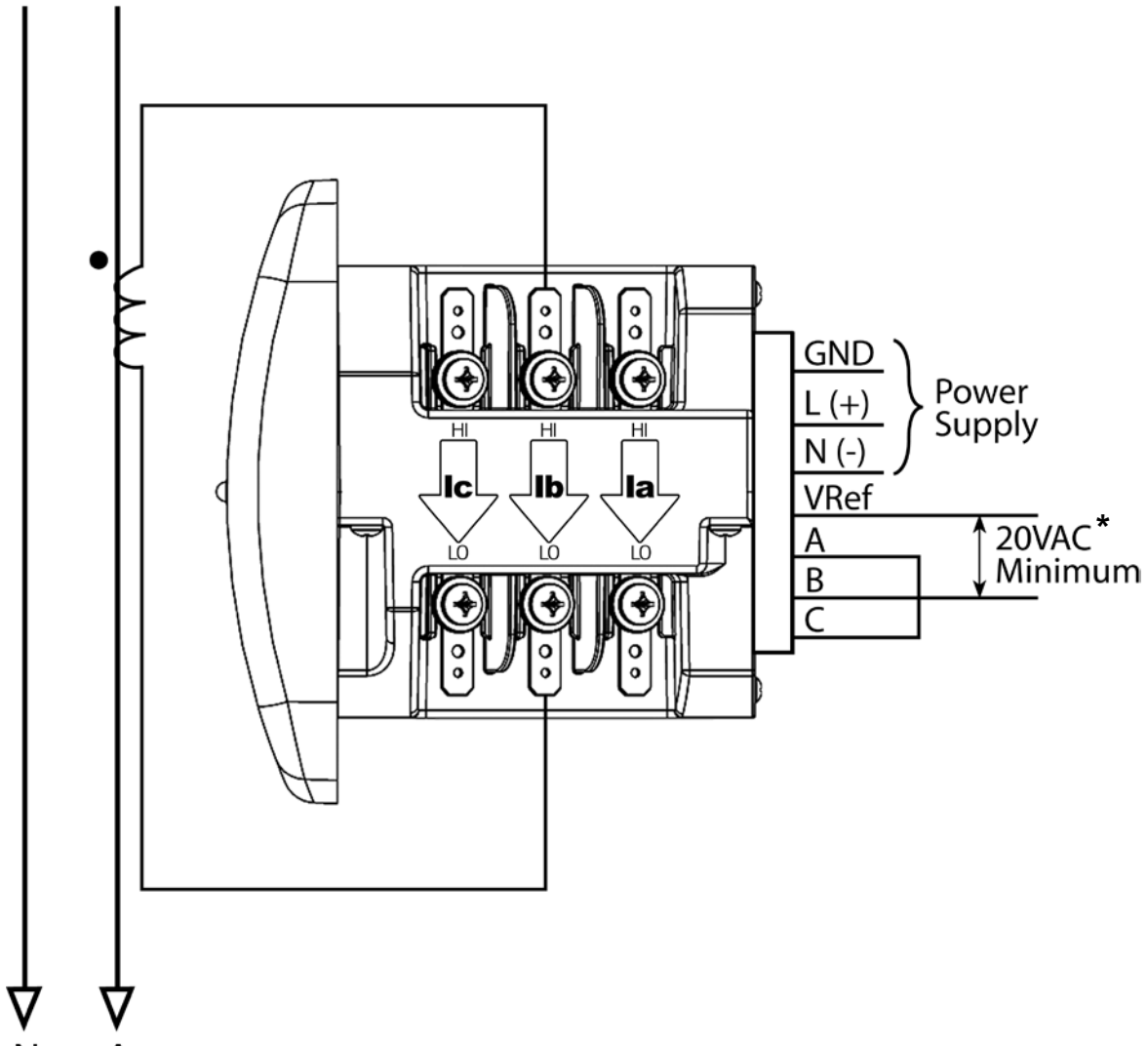
### 9. Service: Current Only Measurement (Dual Phase).



Select: " 3 EL WYE " (3 Element Wye) from the Meter's front panel display. (See Chapter 6.)

\* For improved accuracy, this connection is recommended, but not required.

10. Service: Current Only Measurement (Single Phase).



Select: " 3 EL WYE " (3 Element Wye) from the Meter's front panel display. (See Chapter 6.)

\* For improved accuracy, this connection is recommended, but not required.



# 5 SERIAL COMMUNICATION INSTALLATION

## PXM 2000 Series Communication

The PXM 2000 Series provides RS485 communication speaking Modbus ASCII, Modbus RTU, and DNP 3.0 protocols.

### RS485 / KYZ Output (Com 2)

Com 2 provides a combination RS485 and an Energy Pulse Output (KYZ pulse). See Chapter 2 for the KYZ Output Specifications; see Chapter 6 for Pulse Constants.

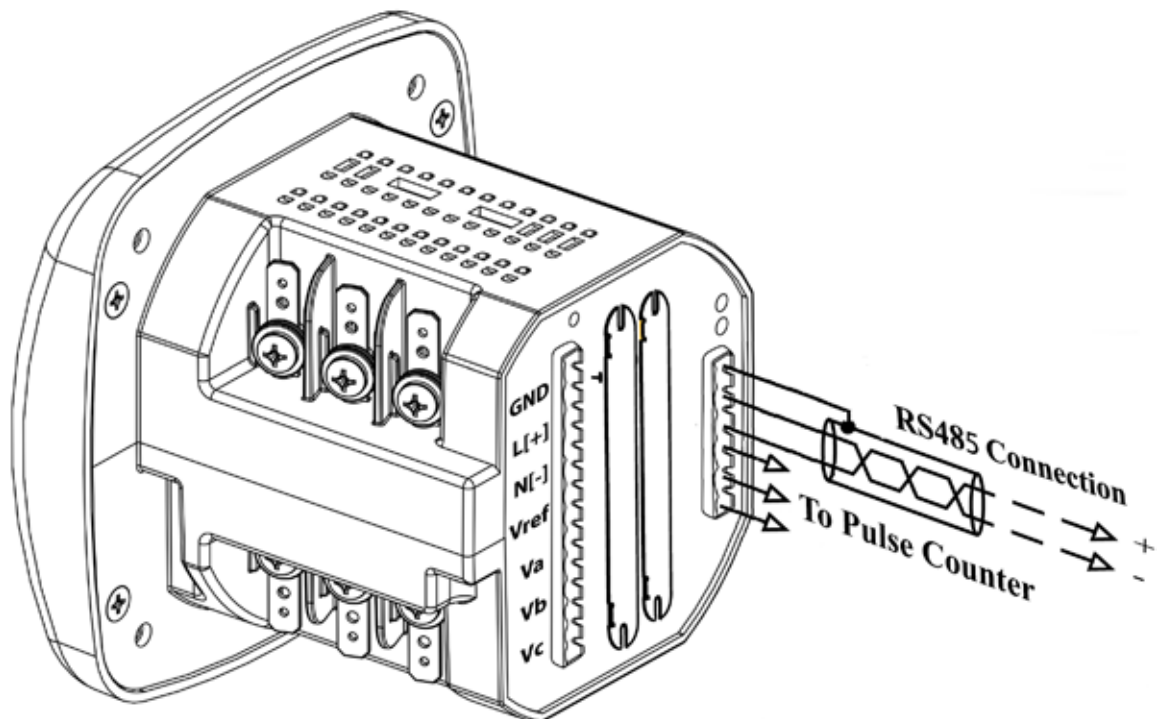


Figure 5.1: Meter Back with RS485 Communication Installation

**RS485** allows you to connect one or multiple PXM 2000 Series meters to a PC or other device, at either a local or remote site. All RS485 connections are viable for up to 4000 ft (1219.20 m).

Figure 5.2 shows the Detail of a 2-Wire RS485 Connection.

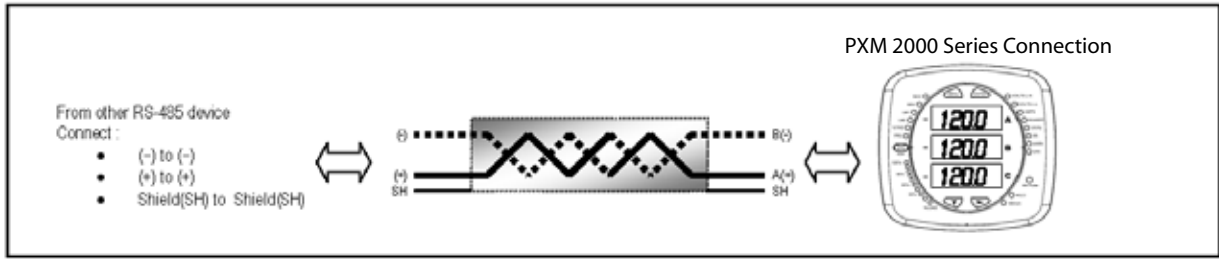


Figure 5.2: 2-Wire RS485 Connection

**Notes:**

**For All RS485 Connections:**

- Use a shielded twisted pair cable 22 AWG (0.33 mm<sup>2</sup>) or thicker, and ground the shield, preferably at one location only.
- Establish point-to-point configurations for each device on a RS485 bus: connect (+) terminals to (+) terminals; connect (-) terminals to (-) terminals.
- You may connect up to 31 meters on a single bus using RS485. Before assembling the bus, each meter must have a unique address: refer to Chapter 8 for instructions.
- Protect cables from sources of electrical noise.
- Avoid both “Star” and “Tee” connections (see Figure 5.4).
- **No more than two cables** should be connected **at any one point** on an RS485 network, whether the connections are for devices, converters, or terminal strips.
- Include all segments when calculating the total cable length of a network. If you are **not** using an RS485 repeater, the maximum length for cable connecting all devices is 4000 ft (1219.20 m).
- Connect shield to RS485 Master and individual devices as shown in Figure 5.3. You may also connect the shield to earth-ground at one point.
- **Termination Resistors (R<sub>T</sub>)** may be needed on both ends for longer length transmission lines. However, since the meter has some level of termination internally, Termination Resistors may not be needed. When they are used, the value of the Termination Resistors is determined by the electrical parameters of the cable.

Figure 5.3 shows a representation of an RS485 Daisy Chain connection.

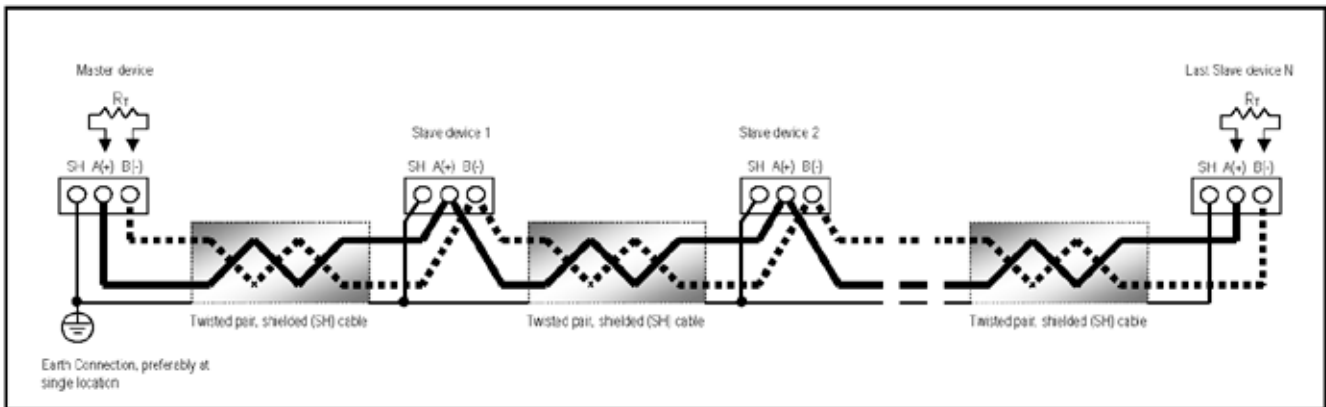


Figure 5.3: RS485 Daisy Chain Connection

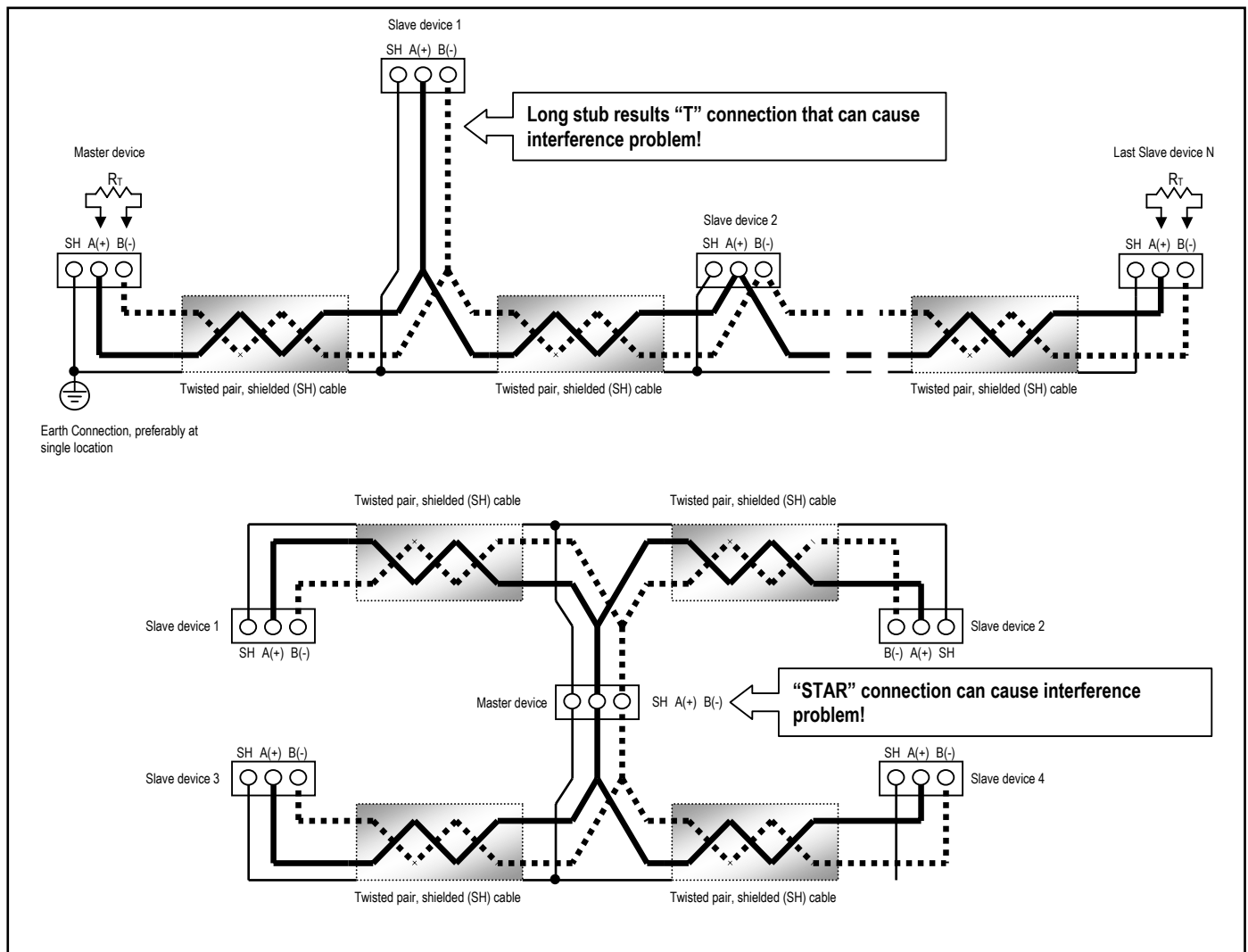


Figure 5.4: Incorrect "T" and "Star" Topologies

## PXM 2000 Series Transducer Communication Information

The PXM 2000 Series Transducer does not include a display or buttons on the front face of the meter. Once a connection with the Gateway Card is established, the Web User Interface can be used to configure the meter. See Chapters 8 - 10 for instructions on using the Web User Interface.

Programming and communication can also be performed with the RS485 connection on the back face of the meter shown in section 5.1.2. Once a connection is established, Eaton Meter Configuration Software can be used to program the meter and communicate to slave devices.

### Meter Connection

To provide power to the meter, attach an **Aux cable** to GND, L (+) and N (-) (refer to Chapter 5, Figure 5-1. The **RS485 cable** attaches to SH, B (-) and A (+) as shown in Figure 5.3 of this chapter.



# 6 USING THE PXM 2000 SERIES

## Introduction

You can use the **Elements** and **Buttons** on the meter's face to view meter readings, reset and/or configure the PXM 2000 Series, and perform related functions. The following sections explain the Elements and Buttons and detail their use.

## Understanding Meter Face Elements

The meter face features the following elements:

- **Reading Type Indicator:**  
Indicates Type of Reading
- **Parameter Designator:**  
Indicates Reading Displayed
- **Watt-Hour Test Pulse:**  
Energy Pulse Output to Test Accuracy
- **Scaling Factor:**  
Kilo or Mega multiplier of Displayed Readings
- **% of Load Bar:**  
Graphic Display of Amps as % of the Load

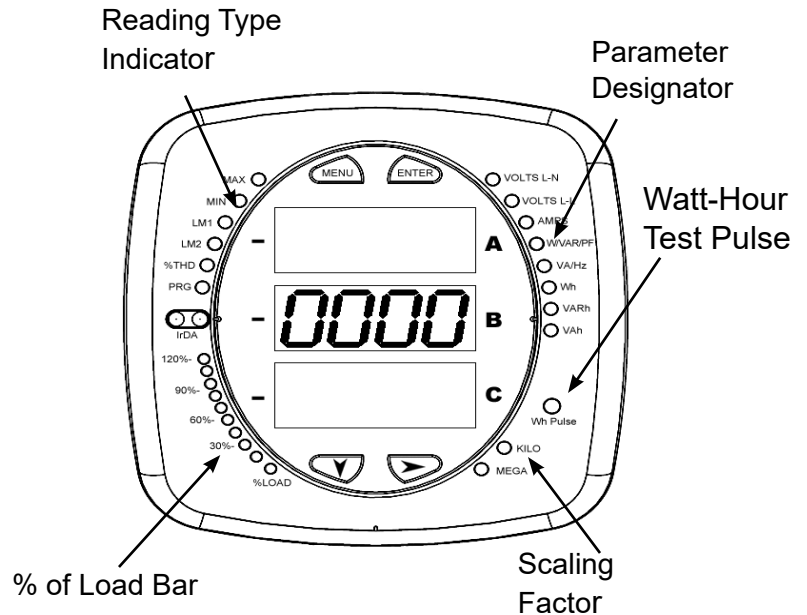


Figure 6.1: Meter's Face Plate with Elements

## Understanding Meter Face Buttons

The meter face has **Menu**, **Enter**, **Down** and **Right** buttons, which allow you to perform the following functions:

- View Meter Information
- Enter Display Modes
- Configure Parameters (may be Password Protected)
- Perform Resets (may be Password Protected)
- Perform LED Checks
- Change Settings
- View Parameter Values
- Scroll Parameter Values
- View Limit States

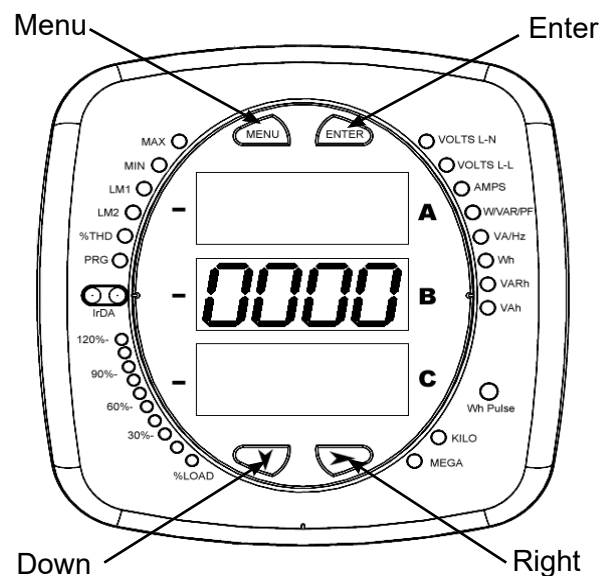


Figure 6.2: Meter's Face Plate with Buttons

## Using the Front Panel

You can access **four** modes using the meter's front panel buttons:

- **Operating Mode** (Default).
- **Reset Mode**.
- **Configuration Mode**.
- **Information Mode**. **Information Mode** displays a sequence of screens that show model information, such as **Frequency** and **Amps**. Use the **Menu**, **Enter**, **Down** and **Right** buttons to navigate through each mode and its related screens.

### Notes:

- Appendix A contains the complete Navigation Map for the front panel display modes and their screens.
- The meter can also be configured from the web pages; see Chapter 8 for instructions.

## Understanding Startup and Default Displays

Upon Power Up, the meter displays a sequence of screens:

- **Lamp Test Screen** where all LEDs are lit.
- **Lamp Test Screen** where all digits are lit.
- **Firmware Screen** showing build number.
- **Error Screen** (if an error exists).

After startup, if auto-scrolling is enabled, the meter scrolls the parameter readings on the right side of the front panel. The Kilo or Mega LED lights, showing the scale for the Wh, VARh, and VAh readings. Figure 6.3 shows an example of a Wh reading.

The meter continues to provide scrolling readings until one of the buttons on the front panel is pressed, causing the meter to enter one of the other modes.

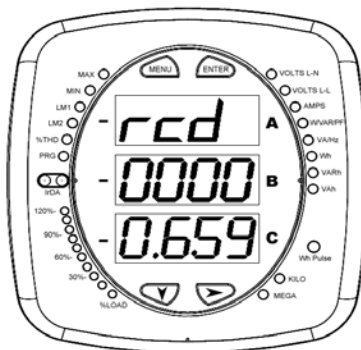
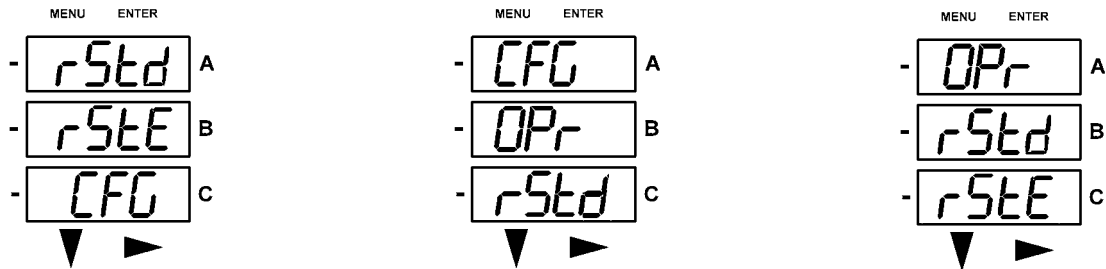


Figure 6.3: Wh Reading

## Using the Main Menu

- Press the **Menu** button. The Main Menu screen appears.
  - The **Reset: Demand** mode (**rStd**) appears in the A window. Use the **Down** button to scroll, causing the **Reset: Energy (rStE)**, **Configuration (CFG)**, **Operating (OPr)**, and **Information (InFo)** modes to move to the **A** window.
  - The mode that is currently flashing in the **A** window is the **“Active”** mode, which means it is the mode that can be configured.



**For example:** Press **Down Twice** - **CFG** moves to A window. Press **Down Twice** - **OPr** moves to A window.

**Note:** If the PXM 2000 Meter has an Ethernet Gateway card, there is an IP menu option after InFo mode. Press Enter when IP is in the A window to see the IP Address. The IP address is displayed with 4 characters to a line, e.g., an IP address of 111.222.333.444 would appear as:

- 111.2
- 22.33
- 3.444

Note that it may take 2-3 minutes after power up for the IP address to display.

- Press the **Enter** button from the Main Menu to view the Parameters screen for the mode that is currently active.

## Using Reset Mode

Reset Mode has **two options**:

- Reset: Demand (rStd):** resets the Max and Min values.
- Reset: Energy (rStE):** resets the energy accumulator fields.

Press the **Enter** button while either **rStd** or **rStE** is in the A window. The **Reset Demand No** or **Reset Energy No** screen appears.

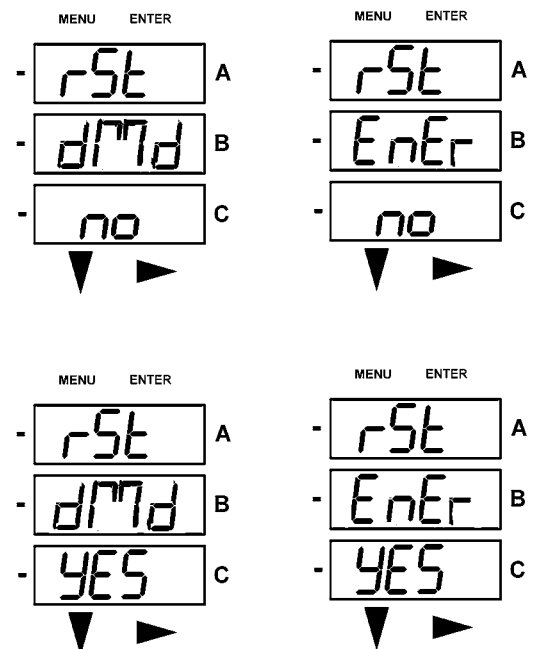
- If you press the **Enter** button again, the Main Menu appears, with **the next mode** in the A window. (The **Down** button does not affect this screen.)
- If you press the **Right** button, the **Reset Demand YES** or **Reset Energy YES** screen appears. Press **Enter** to perform a reset.

**Note:** If Password Protection is enabled for Reset, you must enter the four digit Password before you can reset the meter. (See Chapter 8 for information on Password Protection.)

**To enter a password, follow the instructions on the next page.**



**CAUTION! Reset Demand YES** resets **all** Max and Min values.



Once you have performed a reset, the screen displays either **“rSt dMd donE”** or **“rSt EnEr donE”** and then resumes auto-scrolling parameters.

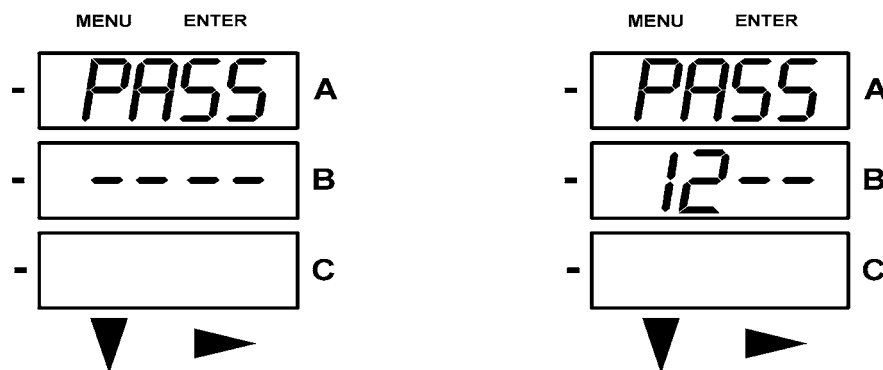
## Entering a Password

If Password Protection has been enabled from the web pages for Reset and/or Configuration (see Chapter 8 for information), a screen appears requesting a password when you try to reset the meter and/or configure settings through the front panel.

- **PASS** appears in the A window and 4 dashes appear in the B window. The leftmost dash is flashing.

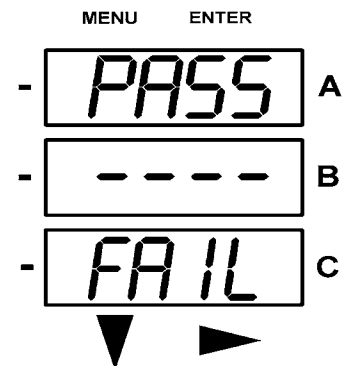
1. Press the **Down** button to scroll numbers from 0 to 9 for the flashing dash. When the correct number appears for that dash, use the the **Right** button to move to the next dash.

**Example:** The left screen, below, shows four dashes. The right screen shows the display after the first two digits of the password have been entered.



2. When all 4 digits of the password have been selected, press the **Enter** button.

- If you are in **Reset Mode** and the correct Password has been entered, “rSt dMd donE” or “rSt EnEr donE” appears and the screen resumes auto-scrolling parameters.
- If you are in **Configuration Mode** and the correct Password has been entered, the display returns to the screen that required a password.
- If an incorrect Password has been entered, “PASS ---- FAIL” appears, and:
  - The previous screen is redisplayed, if you are in **Reset Mode**.
  - The previous Operating Mode screen is redisplayed, if you are in **Configuration Mode**.





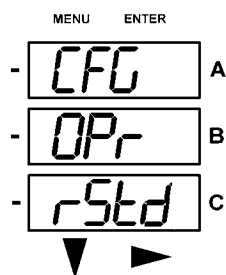
## Using Configuration Mode

**Configuration Mode** follows Reset: Energy on the Main Menu.

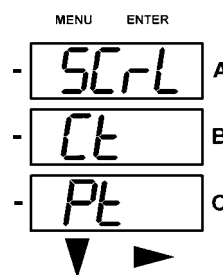
To access **Configuration Mode**:

1. Press the **Menu** button while the meter is auto-scrolling parameters.
2. Press the **Down** button until the Configuration Mode option (**CFG**) is in the A window.
3. Press the **Enter** button. The **Configuration Parameters** screen appears.
4. Press the **Down** button to scroll through the configuration parameters: **Scroll (SCrL)**, **CT**, **PT**, **Connection (Cnct)** and **Port**. The parameter currently "Active," i.e., configurable, flashes in the A window.
5. Press the **Enter** button to access the Setting screen for the currently active parameter.

**Note:** You can use the Enter button to scroll through all of the Configuration parameters and their Setting screens, in order.



Press **Enter** when CFG is in A window.



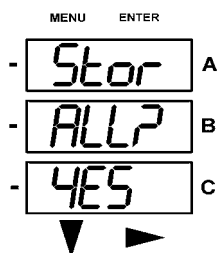
Parameter screen appears - Press **Down**.

Press **Enter** when Parameter you want is in A window.

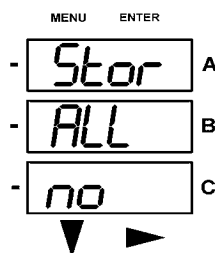
6. The parameter screen appears, showing the current settings. To change the settings:
  - Use either the **Down** button or the **Right** button to select an option.
  - To enter a number value, use the **Down** button to select the number value for a digit and the **Right** button to move to the next digit.

**Note:** When you try to change the current setting and Password Protection is enabled for the meter, the Password screen appears. **See the previous page for instructions on entering a password.**

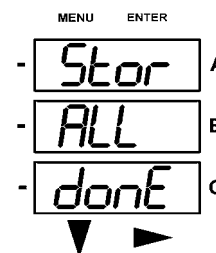
7. Once you have entered the new setting, press the **Menu** button twice.
8. The **Store ALL YES** screen appears. You can either:
  - Press the **Enter** button to **save** the new setting.
  - Press the **Right** button to access the **Store ALL no** screen; then press the Enter button to **cancel** the Save.
9. If you have saved the settings, the **Store ALL done** screen appears and the meter resets.



Press the Enter button to save the settings.  
Press the Right button for Stor All no screen.



Press the Enter button to  
cancel the save.



The settings have been saved.

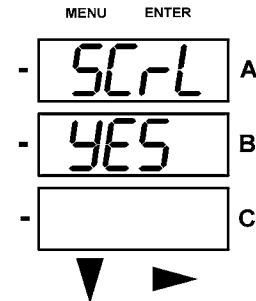
## Configuring the Scroll Feature

When in **Auto Scroll** mode, the meter performs a scrolling display, showing each parameter for 7 seconds, with a 1 second pause between parameters. The parameters that the meter displays are determined by the following conditions:

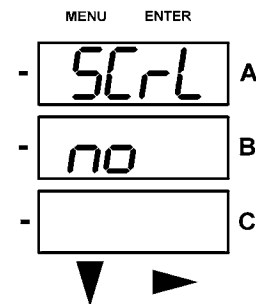
- They have been selected through software. (Refer to Chapter 8 for instructions.)
- Whether your meter model is a PXM 2250, 2260, 2270, 2280, or 2290.

### To enable or disable Auto-scrolling:

1. Press the **Enter** button when **SCrl** is in the A window.  
The **Scroll YES** screen appears.



2. Press either the **Right** or **Down** button if you want to access the **Scroll no** screen. To return to the **Scroll YES** screen, press either button.



3. Press the **Enter** button on either the **Scroll YES** screen (to enable auto-scrolling) or the **Scroll no** screen (to disable auto-scrolling).  
The **CT- n** screen appears (this is the next Configuration mode parameter).

### Notes:

- To exit the screen without changing scrolling options, press the **Menu** button.
- To return to the Main Menu screen, press the **Menu** button twice.
- To return to the scrolling (or non-scrolling) parameters display, press the **Menu** button three times.

### Configuring CT Setting

The CT Setting has three parts: **Ct-n** (numerator), **Ct-d** (denominator), and **Ct-S** (scaling).

1. Press the **Enter** button when Ct is in the A window. The **Ct-n** screen appears. You can either:
  - Change the value for the CT numerator.
  - Access one of the other CT screens by pressing the Enter button: press Enter once to access the **Ct-d** screen, twice to access the **Ct-S** screen.

**Note:** The **Ct-d** screen is preset to a 5 amp or 1 amp value at the factory and cannot be changed.

a. **To change the value for the CT numerator**

**From the Ct-n screen:**

- Use the **Down** button to select the number value for a digit.
- Use the **Right** button to move to the next digit.

b. **To change the value for CT scaling**

**From the Ct-S screen:**

Use the **Right** button or the **Down** button to choose the scaling you want. The Ct-S setting can be **1, 10, or 100.**

**Note:** If you are prompted to enter a password, refer to the instructions earlier in the chapter.

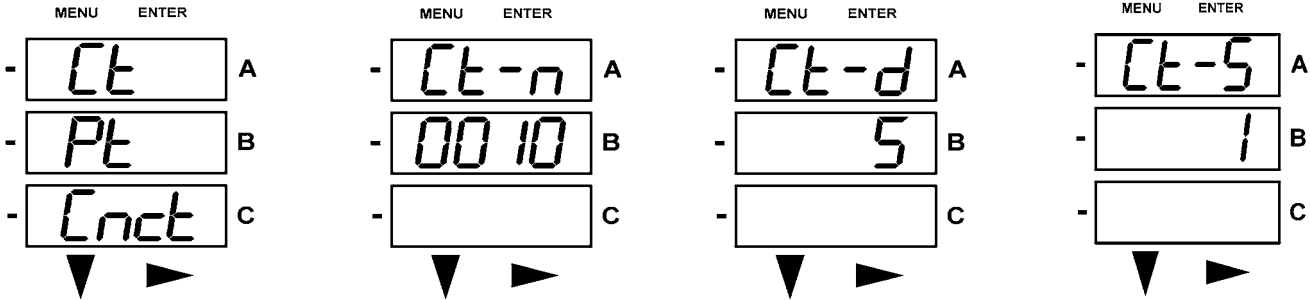
2. When the new setting is entered, press the **Menu** button twice.
3. The **Store ALL YES** screen appears. Press **Enter** to save the new CT setting.

**Example CT Settings:**

- 200/5 Amps: Set the Ct-n value for 200 and the Ct-S value for 1.
- 800/5 Amps: Set the Ct-n value for 800 and the Ct-S value for 1.
- 2,000/5 Amps: Set the Ct-n value for 2000 and the Ct-S value for 1.
- 10,000/5 Amps: Set the Ct-n value for 1000 and the Ct-S value for 10.

**Notes:**

- The value for Amps is a product of the Ct-n value and the Ct-S value.
- Ct-n and Ct-S are dictated by primary current; Ct-d is secondary current.



Press **Enter**.

Use buttons to set Ct-n value. The Ct-d cannot be changed. Use buttons to select scaling.

## Configuring PT Setting

The PT Setting has three parts: **Pt-n** (numerator), **Pt-d** (denominator), and **Pt-S** (scaling).

1. Press the **Enter** button when Pt is in the A window. The **PT-n** screen appears. You can either:
  - Change the value for the PT numerator.
  - Access one of the other PT screens by pressing the **Enter** button: press **Enter** once to access the **Pt-d** screen, twice to access the **Pt-S** screen.

a. **To change the value for the PT numerator or denominator**

**From the Pt-n or Pt-d screen:**

- Use the **Down** button to select the number value for a digit.
- Use the **Right** button to move to the next digit.

b. **To change the value for the PT scaling**

**From the Pt-S screen:**

Use the **Right** button or the **Down** button to choose the scaling you want. The Pt-S setting can be **1, 10, 100, or 1000**.

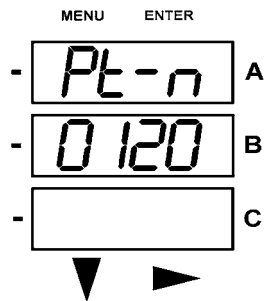
**Note:** If you are prompted to enter a password, refer to the instructions earlier in this chapter.

2. When the new setting is entered, press the **Menu** button twice.
3. The **STOR ALL YES** screen appears. Press Enter to save the new PT setting.

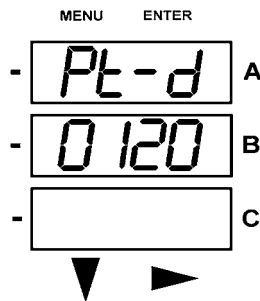
### Example Settings:

277/277 Volts:	Pt-n value is 277, Pt-d value is 277, Pt-S value is 1.
14,400/120 Volts:	Pt-n value is 1440, Pt-d value is 120, Pt-S value is 10.
138,000/69 Volts:	Pt-n value is 1380, Pt-d value is 69, Pt-S value is 100.
345,000/115 Volts:	Pt-n value is 3450, Pt-d value is 115, Pt-S value is 100.
345,000/69 Volts:	Pt-n value is 345, Pt-d value is 69, Pt-S value is 1000.

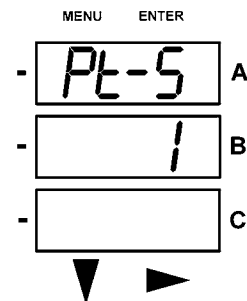
**Note:** Pt-n and Pt-S are dictated by primary voltage; Pt-d is secondary voltage.



Use buttons to set Pt-n value.



Use buttons to set Pt-d value.

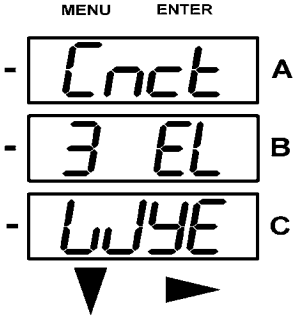


Use buttons to select scaling .

### Configuring Connection Setting

1. Press the **Enter** button when **Cnct** is in the A window. The **Cnct** screen appears.
2. Press the **Right** button or **Down** button to select a configuration.  
The choices are:
  - 3 Element Wye (**3 EL WYE**)
  - 2.5 Element Wye (**2.5EL WYE**)
  - 2 CT Delta (**2 Ct dEL**)

**Note:** If you are prompted to enter a password, refer to the instructions earlier in this chapter.



3. When you have made your selection, press the **Menu** button twice.
4. The **STOR ALL YES** screen appears. Press **Enter** to save the setting.

Use buttons to select configuration

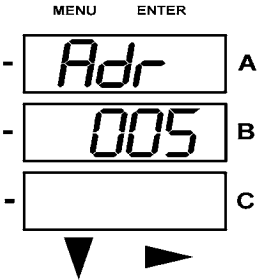
### Configuring Communication Port Setting

Port configuration consists of : **Address** (a three digit number), **Baud Rate** (9600, 19200, 38400, or 57600), and **Protocol** (DNP 3.0, Modbus RTU, or Modbus ASCII).

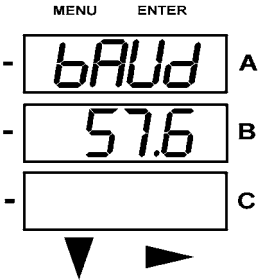
1. Press the **Enter** button when **PORt** is in the A window.  
The **Adr** (address) screen appears. You can either:
  - Enter the address.
  - Access one of the other Port screens by pressing the **Enter** button: press **Enter** once to access the **bAUd** screen (Baud Rate); press **Enter** twice to access the **Prot** screen (Protocol).
    - a. **To enter the Address, from the Adr screen:**
      - Use the **Down** button to select the number value for a digit.
      - Use the **Right** button to move to the next digit.
    - b. **To select the Baud Rate, from the bAUd screen:**  
Use the **Right** button or the **Down** button to select the setting you want.
    - c. **To select the Protocol, from the Prot screen:**  
Press the **Right** button or the **Down** button to select the setting you want.

**Note:** If you are prompted to enter a password, refer to the instructions earlier in this chapter.

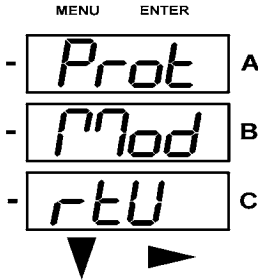
2. When you have finished making your selections, press the **Menu** button twice.
3. The **STOR ALL YES** screen appears. Press **Enter** to save the settings.



Use buttons to enter Address.



Use buttons to select Baud Rate.



Use buttons to select Protocol.

## Using Operating Mode

**Operating Mode** is the PXM 2000 Series' default mode, that is, the standard front panel display. After Startup, the meter automatically scrolls through the parameter screens, if scrolling is enabled. Each parameter is shown for 7 seconds, with a 1 second pause between parameters. Scrolling is suspended for 3 minutes after any button is pressed.

1. Press the **Down** button to scroll all the parameters in **Operating Mode**. The currently "Active," i.e., displayed, parameter has the Indicator light next to it, on the right face of the meter.
2. Press the **Right** button to view additional readings for that parameter. The table below shows possible readings for Operating Mode. **Sheet 2** in *Appendix A* shows the Operating Mode Navigation Map.

**Note:** Readings or groups of readings are skipped if not applicable to the meter type or hookup, or if they are disabled in the programmable settings.

### Operating Mode Parameter Readings

#### Possible Readings

VOLTS L-N	VOLTS_LN	VOLTS_LN_MAX	VOLTS_LN_MIN			VOLTS_LN_THD
VOLTS L-L	VOLTS_LL	VOLTS_LL_MAX	VOLTS_LL_MIN			
AMPS	AMPS	AMPS_NEUTRAL	AMPS_MAX	AMPS_MIN		AMPS_THD
W/VAR/PF	W_VAR_PF	W_VAR_PF_MAX_POS	W_VAR_PF_MIN_POS	W_VAR_PF_MIN_NEG		
VA/Hz	VA_FREQ	VA_FREQ_MAX	VA_FREQ_MIN			
Wh	KWH_REC	KWH_DEL	KWH_NET	KWH_TOT		
VARh	KVARH_POS	KVARH_NEG	KVARH_NET	KVARH_TOT		
VAh	KVAH					

KILO and MEGA LEDs will illuminate when displayed values are kilo-units of mega-units respectively.

**Understanding the % of Load Bar**

The 10-segment LED bar graph at the bottom left of the meter's front panel provides a graphic representation of Amps. The segments light according to the load, as shown in the % Load Segment Table below.

When the Load is over 120% of Full Load, all segments flash "On" (1.5 secs) and "Off" (0.5 secs).

**% of Load Segment Table**

Segments	Load > = % Full Load
None	No load
1	1%
1-2	15%
1-3	30%
1-4	45%
1-5	60%
1-6	72%
1-7	84%
1-8	96%
1-9	108%
1-10	120%
All Blink	>120%

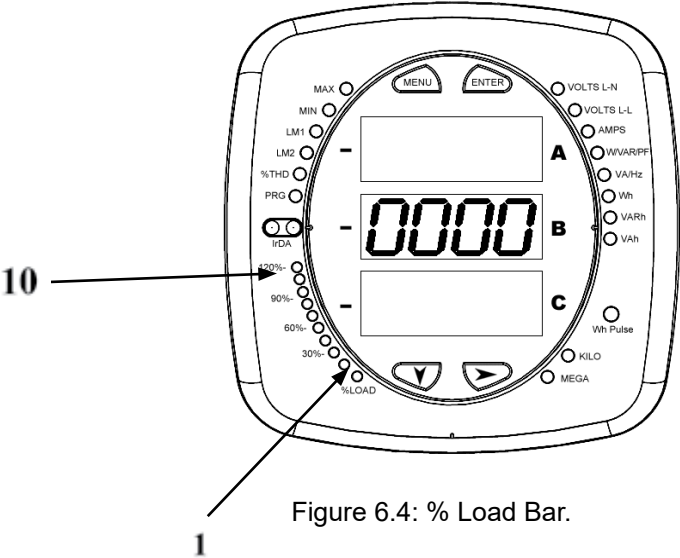


Figure 6.4: % Load Bar.

### Performing Watt-Hour Accuracy Testing (Verification)

To be certified for revenue metering, power providers and utility companies must verify that the billing energy meter performs to the stated accuracy. To confirm the meter's performance and calibration, power providers use field test standards to ensure that the unit's energy measurements are correct. Since the PXM 2000 Series are traceable revenue meters, each model contains a utility grade test pulse that can be used to gate an accuracy standard. This is an essential feature required of all billing grade meters.

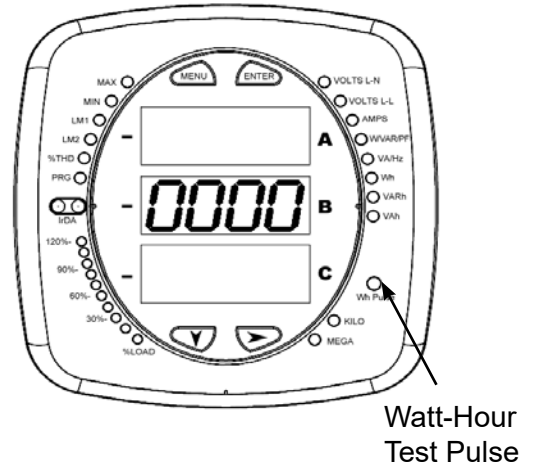


Figure 6.5: Watt-Hour Test Pulse

- Refer to Figure 6.6 for an example of how this process works.
- Refer to the table below for the Wh/Pulse Constants for Accuracy Testing.

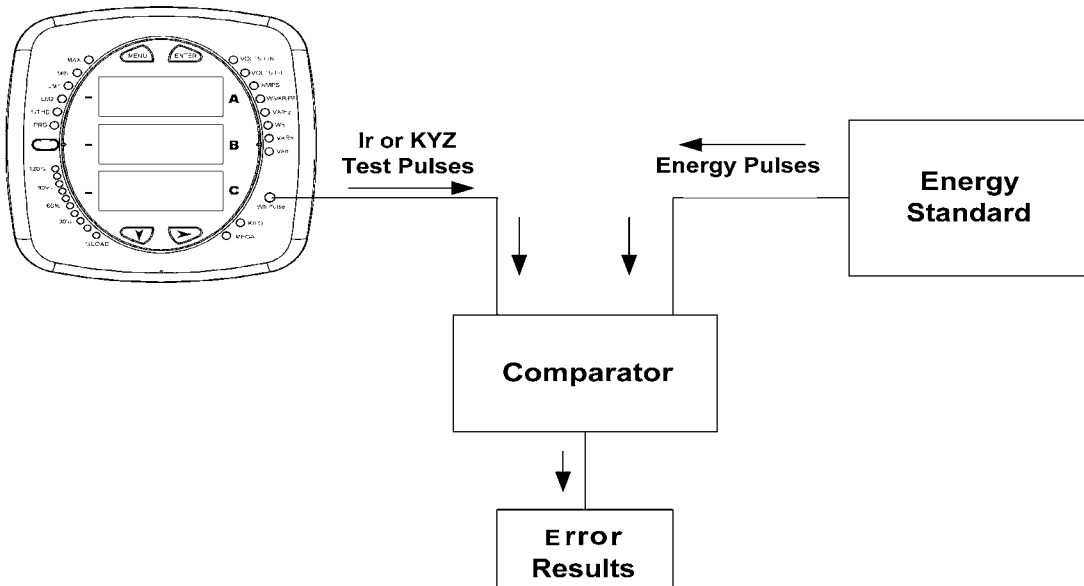


Figure 6.6: Using the Watt-Hour Test Pulse

Infrared and KYZ Pulse Constants for Accuracy Testing - Kh Watthour per Pulse

Input Voltage Level	Class 10 Models (5A Version)	Class 2 Models (1A Version)
Below 150V	0.500017776	0.1000035555
Above 150V	2.000071103	0.400014221

**Note:** Minimum pulse width is 90 milliseconds.



# 7 USING THE I/O OPTION CARDS

## Overview

The PXM 2000 Series offers extensive **I/O expandability**. Using the one universal Option Card slot, the unit can be easily configured to accept a new I/O Option card even after installation, without your needing to remove it from the installation. The meter auto-detects any installed Option card. One module of any type outlined in this chapter can be used per meter.

## Installing an Option Card

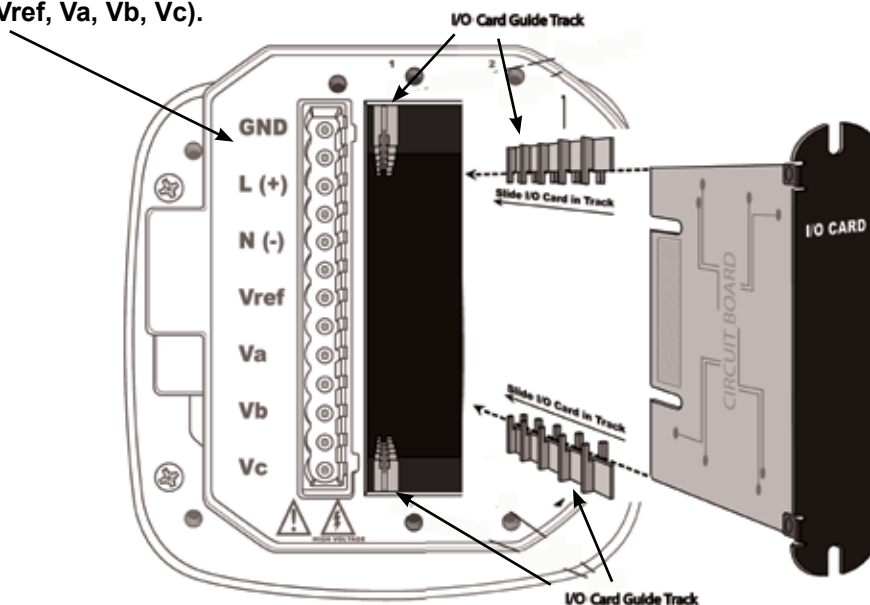
The Option Card is inserted in the Option Card slot in the back of the meter.

**Note:** Remove Voltage Inputs and power supply terminal from the meter before performing card installation.

1. Remove the screws at the top and the bottom of the Option Card slot cover.
2. There is a plastic “track” on the top and the bottom of the slot. The Option card fits into this track.



**WARNING!** For safety, remove these connections before installing Option Card: (GND, L, N, Vref, Va, Vb, Vc).



3. Slide the card inside the plastic track and insert it into the slot. You will hear a click when the card is fully inserted. **Be careful**, it is easy to miss the guide track.

### CAUTIONS!

- Make sure the I/O card is inserted properly into the track to avoid damaging the card's components.
- For proper fit of cards, and to avoid damaging the unit, insert components in the following order:
  1. Option Card
  2. Detachable terminal block 1
  3. Detachable terminal block 2
  4. Communication connection for RS485 Port

## Configuring Option Cards



**CAUTION! FOR PROPER OPERATION, RESET ALL PARAMETERS IN THE UNIT AFTER HARDWARE MODIFICATION.**

The meter auto-detects any Option card installed in it. You configure the Option card through the Power Xpert® Ethernet Gateway card.

The following sections describe the available Option cards.

## Digital Output (Relay Contact) / Digital Input Card (IQ250/260-I01)

The Digital Output/Input card is a combination of relay contact outputs for load switching and dry/wet contact sensing digital inputs. The outputs are electrically isolated from the inputs and from the main unit.

### Specifications

The technical specifications at 25°C (77°F) are as follows:

Power consumption:	0.320 W internal
Relay outputs.	
Number of outputs:	2
Contact type:	Changeover (SPDT)
Relay type:	Mechanically latching
Switching voltage:	AC 25 0V / DC 30 V
Switching power:	1250 VA / 150 W
Switching current:	5 A
Switching rate max.:	10/s
Mechanical life:	$5 \times 10^7$ switching operations
Electrical life:	$10^5$ switching operations at rated current
Breakdown voltage:	AC 1000 V between open contacts
Isolation:	AC 3000 V / 5000 V surge system to contacts
Reset/Power down state:	No change - last state is retained
Inputs.	
Number of Inputs:	2
Sensing type:	Wet or dry contact status detection
Wetting voltage:	DC (12-24 V), internally generated
Input current:	2.5 mA – constant current regulated
Minimum input voltage:	0 V (input shorted to common)
Maximum input voltage:	DC 150 V (diode protected against polarity reversal)
Filtering:	De-bouncing with 50ms delay time
Detection scan rate:	100 ms
Isolation:	AC 2500 V system to inputs

The general specifications are as follows:

Operating temperature:	(-20 to +70)°C ([-4 to +158]°F)
Storage temperature:	(-40 to +80)°C ([-40 to +176]°F)
Relative air humidity:	Maximum 95%, non-condensing
EMC - Immunity Interference:	EN61000-4-2
Weight:	1.5 oz (0.042 kg)
Dimensions (inch) W x H x L:	0.72 x 2.68 x 3.26 in. (18.3 x 68.1 x 82.8 mm)
External Connection:	AWG 12-26/(0.129 - 3.31) mm <sup>2</sup> 9 pin, 0.200" pluggable terminal block

**Wiring Diagram**

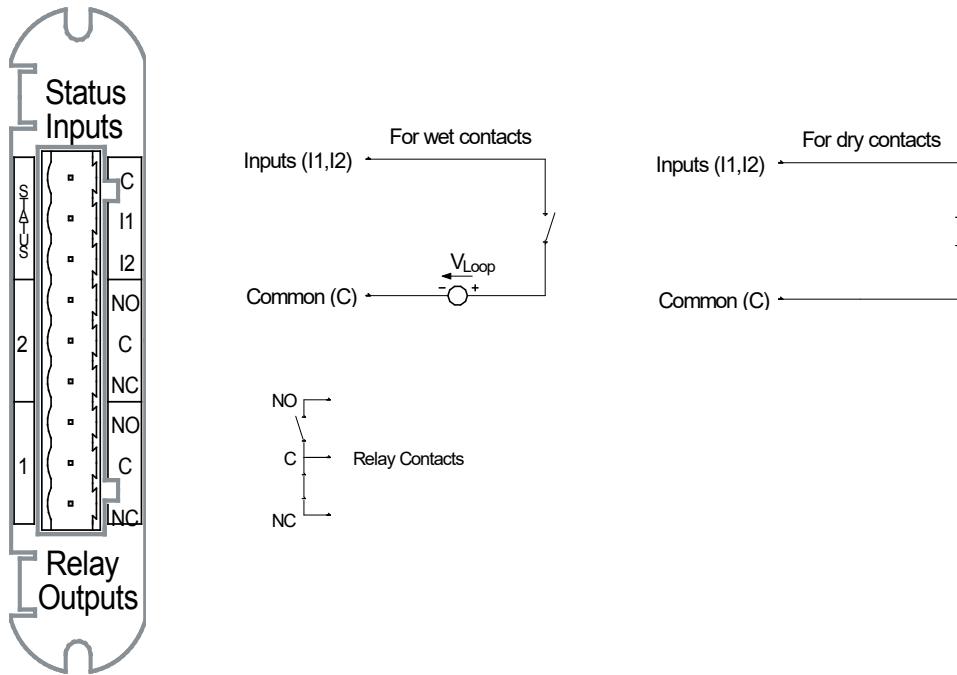


Fig. 7.3: Relay Contact (2) / Status Input (2) Card.

## Pulse Output (Solid State Relay Contacts) / Digital Input Card (IQ250/260-I02)

The Pulse Output/Digital Input card is a combination of pulse outputs via solid state contacts and dry/wet contact sensing digital inputs. The outputs are electrically isolated from the inputs and from the main unit.

### Specifications

The technical specifications at 25°C (77°F) are as follows:

Power consumption:	0.420 W internal
Relay outputs	
Number of outputs:	4
Contact type:	Closing (SPST - NO)
Relay type:	Solid state
Peak switching voltage:	DC ± 350 V
Continuous load current:	120 mA
Peak load current:	350 mA for 10 ms
On resistance, max.:	35 Ω
Leakage current:	1 μA@350 V
Switching Rate max.:	10/s
Isolation:	AC 3750 V system to contacts
Reset/Power down state:	Open contacts

### Inputs

Number of inputs:	4
Sensing type:	Wet or dry contact status detection
Wetting voltage:	DC (12-24 V), internally generated
Input current:	2.5 mA – constant current regulated
Minimum input voltage:	0 V (input shorted to common)
Maximum input voltage:	DC 150 V (diode protected against polarity reversal)
Filtering:	De-bouncing with 50 ms delay time
Detection scan rate:	100 ms
Isolation:	AC 2500 V system to inputs

The general specifications are as follows:

Operating Temperature:	(-20 to +70)°C ([-4 to +158]°F)
Storage Temperature:	(-40 to +80)°C ([-40 to +176]°F)
Relative air humidity:	Maximum 95%, non-condensing
EMC - Immunity Interference:	EN61000-4-2
Weight:	1.3 oz (0.037 kg)
Dimensions (inch) W x H x L:	0.72 x 2.68 x 3.26 in. (18.3 x 68.1 x 82.8 mm)
External Connection:	AWG 12-26/(0.129 - 3.31) mm <sup>2</sup> , 13 pin, 3.5 mm pluggable terminal block

### Default Configuration:

The meter automatically recognizes the installed option card during Power Up. If you have not programmed a configuration for the card, the unit will default to the following outputs:

<b>Status Inputs</b>	Defaulted to Status Detect
<b>Pulse Outputs</b>	Defaulted to Energy Pulses
<b>Pulse Channel 1</b>	1.8 +Watt-hrs per pulse
<b>Pulse Channel 2</b>	1.8 -Watt-hrs per pulse
<b>Pulse Channel 3</b>	1.8 +VAR-hrs per pulse
<b>Pulse Channel 4</b>	1.8 -VAR-hrs per pulse

**Pulse Outputs** Defaulted to Energy Pulses

**Wiring Diagram**

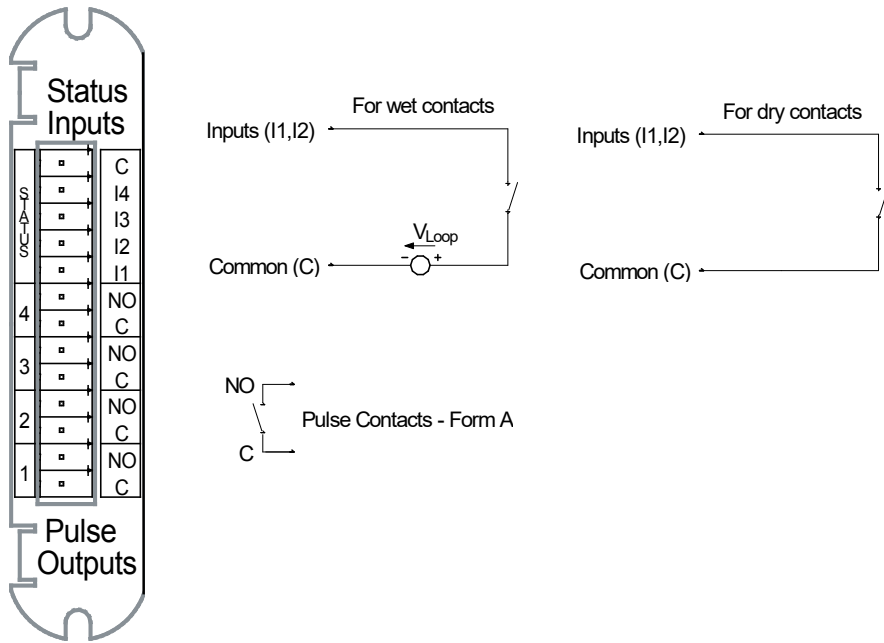


Fig. 7.4: Pulse Output (4) / Status Input (4) Card

## 1mA Output Card (IQ250/260-I03)

The 1mA card transmits a standardized bi-directional 0-1mA signal. This signal is linearly proportional to real-time quantities measured by the meter. The outputs are electrically isolated from the main unit.

### Specifications:

The technical specifications at 25°C (77°F) at 5 kΩ load are as follows:

Number of outputs:	4 single ended
Power consumption:	1.2 W internal
Signal output range:	(-1.2 to +1.2) mA
Max. load impedance:	10 kΩ
Hardware resolution:	12 bits
Effective resolution:	14 bits with 2.5 kHz PWM
Update rate per channel:	100 ms
Output accuracy:	± 0.1% of output range (2.4 mA)
Load regulation	± 0.06 % of output range (2.4 mA) load step of 5 kΩ @ ± 1 mA
Temperature coefficient	± 30 nA/°C
Isolation:	AC 2500 V system to outputs
Reset/Default output value:	0 mA

The general specifications are as follows:

Operating temperature:	(-20 to +70)°C ([-4 to +158]°F)
Storage temperature:	(-40 to +80)°C ([-40 to +176]°F)
Relative air humidity:	Maximum 95%, non-condensing
EMC - Immunity Interference:	EN61000-4-2
Weight:	1.6 oz (0.045 kg)
Dimensions (inch) W x H x L:	0.72 x 2.68 x 3.26 in. (18.3 x 68.1 x 82.8 mm)
External connection:	AWG 12-26/(0.29 - 3.31) mm <sup>2</sup> 5 pin, 0.200" pluggable terminal block

### Default Configuration:

The meter automatically recognizes the installed option card during Power Up. If you have not programmed a configuration for the card, the unit will default to the following outputs:

<b>Channel 1</b>	+ Watts, + 1800 Watts => +1 mA - Watts, - 1800 Watts => -1 mA
<b>Channel 2</b>	+ VARs, + 1800 VARs => +1 mA - VARs, - 1800 VARs => -1 mA
<b>Channel 3</b>	Phase A Voltage WYE, 300 Volts => +1 mA Phase A Voltage Delta, 600 Volts => +1 mA
<b>Channel 4</b>	Phase A Current, 10 Amps => +1 mA

Wiring Diagram

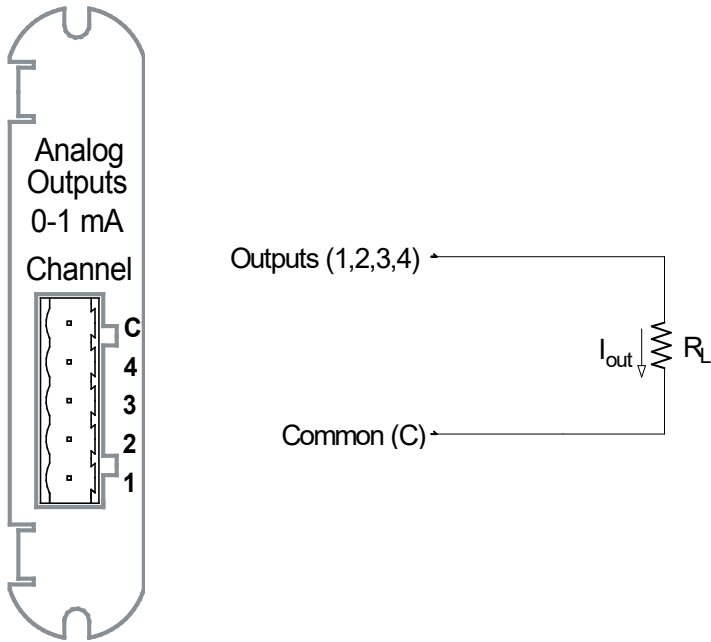


Fig 7.5: 4-Channel 0 - 1 mA Output Card



## 20mA Output Card (IQ250/260-I04)

The 20 mA card transmits a standardized 0-20 mA signal. This signal is linearly proportional to real-time quantities measured by the meter. **The current sources need to be loop powered.** The outputs are electrically isolated from the main unit.

### Specifications

The technical specifications at 25°C (77°F) at 500 Ω load are as follows:

Number of outputs:	4 single ended
Power consumption:	1 W internal
Signal output range:	(0 to 24) mA
Max. load impedance:	850 Ω @ 24 VDC
Hardware resolution:	12 bits
Effective resolution:	14 bits with 2.5 kHz PWM
Update rate per channel:	100 ms
Output accuracy:	± 0.1% of output range (24 mA)
Load regulation:	± 0.03% of output range (24 mA) load step of 200 Ω @ 20 mA
Temperature coefficient	± 300 n A/°C
Isolation:	AC 2500 V system to outputs
Maximum loop voltage:	28 Vdc max
Internal voltage drop:	3.4 VDC @ 24 mA
Reset/Default output value:	12 mA

The general specifications are as follows:

Operating temperature:	(-20 to +70)°C ([-4 to +158]°F)
Storage temperature:	(-40 to +80)°C ([-40 to +176]°F)
Relative air humidity:	Maximum 95%, non-condensing
EMC - Immunity interference:	EN61000-4-2
Weight:	1.6 oz (0.045 kg)
Dimensions (inch) W x H x L:	0.72 x 2.68 x 3.26 in. (18.3 x 68.1 x 82.8 mm)
External connection:	AWG 12-26/(0.129 - 3.31) mm <sup>2</sup> 5 pin, 0.200" pluggable terminal block

### Default Configuration:

The meter automatically recognizes the installed option card during Power Up. If you have not programmed a configuration for the card, the unit will default to the following outputs:

<b>Channel 1</b>	+Watts, +1800 Watts => 20 mA -Watts, -1800 Watts => 4 mA 0 Watts => 12 mA
<b>Channel 2</b>	+VARs, +1800 VARs => 20 mA - VARs, -1800 VARs => 4 mA 0 VARs => 12 mA
<b>Channel 3</b>	Phase A Voltage WYE, 300 Volts => 20 mA 0 Volts => 4 mA Phase A Voltage Delta, 600 Volts => 20 mA
<b>Channel 4</b>	Phase A Current, 10 Amps => 20 mA 0 Phase A Current, 0 Amps => 4 mA

Wiring Diagram

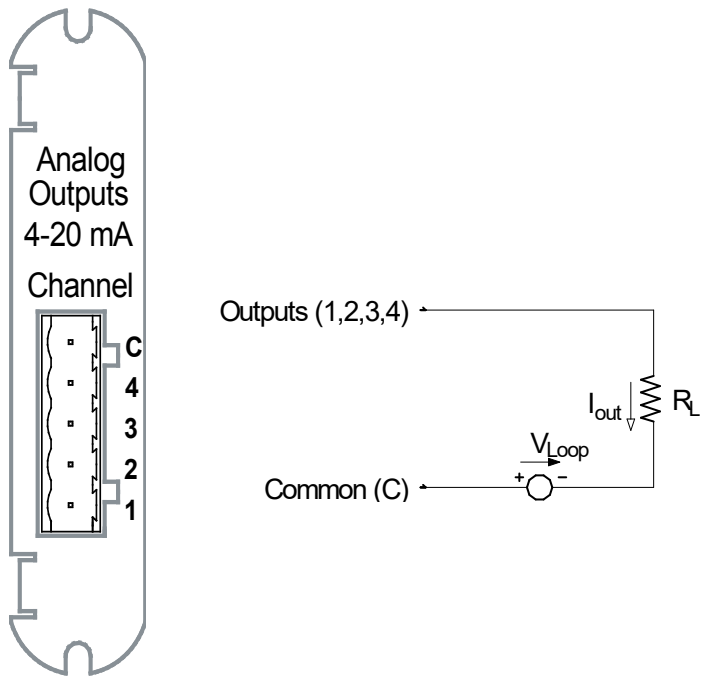


Fig. 7.6: 4-Channel 4 - 20 mA Output Card.

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## Network Communications with the Power Xpert® 2000 Series (PXM2000-GCK)

The Power Xpert® Meter Gateway Card provides the PXM 2000 Series with Ethernet capability.

**Note:** Network configuration will be done through the card.

### Specifications

The technical specifications at 25°C (77°F) are as follows:

Number of ports:	1
Power consumption:	<2.0 Watts internal
Data rate:	10/100 Mbit
Diagnostic features:	100 Mbit LINK and for ACTIVITY. There are also four LEDs for Power, Firmware upgrade activity, DHCP use, and meter communication status.
Number of simultaneous Modbus connections:	10

The general specifications are as follows:

Operating temperature:	(-20 to +60)°C (-4 to +140°F)
Storage temperature:	(-20 to +60)°C (-4 to +140°F)
Relative air humidity:	Maximum, 95% non-condensing
EMC - Immunity Interference:	EN61000-4-2
Weight:	1.7 oz. (0.048 kg)
Dimensions (inches) W x H x L:	0.72 x 2.68 x 3.26 in. (18.3 x 68.1 x 82.8 mm)
Connection type:	RJ45 modular (auto-detecting transmit and receive)

### Default Configuration

The PXM 2000 Series automatically recognizes the installed option card during Power Up. If you have not programmed a configuration for the card, the unit will default to the following.

**IP Address:** 192.168.1.1  
**Subnet Mask:** 255.255.255.0  
**Default Gateway:** 0.0.0.0

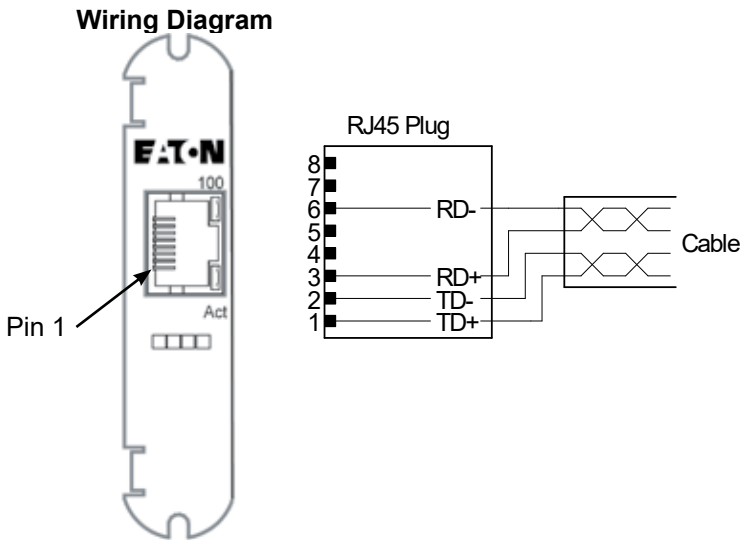


Fig. 7.7: PXM 2000 Gateway Card.



**IMPORTANT!** The PXM 2000 Gateway Card uses an auto-detecting circuit that automatically switches the transmit and receive in order to properly align communication. Because of this, when you are communicating directly to a meter with a PC or a switch, a straight cable can be used.

### Using the PXM 2000 Gateway Card

With the installation of the Power Xpert® Meter 2000 Gateway Card, you gain the capability of communicating over the Ethernet medium using EATON's Power Xpert architecture.

#### Hardware Connection

1. The Gateway Card comes pre-installed in Slot #2 of the PXM Series meter. Refer to instructions at the beginning of this chapter for card installation.
2. Use a CAT 5 or better cable to connect to the Gateway Card.



The card auto-detects cable type and will work with either straight or crossover cable.

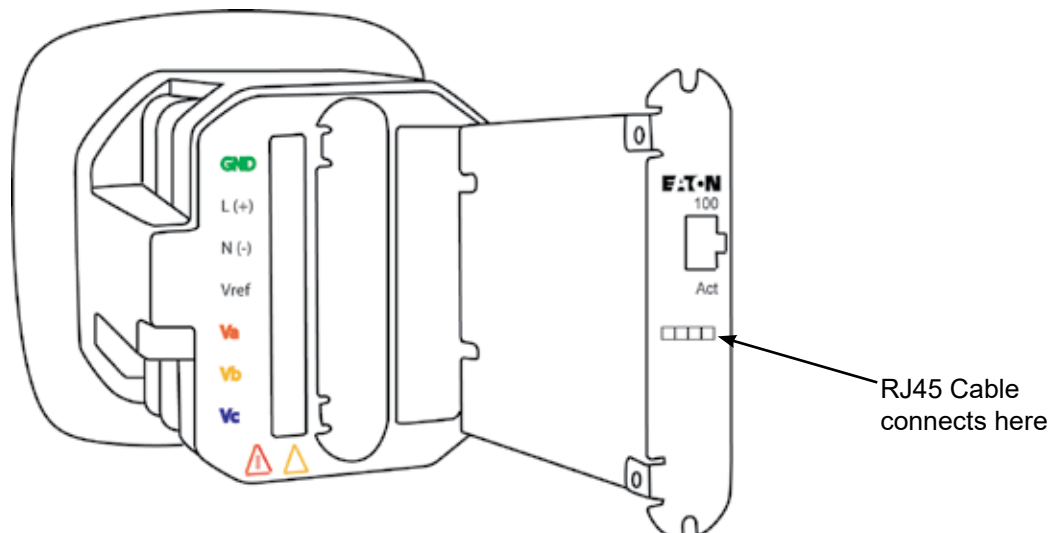


Fig. 7.8: PXM 2000 Series Meter with Gateway Card.

**Performing Network Configuration**

As with the other Option cards, the PXM 2000 auto-detects the presence of the Gateway card. You configure the Gateway card through the Ethernet connection, using the Power Xpert webpage. See Chapter 10 for instructions.



# 8 INTRODUCTION TO WEB SERVER PAGES

This chapter is an introduction to the Power Xpert Meter web server pages and describes how to access basic information through them. Each option provides easy access to basic metering functions as well as setup configuration. Other information, such as waveforms, trending graphs, harmonic tables, and phasors are also available.

The *Functions on the Web Server Pages* chapter provides more detailed information about the functions, features, and options available on each page in the meter's web interface.

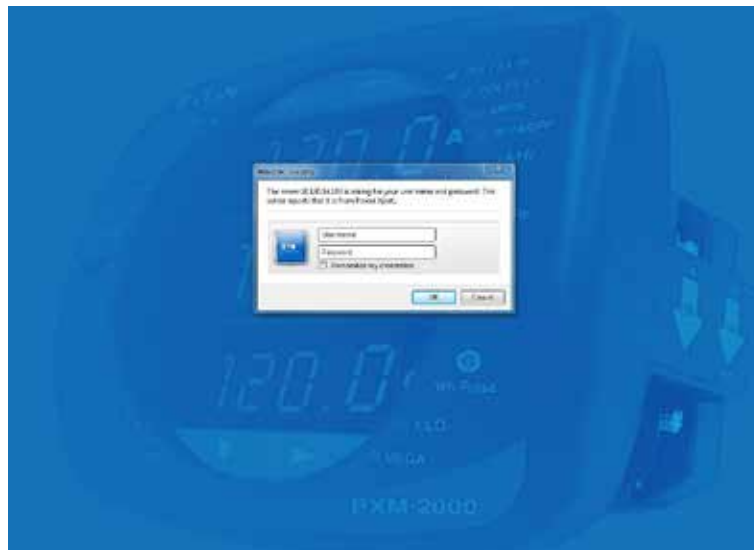
## Accessing the Web Pages

You can access the Power Xpert Meter's built-in web site from a web browser. To access the meter's web site, simply enter the meter's IP address as the URL. You can find this from the front panel of your meter.

Hit the MENU button on the face of your meter. Use the down arrow key to scroll through the menu options until you see "IP" blinking in the top row of the display. Hit the ENTER button. The IP address will be displayed.

You should see something similar to the following page.

Loading Page

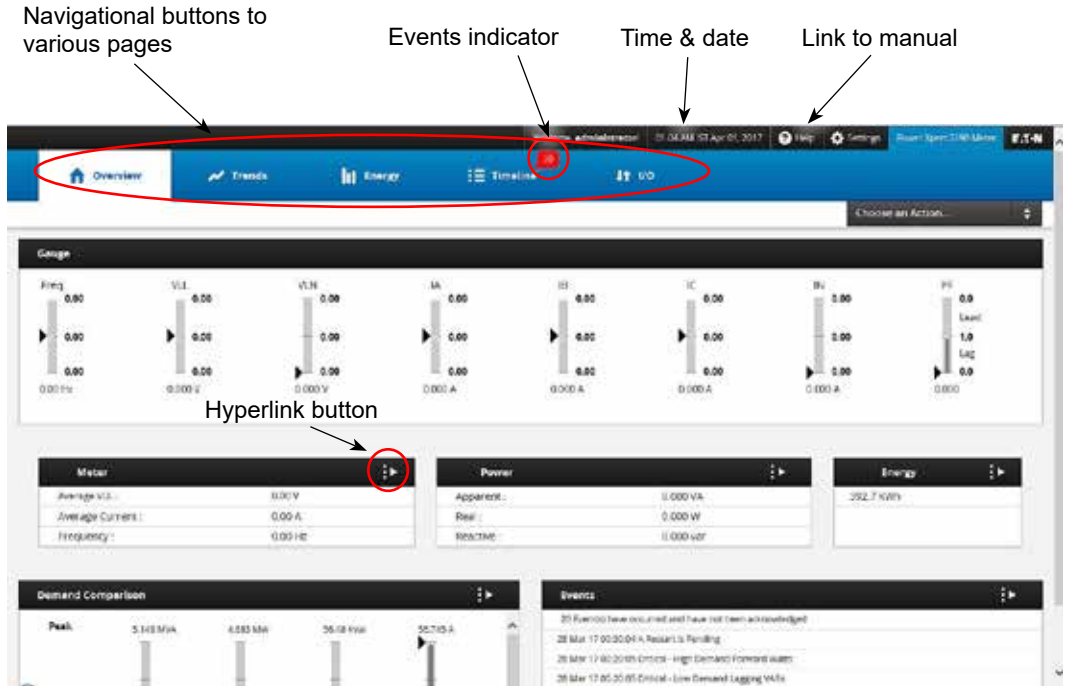


## Overview (Default)

The **Overview** page displays an overview of the most pertinent current meter readings. From this page, you can navigate to the **Trends, Energy, Timeline, and Settings** pages. The navigational buttons are in a row at the top of the screen.

Each section of the **Overview** page also provides the hypertext links that also lead to more detailed information on the relevant page.

Overview Page Controls and Indicators



**Common Controls for Selecting Information**

Under the **Trends** tab, the **Meter**, **Power**, **Quality**, and **Phasor** pages share many features. These pages provide drop-down menus and radio buttons to select the information to be viewed and options for viewing it. For example, in the **Meter** page the left-side drop-down menu selects how voltage is viewed: **Line-Line**, **Line-Neutral** or **Symmetric** (requires firmware version 21 or later). The radio buttons select the voltage information to view: VLL **Average**, **AB**, **BC**, or **CA**.

If more than one type of graph is available on the page, another drop-down menu in the top center of the page provides options for selecting available graphs. For example, in the **Meter** page you can select from the following types of graphs:

- **Trend Max-Min**
- **Waveform** (available in the PXM 2270, PXM 2280, and PXM 2290 models only)
- **Harmonics** (available in the PXM 2270, PXM 2280, and PXM 2290 models only)

Note that harmonic data must be available and of sufficient magnitude for that time period in order to view the single-cycle **Waveform** graph of harmonic distortion. If the required data isn't available or significant enough, you'll see an error message.

The Trend graph is a "snapshot" of the current values plus the historical values in the designated range (zoom). It doesn't update automatically and you must therefore re-select the information to update the display.



You can pan or zoom through a graph. Use the arrows on the sides of the graph to move forward or backward through the available time range. Use the zoom feature by clicking and dragging in the plot area to manually zoom or use the drop-down menu, which provided the following time ranges:

- 1 - 16 hours
- 2 - Two days
- 3 - Eight days

A table containing all of the plotted data points is beneath the graph. You can scroll through this to view individual data points.

For the demand Profile and Demand Comparison on the Energy tab, the zoom feature provides the following time ranges:

- 1 - 16 hours
- 2 - Two days
- 3 - Seven days (Demand Profile)
- 4 - Four and-a-half weeks (Demand Profile)

### The Meter Page

The screenshot displays the 'Energy' tab of a web interface. On the left, there are 'Data selection controls' for Voltage (Line-Line), Current, and Frequency. The 'Voltage' section is expanded, showing 'Line-Line' options: VLL Average (8002.7 V), AB (12003.3 V), BC (12004.5 V), and CA (0.0 V). Below this are 'Current' options: Average (85.19 A), Phase A (85.27 A), Phase B (85.34 A), Phase C (85.33 A), and Neutral (151.81 A). The 'Frequency' section shows Frequency (60.01 Hz). The main area features a line graph titled 'AB Line-Line Voltage' showing three data series: Avg (green), Min (blue), and Max (red) over time. The graph has pan controls on the left and right sides. Above the graph is a 'Graph selection drop-down' menu with 'Trend Max-Min' selected. To the right of the graph is a 'Zoom drop-down' menu with '1' selected. Further right is an 'Export data button' with a download icon. Below the graph is a summary table with columns for Present, Min, and Max values and their corresponding timestamps. At the bottom, there is a 'Datatable' with columns for Point, TimeStamp, Avg (V), Min (V), and Max (V).

Present	12001.4 V		
Min	115.928 V	March 04, 2017 12:37:39 AM GMT	
Max	123793.000 V	March 08, 2017 02:17:29 PM GMT	

Point	TimeStamp	Avg (V)	Min (V)	Max (V)
1	April 10, 2017 01:10 PM IST	12149.81467	12143.81445	12165.45605
2	April 10, 2017 01:15 PM IST	12170.87996	12153.79785	12184.22461
3	April 10, 2017 01:20 PM IST	12176.04053	12164.20020	12183.79395

## Printing and Exporting Information

Most pages have an **Export Data/Download** button. The **Export Data** function will save the set of data to either a comma-separated values (CSV) file or will display the information in your default .csv file viewer (such as Microsoft Excel). Each zoom level provides a different time interval of data.

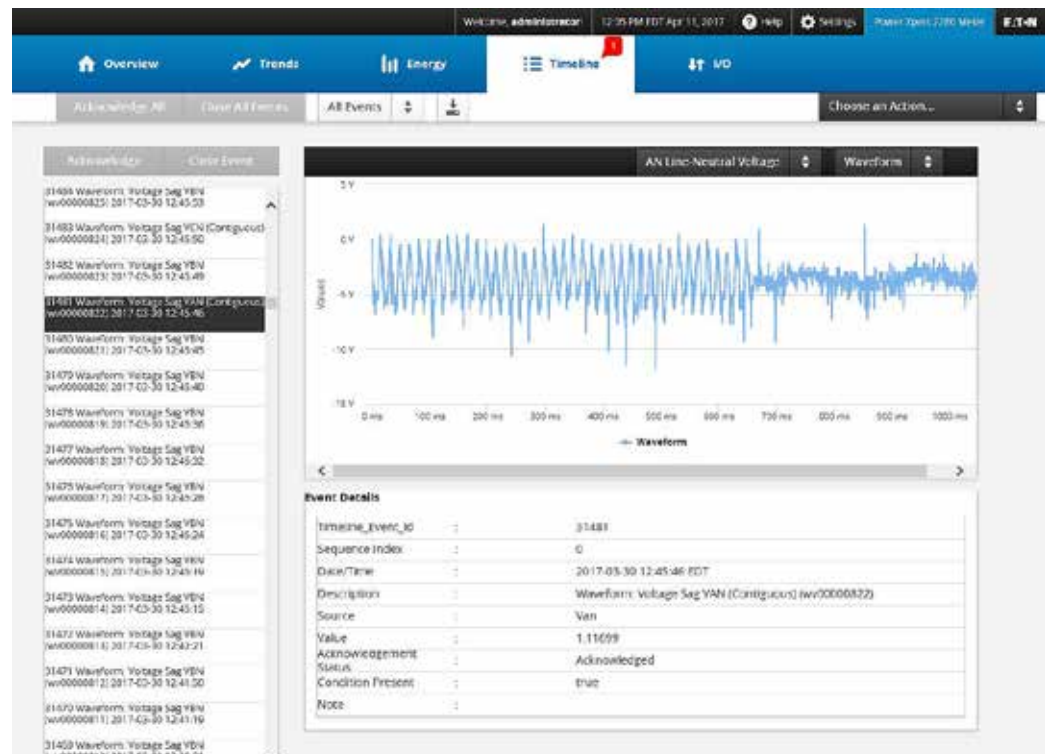
## Timeline Page

The left pane of the Timeline page lists events within the event log. The drop-down menu controls what events are shown in the list, either currently active events or all events (including historical events).

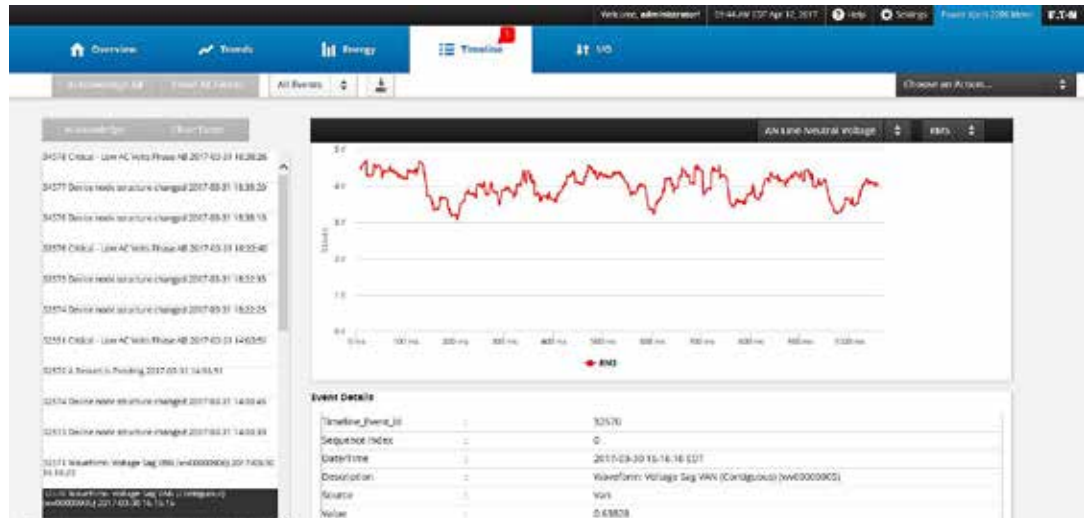
You can also acknowledge and close events from this page (this requires the administrative account name and password).

The bottom pane shows details about all events. For the PXM 2280 or PXM 2290, if the event is a captured waveform, you can view both the event details and the waveform through the top of the right pane (the bottom shows the event details). The drop-down menu selects how the waveform is viewed: **Phase A, B, or C Current** or voltage as **A, B, or C Line-to-Neutral**. You can use the other drop-down list to switch from the normal waveform to an RMS plot.

Timeline Page,



## An RMS Waveform Plot



To zoom-in on the waveform or RMS graph, manually click and drag in the plot area. Waveform capture parameters are on the **Settings** page (see the *Settings on the Web Pages* chapter).

## I/O Page

The I/O page shows the current status of all of the inputs and outputs from any installed I/O cards.

## I/O Page

Inputs	State
<input checked="" type="radio"/> Water Level1	Closed1
<input type="radio"/> Gas Level2	Opened 2

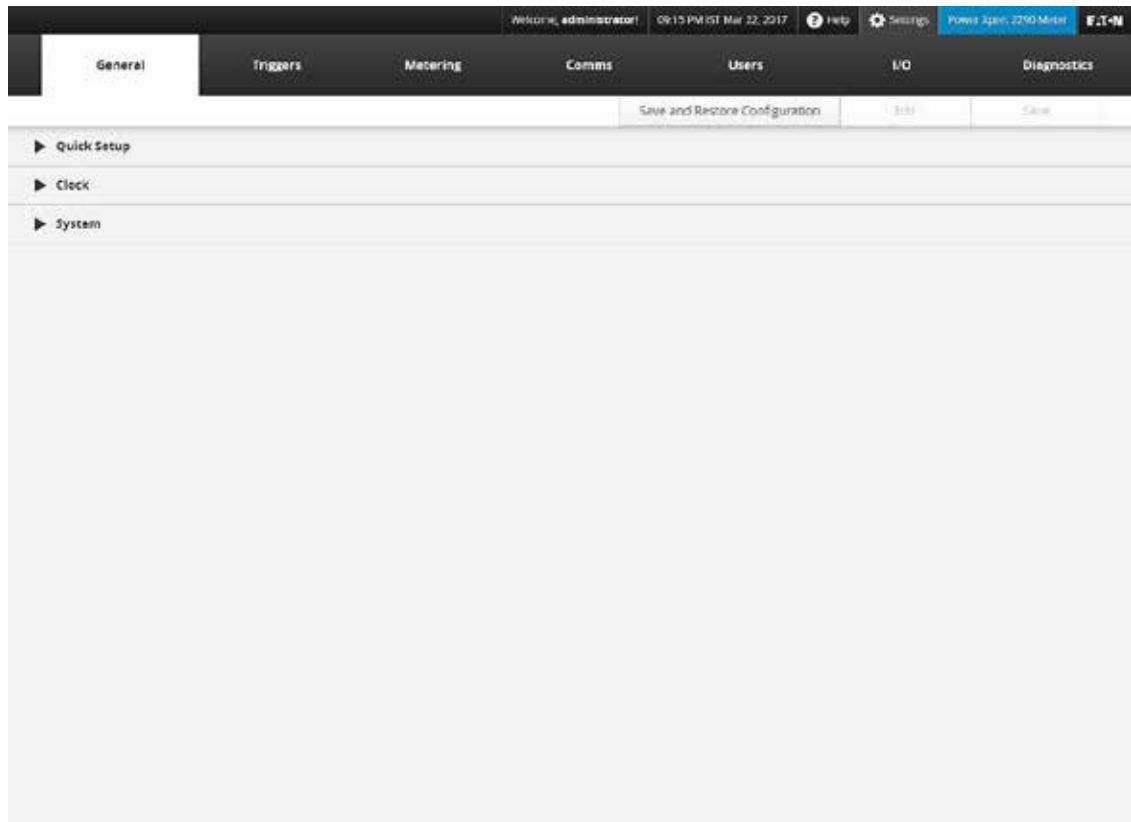
Outputs	State
<input type="radio"/> Relay Output 11	OPENED11
<input type="radio"/> Relay Out 22	CLOSED 22

IQ250/260-101	
Digital Input 1:	Water Level1
State	Closed1
Type	Digital
Mode	Accumulator
Accumulator Details	
AccuLabel 1	150

## Settings Page

The **Settings** page is the administrative interface for the meter. Use this to initially configure the meter for operation as well as to fine-tune the configuration to meet your needs. You'll need the administrative account name and password to modify the setup parameters. Details about using the setup page are covered in the *Meter Settings Using the Web Server* chapter.

### Settings Page



## Help Page

The Help page not only provides access to the manual, but also lets you:

- Generate a map of the Modbus registers for both the meter and installed I/O cards.
- Access a web page from which you can download the various MIB files.
- Access the Eaton firmware update page.
- Access the Eaton Power Xpert Website.
- View licensing information for all 3rd party software used by the Gateway Card.
- Generate the EPICS files for each of the BACnet/IP Devices (meter, gateway, and optional I/O card). You will be prompted to specify a location on your local file system for the generated .TPI file.

## Help Page

The screenshot shows the 'Help' page of the Eaton Power Xpert 2290 Meter web interface. The page is part of a larger application with a dark header and a navigation menu. The header includes the user 'halczoni', the role 'Administrator', the date '06/13/2017', and the device name 'Power Xpert 2290 Meter'. The navigation menu includes 'General', 'Triggers', 'Metering', 'Comms', 'Users', 'I/O', and 'Diagnostics'. The 'Help' page itself has a dark header with the word 'Help' and a list of links for various resources:

Resource	Link
Power Xpert Website	Eaton Power Xpert Website
Firmware	Newest Firmware Image
License Information	3rd Party Licensing
Documents	Protocol Documents
User Guide	Manual
Modbus TCP Register Maps	0,1,255: Power Xpert 2290 Meter
<input checked="" type="checkbox"/> Use 1-based mapping	Generate and View Map
EPICS files	Power Xpert Meter 2000 Gateway Card
<input checked="" type="checkbox"/> Include Values	Generate and View EPICS files



# 9 FUNCTIONS ON THE WEB SERVER PAGES

The Power Xpert® Meter provides a detailed web interface, providing information for five main functional categories:

- Overview
- Trends
- Energy
- Timeline
- I/O

A great deal of information is nested in drop down menus and related pages within these categories. By drilling-down through the many pages within each category, increasing levels of detail about the measurements can be obtained. At the upper right corner of the page for each category is a dropdown list titled “Choose an Action...”. This list can be used to reset data.

This chapter of the manual is not an exhaustive resource that displays every page in the system. The intent is to give the user a general understanding of where the most useful and pertinent information is stored for review.

**Note:** Setup information is not provided in this chapter. See *Meter Settings Using the Web Server* in Chapter 10 for setup details.

## A General Note about Graphs and Plots

When you display a trend plot or other graph on the various meter pages, this is a “snapshot” showing the last values when the graph was displayed plus the historical data. To update with more current values, re-select the value that is displayed in the list of radio buttons along the left of the page.

## Overview

The **Overview** page provides a quick overview of the key current electrical values from the meter. It includes navigational links to each of the pages as well as to frequently used diagrams and graphs.

## Trends

The **Trends** page provides Meter, Power, Quality, and Phasor values. You can view information by measurement type or by phase.

## Meter

The Meter page provides Voltage, Current, and Frequency values.

### Voltage

The Power Xpert Meter measures line-to-line and line-to-neutral voltages and calculates rms values over the period of one second. The system average values are calculated for main voltage channels.

The Power Xpert Meter maintains a log of all voltage rms measurements date and time stamps. This information is also available as a trend graph. The min, max, and averages are recorded for each interval. The following table shows the amount of data logged per Power Xpert Meter model:

Model	5-minute trends/ intervals	15-minute trends/ intervals	1-hour trends/ intervals
2250	90 days	1 year	5 years
2260	180 days	2 years	10 years
2270	1 year	3 years	15 years
2280	1 year	3 years	15 years
2290	1 year	3 years	15 years

All meter models also store 100,000 global event log entries and 1,000,000 global dead-band log entries.

The most recent minimum and maximum values are detected for all the voltage channels and are logged with date and time stamps. Current minimum and maximum values can be cleared by the user at any time through the right-click menu. After the current values are cleared, the meter will begin calculating new minimum and maximum values.

### Locating Voltage Information

From the Meter page select **Line-Line**, **Line-Neutral** or **Symmetric** from the drop-down box beside Voltage on the left side of the page. Click one of the radio buttons below **Voltage** to select a specific voltage measurement:

- **VLL Average, AB, BC, CA** for **Line-Line** or **VLN Average**
- **AN, BN, CN** for **Line-Neutral**
- **Zero-Sequence, Pos-Sequence, Neg-Sequence** (% Voltage and % Current imbalance are also shown) for **Symmetric**.

The page will update to display the selection.

You can select trending, waveform, harmonics or graphs from the drop-down box near the top of the page.

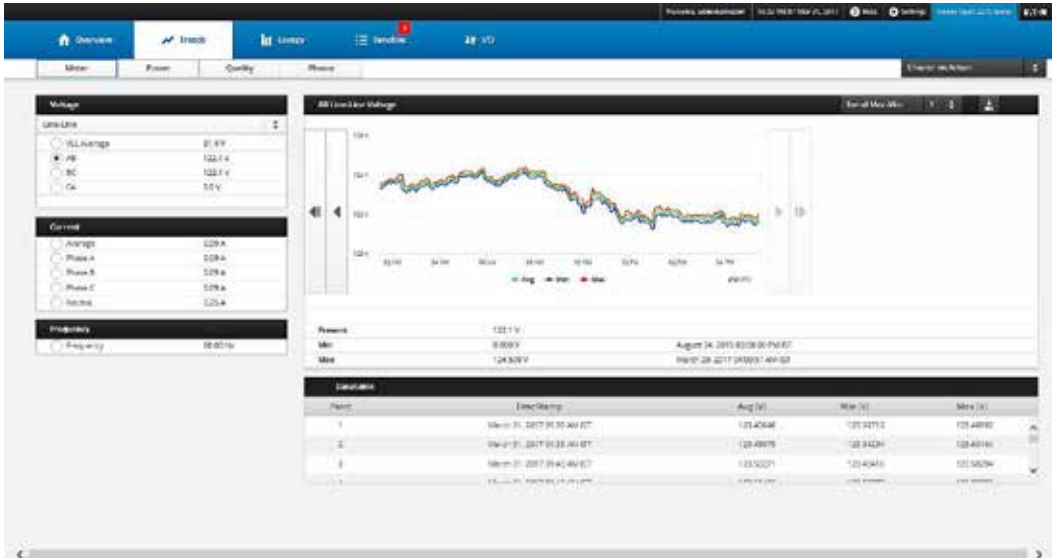
When **Trend Min/Max** is selected, the minimum and maximum values are displayed with date and time stamps.

When **Harmonics** is selected, a table is displayed showing the **Frequency (Hz)**, **Magnitude**, and **Angle (Deg)**. By default, the fundamental frequency is included. It can be excluded by selecting the **Exclude Fundamental** check box on the left side of the page.

**Note:** the **Waveform** and **Harmonics** views are only available on the PXM 2270, PXM 2280, and PXM 2290 models.



Meter Page: Voltage Display

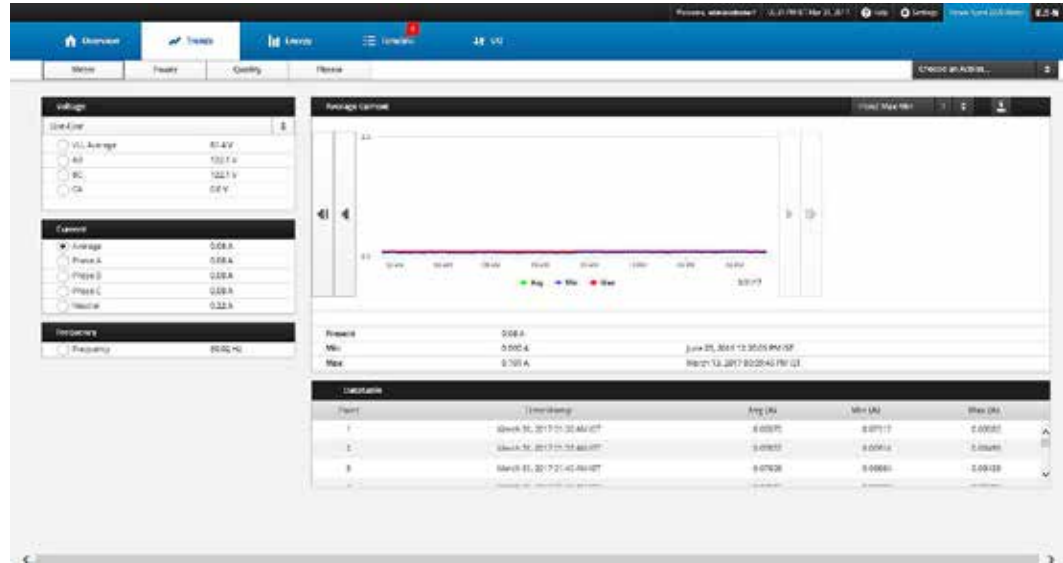


Current

The Power Xpert Meter measures per phase and average system current and calculates rms values over the period of one second. The meter will maintain a log of all rms measurements with date and time stamps. The same information is available as a trend.

The most recent minimum and maximum values are detected for all the channels and are logged with date and time stamps. Current minimum and maximum values can be cleared by the user at any time. After the current values are cleared, the meter will start calculating new minimum and maximum values.

Meter Page: Current Display



**Locating Current Information**

From the **Meter** page, click one of the radio buttons listed below **Current** to select a specific phase or neutral. The page will update to display the selection.

To view the trending, waveform, harmonics, or graphs, click the drop-down box located on the top of the page and make a selection.

When **Trend Min/Max** is selected, the minimum and maximum values are displayed on the bottom, right side of the page with date and time stamps.

When **Harmonics** is selected, a table is displayed showing the **Order, Frequency, Magnitude, and Angle**. (PXM 2270, PXM 2280, and PXM 2290 only).

**Frequency**

Frequency measurements for the meter occur every second using phase A voltage on V1. In the absence of voltage, there is no frequency measurement. The result is a gap in the trend data for frequency-dependent items. A trend of frequency measurements is maintained with date and time stamps. Minimum and maximum values are detected and saved with date and time stamps of the occurrence.

**Locating Frequency Information**

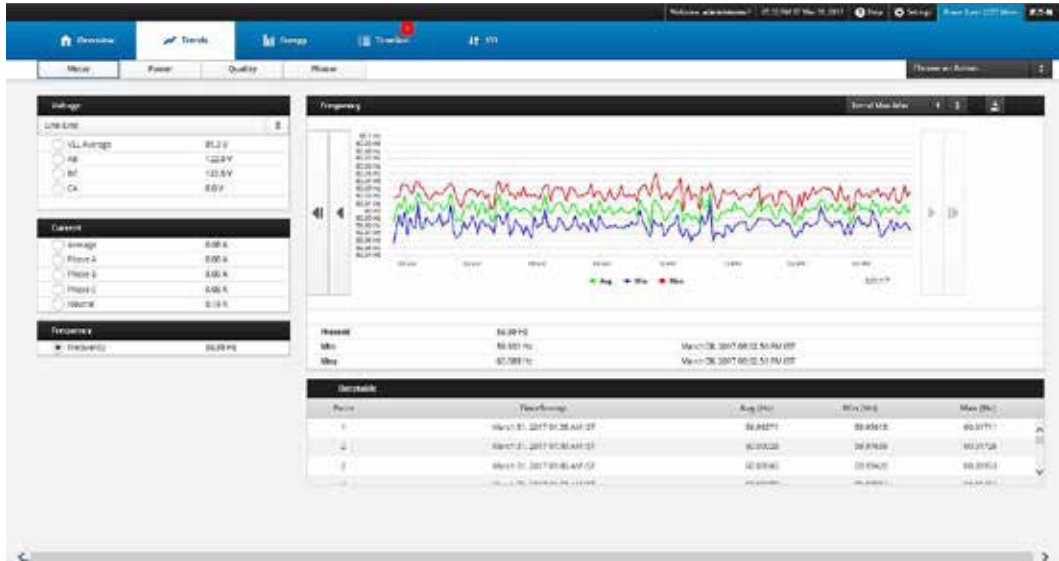
From the **Meter** page, click the **Frequency** radio button on the left side of the page.

To view the trending and graphs, click the drop-down box at the top of the page and make a selection. **Phasor** is not available if wiring configuration is set to **Delta**.

When **Trend Min/Max** is selected, the minimum, maximum, and average values are displayed on the bottom right side of the page with date and time stamps.

**Harmonics** are not available for frequency.

Meter Page: Frequency Display



Power

The **Power** page contains information about the present power consumption and power factor. The meter calculates the following :

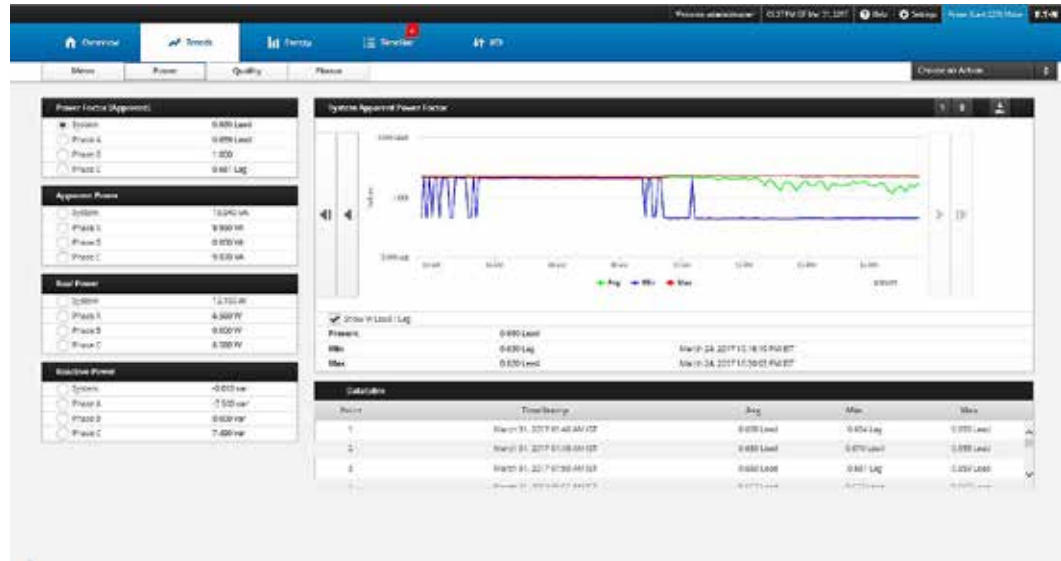
- Apparent Power Factor (PF) for System, Phase A, Phase B, and Phase C
- Apparent Power (kVA) for System, Phase A, Phase B and Phase C
- Real Power (kW) for System, Phase A, Phase B and Phase C
- Reactive Power (kvar) for System, Phase A, Phase B and Phase C

The meter will log the trend for all of the above measurements, as well as detect and save **Minimum** and **Maximum** values with date and time stamps for all of the above parameters.

Locating Power Information

From the **Power** page, click one of the radio buttons on the left side of the page that represents the type of power measurement you want to view. The page will update to display a graph with minimum, maximum and average values as per the selection.

Power Page.



Quality

The **Quality** page contains information about the present power quality for PXM 2000 series meters. These meters calculate the following instantaneous values, averaged over a period of 60 cycles:

- Percent THD of Current for Phases A, B, and C.
- Percent THD of Voltage for Phases A, B, and C.

Using the drop-down box above the graph, you can select to view this information as a trend, with minimum and maximum values, or as harmonics.

**Note:** The PXM 2250 meter does not measure %THD.

**THD**

The Total Harmonic Distortion (THD) is the ratio, expressed as a percentage, of the rms value of the ac signal after the fundamental component is removed and inter-harmonic components are ignored to the rms value of the fundamental. The formula for THD is provided below. The variables  $X_1$  and  $x_n$  may represent either voltage or current and may be expressed either as rms or peak values, as long as all are expressed in the same fashion.

$$D_x = \frac{\sqrt{\sum_{n=2}^n x_n^2}}{X_1} \cdot 100\%$$

$$\%THD x(t) = 100 \cdot \sqrt{\{x_2^2 + x_3^2 + x_4^2 + \dots x_n^2\}} / x_1$$

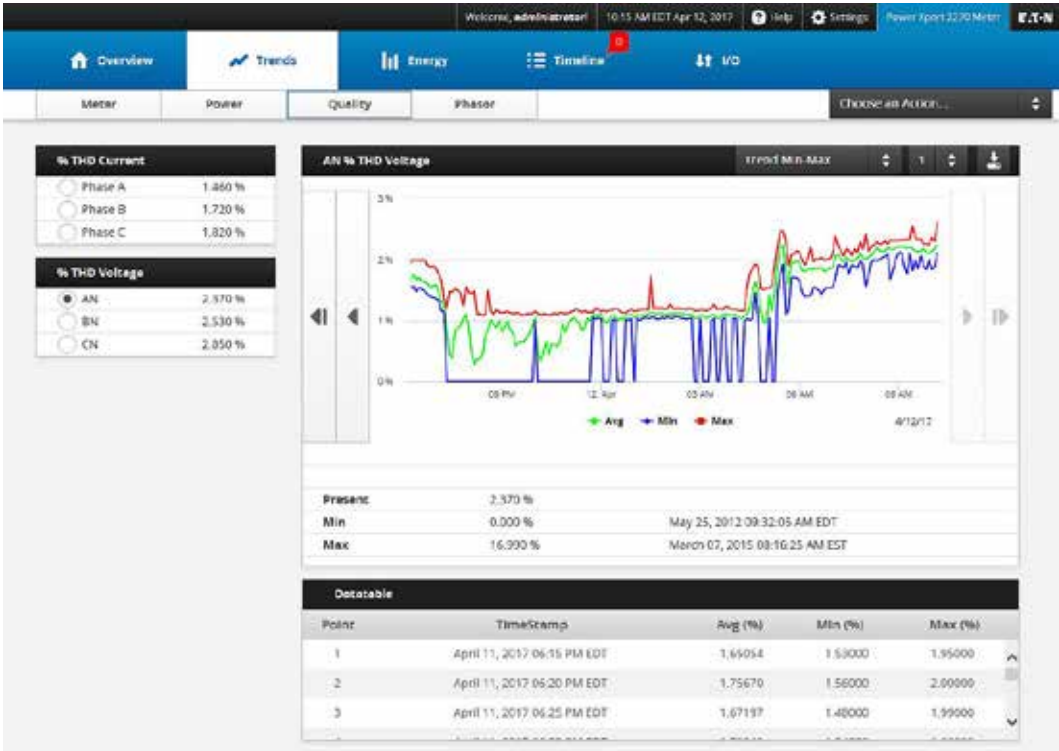
where n is the highest harmonic number used

$X_1$  = fundamental value of current or voltage.  
 $x_n$  = nth harmonic value of current or voltage.

### Trend and Min/Max View

Like most other real-time measures, the **% THD Current** and **Voltage** measurements in the Power Xpert® Meter are trended and minimum and maximum values are logged with date and time stamps.

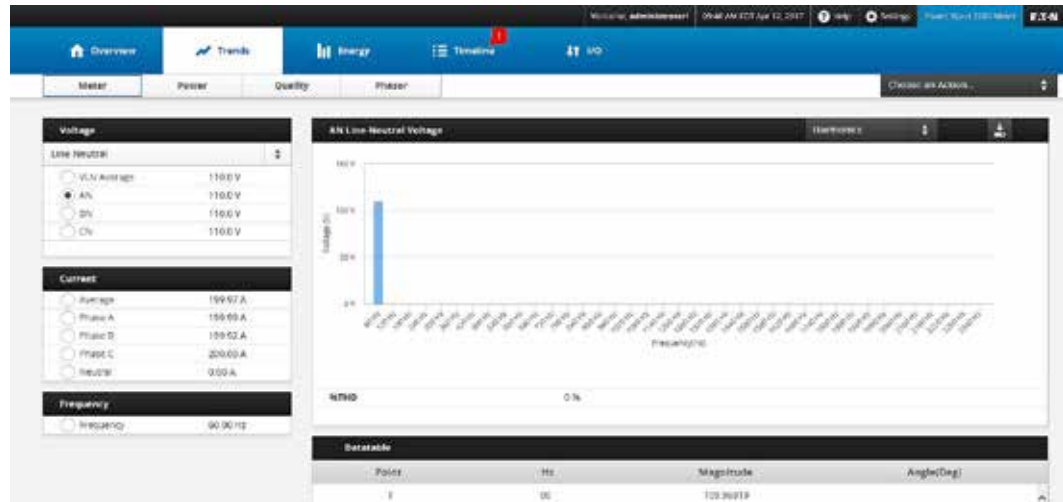
### Trend View



### Harmonics View

(PXM 2270, PXM 2280, and PXM 2290 only) The individual harmonics of the THD may be viewed for up to 40 harmonics of the fundamental frequency. Select this view from the upper-center drop down list.

### Harmonics Plot



### Table of Data Points

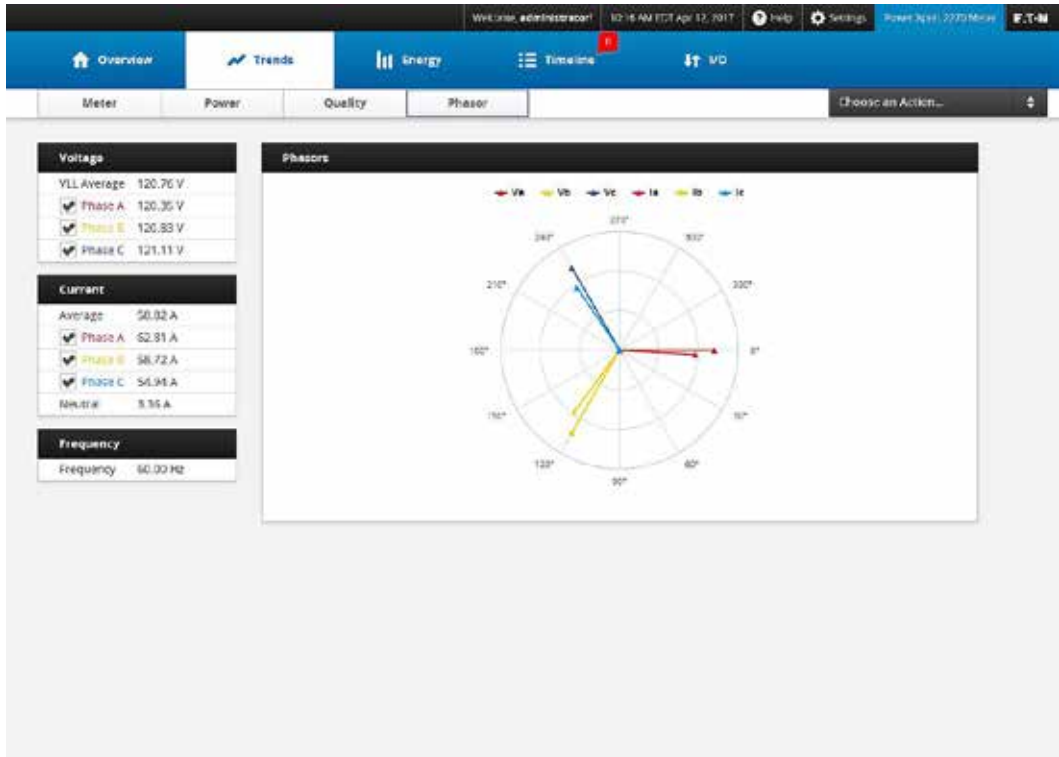
For both views, a table below the graph provides the numeric values as well. This table can be saved as a CSV file by clicking the download button (pictured to the right).



### Phasor

By default, all the options are selected when the Phasor diagram is selected. You can clear an option on the left side of the page to remove the correlating point of the phasor diagram. **Phasor** is not available if wiring configuration is set to **Delta**.

Phasor Page



Energy

The Power Xpert Meter measures and accumulates three kinds of energy values every 60 cycles: Real Power (Watts), Reactive Power (VAR) and Apparent Power (VA). Real Power and Reactive Power take direction into account, and so are recorded for forward, reverse, net and sum.

These measurements are used to calculate accumulators for the kWh Forward/Reverse, Net and Sum; kVARh, Lag/Lead, Net and Sum, and kVAh:

- Real Power (Watts).
- Reactive Power (VAR) is the product of the voltage, the current, and the sine of the phase angle between them.
- Apparent Power (VA) is the square root of the sum of the squares of the active and reactive powers.

Demand

Demand is the power consumption at the receiving terminal averaged over a specific interval of time. The Power Xpert Meter is capable of measuring demand by two methods, fixed (**Block**) or sliding (**Rolling**), in intervals of 5 to 60 minutes. These measurements are performed for the Total Current, kW Forward/Reverse, Net and Sum; kVar Lead/Lag, Net and Sum and kVA.

### Fixed and Sliding Demand

Fixed demand (**Total Current**), which is an average system current over time can be set to average current over a range of 5, 15, 30, or 60 minutes. This is known as a fixed window. For example, setting the current demand window to 15 sets the meter to determine the average current over the past 15 minutes and update the value every 15 minutes.

Power demand can be fixed, as described above, or sliding. For example, a 15 minute average can be obtained that is updated every 5 minutes. To accomplish this, the **Sub-interval** is set to 5 minutes and the **Total Interval** is set to 15.

**Note:** The **Total Interval** is the number of minutes in the average calculation. The sub-interval is the number of minutes between updates.

The Power Xpert Meter starts the demand window on meter startup.

### Demand Profile

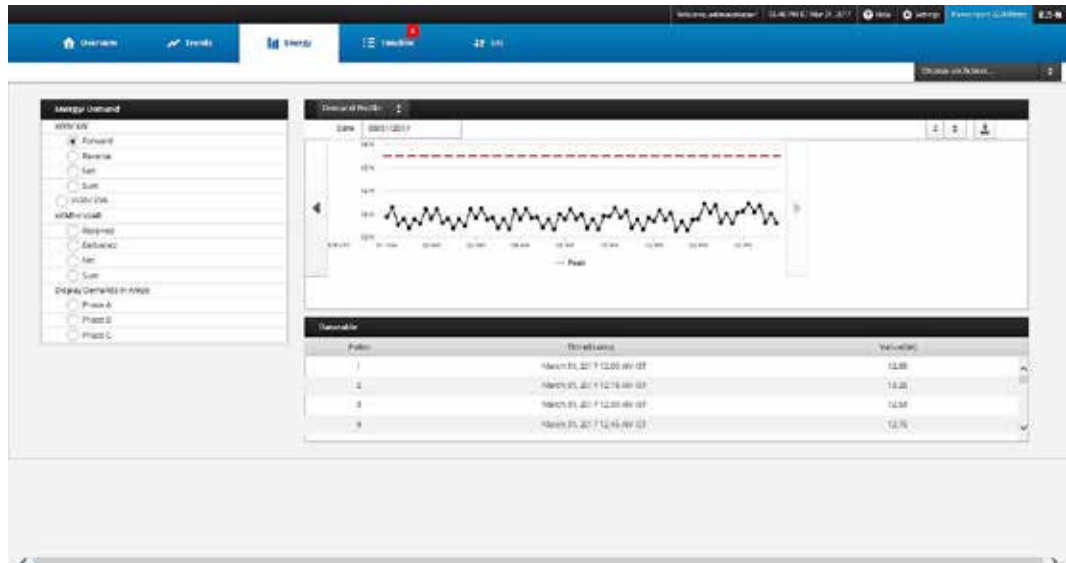
**Demand Profile** is the magnitude and duration of loads applied in a prescribed time sequence, including the transient and steady-state characteristics of the individual loads. The Power Xpert Meter logs demand profile data from the following sources:

- kWh/kW: Forward, Reverse, Net, Sum.
- kVAh/kVA - kVARh/kVAR: Received, Delivered, Net, Sum, Total Current in Amperes, Phase Currents.

You can set the interval (in lengths of 5 to 60 minutes), sub-interval (used if **Sliding** is selected), and the demand type (**Fixed** or **Sliding**) in the **Demand** page under **Setup**. The interval duration for the monthly profile is 15 minutes, it is not user programmable.

For the **Demand Profile**, you can select a date from the drop down list and then click **Show Profile** to change the graph to reflect data from a different day.

### Demand Profile





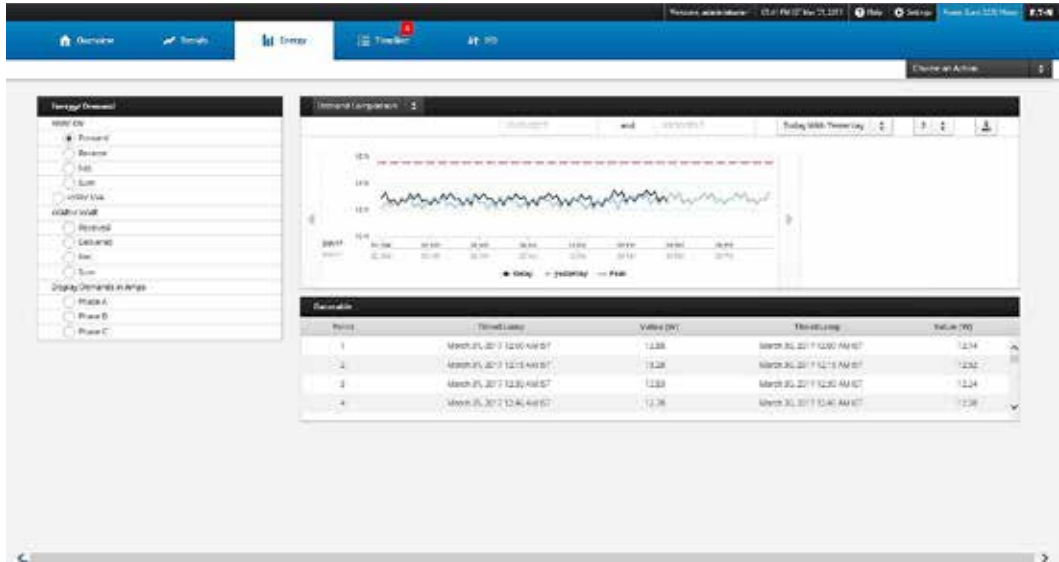
### Demand Comparison

The **Demand Comparison** page is similar to the **Demand Profile** page, but provides a graph you can use to compare two overlaid demand plots from selectable periods of time. You can select to compare plots between:

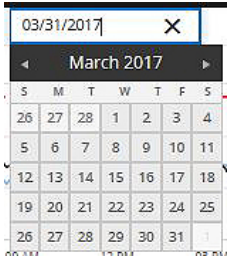
- Today and Yesterday;
- This Week and Last Week;
- This Month and Last Month;
- 2 different Days;
- 2 different Weeks; and
- 2 different Months.

Peak demand is shown in the graph as a dashed line.

#### Demand Comparison Plot



#### Calendar Control



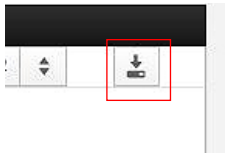
While viewing the **Demand Comparison** page, you can also select to compare the information to previous time periods: day-to-day (**Demand Comparison** only), week-to-week, or month-to-month. If you're comparing two specified time periods, such as two different days, a calendar control appears when you click either date. Click a day in the calendar to select the beginning and ending dates in the comparison. The < and > controls in the calendar move forward or backward one month.

#### Locating Demand and Energy Information

From the **Energy** page:

1. Click a radio button on the left side of the page that represents the kind of **Energy** and **Demand** you wish to view.
2. From the drop-down box near the top of the page, select either **Energy** and **Demand**, **Demand Profile**, or **Demand Comparison**.

The page will update to display the information selected.



The table shown below the graph shows each demand update value along with the time stamp. The contents of the table can be written to file formats that are compatible with various third-party spreadsheet, database, and data analysis tools. The **Export Data** button provides the option to write a comma separated values (. csv) file. Download the . csv file to your computer. The first row in the file contains the column titles.

If you want to just copy a section of a table to paste into a report or e-mail, simply select the information you want in the table and copy it to the Windows clipboard (Ctrl+C). Place the cursor where you wish to paste the information in the third-party application and press Ctrl+V.

## Timeline

The Power Xpert Meter monitors and logs **Out of Limits** and **Alarm on Value** events. Events can be used to send e-mail as well as to change the state of internal or external I/Os.

### Triggers

The following sections highlight available triggers. The meter will use the programmed limits set by the user. Every event and its corresponding parameters along with the date and time of the occurrence are logged and available for display or retrieval.

Triggers are configured in the **Settings** page. Each trigger can have the following limits:

- Upper Critical Limit.
- Upper Cautionary Limit.
- Lower Cautionary Limit.
- Lower Critical Limit.

In addition, you can select:

- If alarms are enabled for this data.
- If the limits simply trigger an event (not an alarm).
- If the alarm/event closes automatically when the value falls below the high limits or above the low limits. If not, a user must acknowledge the alarm to remove it from the active list.

In addition, alarms and events can generate e-mail and alerts. See the *Meter Settings Using the Web Server* chapter for setup details for triggers, I/O, and E-mail.

### Out of Limits

The Power Xpert® Meter monitors and logs **Out of Limit** events for the following triggers:

<b>Ia</b>	<b>Demand Ia Peak</b>	<b>Ib</b>
Demand Ib Peak	Ic	Demand Ic Peak
In	Iavg	Vab
Van	Vbc	Vbn
Vca	Vcn	V(L-L) Average
V(L-N) Average	Avg. Negative PF	Avg Positive PF
Demand Current (3-Phase Avg)	Demand Forward Watts	Demand Ia
Demand Ib	Demand Ic	Demand In
Demand In Peak	Demand Lagging VARs	Demand Leading VARs

Demand Net VARs	Demand Net Watts	Demand Reverse Watts
Demand Sum VARs	Demand Sum Watts	Demand VAs
Frequency	Percent THD Ib	Percent THD Ic
PF App Phase A	PF App Phase B	PF App Phase C
PF Apparent	Peak Demand Amps Avg	Peak Demand Forward Watts
Peak Demand Lagging VARs	Peak Demand Leading VARs	Peak Demand Net VARs
Peak Demand Net Watts	Peak Demand Reverse Watts	Peak Demand Sum VARs
Peak Demand Sum Watts	Peak Demand VAs	Phase Angle Ia
Phase Angle Ib	Phase Angle Ic	Phase Angle Vab
Phase Angle Vbc	Phase Angle Vca	Apparent Power Phase A
Apparent Power Phase B	Apparent Power Phase C	Reactive Power
Apparent Power	Percent THD Van	Reactive Power Phase A
Reactive Power Phase B	Reactive Power Phase C	Percent THD Vbn
Percent THD Vcn	Real Power Phase A	Real Power Phase B
Real Power Phase C	Real Power	

In addition, some of the I/O cards have hardware out of limits. Refer to chapter 10, *Meter Settings Using the Web Server* for more information.

### Alarm on Value

The meter can issue alarms based on the value of a digital input from an option card, if a Modbus/RTU device experiences a communications failure, or if a meter restart is pending.

### Waveform Capture

The PXM 2280 and PXM 2290 support waveform capture during events as well as manual waveform capture. The capabilities of the two models are detailed in the following table.

	PXM 2280	PXM 2290
Simultaneous Waveform Measures	VL-L, VL-N, I for 3 phases	VL-L, VL-N, I for 3 phases
Samples per Cycle – 60 Hz Waveform	32, or 64	32, 64, 128, 256, or 512
Cycles captured – 60 Hz	64 or 32, respectively	64, 32, 16, 8, or 4 respectively
Samples per Cycle – 50 Hz Waveform	38, or 76	153, 307, or 614
Cycles captured – 50 Hz	53 or 26, respectively	13.3, 6.6, or 3.3 respectively
Pre-trigger Cycles Captured	1 to N -1	1 to N -1

Maximum Waveforms Stored	1500	1500
--------------------------	------	------

RMS Triggers:

- Wye, applies to Van, Vbn, Vcn, Ia, Ib, Ic.
- Delta with two CTs, applies to Vab, Vbc, Vca, Ia, Ic.
- 2.5 element Wye, applies to Van, Vcn, Ia, Ib, Ic.
- Specified as a percentage of full scale or as a value.
- Each voltage channel has 2 thresholds (surge & sag).
- Each current channel has 1 threshold (high).

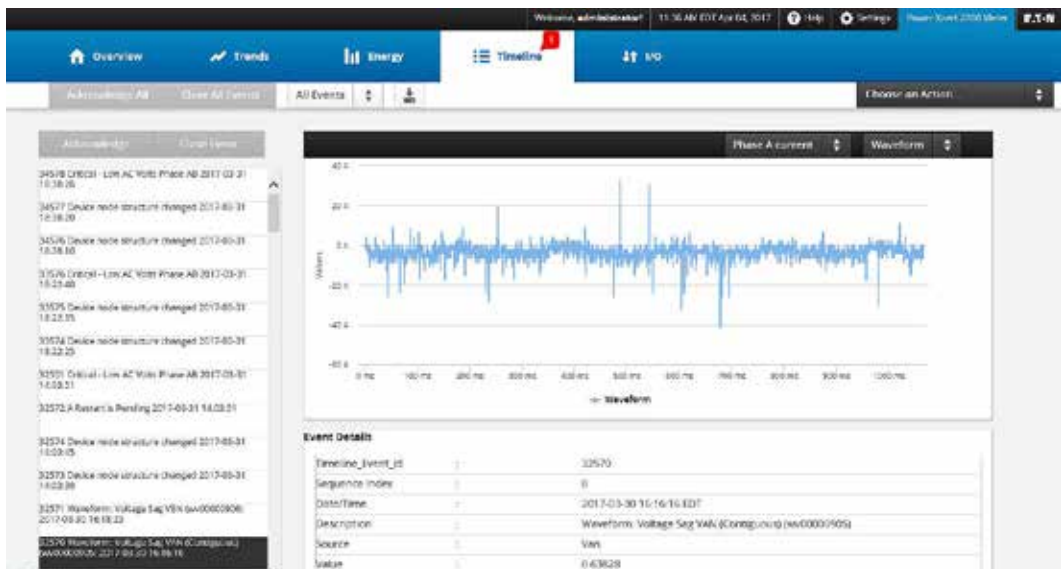
Waveform files can also be triggered manually through the right-click context menu.

### Locating Events

From the **Timeline** page, you can view either currently active events or a log of all events that have occurred. Click a specific event in the list to display the detailed information about that event at the bottom of the page. You can acknowledge or clear either the currently selected event or all events.

The bottom shows details about all events. For the PXM 2280 or PXM 2290, if the event is a captured waveform, you can view both the event details and the waveform. The drop-down menu selects how the waveform is viewed: **Phase A**, **B**, or **C** current or voltage as **A**, **B**, or **C** to either **Neutral**, **Line-to-Line** or **Symmetric**. You can use the lower drop-down list to switch the view from the normal waveform to an RMS plot of the captured data.

### Timeline Page



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# 10 METER SETTINGS USING THE WEB SERVER

## Overview

This section provides information about setup, including the settings that are currently active and how to change settings in specific categories.

### Settings Page

When the **Settings** pages load, the page defaults to the **General** tab. Underneath the **General** tab, as well as the other tabs, are arrows that expand to display all of the detailed information available for viewing or configuration. The detailed information will be displayed directly underneath each dropdown heading.

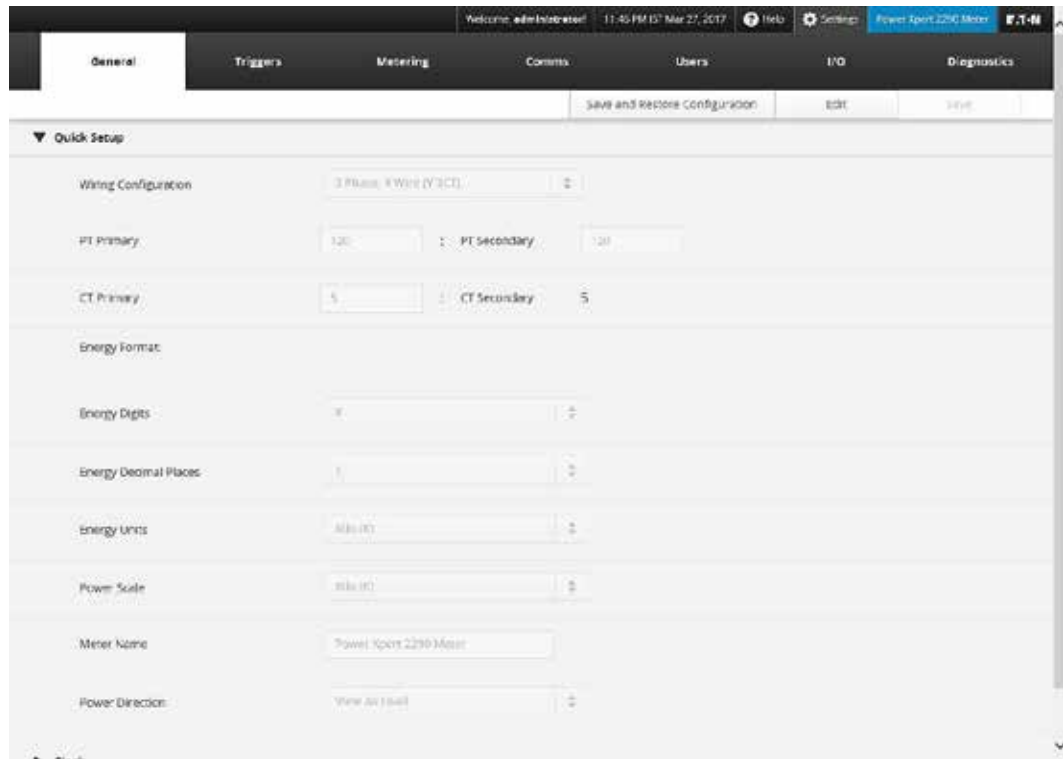
List boxes, radio buttons, text boxes, etc., that are appropriate to the selection, will appear to facilitate editing.

**Note:** All configuration (edit) abilities discussed in the following sections require login with a user name and password to complete. The user account must have sufficient privileges to edit the page.

After login, if the page remains idle for 10 minutes or longer, an automatic logout will occur with no visual confirmation that this has happened. If this occurs, the system will not respond to data entry attempts and you will have to login again to continue the editing process.

**Note:** The user will be prompted with a pop-up message if an invalid entry is attempted. To edit any of the Setting pages, click Edit / Save / Cancel in the upper right hand corner.

## Typical Settings Page



## General Screen

### Quick Setup

The **Quick Setup** page provides quick access to the most common configuration settings.

**Note:** Only users with Wiring and Meter configuration permissions will be able to edit the Quick Setup.

The **Quick Setup** page provides access to:

- The **Wiring Configuration** selection.
- Potential Transformer (PT) Ratio and the Current Transformer (CT Ratio).
- Energy units display format and the meter name.

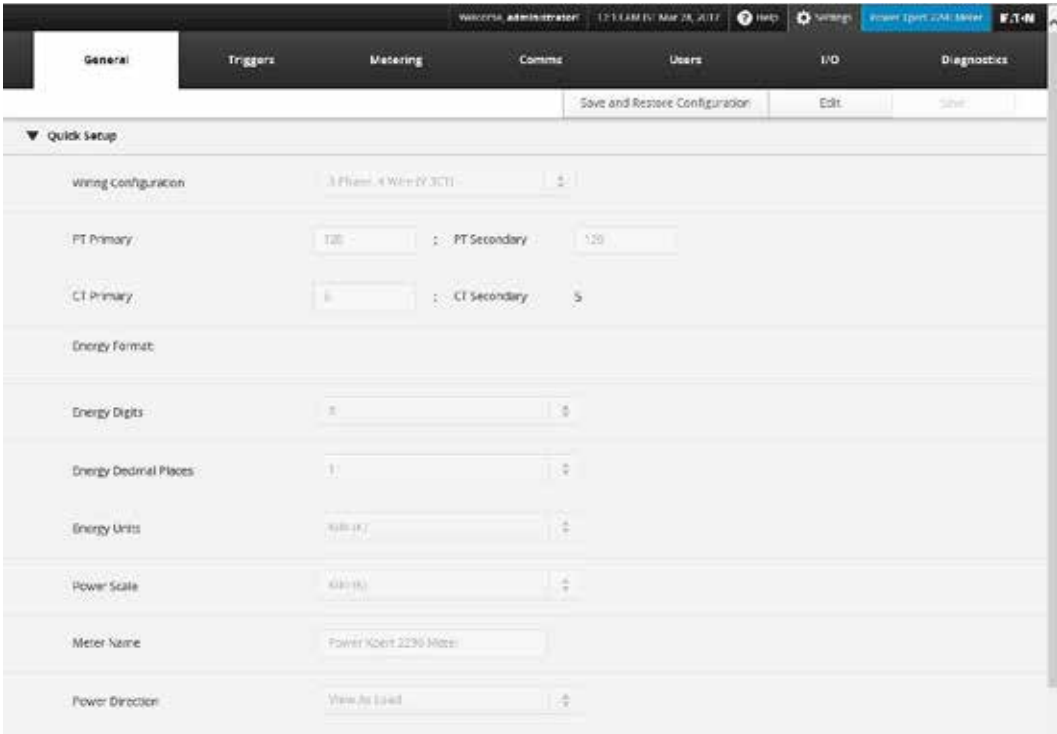
Select one of the following wiring configurations based on the installation:

- 3-Phase, 4-wire (Y 3 CT).
- 3-Phase, 3-wire (Delta 2 CT).
- 3-Phase, 4-wire (Y 3 CT, 2 V) 2 1/2 Element. (This configuration is **not** recommended. In this configuration the B phase voltage is not measured to save the cost of a B Phase voltage transformer. A balanced 3-Phase voltage is assumed to estimate B phase voltage for the purpose of 3-Phase power and energy estimation (does not comply with Blondel's theory). 2.5 element Wye configuration cannot detect problems with B phase voltage. The Phase AB and BC voltage values shown on the Meter web

page are estimates only, and on the Power web page only the System values will be shown. Phase A, B, and C values will display as zero.)

**Note:** Wiring configurations are detailed in Chapter 4, *Electrical Installation*.

Quick Setup Page - Meter



## Clock

The PowerXpert Meter uses a real-time clock for time keeping. The meter can be configured to adjust for Daylight Savings Time (DST) based on the time zone selection and to synchronize time using NTP. By using NTP, time will be maintained by the real time clock, and the real time clock will be calibrated and time corrected using NTP.

The **Clock Setup** page allows you to set the time in hours and minutes (in 24 hour time), select a time sync option, and set the date for the meter. If NTP is selected for time synch, an IP address of the NTP server should be set. When selecting NTP (Network Time Protocol) as the Time Sync Source, at least one IP Address must be entered (as many as three NTP server IP addresses may be entered). A list of public NTP servers is available at: <http://support.ntp.org/bin/view/Servers/WebHome>.

**Note:** The **Time Zone** and **Date** format settings only affect logs and e-mails.

### Clock Setup Page

The screenshot shows the 'Clock Setup' page in the PowerXpert Meter web interface. The page has a dark header with navigation tabs: General, Triggers, Metering, Comms, Users, I/O, and Diagnostics. The 'General' tab is selected. Below the header, there are buttons for 'Save and Restore Configuration', 'OK', 'Save', and 'Cancel'. The main content area is titled 'Clock Setup' and contains the following information:

- Current System Time (UTC): 27 March 2017 07:33 PM Greenwich Mean Time
- Current System Time (Meter Timezone): 28 March 2017 01:03 AM Indian Standard Time
- Current System Time (Local Timezone): 27 March 2017 03:33 PM Eastern Standard Time
- Set Time (will be converted to Meter Time):
  - No Changes
  - Set date/time from the PC clock
- Time: 03:34:24 PM Date: Mar 27, 2017 Timezone: Eastern Standard Time
- Set date/time manually
- Time: 00 : 00 Date: Mar 28, 2017 Timezone: Indian Standard Time
- Synchronize with NTP Server



## System

The **System** page is divided into two sections: Hardware and System Firmware.

### Hardware Setup - Faceplate Display

You can configure the meter's faceplate display. Options include:

- **Phases Displayed: A; A and B; A, B, and C.** This field determines which phases display on the faceplate. For example, if you select A and B, only those two phases will be displayed on the faceplate.
- **Auto Scroll:** This field enables or disables the scrolling of selected readings on the faceplate. If enabled, the readings scroll every 5 seconds.
- **Measurements to Display:** Check the boxes of the readings you want displayed on the faceplate of the meter. You must select at least one reading.

### Faceplate Display Page

The screenshot shows a web interface for configuring a meter's faceplate display. The interface includes a top navigation bar with tabs for General, Triggers, Metering, Comms, Users, I/O, and Diagnostics. Below the navigation bar are buttons for 'Save and Restore Configuration', 'OK', 'Save', and 'Cancel'. The main content area is titled 'Faceplate Display' and contains the following settings:

- Phases Displayed:** A dropdown menu set to 'A, B, and C'.
- Enable Auto Scroll:** A checked checkbox.
- Measurements to display:** A grid of checkboxes for various measurements:
 

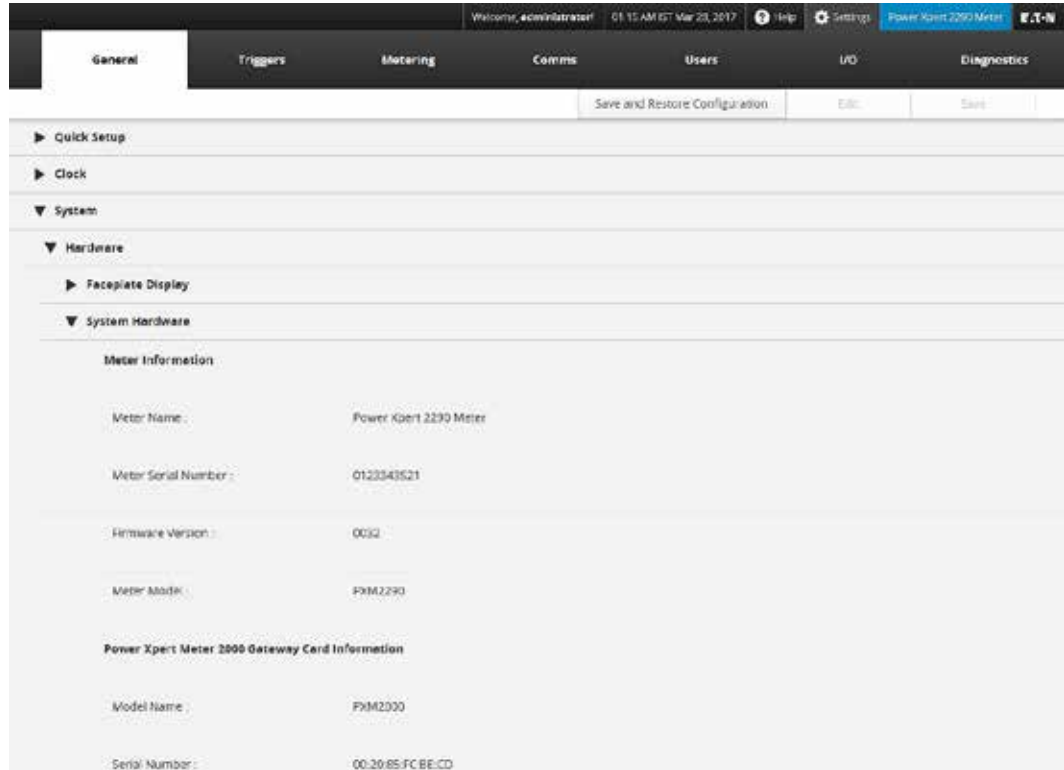
Volts L-N	<input checked="" type="checkbox"/>	Volts L-L	<input checked="" type="checkbox"/>
Amps	<input checked="" type="checkbox"/>	WVar/PP	<input checked="" type="checkbox"/>
VA/Hz	<input checked="" type="checkbox"/>	Wh	<input checked="" type="checkbox"/>
var/Hz	<input checked="" type="checkbox"/>	VAR	<input checked="" type="checkbox"/>

At the bottom of the page, there is a button for 'System Hardware'.

## Hardware Setup - System Hardware

The **System Hardware** page provides a single, convenient page you can use to check information about the meter and the cards installed in it.

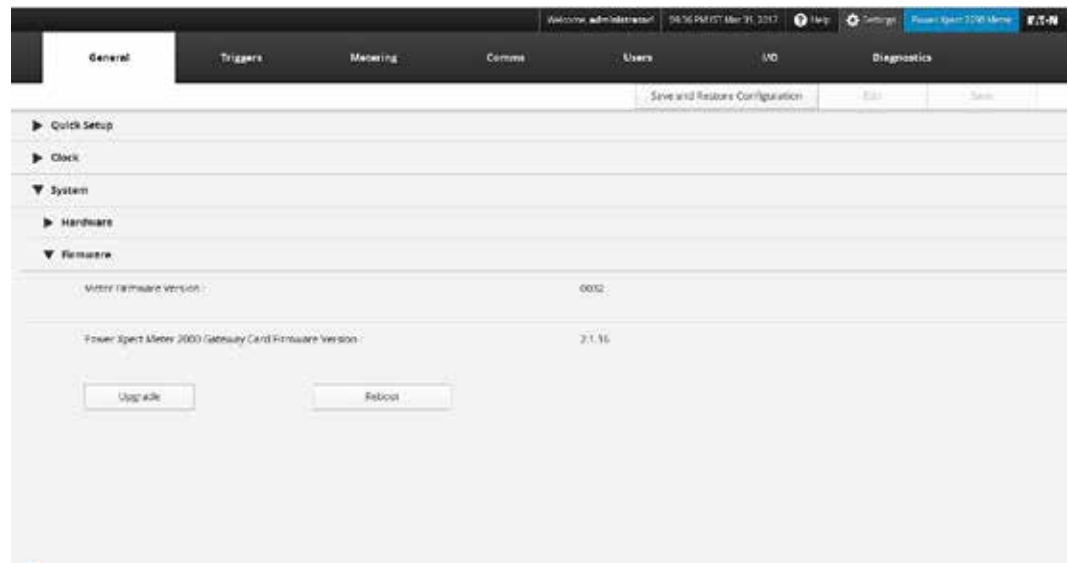
### System Hardware Page



### Firmware

The **Firmware** page displays both the meter and gateway firmware version. Firmware files can be downloaded from Eaton. Click the **Upgrade** button to launch the **Firmware Configuration** page.

## Firmware Page



**CAUTION! DO NOT ATTEMPT TO LOAD AN OLDER VERSION OF THE FIRMWARE. THIS CAN CAUSE THE METER TO NO LONGER FUNCTION. SHOULD THIS OCCUR, YOU MAY BE ABLE TO RESTORE THE METER TO WORKING ORDER BY RESETTING IT TO THE FACTORY DEFAULT STATE (SEE “RESTORING THE METER TO FACTORY DEFAULT CONFIGURATION” ON PAGE C-2).**

**To download firmware from the Firmware Page:**

1. Go to [www.eaton.com/meters](http://www.eaton.com/meters) and navigate to the PXM 2000 page. From there you can click on Upgrade your meter/card firmware. Click on either the meter firmware or Gateway Card firmware links.
2. Fill out the form (if required).
3. Download the firmware to your local file system.
4. Click the **Browse** button.
5. Select the firmware file.
6. Click the **Open** button.

**Note:** On rare instances (such as a problem occurring in the firmware upgrade) you may need to reload the meter page after rebooting the meter. It can take around five minutes for values to display after a reboot.

## Triggers Screen

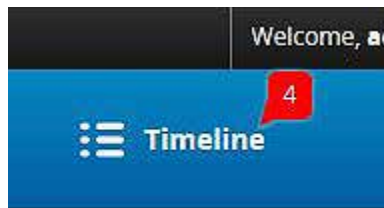
The meter has two types of triggers:

- **Out of Limits** triggers provide set points for issuing alarms for any of the supported electrical measurements. You can also set a hysteresis value for these to avoid rapid, multiple trips from a value that hovers around the set point.
- **Alarm on Value** has a set of core reset or communications parameters and may include additional communication or reset parameters from option cards. These parameters reflect device status and not electrical measurements.
- **Waveform Capture** provides setup parameters for capturing waveform data.

### Out of Limits

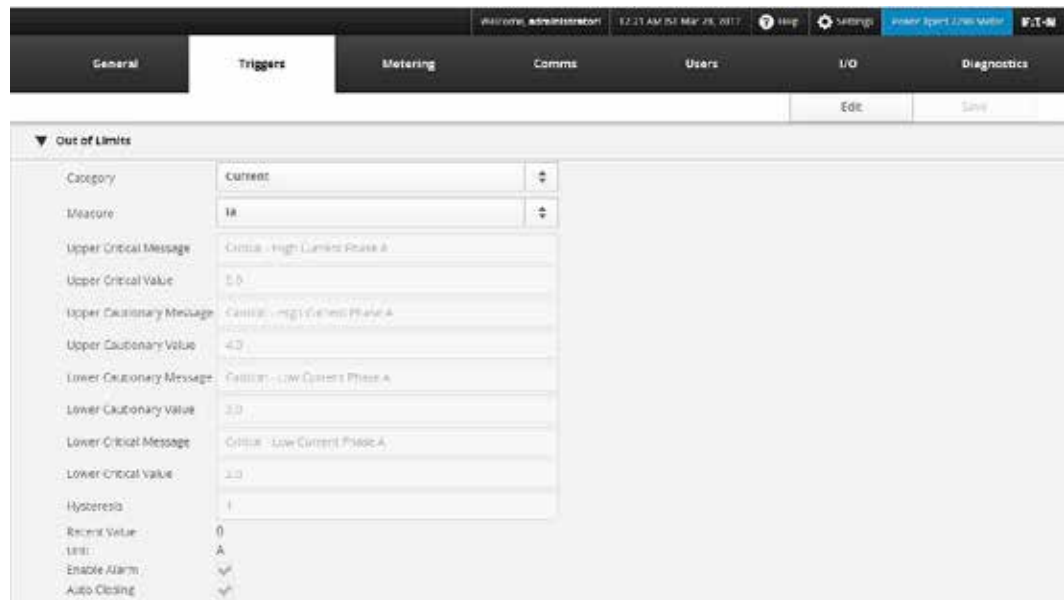
You can use the **Out of Limits Triggers** page to set hi and low cautionary and critical alarms for a wide range of electrical parameters (see page “Triggers” on page 9-12 for a complete list of parameters). For a detailed discussion of triggers, see page “Triggers” on page 9-12. Triggers can cause the following actions:

- An event is added to the event log, and can be seen in the **Timeline** screen.
- An event indicator will appear on the Timeline tab.



- The event information can be sent to one or more recipients as an e-mail message.

### The Out of Limits Page



In addition to setpoints and alarm messages, you can also set the hysteresis. This is set as a percentage, and is used to dampen “noise” events caused by a value bouncing back and forth across a set point.

Out of Limits Edit Page

Out of Limits	
Category	Current
Measure	Ia
Upper Critical Message	Critical - High Current Phase A
Upper Critical Value	5.0
Upper Cautionary Message	Caution - High Current Phase A
Upper Cautionary Value	4.0
Lower Cautionary Message	Caution - Low Current Phase A
Lower Cautionary Value	3.0
Lower Critical Message	Critical - Low Current Phase A
Lower Critical Value	2.0
Hysteresis	1
Recent Value	0
Unit	A
Enable Alarm	<input checked="" type="checkbox"/>
Auto Closing	<input checked="" type="checkbox"/>

Alarm on Value

Use the **Alarm on Value** page to configure device, option card, or communications status event triggers. You can configure if such events are to be treated as alarms, what the alarm levels are, the messages associated with the events, the limit values, and if the alarms are to be auto-closing. These alarms include:

- Restart is pending
- Modbus RTU communications failure
- Alarms based on the state of digital inputs.

Alarm on Value Page

Alarm on Value	
Category	Discrete IO
Measure	Digital Input 1
Limit Value	Closed
Alarm Message	Digital Input 1 Active
Level	Cautionary Level
Enable Alarm	<input checked="" type="checkbox"/>
Auto Closing	<input checked="" type="checkbox"/>

### Waveform Capture

Use the **Waveform Capture** page to configure capture parameters. Parameters you can set are:

**Samples per Cycle:** For the PXM 2280 you can choose between 32 and 64 samples and for the PXM 2290 you can choose either 32, 64, 128, 256, or 512 samples.

**Cycles per Capture:** This depends on the **Samples per Cycle** setting. The following table lists the relationship between these settings (at 60 Hz):

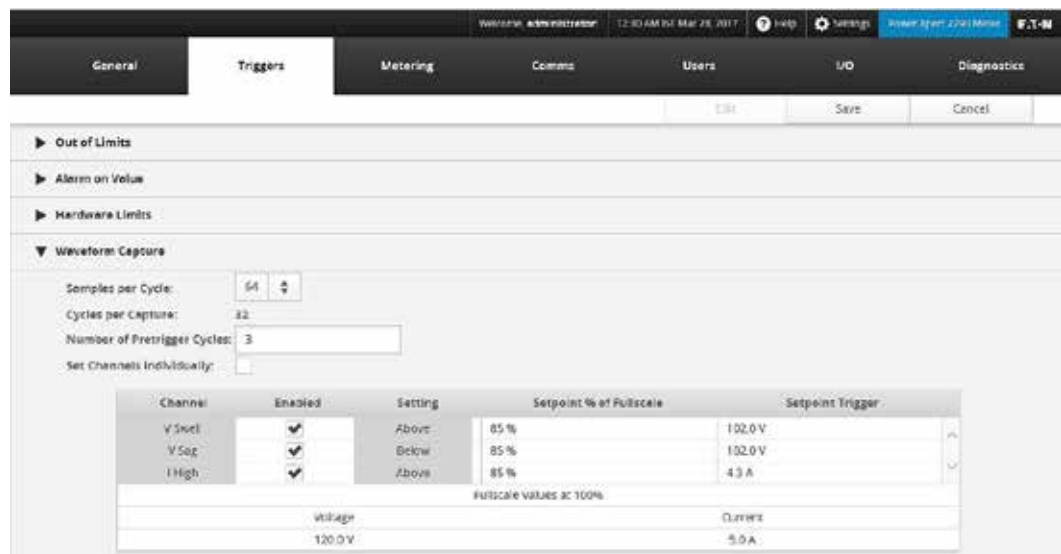
Samples per Cycle	Cycles per Capture
32	64
64	32
128	16
256	8
512	4

**Number of Pretrigger Cycles:** This is an integer up to the number of **Cycles per Capture** minus one.

**Set channels individually:** When selected, the channels list expands to allow you to select individual sag and swell values for each voltage line-to-neutral channel as well as high current values for each phase. Otherwise, you can select general voltage sag and swell voltage values and a general high current value for all phases.

**Trigger Settings:** To set an individual sag, swell, or high value, first select the check box in the **Enabled** column. Next, enter the setpoint value either as a percentage of full scale or as specific voltage or current value. Regardless of which you choose to enter, the meter will calculate the value for the remaining column.

### Waveform Capture Page



## Metering Screen

### Demand

The **Demand** page allows you to select either a fixed window or sliding window and the respective intervals in minutes. A fixed window setting allows you to select one interval period. For example, if 15 minutes is selected, the demand calculation will be performed and the demand values will be updated every 15 minutes.

With a sliding window setting, the PowerXpert Meter provides a rolling average; you select the interval period and the subinterval period. For example, if you select 15 minutes as the demand interval and 5 minutes as the subinterval, the demand will calculate every 5 minutes using the 3 subinterval values ( $15 = 5 \times 3$ ).

### Fixed Settings

The screenshot shows the 'Metering' tab in the web interface. Under the 'Demand' section, the 'interval type' is set to 'Fixed' and the 'Total interval' is set to '15 minutes'. The interface includes a top navigation bar with 'General', 'Triggers', 'Metering', 'Comms', 'Users', 'I/O', and 'Diagnostics'. A status bar at the top right shows 'Welcome, administrator!', '12:40 AM EDT Mar 28, 2017', and 'PowerXpert 2270-Web'. Buttons for 'Save' and 'Cancel' are visible at the bottom right of the settings area.

### Sliding Settings

The screenshot shows the 'Metering' tab in the web interface. Under the 'Demand' section, the 'interval type' is set to 'Sliding', the 'Total interval' is set to '60 minutes', and the 'sub interval' is set to '30 minutes'. The interface includes a top navigation bar with 'General', 'Triggers', 'Metering', 'Comms', 'Users', 'I/O', and 'Diagnostics'. A status bar at the top right shows 'Welcome, administrator!', '12:41 AM EDT Mar 28, 2017', and 'PowerXpert 2270-Web'. Buttons for 'Save' and 'Cancel' are visible at the bottom right of the settings area.

## Comms Screen

Under **Comms**, you can set the serial Ethernet/LAN settings, the e-mail settings (including the mail server and recipients), as well as the setup parameters for SNMP. See Chapter 11 for detailed information about security best practices.

### Com 2 Setup

You can set the protocol, Modbus address, baud rate, response delay, parity, and stop and data bits for the RS-485 serial connection. The protocol is selectable between Modbus RTU, Modbus ASCII, or DNP. See Chapter 11 for detailed information about security best practices.

## Com 2 Setup Page

The screenshot shows a web interface for configuring a meter. At the top, there is a navigation bar with tabs for General, Triggers, Metering, Comms, Users, I/O, and Diagnostics. The 'Comms' tab is selected. Below the navigation bar, there are buttons for 'Save' and 'Cancel'. The main content area is titled 'Com 2 Setup' and contains the following fields:

Protocol	Modbus (RTU)
Address	2
Baud	19200
Response Delay	2 msec
Parity	None
Stop Bits	1
Data Bits	8

Below the 'Com 2 Setup' section, there is a collapsed section titled 'Ethernet/LAN Setup'.

The **Ethernet/LAN Setup** page provides all of the TCP/IP communications settings. You have two choices for configuring the meter:

- Fixed (static) IP address
- DHCP which resolves to a fixed IP address

Eaton does not recommend using a DHCP setup that can randomly assign an IP address from a pool of possible addresses. Rather, if you use DHCP you should use a scheme wherein the router or layer 3 switch assigns a fixed IP based on the MAC address of the meter. Thus, at every reboot or power-up, the meter will always be granted the same IP address. This method is sometimes called “static DHCP”.

Eaton recommends using a method that assigns a fixed IP address for two reasons:

- Software that may connect to and monitor the meter, such as PowerXpert Software, accesses the meter via its IP address, and therefore if the meter loses power and receives a new IP address on power-up, the connection from the software to the meter will be broken.
- Users will also generally navigate to the meter’s web pages via the meter’s IP address. If the meter is assigned a different IP on power-up or reboot via DHCP, users won’t know the new address and won’t be able to access the meter.

**Note:** After you’ve assigned an IP address, it is visible from the front panel via the IP menu.



## Ethernet/LAN Setup Edit

Welcome, administrator | 12:14 PM EDT Mar 28, 2017 | Help | Settings | Power System 2000 Meter | E.T.M.

General | Triggers | Metering | **Comms** | Users | I/O | Diagnostics

Com 2 Setup

Ethernet/LAN Setup

This page may be used to change various network configuration items on the gateway. To save the changes, click Save. Click Cancel to cancel any unsaved changes and revert to the values stored in the gateway. Any applied changes will take effect immediately, so if the IP address changes you'll need to connect your browser to the new address.

Account:

Who To Contact:

Asset ID:

**IPv4 Settings:**

MAC ID:

Link Status:

IP Address:

IP Address:

Subnet Mask:

In addition to network settings, you can also add account contact , and asset ID information.

### E-mail Setup

The PXM 2000 meter provides a highly configurable capability to report on meter activity via e-mail. You can configure up to 10 separate recipients. If you are unsure as to how to do this, ask your information technologies group or the person in charge of your mail server for assistance. You can configure:

- The SMTP server, including the server and account information. You'll need the following information from your system administrator to enter under Global e-mail configuration. The meter cannot communicate using the Microsoft exchange e-mail protocol.
  - A valid e-mail account (user name and password).
  - The address of the SMTP mail server.
- The e-mail address of the account. Each meter can be assigned a separate e-mail account. This allows you to easily determine which meter sent the e-mail through its address.
- E-mail triggers. The meter will send emails in response to any event trigger that has been enabled for e-mail, and this set includes a core set of hardware and communications failure triggers that you can also select. The contents of this list are dependent on the option card installed in the meter.
- Recipient specific settings for up to 10 e-mail recipients. This includes settings for sending emails when an event occurs and/or clears and for sending periodic status emails. You can configure the e-mail address for each recipient by selecting a recipient through the Recipient drop-down list then configuring the recipient's address information by clicking the **Edit** button.

The following example is typical of the status e-mails sent by the meter:

```
PowerXpert Meter Status Report
Device=PowerXpert Meter 2000 Gateway Card
Time=09/24/2009 00:00:48
Serial Number=0036216826
MAC=00:20:85:00:FF:EA
Location=Meter Location
Model=PXM2270
```

The e-mail also includes two comma-separated files containing a trend log file with the last 1000 entries and an event log file with the last 100 entries.

### E-mail Setup Page

E-mail notifications can be configured individual for each recipient. Use the Recipients drop-down to select which profile to configure. Select Edit in the Action Bar at the top of the page. You can then make any changes to the email settings configuration. Choose Save in the Action Bar at the top of the page when you are done making changes to this recipient profile. The Test SMTP Server Connection button will test your settings and report any errors directly on the E-mail Setup page.

### SNMP Setup

The meter provides authentication configuration for both SNMP version 1 and version 3, and you can enable/disable either or both protocols. You can also specify up to six trap recipients. You can review/download the various supported management information bases (MIBs) by clicking **Help** and then clicking **Protocol Documents**.

Note that the requirements for the two protocols are different. For SNMP 1 you are only required to provide a read-only and read-write community string. However, SNMP 3 requires separate user names and pass phrases (passwords) for both read and write privileges. Consult your SNMP software documentation for more information.

See Chapter 11 for detailed information about security best practices.

## SNMP Setup Edit Page

The screenshot displays the 'SNMP Setup' configuration page. It is divided into two main sections: 'SNMPv1 Configuration' and 'SNMPv2 Configuration'. The 'SNMPv1 Configuration' section includes a checkbox for 'Enable SNMP v1', a 'Read-only community string' field with the value 'public', and a 'Read/Write community string' field with a masked value. The 'SNMPv2 Configuration' section includes a checkbox for 'Enable SNMP v3', a 'Read-only username' field with the value 'admin', a 'Read-only passphrase' field with a masked value, a 'Read/Write username' field with a masked value, a 'Read/Write passphrase' field with a masked value, a 'Trap recipients community string' field with the value 'public', and a 'Trap recipients IP' field.

**BACnet/IP**

The PXM 2080 and PXM 2090 meters have support for communications via BACnet/IP, including:

- Support for BBMD for connecting across BACnet/IP routers.
- Limited BACnet router capability to create a “virtual subnet” that presents the network card, meter and option card as separate, virtual BACnet devices. The virtual subnet must be assigned a unique network number within your BACnet/IP network.
- Convenience features to automatically create instance numbers (if you wish to assign a base ID for this purpose).

The meter can also generate an EPICS for the selected virtual device. See the meter's **Help** page to generate the file.

Consult your BACnet/IP administrator for information concerning network numbers and BBMD setup information before setting the following those parameters.

The initial setup screen requires that you first set a Routed network number. The meter presents the meter and the option card as two separate, virtual devices on a virtual BACnet/IP network that is routed to via the gateway card. As such, you must provide the number that will be assigned to the virtual network.

### BACnet/IP Setup Page

The screenshot displays the BACnet/IP Setup Page with the following configuration fields:

- Identification:**
  - Base ID for Auto-assign: 15
  - Auto-assign network card ID:
- Network Card:**
  - Device ID (object-identifier): 16
  - Device object name: PNM 2000 0020 B5FC F7E7
  - BACnet/IP MAC address: 00-C0-00-00-BACB
- BBMD:**
  - IPv4 IP address for foreign registration: [empty]
  - BBMD time to live (seconds): 360
- Virtual Routing:**
  - Routed Network Number: 1
  - Auto-assign virtual device IDs:
  - MAC template for virtual devices: 1.1.1.1.1.1

After setting the Routed network number, the meter will provide a setup page in which you can set the following:

**Identification:** These fields provide the unique identifiers for the gateway card itself. They include:

- **Base ID for Auto-assign:** You can set a base ID number, and the meter will use this number to automatically generate the object-identifier for the network card, the meter itself, and the option card. To enable the Base ID method, select the **Auto-assign network card ID** check box.
- **Device ID (object-identifier):** This is the address of the device on the network. You can manually set the number in a range of 1 to 4194302; however, **Auto-assign network card ID** must not be selected in order to edit this field.
- **Device object-name:** This is an automatically generated string, designed to be unique (it must be unique within your network). You can modify the string if required.
- **BACnet/IP Mac address:** This is not user-settable, and is provided as reference only.

### BBMD

If you're using a BBMD to connect your meter to another subnet in your BACnet/IP network, you must also define the BBMD IP address to register with the BBMD on the remote subnet. You can also set the **BBMD time to live** value. The default for the time to live is 360 s, and you can set any value (in seconds) from 30 to 65534.

### Virtual Routing

In addition to the **Routed network number**, you must designate **if the virtual device IDs** (object-identifiers) for the meter and the option card will be automatically assigned. Finally, you can set an IP address to be used as a template in generating the separate **BACnet/IP Mac addresses** for the meter and option card.

### Routed Device Settings

Depending on the settings under **Virtual Routing**, you can use these fields to either specify the **Device ID (object-identifier)** or allow the meter to automatically select this. You can also specify the **Device object-name** for each of the virtual devices. If an option card is installed, you can select its virtual device through the drop down list.

#### BACnet/IP Setup Page

The screenshot shows the BACnet/IP Setup Page with the following fields and values:

- Ident/Ladder**
  - Base ID for Auto-assign: 15
  - Auto-assign network card ID:
- Network Card**
  - Device ID (object-identifier): 14
  - Device object name: PXM 2000 0C20 B5FC F7E7
  - BACnet/IP MAC address: 00-00-00-00-0A-0B
- BEMD**
  - IPv4 IP address for foreign registration:
  - BEMD time to live (seconds): 360
- Virtual Routing**
  - Route Network Number: 1
  - Auto-assign virtual device IDs:
  - MAC template for Virtual Devices: 1.1.16&D

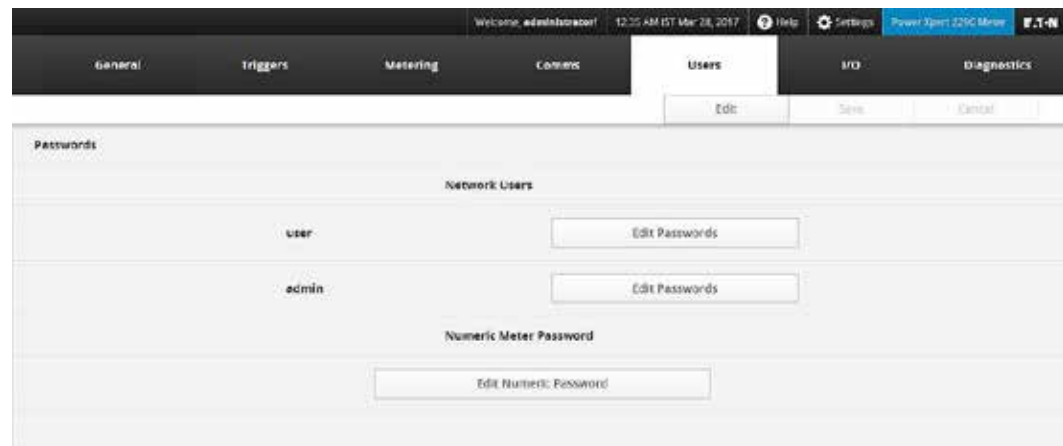
## Users Screen

### Passwords

See Chapter 11 for detailed information about security best practices. The PXM 2000 meter has two built-in accounts and an additional password for access to data deletion functions from the meter front panel. You cannot change the name of any of the accounts, but you may change the password.

- The **Numeric Meter Password** account provides access to configuration settings and resets from the meter front panel. This can be configured only from this page. This must be a four-digit password. The default is 5555, which disables the need for a password to change configuration settings or resets. You must have admin privileges to change this.
- The **user** account is for access to the meter web pages only. Someone logged in as user cannot change any settings. The default password is user.
- Use the **admin** account to change settings or delete data. The default password is admin.

### Passwords



### Access Control

You can additionally limit access to the meter in the following ways:

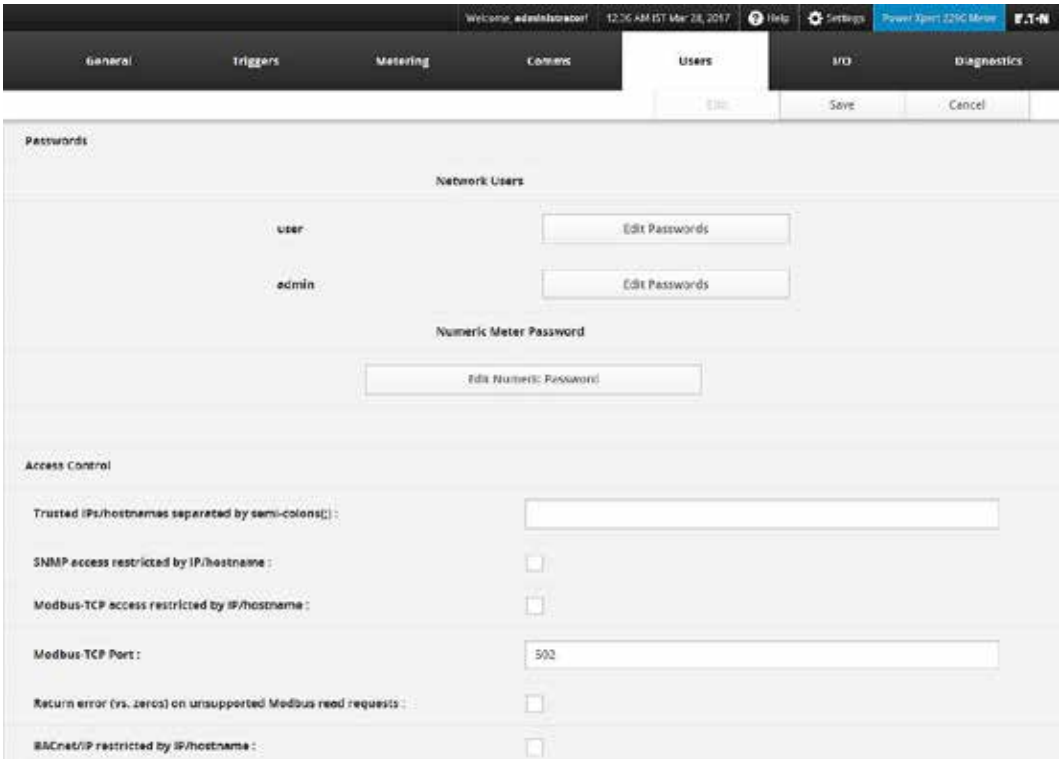
- You can restrict either SNMP or Modbus access to the meter to a set of trusted IP addresses or host names. You can have separate sets of trusted machines for either setting.
- You can set the ports for Modbus, HTTP, or HTTPS.
- You can require the HTTPS for web access to the meter.

See Chapter 11 for detailed information about security best practices.

You can also post a System Use Notification. Such a notification may be required for meters owned by branches of the U.S. Government and should provide privacy and security notices consistent with applicable federal laws, Executive Orders, directives, policies, regulations, standards, and guidance. Typically, such notices state that users are

accessing a U.S. Government information system, system usage may be monitored, and unauthorized use of the system is prohibited. Refer to your system administration group for guidance about exact wording.

Access Control



## I/O Cards

The PXM 2000 meter supports the following types of option cards:

- Digital Output (Relay Contact) / Digital Input Card.
- Pulse Output (Solid State Relay Contacts) / Digital Input Card.
- 1 mA Output Card.
- 20 mA Output Card.

Electrical specifications and installation information for each card is covered in Chapter 7.

### Digital Output (Relay Contact) / Digital Input Card

The Relay Output/Digital Input Option Card has:

- Two relay contact outputs for load switching.
- Two wet/dry contact sensing digital inputs.
- Accumulators in the software which count the transitions of the **Inputs** and **Outputs**.

A typical use of this card is to monitor the status of circuit breakers or relays.

**Important:** First use the **Hardware Limits** page found under the **Triggers** tab to set up the limits you want to assign to an **Output**.

On the PXM 2260/2270/2280/2290 you can use the Hardware Limits to configure up to eight limits. When configuring this page, keep the following in mind:

- Channel selects the electrical parameter through the **Set Limit Channel** dialog box. The various electrical measurements from the meter are grouped under the categories of **Demand**, **Reading**, and Total Harmonic Distortion (**THD**).
- The **Enabled** check boxes activate the **Above** and **Below** settings. When active, the output is triggered for when that condition occurs. Once active, you can click any of the **Setpoint** and **Hysteresis** fields and edit their contents.

### Hardware Limits Edit Page

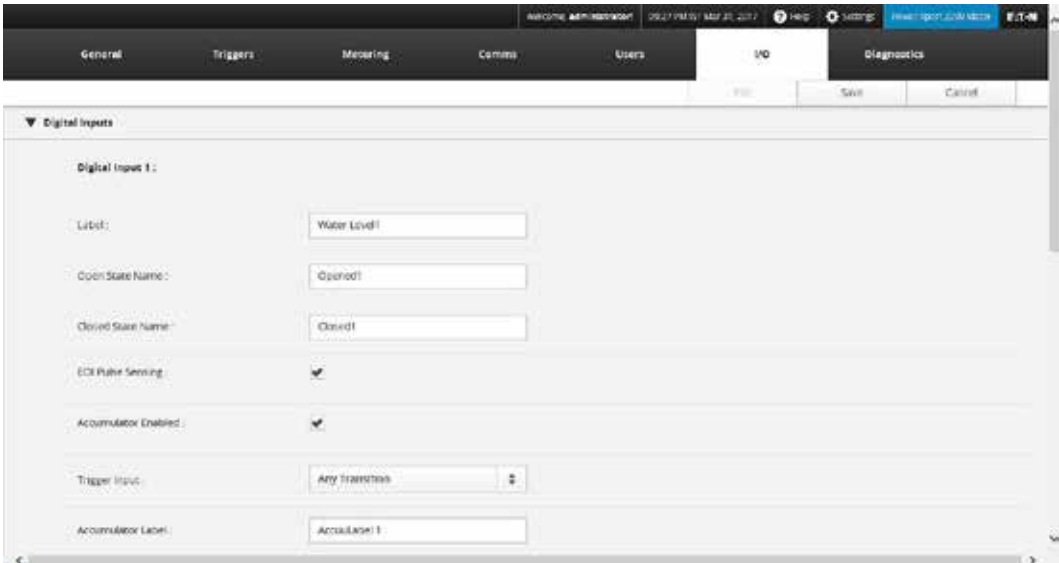
ID	Channel	Enabled	Setting	Setpoint % of Fullscale	Setpoint Primary	Setpoint % of Hysteresis	Alarm with Primary
1	Frequency	<input checked="" type="checkbox"/>	Above	120 %	72.0 Hz	100 %	60.0 Hz
2	Demand (A)	<input checked="" type="checkbox"/>	Below	80 %	48.0 Hz	90 %	54.0 Hz
3	Demand (W)	<input checked="" type="checkbox"/>	Above	120 %	147.6	100 %	135.3
4	Demand Forward (Watts)	<input checked="" type="checkbox"/>	Below	80 %	95.4	90 %	110.7
5	Total PF	<input checked="" type="checkbox"/>	Above	120 %	147.6	100 %	135.3
6	Vrms	<input checked="" type="checkbox"/>	Below	80 %	95.4	90 %	110.7
7	THD (V%)	<input checked="" type="checkbox"/>	Above	120 %	147.6	100 %	135.3
8	Demand (C)	<input checked="" type="checkbox"/>	Below	80 %	95.4	90 %	110.7
9	I	<input checked="" type="checkbox"/>	Above	120 %	6.0 A	100 %	5.5 A
10		<input checked="" type="checkbox"/>	Below	80 %	4.0 A	90 %	4.5 A

You can use the **Digital Input** page to configure the relay inputs. You can assign labels for the open and closed states as well as the accumulator. You can also disable/enable the accumulator as well as the set the state of the **Trigger Input: Disabled, Open to Close, Close to Open, or Any Transition**.



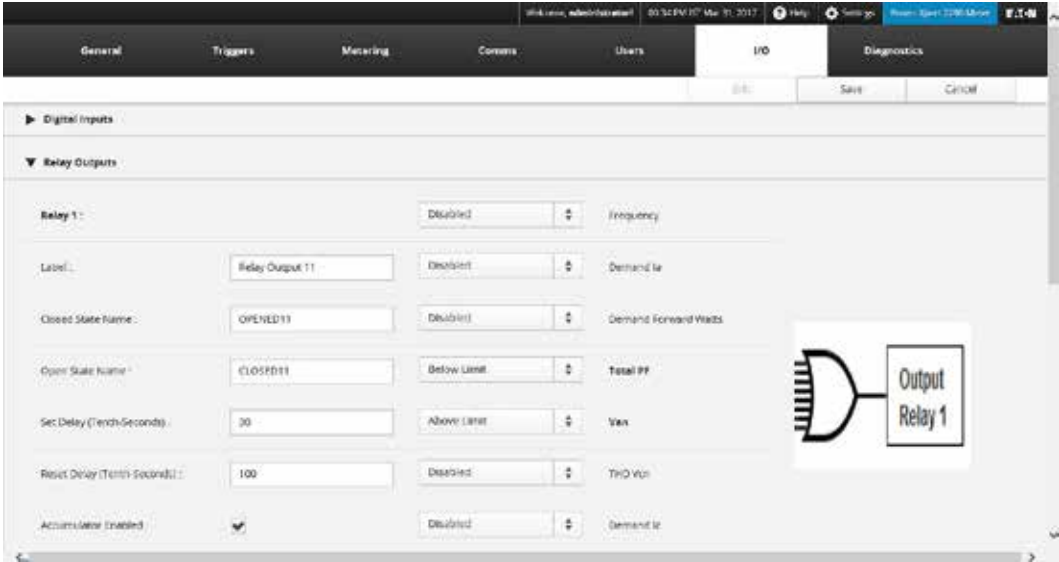
You can use the digital inputs to accept pulses from gas or water meters. The divisor is a compression factor you can use to keep the results within the meter’s ability to report. Without the compression factor, the accumulator might roll over either too much or too rapidly and lose history.

Digital Input Page



Use the **Relay Outputs** page to set the output behavior of the relays. The count reflects the number of times the relay has energized. (You can define the labels, state names, operating delays, and configure the accumulator. The **Divisor** is a compression factor for the accumulator, and you can select 1, 10, 100, 1000, 10000, and 100000. For example, if you choose a **Divisor** of 10, each time 10 state changes occur, the accumulator count will increment by 1.

Relay Output Setup Page



## Pulse Output (Solid State Relay Contacts) / Digital Input Card

This option card has:

- Four pulse outputs via solid state contacts.
- Four wet/dry contact sensing digital inputs.

Accumulators in the software count the pulses of the **Inputs** and **Outputs** (the accumulators are shown on the I/O page). Typically, this card is used in a sub-metering application where a pulse output is needed. The **Input Accumulators** (which perform the same function as the inputs on the relay card) allow you to count the pulses from another device, for example, a KYZ module or another meter. The **Output Accumulators** allow you to count the pulses being output by the card.

For inputs, you can configure up to four inputs for your card, and assign a **Label**, **Open State Label**, and **Closed State Label** for each. You can also set labels and other information for **Accumulators** for the **Inputs**. Triggers can be set as **Disabled**, **Open to Close**, **Close to Open**, or on **Any Transition**.

Accumulators have both a compression factor and a device output ration setting. The divisor is a compression factor for the accumulator, and you can select 1, 10, 100, 1000, 10000, and 100000. For example, if you choose a **Divisor** of 10, each time 10 state changes occur, the accumulator count will increment by 1. The **Accumulator Kt** is the output ratio from the device that is being input into the meter. For example, if you have a KYZ module that is outputting a pulse every 1.8 kWh, you would set the **Accumulator Kt** to be the value of the KYZ; in this case either 1.8 or a ratio of that number.

The Set Limit Channel dialog box associates a meter measure, like kW Demand or Phase B current, with each of the outputs, and gets a pulse train whose rate reflects the present value of that measure.

### Digital Input Page

The screenshot shows a web interface for configuring digital inputs. The top navigation bar includes tabs for General, Triggers, Metering, Comm, Users, I/O, and Diagnostics. The I/O tab is active, and the 'Digital inputs' section is expanded. The configuration for 'Pulse Input 1' is shown with the following fields:

- Label:** Pulse Input 1
- Open State Name:** Closed 1
- Closed State Name:** Opened 1
- Accumulator Enabled:**
- Trigger Input:** Close To Open
- Accumulator Label:** kWh 11
- Divisor:** 10

You can set up to four outputs for your card. You can define the labels, state names, and configure the accumulator. You can also specify the phase source and measurement.

Accumulators have both a compression factor and a device output ration setting. The divisor is a compression factor for the accumulator, and you can select 1, 10, 100, 1000, 10000, and 100000. For example, if you choose a **Divisor** of 10, each time 10 state changes occur, the accumulator count will increment by 1. The **Accumulator Kt** is the

output ratio from the device that is being input into the meter. For example, if you have a KYZ module that is outputting a pulse every 1.8 kWh, you would set the **Accumulator Kt** to be the value of the KYZ; in this case either 1.8 or a ratio of that number.

### Pulse Output

The screenshot shows the 'I/O' configuration page in a web browser. The 'Pulse Outputs' section is expanded, showing configuration for 'Pulse Output 1'. The fields are as follows:

Field	Value
Label	Pulse Out 1
Pulse Source	None
Metering	Watt hours, Capable
Accumulator Kt	10
Accumulator Enabled	<input checked="" type="checkbox"/>
Divisor	10

### Option Cards - 0-1 mA Analog Output Card and 4-20 mA Output Card

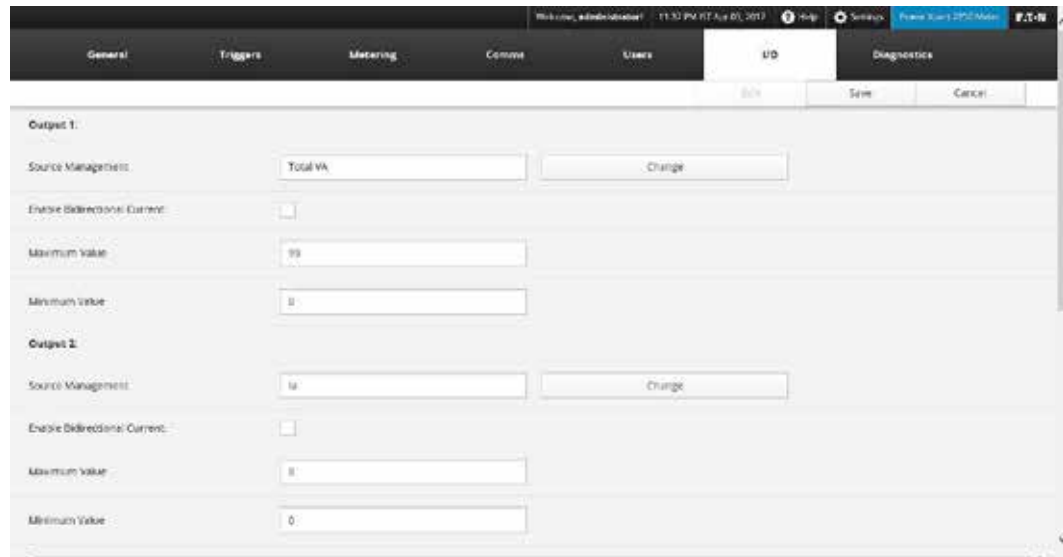
The 0-1 mA Output Option Card is an analog communication card, which transmits a standard, bidirectional 0-1 milliamp signal. Bidirectional is useful when you want the output (-1 to 1 V) to reflect the sign of a measure that goes negative (like VAR). Although you can configure offset-from-zero limits, normally you should set the high and low limits to have the same absolute value to keep it symmetrical.

The 4-20 mA card transmits a standard, unidirectional 4-20 milliamp signal. An example use of either card is in enabling the meter to communicate with an RTU (Remote Terminal Unit).

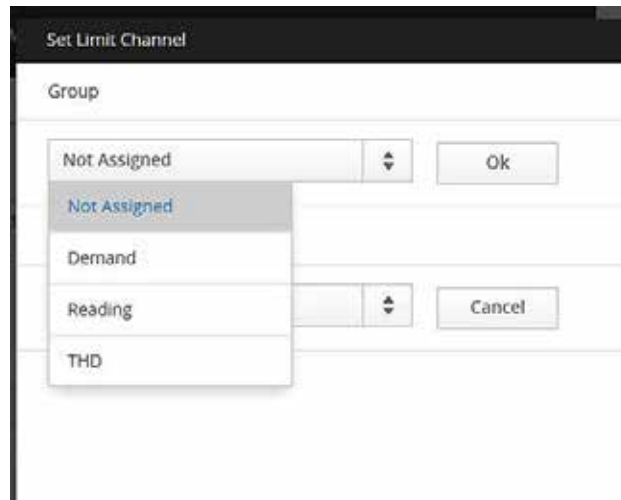
Setup for the cards is almost identical. The only difference is that the 4-20 mA is unidirectional.

The **Analog Output** page provides access to configuration parameters for each of the card outputs. Each output can be assigned to one of any of the electrical parameters in the **Demand**, **Reading**, or **THD** groups. You can set the **Minimum** and **Maximum** values as well as enable **Bidirectional Current** (0-1 mA card only).

### Analog Output Page



### Set Limit Channel



## Diagnostics Screen

The Diagnostics Screen provides information about the number of subscriptions by instances of PowerXpert Software (PXS) and MODBUS TCP clients and allows access to the system log.

### System Log

The system log shows system events, such as changes to settings, firmware updates, and meter restarts. Each event carries a time-and-date stamp and a severity level. You can print the log by clicking the **Print** button; however, the printout contains a screen image, not the entire log. To print an entire log you may need to use the scroll bar to reposition the log in the window and print it in sections.

**Note:** You can tell who has made configuration changes to the meter from the log as it not only logs changes but the IP address of the computer from which the changes were made.

### System Log

The screenshot shows the Diagnostics screen with the following statistics:

- Number of PXS Subscriptions: No subscriptions
- Number of MODBUS TCP Clients: No MODBUS TCP clients

The System Log table contains the following data:

Index	Date	Time Time(seconds)	Severity	Value	Changed From
1	03/20/2017	11:50:35.360516	Informational	Rebooting card	
2	03/20/2017	11:56:42.508505	Cautionary	Scheduled a F90M2000 Reboot after meter module data is updated	
3	03/20/2017	11:57:47.565212	Informational	Rebooting card	
4	03/20/2017	12:08:00.765902	Informational	Rebooting card	
5	03/20/2017	12:26:02.543401	Informational	BACnet-IP configuration changed	admin@10.234.65.108 (Web-Services)
6	03/20/2017	12:26:14.397544	Informational	BACnet-IP configuration changed	
7	03/20/2017	12:26:16.261355	Informational	BACnet-IP configuration changed	
8	03/20/2017	12:30:25.134902	Informational	BACnet-IP configuration changed	admin@10.234.65.108 (Web-Services)
9	03/20/2017	12:30:28.228909	Informational	BACnet-IP configuration changed	
10	03/20/2017	12:30:30.462406	Informational	Reset command: Restart the Meter	
11	03/20/2017	12:32:36.412517	Informational	BACnet-IP configuration changed	
12	03/20/2017	12:32:37.611546	Informational	BACnet-IP configuration changed	
13	03/20/2017	12:38:33.219013	Informational	Meter module	admin@10.234.65.108 (Web-Services)
14	03/20/2017	12:38:33.246409	Informational	Meter module	admin@10.234.65.108 (Web-Services)
15	03/20/2017	12:38:33.260686	Informational	Meter module	admin@10.234.65.108 (Web-Services)
16	03/20/2017	12:38:33.270466	Informational	Meter module	admin@10.234.65.108 (Web-Services)
17	03/20/2017	12:38:33.280547	Informational	Meter module	admin@10.234.65.108 (Web-Services)
18	03/20/2017	12:38:33.287843	Informational	Meter module	admin@10.234.65.108 (Web-Services)
19	03/20/2017	12:38:33.294915	Informational	Meter module	admin@10.234.65.108 (Web-Services)
20	03/20/2017	12:38:33.303486	Informational	Meter module	admin@10.234.65.108 (Web-Services)



# 11 SECURING THE POWER XPERT METER

This chapter outlines how to harden network security for the PXM 2000 Series meter. The meter communicates via Ethernet and uses the network security mechanisms outlined in this chapter.

## Inbound/Outbound TCP/IP Ports

Access to the PXM 2000 Series meter is restricted by ports and can be restricted by trusted hosts. The following lists the ports open by default on the meter:

Port	Protocol
20 (TCP)	FTP Control
21 (TCP)	FTP Data
80 (TCP)	HTTP
161 (UDP)	SNMP
162 (UDP)	SNMP Trap
443 (TCP)	HTTPS
502 (TCP)	Modbus TCP
1900/7014 (TCP)	UPnP
47808 (UDP)	BACnet IP

You may change the port numbers for HTTP, HTTPS, Modbus TCP, and BACnet/IP as outlined on Chapter 11.

## Trusted Hosts

Trusted host restrictions can be applied to SNMP, Modbus TCP, and FTP. However, trusted host restrictions are not applied to ping, HTTP, HTTPS, or other protocols.

## Hardening Security for the PXM 2000 Series Meter

Eaton's recommendations for hardening the meter, in decreasing order of importance, are (see Chapter 11 for details on all):

- Change the Admin password from the default.
- Change the User password from the default.
- Change the Meter password from the default.
- Require HTTPS only.
- Change the SNMP v1 and v3 user names and passwords from their defaults (public, private).
- Set the trusted host list for SNMP and Modbus TCP.

- Disable SNMP v1 if not needed. Use SNMP v3 only if you can.
- Disable SNMP v3 if not needed.
- Remove all the SNMP trap recipients if traps are not needed.
- Remove all e-mail recipients if e-mail is not needed.
- Change the default port for Modbus TCP.
- Change the default port for HTTP and HTTPS.

## Passwords and Accounts

The PXM 2000 Series meter provides two user accounts for network access: a user account and an admin account. The user account provides read-only access to all of the pages in the web interface while the admin account provides that plus the ability to modify any of the meter settings. Meter users should only be given access through the user account. The admin account should be reserved for use by only those people who are authorized to change meter settings.

The front panel account provides administrative access as well, and you can use it to change any meter settings directly from the front panel. The password for this account is also mentioned in the following table.

**IMPORTANT! YOU SHOULD CHANGE THE PASSWORDS OF ALL ACCOUNTS DURING THE COMMISSIONING PROCESS. WHEN CREATING NEW NETWORK PASSWORDS, USE A COMBINATION OF LETTERS (MIXED CASE), NUMBERS, AND SPECIAL CHARACTERS.**

### Default Passwords

The following are the factory default password values for the three meter accounts:

Account Type	User Name	Default Password	Description
Network	user	user	Can access and view all web pages on the meter.
Network	admin	admin	Can access and view all web pages as well as change all settings for the meter.
Front Panel	not applicable	5555	This password disables password checking for the front panel. Unless this is changed, anyone with access to the front panel can change any electrical parameters for the meter.

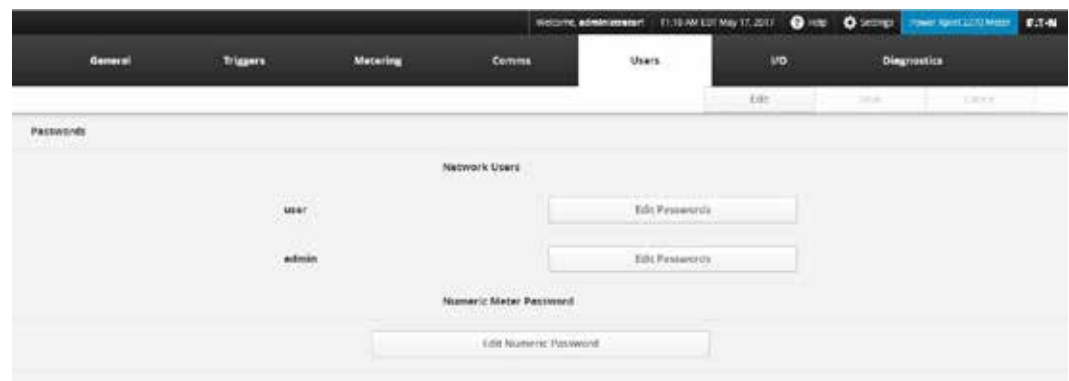
### To change the passwords via the web interface:

1. Access the meter home page. You may be challenged for the admin account user name and password.



2. Click the **Settings** tab.
3. Navigate to the **Users > Passwords** page.
4. Click the **Edit Password** button for each of the **Network** users and change the default values. If you didn't log in earlier, you must enter the admin account user name and password.
5. You must enter the new password twice and both entries must match to change the new password.
6. Click **Save**.
7. Click the **Edit Numeric Password** button and change the default four digit numeric password.
8. You must enter the new four-digit password twice and both entries must match to change the password.
9. Click **Save**.

### User Setup Page for Changing Passwords



### Recommended Meter Access Control Settings

The following are “best practice” recommendations for PowerXpert Meter security settings. You should adopt these to harden the security of the meter.

#### To access the PXM 2000 Series security settings:

1. Access the meter home page. You may be challenged for the admin account user name and password.
2. Click the **Settings** tab.
3. Navigate to the **Users > Access Control** page.
4. Click the **Edit** button.
5. If you did not log in earlier, you must enter the admin account user name and password.

The following comprise Eaton's recommendations for Access Control best practices:

#### Trusted IPs/hostnames separated by semi-colons(;

If you are using SNMP or Modbus TCP, you should specify the IP addresses or host names for one or more computers that are to be allowed access to the meter via SNMP or Modbus TCP and then enable the trusted host feature for that protocol. This provides

an added measure of security. You should also audit this list periodically and ensure any unused host names are removed.

**Note:** SNMP and Modbus/TCP-IP access is restricted to trusted host names by default; therefore, an empty list of IP addresses/host names means that meter will not respond to SNMP or Modbus/TCP-IP.

**SNMP access restricted by IP/host name:**

Restricting SNMP access to a set of trusted hosts is a best practice. As this is enabled by default, Eaton strongly recommends that you leave this enabled.

**Modbus/TCP-IP access restricted by IP/host name**

Restricting Modbus access to a set of trusted hosts is a best practice. As this is enabled by default, Eaton strongly recommends that you leave this enabled.

**Modbus-TCP Port:**

This is set to 502 by default. Changing this provides an added measure of security.

**BACnet/IP restricted by IP/hostname:**

Restricting BACnet/IP access to a set of trusted hosts is a best practice. As this is enabled by default, Eaton strongly recommends that you leave this enabled.

**BACnet/IP Port:**

This is set to 47808 by default. Changing this provides an added measure of security.

**FTP restricted by IP/hostname:**

Restricting FTP access to a set of trusted hosts is a best practice. As this is enabled by default, Eaton strongly recommends that you leave this enabled. Note that FTP access is read-only.

**HTTP Port:**

This is set to 80 by default. Changing this provides an added measure of security. Should you change this, users must append the port number (after a colon) to the meter URL.

**HTTPS Port:**

This is set to 443 by default. Changing this provides an added measure of security. Should you change this, users must append the port number (after a colon) to the meter URL.

**Require HTTPS:**

Eaton strongly recommends that you enable this setting. When enabled, HTTP access is disabled and all communications with the meter web server must be through HTTPS. Note that HTTPS may provide slower performance loading web pages than HTTP.

## Access Control Edit Page

Access Control	
Trusted IPs/hostnames separated by semi-colons:	<input type="text"/>
SNMP access restricted by IP/hostname:	<input checked="" type="checkbox"/>
Modbus-TCP access restricted by IP/hostname:	<input checked="" type="checkbox"/>
Modbus-TCP Port:	<input type="text" value="502"/>
Return error (vs. zero) on unsupported Modbus read requests:	<input type="checkbox"/>
BACnet/IP restricted by IP/hostname:	<input checked="" type="checkbox"/>
BACnet/IP Port:	<input type="text" value="47808"/>
FTP restricted by IP/hostname:	<input checked="" type="checkbox"/>
HTTP Port:	<input type="text" value="80"/>
HTTPS Port:	<input type="text" value="443"/>
Require HTTPS:	<input type="checkbox"/>
System Use Notification:	<input type="text"/>

## SNMP Hardening

As noted in the previous section, you can specify a set of trusted hosts for SNMP. On the SNMP setup page, you can disable one or both versions of the SNMP protocol (the older version 1 or the more secure version 3). You should disable any version you are not using. We recommend using version 3 only if possible as this is more secure. You can also set pass phrases for both the user and admin accounts for both versions of the SNMP protocol.

You can specify a set of trap recipients by either IP address or host name. If you are not using traps, clear these fields.

### To access the PXM 2000 Series meter security settings:

1. Access the meter home page. You may be challenged for the admin account user name and password.
2. Click the **Setup** tab.
3. Navigate to the **Comms > Ethernet/LAN Setup > SNMP Setup** page.
4. Click the **Edit** button.
5. If you didn't log in earlier, you must enter the admin account user name and password.

### SNMP Setup Edit Page

The screenshot shows the 'SNMP Setup' configuration page. It is divided into two main sections: 'SNMPv1 Configuration' and 'SNMPv3 Configuration'.  
 In the 'SNMPv1 Configuration' section, there is a checked checkbox for 'Enable SNMPv1'. Below it are two text input fields: 'Read-only community string' with the value 'public' and 'Read/Write community string' with the value 'private'.  
 The 'SNMPv3 Configuration' section has a checked checkbox for 'Enable SNMPv3'. To its right, the 'Authenticator' is set to 'SHA Privacy AES'. Below this are three text input fields: 'Read-only username' with the value 'user', 'Read-only password' (empty), and 'Read/Write username' with the value 'admin'.

### Accessible Folders

The PXM 2000 Series meter provides user documentation and SNMP MIB files through its web UI. These documents are also available from the meter via a read-only user-accessible folder. This is meant for convenient access to these publicly available files for the PXM 2000 Series meter. This folder, and a description of its contents, are listed below:

Folder Address	Folder Contents
<i>PXM_url_or_IP/docs</i>	User documentation and SNMP MIB files.

#### Example Contents of the docs Folder

The screenshot shows a web browser displaying the 'Index of /docs/' directory. The page title is 'Index of /docs/'. Below the title is a table listing the contents of the directory. At the bottom of the page, the text 'lighttpd/1.4.23-devel-31665' is visible.

Name	Last Modified	Size	Type
Parent Directory/		-	Directory
<a href="#">EATON-OIDS.txt</a>	2009-Nov-05 16:18:13	5.8K	text/plain
<a href="#">EATON-PCD-MIB.txt</a>	2009-Nov-05 16:18:13	19.8K	text/plain
<a href="#">EATON-PWR-MTR-MIB.txt</a>	2009-Nov-05 16:18:13	33.7K	text/plain
<a href="#">EATON-PXG-MIB.txt</a>	2009-Nov-05 16:18:13	17.2K	text/plain
<a href="#">ENTITY-MIB.txt</a>	2009-Nov-05 16:18:13	57.7K	text/plain
<a href="#">ENTITY-STATE-MIB.txt</a>	2009-Nov-05 16:18:13	11.9K	text/plain
<a href="#">ENTITY-STATE-TC-MIB.txt</a>	2009-Nov-05 16:18:13	6.1K	text/plain
<a href="#">PXM2000ug.pdf</a>	2009-Nov-05 16:12:49	6.8M	application/pdf
<a href="#">ug.html</a>	2009-Nov-05 16:12:49	0.3K	text/html

## E-mail Security

The PXM 2000 Series meter can be set to send e-mails whenever an alarm or event occurs or an alarm is cleared. It can also be configured to send periodic status e-mails. Eaton recommends that you should periodically examine this list and remove any e-mail addresses that are no longer required.

To access the E-mail settings:

### To access the PXM 2000 Series meter security settings:

1. Access the meter home page. You may be challenged for the admin account user name and password.
2. Click the **Setup** tab.
3. Navigate to the **Comms > Ethernet/LAN Setup > E-mail** page.
4. Click the **Edit** button.
5. If you did not log in earlier, you must enter the admin account user name and password.

### E-Mail Setup Edit Page

The screenshot shows the 'E-mail Setup' page. At the top, there is a title 'E-mail Setup' with a dropdown arrow. Below the title is a paragraph of instructions: 'This page may be used to change the email configuration for the gateway. Configuration for ten different recipients lists may be applied. Click Done for each recipient to save the changes before moving on to the next recipient. Click Cancel to cancel any unsaved changes and revert to the values stored in the gateway.' Below this is a section titled 'Global email configuration' with a grey background. It contains four input fields: 'SMTP Server', 'Account', 'Password', and 'From'. The 'From' field is pre-filled with 'Power.Xpert.Meter@eaton.com'. Below these fields is a button labeled 'Edit Triggers'. Below the button is a section titled 'Recipient Configuration' with a 'To:' label and an empty input field.

## Root Certificate Authority Installation

Improve the security of your Power Xpert Meter on the Web by installing a root certificate authority (CA). A CA is a trusted third-party organization that issues digital certificates for use with encrypted digital transactions. The digital certificate guarantees that the company holding a certificate is who it claims to be.

You can use the meter without installing a root CA (using http), but the transactions will not be as secure as with the root CA (using https). The performance of the meter is not impacted by using secure transactions.

This section explains root CA installation for:

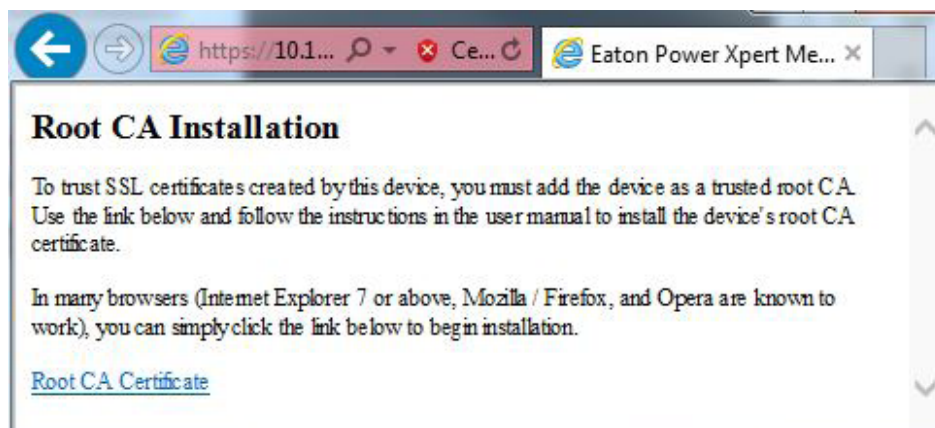
- Microsoft Internet Explorer 11
- Google Chrome
- Mozilla Firefox
- Edge
- Safari

### Installing Root CA with Microsoft Internet Explorer 11

To install a certificate for the Power Xpert Meter with Microsoft Internet Explorer 11:

1. Open the browser and type the IP address of the meter followed by the path “/ca.html” in the address bar. For example: https://192.168.1.1/ca.html

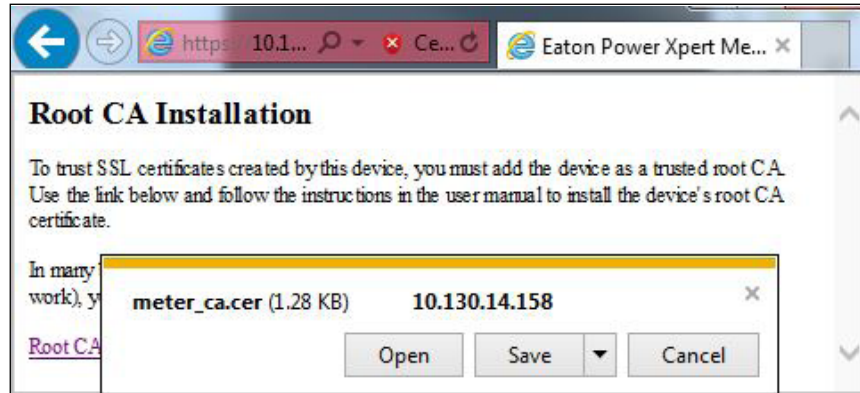
The install CA certificate page appears.



**Figure 1:** Install CA Certificate Page.

2. Click the Root CA Certificate link.

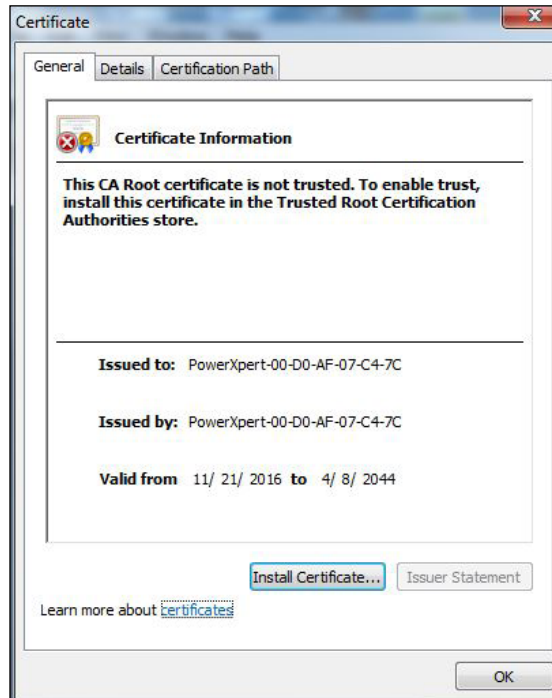
3. Click the Open button.



**Figure 2:** File Download Dialog Box.

4. In the Certificate dialog box, click the Install Certificate... button.

**Note:** The certificate cannot be verified yet because it is issued by a non-trusted CA.



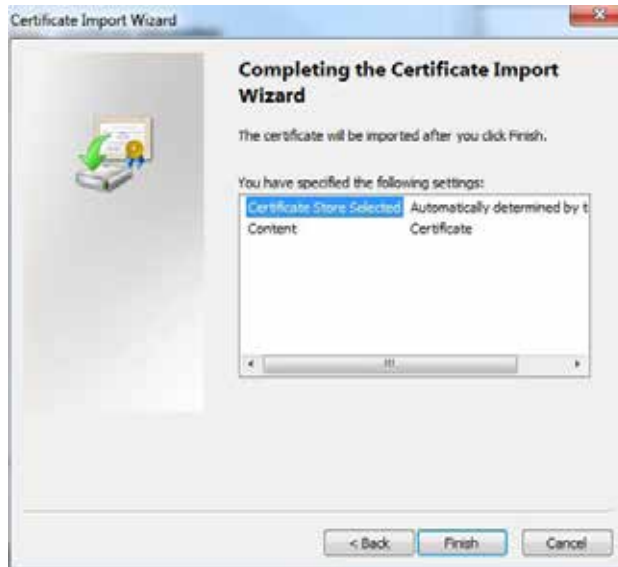
**Figure 3:** Certification Path Window.

5. The Certificate Import Wizard window opens. Click Next. Verify that the default setting, Automatically select the certificate store based on the type of certificate, is selected and then Click Next.



**Figure 4:** Certificate Import Wizard.

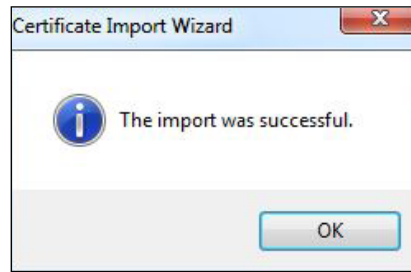
6. The certificate wizard confirms the selected setting for certificate import. Click Finish.



**Figure 5:** Certificate Import Wizard – Confirming Import Settings.



7. A new dialog box window opens to verify that the import was done successfully.



**Figure 6:** Import Successful Dialog Box.

8. Click OK.
9. Click OK to close the Certificate Window. The installation process is complete. You can now access the meter using the https protocol (for example: <https://192.168.1.1/>).

### Installing Root CA with Google Chrome

#### To install a certificate for the Power Xpert Meter with Google Chrome:

1. Open the browser and type the IP address of the meter followed by the path “/ca.html” in the address bar. For example: <https://192.168.1.1/ca.html>  
The install CA certificate page appears (see Figure 1).
2. Click the Root CA Certificate link.
3. Click the Open button (see Figure 2).
4. In the Certificate dialog box, click the Install Certificate... button (see Figure 3).

**Note:** The certificate cannot be verified yet because it is issued by a non-trusted CA.

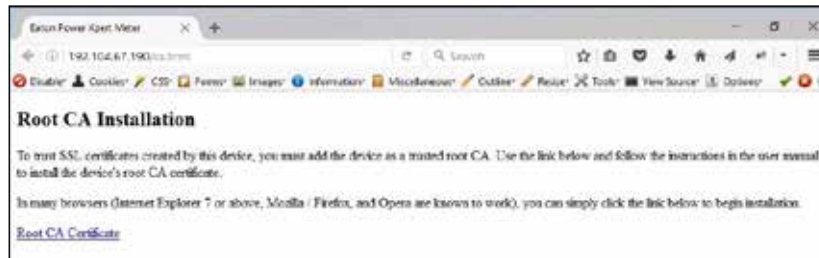
5. The Certificate Import Wizard window opens. Click Next. Verify that the default setting, Automatically select the certificate store based on the type of certificate, is selected and then Click Next (see Figure 4).
6. The certificate wizard confirms the selected setting for certificate import. Click Finish (see Figure 5).
7. A new dialog box window opens to verify that the import was done successfully (see Figure 6).
8. Click OK.
9. Click OK to close the Certificate Window. The installation process is complete. You can now access the meter using the https protocol (for example: <https://192.168.1.1/>).

## Installing Root CA with Mozilla Firefox

To install a certificate for the Power Xpert Meter with Mozilla Firefox:

1. Open the browser and type the IP address of the meter followed by the path “/ca.html” in the address bar. For example: `https://192.168.1.1/ca.html`

The install CA certificate page appears.



**Figure 7:** Install CA Certificate Page.

2. Click the Root CA Certificate link. Firefox opens the Downloading Certificate window.
3. Click the Trust this CA to identify web sites check box option.



**Figure 8:** Downloading Certificate Window.

4. Click OK to complete the installation process. The installation process is complete. You can now access the meter using the https protocol (for example, `https://192.168.1.1/ca.html`).

## Installing Root CA with Edge

### To install a certificate for the Power Xpert Meter with Edge:

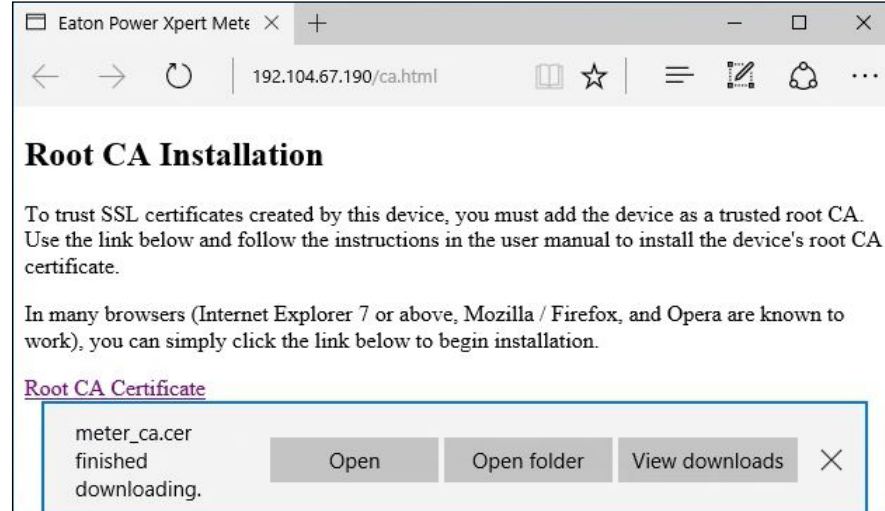
1. Open the browser and type the IP address of the meter followed by the path “/ca.html” in the address bar. (For example: https://192.168.1.1/ca.html).

The install CA certificate page appears.



**Figure 9:** Install CA Certificate Page.

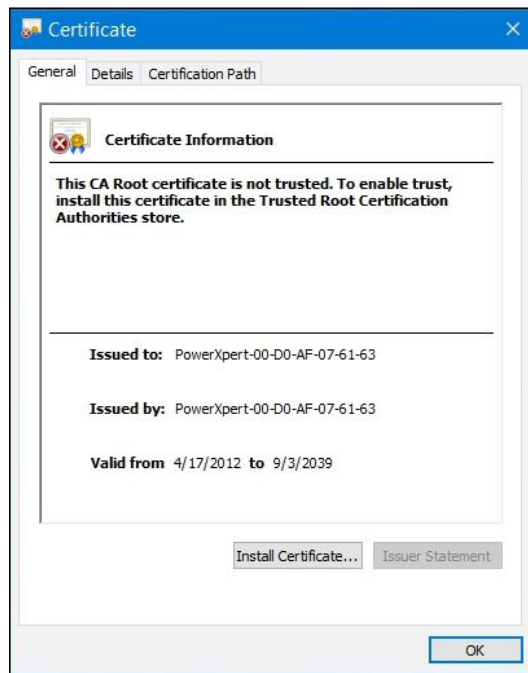
2. Click the Root CA Certificate link.
3. Click the Open button.



**Figure 10:** File Download Dialog Box.

4. In the Certificate dialog box, click the Install Certificate... button.

**Note:** The certificate cannot be verified yet because it is issued by a non-trusted CA.



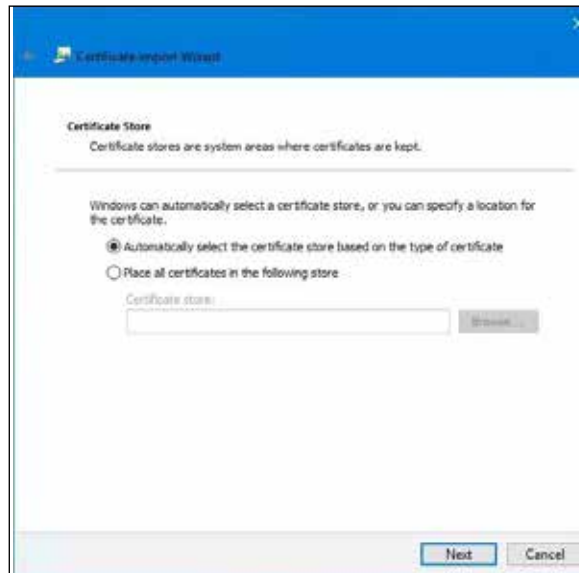
**Figure 11:** Certification Path Window.

5. The Certificate Import Wizard window opens. Verify that the default setting, Current User, is selected and then Click Next.



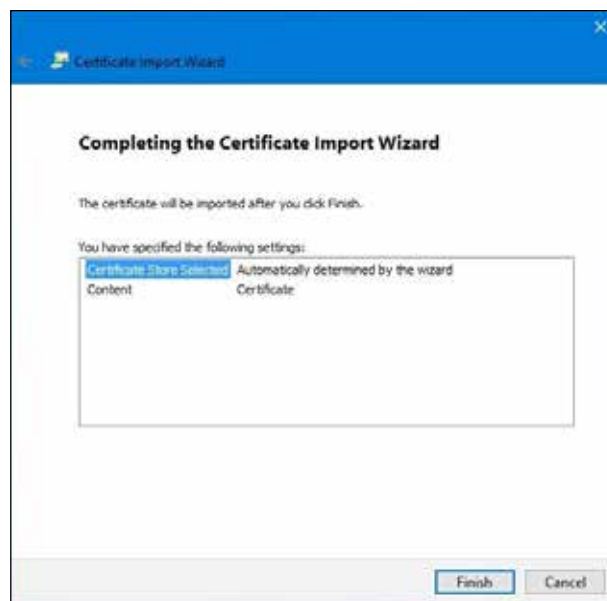
**Figure 12:** Certification Import Wizard – Welcome Screen

- Verify that the default setting, Automatically select the certificate store based on the type of certificate, is selected and then Click Next.



**Figure 13:** Certification Import Wizard – Certificate Store

- The certificate wizard confirms the selected setting for certificate import. Click Finish.



**Figure 14:** Certification Import Wizard – Confirming Import Settings

8. A new dialog box window opens to verify that the import was done successfully.



**Figure 15:** Import Successful Dialog Box.

9. Click OK.

---

# A NAVIGATION MAPS

## Introduction

You can configure the meter and perform related tasks using the buttons on the meter face.

- Chapter 6 contains a description of the buttons on the meter face and instructions for programming the meter using them.
- The meter can also be programmed using software. See chapter 8 for instructions on programming the meter using the Configuration software.

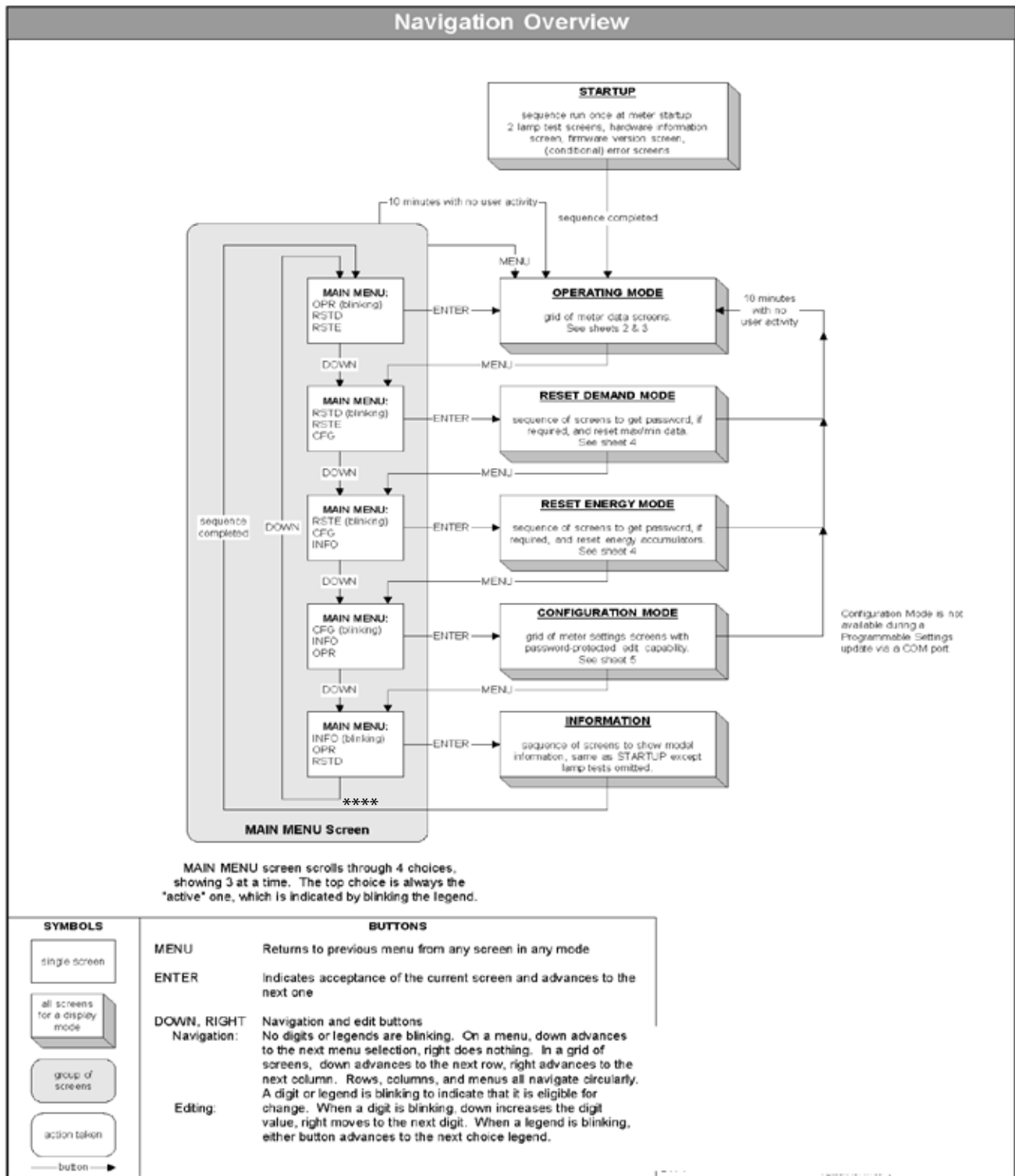
## Navigation Maps (Sheets 1 to 4)

The PXM 2000 Series Navigation Maps begin on the next page. The maps show in detail how to move from one screen to another and from one Display Mode to another using the buttons on the face of the meter. All Display Modes will automatically return to Operating Mode after 10 minutes with no user activity.

### Navigation Map Titles:

- Main Menu Screens (Sheet 1)
- Operating Mode Screens (Sheet 2)
- Reset Mode Screens (Sheet 3)
- Configuration Mode Screens (Sheet 4)

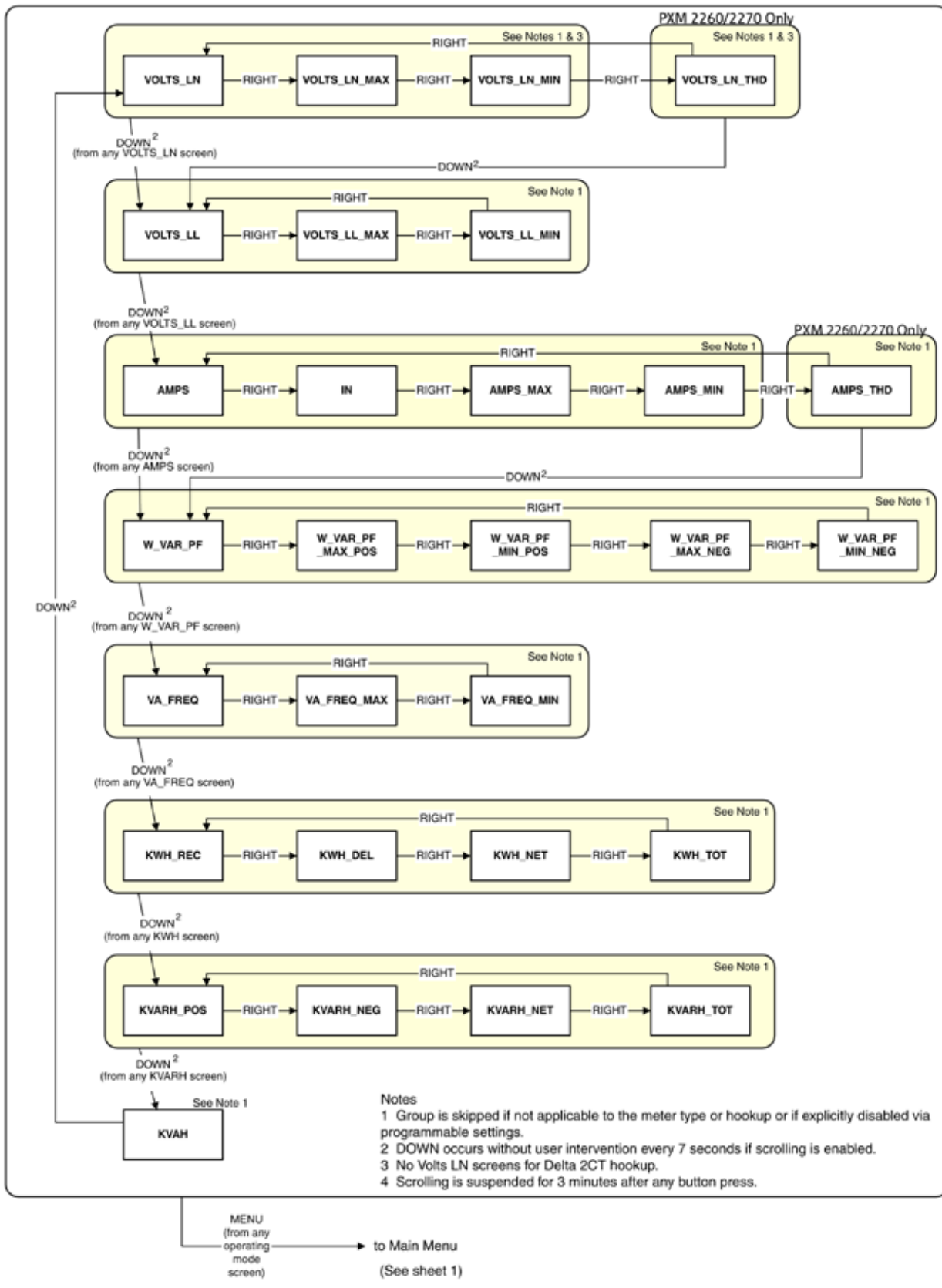
## Main Menu Screens (Sheet 1)



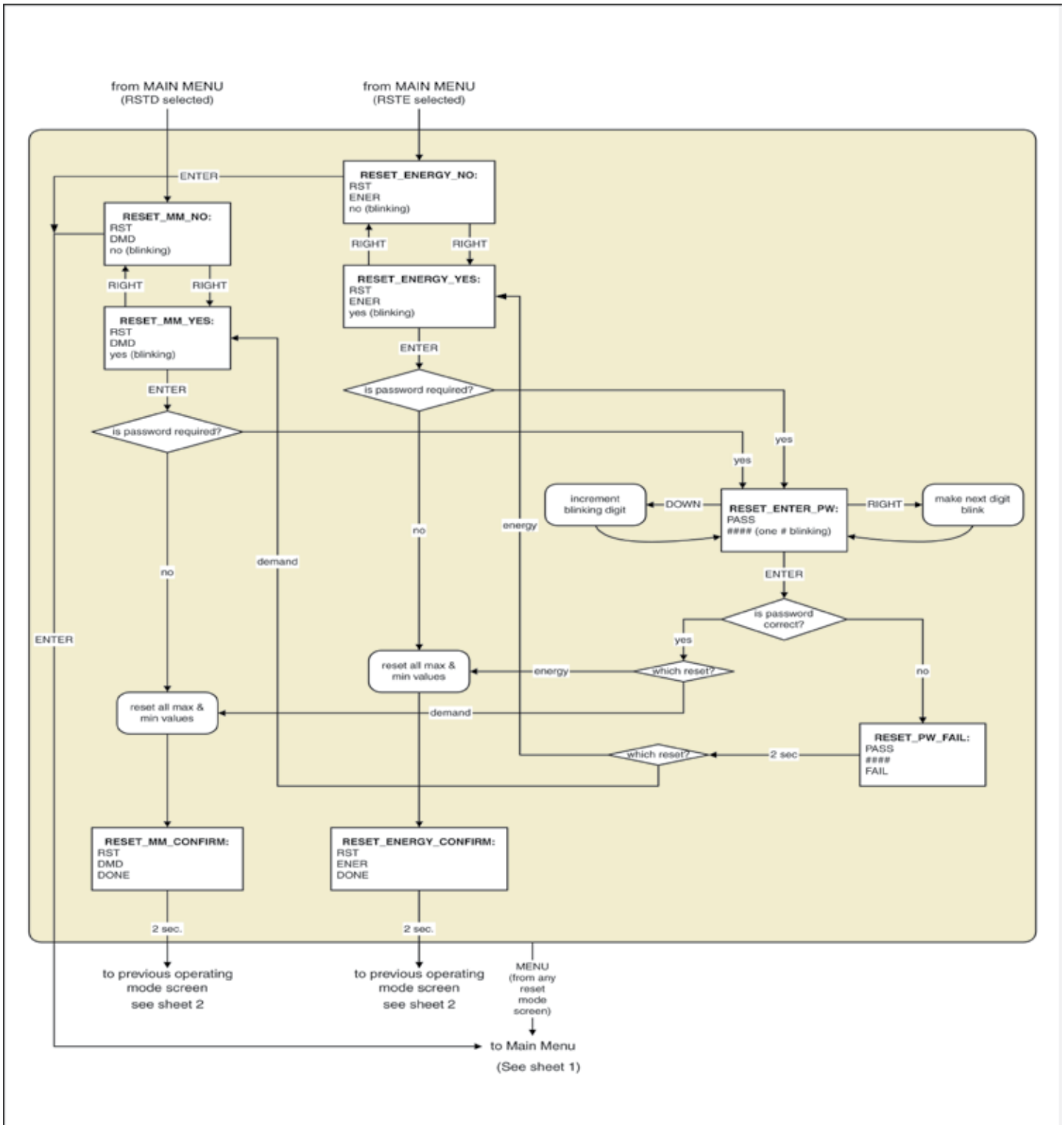
\*\*\*\* If the PXM 2000 meter has an Ethernet Gateway card, there is an IP Menu option after the Information screen.



### Operating Mode Screens (Sheet 2)



Reset Mode Screens (Sheet 3)







# B DIP SWITCH DESCRIPTION

The DIP Switch definitions for the Gateway Card are listed in the following table.

S1 Position Number	OFF Position (Default)	ON Position
<b>1</b>	Enable previously stored network configuration settings (Normal mode).	Override network settings to assign a private IP address (Configuration mode); the port is set to 169.254.1.1.
<b>2</b>	Reserved	Reserved
<b>3</b>	Normal behavior	Reset the HTTP passwords to the defaults on boot up ( <b>user</b> and <b>admin</b> ). After a successful boot, the switch should be turned back off before rebooting the card.
<b>4</b>	Reserved	Reserved
<b>5</b>	Reserved	Reserved
<b>6</b>	Normal behavior	Reset the card to factory defaults on boot up. After a successful boot, the switch should be turned back off before rebooting the card.
<b>7</b>	Reserved	Reserved
<b>8</b>	Reserved	Reserved



# C CONFIGURATION MANAGEMENT

This appendix covers:

- Backing up and restoring configuration settings
- Replacing a meter
- Monitoring changes to configuration settings.
- Restoring a meter to factory configuration settings (wiping out any undesired settings)

## Backing Up and Restoring Your Configuration

**You should save your current configuration settings to a file (in XML format), which can then be used in case a problem develops and you must restore your meter configuration at a later time. Backing up your configuration makes it easy to return to a working configuration or to install the correct configuration in a replacement meter. After you have finalized the configuration for your meter, create a configuration backup file and store this in a secure place.**

The primary reason to create a backup of your working configuration is so that you can easily restore these settings should they be unintentionally changed either by a user or hardware fault.

This is also a handy feature if you're setting up multiple meters with either the same or similar settings. You can set up one meter, download the configuration file to your local computer, and then upload that same configuration file to other meters. Note that network settings are part of the backup, so if you upload a configuration file to another meter you must adjust its network settings appropriately.

Backup files are downloaded to your browser's default download folder. After creating a backup file, you should archive this in a safe location.

**To download the current configuration file:**

1. Click **Setup**.
2. Expand **Meter Setup & Commissioning**.
3. Click **Save/Restore Settings**.
4. Click the **Save and Restore Configuration** button.
5. When prompted, type the **admin** account **User Name** and **Password**.
6. Click the **Save meter configuration** button.
7. Click **OK**.

**To upload a configuration file to a meter:**

Click **Setup**.

1. Expand **Meter Setup & Commissioning**.
2. Click **Save/Restore Settings**.
3. Click the **Browse** button beside the **Configuration file to restore** field.
4. Select the configuration `.xml` file.
5. Click **OK**.

Save/Restore Configuration Page



Replacing a Meter

If you are replacing a meter, you can use the backup file for your meter’s configuration to configure the new meter with the same settings as the meter it replaced (see the previous section). While following the installation instructions in the *Quick Start Guide*, instead of manually configuring the meter on the bench, use the previous meter’s configuration file to set the meter parameters.

Monitoring Changes to the Configuration

The system log shows system events, such as changes to settings, firmware updates, and meter restarts. Each event carries a time-and-date stamp and a severity level. You can print the log by clicking the **Print** button; however, the printout contains a screen image, not the entire log. To print an entire log you may need to use the scroll bar to reposition the log in the window and print it in sections.

**Note:** You can tell who has made configuration changes to the meter from the log as it not only logs changes but the IP address of the computer from which the changes were made.

System Log Page

System Log

894	10/02/2009 16:15	47.648258	Informational	Rebooting card	
895	10/02/2009 16:24	43.212271	Informational	Meter module Phases to Display on Meter Front set to 3 by Web-Services://admin@99.999.45.81	admin@99.999.45.81 (Web-Services)
896	10/02/2009 16:24	43.455388	Informational	Meter module Front Display Volts L-N set to true by Web-Services://admin@99.999.45.81	admin@99.999.45.81 (Web-Services)
897	10/02/2009 16:24	43.675067	Informational	Meter module Front Display Watt-VARs-PF set to true by Web-Services://admin@99.999.45.81	admin@99.999.45.81 (Web-Services)
898	10/02/2009 16:24	43.865706	Informational	Meter module Front Display VA-Hz set to true by Web-Services://admin@99.999.45.81	admin@99.999.45.81 (Web-Services)
899	10/02/2009 16:24	44.097539	Informational	Meter module Front Display Vah set to true by Web-Services://admin@99.999.45.81	admin@99.999.45.81 (Web-Services)
900	10/02/2009 16:24	59.281280	Informational	Saving configuration change(s) and restarting Meter module.	
901	10/02/2009 16:24	59.419713	Informational	Reset command: Restart the Meter	



---

## Restoring the Meter to Factory Default Configuration

You can use the Gateway Card's DIP switch to:

- Override the existing network settings and assign the local IP address 169.254.1.1.
- Reset the HTTP passwords.
- Reset return the meter to factory defaults.

To change DIP switch settings, you must remove the Gateway Card from the meter. The best practice for this is to remove the meter to a workbench.

**IMPORTANT! When the meter was originally installed, you should have recorded information concerning the IP, subnet mask, and DNS servers. You will need this information to reconfigure the meter.**

### Turn Power Off And Remove Current Sensing Conductors

Turn power off at the breaker feeding the meter. There may be more than one breaker. Use local safety procedures such as "Lock out/ Tag out" to ensure the breaker(s) is not inadvertently energized.

Ensure the high power connections on the meter are de-energized.

- Current sensing wires may be connected directly to the load by simply passing the current carrying conductors (load or Current Transformers) directly through the meter. There is no physical connection to the meter.
- Current sensing wires may be connected directly to the meter by attaching the current carrying conductors to "current gills" or quick connect terminals on the meter.

Then remove or disconnect the current sensing wires from the meter.

---

### Warning!

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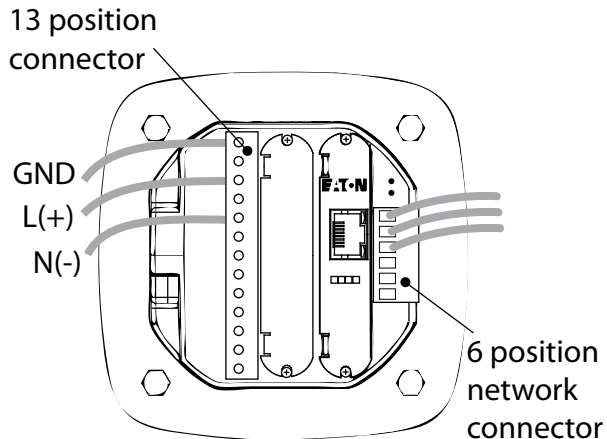
Use caution to ensure the current through the CTs is off or suitable protection is in place to prevent contact with the leads from the CT.

Ensure the control or logic power to the meter is de-energized. The voltage at these terminals is the local AC voltage.

### Disconnect power connections, CTs, and Modbus

1. Remove the large 13 position connector on the back of the meter.  
Removing this connector will remove power to the meter. The Gateway Card is not designed to be hot-pluggable (removed/installed with power on).  
If an extra 13 position connector is not available, make note of where the wires are connected to the 13 pin connector. You will need this information when re-connecting the wires. Then remove the wires from the 13 position connector and replace the connector into the meter.
2. Remove the six position Modbus connector (if used).
3. Remove the Ethernet cable (if connected).

13 and 6 position connectors



### Remove Meter from Panel

When removing the meter keep the mounting hardware (screws, washers, etc.) in a safe place for use when re-installing the meter.

1. For ANSI installations remove the four nuts and washers.
2. Move the meter to a workbench.

### Resetting Configuration Settings

---

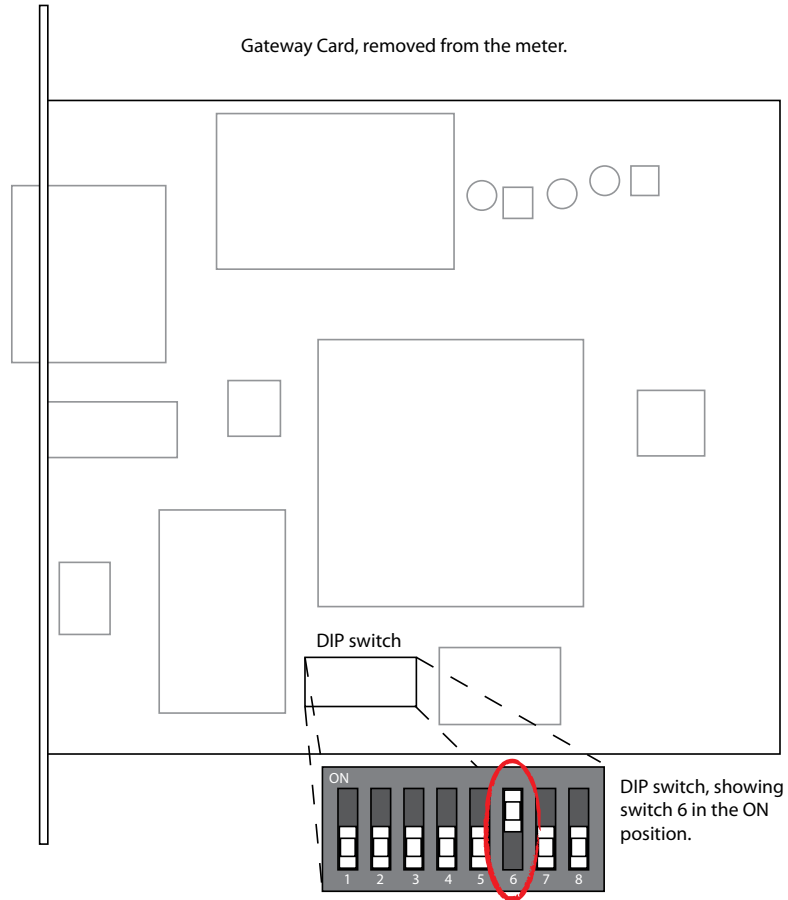
**⚠ Caution!**

---

Use local electrostatic discharge protection or touch a suitably grounded metal surface to discharge any static electrical charge. Failure to follow these guidelines could cause damage to the Gateway Card.

1. Remove the two Gateway Card retaining screws and retain these for later use.
2. Remove the Gateway Card from meter slot 2.
3. Locate the DIP switch array (shown in the following figure) Move switch 6 to the ON position.

DIP Switches on the Gateway Card



4. Move the appropriate switch to the ON position.

S1 Position Number	OFF Position (Default)	ON Position
1	Enable previously stored network configuration settings.	Override network settings to assign a private IP address (Configuration mode); the port is set to 169.254.1.1.
2	Reserved	Reserved
3	Normal Behavior	Reset the HTTP passwords to the defaults on boot (user and admin). After a successful boot, the switch should be turned back off before rebooting the card.
4	Reserved	Reserved
5	Reserved	Reserved
6	Normal Behavior	Reset the card to factory defaults on boot (after a successful boot, the switch should be turned back off before rebooting the card again).

5. Insert the Gateway Card into meter slot 2 using the meter's built-in card guides. Use care to correctly locate the card in the guides. An incorrectly installed card may be damaged or may damage the meter. Slide the card carefully into the meter until it stops. Gently push on the card until it "clicks" into place.
6. Attach the power cord. If an AUX power cord was assembled using a spare 13 position connector then insert the connector into the socket. Otherwise connect GND, L(+) and N(-) to the 13 position connector as indicated in the figure on page 4-7.
7. Apply power to the power cord.
8. Watch the lights on the back of the Gateway Card. They should all turn off for a few seconds and then the right (Status) and the left (Power) lights should be illuminated to indicate the card has power and has started correctly. The card has now been returned to its factory configuration

### Configuring the Meter

1. Remove power from the meter.
2. Remove the Gateway Card from meter slot 2
3. Locate the DIP switch array. Return switch 6 back to the OFF position.
4. Insert the Gateway Card into meter slot 2 using the meter's built-in card guides. Again, use care to correctly locate the card in the guides. An incorrectly installed card may be damaged or may damage the meter. Slide the card carefully into the meter until it stops. Gently push on the card until it "clicks" into place.
5. Secure the card by replacing the screws removed while removing the cover.
6. Connect the building Ethernet cable to the jack on the Gateway Card.
7. If in use, connect the Modbus connector (6 position connector) that is attached to the Modbus network.
8. Attach the power cord. If an AUX power cord was assembled using a spare 13 position connector then insert the connector into the socket. Otherwise connect GND, L(+) and N(-) to the 13 position connector.
9. Apply power to the power cord.

There are four lights (LEDs) on the Gateway Card labeled Status, DHCP, Ident, and Power. When power is applied all the lights should be off for a few seconds and then the top (Status) and bottom (Power) lights should illuminate. This indicates the card has power and is running.

There are two lights (LEDs) located on the Ethernet cable jack. If the Ethernet cable has an active Ethernet connection the light labeled Act may be flickering. The light labeled 100 will be lit if the Ethernet connection is active at 100 Mbps.

### Configuring the Gateway Card Network Settings

The Network PC requires a web browser. See the Power Expert Meter 2000 User and Installation Guide for additional information.

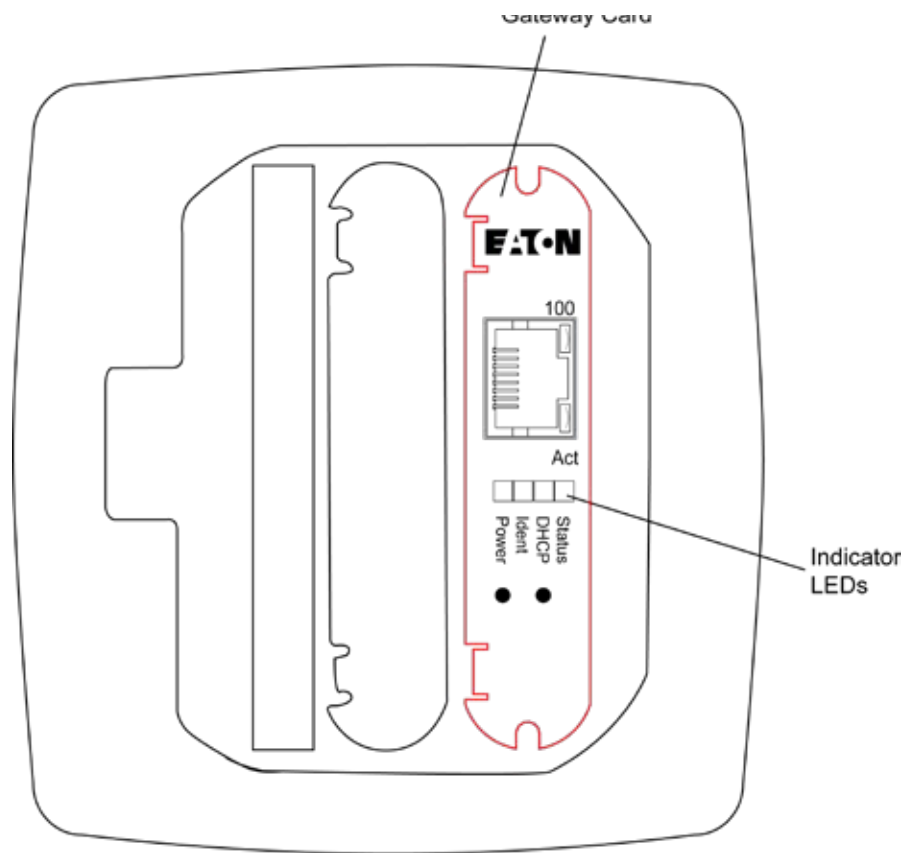
An Ethernet connection is used for configuring the meter's gateway card communication settings via a web browser. You may need to contact your network administrator for some network and configuration information. In preparation, you will need to decide if the meter will be manually assigned a fixed (static) IP address or will be automatically assigned a fixed IP address by a DHCP server somewhere on the network. With either method the assigned network address must not change once the meter has been deployed. Changing the IP address will cause loss of communication until the associated client PCs change the corresponding meter's IP addresses.

Discuss with your network administrator whether you should manually configure the meter with an assigned IP address or whether the DHCP server will assign one. For the DHCP server to provide a fixed IP address, your network administrator will need to know the MAC address assigned to the meter.

## Checking Gateway Card Indicators

First, ensure power is applied to the meter.

Location of Gateway Card



There are four indicator LEDs on the Gateway Card labeled: **Status**, **DHCP**, **Ident**, and **Power**. When power is first applied all the lights should be off for a few seconds and then the **Power** light will illuminate. This indicates the card has power and is running.

## Configuring the Meter's Gateway Card for Network Accessibility

### Configuring a Fixed IP Address for the Gateway Card using a local PC

Your network administrator provided an IP address, a subnet mask, and a default gateway (which you entered in the previous section). This information must be entered into the Gateway Card using a local PC, such as a laptop.

This method requires a PC with the following:

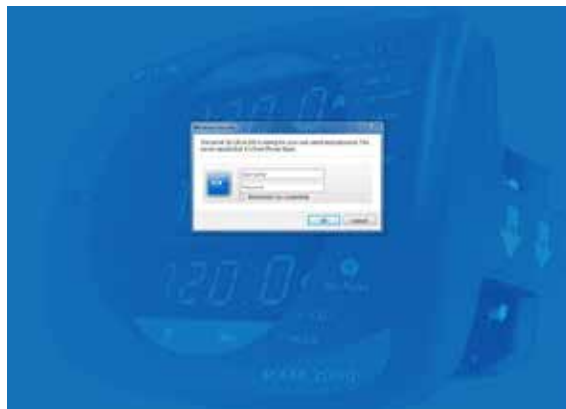
- an Ethernet port
- an Ethernet cable (either straight-through or cross-over)
- one of the following web browsers -
  - Microsoft Internet Explorer 11
  - Google Chrome
  - Mozilla Firefox

- Edge
- Safari

### To configure the Gateway Card:

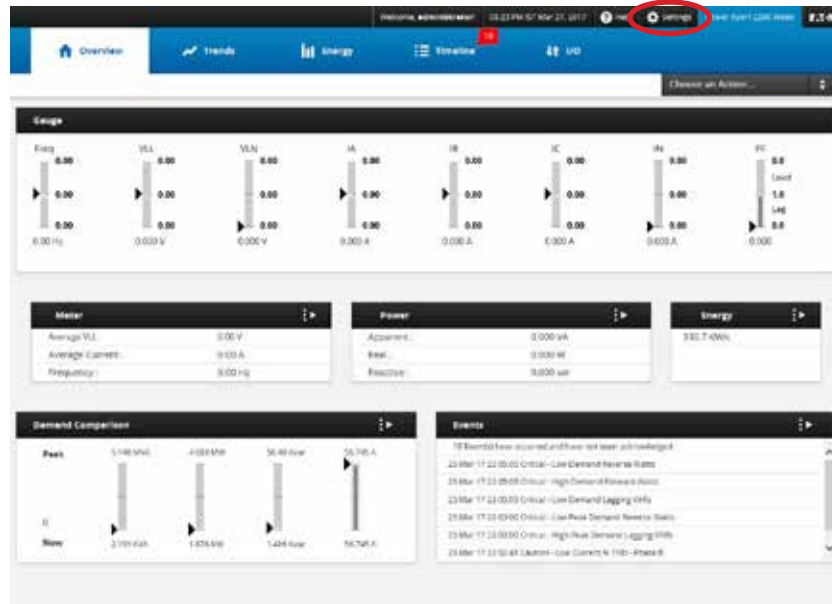
1. Connect the PC to the Gateway Card through an Ethernet cable (either a straight though or cross-over CAT 5 cable).  
There are two green lights (LEDs) located on the gateway card's Ethernet port. If the Ethernet cable is connected to an active Ethernet port on the PC both lights should be illuminated (the light labeled Act may be flickering reflecting network activity).
2. The card's default Ethernet IP address is 192.168.1.1. Set the PC's address to an address on the same subnet, such as 192.168.1.100. To do this, use the following steps:
  - a. Click Window's Start.
  - b. Then click **Settings**. Navigate to the Control Panel of your computer.
  - c. In the **Control Panel**, click **Network Connections** and right-click **Local Area Connection**. Select **Properties** from the shortcut menu.
  - d. Click the **Properties** button.
  - e. In the **Properties** dialog box, select **Internet Protocol (TCP/IP)** and click the **Properties** button.
  - f. In the **Internet Protocol (TCP/IP) Properties** dialog box, select Use the following IP address and enter the following in the **IP address** field: **192.168.1.100**
  - g. Click **OK** throughout the various dialog boxes.
3. Open the browser and type the IP address of the meter followed by the path "/ca.html" in the address bar. For example: https://192.168.1.1/ca.html. Install the SSL Certificate found on this page. For step by step instructions, see the User and Installation Manual, Section 11.
4. Launch your web browser and navigate to the following IP address: **192.168.1.1**  
If an information screen appears stating the certificate cannot be verified and asking if you want to run anyway, select run.

### Loading Page



The meter's **Overview** page will appear.

Meter Overview Page



5. Click the **Settings** button. The **Settings** page will appear.
6. Select the Comms tab.

Opening the Comms Tab



7. Expand the Ethernet/LAN Setup section.
8. Click the **Edit** button.

Edit Button (on the right of the page)



You may be prompted to provide administrative credentials.

9. If you successfully logged in as admin you may now configure the card for the settings specified by your network administrator. Refer to the previously recorded network settings.

You can also enter such optional information as the meter's location, who to contact in case of problems, etc.

10. When you've completed configuration, click the **Save** button.

The new IP address will take effect shortly after clicking **Save**. The Gateway Card will redirect you to the new IP address and reload the Java applet. You can continue to configure the meter after it is connected to your LAN.

Refer to the *PXM 2000 Meter User's Guide (IM02601001E)* for additional configuration details.

11. Disconnect the Ethernet cable to the PC and connect the meter to the LAN.

**Note:** Remember to reconfigure the PC's network settings for your LAN.

This concludes network configuration. You can now proceed to verify the IP address.

### Verify the IP address

**To check the IP address from the meter's front panel:**

1. If the meter has power the display should be showing normal data, such as voltage, current, etc.
2. Push the **MENU** button on the face of the meter. The main menu screen appears.
3. Push **DOWN** repeatedly until **IP** blinks.
4. Push **ENTER** and the meter's IP address appears, which should appear something like the following:

```
010.2  
22.05  
1.066
```

In this example the IP address is 010.222.051.066. This should match the address the network administrator provided for this meter.

5. Push **MENU** to return to the main menu.

### Network Access

Once the network IP address is known, most meter functions and configuration can be done via the network. Use a networked client PC and web browser to navigate to the meter's IP address. See the meter's complete user's manual for additional information.

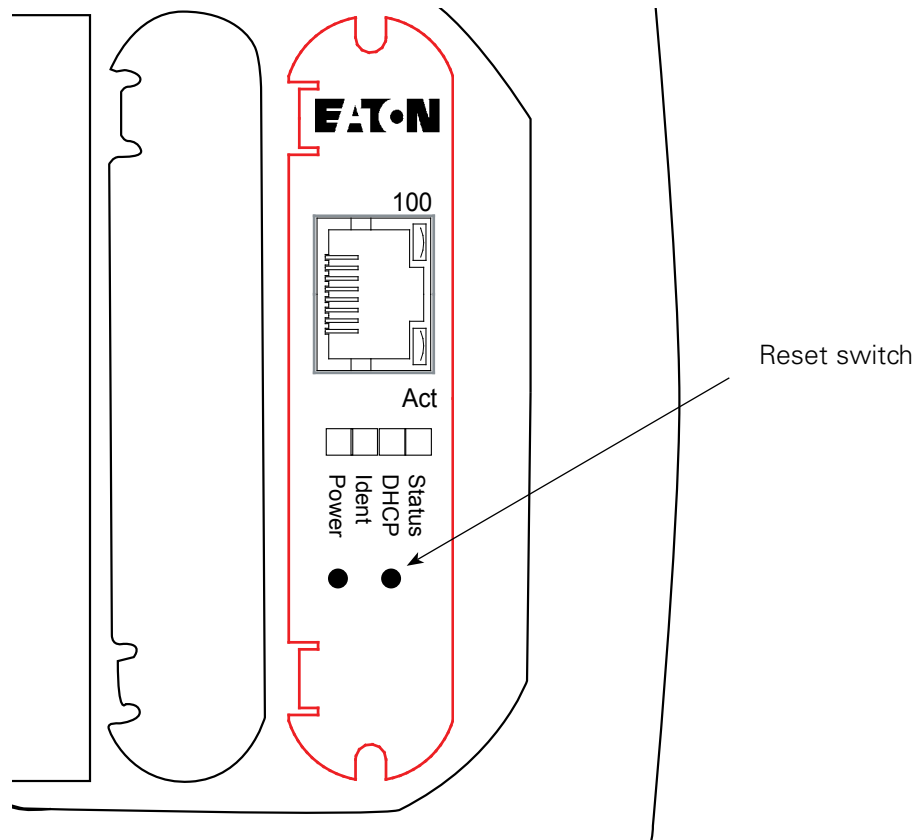
### Restart the Gateway Card

The Gateway Card restart push-button switch is located behind the hole in the card face plate closest to the LED labelled **DHCP**. This switch is used to restart just the Gateway Card (not the meter) should it be necessary to recover from some abnormal condition.

Momentarily press the switch by pushing a small device into the hole to activate the switch.



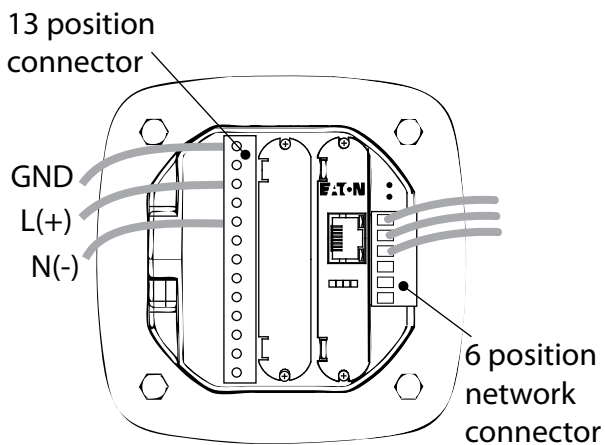
Reset Switch



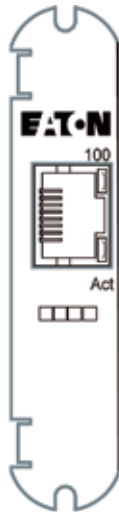
Reinstalling the Meter

1. Turn power off to the 13 position connector. If an AUX cable was used then remove the 13 position connector. Else, disconnect the GND, L(+), and L(-) wires from the 13 position connector.

Connectors

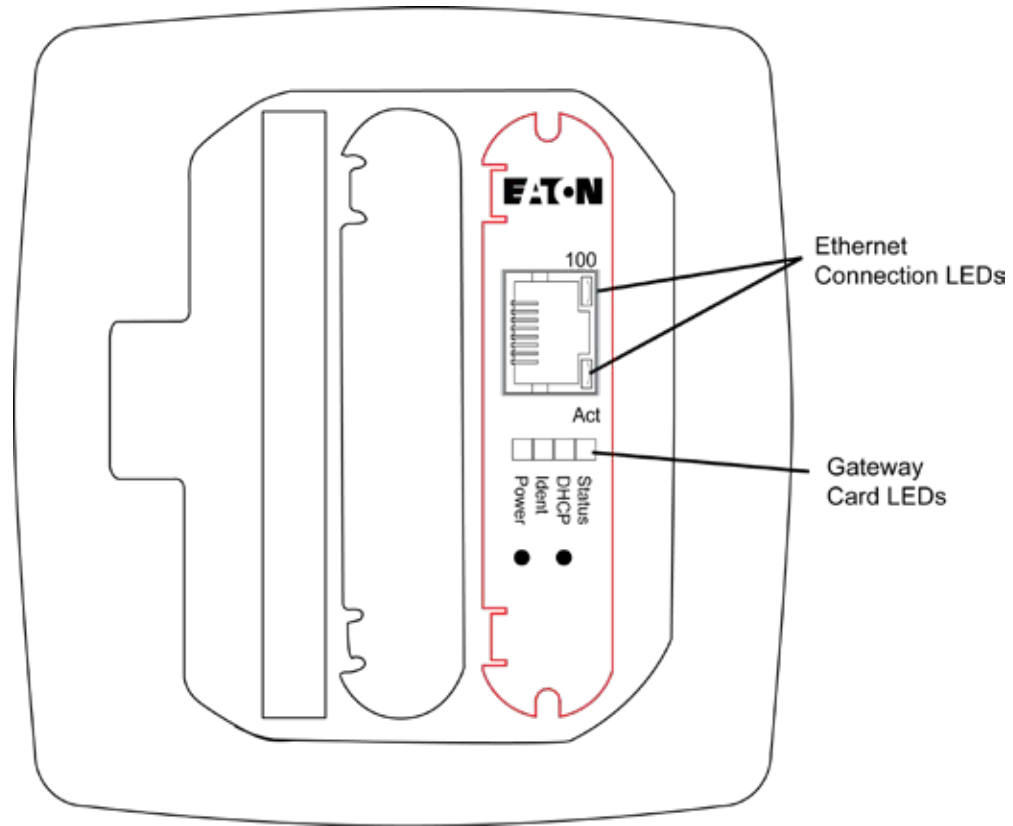


2. If a Modbus network was connected remove the six position network connector.
3. Return the meter to the mounting panel using any hardware removed in previous steps.
4. Reconnect the current sensing (CT or direct connections) wires.
5. If an AUX cable was not used, reconnect the wires to the 13 position connector. Otherwise plug the wired connector into the meter.
6. Reconnect the Modbus network using the six position Modbus connector.
7. Insert the Ethernet cable into the socket on the new Gateway Card. Be sure to route the cable away from any high voltage wires. Secure the cable in compliance with local electrical codes.
8. Take any necessary safety precautions in preparation for restoring power.
9. Turn the power on at the breaker(s).
10. Watch the lights on the back of the Gateway Card. They should all turn off for a few seconds and then the right (Status) and the left (Power) lights should be illuminated to indicate the card has power and has started correctly.
11. Power and Status LEDs.



12. If the Ethernet is active then the ACT light located at the Ethernet cable should be flickering.

Location of LEDs









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