

Power Xpert Meter 2000 Series



Powering Business Worldwide

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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.

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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.



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.



WARNINGS

SHOCK HAZARDS:

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

Follow all Warnings and Cautions. Completely read and understood 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 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, as well as standard Ethernet communication.



Voltage and Current Inputs

Universal Voltage Inputs

Voltage Inputs allow measurement up to 576VAC (Phase to Reference) and 721VAC (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

PXM -2260 -M - A - 6 - 5 - 1 - 1 - 5

1	2	3	4	5	6	7

1. Model:

- 2250 = Power Meter
- 2260 = Power Quality Meter
- 2270 = Power Quality Plus Meter
- 2280 = Power Quality Plus with up to 64 samples/cycle waveform recording meter
- 2290 = Power Quality Plus with up to 512 samples/cycle waveform recording meter

2. Meter Type

- M = Meter (with integral display)
- T = Transducer Only (no display)

3. Frequency:

- 5 = 50 Hz System
- 6 = 60 Hz System

4. Current Input:

- 5 = 5 Amp Secondary
- 1 = 1 Amp Secondary

5. Power Supply:

- 1 = Universal, (90 - 265) VAC @50/60Hz or (100-370) VDC
- 4 = (18 - 60) VDC

6. I/O Slot 1: (See Chapter 7 for I/O Card Specifications.)

- 0 = None
- 1 = 2 Relay Outputs/2 Status Inputs
- 2 = 4 KYZ Pulses/4 Status Inputs
- 3 = 4 Analog Outputs - 0-1 mA
- 4 = 4 Analog Outputs - 4-20 mA

7. I/O 2: (See Chapter 7 for I/O Card Specifications.)

- 5 = Power Xpert® Ethernet Gateway Card

Example: PXM 2260-M-A-6-5-1-1-5

(PXM 2260 Meter with 60 Hz System, 5 Amp Secondary, 90-265 VAC/100-370 VDC Power Supply, 2 Relay Outputs/2 Status Inputs I/O Card in Card Slot 1 and standard Power Xpert® Ethernet Gateway Card in Card Slot 2)

Measured Values

The PXM 2000 Series provides the following measured values as Average, Maximum, Minimum and Actual values

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

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	
mACVavgLLLlongtermAvg				X
mDemandIa			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 or 30 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.

Utility Demand Features can be used to calculate Watt, VAR, VA and PF readings. 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)..

Specifications

Power Supply

Range:	1 Option: Universal, (90 - 265)VAC @50/60 Hz or (100-370)VDC 4 Option: (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
Input Impedance:	1M Ohm/Phase
Burden:	0.36VA/Phase Max at 600 Volts; 0.014VA at 120 Volts
Pickup Voltage:	20VAC
Connection:	7 Pin 0.400" Pluggable Terminal Block AWG#12 -26/ (0.129 -3.31) mm ²
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:	5A Nominal, 10A Maximum
Class 2:	1A Nominal, 2A Maximum
Burden:	0.005VA 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:	100A/10sec., 300A/3sec., 500A/1sec.

KYZ/RS485 Port Specifications

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

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

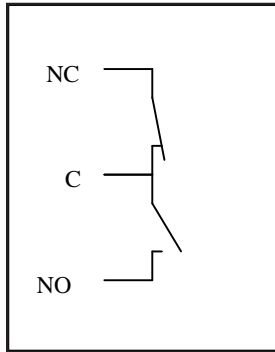
Wh Pulse

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

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

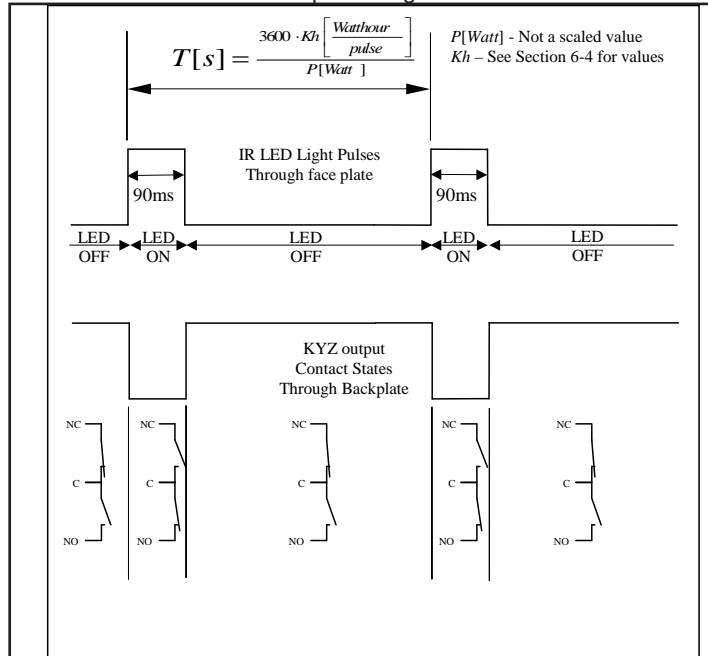
Infrared LED:
 Peak Spectral Wavelength:940nm
 Reset State: Off

Internal Schematic:



(De-energized State)

Output timing:



Isolation

All Inputs and Outputs are galvanically isolated to 2500 Vac

Environmental Rating

Storage: (-20 to +70)⁰ C
Operating: (-20 to +70)⁰ 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
PXM 2000 Series
Transducer 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

Mechanical Parameters

Dimensions: see Chapter 3.
Weight: 2 pounds/ 0.9kg (ships in a 6"/152.4mm 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

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), 5A (Class 10) nominal unit:

Parameter	Accuracy	Accuracy Input Range ¹
Voltage L-N [V]	0.1% of reading	(69 to 480)V
Voltage L-L [V]	0.2% of reading ²	(120 to 600)V
Current Phase [A]	0.1% of reading ³	(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 ^{1, 2}	(0.15 to 5) A @ (69 to 480) V @ +/- (0.5 to 1) lag/lead PF
Active Energy Total [Wh]	0.2% of reading ^{1, 2}	(0.15 to 5) A @ (69 to 480) V @ +/- (0.5 to 1) lag/lead PF
Reactive Power Total [VAR]	0.2% of reading ^{1, 2}	(0.15 to 5) A @ (69 to 480) V @ +/- (0 to 0.8) lag/lead PF
Reactive Energy Total [VARh]	0.2% of reading ^{1, 2}	(0.15 to 5) A @ (69 to 480) V @ +/- (0 to 0.8) lag/lead PF
Apparent Power Total [VA]	0.2% of reading ^{1, 2}	(0.15 to 5) A @ (69 to 480) V @ +/- (0.5 to 1) lag/lead PF
Apparent Energy Total [VAh]	0.2% of reading ^{1, 2}	(0.15 to 5) A @ (69 to 480) V @ +/- (0.5 to 1) lag/lead PF
Power Factor	0.2% of reading ^{1, 2}	(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 ⁴ 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, 120V/120V/208V 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].

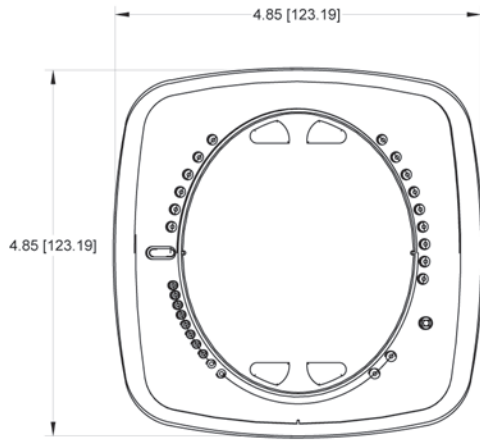


Figure 3.1: Meter Face

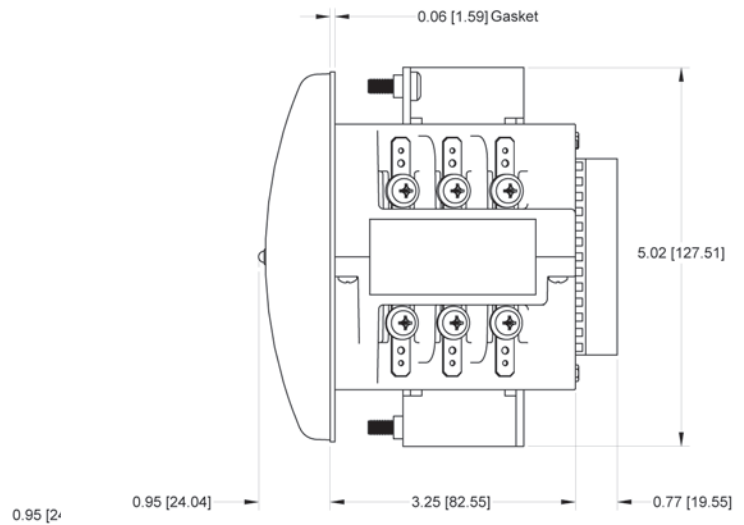


Figure 3.2: Meter Dimensions

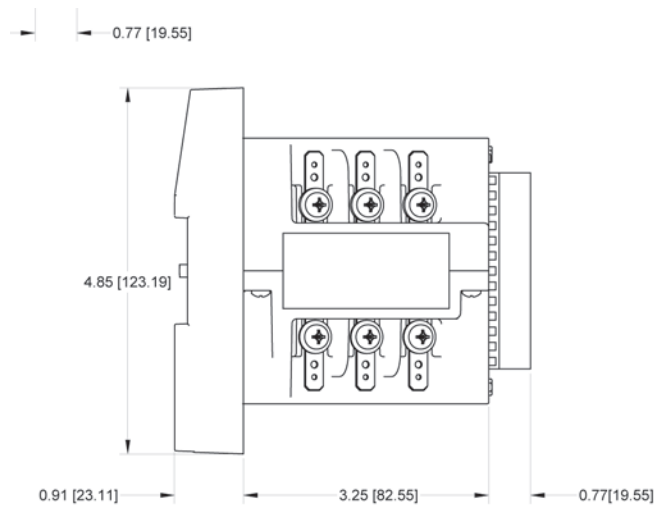


Figure 3.3: Transducer Dimensions

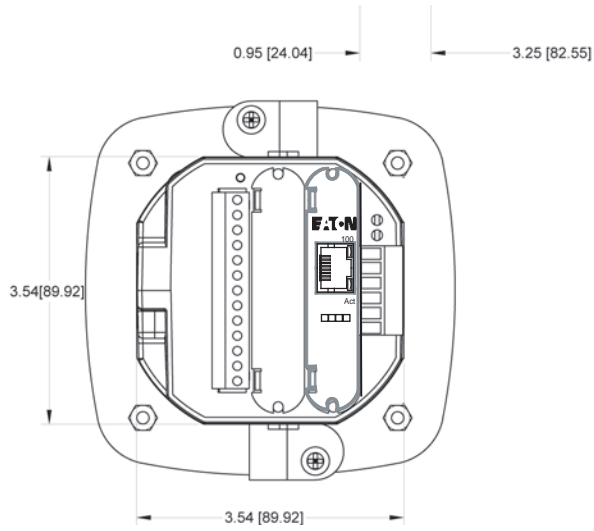


Fig. 3.4: Meter Back

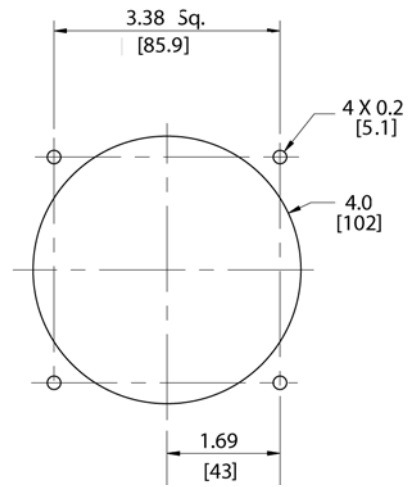


Figure 3.5: ANSI Mounting Panel Cutout

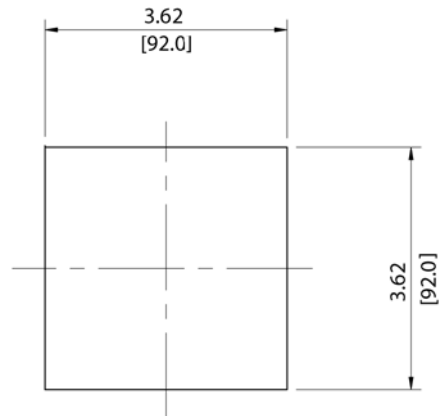


Figure 3.6: DIN Mounting Cutout

ANSI Installation Steps

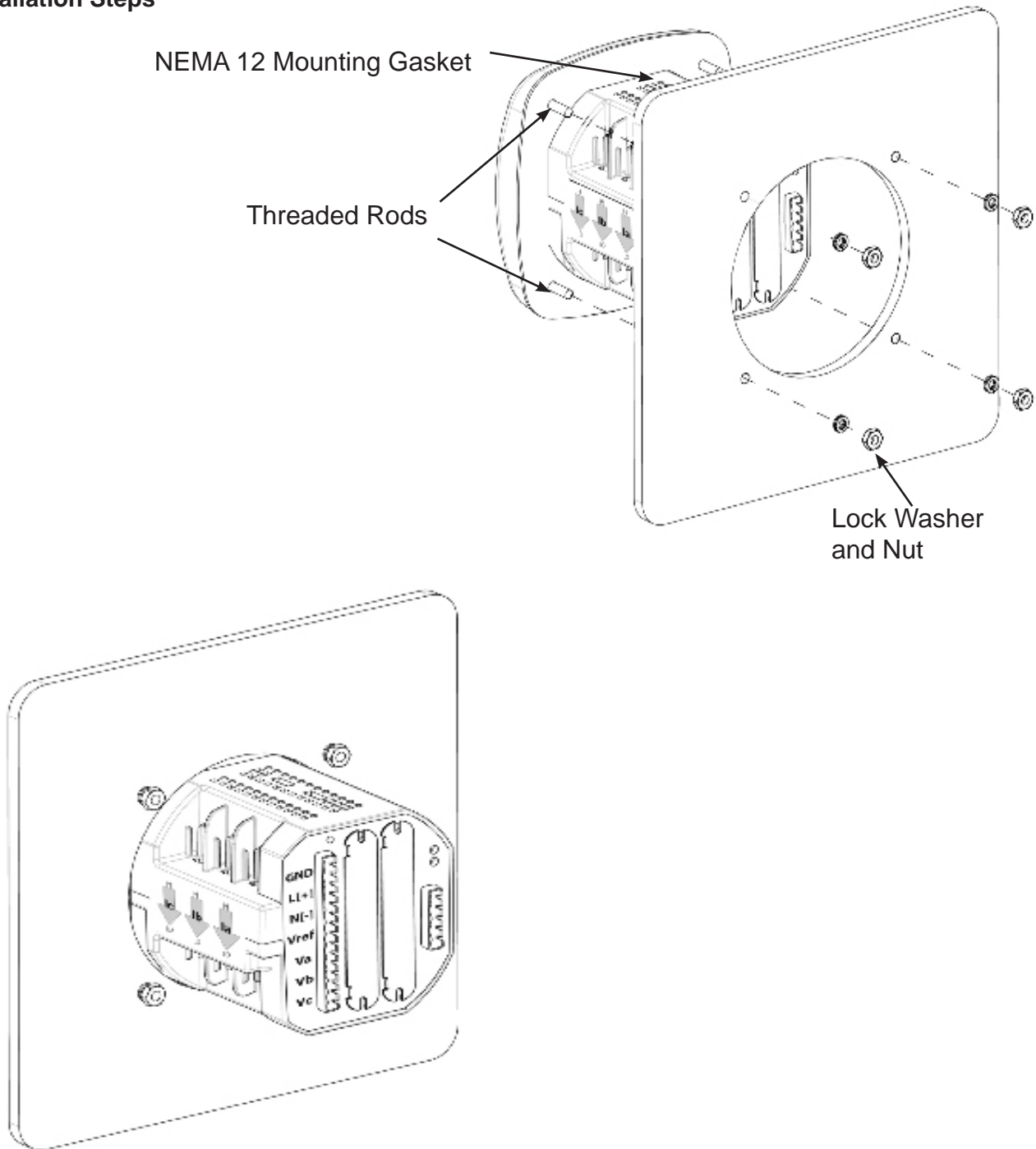


Figure 3.7: ANSI Mounting Procedure

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 0.4 Newton-Meter.

DIN Installation Steps

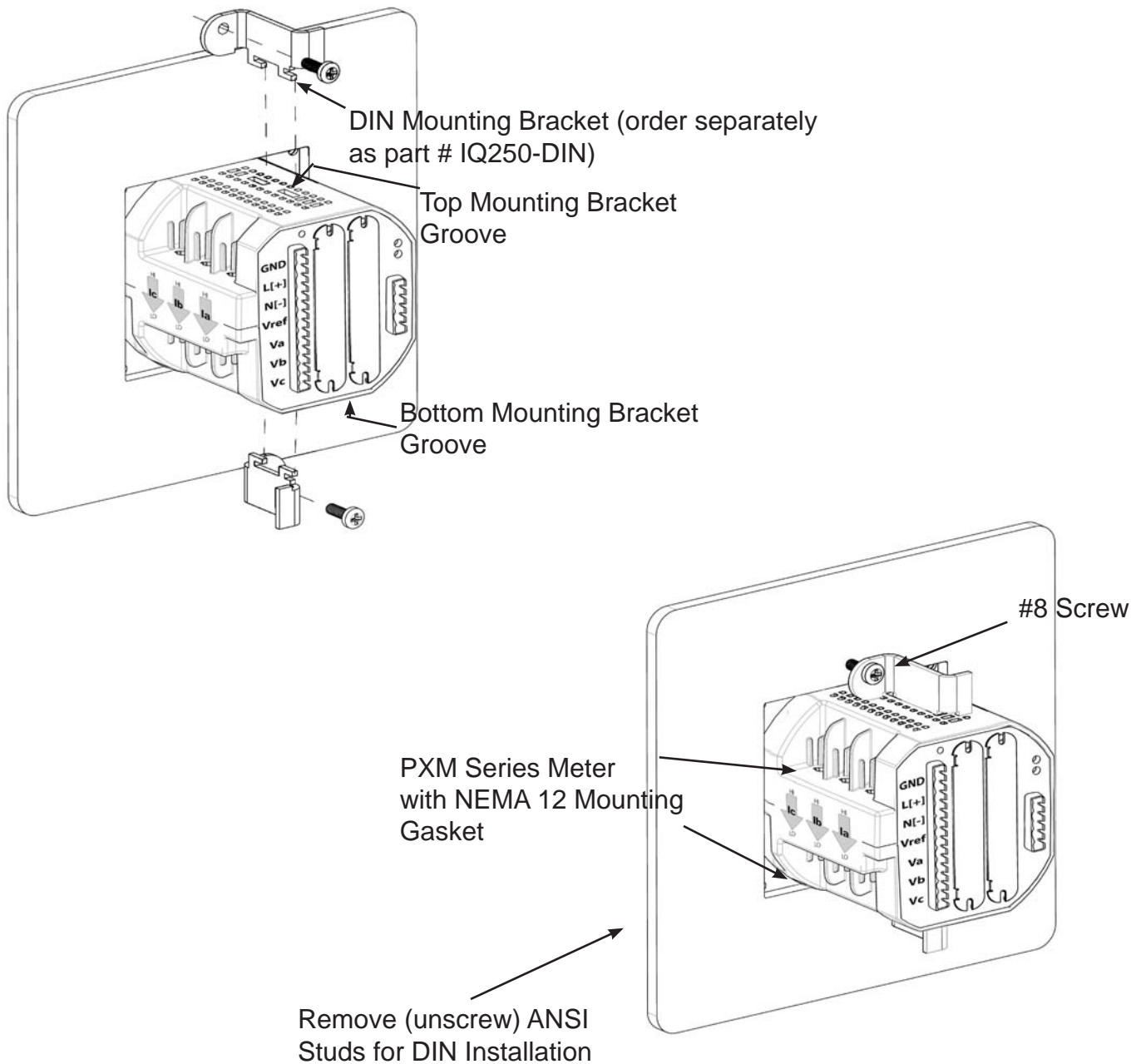


Figure 3.8: DIN Mounting Procedure

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 (order these separately as Eaton part # IQ250-DIN) 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 0.4 Newton-Meter.

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)
 7.55mm x 35mm x 76.2mm (millimeters)

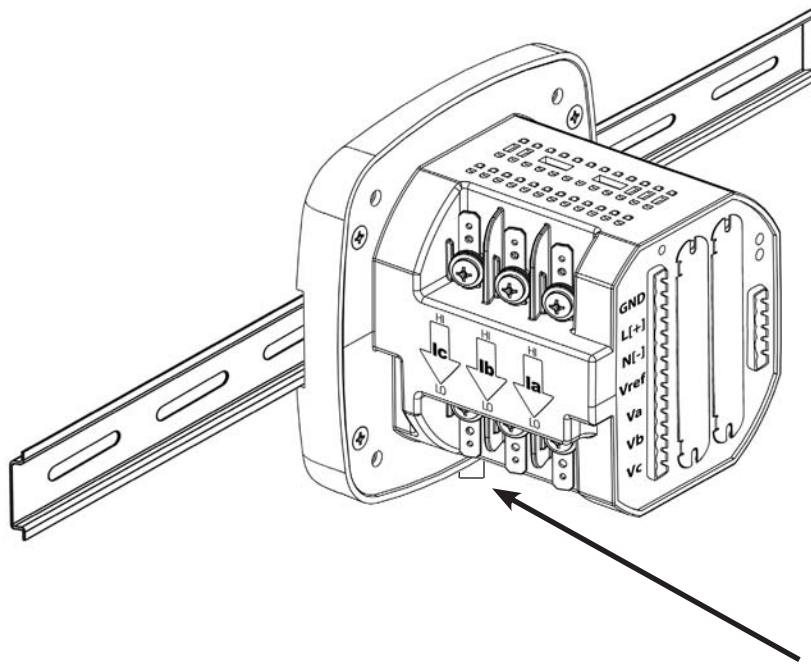


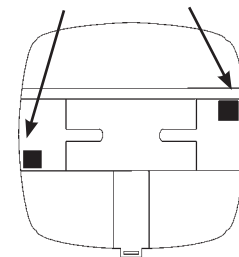
Figure 3.9: DIN Rail Mounting Procedure

Release Clip

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 on 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 electrologically 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. Diagram 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 1 Newton-Meter.

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

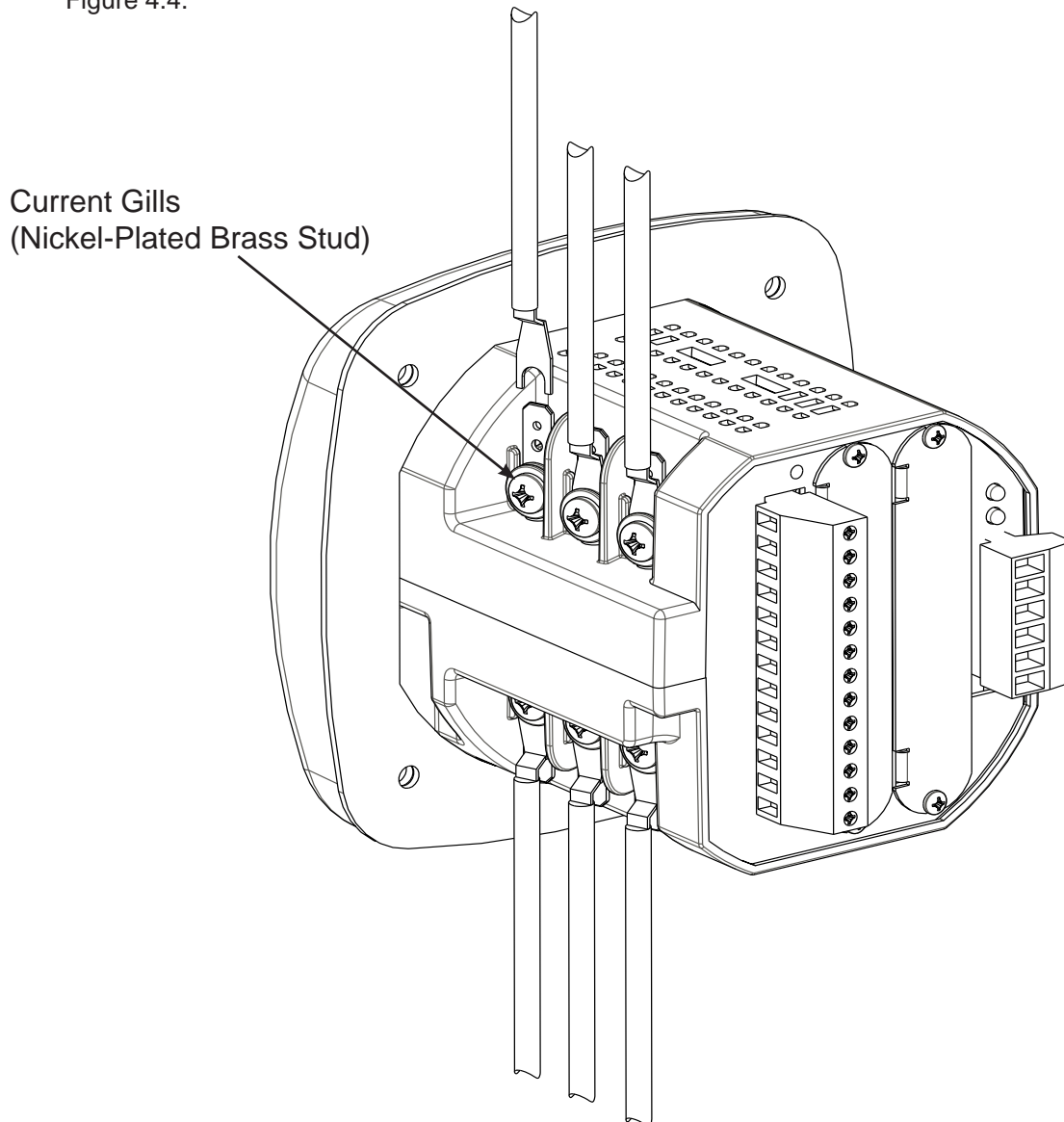


Figure 4.1: CT Leads terminated to Meter, #8 Screw for Lug Connection

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" / 4.5mm maximum diameter CT wire.

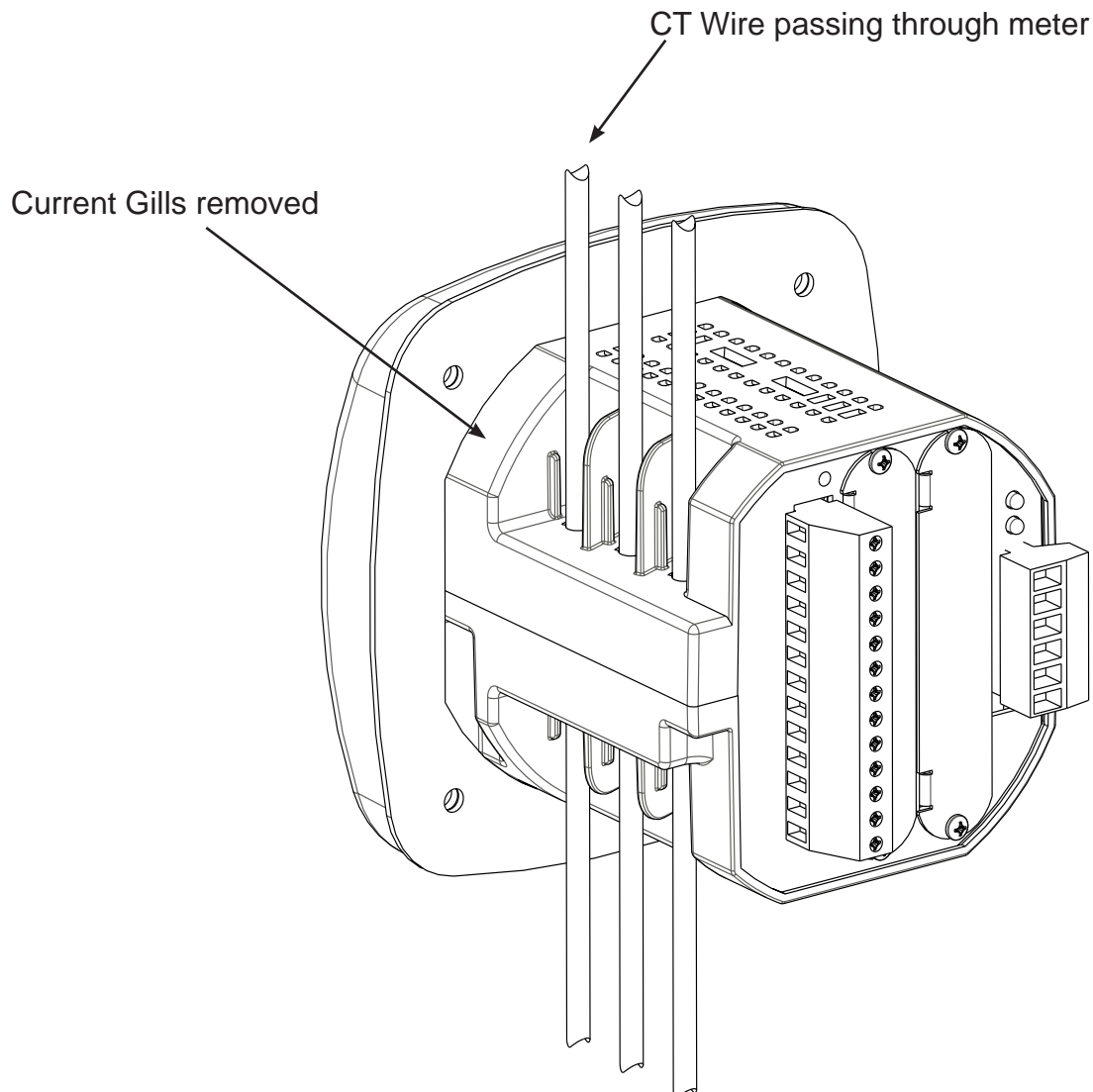


Figure 4.2: Pass-Through Wire Electrical Connection

Quick Connect Crimp-on Terminations

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

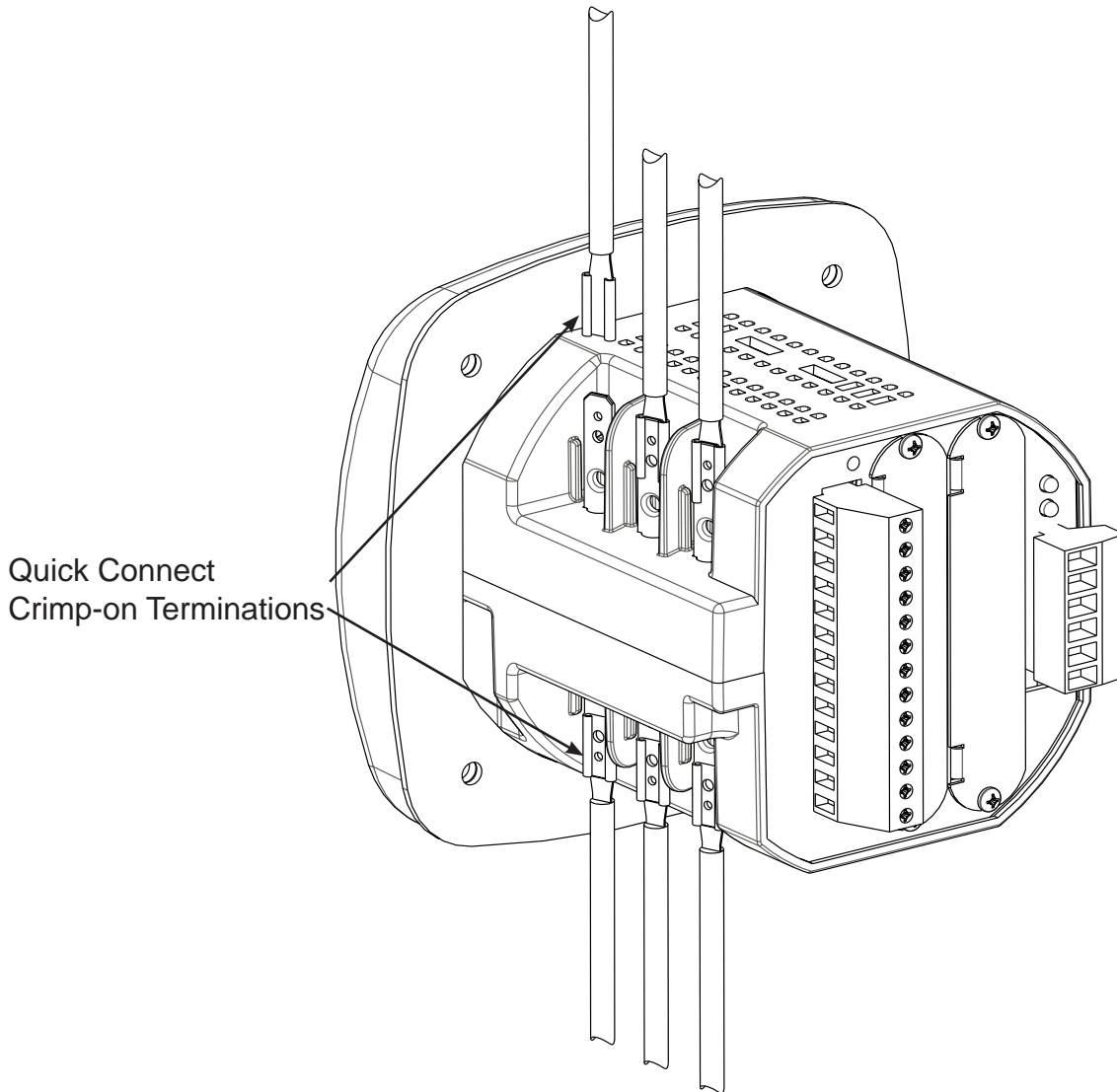


Figure 4.3: Quick Connect Electrical Connection

Voltage and Power Supply Connections

Voltage Inputs are connected to the back of the unit via a optional wire connectors. The connectors accomodate AWG# 12 -26/ (0.129 - 3.31)mm².

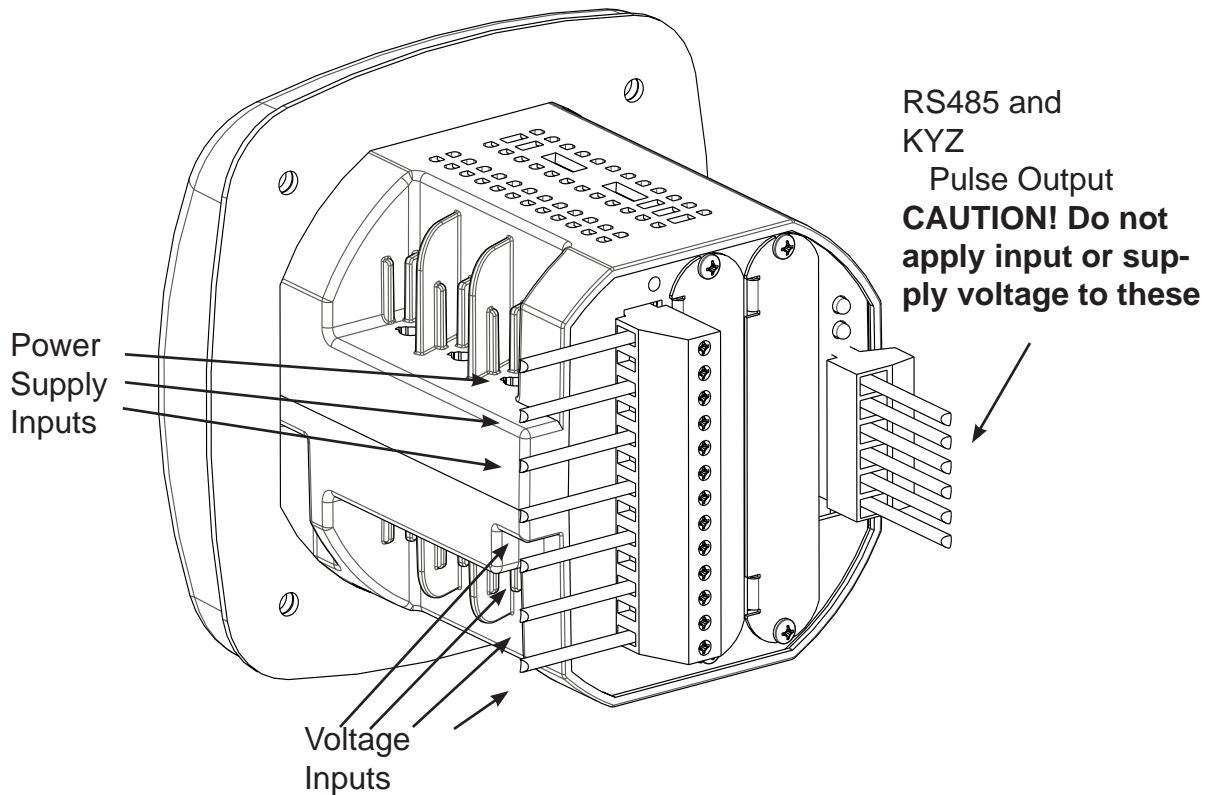


Figure 4.4: Voltage Connection

Ground Connections

The meter's Ground Terminals should be connected directly to the installation's protective earth ground. Use AWG# 12/2.5 mm² 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.

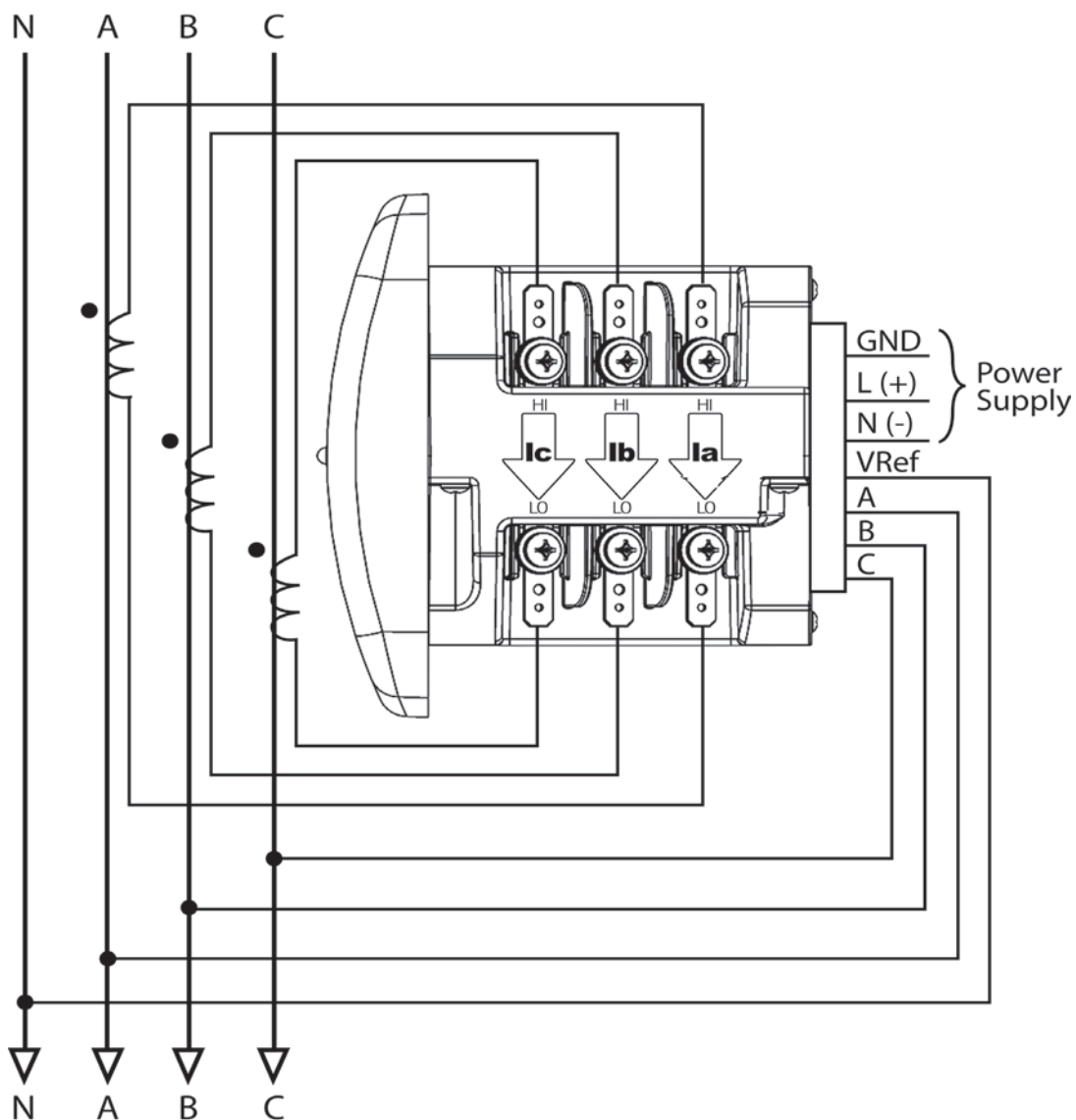
Electrical Connection Diagrams

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.

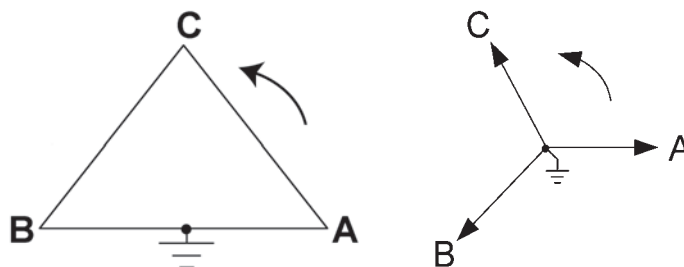
The diagrams are presented in the following order:

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

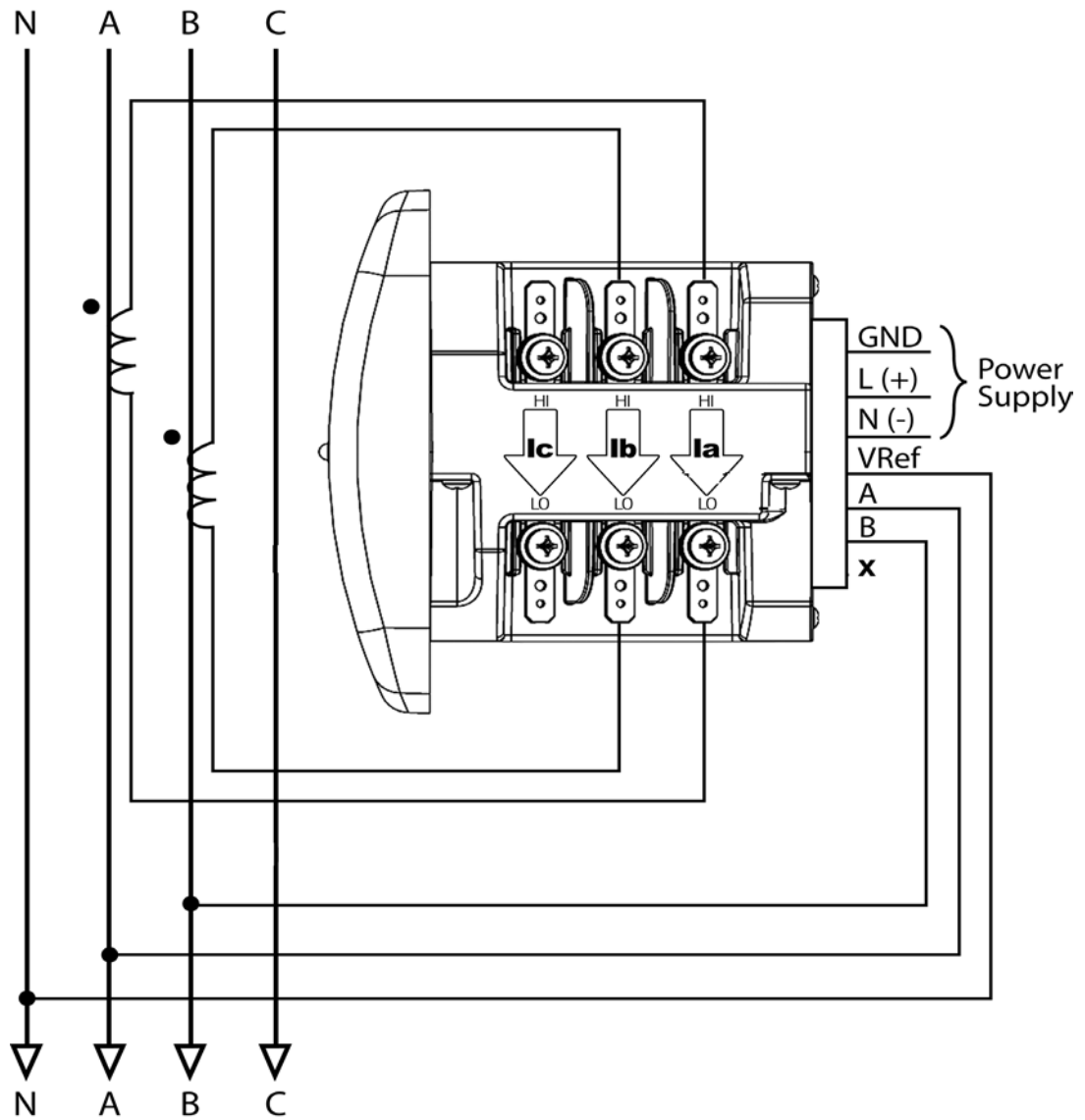
1. Service: WYE/Delta, 4-Wire with No PTs, 3 CTs



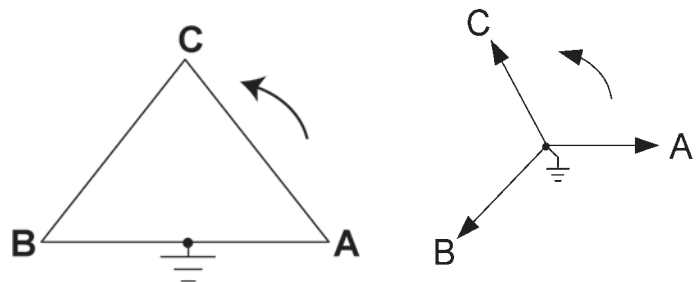
Select: "3 EL WYE" (3 Element Wye) from the Meter's Front Panel Display. (See Chapter 6.)



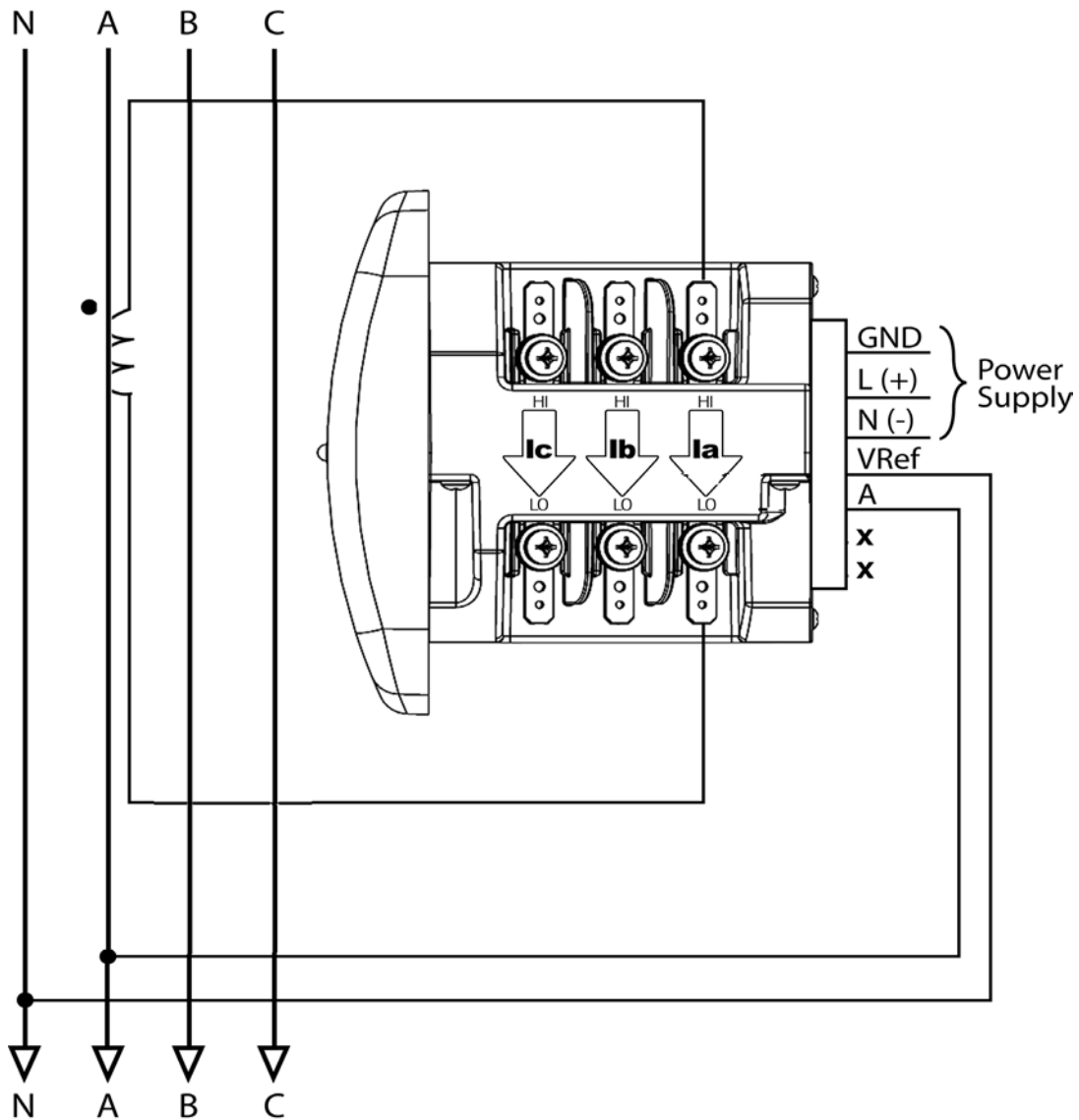
1a. Example of Dual Phase Hookup



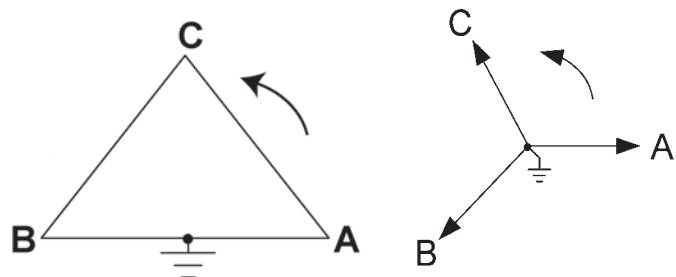
Select: "3 EL WYE" (3 Element Wye) from the Meter's Front Panel Display. (See Chapter 6.)



1b. Example of Single Phase Hookup

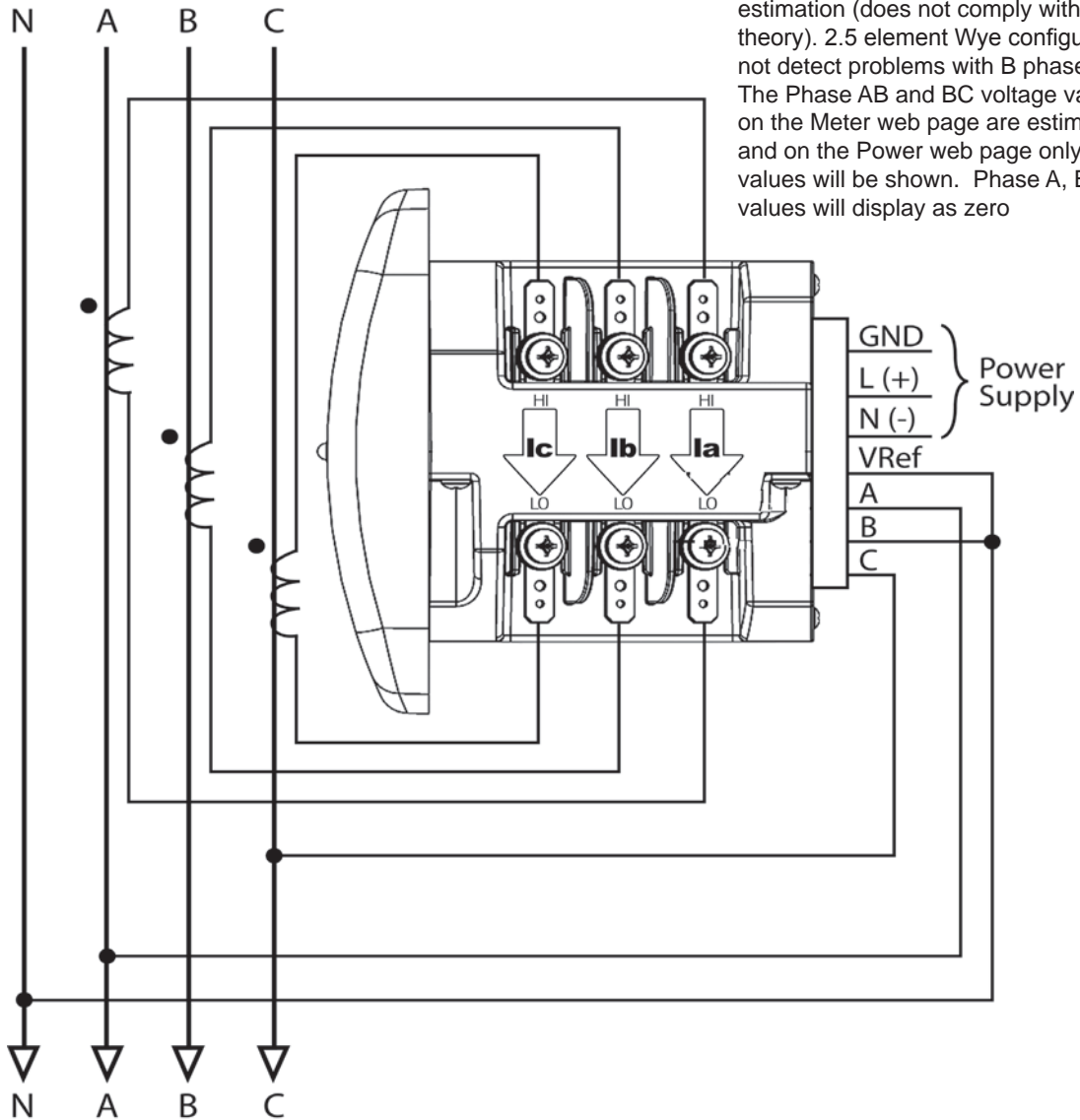


Select: "3 EL WYE" (3 Element Wye) from the Meter's Front Panel Display. (See Chapter 6.)

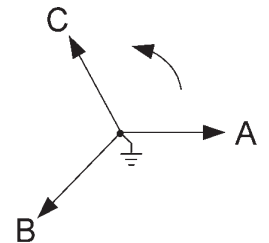


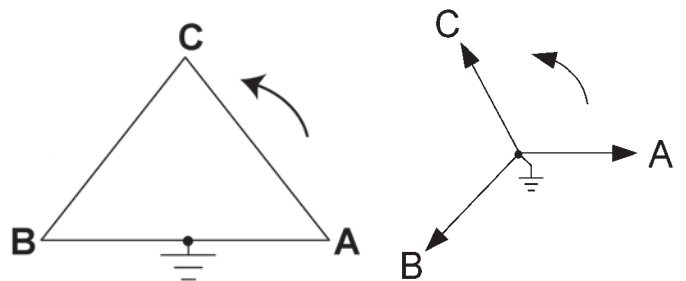
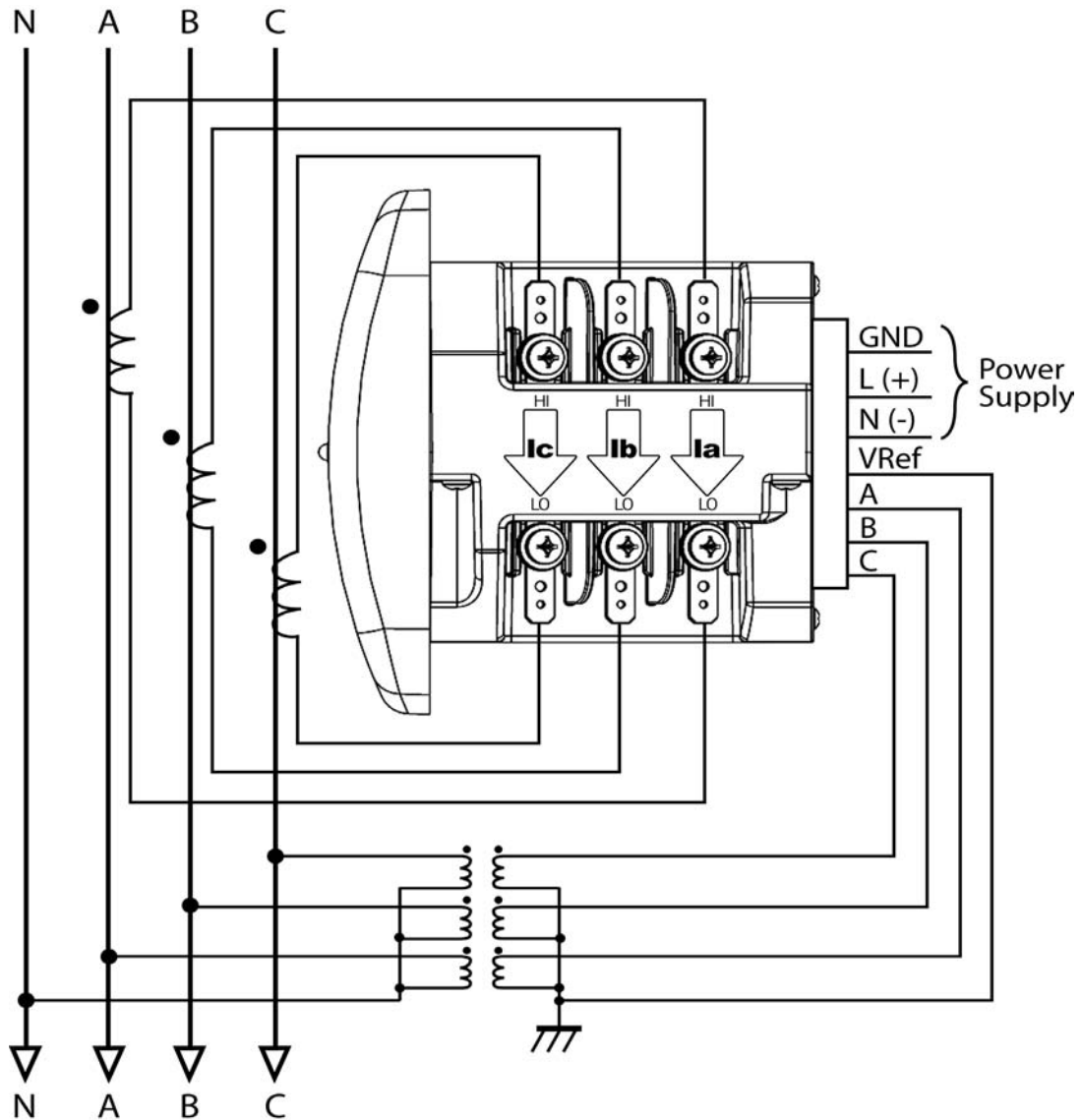
2. Service: 2.5 Element WYE, 4-Wire with No PTs, 3 CTs

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.)

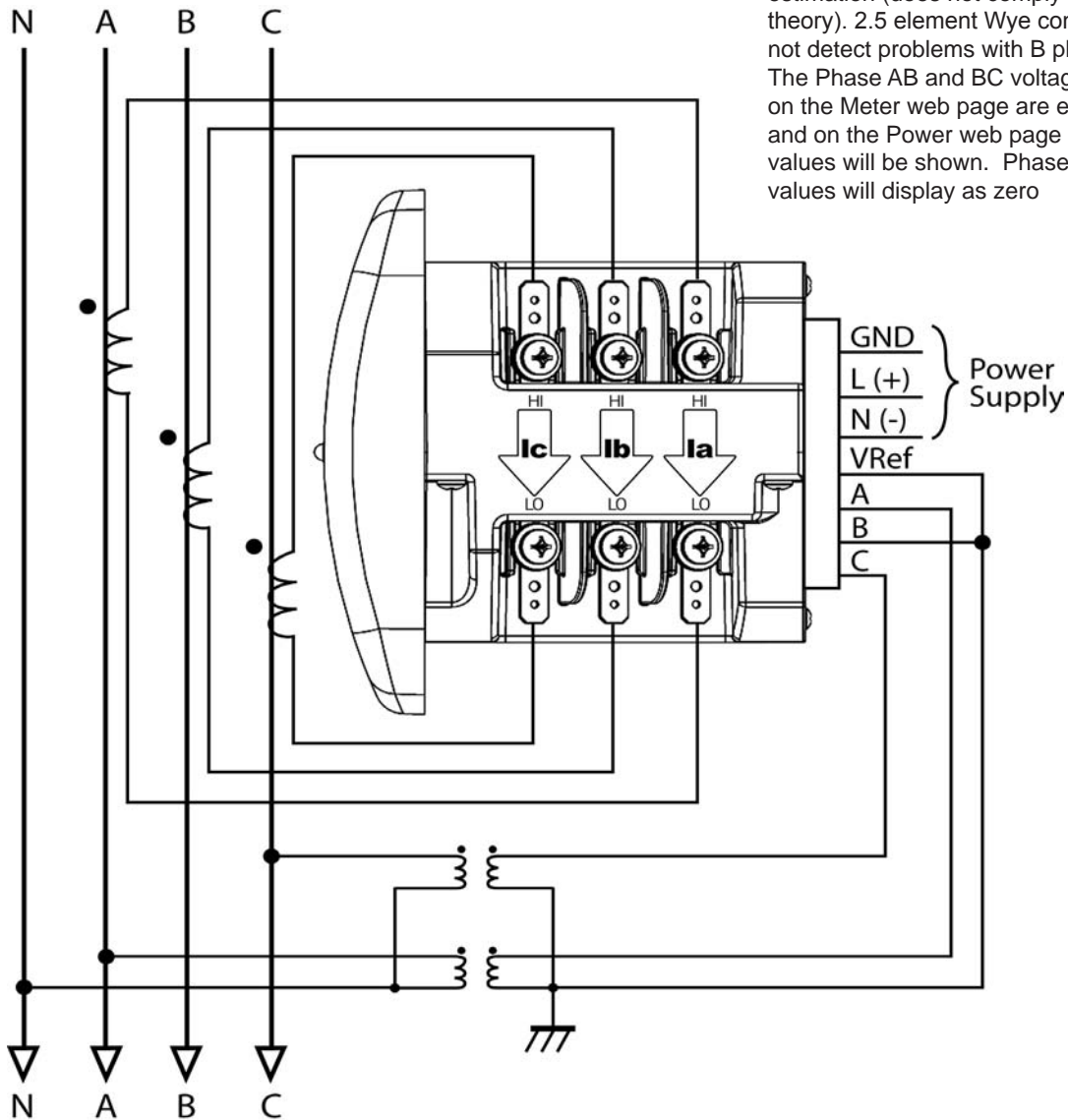




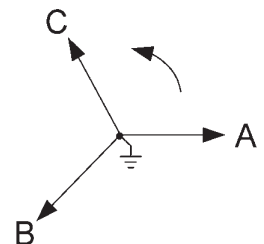
Select: " 3 EL WYE " (3 Element Wye) from the Meter's Front Panel Display. (See Chapter 6.)

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

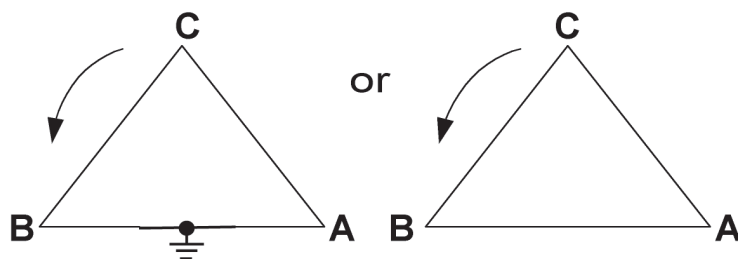
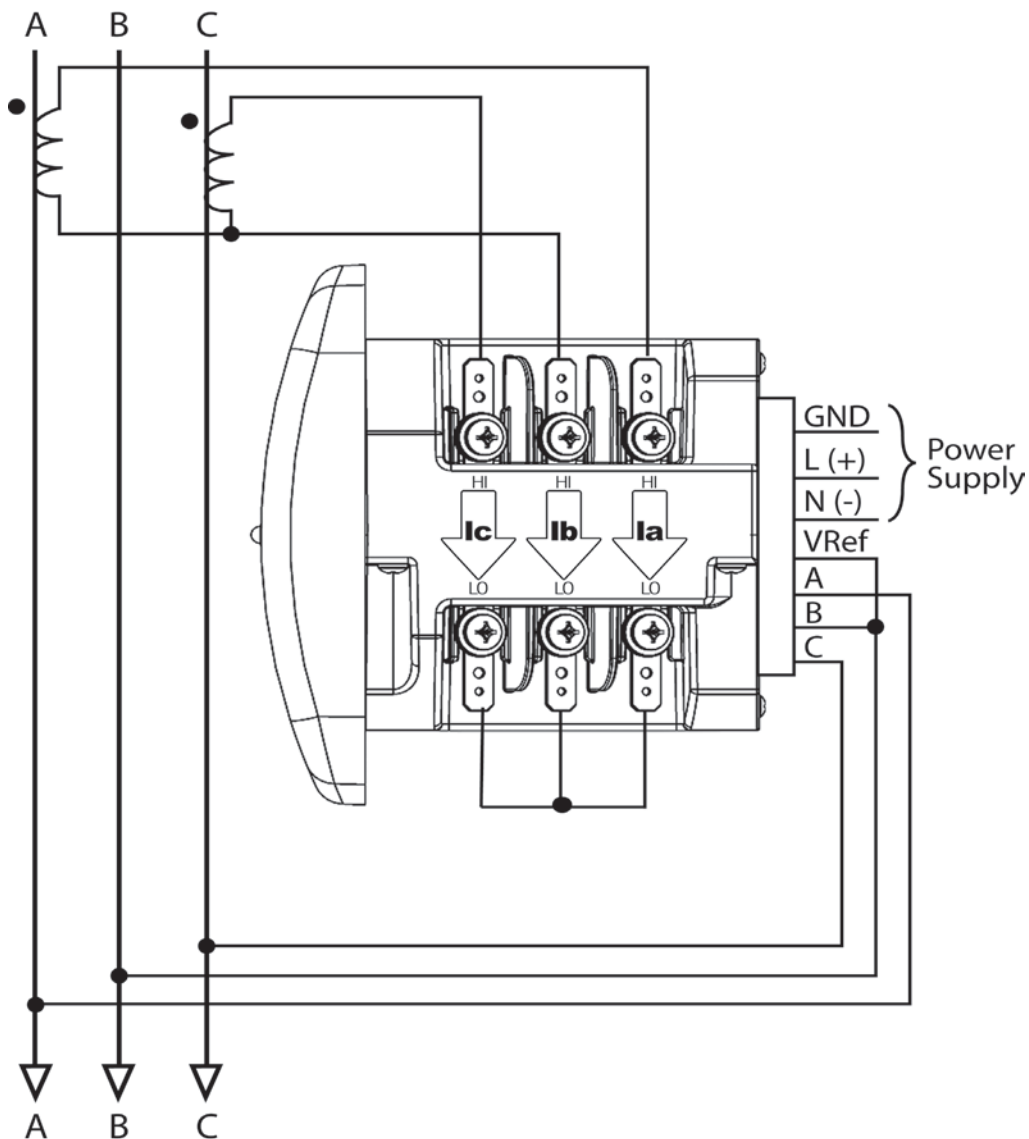
This configuration is **not** recommended. In this configuration the B phase voltage is not measured to save the cost of a B Phase voltage transformer. A balanced 3 phase voltage is assumed to estimate B phase voltage for the purpose of 3 phase power and energy estimation (does not comply with Blondel's 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.)



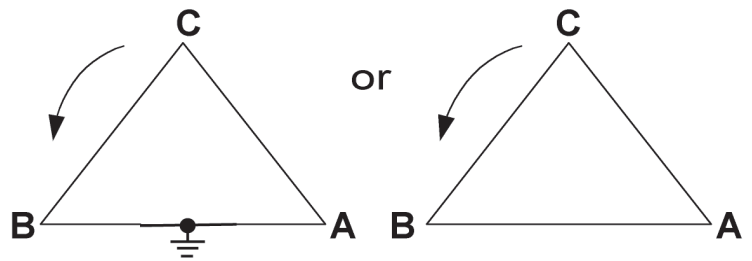
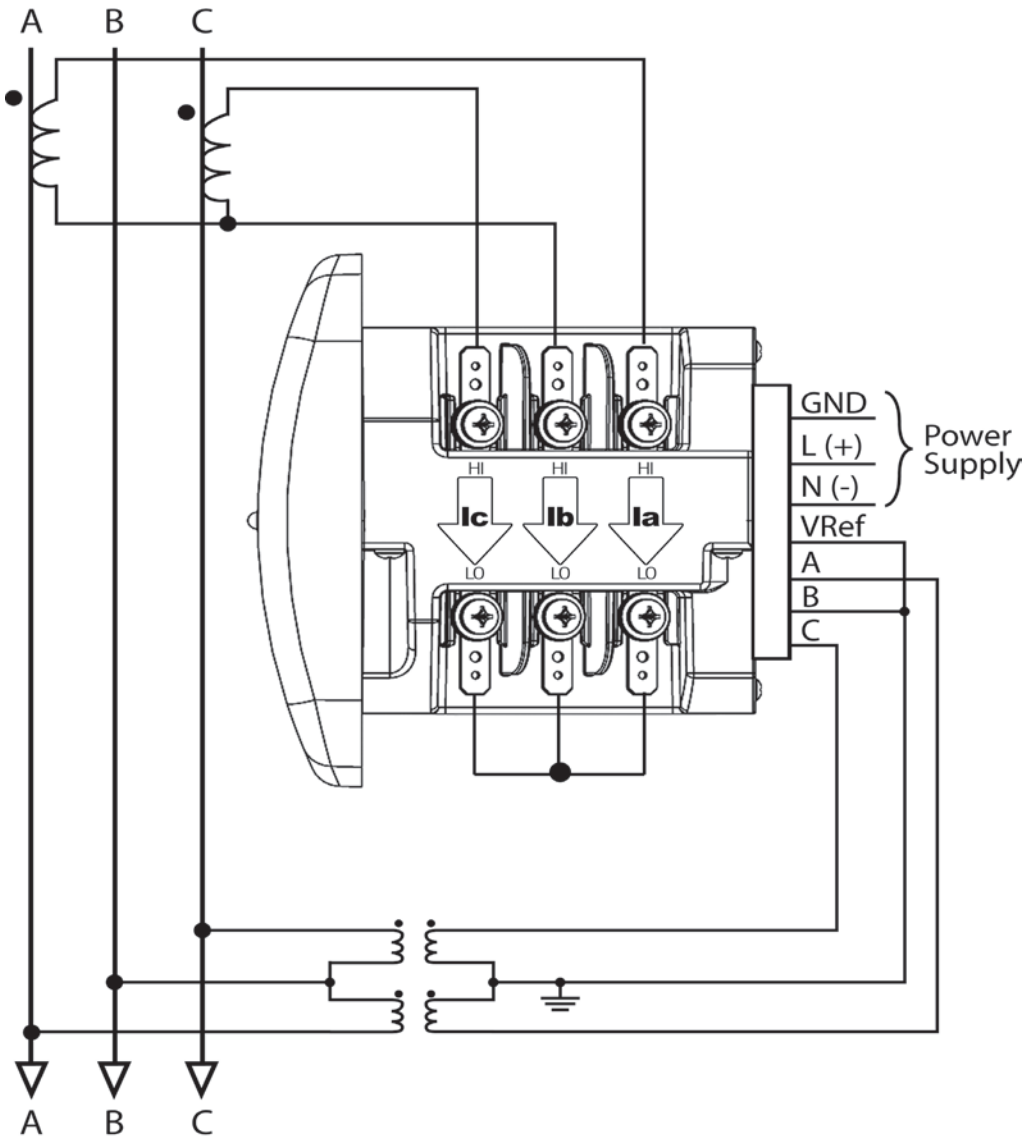
5. Service: Delta, 3-Wire with No PTs, 2 CTs



Select: "2 CT DEL" (2 CT Delta) from the Meter's Front Panel Display. (See Chapter 6.)

Not connected to meter

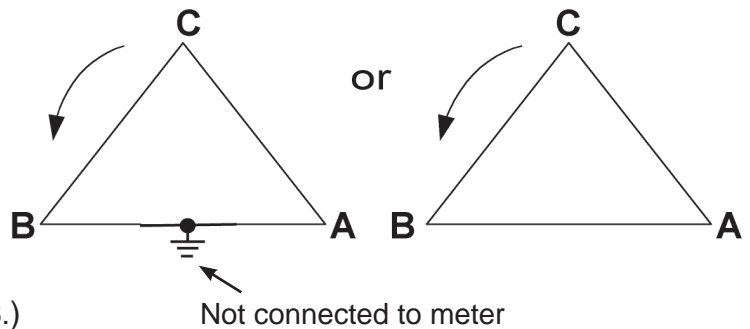
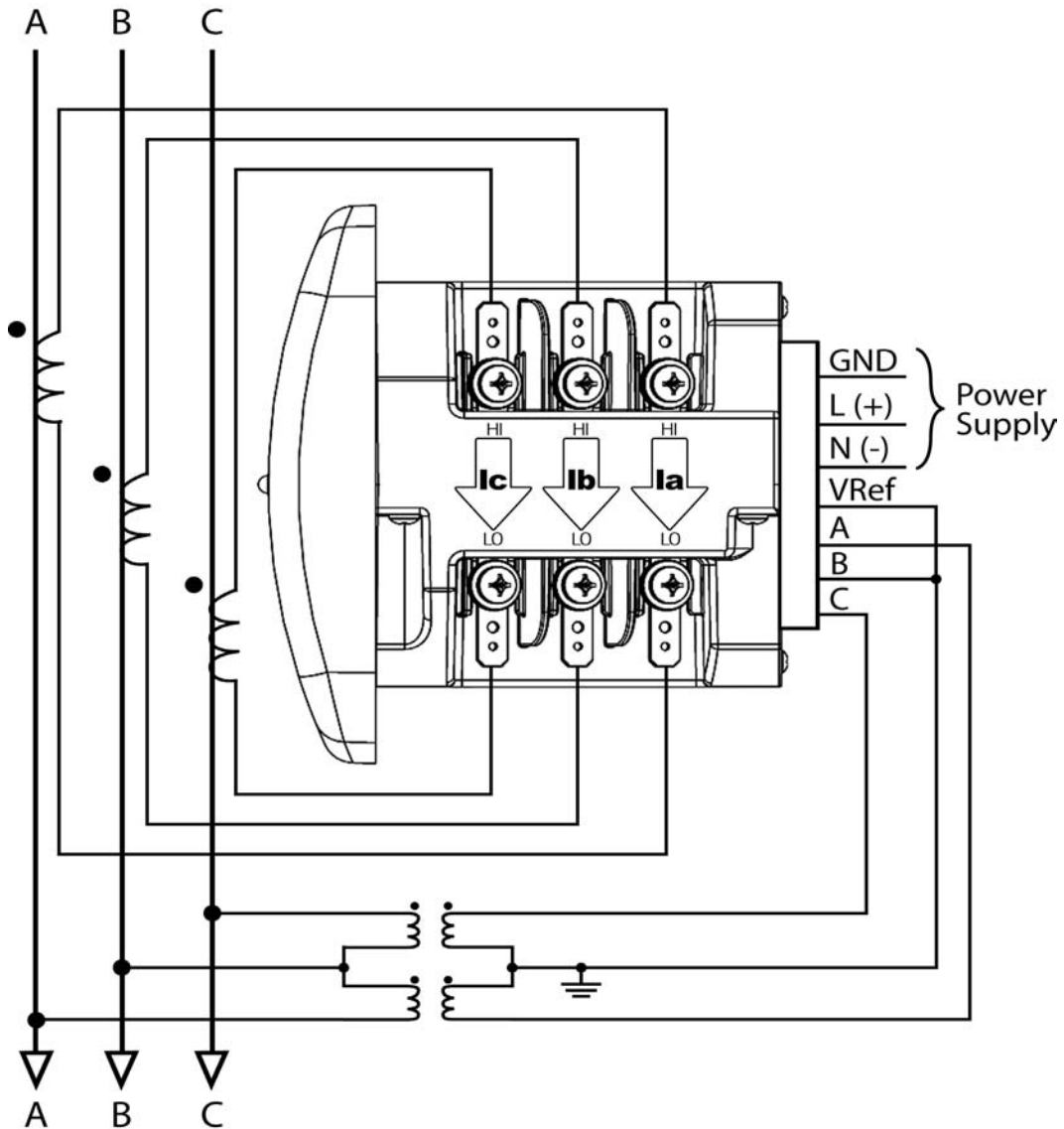
6. Service: Delta, 3-Wire with 2 PTs, 2 CTs



Select: "2 CT DEL" (2 CT Delta) from the Meter's Front Panel Display. (See Chapter 6.)

Not connected to meter

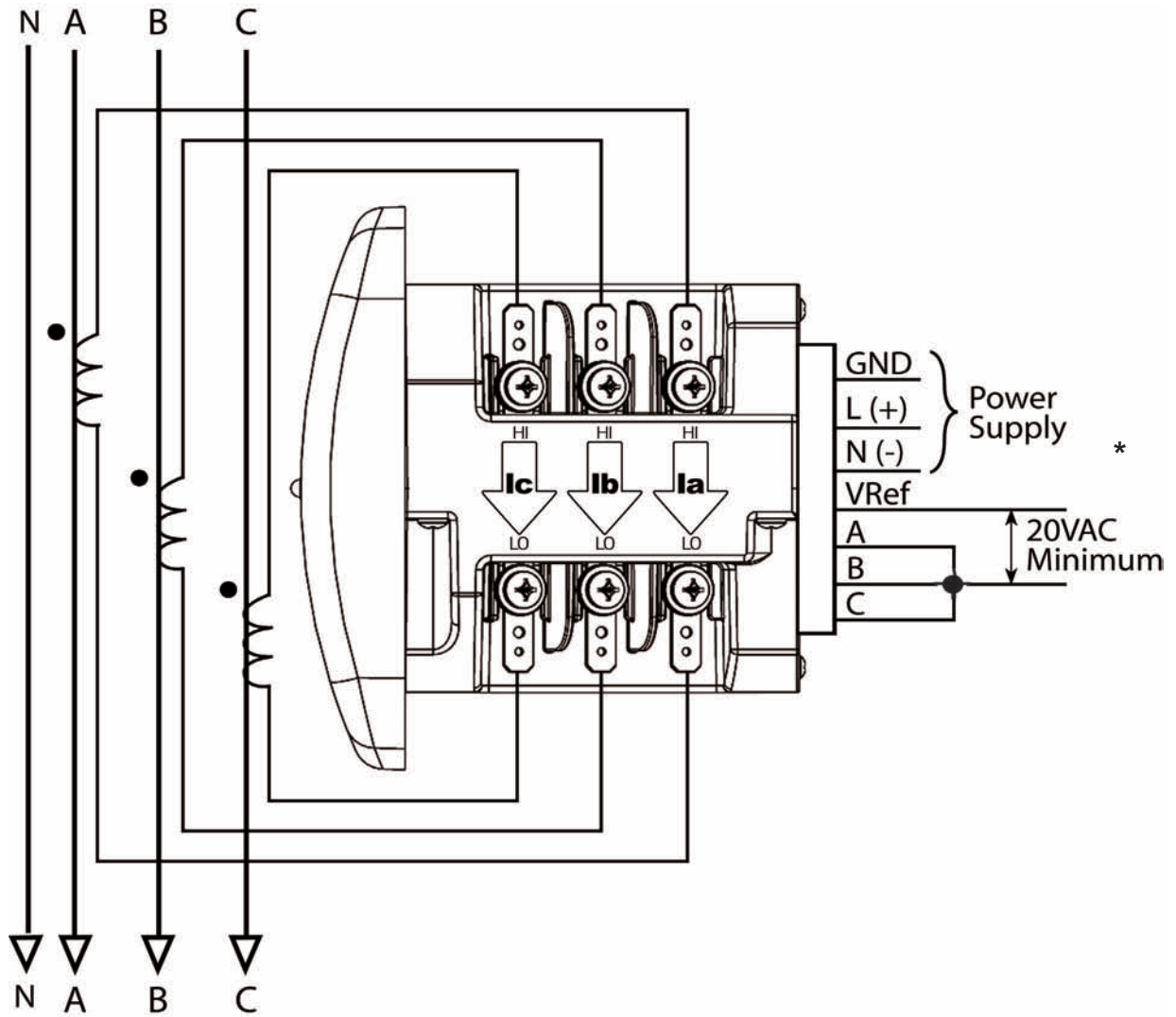
7. Service: Delta, 3-Wire with 2 PTs, 3 CTs



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.

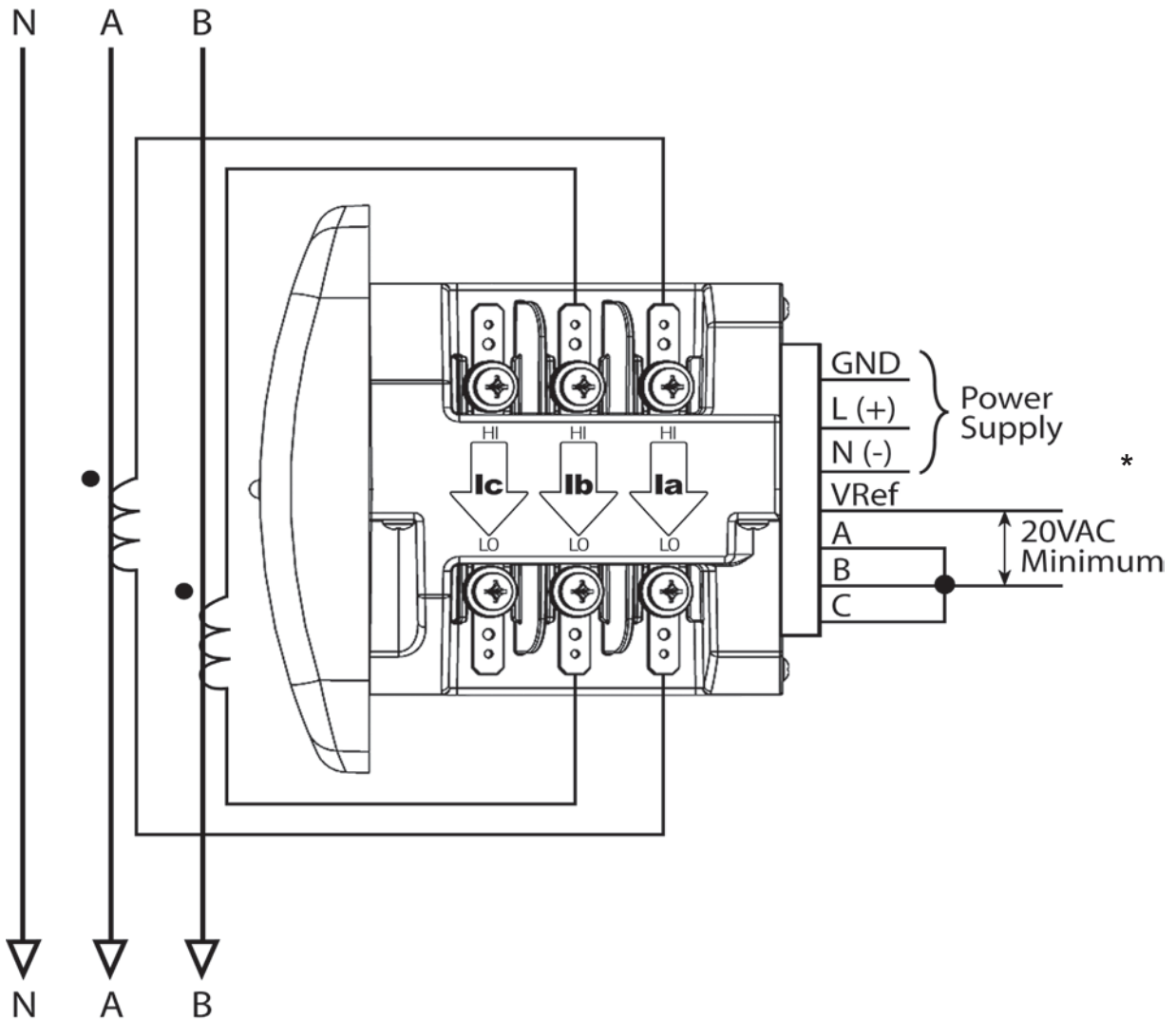
8. Service: Current Only Measurement (Three Phase)



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.

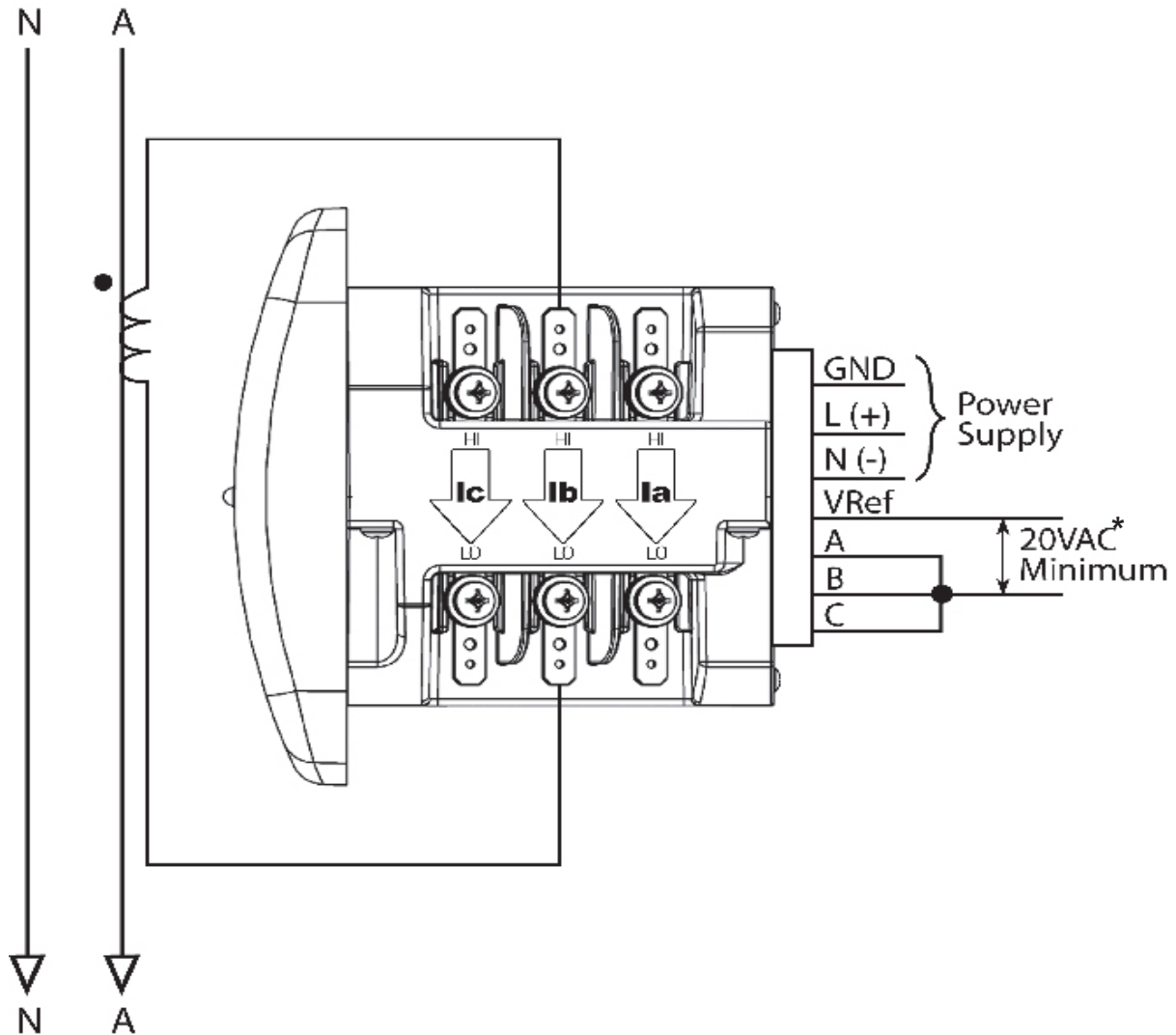
9. Service: Current Only Measurement (Dual Phase)



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.

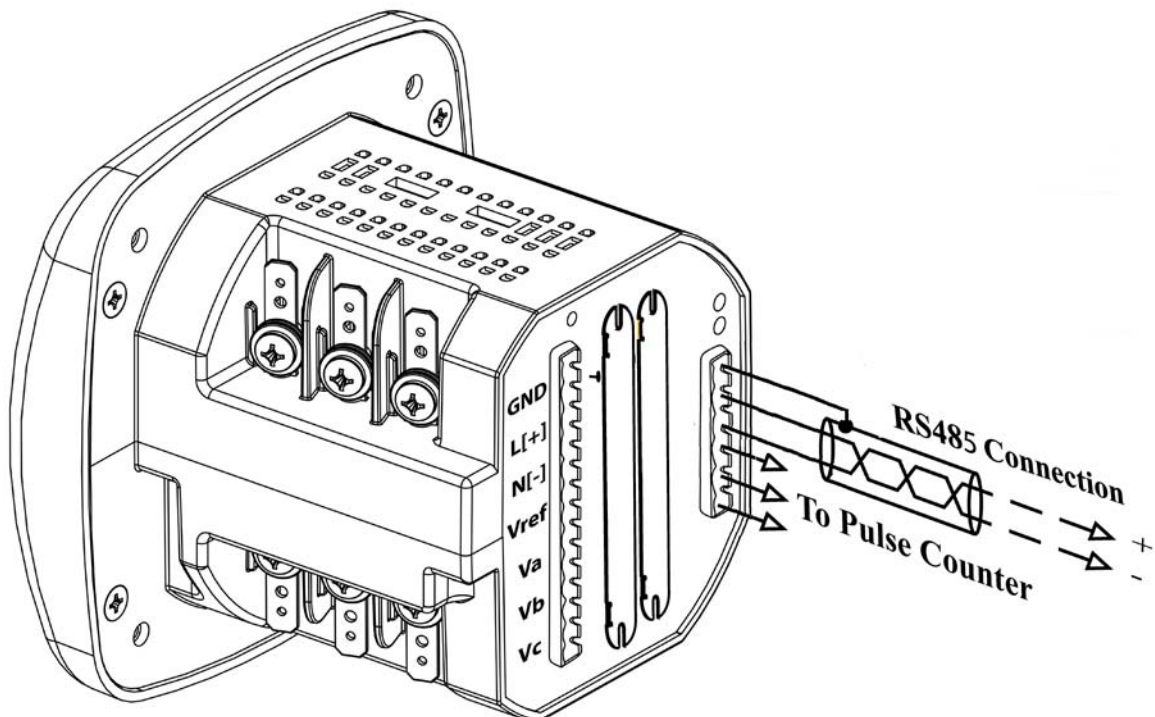


Figure 5.1: Meter Back with RS485 Communication Installation

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 feet (1219.20 meters).

Figure 5.2 shows the detail of a 2-wire RS485 connection.

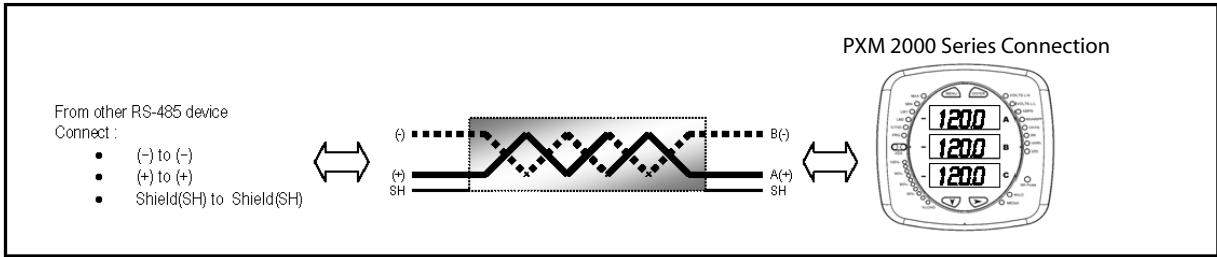


Figure 5.2: 2-wire RS485 Connection

NOTES:

For All RS485 Connections:

- Use a shielded twisted pair cable 22 AWG (0.33 mm²) 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 feet (1219.20 meters).
- 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_T)** 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.

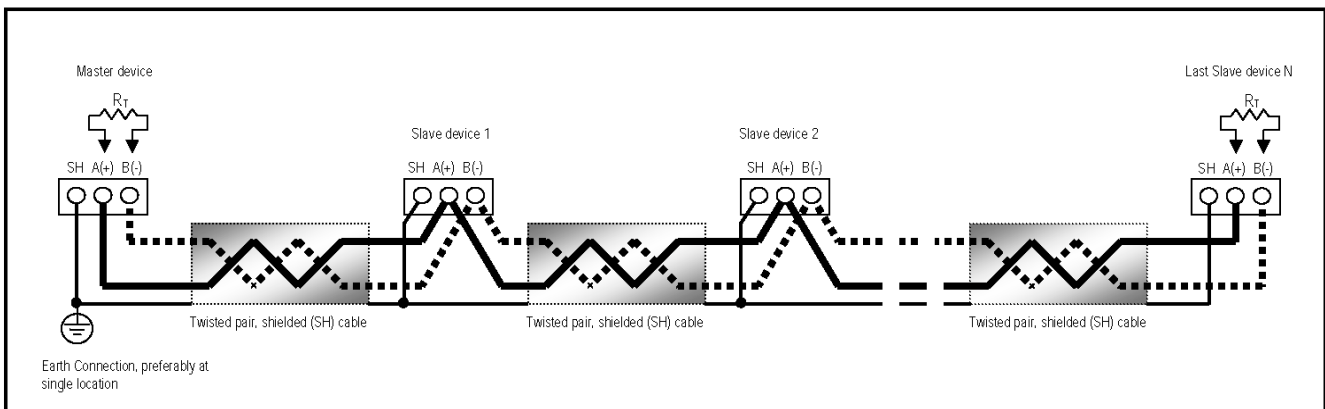


Figure 5.3: RS485 Daisy Chain Connection

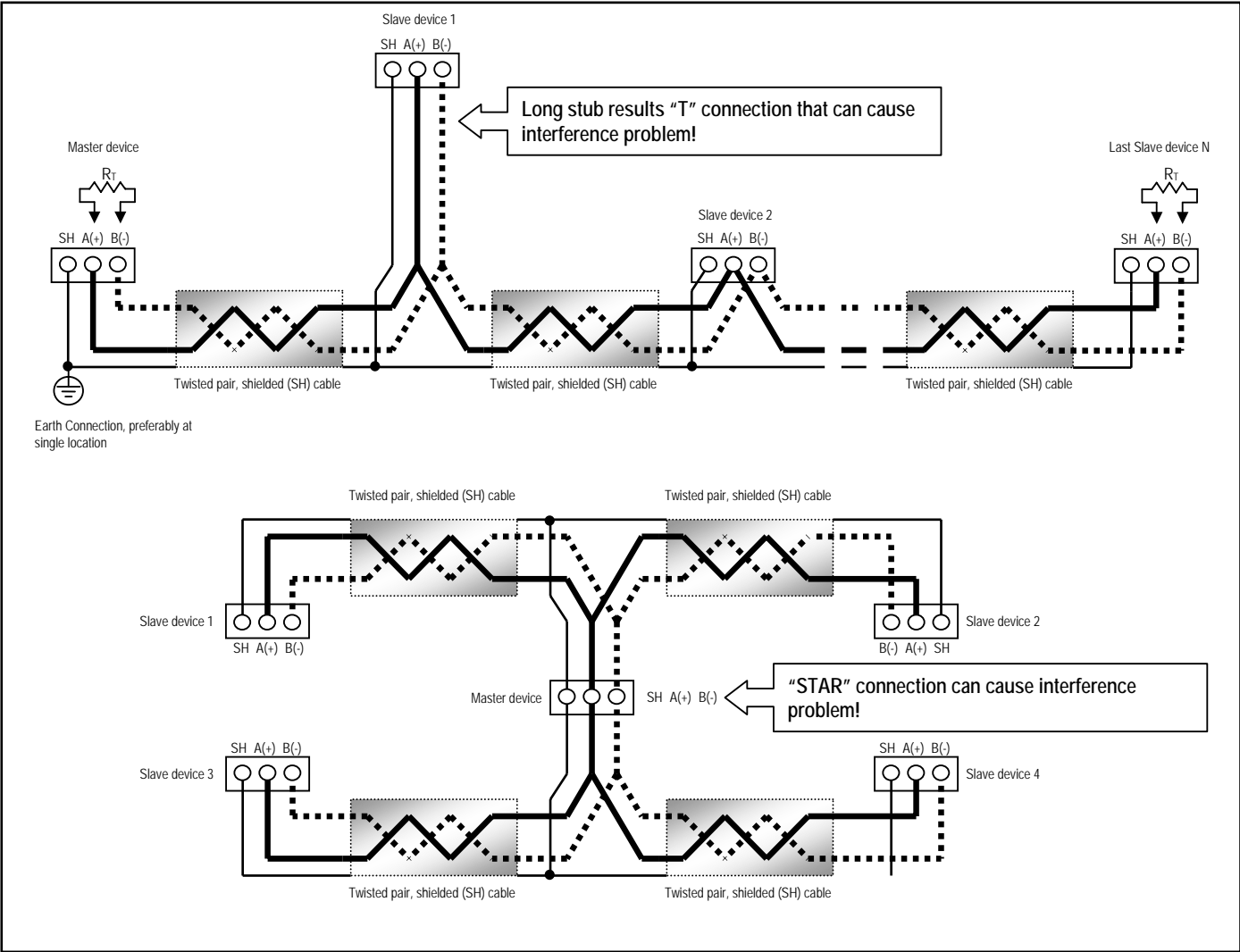


Figure 5.4: Incorrect "T" and "Star" Topologies

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. Programming and communication utilize 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 4, Figure 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

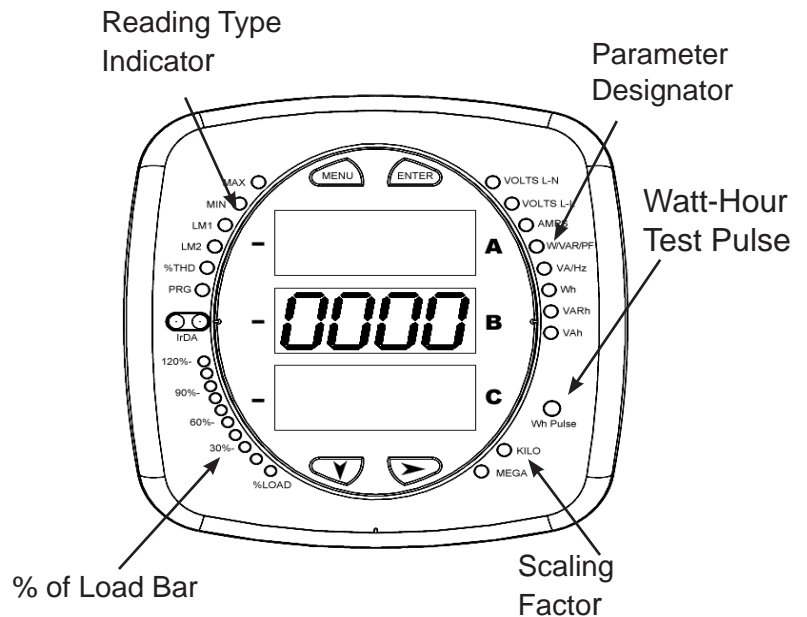


Figure 6.1: Meter's Face Plate with Elements

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

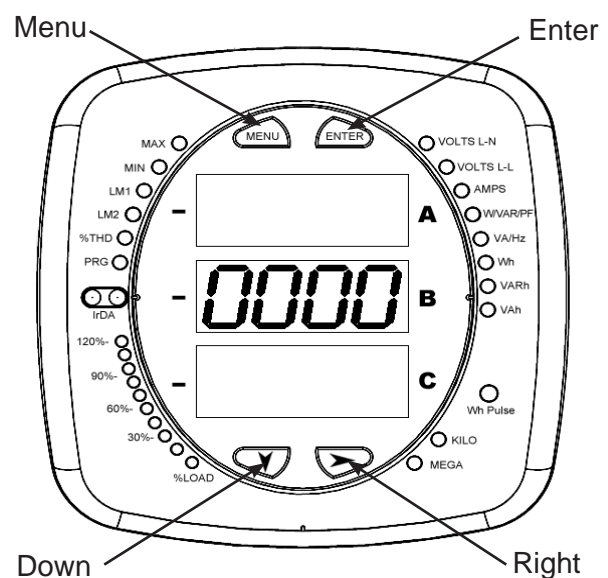
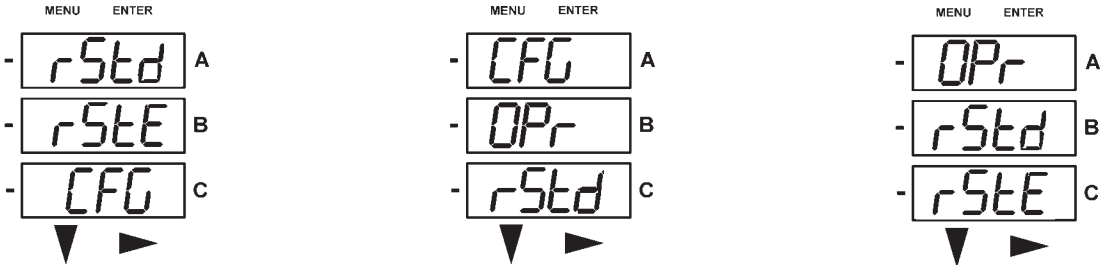


Figure 6.2: Meter's Face Plate with Buttons

Using the Main Menu

- 1. 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.

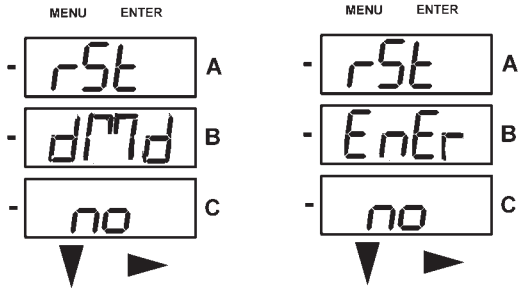
- 2. Press the **Enter** button from the Main Menu to view the Parameters screen for the mode that is currently active.

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.



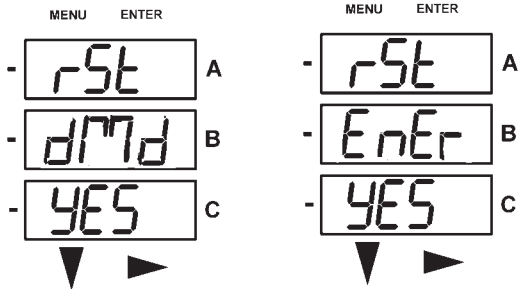
- If you press the **Enter** button again, the Main Menu appears, with **the next mode** in the A window. (The **Down** button does not affect this screen.)

- 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 dMnd donE**” or “**rSt EnEr donE**” and then resumes auto-scrolling parameters.

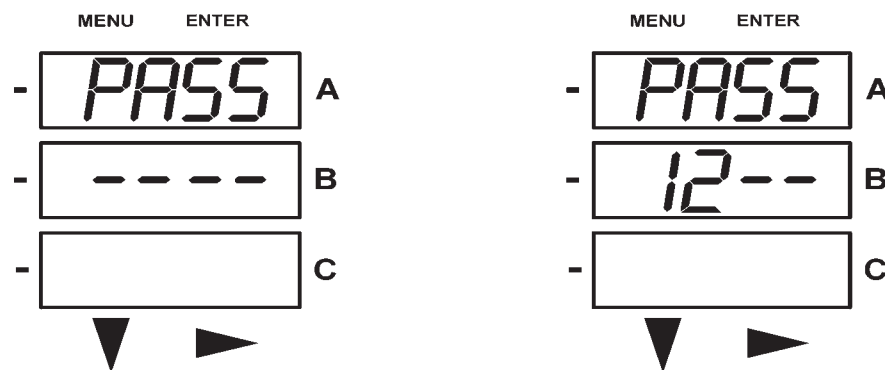
Entering a Password

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.

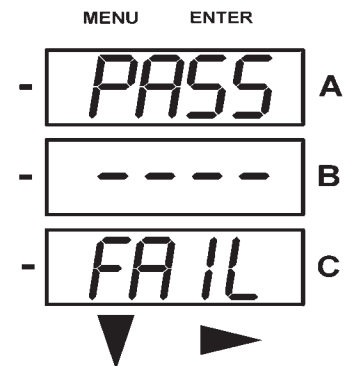
1. Press the **Down** button to scroll numbers from 0 to 9 for the flashing dash. When the correct number appears for that dash, use the the **Right** button to move to the next dash.

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**.



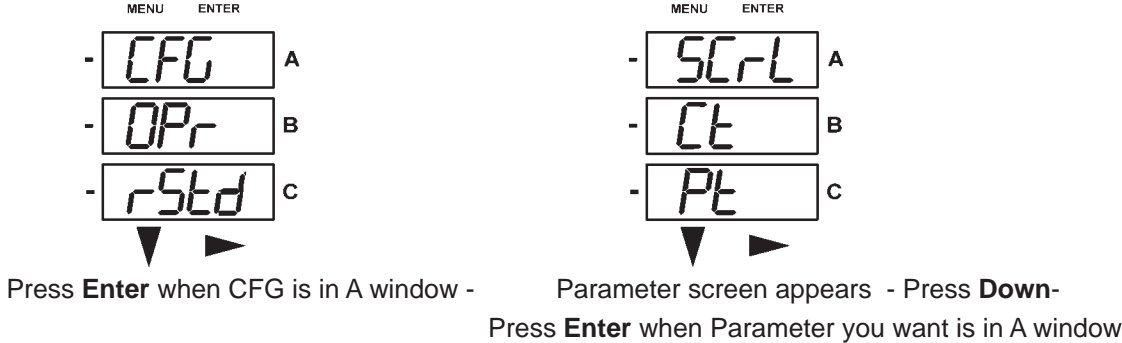
Using Configuration Mode

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.

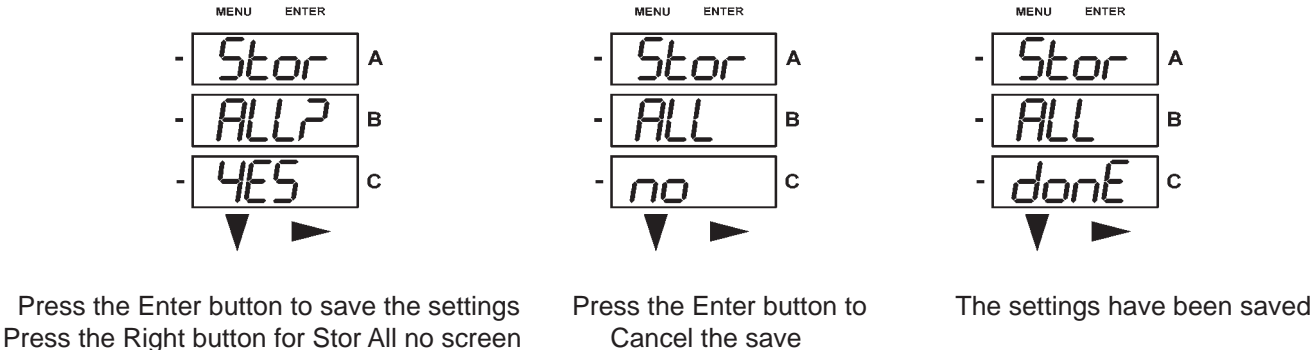
NOTE: You can use the Enter button to scroll through all of the Configuration parameters and their Setting screens, in order.



- 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.



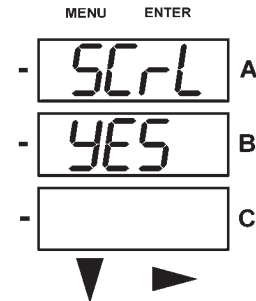
Configuring the Scroll Feature

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:

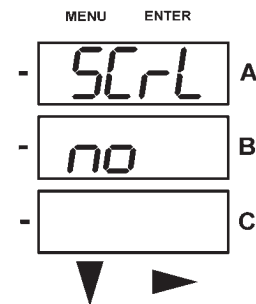
- They have been selected through software. (Refer to Chapter 8 for instructions.)
- Whether your meter model is a PXM 2250, 2260, 2270, 2280 or 2290.

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).

NOTE:

- 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.

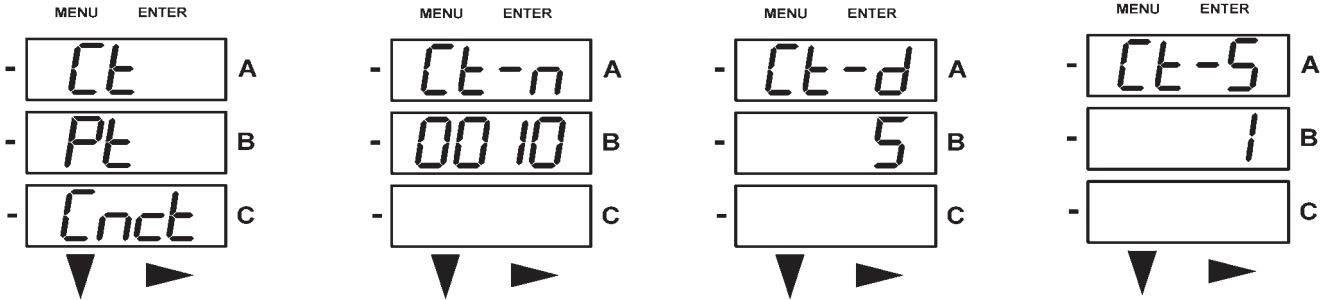
2. When the new setting is entered, press the **Menu** button twice.
3. The **Store ALL YES** screen appears. Press **Enter** to save the new CT setting.

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:

14,400/120 Volts:

138,000/69 Volts:

345,000/115 Volts:

345,000/69 Volts:

Pt-n value is 277, Pt-d value is 277, Pt-S value is 1.

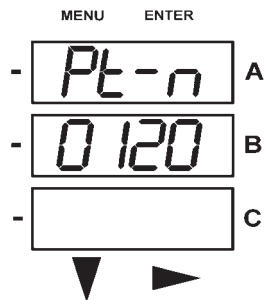
Pt-n value is 1440, Pt-d value is 120, Pt-S value is 10.

Pt-n value is 1380, Pt-d value is 69, Pt-S value is 100.

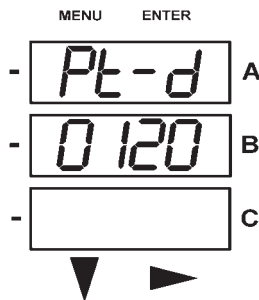
Pt-n value is 3450, Pt-d value is 115, Pt-S value is 100.

Pt-n value is 345, Pt-d value is 69, Pt-S value is 1000.

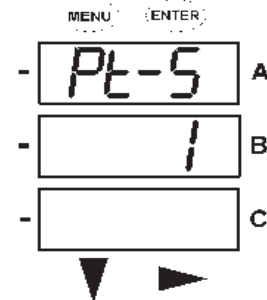
NOTE: Pt-n and Pt-S are dictated by primary voltage; Pt-d is secondary voltage.



Use buttons to set Pt-n value



Use buttons to set Pt-d value

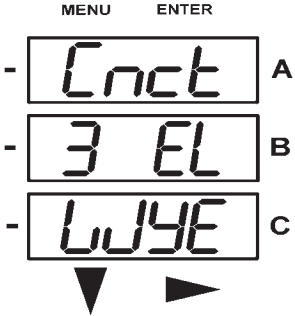


Use buttons to select scaling

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.



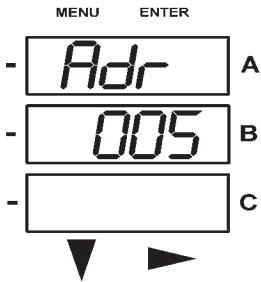
Use buttons to select configuration

Configuring Communication Port Setting

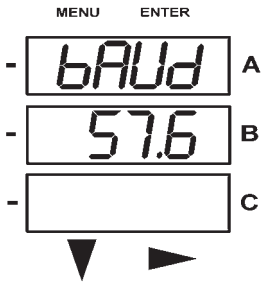
Port configuration consists of : **Address** (a three digit number), **Baud Rate** (9600; 19200; 38400; or 57600), and **Protocol** (DNP 3.0; Modbus RTU; or Modbus ASCII).

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.

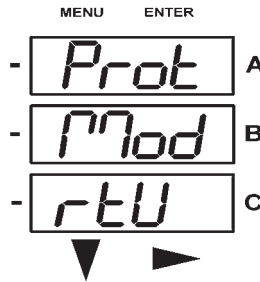
NOTE: If you are prompted to enter a password, refer to the instructions earlier in this chapter.
2. When you have finished making your selections, press the **Menu** button twice.
3. The **STOR ALL YES** screen appears. Press **Enter** to save the settings.



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

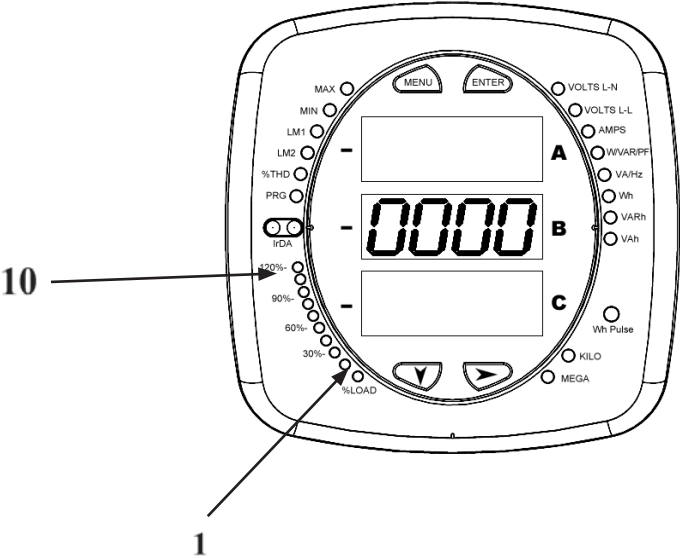
VOLTS L-N	VOLTS_LN	VOLTS_LN_MAX	VOLTS_LN_MIN			VOLTS_LN_THD
VOLTS L-L	VOLTS_LL	VOLTS_LL_MAX	VOLTS_LL_MIN			
AMPS	AMPS	AMPS_NEUTRAL	AMPS_MAX	AMPS_MIN		AMPS_THD
W/VAR/PF	W_VAR_PF	W_VAR_PF_MAX_POS	W_VAR_PF_MIN_POS	W_VAR_PF_MIN_NEG		
VA/Hz	VA_FREQ	VA_FREQ_MAX	VA_FREQ_MIN			
Wh	KWH_REC	KWH_DEL	KWH_NET	KWH_TOT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

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%



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.

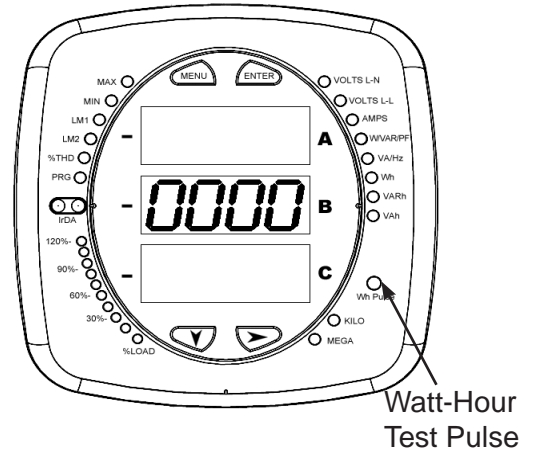


Figure 6.4: Watt-Hour Test Pulse

- Refer to Figure 6.5 for an example of how this process works.
- Refer to Table 6.1 for the Wh/Pulse Constants for Accuracy Testing.

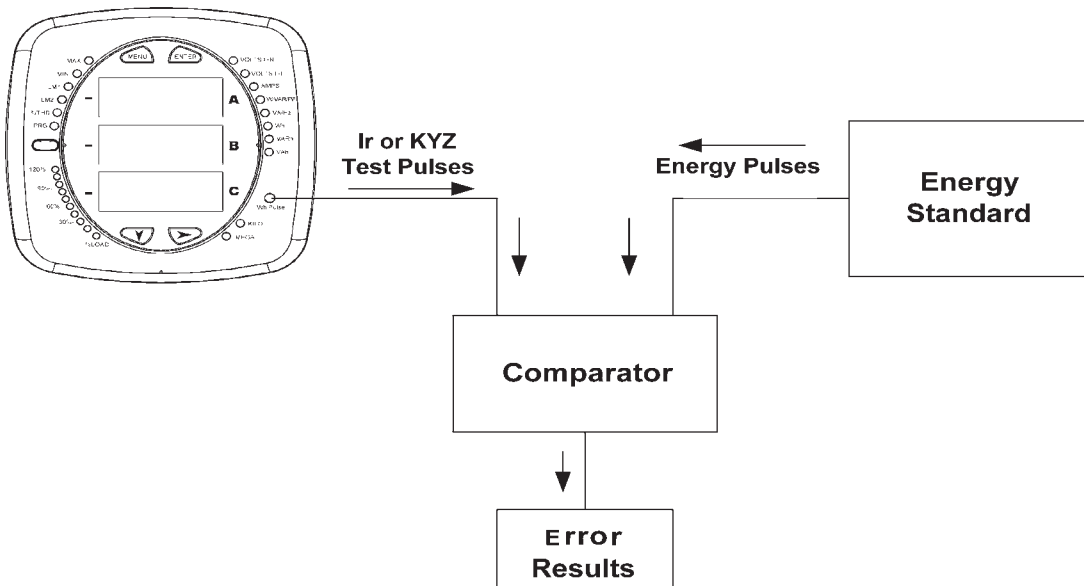


Figure 6.5: Using the Watt-Hour Test Pulse

Table 6.1: Infrared & KYZ Pulse Constants for Accuracy Testing - Kh Watthour per pulse

Input Voltage Level	Class 10 Models	Class 2 Models
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.

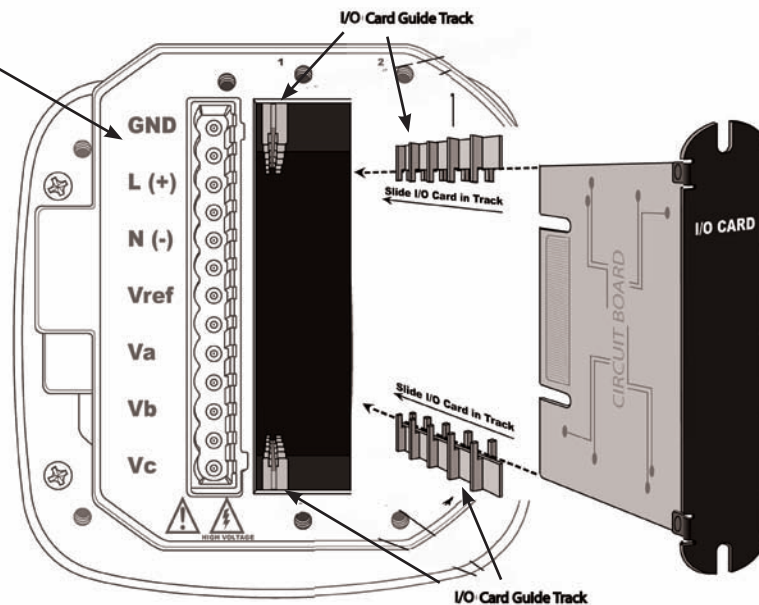
Installing an Option Card

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 (-1)

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 are as follows:

Power consumption:	0.320W internal
Relay outputs.	
Number of outputs:	2
Contact type:	Changeover (SPDT)
Relay type:	Mechanically latching
Switching voltage:	AC 250V / DC 30V
Switching power:	1250VA / 150W
Switching current:	5A
Switching rate max.:	10/s
Mechanical life:	5×10^7 switching operations
Electrical life:	10^5 switching operations at rated current
Breakdown voltage:	AC 1000V between open contacts
Isolation:	AC 3000V / 5000V 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 (12-24V), internally generated
Input current:	2.5mA – constant current regulated
Minimum input voltage:	0V (input shorted to common)
Maximum input voltage:	DC 150V (diode protected against polarity reversal)
Filtering:	De-bouncing with 50ms delay time
Detection scan rate:	100ms
Isolation:	AC 2500V system to inputs

The general specifications are as follows:

Operating temperature:	(-20 to +70) °C
Storage temperature:	(-40 to +80) °C
Relative air humidity:	Maximum 95%, non-condensing
EMC - Immunity Interference:	EN61000-4-2
Weight:	1.5oz
Dimensions (inch) W x H x L:	0.72 x 2.68 x 3.26
External Connection:	AWG 12-26/(0.129 - 3.31)mm ² 9 pin, 0.200" pluggable terminal block

Wiring Diagram

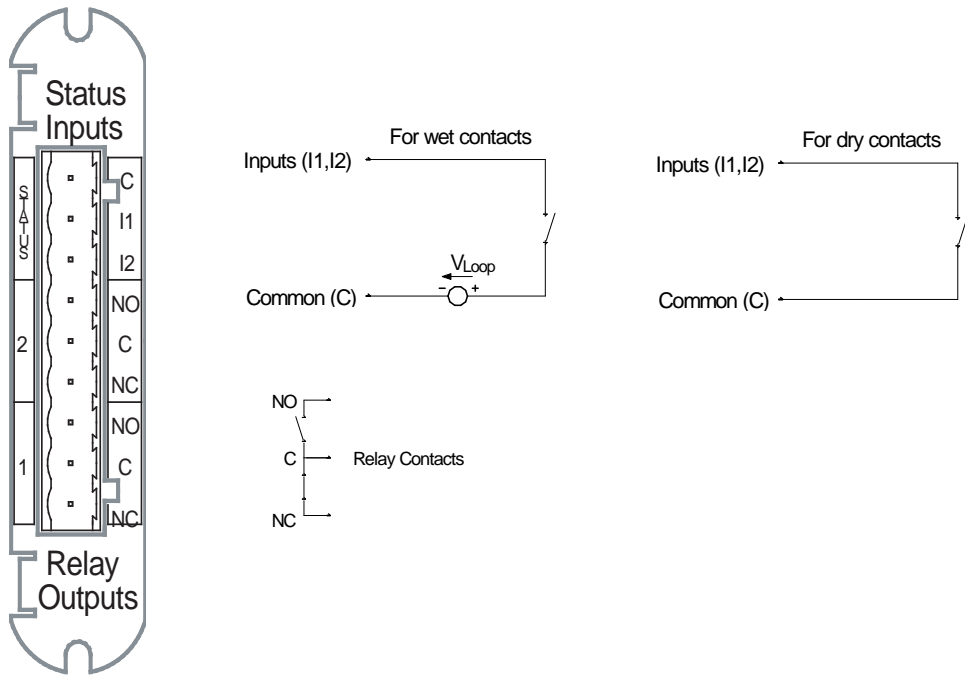


Fig. 7.3: Relay Contact (2) / Status Input (2) Card

Pulse Output (Solid State Relay Contacts) / Digital Input Card (-2)

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 are as follows:

Power consumption:	0.420W internal
Relay outputs	
Number of outputs:	4
Contact type:	Closing (SPST - NO)
Relay type:	Solid state
Peak switching voltage:	DC \pm 350V
Continuous load current:	120mA
Peak load current:	350mA for 10ms
On resistance, max.:	35 Ω
Leakage current:	1 μ A@350V
Switching Rate max.:	10/s
Isolation:	AC 3750V 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 (12-24V), internally generated
Input current:	2.5mA – constant current regulated
Minimum input voltage:	0V (input shorted to common)
Maximum input voltage:	DC 150V (diode protected against polarity reversal)
Filtering:	De-bouncing with 50ms delay time
Detection scan rate:	100ms
Isolation:	AC 2500V system to inputs

The general specifications are as follows:

Operating Temperature:	(-20 to +70) °C
Storage Temperature:	(-40 to +80) °C
Relative air humidity:	Maximum 95%, non-condensing
EMC - Immunity Interference:	EN61000-4-2
Weight:	1.3oz
Dimensions (inch) W x H x L:	0.72 x 2.68 x 3.26
External Connection:	AWG 12-26/(0.129 - 3.31)mm ² 13 pin, 3.5mm 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:

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

Wiring Diagram

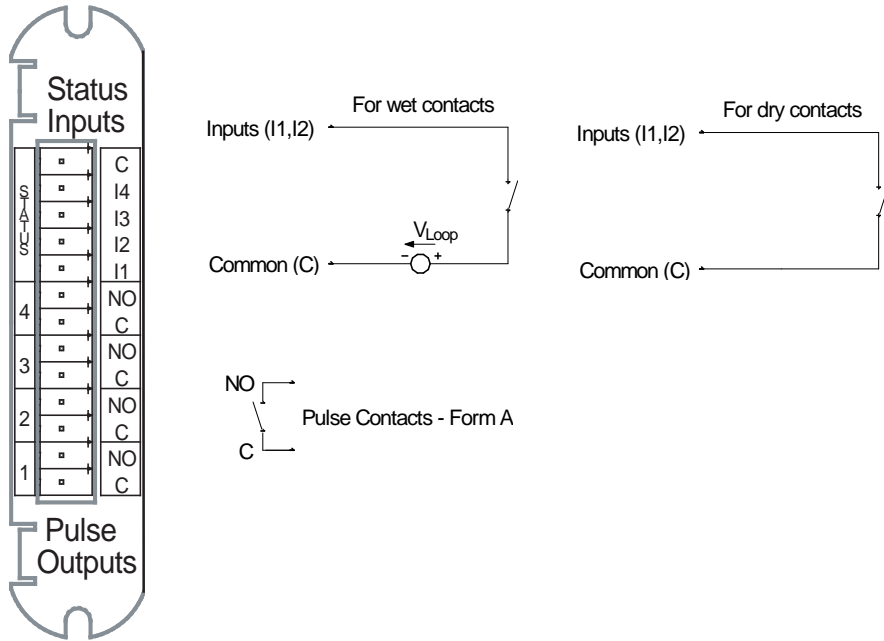


Fig. 7.4: Pulse Output (4) / Status Input (4) Card

1mA Output Card (-3)

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 at 5kΩ load are as follows:

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

The general specifications are as follows:

Operating temperature:	(-20 to +70) °C
Storage temperature:	(-40 to +80) °C
Relative air humidity:	Maximum 95%, non-condensing
EMC - Immunity Interference:	EN61000-4-2
Weight:	1.6oz
Dimensions (inch) W x H x L:	0.72 x 2.68 x 3.26
External connection:	AWG 12-26/(0.29 - 3.31) mm ² 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:

Channel 1 +Watts, +1800 Watts => +1mA
-Watts, - 1800 Watts => -1mA

Channel 2 +VARs, +1800 VARs => +1mA
- VARs, -1800 VARs => -1mA

Channel 3 Phase A Voltage WYE, 300 Volts => +1mA
Phase A Voltage Delta, 600 Volts => +1mA

Channel 4 Phase A Current, 10 Amps => +1mA

Wiring Diagram

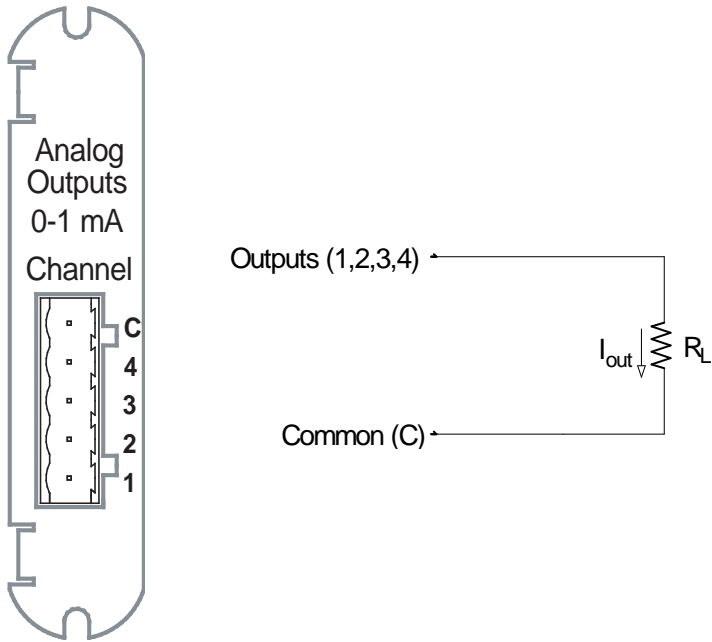


Fig 7.5: 4-Channel 0 - 1mA Output Card

20mA Output Card (-4)

The 20mA 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 at 500Ω load are as follows:

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

The general specifications are as follows:

Operating temperature:	(-20 to +70) °C
Storage temperature:	(-40 to +80) °C
Relative air humidity:	Maximum 95%, non-condensing
EMC - Immunity interference:	EN61000-4-2
Weight:	1.6oz
Dimensions (inch) W x H x L:	0.72 x 2.68 x 3.26
External connection:	AWG 12-26/(0.129 - 3.31)mm ² 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:

Channel 1+Watts, +1800 Watts => 20mA
 -Watts, -1800 Watts => 4mA
 0 Watts => 12mA

Channel 2+VARs, +1800 VARs => 20mA
 - VARs, -1800 VARs => 4mA
 0 VARs => 12mA

Channel 3Phase A Voltage WYE, 300 Volts => 20mA
 0 Volts => 4 mA
 Phase A Voltage Delta, 600 Volts => 20mA

Channel 4Phase A Current, 10 Amps => 20mA
 0 Phase A Current, 0 Amps => 4 mA

Wiring Diagram

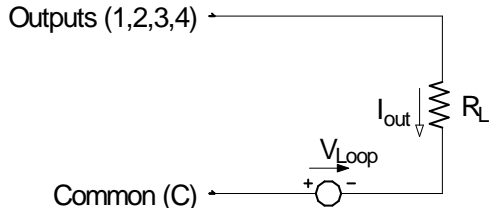
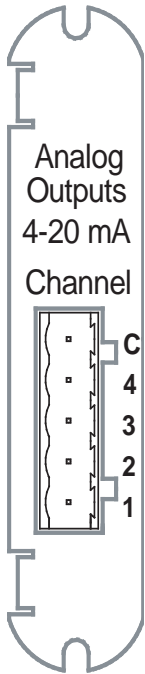


Fig. 7.6: 4-Channel 4 - 20mA Output Card

Network Communications with the Power Xpert® 2000 Series (-5)

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 are as follows:

Number of ports:	1
Power consumption:	<2.0 Watts internal
Data rate:	10/100Mbit
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:	Ten

The general specifications are as follows:

Operating temperature:	(-20 to +70)°C
Storage temperature:	(-20 to +70)°C
Relative air humidity:	Maximum, 95% non-condensing
EMC - Immunity Interference:	EN61000-4-2
Weight:	1.7 oz.
Dimensions (inches) W x H x L:	0.72 x 2.68 x 3.26
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

Wiring Diagram

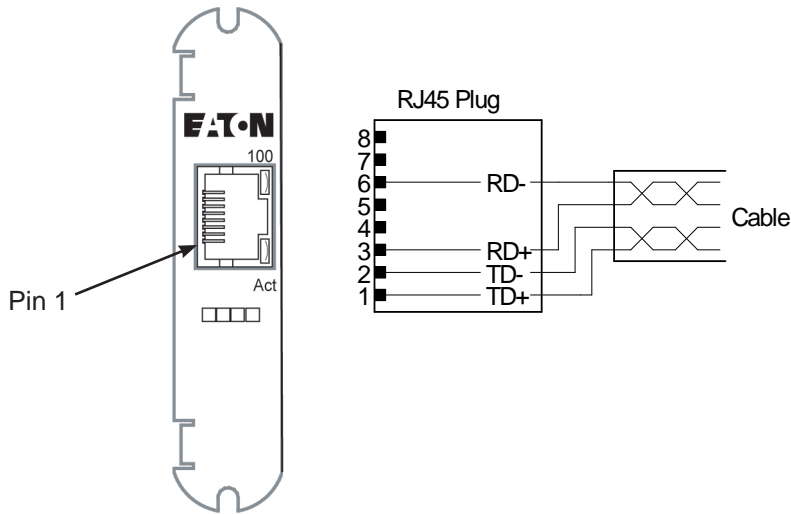


Fig. 7.7: PXM 2000 Gateway Card



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.

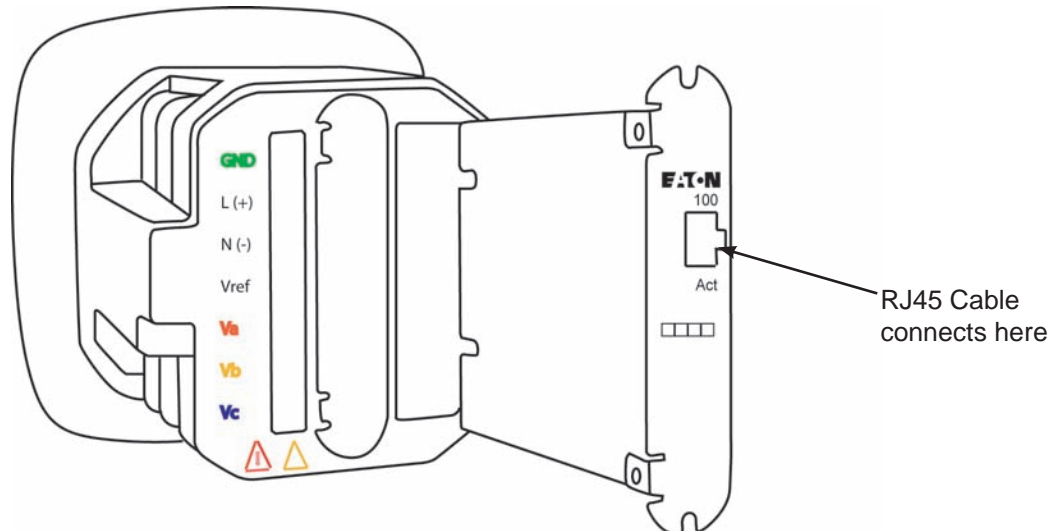


Fig. 7.8: PXM 2000 Series Meter with Gateway Card

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.

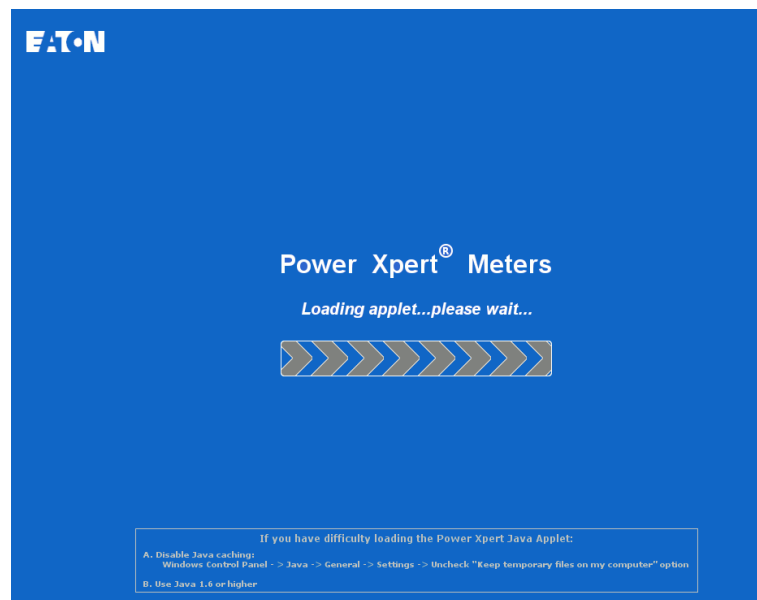
The *Functions on the Web Server Pages* chapter provides more detailed information about the functions, features, and options available on each page in the meter's web interface.

Accessing the Web Pages

You can access the Power Xpert Meter's built-in web site from a web browser such as Microsoft Internet Explorer version 7 or 8. On your client machine, you'll also need the Java Runtime Environment (JRE), version 6 or newer. The web pages use a Java applet and you must have Java installed for this to work.

To access the meter's web site, simply enter the meter's IP address as the URL. You should see something similar to the following page.

Loading Page



If you see a blank white or blue page and you don't see a "site unavailable" message, the likely cause is that you either don't have Java installed or that it isn't active. Check the Java console in the Windows Control Panel.

Home Page (Default)

The **Home** page displays an overview of the most pertinent current meter readings. From this page you can navigate to the **Meter**, **Power**, **Quality**, **I/O**, **Energy**, **Events** and **Setup** pages. The navigational buttons are in a row at the top of the screen.

Each section of the **Home** page also provides the hypertext links that also lead to more detailed information on the relevant page. For example, in the **Setup** section of the **Home** page below, the phrases **Setup Triggers** and **Setup Meter** are hyperlinks.

Meter Main Page Controls and Indicators

The screenshot shows the Power Xpert Meters web interface. At the top, there is a navigation bar with buttons for Home, Meter, Power, Quality, Energy, I/O, Events, Setup, Print, and Help. Below the navigation bar, there are several data fields for frequency, voltage, current, and power. There are also graphs for Demand Comparison and a section for Events and Setup. Annotations point to various elements: 'Link to Home page' points to the Home button; 'Current page' points to the Home button; 'Hyperlink' points to the Meter button; 'Navigational buttons to various pages' points to the row of buttons; 'Time & Date' points to the top right corner; 'Events Indicator' points to the Event icon; 'RSS Feed' points to the RSS icon; 'Link to manual' points to the Help button.

Common Controls for Selecting Information

The user interface of the **Meter** page shares many features with the **Power**, **Quality**, and **Energy** pages. 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: **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 and Min/Max**
- **Waveform** (available in the PXM 2270, 2280, and 2290 models only)
- **Individual Harmonics** (available in the PXM 2270, 2280, 2290 models only)
- **Phasors** (not a selection item if wiring configuration is set to Delta)

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 the display.

You can pan or zoom through a graph by clicking one of the options below the graph. Use the pan feature to move forward or backward through the available time range. The zoom feature (plus, minus, and drop-down menu) provides the following time ranges:

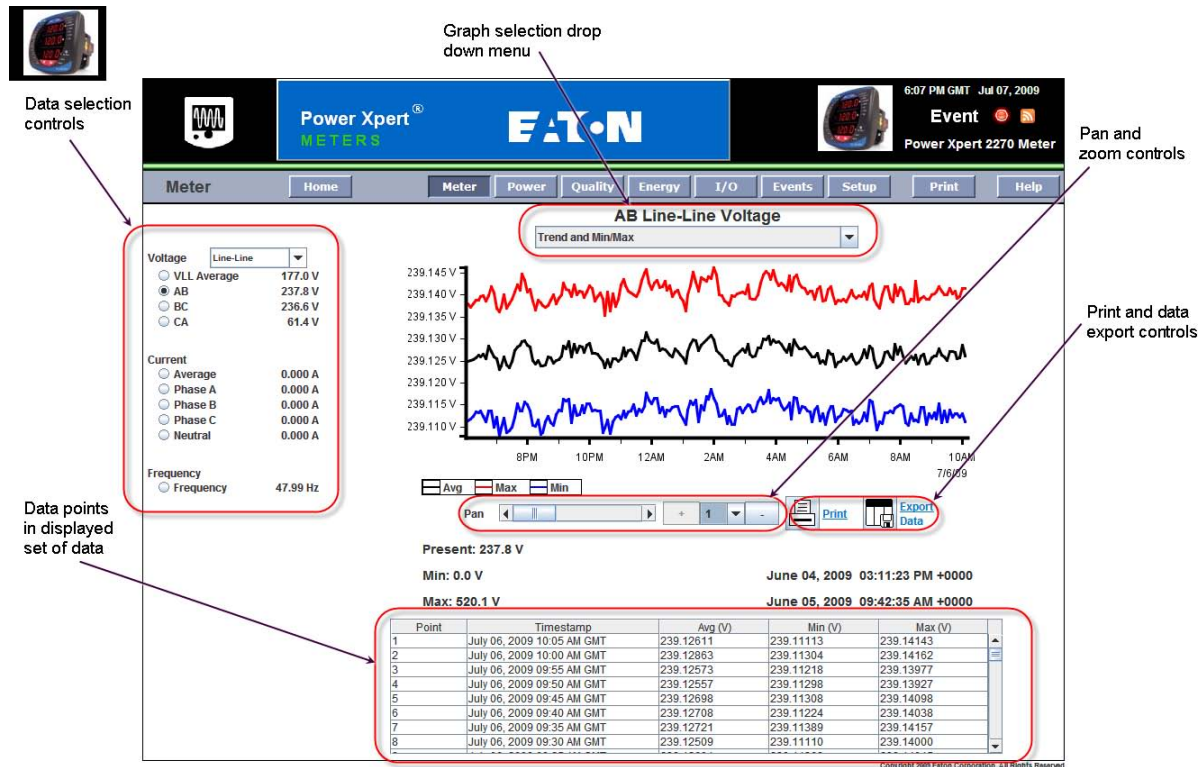
- 1 - 16 hours
- 2 - Two days
- 3 - Eight days

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

For the Energy Page, 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



Printing and Exporting Information

Most pages have both **Print** and **Export Data** controls. The **Print** control outputs the current graph to the selected printer. 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). You can select intervals of 5, 15, or 60 minutes and specify the beginning and ending dates for the data set.

I/O Page

The I/O page shows the current status of all of the inputs and outputs from any installed I/O cards. It also contains controls for resetting input and output accumulators as well as a link button that launches the Digital Input Setup page.

I/O Page

1:06 PM EDT Sep 14, 2011
Event
Power Xpert 2290 Meter

I/O Home Meter Power Quality Energy I/O Events Setup Print Help

IQ250/260-IQ1
Edit Inputs

Inputs

Name	State
<input checked="" type="radio"/> Switch Counts	Open
<input type="radio"/> KYZ Counter	Open

Reset Input Accumulators

Outputs

Name	State
<input type="radio"/> Relay Output 1	Open
<input type="radio"/> Relay Output 2	Open

Reset Output Accumulators

Digital Input 1: Switch Counts

State: Open
Type: Digital
Mode: Accumulator

Accumulator Details

Switch Counts 0

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Events Page

The left pane of the events 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 2280/2290, if the event has 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** or **Line-to-Line**. You can use the lower drop-down list to switch from the normal waveform to an RMS plot.

Events Page, Showing a Non-waveform Event

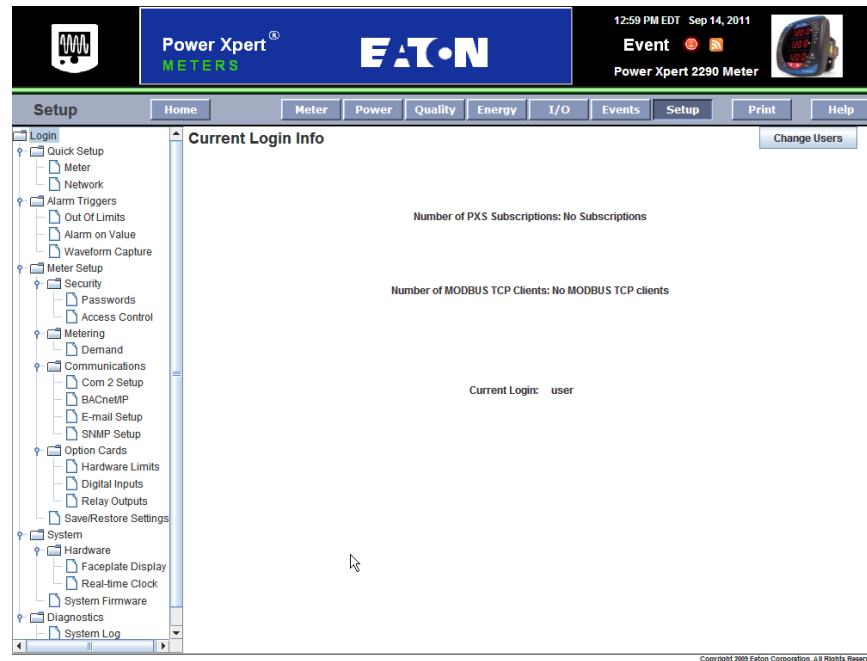
An RMS Waveform Plot

The zoom controls provide the ability to view 32, 64, 128, 256, 512, 1024, and 2048 points per view by selecting zoom values 7 (2048 points) through 1 (32 points). The count depends on the number of points in the captured waveform and therefore can't show more points than was captured. Use the **Pan** slider to move along the graph timeline. Waveform capture parameters are on the **Setup** page (see the *Setup on the Web Pages* chapter).

Setup Page

The **Setup** 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 *Setup on the Web Pages* chapter.

Setup 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 an EPICS file for a selected BACnet/IP virtual device (meter, gateway, and optional I/O card). You'll be prompted to specify a location on your local file system for the generated .TPI file.

Help Page

Power Xpert METERS EATON

1:13 PM EDT Sep 14, 2011
Event Power Xpert 2290 Meter

Help Home Meter Power Quality Energy I/O Events Setup Print Help

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

Use 1-based mapping [Generate and View Map](#)

EPICS files: Power Xpert Meter 2000 Gateway Card

Include Values [Generate and View EPICS file](#)

9 FUNCTIONS ON THE WEB SERVER PAGES

Overview

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

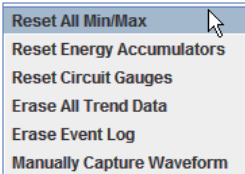
- Home page (a summary of current values and navigation to other pages)
- Meter
- Power
- Quality
- Energy
- I/O
- Events
- Setup
- Help

This chapter is not an exhaustive resource, but rather the intent is to provide a general understanding of the information available on each of the meter pages.

Note: Setup information is not provided in this chapter. See *Setup on the Web Pages* 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’s displayed in the list of radio buttons along the left of the page.



Right Click Menu

By right-clicking on any measurement page, a drop-down list appears that you can use to reset data accumulation or clear logs (as shown to the left). You can also manually capture any currently displayed waveform, which then appears in the Event Log (accessible from the Events page).

Home

The **Home** 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.

Meter

The **Meter** page provides **Voltage**, **Current**, and **Frequency** values. You can view information by measurement type or by phase. **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** or **Line-Neutral** 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.

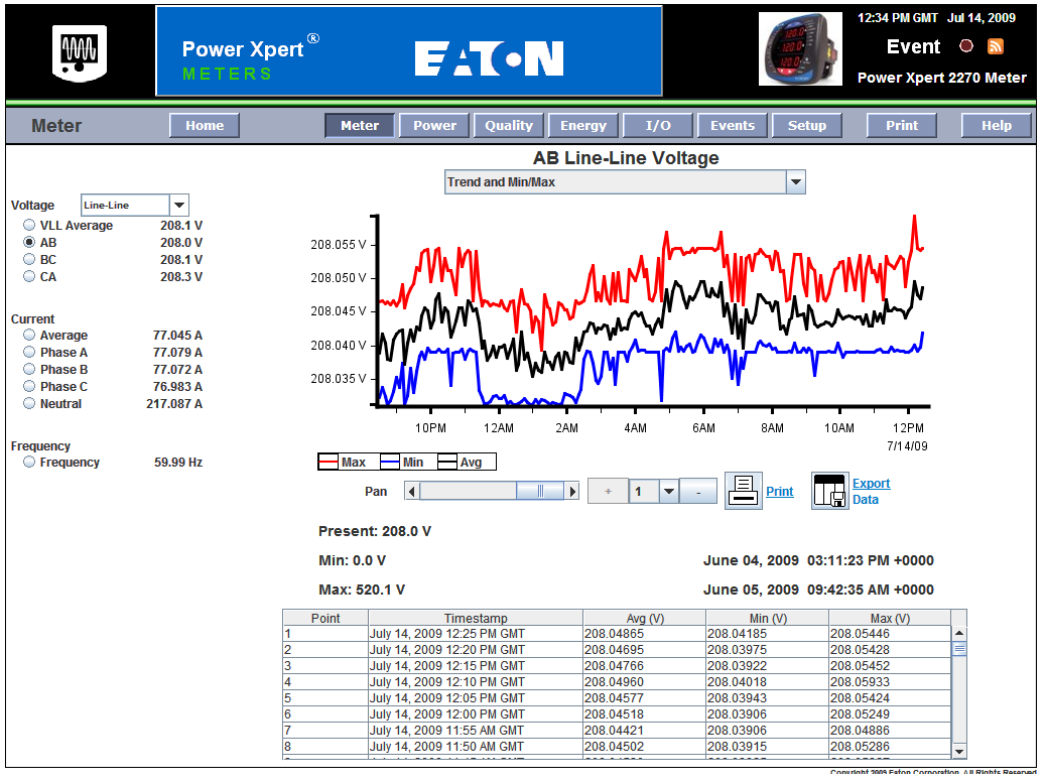
You can select trending, waveform, harmonics or phasor graphs from the drop-down box near the top of the page.

When **Trend and 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 2270/2280/2290 models.

Meter Page: Voltage Display

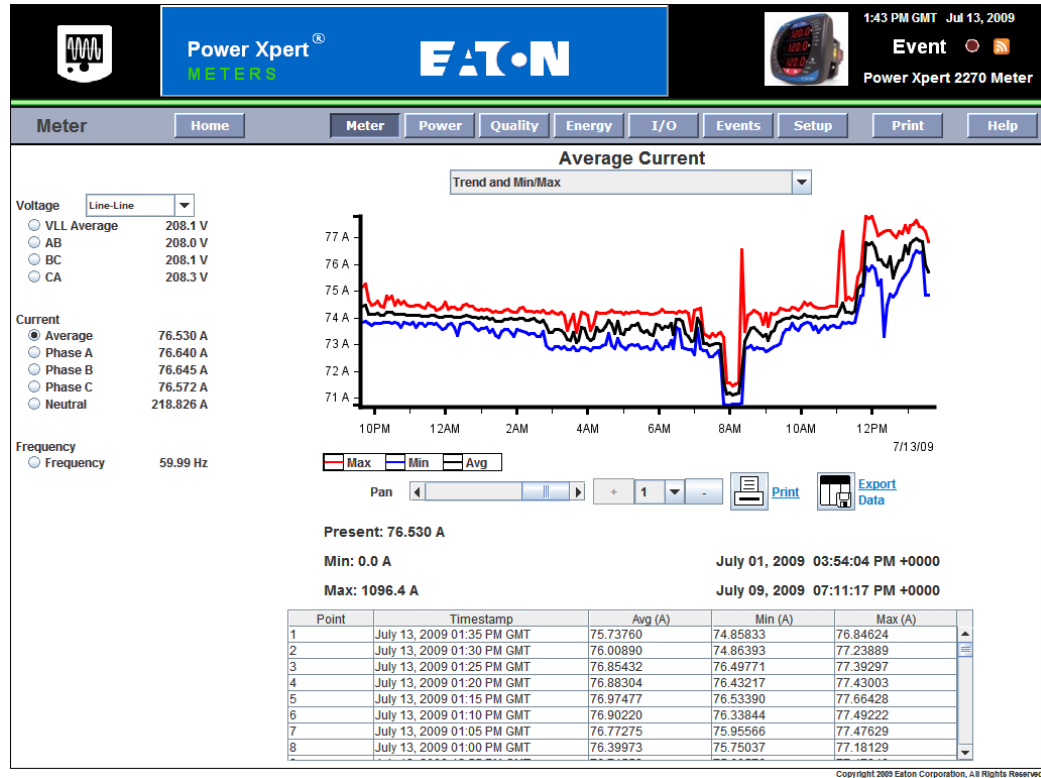


Current

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 phasor graphs, click the drop-down box located on the top of the page and make a selection.

When **Trend and 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 2270/2280/2290 only).

By default, all the measurement 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 arrow of the phasor diagram. **Phasor** is not available if wiring configuration is set to **Delta**.

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.

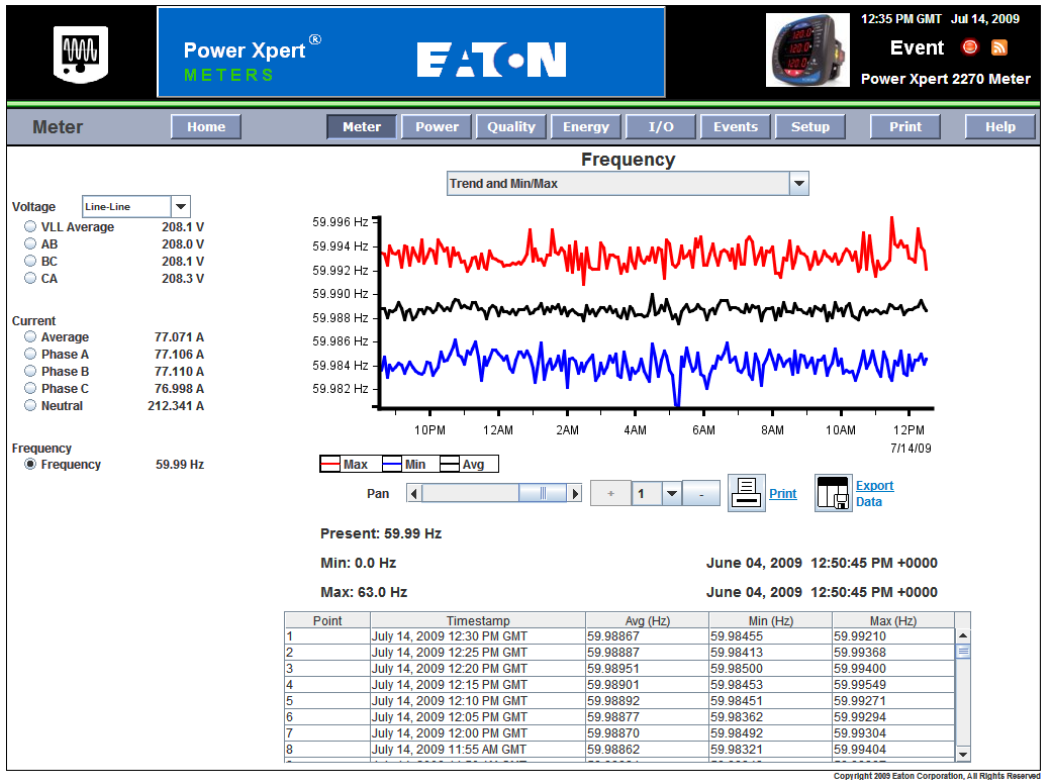
To view the trending and phasor graphs, click the drop-down box at the top of the page

and make a selection.

When **Trend and 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 :

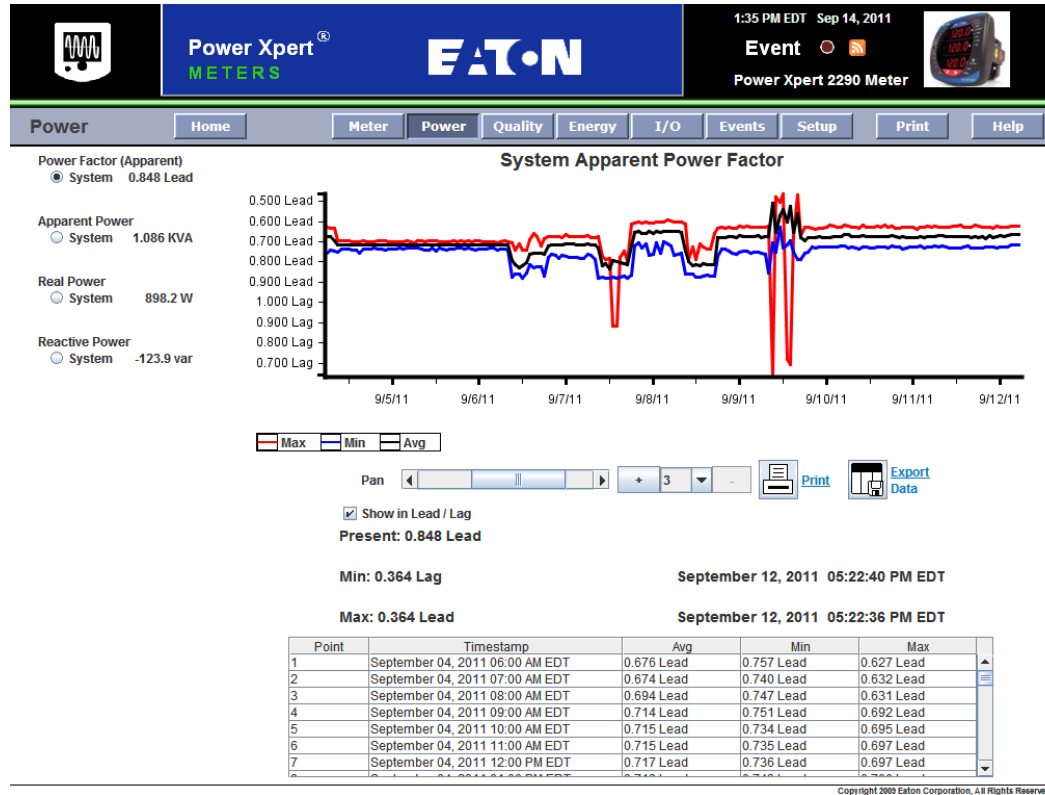
- Apparent Power Factor (PF) for System, Phase A, Phase B, and Phase C
- Apparent Power (kVA) for System, Phase A, Phase B and Phase C
- Real Power (kW) for System, Phase A, Phase B and Phase C
- Reactive Power (kvar) for System, Phase A, Phase B and Phase C

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 Factor (Apparent)



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.

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

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

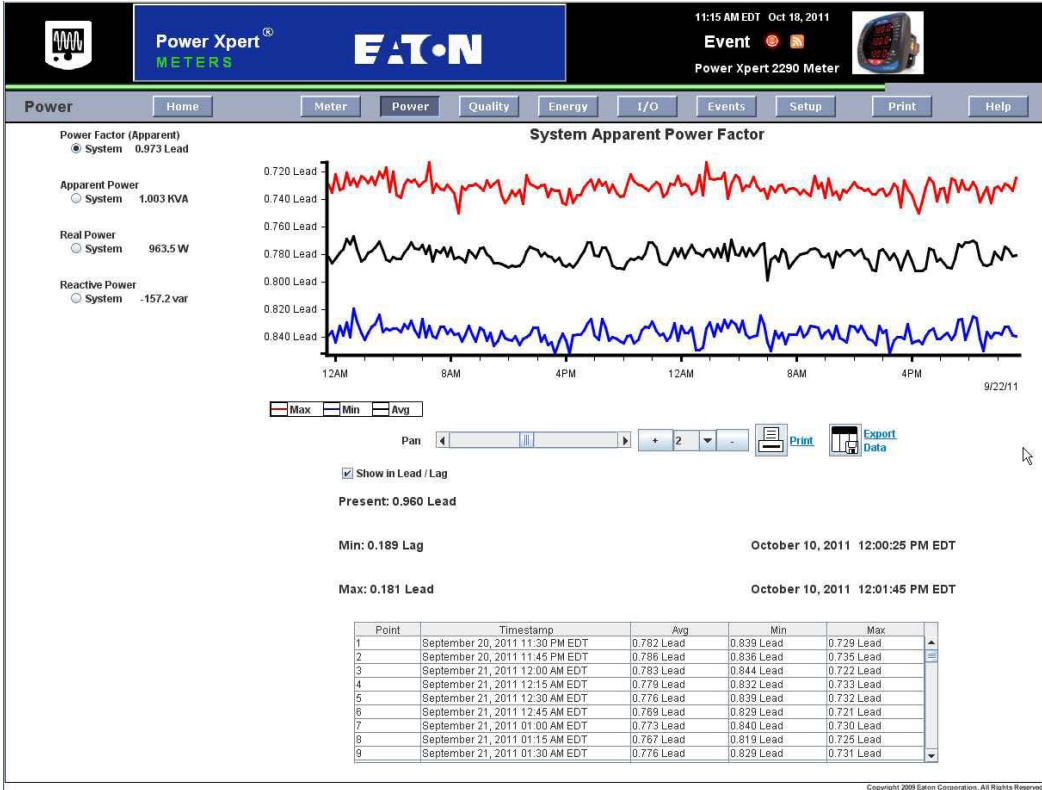
where n is the highest harmonic number used

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 2270/2280/2290 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

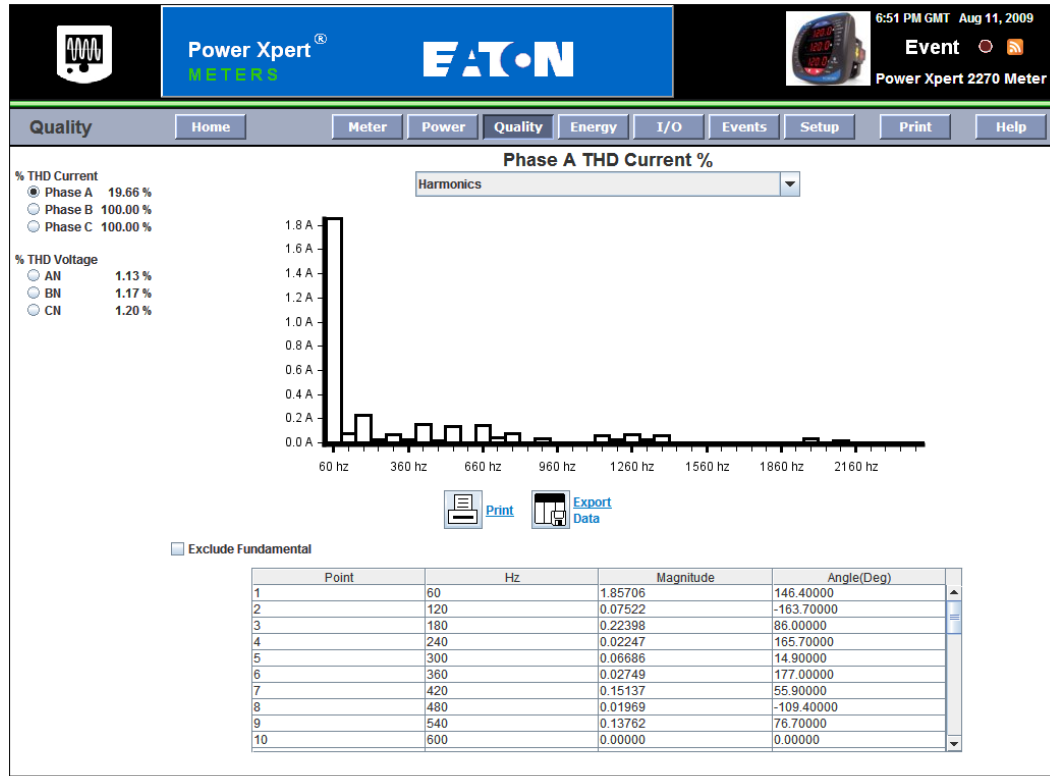


Table of Data Points

For both views, a table below the graph provides the numeric values as well. This table can be saved as a CSV file.

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.

- 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

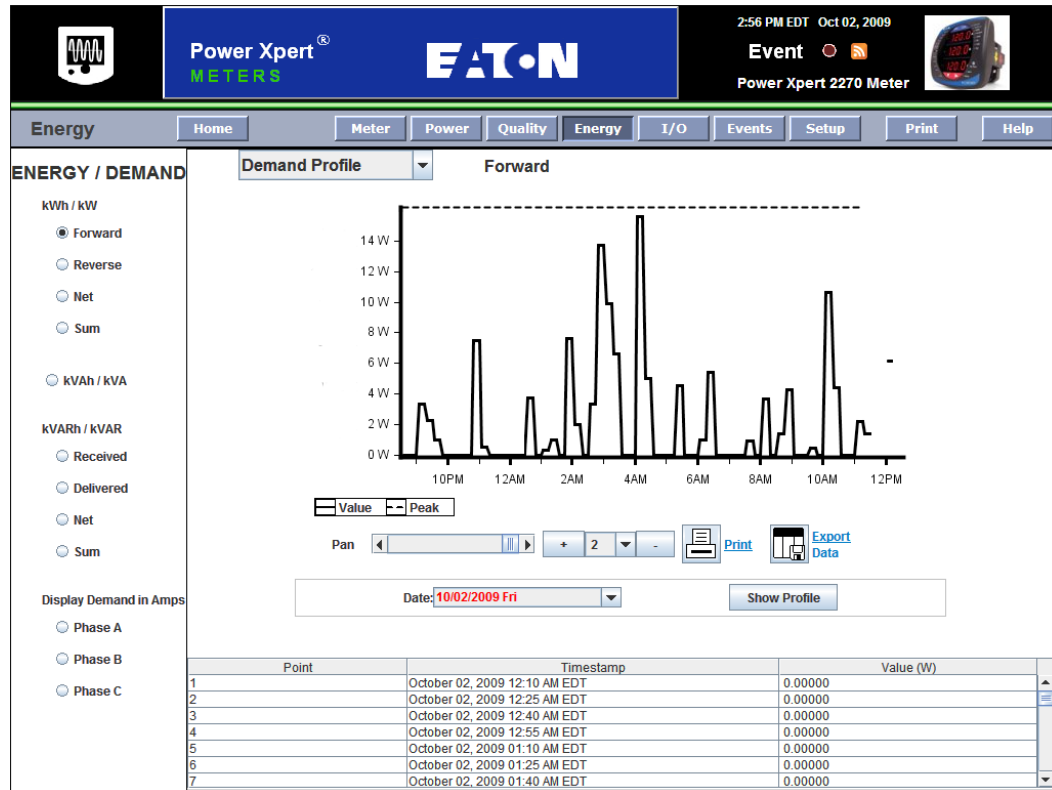
Demand Profile is the magnitude and duration of loads applied in a prescribed time sequence, including the transient and steady-state characteristics of the individual loads. The Power Xpert[®] Meter logs demand profile data from the following sources:

- 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



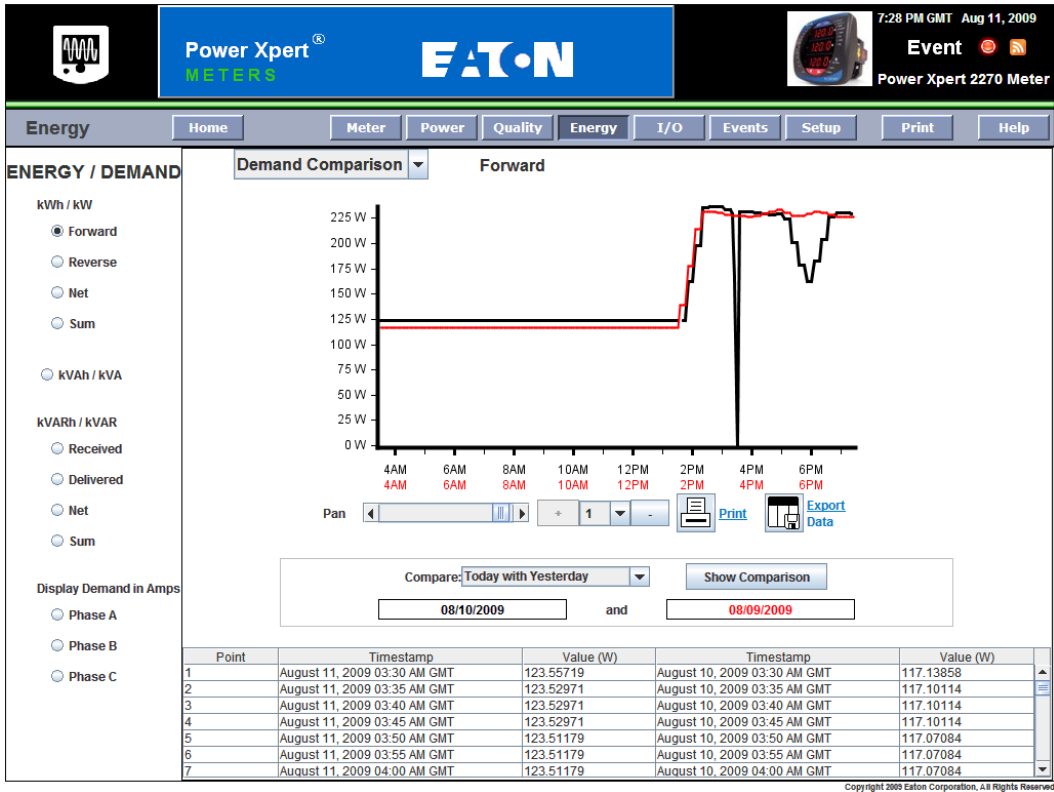
Demand Comparison

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:

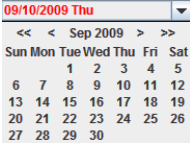
- Today and Yesterday
- This Week and Last Week
- This Month and Last Month
- 2 different Days
- 2 different Weeks
- 2 different Months

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. The << and >> controls move the calendar forward or backward one year.

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. The . csv file is written to the **My Documents** folder of your local 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 email, 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. To select the entire table, press Ctrl+A. You can also right-click and select **Copy**.

Events

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 **Setup** 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 will generate an RSS feed and can generate email and alerts. See the *Setup on the Web Pages* 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:

Apparent Power	Apparent Power Phase A	Apparent Power Phase B
Apparent Power Phase C	Avg Positive PF	Avg. Negative PF
Demand Current (3 Phase Avg)	Demand Forward Watts	Demand Ia
Demand Ia Peak	Demand Ib	Demand Ib Peak
Demand Ic	Demand Ic Peak	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	Ia	Iavg
Ib	Ic	In
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	Percent THD Ib	Percent THD Ic
Percent THD Van	Percent THD Vbn	Percent THD Vcn
PF App Phase A	PF App Phase B	PF App Phase C
PF Apparent	Phase Angle Ia	Phase Angle Ib
Phase Angle Ic	Phase Angle Vab	Phase Angle Vbc
Phase Angle Vca	Reactive Power	Reactive Power Phase A
Reactive Power Phase B	Reactive Power Phase C	Real Power
Real Power Phase A	Real Power Phase B	Real Power Phase C
V(L-L) Average	V(L-N) Average	Vab
Van	Vbc	Vbn
Vca	Vcn	

In addition, some of the I/O cards have hardware out of limits. Refer to chapter 10, *Setup on the Web Server Pages* 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 2280/2290 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 **Events** 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 2280/2290, 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 drop-down menu selects how the waveform is viewed: **Phase A, B, or C** current or voltage as **A, B, or C** to **Line-to-Neutral**. You can use the lower drop-down list to switch the view from the normal waveform to an RMS plot of the captured data.

Events Page

The screenshot displays the Eaton Power Xpert Meters web interface. At the top, there is a navigation bar with 'Home', 'Meter', 'Power', 'Quality', 'Energy', 'I/O', 'Events', 'Setup', 'Print', and 'Help'. The 'Events' section is active, showing a list of events on the left. The selected event, ID 39165, is highlighted. The main area shows a waveform plot for 'Phase A Current' with a y-axis ranging from -8.0000 A to 6.0000 A and an x-axis showing time from -0.053 s to 0.160 s. Below the plot is a zoom control set to '7'. The 'Event Details' section on the right provides the following information:

Event ID:	39165
Sequence Index:	0
Time:	2011-09-14 11:46:19 EDT
Description:	Waveform: Current High IA (wv00001151)
Source:	Ia
Value:	4.36585
Acknowledgment Status:	Acknowledged
Condition Present:	true
Note:	

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10 SETUP ON THE WEB SERVER PAGES

Overview

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

Setup Page

When the **Setup** page opens, a collapsed tree structure is displayed on the left side of the page. Clicking topics within the structure will expand the list to include all the pages available for viewing or configuration. Click one of the options to view detailed information about the selection, as displayed below. The information will be displayed in the midsection of the page.

Typical Setup Page

The screenshot shows the web interface for the Power Xpert 2290 Meter. The top navigation bar includes tabs for Home, Meter, Power, Quality, Energy, I/O, Events, Setup, Print, and Help. The left sidebar contains a tree structure with categories like Login, Quick Setup, Alarm Triggers, Meter Setup, Security, Metering, Communications, Option Cards, System, and Diagnostics. The main content area displays the 'Quick Setup' configuration for a 3 Phase, 3 Wire (Delta 2CT) system. The configuration details are as follows:

Wiring Configuration:	3 Phase, 3 Wire (Delta 2CT)
PT Primary:	480 : 120
CT Primary:	5 : 5
Energy Digits:	7
Energy Decimal Places:	2
Energy Units:	kilo (k)
Power Scale:	unit
Meter Name:	Power Xpert 2290 Meter
Power Direction:	View As Load

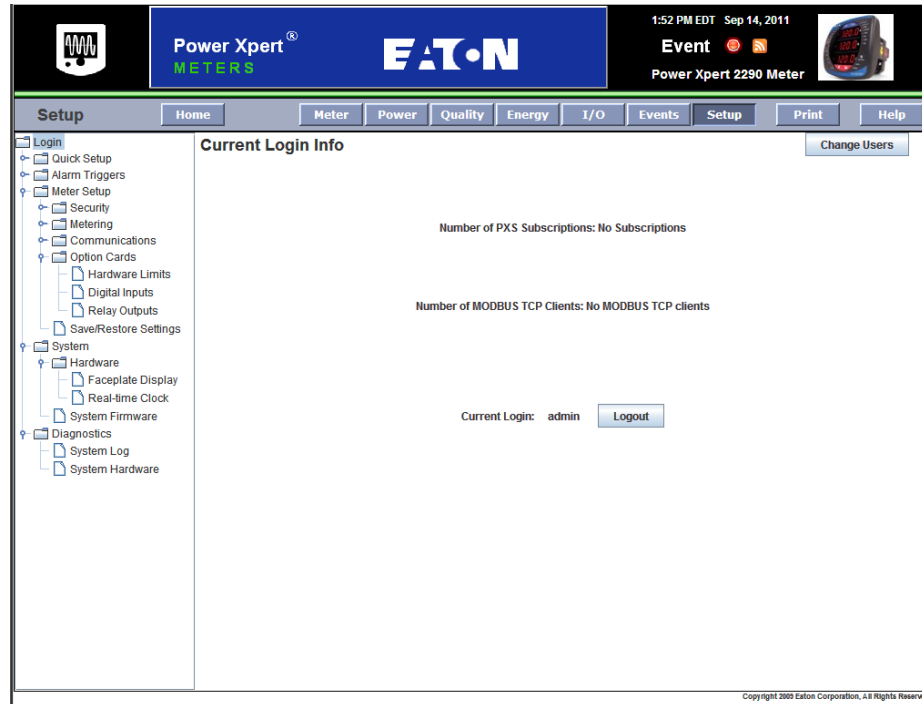
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Note: All configuration (edit) abilities discussed in the following sections require you to login with the **admin** account. You can view all of the settings through user account.

Login

The Login page provides information about the number of subscriptions by instances of Power Xpert Software (PXS) and MODBUS TCP clients. The current user is identified by name. You can also either logout from this page or log in as a different user.

Login Page



Quick Setup - Meter

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

The **Quick Setup - Meter** 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 3CT)
- 3 Phase, 3 wire (Delta 2CT)
- 3 Phase, 4 wire (Y 3 CT, 2V) 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

The screenshot shows the 'Quick Setup Edit' page for a Power Xpert 2290 Meter. The interface includes a top navigation bar with 'Setup', 'Home', 'Meter', 'Power', 'Quality', 'Energy', 'I/O', 'Events', 'Setup', 'Print', and 'Help'. A left-hand navigation tree lists categories like Login, Quick Setup, Alarm Triggers, Meter Setup, Security, Metering, Communications, Option Cards, Hardware Limits, Digital Inputs, Relay Outputs, Save/Restore Settings, System, Hardware, Faceplate Display, Real-time Clock, System Firmware, Diagnostics, System Log, and System Hardware. The main content area is titled 'Quick Setup Edit' and contains the following configuration options:

- Wiring Configuration:**
 - 3 Phase, 4 Wire (Y 3CT)
 - 3 Phase, 3 Wire (Delta 2CT)
 - 3 Phase, 4 Wire (Y 3CT, 2V) 2 1/2 Element
- PT Primary:** 480 ; **PT Secondary:** 120
- CT Primary:** 5 ; 5
- Energy Format:**
- Energy Digits:** 7
- Energy Decimal Places:** 2
- Energy Units:** kilo (k)
- Power Scale:** unit
- Meter Name:** Power Xpert 2290 Meter
- Power Direction:** View As Load

Buttons for 'OK' and 'Cancel' are located at the top right of the configuration area. A copyright notice 'Copyright 2009 Eaton Corporation. All Rights Reserved' is visible at the bottom right of the page.

Quick Setup - Network

The **Ethernet/LAN Setup Edit** 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 Power Xpert 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

Power Xpert[®] METERS EATON

2:08 PM EDT Sep 14, 2011 Event Power Xpert 2290 Meter

Setup Home Meter Power Quality Energy I/O Events Setup Print Help

Login

- Quick Setup
 - Meter
 - Network
- Alarm Triggers
- Meter Setup
 - Security
 - Metering
 - Communications
 - Option Cards
 - Hardware Limits
 - Digital Inputs
 - Relay Outputs
 - Save/Restore Settings
- System
 - Hardware
 - Faceplate Display
 - Real-time Clock
 - System Firmware
- Diagnostics
 - System Log
 - System Hardware

Ethernet/LAN Setup Edit

This page may be used to change various network configuration items on the gateway. To save the changes, click Apply. Click Discard 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.

Location: Building 7

Who To Contact: Tom

Asset ID: Customer AssetIdTag

IPv4 Settings

MAC ID: 00:00:00:00:00:00

Link Status: Connected

Obtain Automatically

Use the following

IP Address: 10.255.48.138

Subnet Mask: 255.255.252.0

Default Gateway: 10.255.51.254

Preferred DNS Server: 10.255.48.1

Alternative DNS Server: 10.255.1.80

Domain Name: software.com

IPv6 Settings

Gateway:

Automatic Address: fe80::220:fe80:fe80::557:64

Link-Local Address:

Static Address:

DHCP Settings

Use NTP Servers From DHCP:

Use DNS Servers From DHCP:

Use Domain From DHCP:

DHCP Lease Obtained: True

OK Cancel

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

Alarm Triggers

The meter has three 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.

Alarm Triggers - Out of Limits

You can use the **Out of Limits Triggers** page to set high 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 **Events** page.
- The event indicator at the top of each meter page flashes.
- The event information is sent via SNMP as a trap. SNMP is a standard protocol used to monitor and manage devices on a network. The trap protocol allows a node (such as the meter) to send a message to SNMP monitoring/management software without being queried.
- The event information is sent as an RSS (Atom) feed. You can subscribe to the meter’s Atom feed by clicking the RSS icon at the top, right side of the page. In the RSS feeds page that appears click the **Subscribe to this feed** link. In the dialog box that appears, click the **Subscribe** button.

RSS Icon



RSS Feeds Page, Showing Subscription Dialog Box

The screenshot shows a web page with a yellow banner at the top that says "Power Xpert Meter 2000 Gateway Card device history (10.222.50.94)". Below the banner, there is a "Subscribe to this feed" link. A dialog box is open over the page, titled "Subscribe to this Feed". The dialog box contains the following text: "When you subscribe to a feed, it is automatically added to the Favorites Center and kept up to date." The "Name" field is filled with "eter:2000 Gateway Card device history (10.222.50.94)". The "Create in" dropdown is set to "Feeds". There are "Subscribe" and "Cancel" buttons. Below the dialog box, the RSS feeds page is visible, showing a list of feeds and a "Filter by category" section.

The RSS feed subscription appears in Internet Explorer under **Favorites** in the Feeds tab. Each event is shown as an individual feed. Clicking a feed launches the RSS feeds page, from which you can view event details. Clicking an event on the RSS feeds page launches the meter’s Home web page.

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

The Out of Limits Triggers Page

Parameter	Value
Category:	Current
Measure:	Frequency
Upper Critical Message:	
Upper Critical Value:	
Upper Cautionary Message:	
Upper Cautionary Value:	
Lower Cautionary Message:	Caution - Low Current Phase A
Lower Cautionary Value:	0.0
Lower Critical Message:	Critical - Low Current Phase A
Lower Critical Value:	0.0
Hysteresis:	1.0
Recent Value:	0.995169
Unit:	A
Enable Alarm:	Disabled
Auto Closing:	No

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 Setup Edit Page

Setup		Home	Meter	Power	Quality	Energy	I/O	Events
<ul style="list-style-type: none"> Login Quick Setup Alarm Triggers <ul style="list-style-type: none"> Out Of Limits Alarm on Value Waveform Capture Meter Setup System Diagnostics 	<h3>Out of Limits Setup Edit</h3> <p>Category: Current</p> <p>Measure: Ia</p> <p>Upper Critical Message: Critical - High Current Phase A</p> <p>Upper Critical Value: 0.0</p> <p>Upper Cautionary Message: Caution - High Current Phase A</p> <p>Upper Cautionary Value: 0.0</p> <p>Lower Cautionary Message: Caution - Low Current Phase A</p> <p>Lower Cautionary Value: 0.0</p> <p>Lower Critical Message: Critical - Low Current Phase A</p> <p>Lower Critical Value: 0.0</p> <p>Hysteresis: 1.0</p> <p>Recent Value: 0.995212</p> <p>Unit: A</p> <p>Enable Alarm: <input type="checkbox"/></p> <p>Auto Closing: <input type="checkbox"/></p>							

Alarm Triggers - Alarm on Value

Use the **Alarm on Value Setup** 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 autoclosing. These alarms include:

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

Alarm on Value Setup Page

Setup		Home	Meter	Power	Quality	Energy	I/O	Events	Setup	Print	Help
<ul style="list-style-type: none"> Login Quick Setup <ul style="list-style-type: none"> Meter Network Alarm Triggers <ul style="list-style-type: none"> Out Of Limits Alarm on Value Meter Setup & Commissioning System Diagnostics 	<div style="text-align: right;">8:05 AM EDT Jul 31, 2009</div> <div style="text-align: right;">Event ●</div> <div style="text-align: right;">Power Xpert 2260 Meter1</div> <h3>Alarm on Value Setup Edit</h3> <p>Category: Measure/Alarm</p> <p>Measure: Modbus/RTU Device Communication Failure</p> <p>Limit Value: Active</p> <p>Alarm Message: Modbus/RTU Device Communication Failure</p> <p>Level: Critical Limit</p> <p>Enable Alarm: <input checked="" type="checkbox"/></p> <p>Auto Closing: <input checked="" type="checkbox"/></p> <div style="text-align: right;">Done Cancel</div>										

Alarm Triggers - Waveform Capture

Use the **Waveform Capture Settings** 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 Settings Page

Waveform Capture Settings Edit

OK Cancel

Samples per Cycle:
 Cycles Per Capture:
 Number of Pretrigger Cycles:
 Set channels individually:

Channel	Enabled	Setting	Setpoint % of Fullscale	Setpoint Trigger
Va Swell	<input checked="" type="checkbox"/>	Above	100%	230 V
Va Sag	<input checked="" type="checkbox"/>	Below	95%	218.5 V
Ia High	<input type="checkbox"/>	Above	0%	0 A
Vb Swell	<input checked="" type="checkbox"/>	Above	100%	230 V
Vb Sag	<input checked="" type="checkbox"/>	Below	95%	218.5 V
Ib High	<input type="checkbox"/>	Above	0%	0 A
Vc Swell	<input checked="" type="checkbox"/>	Above	100%	230 V
Vc Sag	<input checked="" type="checkbox"/>	Below	95%	218.5 V
Ic High	<input type="checkbox"/>	Above	0%	0 A

Fullscale values at 100%
 Voltage 230.0 V
 Current 50.0 A

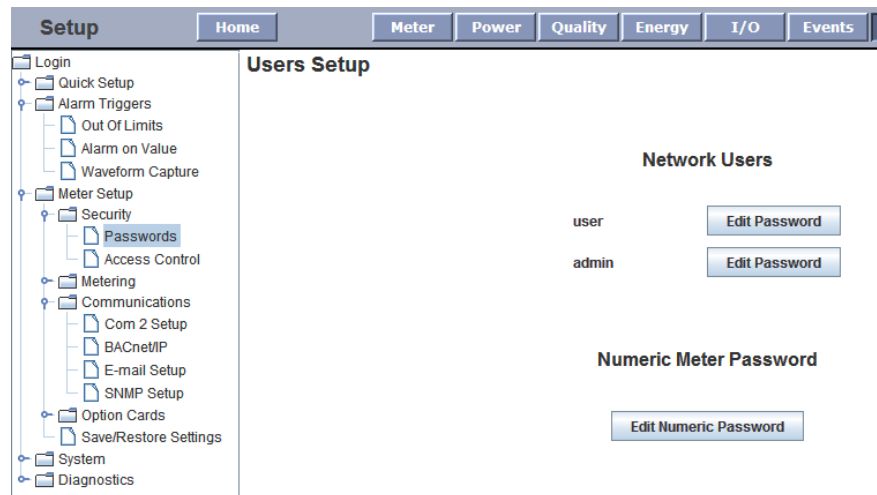
Meter Setup & Commissioning

Security Setup

See page page 11-1 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 Page



Security - Access Control

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

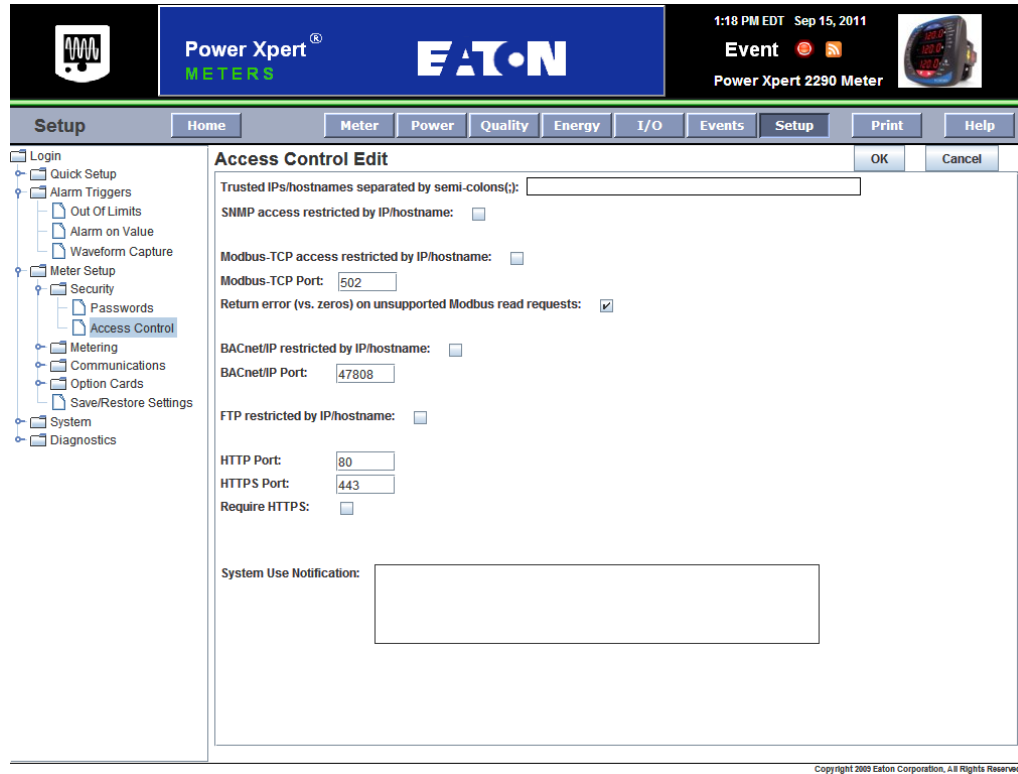
- You can restrict either SNMP or Modbus access to the meter to a set of trusted IP addresses or hostnames. You can have separate sets of trusted machines for either setting.
- You can set the ports for Modbus, HTTP, or HTTPS.
- You can require the HTTPS for web access to the meter.
- You can restrict access to the meter's FTP site to a set of trusted IP addresses or hostnames. Note that the FTP site is read only.

See page page 11-1 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 Edit Page



Metering - Demand

The **Demand Setup** 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 Power Xpert 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 'Setup' page with a navigation menu on the left and a 'Demand' configuration panel on the right. The navigation menu includes: Login, Quick Setup, Alarm Triggers (Out Of Limits, Alarm on Value), Meter Setup & Commissioning (Security, Metering, Demand), Communications, Option Cards, Save/Restore Settings, System, and Diagnostics. The 'Demand' panel has the following settings:

- Interval Type: Fixed
- Total Interval: 15

Sliding Settings

The screenshot shows the 'Setup' page with a navigation menu on the left and a 'Demand' configuration panel on the right. The navigation menu is identical to the previous screenshot. The 'Demand' panel has the following settings:

- Interval Type: Sliding
- Total Interval: 15
- Sub-Interval: 5

Communications Settings

Under **Communications**, you can set the serial communications parameters, the email settings (including the mail server and recipients), as well as the setup parameters for SNMP. See page page 11-1 for detailed information about security best practices.

Communications Settings - Com 2 Setup

You can set the protocol, Modbus address, baud rate, and response delay for the RS-485 serial connection. The protocol is selectable between Modbus RTU, Modbus ASCII, or DNP. See page page 11-1 for detailed information about security best practices.

Serial Communications Setup Page

The screenshot shows a web interface for configuring serial communications. At the top, there is a navigation bar with tabs for 'Setup', 'Home', 'Meter', 'Power', 'Quality', 'Energy', 'I/O', and 'Eve'. Below this is a tree view on the left with categories like 'Login', 'Quick Setup', 'Alarm Triggers', 'Meter Setup', 'Security', 'Metering', 'Communications', 'Option Cards', 'System', and 'Diagnostics'. The 'Communications' category is expanded, showing 'Com 2 Setup' selected. The main content area is titled 'Serial Communications Edit' and contains the following settings for 'Com 2':

- Protocol: Modbus (RTU) (dropdown menu)
- Address: (empty text input field)
- Baud: 9600 (dropdown menu)
- Response Delay: (empty text input field) msec
- Parity: None
- Stop Bits: 1
- Data Bits: 8

Communications Settings - BACnet/IP

The PXM 2250-2290 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 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 sequential 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 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.

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 (including port) 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 Edit' configuration page in the Eaton Power Xpert Meters web interface. The interface includes a navigation tree on the left, a header with the Eaton logo and system status (2:30 PM EDT Sep 15, 2011), and a main configuration area with the following fields:

Section	Field Name	Value
Identification	Base ID for Auto-assign:	432220
	Auto-assign network card ID:	<input checked="" type="checkbox"/>
	Network Card	
Network Card	Device ID (object-identifier):	432221
	Device object-name:	PXM 2000 00:20:85:FC:05:57
	BACnet/IP MAC address:	0A:DE:30:8A:BA:C0
BBMD	IPv4 IP address for foreign registration:	10.130.13.254
	BBMD time to live (seconds):	360
Virtual Routing	Routed network number:	431
	Auto-assign virtual device IDs:	<input checked="" type="checkbox"/>
	MAC template for Virtual Devices:	138.48.222.0
Routed Device Settings	Virtual Device:	Power Xpert 2290 Meter
	Device ID (object-identifier):	432222
	Device object-name:	PXM2290 0021854323
	BACnet/IP MAC address:	8A:30:DE:02:BA:C0

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Communications Settings - E-mail Setup

The PXM 2000 meter provides a highly configurable capability to report on meter activity via email. You can configure up to 10 separate recipients. This is just like configuring an email application such as Outlook Express or Thunderbird. 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 email configuration. The meter cannot communicate using the Microsoft exchange email protocol.
 - A valid email account (user name and password).
 - The address of the SMTP mail server.
 - The email address of the account. Each meter can be assigned a separate email account. This allows you to easily determine which meter sent the email through its address.
- Email triggers. The meter will send emails in response to any event trigger that has been enabled for email, 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 email recipients. This includes settings for sending emails when an event occurs and/or clears and for sending periodic status emails. You can configure the email address for each recipient by selecting a recipi-

ent through the **Recipient** drop-down list and then configuring the recipient's address information by clicking the **Edit** button.

The following example is typical of the status emails sent by the meter:

```
Power Xpert Meter Status Report
Device=Power Xpert 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 email 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

Setup Home Meter Power Quality Energy I/O Events Setup Print Help

Login

- Quick Setup
 - Meter
 - Network
- Alarm Triggers
- Meter Setup
 - Security
 - Metering
 - Communications
 - Com 2 Setup
 - BACnet/IP
 - E-mail Setup**
 - SNMP Setup
 - Option Cards
 - Save/Restore Settings
- System
- Diagnostics

E-mail Setup Edit OK Cancel

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.

Global email configuration

SMTP Server:

Account:

Password:

From:

Edit Triggers

Recipient 1 configuration

To:

Send on event active

Send on event clear

Send periodic status emails

Days between status emails:

Time of day to send periodic status emails: :

Use the **Recipients** drop-down box to select each of the 10 possible recipients to configure. The **Test SMTP Server Connection** button will test your settings and report any errors directly on the **E-mail Setup** page.

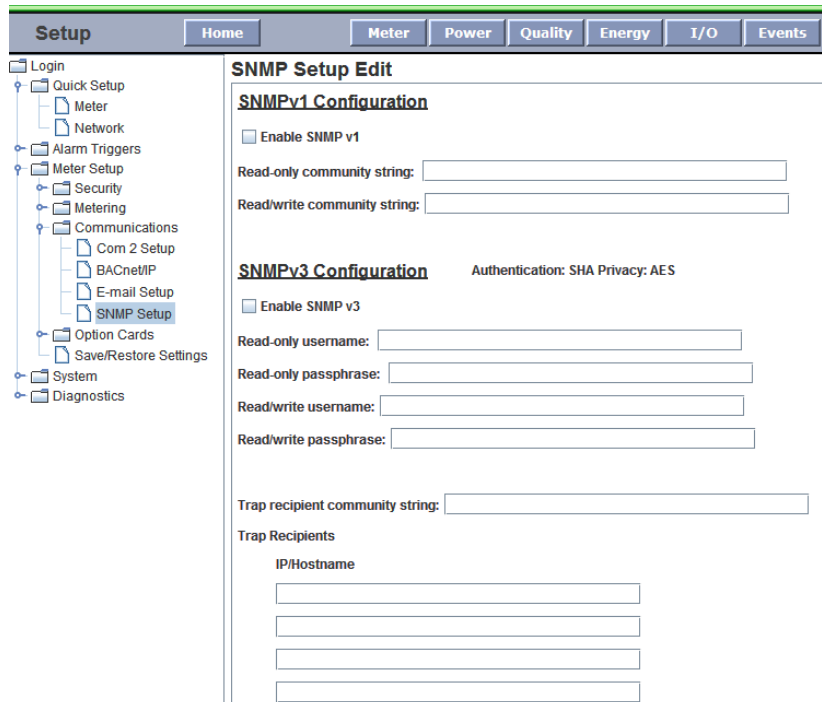
Communications Settings - SNMP Setup

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 usernames and passphrases (passwords) for both read and write privileges. Consult your SNMP software documentation for more information.

See page 11-1 for detailed information about security best practices.

SNMP Setup Edit Page



Option 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
- 1mA Output Card
- 20mA 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 Edit** screen 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 Edit** screen 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 when that condition occurs. Once active, you can click any of the **Setpoint** and **Hysteresis** fields and edit their contents.

Hardware Limits Edit Page

Hardware Limits Edit

ID	Channel	Enabled	Setting	Setpoint % of Fullscale	Setpoint Primary	Hysteresis % of Fullscale	Hysteresis Primary
1	Not Assigned	<input type="checkbox"/>	Above	0%	0	0%	0
		<input type="checkbox"/>	Below	0%	0	0%	0
2	Not Assigned	<input type="checkbox"/>	Above	0%	0	0%	0
		<input type="checkbox"/>	Below	0%	0	0%	0
3	Not Assigned	<input type="checkbox"/>	Above	0%	0	0%	0
		<input type="checkbox"/>	Below	0%	0	0%	0
4	Not Assigned	<input type="checkbox"/>	Above	0%	0	0%	0
		<input type="checkbox"/>	Below	0%	0	0%	0
5	Not Assigned	<input type="checkbox"/>	Above	0%	0	0%	0
		<input type="checkbox"/>	Below	0%	0	0%	0
6	Not Assigned	<input type="checkbox"/>	Above	0%	0	0%	0
		<input type="checkbox"/>	Below	0%	0	0%	0
7	Not Assigned	<input type="checkbox"/>	Above	0%	0	0%	0
		<input type="checkbox"/>	Below	0%	0	0%	0
8	Not Assigned	<input type="checkbox"/>	Above	0%	0	0%	0
		<input type="checkbox"/>	Below	0%	0	0%	0

Fullscale values at 100%

Voltage	Current	Frequency	Power	Power Total	Power Factor	THD
120.0 V	5.0 A	60.0 Hz	0.0 W	0.0 W	1.0	100.0 %

You can use the **Digital Input Setup Edit** 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 Setup Edit Page

The screenshot displays the 'Digital Input Setup Edit' page. At the top, there is a navigation bar with 'Setup' selected, and sub-tabs for 'Home', 'Meter', 'Power', 'Quality', 'Energy', 'I/O', 'Events', 'Setup', 'Print', and 'Help'. The main content area is divided into a left-hand tree view and a right-hand configuration panel. The tree view includes categories like 'Quick Setup', 'Alarm Triggers', 'Meter Setup', 'Security', 'Metering', 'Communications', 'Option Cards', 'System', and 'Diagnostics'. The configuration panel is titled 'Digital Input Setup Edit' and contains two sections: 'Digital Input 1' and 'Digital Input 2'. Each section has fields for 'Label', 'Open State Name', 'Closed State Name', 'EOI Pulse Sensing' (checkbox), 'Accumulator Enabled' (checkbox), 'Trigger Input' (dropdown), 'Accumulator Label', 'Divisor' (dropdown), and 'Accumulator Kt' (text input). The 'Digital Input 1' section is currently populated with 'Switch Counts' for the label and accumulator label, and 'Any Transition' for the trigger input. The 'Digital Input 2' section is populated with 'kYZ Counter' for the label and 'kYZ clicks' for the accumulator label, with 'Open To Close' selected for the trigger input. Buttons for 'OK' and 'Cancel' are located at the top right of the configuration panel. A copyright notice for Eaton Corporation is visible at the bottom right of the page.

Use the **Relay Outputs Setup Edit** 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 Edit 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.

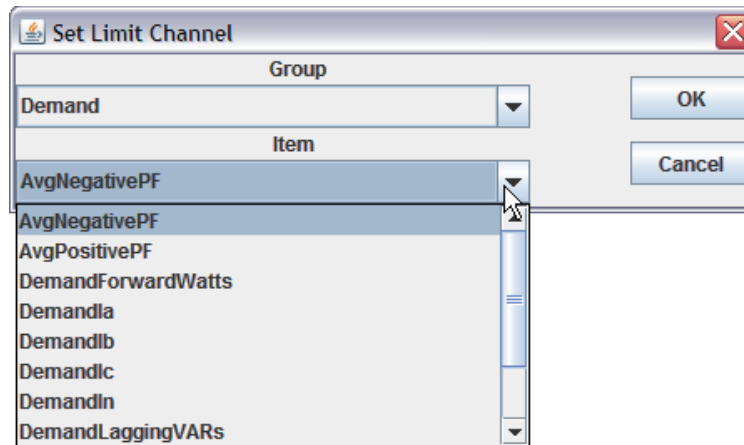
Digital Input Setup Edit Page

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 Setup Edit

Set Limit Channel Dialog Box.



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

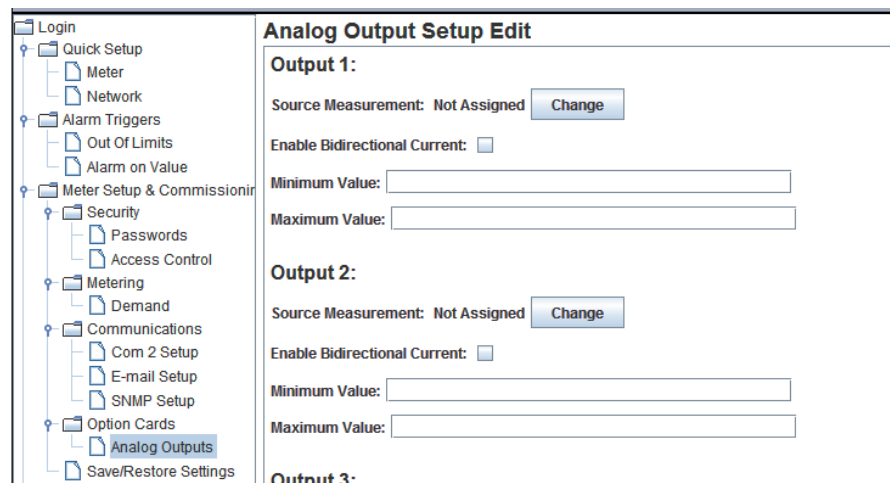
The 0-1mA Output Option Card is an analog communication card, which transmits a standard, bi-directional 0-1 milliamp signal. Bi-directional is useful when you want the output (-1 to 1 V) to reflect the sign of a measure that goes negative (like VAR). Although you can configure offset-from-zero limits, 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, uni-directional 4-20 milliamp signal. An example use of either card is in enabling the meter to communicate with an RTU (Remote Terminal Unit).

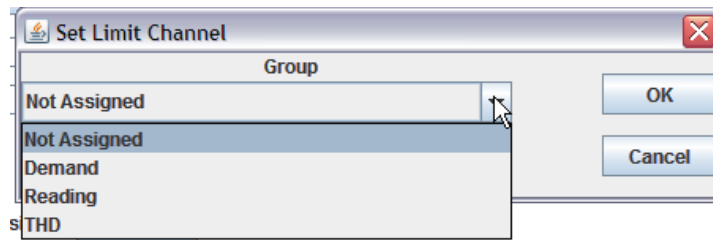
Setup for the cards is almost identical. The only difference is that the 4-20 mA is unidirectional.

The **Analog Output Setup Edit** 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 Setup Edit Page



Setting the Source Measurement



System Setup

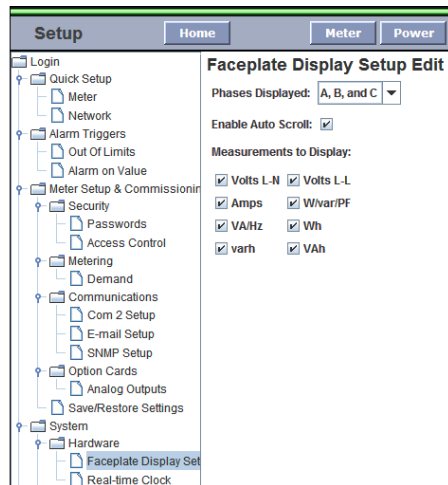
The **System Setup** page is divided into two sections: Hardware and System Firmware.

Hardware Setup - Faceplate Setup

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 Setup Page



Hardware - Real-Time Clock

The Power Xpert 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 Edit** 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. The Preview Date after changes are applied field shows only

Clock Setup Edit Page

The screenshot shows the 'Clock Setup Edit' page in the Power Xpert Meters web interface. The page is titled 'Clock Setup Edit' and includes 'OK' and 'Cancel' buttons. The main content area is divided into several sections:

- Set Time (will be converted to Meter time):**
 - No Changes
 - Set date/time from the PC clock
 - Time: 3:06:55 PM
 - Date: Sep 15, 2011
 - Timezone: Eastern Daylight Time
 - Set date/time manually
 - Time: 14 : 53
 - Date: Sep 15, 2011
 - Timezone: Eastern Daylight Time
 - Synchronize with NTP Server
 - NTP Server IP/hostname #1: 151.110.126.15
 - NTP Server IP/hostname #2: 10.222.50.244
 - NTP Server IP/hostname #3: 10.222.50.245
- Time Zone used for logs, e-mails, and connected device:** [GMT -05:00] Eastern Time (US & Canada)
- Date Format for logs:** mm/dd/yyyy
- Preview Date after changes are applied:** 09/15/2011 03:06 PM Eastern Daylight Time

The left navigation menu includes: Login, Quick Setup, Alarm Triggers, Meter Setup, Security, Metering, Communications, Option Cards, Hardware Limits, Digital Inputs, Relay Outputs, Save/Restore Settings, System, Hardware, and Diagnostics.

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Hardware - System Firmware

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

1. Select the **Reboot when complete** checkbox.
2. Click the new firmware image link, which will direct the meter to the eaton.com website where firmware files are stored.
3. Select the firmware type from the list.

4. Fill out the form (if required).
5. Download the firmware to your local file system.
6. Click the **Browse** button.
7. Select the firmware file.
8. 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.

Diagnostics

You can access the system log or a page that displays the names, serial numbers, and versions of the various components in the meter.

Diagnostics - 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 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	

Diagnostics - 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

SetupHomeMeterPowerQualityEnergyI/O

- Login
- Quick Setup
- Alarm Triggers
- Meter Setup
- System
- Diagnostics
 - System Log
 - System Hardware**

System Hardware

Meter Information:

Meter Name:	Power Xpert 2260 Meter
Meter Serial Number:	0036557329
Firmware Version:	14
Meter Model:	PXM2260

Power Xpert Meter 2000 Gateway Card Information:

Model Name:	PXM2000
Serial Number:	00:20:85:00:FF:FE
Software Version:	1.4.0

Optional Card Information

Card Name:	2 Relay Out/ 2 Status In Module
Serial Number:	0020063617
Version:	A
Model:	IQ250/260-IO1



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 page page 11-3.

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:

- Change the Admin password from the default. See page page 11-2.
- Change the User password from the default. See page page 11-2.
- Change the Meter password from the default. See page page 11-2.
- Require HTTPS only. See page page 11-3.
- Change the SNMP v1 and v3 user names and passwords from their defaults (public, private). See page page 11-3.
- Set the trusted host list for SNMP and Modbus TCP. See page page 11-3.

- Disable SNMP v1 if not needed. Use SNMP v3 only if you can. See page page 11-5.
- Disable SNMP v3 if not needed. See page page 11-5.
- Remove all the SNMP trap recipients if traps are not needed. See page page 11-5.
- Remove all email recipients if email is not needed. See page page 11-7.
- Change the default port for Modbus TCP. See page page 11-3.
- Change the default port for HTTP and HTTPS. See page page 11-3.

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:

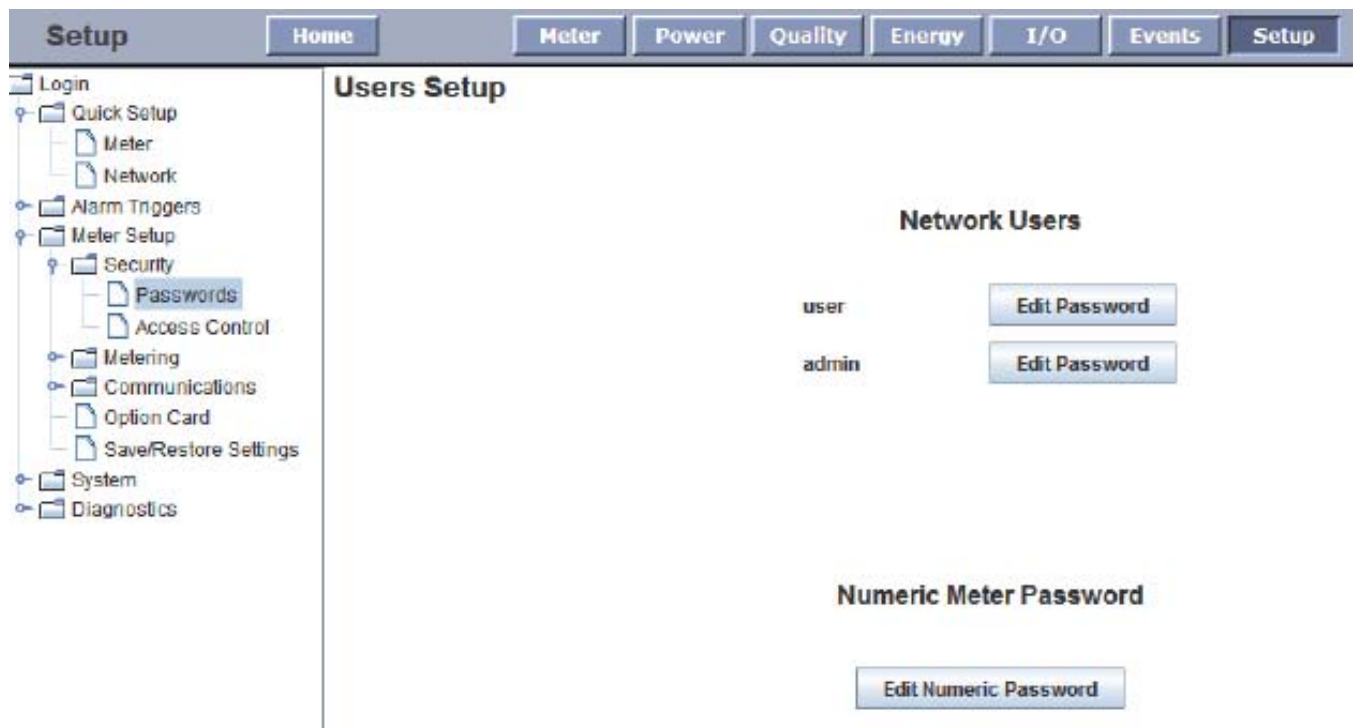
Account Type	User Name	Default Password	Description
Network	user	user	Can access and view all web pages on the meter.
Network	admin	admin	Can access and view all web pages as well as change all settings for the meter.
Front Panel	not applicable	5555	This password disables password checking for the front 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 **Setup** tab.
3. Navigate to the Meter **Setup > Security > 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 **OK**.
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 **OK**.

User Setup Page for Changing Passwords



Recommended Meter Access Control Settings

The following are “best practice” recommendations for Power Xpert 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 **Setup** tab.
3. Navigate to the **Meter Setup > Security > Access Control** page.
4. Click the **Edit** button.

5. If you didn't 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, Modbus TCP, BACnet/IP or FTP, you should specify the IP addresses or host names for one or more computers that are to be allowed access to the meter 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 hostnames are removed.

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

SNMP access restricted by IP/hostname:

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/hostname

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

The screenshot displays the 'Access Control Edit' page within the Power Xpert Meters web interface. The top header shows the time as 2:47 PM GMT on Oct 17, 2011, and the device as a Power Xpert 2290 Meter. The navigation menu on the left includes options like Login, Quick Setup, Alarm Triggers, Meter Setup, Security, Metering, Communications, Option Cards, Save/Restore Settings, System, and Diagnostics. The main content area is titled 'Access Control Edit' and contains the following settings:

- Trusted IPs/hostnames separated by semi-colons(;): [Empty text box]
- SNMP access restricted by IP/hostname:
- Modbus-TCP access restricted by IP/hostname:
- Modbus-TCP Port: [502]
- Return error (vs. zeros) on unsupported Modbus read requests:
- BACnet/IP restricted by IP/hostname:
- BACnet/IP Port: [47808]
- FTP restricted by IP/hostname:
- HTTP Port: [80]
- HTTPS Port: [443]
- Require HTTPS:
- System Use Notification: [Empty text area]

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 passphrases 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 aren't 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 **Meter Setup > Communications > 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

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

Index of /docs/

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

lighttpd/1.4.23-devel-31665

Email Security

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

To access the Email 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 **Meter Setup > Communications > Email** page.
4. Click the **Edit** button.
5. If you didn't log in earlier, you must enter the admin account user name and password.

E-Mail Setup Edit Page

Enabling Root Certificate Authority in Internet Explorer

You can improve the security of your PXM 2000 Series 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 measurably reduced by using secure transactions.

This section explains root CA installation for:

To install a certificate using Microsoft Internet Explorer 7 or 8:

1. Open the browser, type the IP address of the meter in the address bar, and select **Go**. For example: `https://192.168.1.1/ca.html`.
2. You may see the following alert page. If so, click **Continue to this website**.

Security certificate problem page

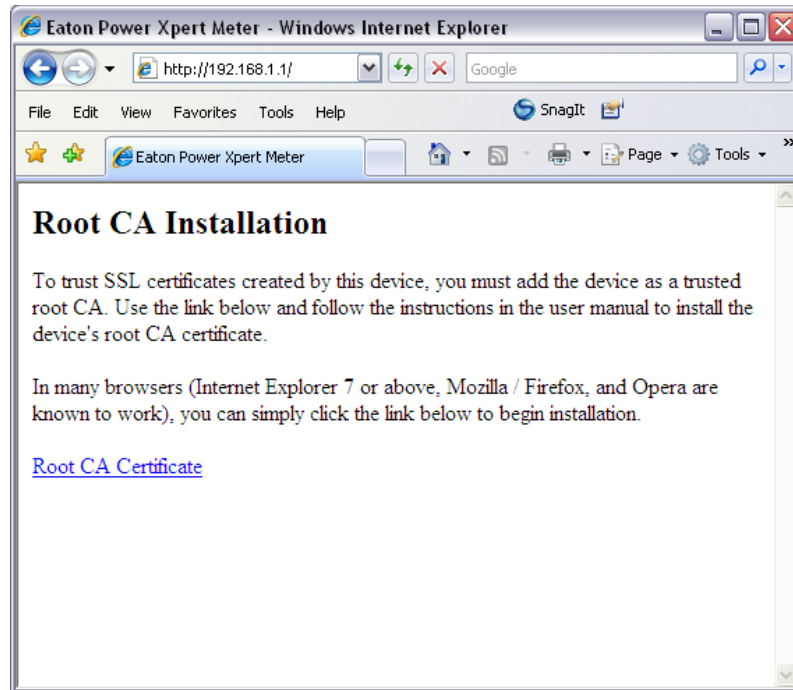
3. If the security certificate problem page appears, you'll next see the following security warning dialog box. Click **Yes**.

Warning: Security dialog box



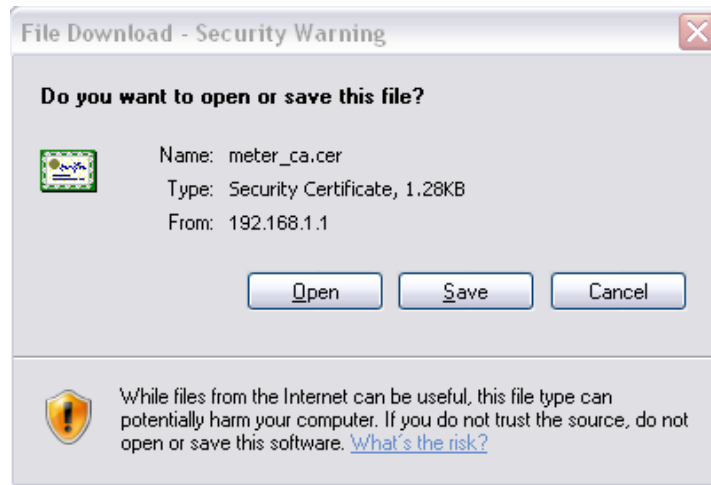
4. The install CA certificate page appears. Click the **Root CA Certificate** link.

Install CA certificate page



5. Click the **Open** button.

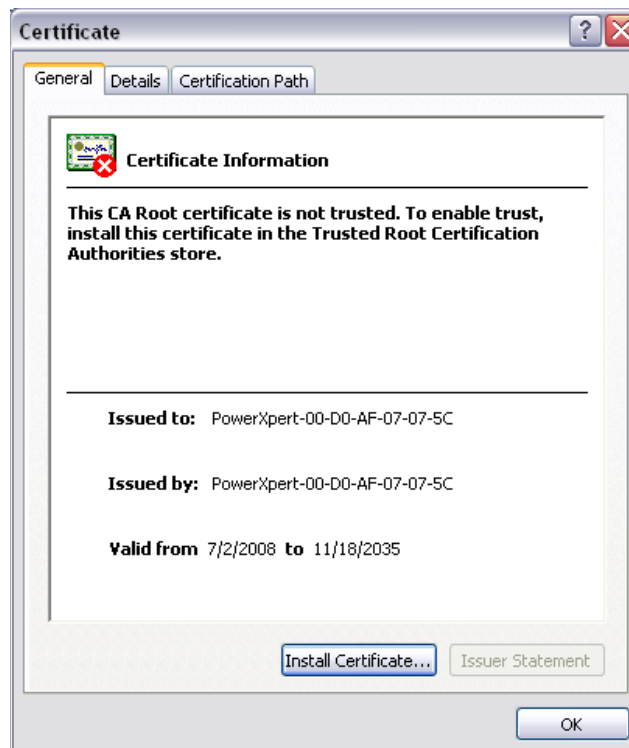
Figure 2. File download dialog box



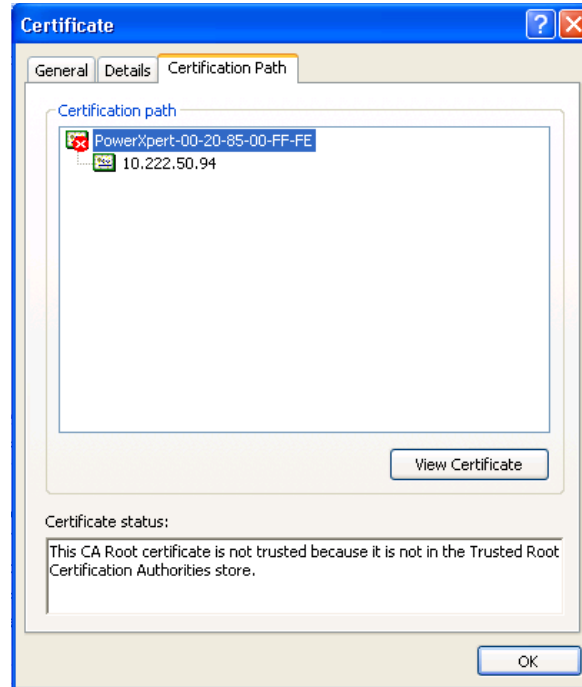
6. In the **Certificate** dialog box, click the **Install Certificate** button.

NOTE: The certificate cannot be verified yet because it is issued by a nontrusted CA.

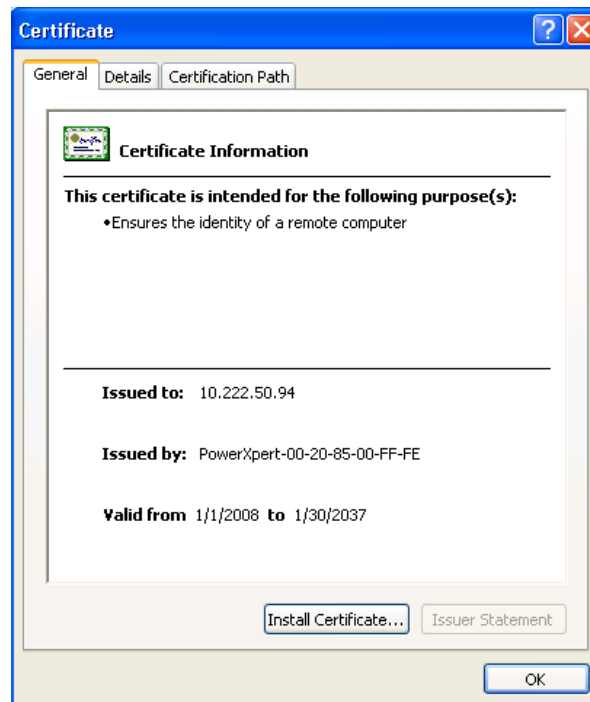
Figure 3. Certification Path Window



7. Select the **Certification Path** tab. On the tab, select the line with **PowerXpert** followed by a series of hexadecimal digits.



8. Click the **View Certificate** button. The **Certificate** dialog box appears.



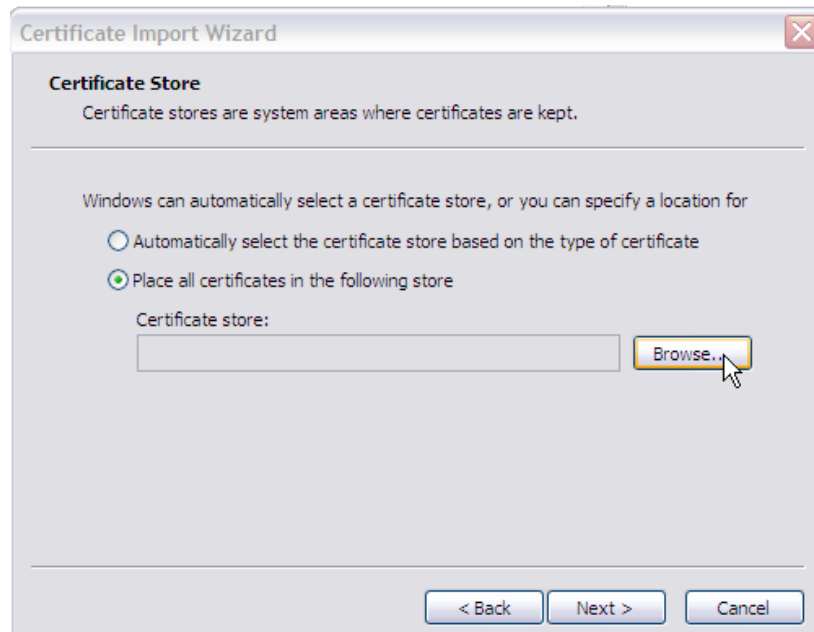
9. Click the **Install Certificate** button. The **Certificate Import Wizard** appears.

Certificate Import Wizard



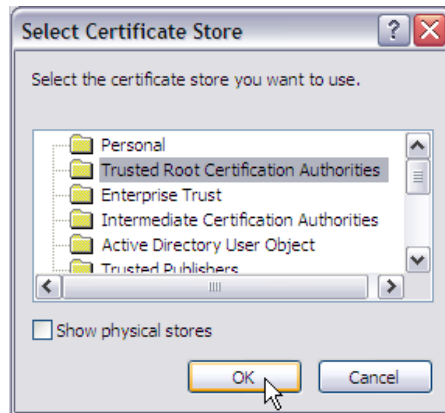
Click the **Next** button. The store dialog box appears.

Certificate Import Wizard - store dialog



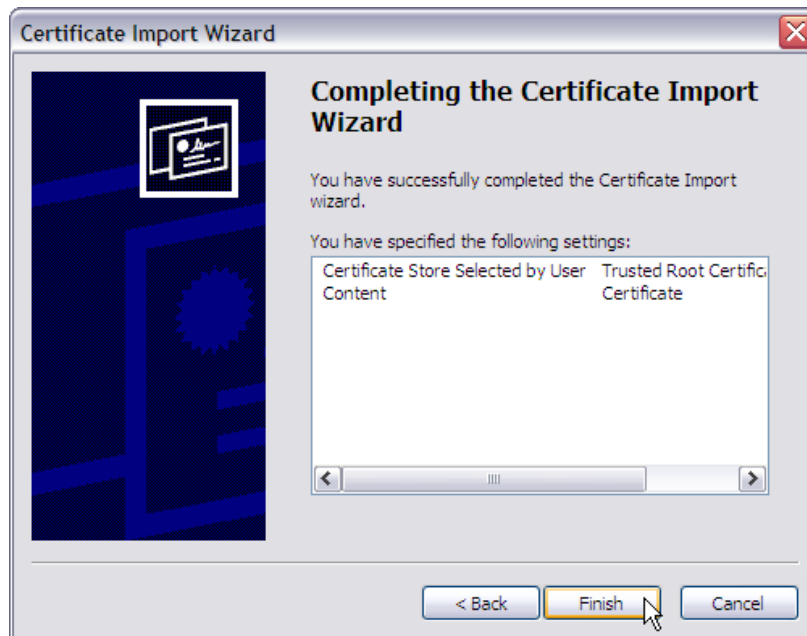
10. Select **Place all certificates in the following store** and then click **Browse**.

11. Select **Trusted Root Certificate Authorities** and then click **OK**.



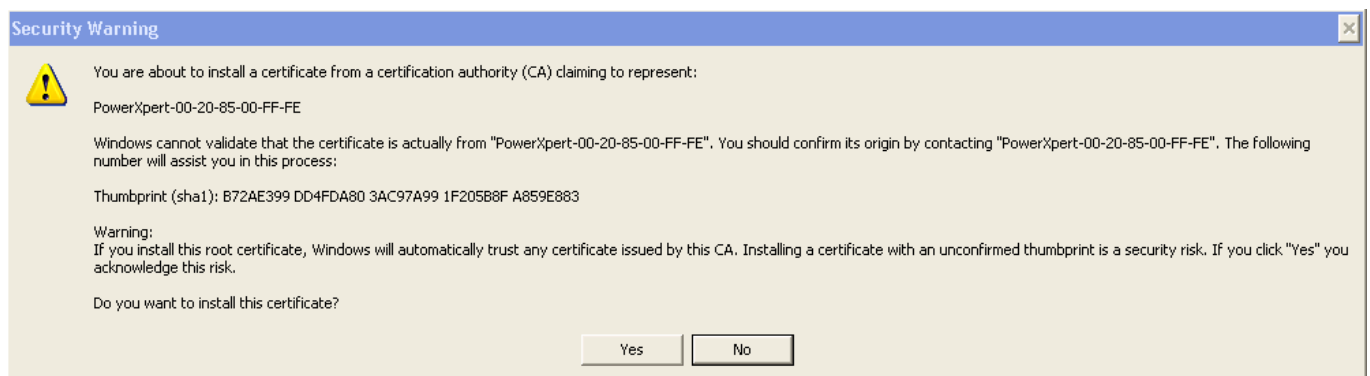
12. Click **Next**.

Certificate Import Wizard - successfully stored



13. The certificate wizard displays a completed dialog. Click **Finish**. The **Security Warning** dialog box will appear.

Security Warning dialog box



14. Click **Yes** to install the CA.
15. A message box opens to verify that the import was successful.

Import Successful message box



16. Click **OK**.
17. Click **OK** to close the dialog box. The installation process is complete. You can now access the meter using the HTTPS protocol (for example, `https://192.168.1.1/`).

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.

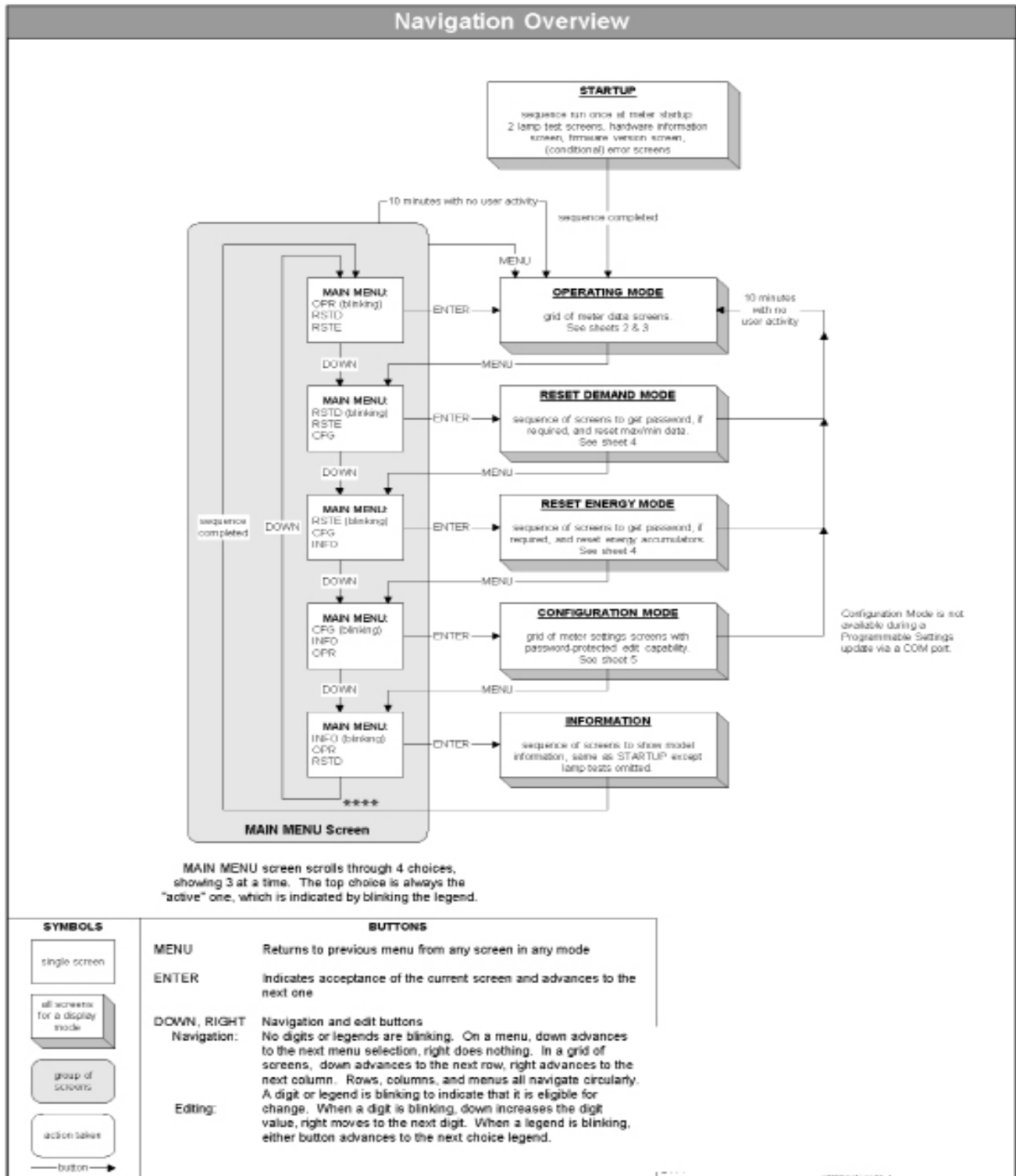
Navigation Maps (Sheets 1 to 4)

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:

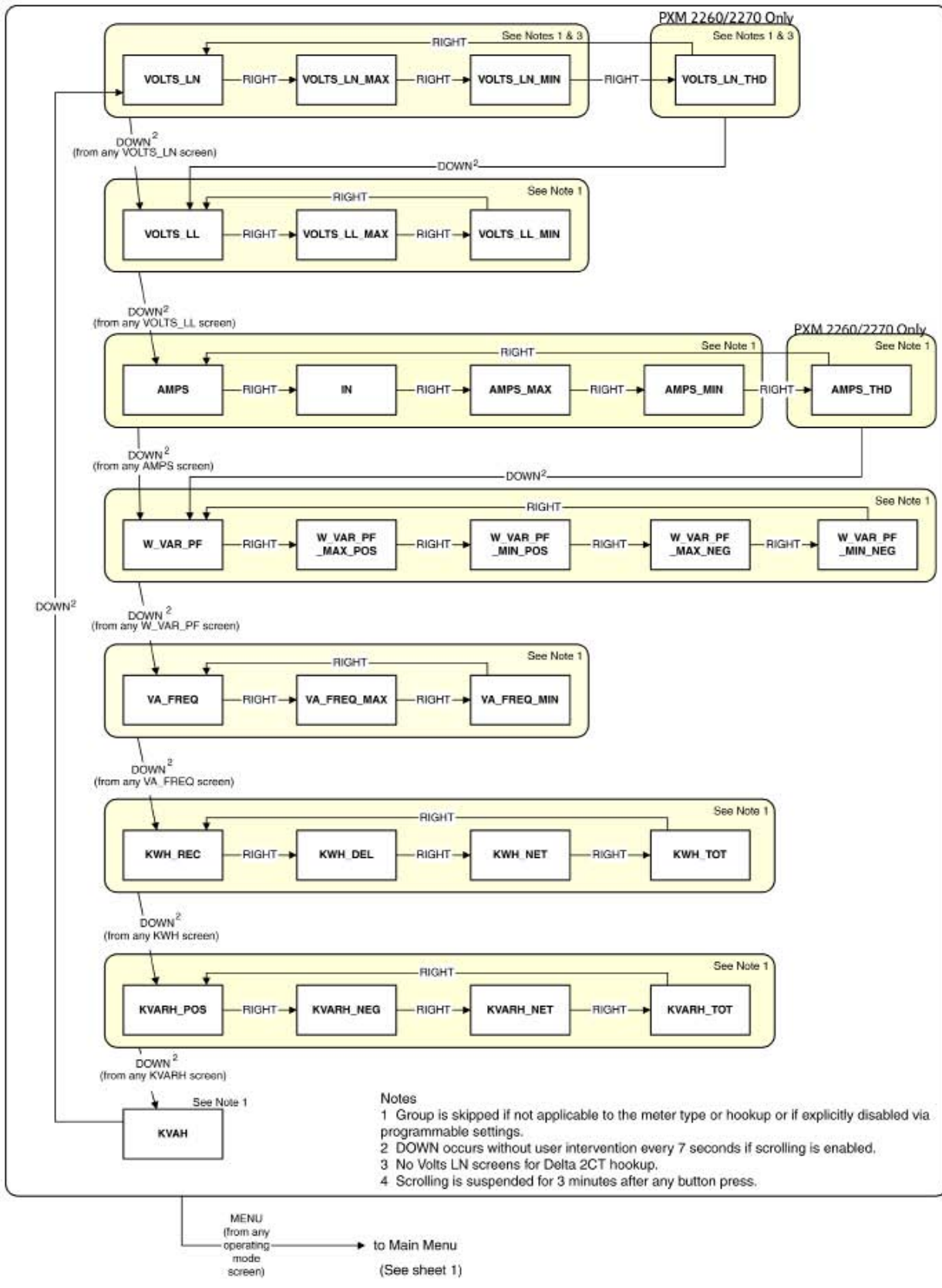
- Main Menu Screens (Sheet 1)
- Operating Mode Screens (Sheet 2)
- Reset Mode Screens (Sheet 3)
- Configuration Mode Screens (Sheet 4)

Main Menu Screens (Sheet 1)

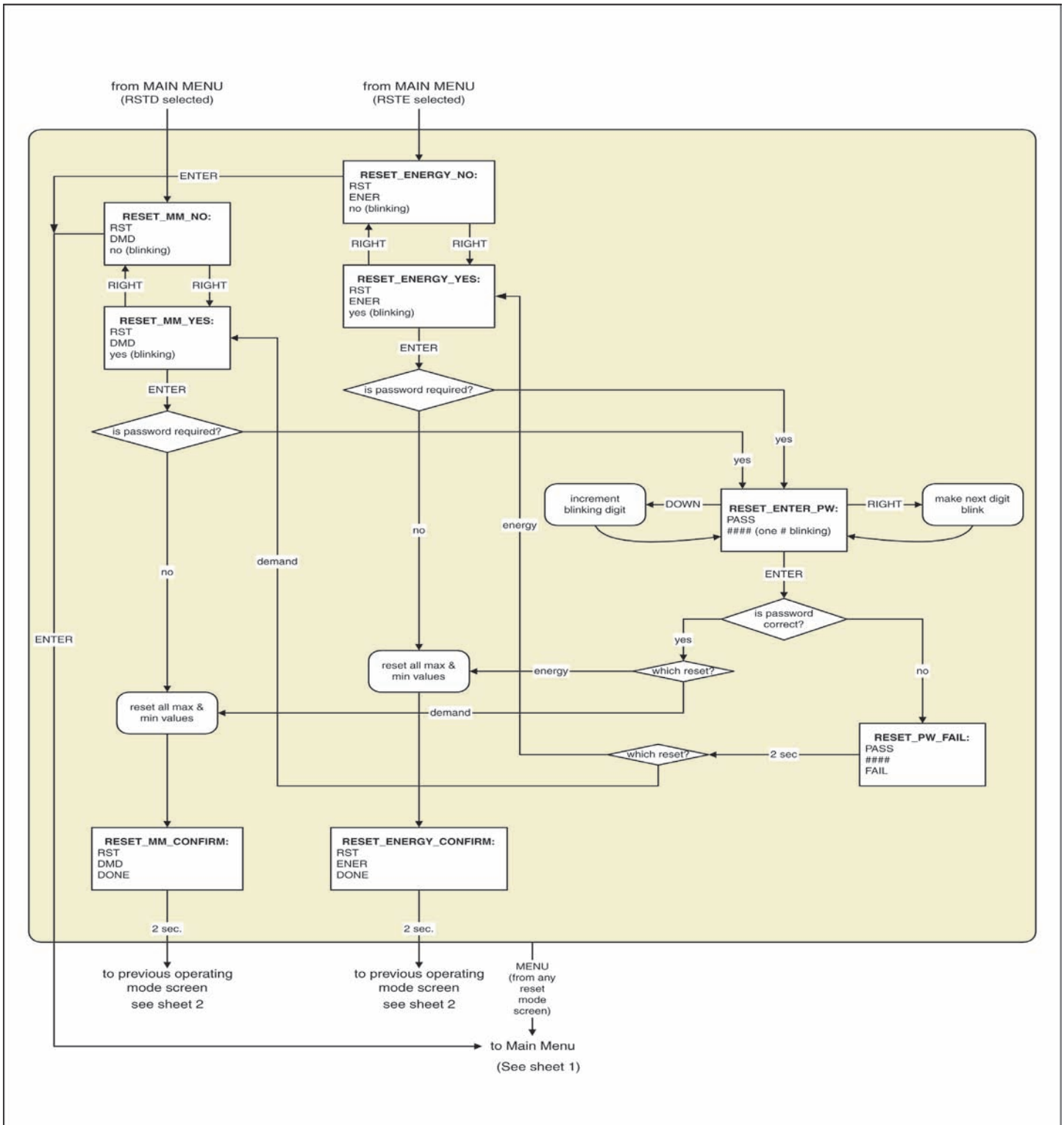


**** If the PXM 2000 meter has an Ethernet Gateway card, there is an IP Menu option after the Information screen.

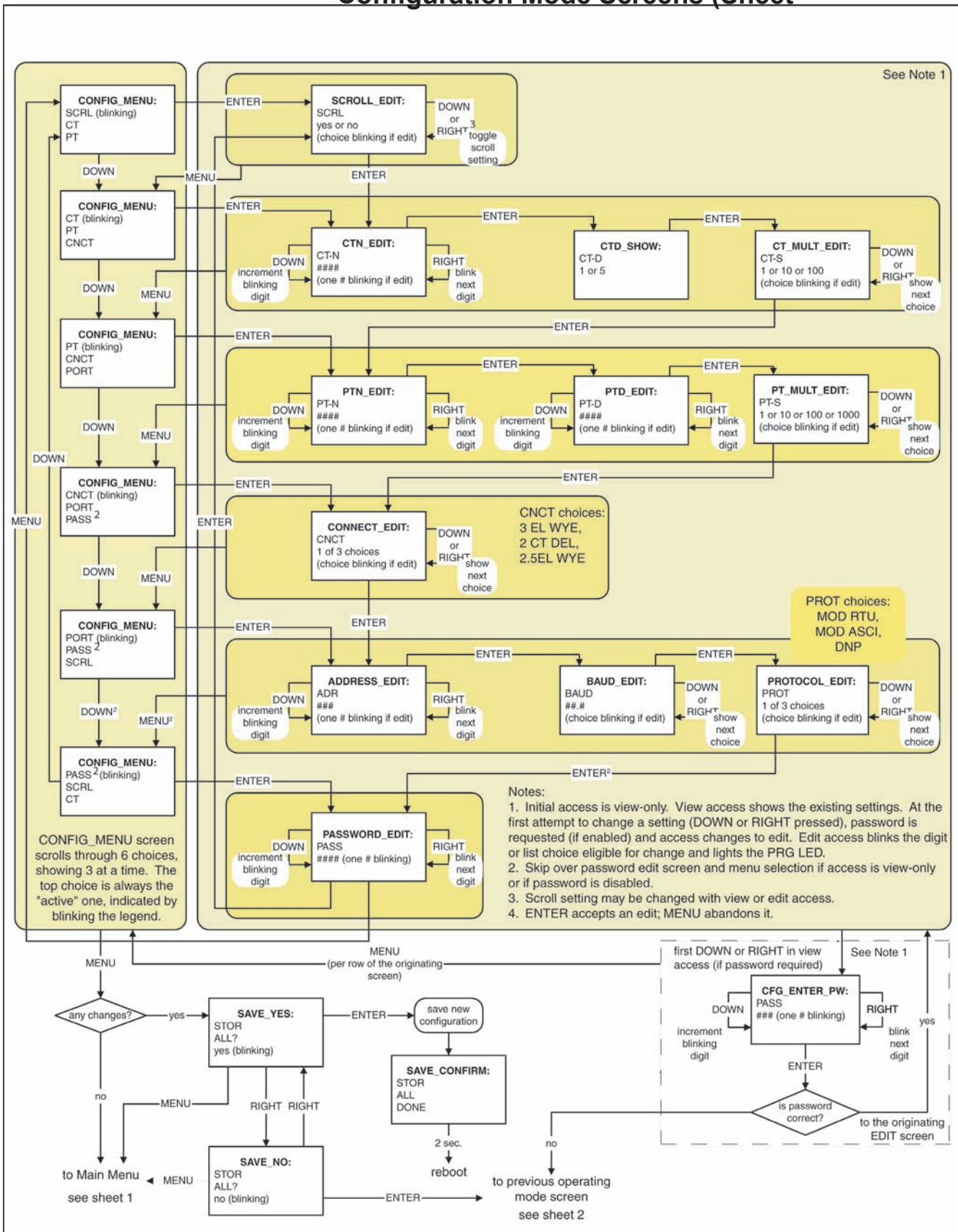
Operating Mode Screens (Sheet 2)



Reset Mode Screens (Sheet 3)



Configuration Mode Screens (Sheet



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
1	Enable previously stored network configuration settings (Normal mode).	Override network settings to assign a private IP address (Configuration mode); the port is set to 192.254.1.1.
2	Reserved	Reserved
3	Normal behavior	Reset the HTTP passwords to the defaults on boot up (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 up. After a successful boot, the switch should be turned back off before rebooting the card.
7	Reserved	Reserved
8	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've 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:

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

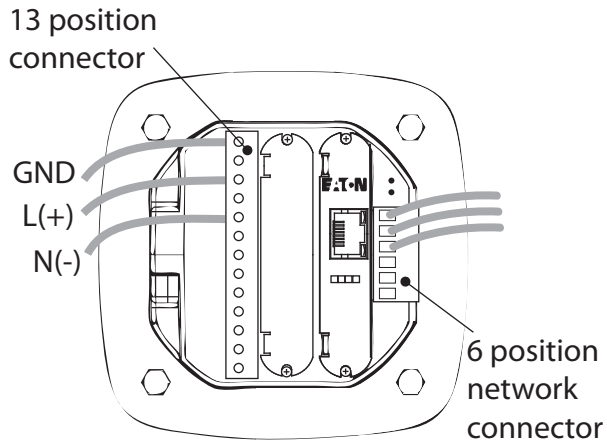
Use caution to ensure the current through the CTs is off or suitable protection is in place to prevent contact with the leads from the CT.

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.

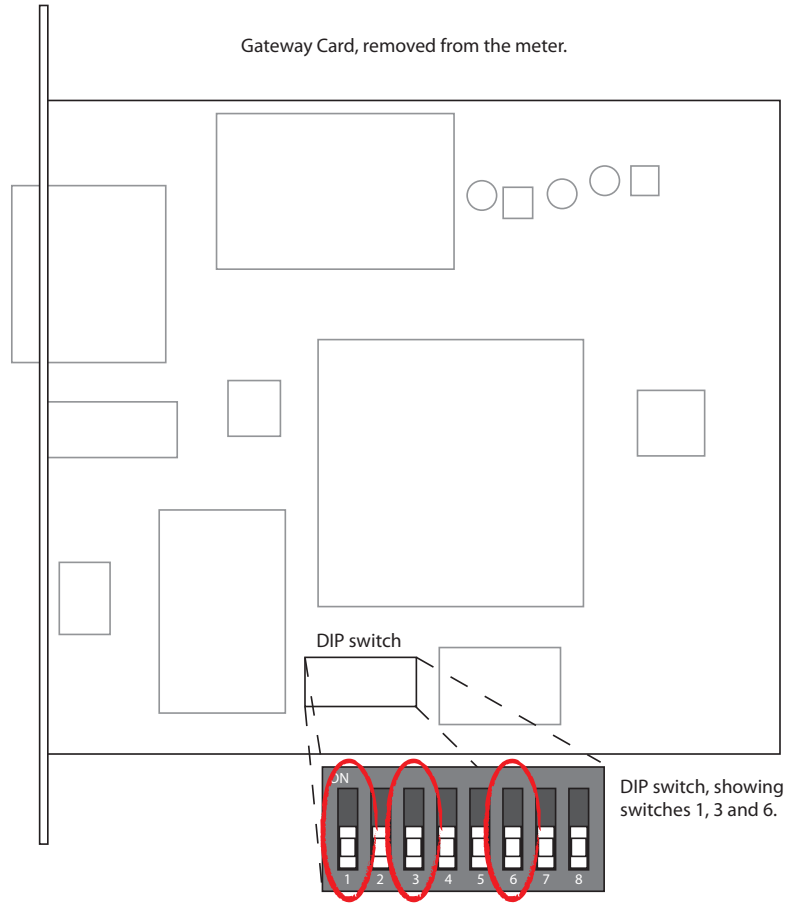
Resetting Configuration Settings

⚠ 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

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 192.254.1.1.
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 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 after 2 minutes 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(es) 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 used to configure the card requires a web browser (Internet Explorer versions 7 or 8 are supported) and an installed version 6 or newer of the JAVA J2SE JRE (Java Runtime Environment). If not already installed you or the network administrator may download it from www.java.com and install it per Sun's instructions.

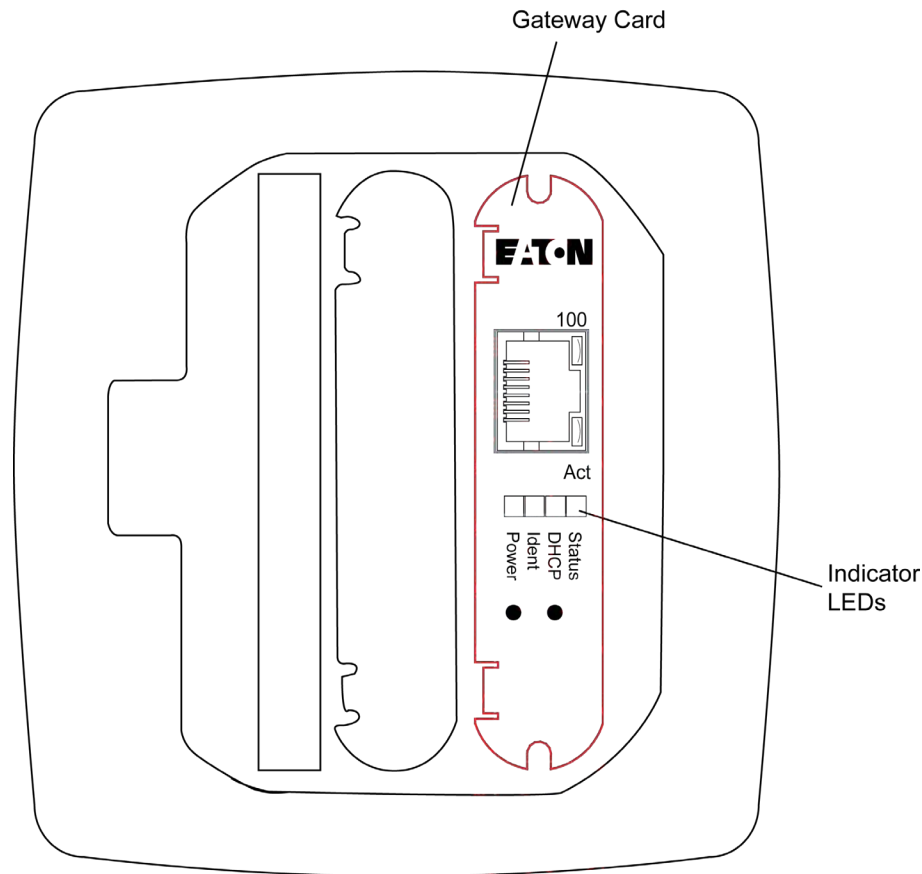
An Ethernet connection is used for configuring the meter's Gateway Card communication settings via a web browser. You may need to contact your network administrator for some network and configuration information. In preparation, you will need to decide if the meter will be manually assigned a fixed (static) 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.

Refer to the network configuration settings you recorded when the meter was initially placed into service.

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 a Fixed IP Address for the Meter Using a Local PC

When the meter was originally commissioned, your network administrator provided an IP address, a subnet mask, and a default gateway (this should have been recorded in the *Quick Start Guide*). This information must be entered into the meter 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)
- a Java-enabled web browser (Microsoft Internet Explorer versions 7 or 8 are supported).
- an installed version 6 or greater JAVA J2SE JRE (Java Runtime Environment). If not already installed, when you connect to the meter you'll be given the option to navigate to the Sun Java website and download the JRE.

To configure the meter:

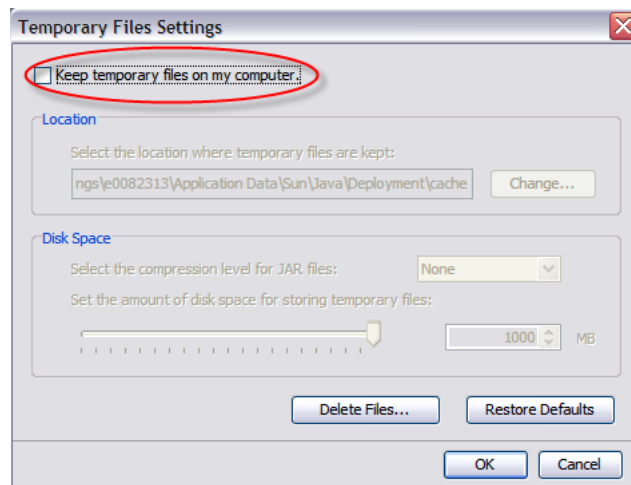
1. On the PC, launch the **Java Control Panel** screen (available through the Windows **Control Panel**).
2. On the **General** tab, click the **Settings** button under **Temporary Internet Files**.

Settings Button



3. Ensure the **Keep Temporary Files on My Computer** check box is cleared.

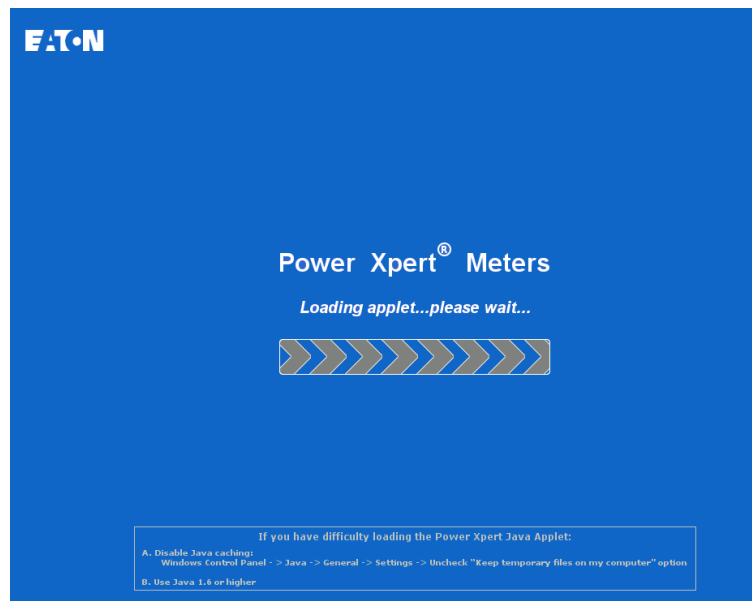
Keep Temporary Files on My Computer check box



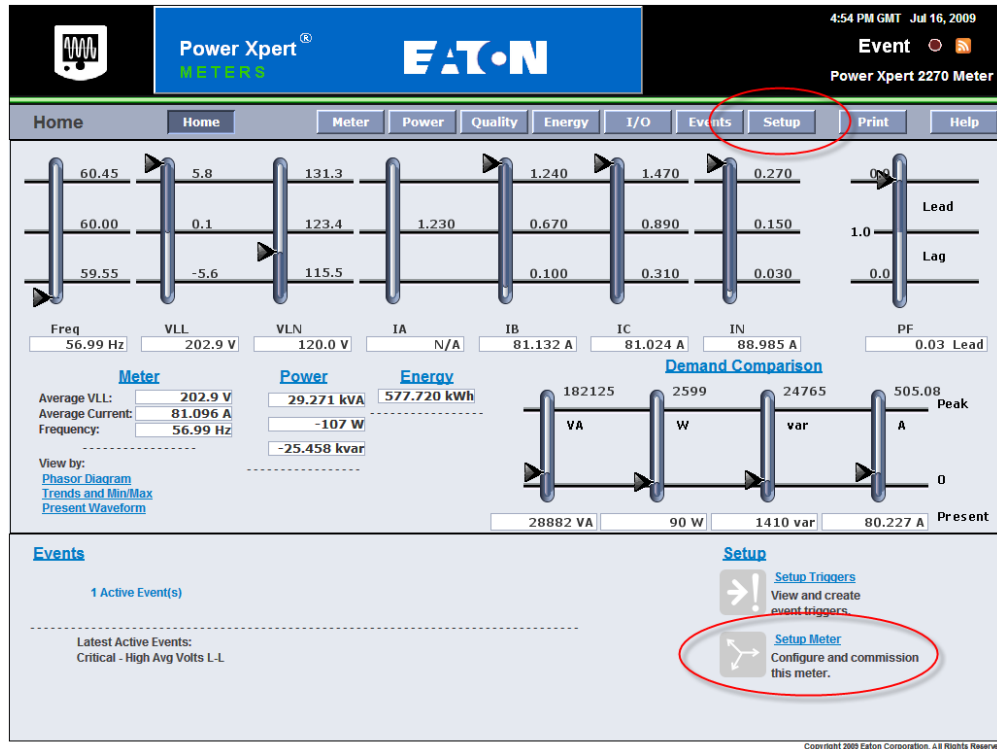
4. Connect the PC to the Gateway Card through the seven-foot Ethernet cable shipped with the meter.
There are two green lights (LEDs) located on the Gateway Card's Ethernet port. If the Ethernet cable is connected to an active Ethernet port on the PC both lights should be illuminated (the light labeled **Act** may be flickering reflecting network activity).
5. 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. Choose either **Settings > Control Panel** (Windows 2000) or **Control Panel** (Windows XP).

- 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.
6. Launch your Java-enabled 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

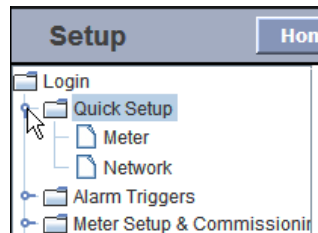


Java will load and then the meter's **Home** page will appear.



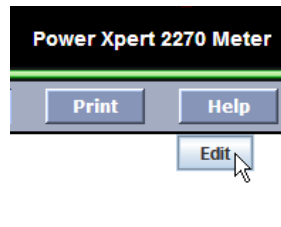
7. Click the **Setup** button. The **Setup** page will appear.
8. Locate and click the open icon to the left of the **Quick Setup** folder. The folder opens to show two subfolders: **Meter** and **Network**.

Opening the Quick Setup Folder



9. Click the **Network** folder.
10. Click the **Edit** button.

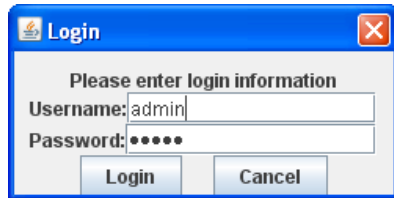
Edit Button (on the right of the page)



A **Login** dialog box appears.

- The default **Username** is `admin` and the default **Password** is `admin`. Log in using these credentials.

Login dialog



- 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.
- When you've completed configuration, click the **OK** button.
The new IP address will take effect shortly after clicking **OK**. Communication with the PC will then be lost. You can continue to configure the meter after it is connected to your LAN (see chapter 10 of this guide).
- 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:

- If the meter has power the display should be showing normal data, such as voltage, current, etc.
- Push the **MENU** button on the face of the meter. The main menu screen appears.
- Push **DOWN** repeatedly until **IP** blinks.
- 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.
- 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 running version 6 or greater of the JAVA J2SE JRE and a web browser such as Internet Explorer version 7 or 8 to navigate to the meter's IP address.

Restarting The Gateway Card

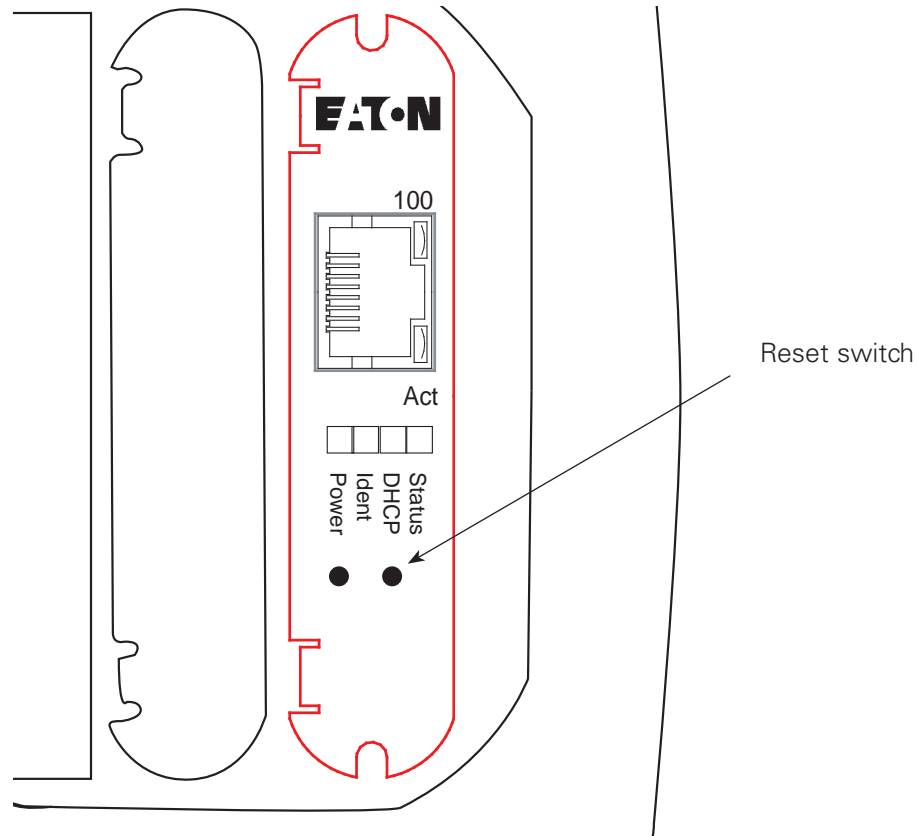
You can restart the Gateway Card through a momentary push-button switches accessed through two small holes in the face plate of the Gateway Card. Although this is not used in normal operations, this switch allows you to restart the Gateway Card in the meter.

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.

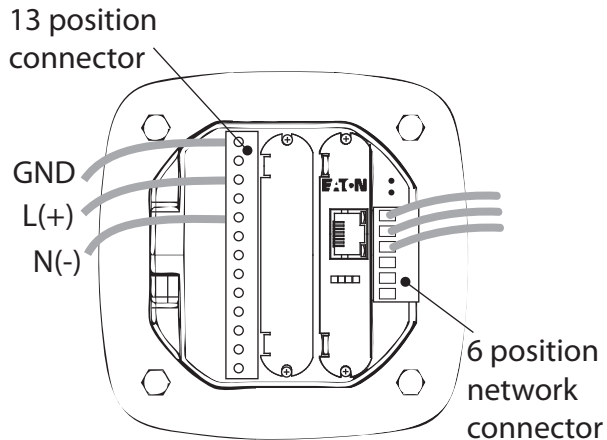
Reset Switch



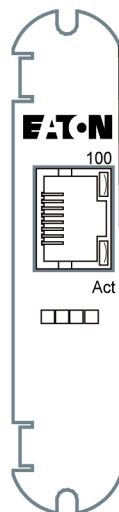
Reinstalling the Meter

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

