

# IQ 150S/250S

Electronic Self-Enclosed Submeters with  
Wifi Ethernet Capability

## User & Installation Manual



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Product Model or Version Number: \_\_\_\_\_

Product Serial or License Number: \_\_\_\_\_

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Your Name: \_\_\_\_\_

Address: \_\_\_\_\_

Address: \_\_\_\_\_

City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_

Email: \_\_\_\_\_

Today's Date: \_\_\_\_\_

Phone: \_\_\_\_\_

Eaton GO number (if known) \_\_\_\_\_



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# 1 Introduction

## About This Manual

This document is the user manual for the installation, operation, and maintenance of the Eaton IQ 150S/250S Meter. It is intended for authorized and qualified personnel who use the IQ 150S/250S Meter. 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 IQ 150S/250S Meter.

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 IQ 150S/250S METER MAY RESULT IN INJURY, DEATH, OR EQUIPMENT DAMAGE. Properly ground the IQ 150S/250S Meter during installation.

## FCC Information

Regarding the wireless module:

- This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: 1) this device may not cause harmful interference, and 2) this device must accept any interference received, including interference that may cause undesired operation.
- The antenna provided must not be replaced with an different type. Attaching a different antenna will void the FCC approval and the FCC ID can no longer be considered.

Covered by one or more of the following patents:

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

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## 2: IQ 150S/250S Submeter Overview and Specifications

### 2.1: Hardware Overview

Eaton's IQ 150S/250S submeter is designed to measure revenue grade electrical energy usage and communicate that information via various communication media. The unit supports RS485, RJ45 wired Ethernet or IEEE 802.11 WiFi Ethernet connections. This allows the submeter to be placed anywhere within an industrial or commercial facility and still communicate quickly and easily back to central software.

The unit is designed with advanced measurement capabilities, allowing it to achieve high performance accuracy. The IQ 150S meter is specified as a 0.2% class energy meter for billing applications (the IQ 250S is so specified for Class 10 only). To verify the submeter's performance and calibration, power providers use field test standards to verify that the unit's energy measurements are correct. The IQ 150S/250S meter is a traceable revenue meter and contains a utility grade test pulse to verify rated accuracy.

The IQ 250S meter has up to 2 MegaBytes\* for datalogging. It offers three historical logs, a Limits (Alarm) log, and a System Events log.

**\*NOTE:** Because the memory is flash-based rather than NVRAM (non-volatile random-access memory), some sectors are reserved for overhead, erase procedures, and spare sectors for long-term wear reduction.

**IQ 150S/250S meter features detailed in this manual are:**

- 0.2% Class Revenue Certifiable Energy and Demand Submeter (IQ 250S Class 10 only)
- Meets ANSI C12.20 (0.2%) and IEC 62053-22 (0.2%) Classes (IQ 250S Class 10 only)
- Multifunction Measurement including Voltage, Current, Power, Frequency, Energy, etc.
- Three line 0.56" bright red LED display
- 2 MegaBytes Memory for Datalogging (IQ 250S)



- Real Time Clock for Time-Stamping of Logs (Logs are available only with the IQ 250S)
- Percentage of Load bar for Analog meter perception
- Modbus RTU (over Serial) and Modbus TCP (over Ethernet)
- Serial RS485 communication
- Ethernet and wireless Ethernet (WiFi)
- Easy to use faceplate programming
- Direct interface with most Building Management systems

The IQ 150S/250S submeter uses standard 5 or 1 Amp CTs (either split or donut). It surface mounts to any wall and is easily programmed. The unit is designed specifically for easy installation and advanced communication.

### 2.1.1: Ordering Information

**IQ - 150 - S - A - 6 - 5 - 1 - 1**

**1      2            3 4    5 6**

1. Model:

150 = Energy

250 = Energy Plus

2. Meter Type

S = Self-enclosed Submeter

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 - 400) VAC @50/60Hz or (100-370) VDC

6. Communication

1 = RS485 with Modbus RTU and KYZ Pulse Output

2 = RJ45 Ethernet Connection or Wireless (802.11b) with Modbus TCP and KYZ  
Pulse Output (also configurable for RS485)

Example: IQ 150-S-A-6-5-1-1

(IQ 150 Self-enclosed Energy submeter with 60Hz System, 5 Amp Secondary, 90-400 VAC/100-370 VDC Power Supply, RS485 Modbus and KYZ Pulse Output)

### 2.1.2: Measured Values

The IQ 150S/250S meter provides the following measured values all in real time and some additionally as average, maximum and minimum values.

| IQ150S/250S Meter Measured Values |           |         |         |         |
|-----------------------------------|-----------|---------|---------|---------|
| Measured Values                   | Real Time | Average | Maximum | Minimum |
| Voltage L-N                       | X         |         | X       | X       |
| Voltage L-L                       | X         |         | X       | X       |
| Current per Phase                 | X         | X       | X       | X       |
| Current Neutral                   | X         |         |         |         |
| Watts                             | X         | X       | X       | X       |
| VAR                               | X         | X       | X       | X       |
| VA                                | X         | X       | X       | X       |
| PF                                | X         | X       | X       | X       |
| +Watt-hr                          | X         |         |         |         |
| -Watt-hr                          | X         |         |         |         |
| Watt-hr Net                       | X         |         |         |         |
| +VAR-hr                           | X         |         |         |         |
| -VAR-hr                           | X         |         |         |         |
| VAR-hr Net                        | X         |         |         |         |
| VA-hr                             | X         |         |         |         |
| Frequency                         | X         |         | X       | X       |
| Voltage Angles                    | X         |         |         |         |
| Current Angles                    | X         |         |         |         |
| % of Load Bar                     | X         |         |         |         |

### 2.1.3: Utility Peak Demand

The IQ150S/250S meter provides user-configured Block (Fixed) window or Rolling window Demand. This feature allows you to set up a customized Demand profile. Block window Demand is Demand used over a user-configured Demand period (usually 5, 15 or 30 minutes). Rolling window Demand is a fixed window Demand that moves for a user-specified subinterval period.

For example, a 15-minute Demand using 3 subintervals and providing a new Demand reading every 5 minutes, based on the last 15 minutes.

Utility Demand features can be used to calculate kW, kVAR, kVA and PF readings. All other parameters offer Max and Min capability over the user-selectable averaging period. Voltage provides an Instantaneous Max and Min reading which displays the highest surge and lowest sag seen by the meter

## 2.2: Specifications

### Power Supply

|        |                                                             |
|--------|-------------------------------------------------------------|
| Range: | Universal, (90 to 400)VAC<br>@50/60Hz or<br>(100 to 370)VDC |
|--------|-------------------------------------------------------------|

|                    |               |
|--------------------|---------------|
| Power Consumption: | 16 VA Maximum |
|--------------------|---------------|

### Voltage Inputs (Measurement Category III)

|        |                                                                  |
|--------|------------------------------------------------------------------|
| Range: | IQ 150S: Universal, Auto-ranging<br>up to 416VAC L-N, 721VAC L-L |
|--------|------------------------------------------------------------------|

|                                                                  |
|------------------------------------------------------------------|
| IQ 250S: Universal, Auto-ranging<br>up to 576VAC L-N, 721VAC L-L |
|------------------------------------------------------------------|

|                    |                                                                  |
|--------------------|------------------------------------------------------------------|
| Supported hookups: | 3 Element Wye, 2.5 Element Wye,<br>2 Element Delta, 4 Wire Delta |
|--------------------|------------------------------------------------------------------|

|                  |              |
|------------------|--------------|
| Input Impedance: | 1M Ohm/Phase |
|------------------|--------------|

|         |                                                     |
|---------|-----------------------------------------------------|
| Burden: | 0.36VA/Phase Max at 600V,<br>0.0144VA/Phase at 120V |
|---------|-----------------------------------------------------|

|                 |       |
|-----------------|-------|
| Pickup Voltage: | 10VAC |
|-----------------|-------|

|                   |                                                     |
|-------------------|-----------------------------------------------------|
| Connection:       | Screw terminal - #6 - 32 screws<br>See Figure 3.1   |
| Input Wire Gauge: | AWG#16 - 26                                         |
| Fault Withstand:  | Meets IEEE C37.90.1 (Surge<br>Withstand Capability) |
| Reading:          | Programmable Full Scale to any PT<br>Ratio          |

**Current Inputs**

|                          |                                                |
|--------------------------|------------------------------------------------|
| Class 10:                | 5A Nominal, 10 Amp Maximum                     |
| Class 2:                 | 1A Nominal, 2 Amp Secondary                    |
| Burden:                  | 0.005VA Per Phase Max at 11 Amps               |
| Pickup Current:          | 0.1% of Nominal                                |
| Connections:             | Screw terminal - #6-32 screws<br>(Diagram 3.1) |
| Current Surge Withstand: | 100A/10 seconds at 23° C                       |
| Reading:                 | Programmable Full Scale to any CT<br>Ratio     |

**Isolation**

All Inputs and Outputs are galvanically isolated and tested to 2500VAC

**Environmental Rating**

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

**Measurement Methods**

|                   |                                                                                     |
|-------------------|-------------------------------------------------------------------------------------|
| Voltage, Current: | True RMS                                                                            |
| Power:            | Sampling at 400+ Samples per Cycle on All Channels Measured Readings Simultaneously |
| A/D Conversion:   | 6 Simultaneous 24 bit Analog to Digital Converters                                  |

**Update Rate**

|                       |                                                                     |
|-----------------------|---------------------------------------------------------------------|
| Watts, VAR and VA:    | Every 6 cycles, e.g., 100 milliseconds (Ten times per second) @60Hz |
| All other parameters: | Every 60 cycles, e.g, 1 second @60Hz                                |

**Communication Format**

|                     |                                                                      |
|---------------------|----------------------------------------------------------------------|
| RS485               |                                                                      |
| Protocols:          | Modbus RTU, Modbus ASCII, DNP 3.0, Modbus TCP (for Ethernet-enabled) |
| Com Port Baud Rate: | 9600 to 57600 b/s                                                    |
| Com Port Address:   | 001-247                                                              |
| Data Format:        | 8 Bit, No Parity                                                     |

**Wireless Ethernet (Optional)**

|                                          |                           |
|------------------------------------------|---------------------------|
| 802.11b Wireless or 10/100BaseT Ethernet | WiFi or RJ45 Connection   |
| 128 bit WEP Encryption                   | 128 bit Wireless Security |
| Modbus TCP Protocol                      |                           |

**Mechanical Parameters**

Dimensions: (H7.9 x W7.6 x D3.2) inches,  
(H200.7 x W193.0 x D81.3) mm

Weight: 4 pounds

**KYZ/RS485 Port Specifications**

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

Type: Two-wire, half duplex

Min. Input Impedance: 96k $\Omega$

Max. Output Current:  $\pm 60$ mA

**Wh Pulse**

KYZ output contacts (and infrared LED light pulses through face plate; see Section 6.4 for Kh values):

Pulse Width: 40ms for IQ 150S; 90ms for IQ  
250S

Full Scale Frequency: ~6Hz for IQ 150S; ~3Hz for IQ  
250S

Contact type: Solid State – SPDT (NO – C – NC)

Relay type: Solid state

Peak switching voltage: DC  $\pm 350$ V

Continuous load current: 120mA

Peak load current: 350mA for 10ms

On resistance, max.: 35 $\Omega$

Leakage current: 1 $\mu$ A@350V

Isolation: AC 3750V

Reset State: (NC - C) Closed; (NO - C) Open

Infrared LED:

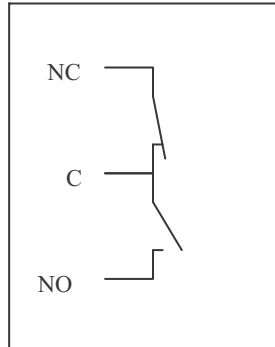
Peak Spectral Wavelength:

940nm

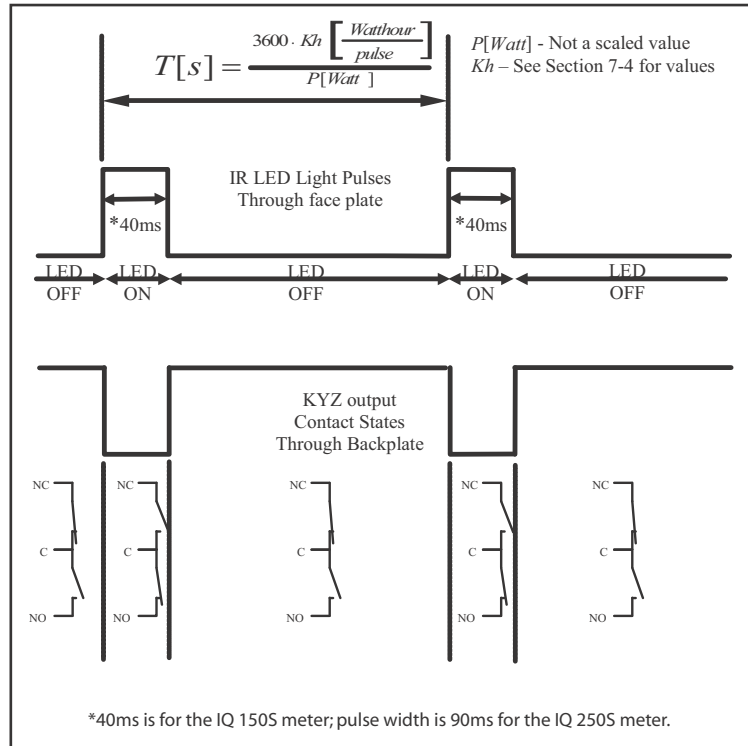
Reset State:

Off

Internal Schematic:



Output Timing:



## 2.3: Compliance

- IEC 62053-22 (0.2% Accuracy), IQ 250S - Class 10 only
- ANSI C12.20 (0.2% Accuracy), IQ 250S - Class 10 only
- ANSI (IEEE) C37.90.1 Surge Withstand
- ANSI C62.41 (Burst)
- IEC1000-4-2: ESD
- IEC1000-4-3: Radiated Immunity
- IEC1000-4-4: Fast Transient
- IEC1000-4-5: Surge Immunity
- UL Listed
- CE Compliant

## 2.4: Accuracy

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                                     |
|----------------------------------|---------------------------------|----------------------------------------------------------|
| Voltage L-N [V]                  | 0.1% of reading <sup>2</sup>    | (69 to 480)V                                             |
| Voltage L-L [V]                  | 0.1% of reading                 | (120 to 600)V                                            |
| Current Phase [A]                | 0.1% of reading <sup>1</sup>    | (0.15 to 5)A                                             |
| Current Neutral (calculated) [A] | 2.0% of Full Scale <sup>1</sup> | (0.15 to 5)A @ (45 to 65)Hz                              |
| Active Power Total [W]           | 0.2% of reading <sup>1,2</sup>  | (0.15 to 5)A @ (69 to 480)V @ +/- (0.5 to 1) lag/lead PF |
| Active Energy Total [Wh]         | 0.2% of reading <sup>1,2</sup>  | (0.15 to 5)A @ (69 to 480)V @ +/- (0.5 to 1) lag/lead PF |
| Reactive Power Total [VAR]       | 0.2% of reading <sup>1,2</sup>  | (0.15 to 5)A @ (69 to 480)V @ +/- (0 to 0.8) lag/lead PF |
| Reactive Energy Total [VARh]     | 0.2% of reading <sup>1,2</sup>  | (0.15 to 5)A @ (69 to 480)V @ +/- (0 to 0.8) lag/lead PF |
| Apparent Power Total [VA]        | 0.2% of reading <sup>1,2</sup>  | (0.15 to 5)A @ (69 to 480)V @ +/- (0.5 to 1) lag/lead PF |

|                             |                                |                                                             |
|-----------------------------|--------------------------------|-------------------------------------------------------------|
| Apparent Energy Total [VAh] | 0.2% of reading <sup>1,2</sup> | (0.15 to 5)A @ (69 to 480)V<br>@ +/- (0.5 to 1) lag/lead PF |
| Power Factor                | 0.2% of reading <sup>1,2</sup> | (0.15 to 5)A @ (69 to 480)V<br>@ +/- (0.5 to 1) lag/lead PF |
| Frequency                   | +/- 0.01Hz                     | (45 to 65)Hz                                                |
| Load Bar                    | +/- 1 segment                  | (0.005 to 6)A                                               |

<sup>1</sup> 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.

<sup>2</sup> For unbalanced voltage inputs where at least one crosses the 150V auto-scale threshold (for example, 120V/120V/208V system), degrade accuracy by additional 0.4%.

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## 3: Mechanical Installation

### 3.1: Overview

The IQ 150S/250S meter can be installed on any wall. See Chapter 4 for wiring diagrams.

Mount the meter in a dry location, which is free from dirt and corrosive substances.

#### Recommended Installation Tools

- #2 Phillips screwdriver
- Wire cutters

### 3.2: Install the Base

1. Determine where you want to install the submeter.
2. With the submeter power off, open the top of the submeter. Use the front cover support to keep the cover open as you perform the installation (see Figure 3.1).

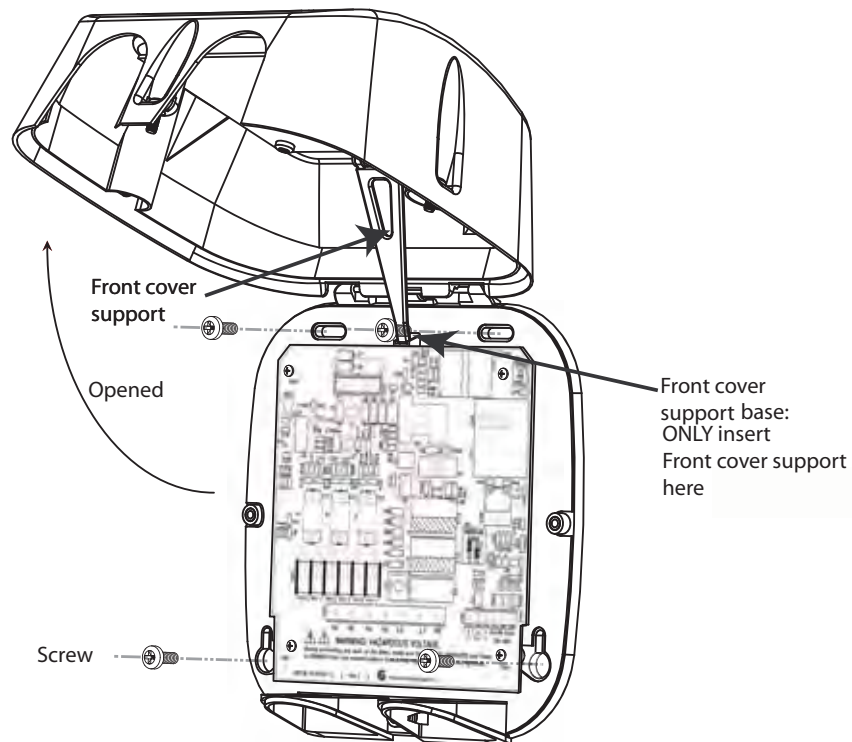


Figure 3.1: Submeter with Cover Open

**CAUTIONS!**

- Remove the antenna before opening the unit.
  - Only use the front cover support if you are able to open the front cover to the extent that you can fit the front cover support into its base. **DO NOT** rest the front cover support on the inside of the meter, even for a short time - by doing so, you may damage components on the board assembly. Always insert the front cover support into its base.
3. Find the 4 Installation Slots and insert screws through each slot into the wall or panel.
  4. Fasten securely - DO NOT overtighten. Maximum recommended torque is 0.5/0.6 Nm (4.42/5.31 lbF in).

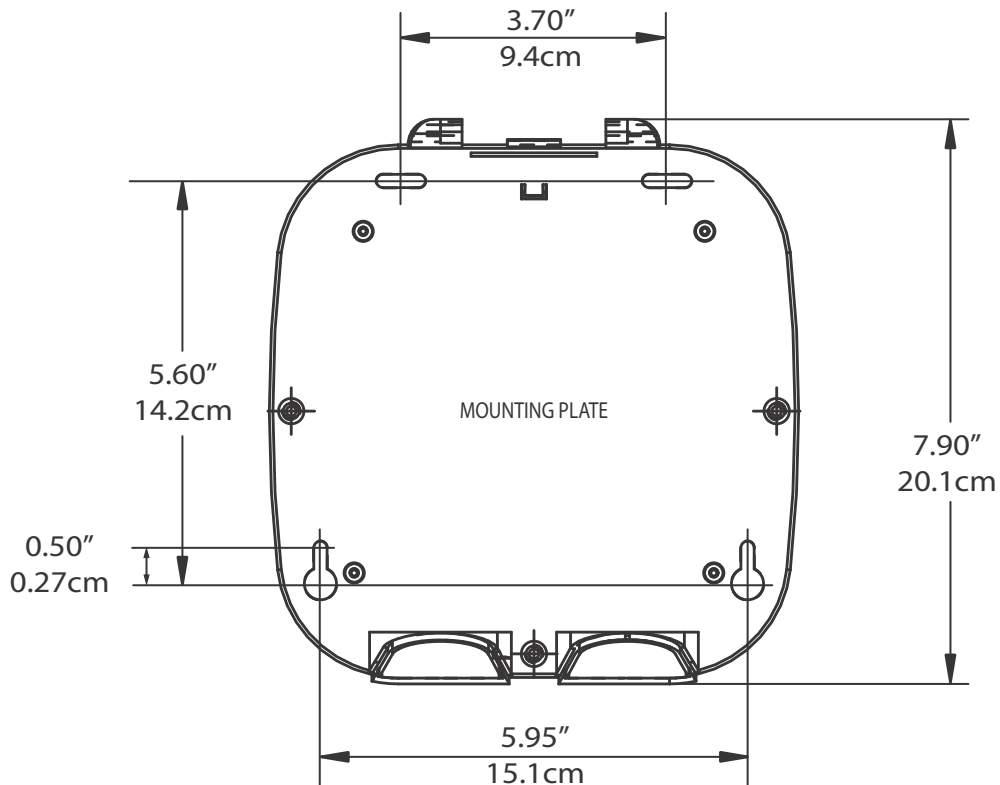
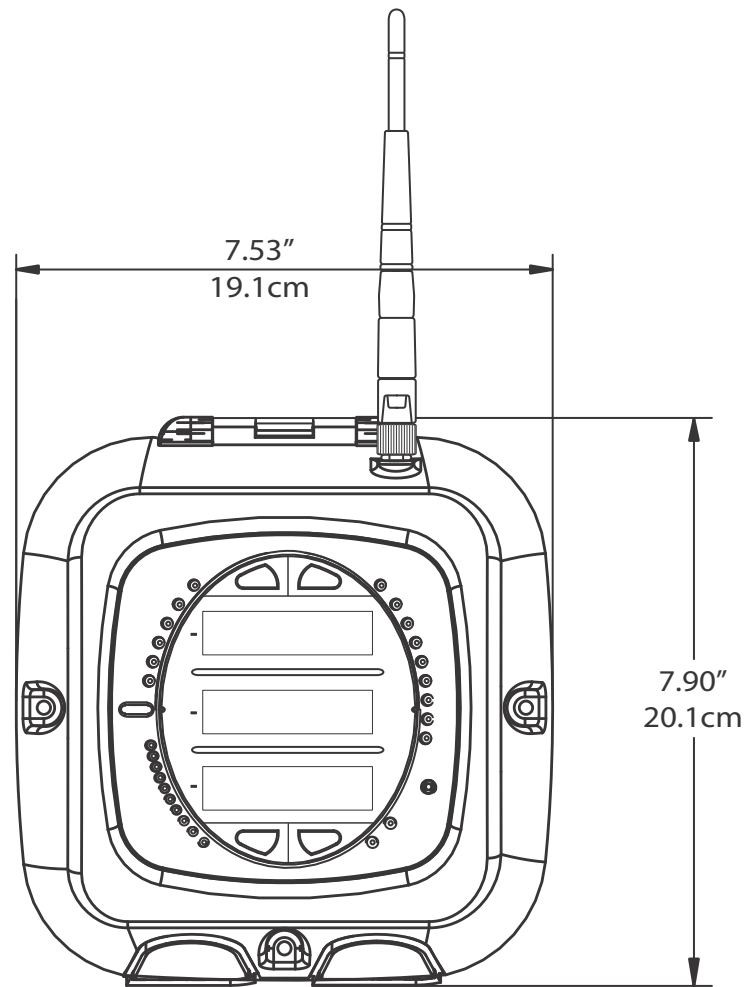
**3.2.1: Mounting Diagrams**

Figure 3.2: Mounting Plate Dimensions



Antenna Length: 4.4" (11.2cm)

Figure 3.3: Front Dimensions

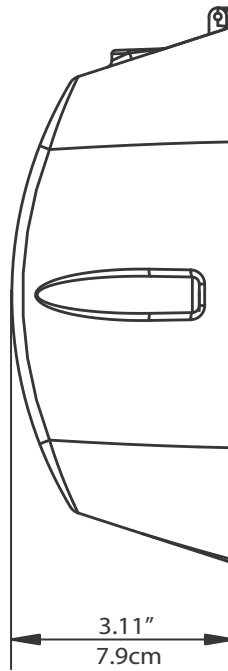


Figure 3.4: Side Dimensions

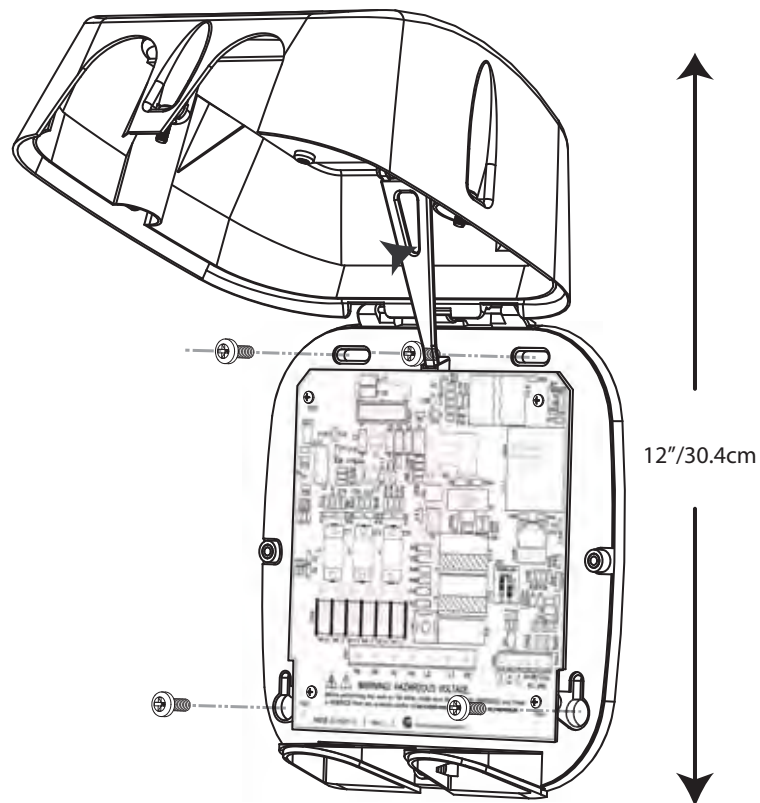


Figure 3.5: Open Cover Dimensions

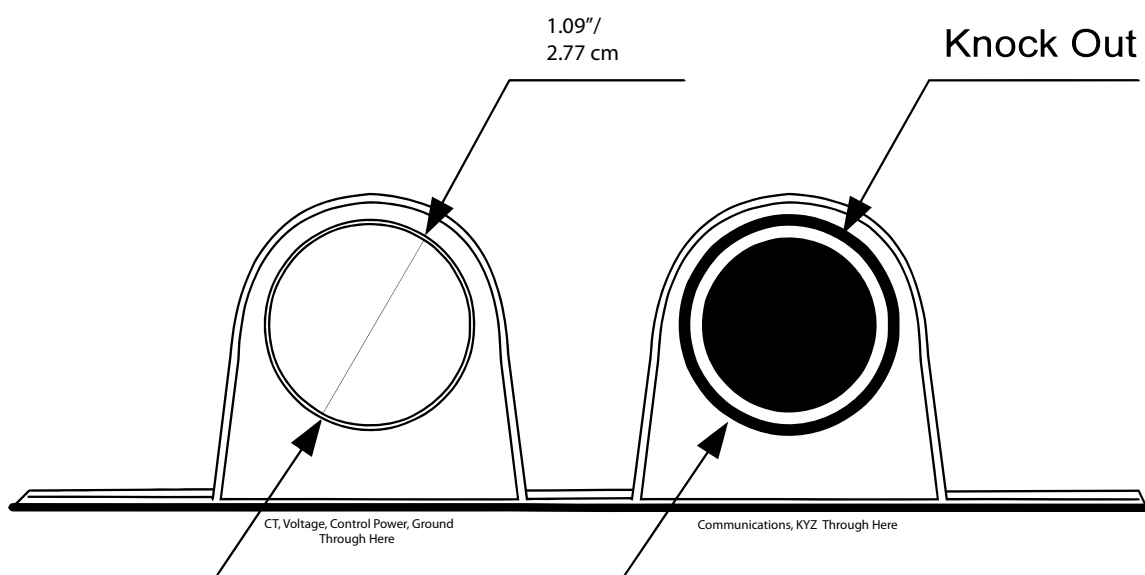


Figure 3.6: Bottom View with Access Holes

### 3.3: Secure the Cover

1. Close the cover, making sure that power and communications wires exit the submeter through the openings at the base (see Figure 3.6).

**CAUTION!** To avoid damaging components on the board assembly, make sure the front cover support is in the upright position before closing the front cover.

2. Using the 3 enclosed screws, secure the cover to the base in three places - DO NOT over-tighten (you may damage the cover). Maximum recommended torque is 0.5/0.6 Nm (4.42/5.31 lbF in).
3. The unit can be sealed after the front cover is closed. To seal the unit, thread a seal tag (not supplied by Eaton) through the housing located between the bottom access holes (see figures 3.6 and 3.7).
4. Reattach the antenna, if applicable.

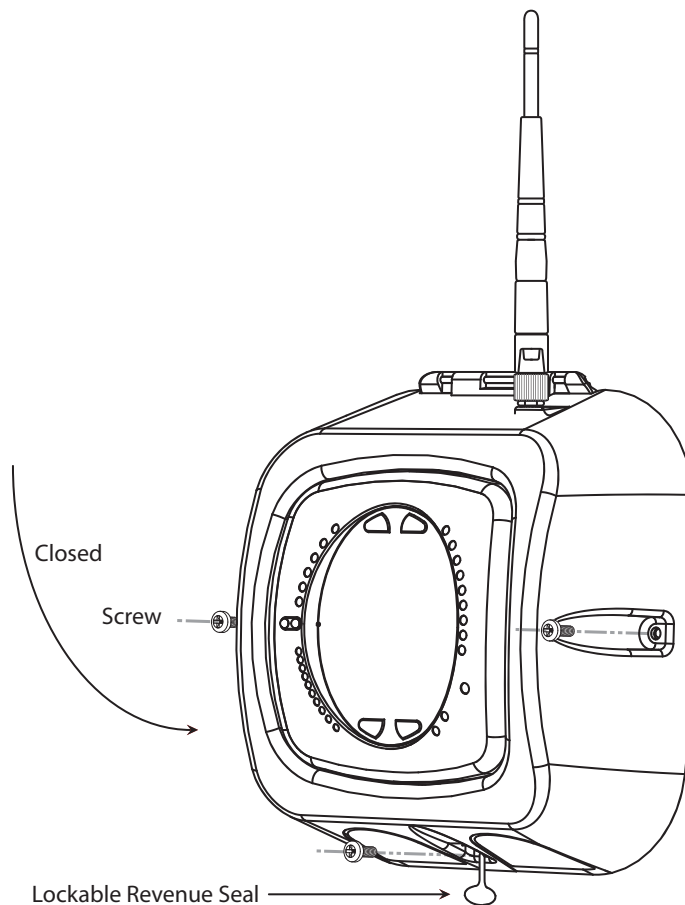


Figure 3.7: Submeter with Closed Cover

## 4: Electrical Installation

### 4.1: Considerations When Installing Meters



Installation of the IQ 150S/250S meter 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 IQ 150S/250S meter, 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.

**IMPORTANT!**

- 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.

**4.2: Electrical Connections**

All wiring for the IQ 150S/250S is done through the front of the unit (lifting the cover with the power to the unit OFF) so that the unit can be surface mounted. Connecting cables exit the unit via two openings in the base plate (see figures 3.6 and 4.1).



DO NOT over-torque screws. Maximum recommended torque is 0.5/0.6 Nm (4.42/5.31 lbF in).

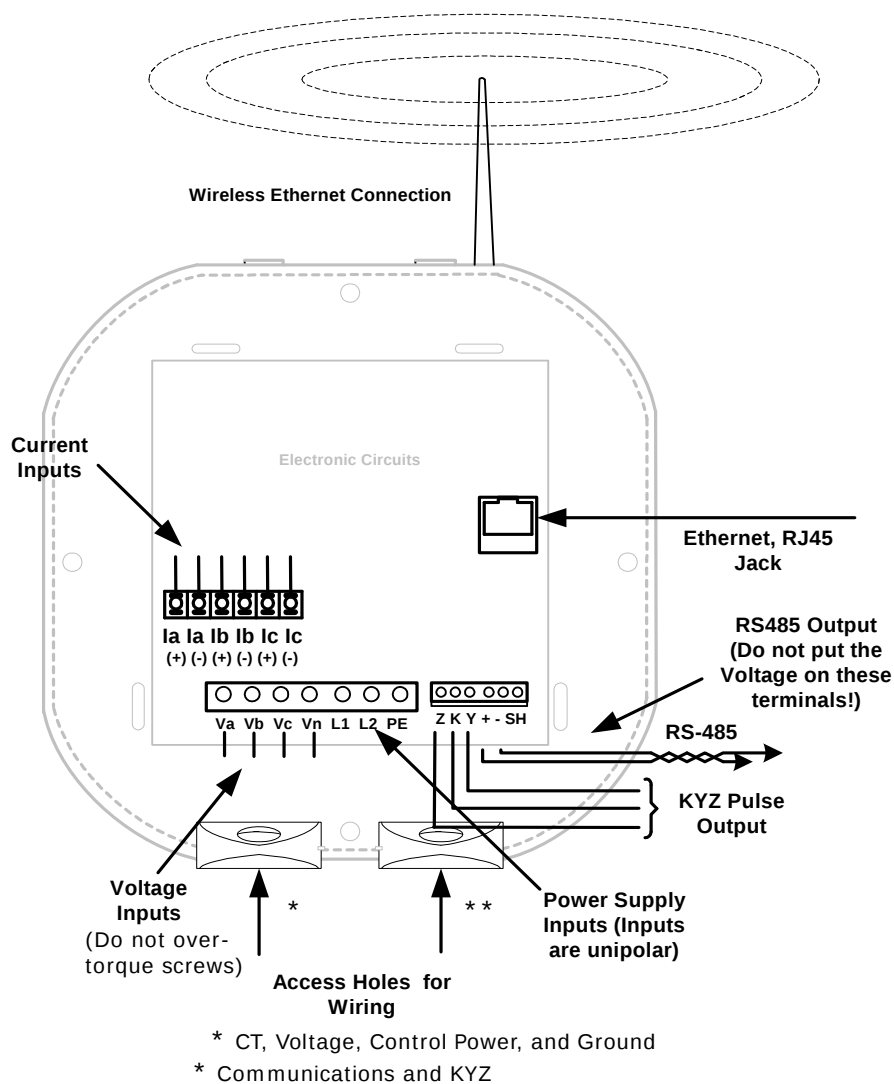


Figure 4.1: Submeter Connections

### 4.3: Ground Connections

The meter's Ground Terminal (PE) should be connected directly to the installation's protective earth ground.

### 4.4: 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.

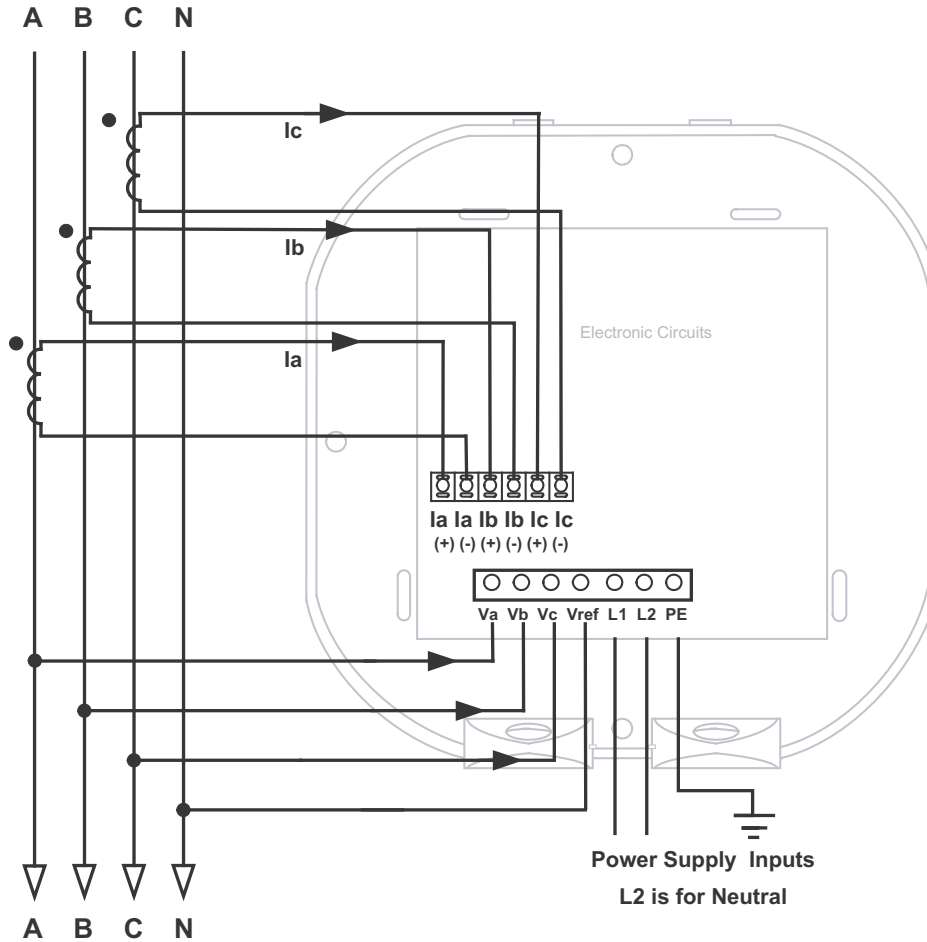
- Use a 0.1 Amp fuse on each Voltage input.
- Use a 3 Amp fuse on the power supply.

## 4.5: Electrical Connection Diagrams

Choose the diagram that best suits your application. Make sure the CT polarity is correct.

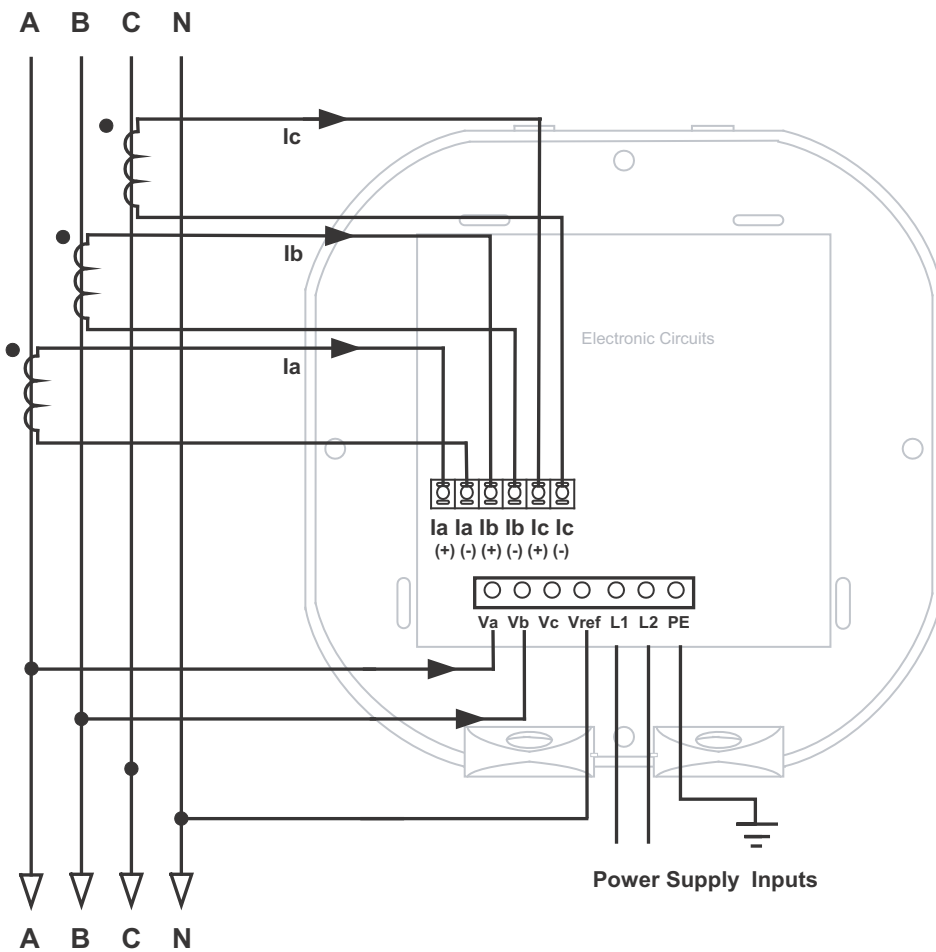
1. Three Phase, Four-Wire System Wye with Direct Voltage, 3 Element
  - a. Dual Phase Hookup
  - b. Single Phase Hookup
3. Three Phase, Four-Wire System Wye with Direct Voltage, 2.5 Element
4. Three-Phase, Four-Wire Wye with PTs, 3 Element
5. Three-Phase, Four-Wire Wye with PTs, 2.5 Element
6. Three-Phase, Three-Wire Delta with Direct Voltage (No PTs, 2 CTs)
7. Three-Phase, Three-Wire Delta with Direct Voltage (No PTs, 3 CTs)
8. Three-Phase, Three-Wire Delta with 2 PTs, 2 CTs
9. Three-Phase, Three-Wire Delta with 2 PTs, 3 CTs
10. Current Only Measurement (Three Phase)
11. Current Only Measurement (Dual Phase)
12. Current Only Measurement (Single Phase)

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

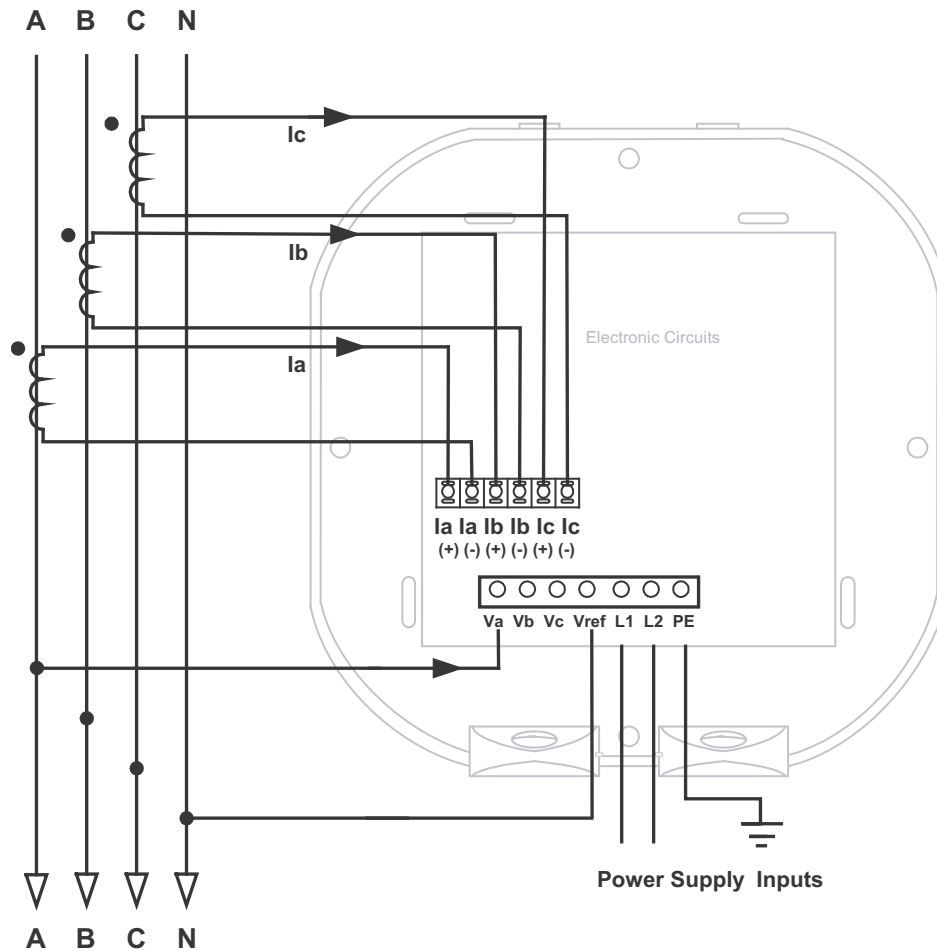


Select: "3 EL WYE" (3 Element Wye) in Meter Programming setup.

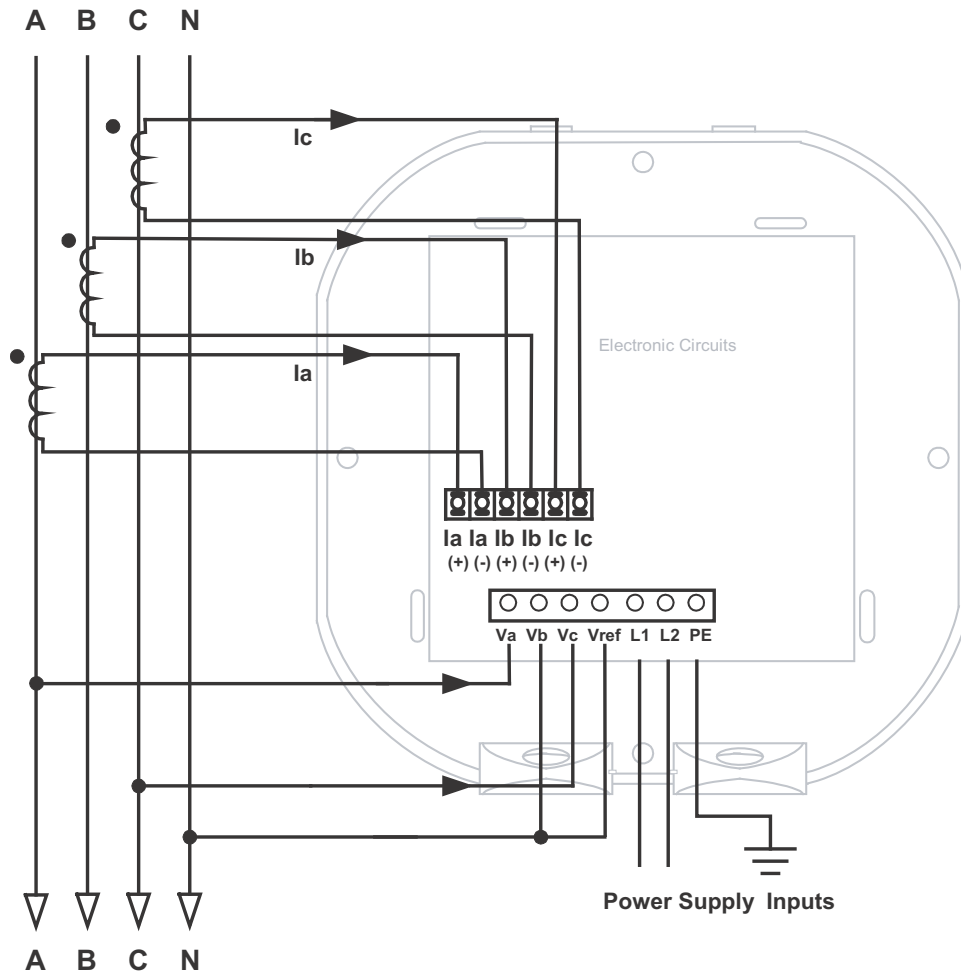
**1a. Dual Phase Hookup**



**1b. Single Phase Hookup**

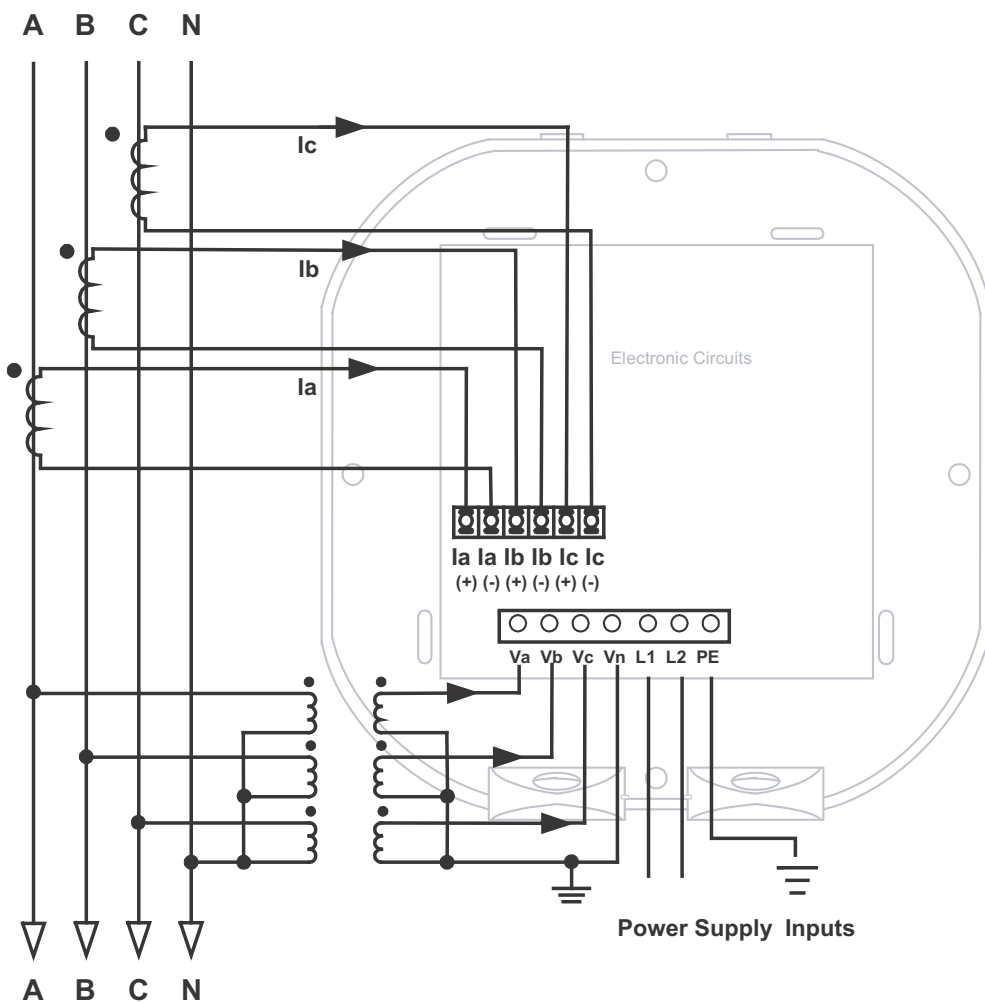


**2. Service: 2.5 Element WYE, 4-Wire with No PTs, 3 CTs**



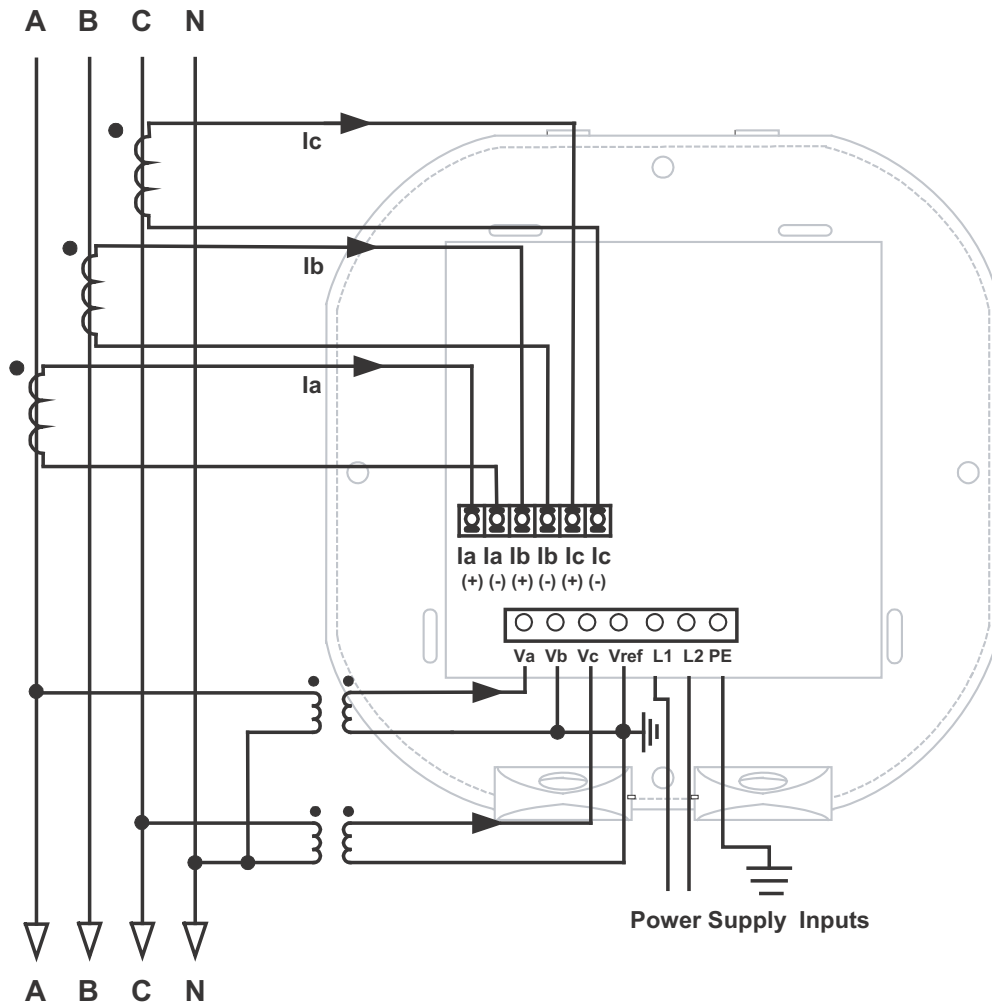
Select: "2.5 EL WYE" (2.5 Element Wye) in Meter Programming setup.

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



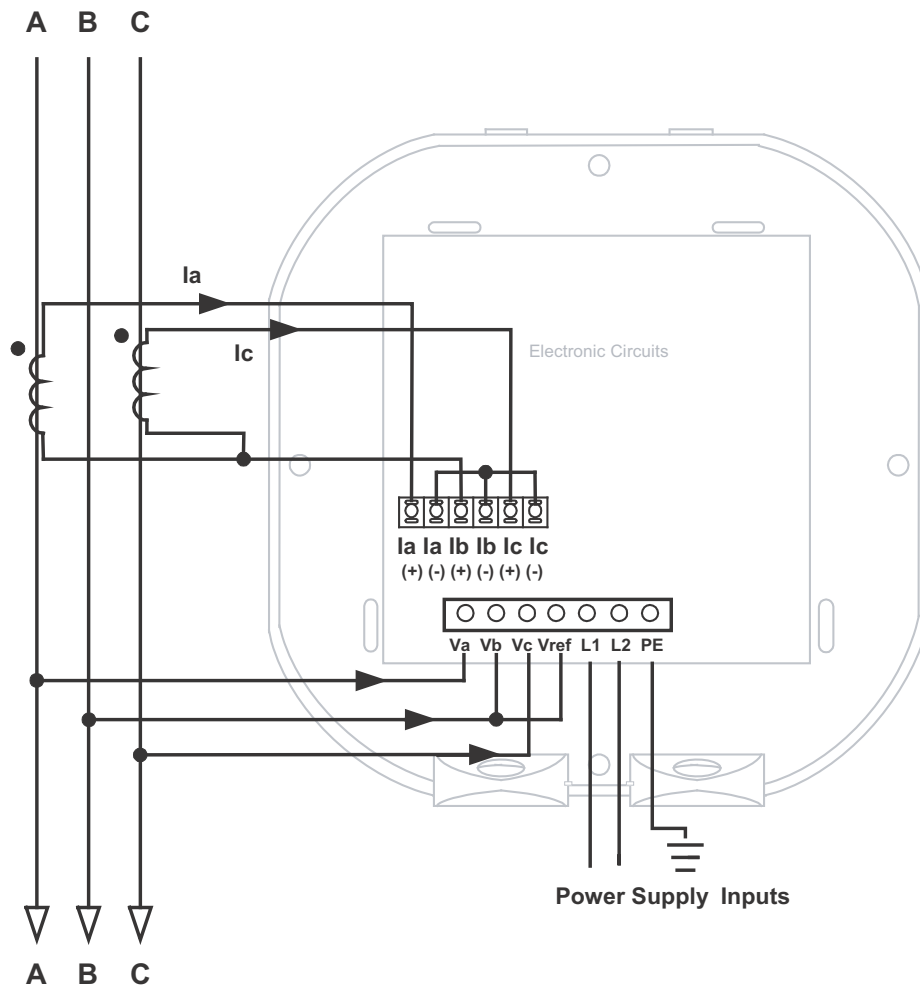
Select: "3 EL WYE" (3 Element Wye) in Meter Programming setup.

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



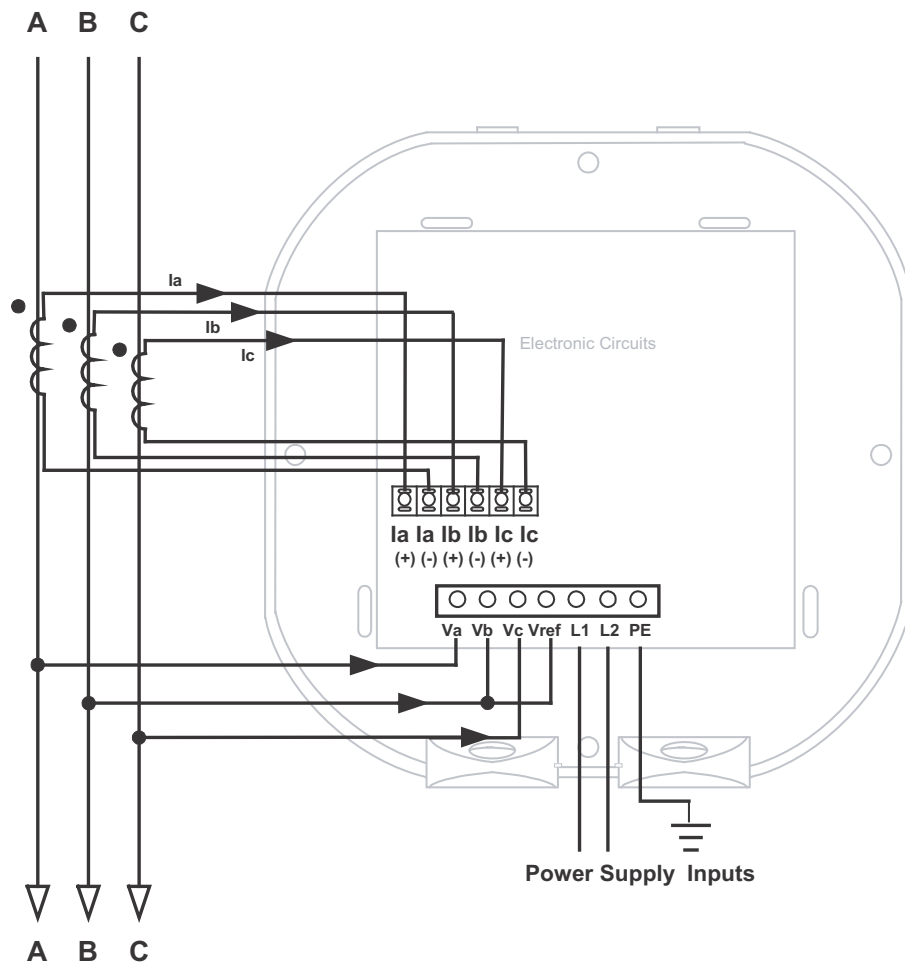
Select: "2.5 EL WYE" (2.5 Element Wye) in Meter Programming setup.

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



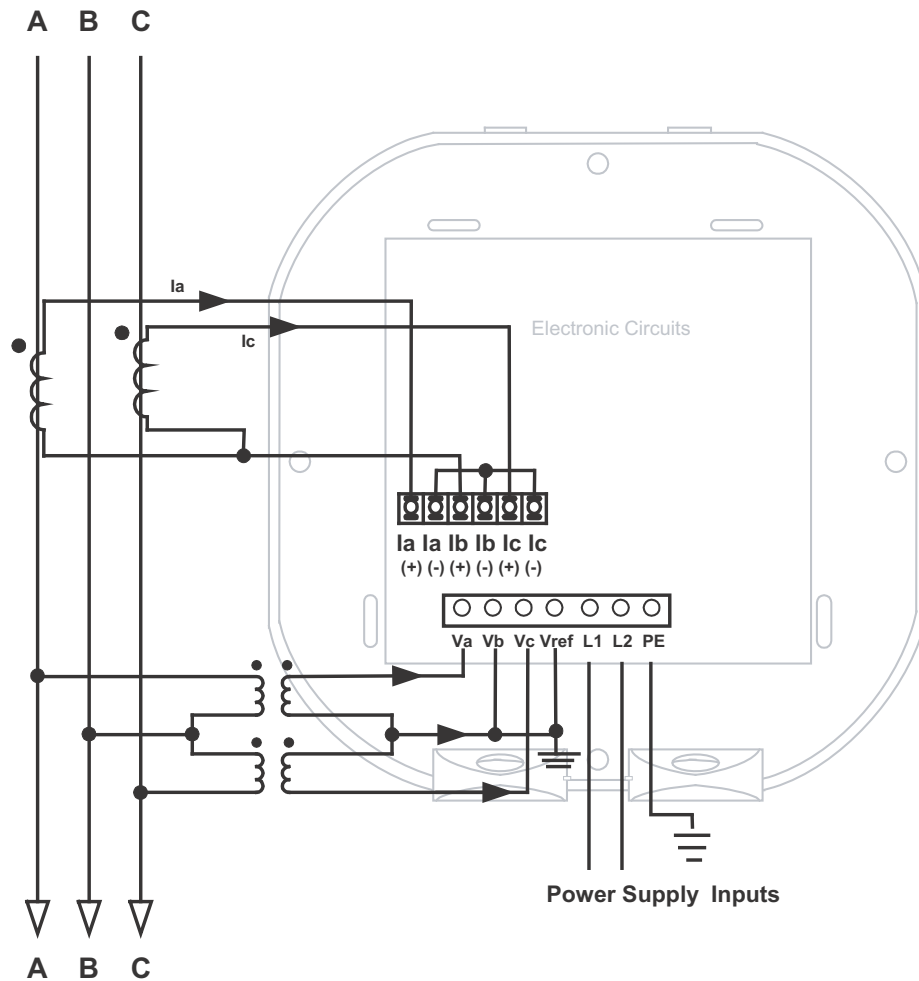
Select: "2 Ct dEL" (2 CT Delta) in Meter Programming setup.

**6. Service: Delta, 3-Wire with No PTs, 3 CTs**



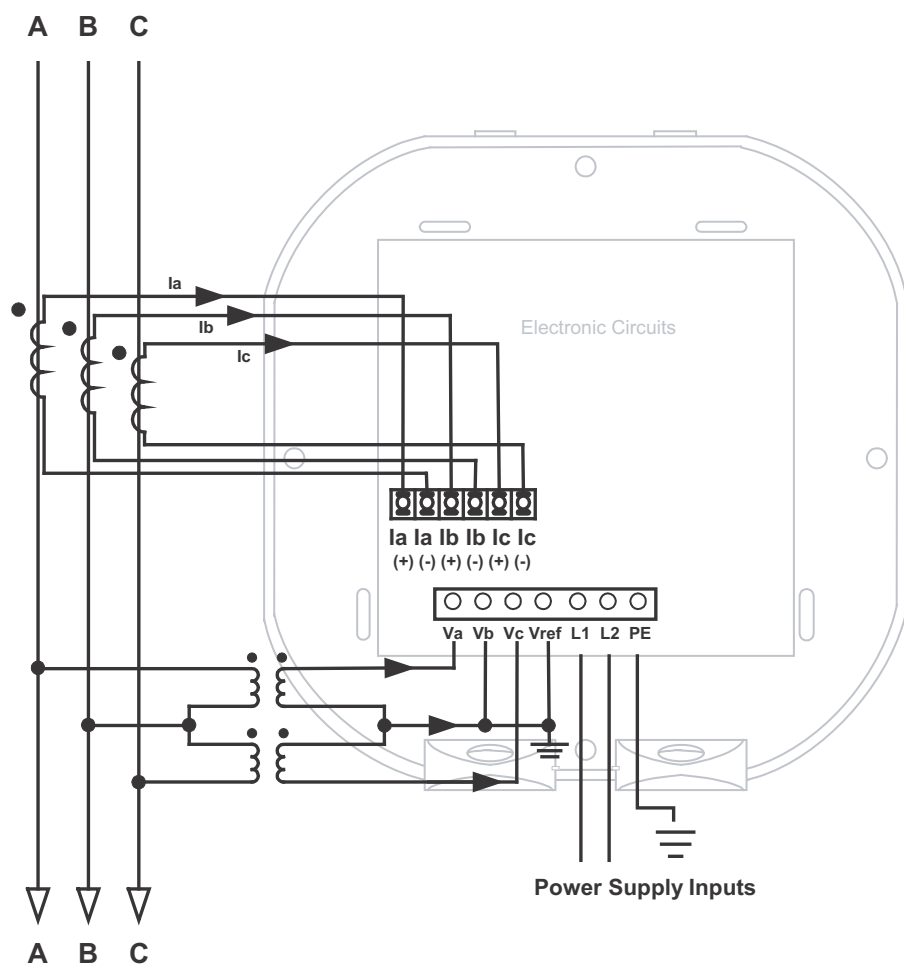
Select: "2 Ct dEL" (2 CT Delta) in Meter Programming setup.

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



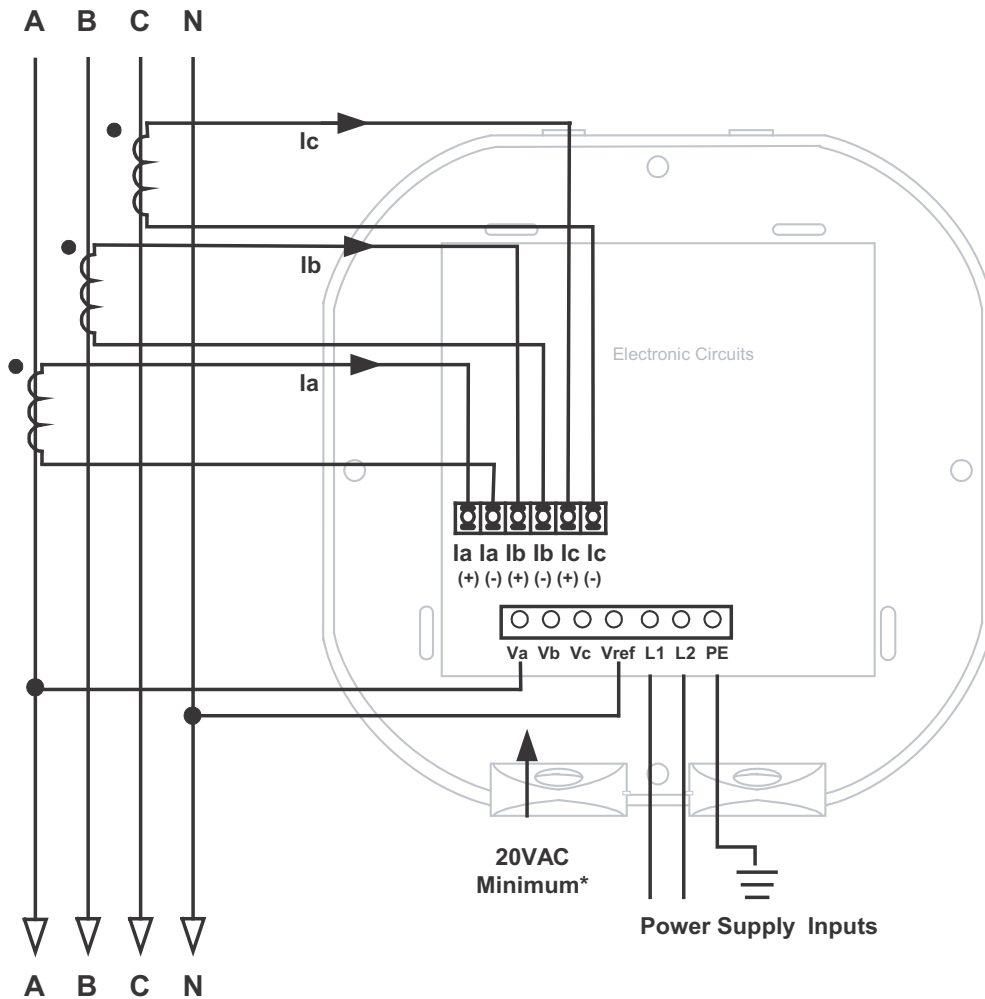
Select: "2 Ct dEL" (2 CT Delta) in Meter Programming setup.

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



Select: "2 Ct dEL" (2 CT Delta) in Meter Programming setup.

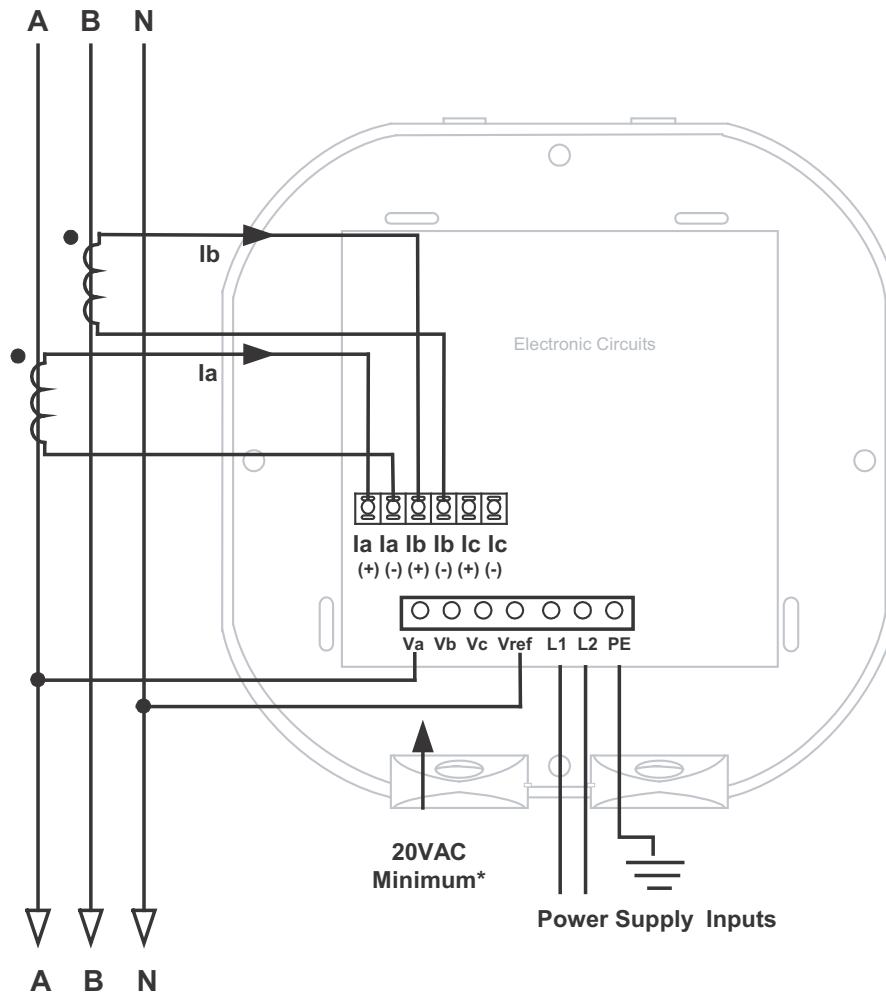
### 9. Service: Current Only Measurement (Three Phase)



Select: "3 EL WYE" (3 Element Wye) in Meter Programming setup.

**NOTE:** Even if the meter is used for only Amp readings, the unit requires a Volts AN reference. Please make sure that the Voltage input is attached to the meter. AC Control Power can be used to provide the reference signal.

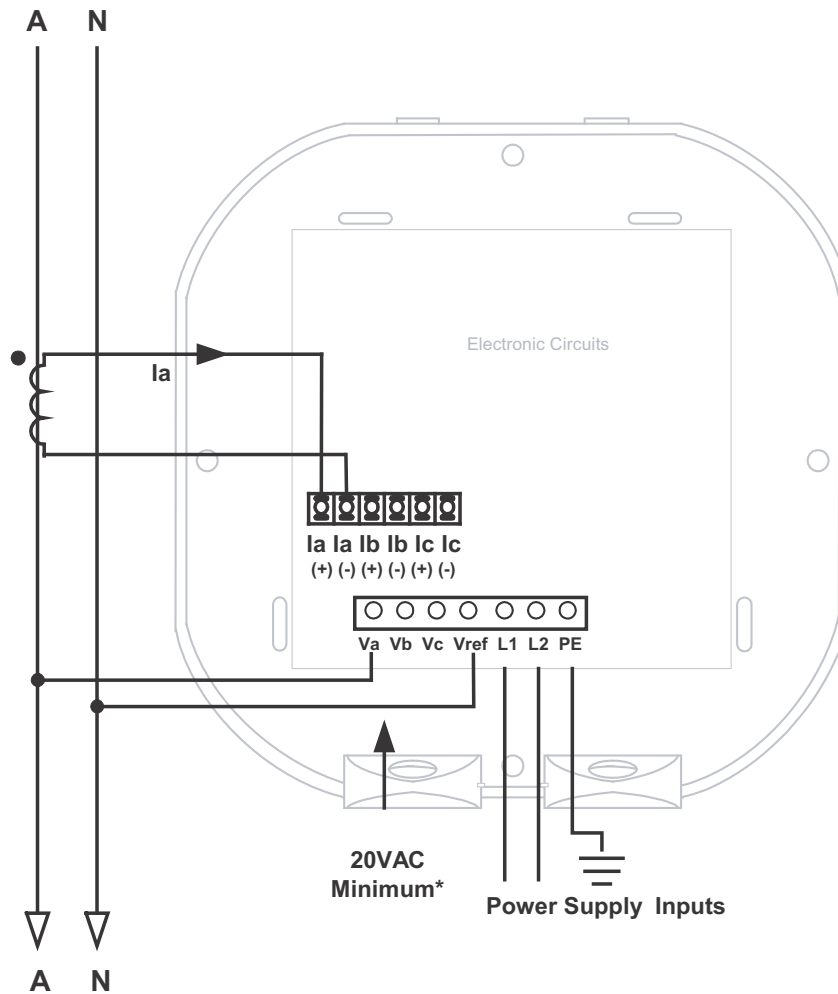
### 10. Service: Current Only Measurement (Dual Phase)



Select: "3 EL WYE" (3 Element Wye) in Meter Programming setup.

**NOTE:** Even if the meter is used for only Amp readings, the unit requires a Volts AN reference. Please make sure that the Voltage input is attached to the meter. AC Control Power can be used to provide the reference signal.

### 11. Service: Current Only Measurement (Single Phase)



Select: "3 EL WYE" (3 Element Wye) in Meter Programming setup.

**NOTE:** Even if the meter is used for only Amp readings, the unit requires a Volts AN reference. Please make sure that the Voltage input is attached to the meter. AC Control Power can be used to provide the reference signal.

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## 5: Communication Installation

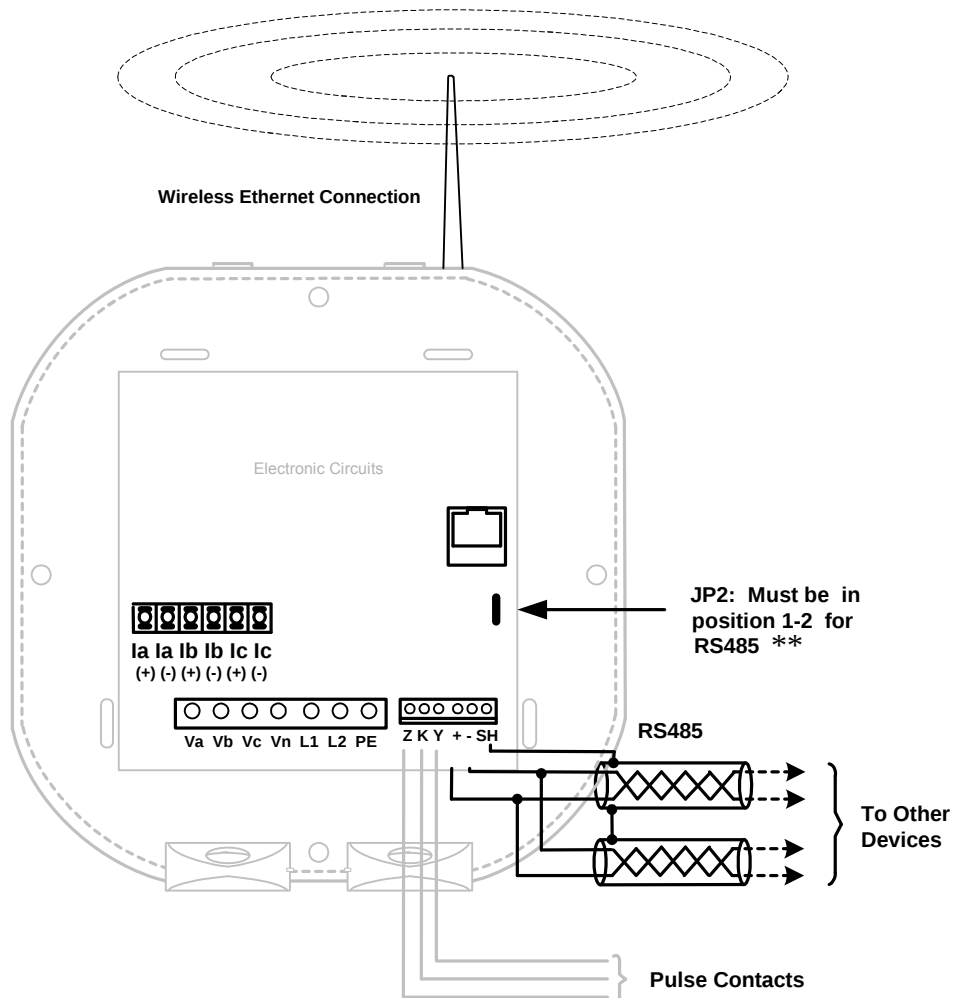
### 5.1: IQ 150S/250S Communication

The IQ 150S/250S submeter provides a communication port plus a KYZ pulse output. The communication port, Com 2, provides RS485 or RJ45 Ethernet or WiFi Ethernet communication (see Chapter 6 for Ethernet communication).

#### 5.1.1: RS485 Communication Com 2 (485 Option)

The IQ 150S/250S submeter's RS485 port uses standard 2-Wire, half duplex architecture. The RS485 connector is located on the front of the meter, under the cover. A connection can easily be made to a Master device or to other slave devices, as shown below.

**NOTE:** Care should be taken to connect + to + and - to - connections.



The IQ150S/250S submeter's RS485 connection can be programmed with the buttons on the face of the meter or by using Eaton Meter Configuration software.

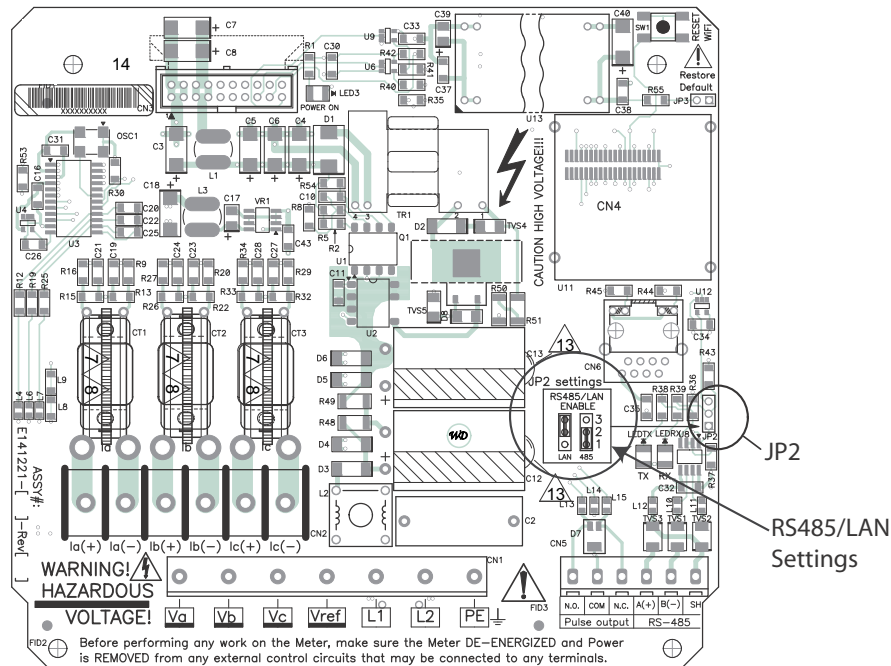
### Standard RS485 Port Settings

Address: 001 to 247

Baud Rate: 9600, 19200, 38400 or 57600 Baud

Protocol: Modbus RTU, Modbus ASCII, or DNP 3.0

\*\* The position of Jumper 2 (JP2) must be set for either RS485 or Ethernet communication. See the figure below. You put the jumper on positions 2 and 3 for LAN (Ethernet) communication, and on 1 and 2 for RS485 communication.

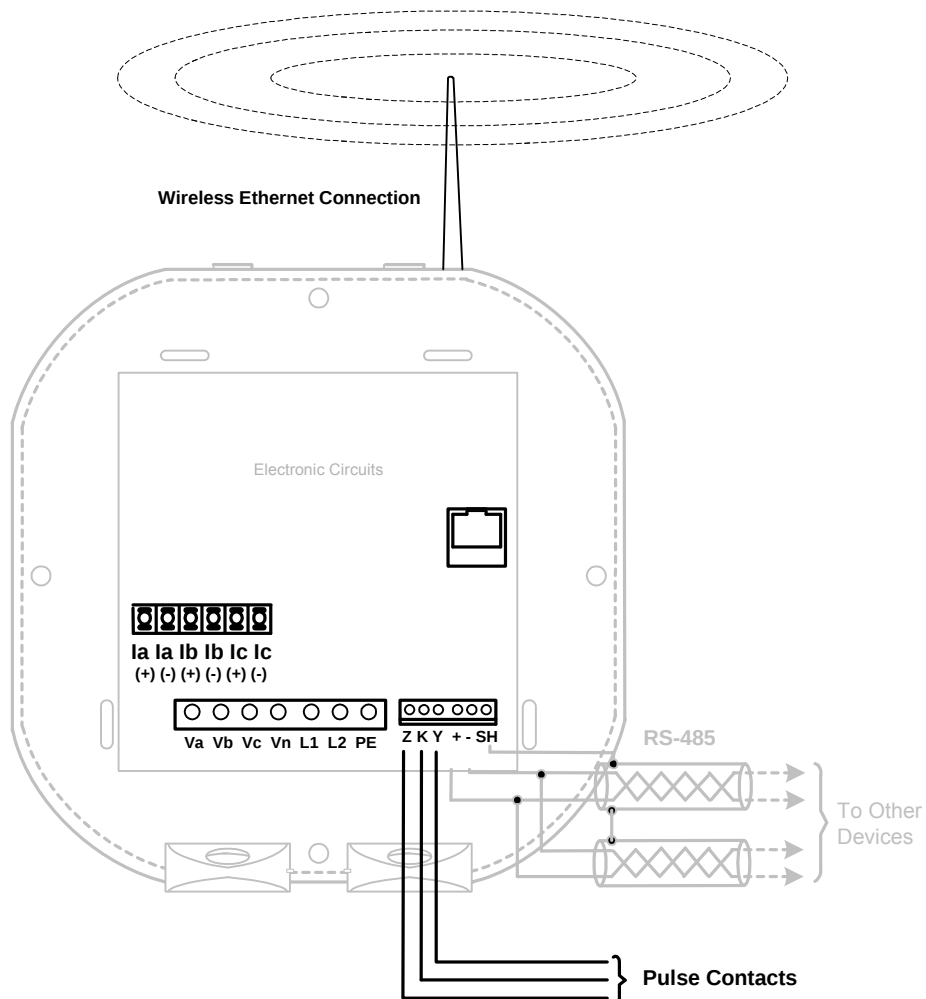


### 5.1.2: KYZ Output

The KYZ pulse output provides pulsing energy values that verify the submeter's readings and accuracy.

The KYZ Pulse Output is located on the face of the meter, under the cover and just below the RS485 connection.

See Section 2.2 for the KYZ output specifications; see Section 7.4 for pulse constants.

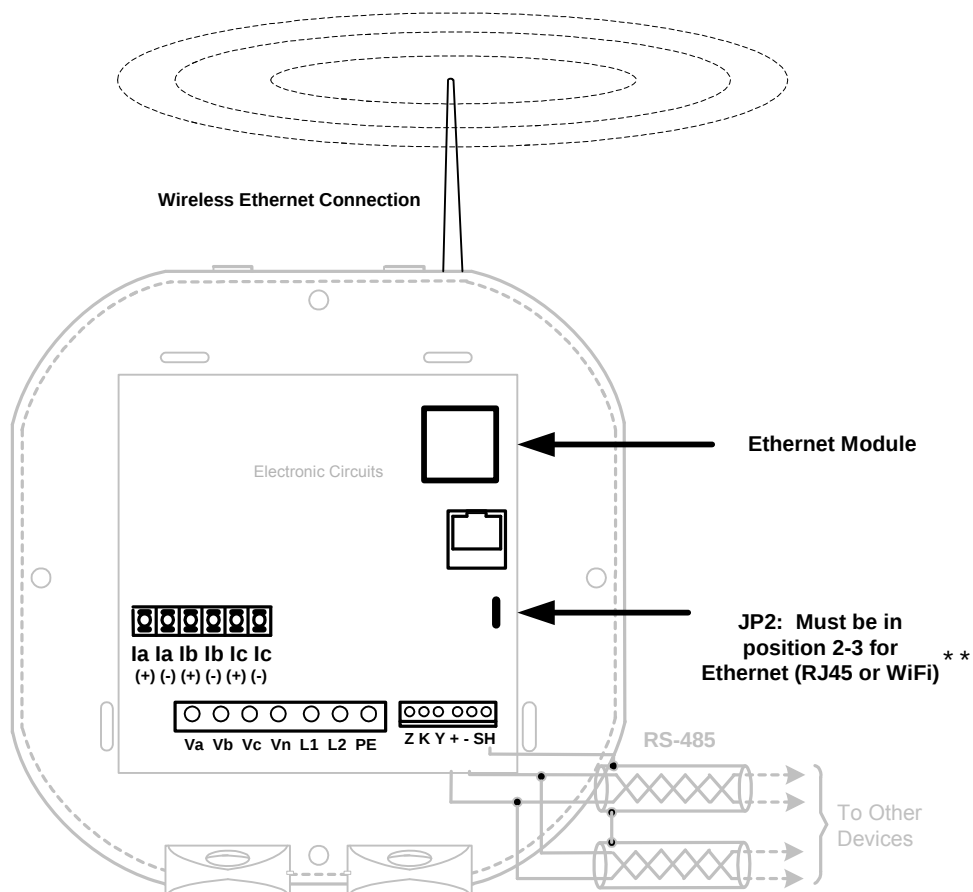


### 5.1.3: Ethernet Connection

In order to use the IQ 150S/250S submeter's Ethernet capability, the Ethernet Module must be installed in your meter, and the JP2 must be set to positions 2-3. You can use either wired Ethernet, or WiFi.

For wired Ethernet, use Standard RJ45 10/100BaseT cable to connect to the IQ 150S/250S submeter. The RJ45 line is inserted into the RJ45 port of the meter.

For WiFi connections, make sure you have the correct antenna attached to the meter.



Refer to Chapter 6 for instructions on how to set up the Network Module.

\*\* See the JP2 figure and instructions on page 5-2.

## 5.2: Meter Communication and Programming Overview

Programming and communication can utilize the RS485 connection shown in Section 5.1.1 or the RJ45/WiFi connection shown in Section 5.1.3. Once a connection is established, Eaton Meter Configuration software can be used to program the meter and communicate to other devices.

### Meter Connection

To provide power to the meter, use one of the wiring diagrams in Chapter 4 or attach an Aux cable to GND, L(+) and N(-).

The RS485 cable attaches to SH, - and + as shown in Section 5.1.1.

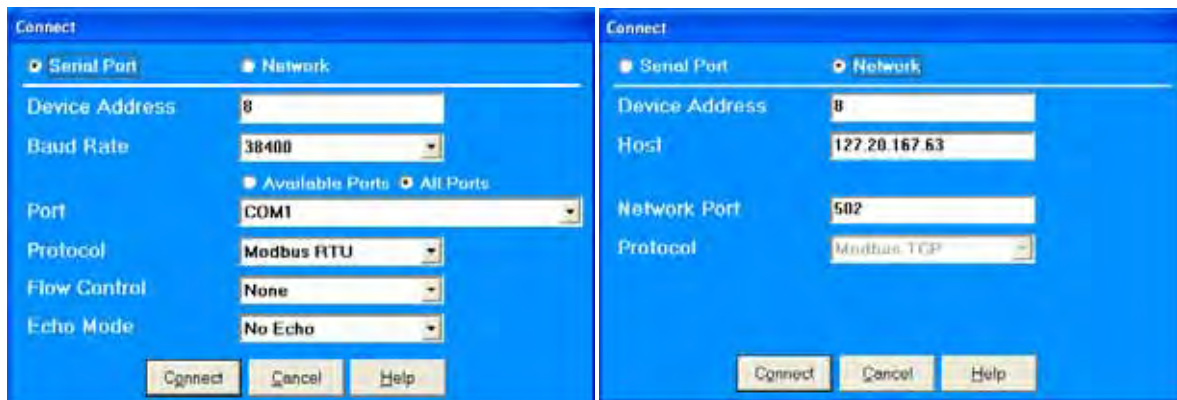
### 5.2.1: How to Connect to the Submeter

1. Open Eaton Meter Configuration software.
2. Click the **Connect** icon on the Icon bar.



The Connect screen opens, showing the Initial settings. Make sure your settings are the same as those shown here, except for the IP Address field, which must be your device's IP address. The address shown here is the default Ethernet option address.

**NOTE:** The settings you make will depend on whether you are connecting to the meter via Serial Port (screen on the left) or Network (screen on the right). Use the pull-down menus to make any necessary changes.



3. Click the **Connect** button on the screen.

**NOTE:** You may have to disconnect power, reconnect power and then click **Connect**.

The Device Status screen appears, confirming a connection.

4. Click **OK**.

5. The Eaton Meter Configuration software Main screen appears. Click the **Profile** icon in the Title Bar.

6. You will see the IQ 150S/250S meter's Device Profile screen.

**NOTE:** The following screens are for the IQ 150S. If you are connected to an IQ 250S, see Section 5.2.3.

The tabs at the top of the screen allow you to navigate between settings screens (see below).

The screenshot shows the 'IQ 100 Profile' window with the 'Scaling' tab selected. The window has a blue background and a title bar with a close button. The tabs at the top are 'Scaling', 'Energy And Display', 'Communication', and 'Settings'. The main content area is titled 'CT, PT Ratios and System Wiring'. It contains several input fields and buttons:

- CT Numerator (Primary): 5
- CT Denominator (Secondary): 5
- CT Multiplier: 1 (dropdown)
- CT Fullscale: 5.000 amps
- PT Numerator (Primary): 600
- PT Denominator (Secondary): 600
- PT Multiplier: 1 (dropdown)
- PT Fullscale: 600.0 volts
- System Wiring: 3 element wye (dropdown)
- ABC (dropdown)

There are 'Recalculate' buttons next to the 'CT Fullscale' and 'PT Fullscale' fields. At the bottom of the window, there are buttons for 'Update', 'Cancel', 'Load', 'Save', 'Report', and 'Help'.

7. Click the **Communications** tab. You will see the following screen. Use this screen to enter communication settings for the meter's RS485 port (COM 2) Make any necessary changes to settings.

The screenshot shows a software window titled "IQ 100 Profile" with a blue background. It has four tabs: "Scaling", "Energy And Display", "Communication" (which is selected), and "Settings". Under the "Communication" tab, the text "COM2 (RS485)" is displayed. Below this, there are four settings, each with a label and a corresponding input field or dropdown menu:

- Address:** A text box containing the number "2".
- Protocol:** A dropdown menu showing "Modbus RTU".
- Baud Rate:** A dropdown menu showing "57600".
- Response Delay (msec):** A dropdown menu showing "0".

At the bottom of the window, there are six buttons: "Update", "Cancel", "Load", "Save", "Report", and "Help".

8. Valid Communication Settings are as follows:

|                |                                   |
|----------------|-----------------------------------|
| COM2           | (RS485)                           |
| Address        | (1-247)                           |
| Protocol       | (Modbus RTU, Modbus ASCII or DNP) |
| Baud Rate      | (9600 to 57600)                   |
| Response Delay | (0-750 msec)                      |

9. When changes are complete, click the **Update** button to send the new profile to the meter.

10. Click **Exit** to leave the Device Profile or click other menu items to change other aspects of the Device Profile (see following section for instructions).

### 5.2.2: IQ 150S Submeter Device Profile Settings

**NOTE:** You can view this manual online by clicking **Help>Contents** from the Eaton Meter Configuration Software's Main screen.

#### CT, PT Ratios and System Wiring (Scaling tab)

The screenshot shows the 'IQ 100 Profile' window with the 'Scaling' tab selected. The title bar reads 'IQ 100 Profile' and the tab bar includes 'Scaling', 'Energy And Display', 'Communication', and 'Settings'. The main area is titled 'CT, PT Ratios and System Wiring'. It contains the following fields and controls:

- CT Numerator (Primary): Text box with value '5'
- CT Denominator (Secondary): Text box with value '5'
- CT Multiplier: Dropdown menu with value '1'
- CT Fullscale: Text box with value '5.000 amps' and a 'Recalculate' button to its right.
- PT Numerator (Primary): Text box with value '600'
- PT Denominator (Secondary): Text box with value '600'
- PT Multiplier: Dropdown menu with value '1'
- PT Fullscale: Text box with value '600.0 volts' and a 'Recalculate' button to its right.
- System Wiring: Two dropdown menus, the first with value '3 element wye' and the second with value 'ABC'.

At the bottom of the window are six buttons: 'Update', 'Cancel', 'Load', 'Save', 'Report', and 'Help'.

The screen fields and acceptable entries are as follows:

#### CT Ratios

CT Numerator (Primary): 1 - 9999

CT Denominator (Secondary): 5 or 1 Amp

**NOTE:** This field is display only.

CT Multiplier: 1, 10 or 100

Current Full Scale: Calculations based on selections. Click **Recalculate** to see the result of changes.

#### PT Ratios

PT Numerator (Primary): 1 - 9999

PT Denominator (Secondary): 40 - 600

PT Multiplier: 1, 10, 100, or 1000

Voltage Full Scale: Calculations based on selections. Click **Recalculate** to see the result of changes.

### System Wiring

3 Element Wye; 2.5 Element Wye; 2 CT Delta

### Phases Displayed

A, AB, or ABC

**NOTE:** Voltage Full Scale = PT Numerator x PT Multiplier

### Example:

A 14400/120 PT would be entered as:

PT Numerator:           1440

PT Denominator:       120

Multiplier:             10

This example would display a 14.40kV.

### Example CT Settings:

200/5 Amps: Set the Ct-n value for 200, Ct-Multiplier value for 1

800/5 Amps: Set the Ct-n value for 800, Ct-Multiplier value for 1

2,000/5 Amps: Set the Ct-n value for 2000, Ct-Multiplier value for 1

10,000/5 Amps: Set the Ct-n value for 1000, Ct-Multiplier value for 10

### Example PT Settings:

277/277 Volts: Pt-n value is 277, Pt-d value is 277, Pt-Multiplier is 1

14,400/120 Volts: Pt-n value is 1440, Pt-d value is 120, Pt-Multiplier value is 10

138,000/69 Volts: Pt-n value is 1380, Pt-d value is 69, Pt-Multiplier value is 100

345,000/115 Volts: Pt-n value is 3450, Pt-d value is 115, Pt-Multiplier value is 100

345,000/69 Volts: Pt-n value is 345, Pt-d value is 69, Pt-Multiplier value is 1000

**NOTE:** Settings are the same for Wye and Delta configurations.

### Energy and Display

The settings on this screen determine the display configuration of the meter's faceplate.

**IQ 100 Profile**

Scaling | **Energy And Display** | Communication | Settings

**Power and Energy Format**

Power Scale: auto

Energy Digits: 8

Energy Decimal Places: 1

Energy Scale: kilo (k)

Example: 1234567.8k **Recalculate**

Power Direction: view as load

**Demand Averaging**

Averaging Method: Fixed

Interval(Minutes): 15

Sub Interval: 1

Auto Scroll Display: ☒ On

**Display Configuration**

|                                               |                                           |
|-----------------------------------------------|-------------------------------------------|
| <input checked="" type="checkbox"/> Volts L-L | <input checked="" type="checkbox"/> VA/Hz |
| <input checked="" type="checkbox"/> Volts L-N | <input checked="" type="checkbox"/> Wh    |
| <input checked="" type="checkbox"/> Amps      | <input checked="" type="checkbox"/> VARh  |
| <input checked="" type="checkbox"/> W/VAR/PF  | <input checked="" type="checkbox"/> VAh   |

Update Cancel Load Save Report Help

The screen fields and acceptable entries are as follows:

#### Power and Energy Format

Power Scale: Unit, kilo (k), Mega (M), or auto.

Energy Digits: 5, 6, 7, or 8

Energy Decimal Places: 0-6

Energy Scale: Unit, kilo (k), or Mega (M)

For Example: a reading for Digits: 8; Decimals: 3; Scale: k would be formatted:

00123.456k

Power Direction: View as Load or View as Generator

**Demand Averaging**

Averaging Method: Block or Rolling

Interval (Minutes): 5, 15, 30, or 60

Sub Interval (if Rolling is selected): 1-4

**Auto Scroll**

Click to set On or Off.

**Display Configuration:**

Click Values to be displayed.

**NOTE:** You MUST select at least ONE.

**NOTE:** If incorrect values are entered on this screen the following message appears:WARNING:  
Current, CT, PT and Energy Settings will cause invalid energy accumulator values.  
Change the settings until the message disappears.

## Settings

IQ 100 Profile

Scaling | Energy And Display | Communication | Settings

**Password**

Enable password for reset ☐ Off

Enable password for configuration ☐ Off

Change Password

Device Designation

The screen fields are as follows:

### Password

**NOTE:** The meter is shipped with Password Disabled. There is NO DEFAULT PASSWORD.

Enable Password for Reset: click to Enable.

Enable Password for Configuration: click to Enable.

Change Password: click to Change.

Device Designation: optional user-assigned label.

### 5.2.3: IQ 250S Submeter Device Profile Settings

1. When you are connected to an IQ 250S meter and click **Profile**, you see the following screen.

IQ250 S : IQ250\_unit11S[Serial Number: 0020059117]

File Tools View User Manual

General Settings

- CT, PT Ratios and System Hookup
- Time Settings
- System Settings
- Communications
- Display Configuration
- Revenue & Energy Settings

CT, PT Ratios and System Hookup

CT Numerator (Primary) 2000 < Update CT 400 Ratio

CT Denominator (Secondary) 5 Update Ratio > 1

CT Multiplier 1

Current Full Scale 2000.00

PT Numerator (Primary) 1440 < Update PT 120 Ratio

PT Denominator (Secondary) 120 Update Ratio > 1

PT Multiplier 10

Voltage Full Scale 14.40k

System Wiring 3 Element Wye

Note: To configure the CT & PT settings, either enter the Numerator, Denominator and Multiplier or enter the Denominator followed by the Ratio for the CT or PT and click the update button to have the software fill in the Numerator, Denominator and Multiplier.

Update Device Save Profile Load Profile View Report Exit

The IQ 250S meter's Profile screen features a Tree Menu on the left for Settings navigation, and Buttons and a Title Bar that allow you to perform tasks, for example, updating the Device Profile.

#### Selecting Settings

- The Tree Menu on the left side of the screen allows you to navigate between Settings. The example screen pictured above shows the Tree Menu you see when you first open the screen. Click on the + next to a Setting (for example, Revenue & Energy Settings) to see additional Setting options.
- From the Tree Menu, click on the Setting you want to configure (for example, System Settings) to display its screen in the right side of the Device Profile screen.

## Performing Tasks

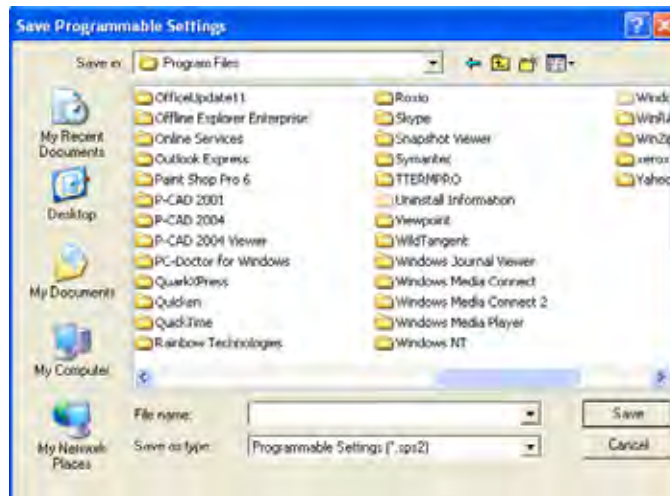
You can perform tasks from either the Device Profile screen Buttons or from the Title Bar.

The screen Buttons and their functions are as follows:

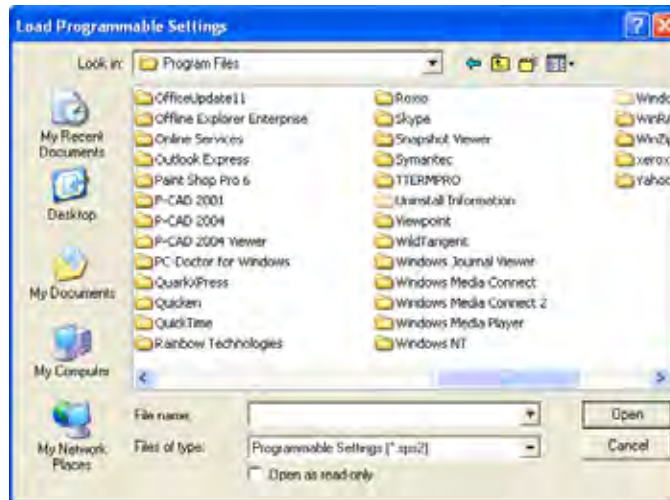
- Update Device: Click to send the current settings to the meter.

**NOTE:** You must click the Update Device button after making changes to the Settings screens, if you want to update the connected meter's settings.

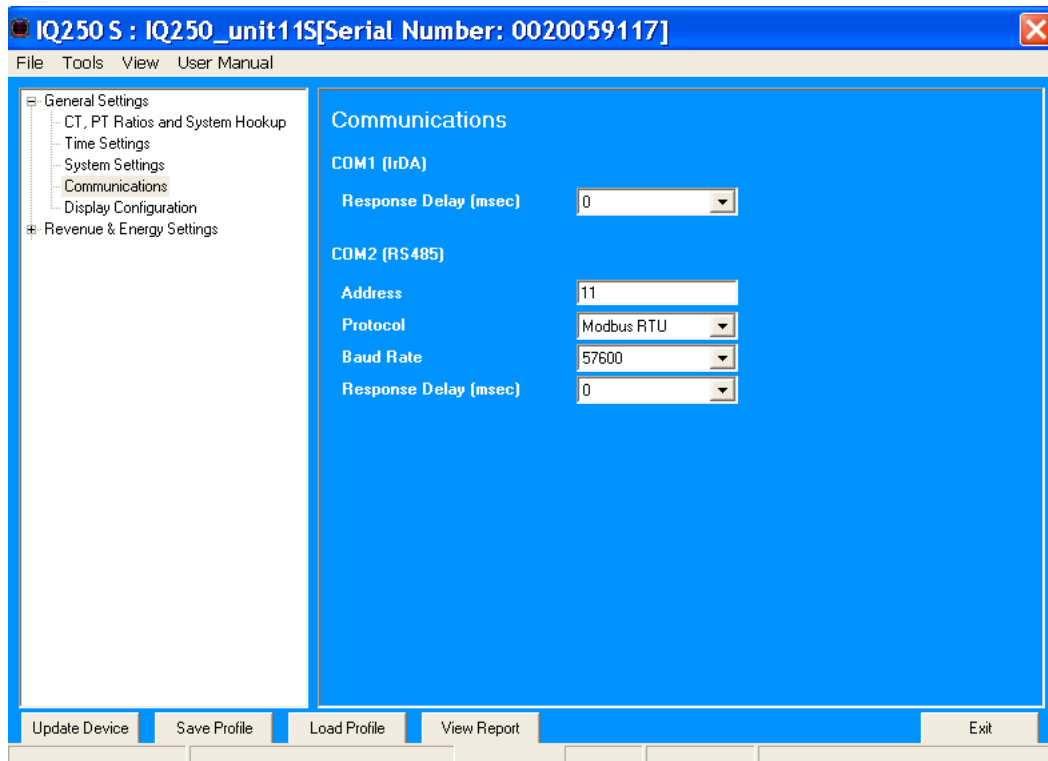
- Save Profile: Click to save the Device Profile settings to a file. You will see the Save Programmable Settings window, shown below. Give a name to the Device Profile and click Save.



- **Load Profile:** Click to load a previously saved Device Profile Settings file. You will see the Load Programmable Settings window, shown below. Select the saved Device Profile you want and click Open. The settings from that file will now appear in the Settings screens; for example, the CT and PT Ratios will be those from the saved Device Profile, rather than from the currently connected meter.



- **View Report:** Click to open a Notepad window containing the Device Profile settings in a text file.
    - Print the text file by selecting File>Print from the Notepad Title Bar.
    - Save the text file by selecting File>Save from the Notepad Title Bar.
  - **Exit:** Click to leave the Device Profile Editor.
2. Click the **Communications** tab. You will see the following screen. Use this screen to enter communication settings for the meter's RS485 port (COM 2) Make any necessary changes to settings.



3. Valid Communication Settings are as follows:

|                |                                   |
|----------------|-----------------------------------|
| COM2           | (RS485)                           |
| Address        | (1-247)                           |
| Protocol       | (Modbus RTU, Modbus ASCII or DNP) |
| Baud Rate      | (9600 to 57600)                   |
| Response Delay | (0-750 msec)                      |

4. When changes are complete, click the **Update Device** button to send the new profile to the meter.

5. Click **Exit** to leave the Device Profile or click other menu items to change other aspects of the Device Profile (see following section for instructions).

## Additional Settings for the IQ250S

### CT, PT Ratios and System Hookup

**IQ250 S : IQ250\_unit11S[Serial Number: 0020059117]**

File Tools View User Manual

General Settings  
 CT, PT Ratios and System Hookup  
 Time Settings  
 System Settings  
 Communications  
 Display Configuration  
 Revenue & Energy Settings

### CT, PT Ratios and System Hookup

| CT                         |         | Ratio            |
|----------------------------|---------|------------------|
| CT Numerator (Primary)     | 2000    | < Update CT 400  |
| CT Denominator (Secondary) | 5       | Update Ratio > 1 |
| CT Multiplier              | 1       |                  |
| Current Full Scale         | 2000.00 |                  |

| PT                         |        | Ratio            |
|----------------------------|--------|------------------|
| PT Numerator (Primary)     | 1440   | < Update PT 120  |
| PT Denominator (Secondary) | 120    | Update Ratio > 1 |
| PT Multiplier              | 10     |                  |
| Voltage Full Scale         | 14.40k |                  |

System Wiring: 3 Element Wye

**Note:** To configure the CT & PT settings, either enter the Numerator, Denominator and Multiplier or enter the Denominator followed by the Ratio for the CT or PT and click the update button to have the software fill in the Numerator, Denominator and Multiplier.

Update Device Save Profile Load Profile View Report Exit

The screen fields and acceptable entries are as follows:

#### CT Ratios

CT Numerator (Primary): 1 - 9999

CT Denominator (Secondary): 5 or 1 Amp

**NOTE:** This field is display only.

CT Multiplier: 1, 10 or 100

Current Full Scale: Calculations based on selections. Click **Recalculate** to see the result of changes.

#### PT Ratios

PT Numerator (Primary): 1 - 9999

PT Denominator (Secondary): 40 - 600

PT Multiplier: 1, 10, 100, or 1000

Voltage Full Scale: Calculations based on selections. Click **Recalculate** to see the result of changes.

### System Wiring

3 Element Wye; 2.5 Element Wye; 2 CT Delta

### Phases Displayed

A, AB, or ABC

**NOTE:** Voltage Full Scale = PT Numerator x PT Multiplier

### Example:

A 14400/120 PT would be entered as:

PT Numerator:           1440

PT Denominator:       120

Multiplier:             10

This example would display a 14.40kV.

### Example CT Settings:

200/5 Amps: Set the Ct-n value for 200, Ct-Multiplier value for 1

800/5 Amps: Set the Ct-n value for 800, Ct-Multiplier value for 1

2,000/5 Amps: Set the Ct-n value for 2000, Ct-Multiplier value for 1

10,000/5 Amps: Set the Ct-n value for 1000, Ct-Multiplier value for 10

### Example PT Settings:

277/277 Volts: Pt-n value is 277, Pt-d value is 277, Pt-Multiplier is 1

14,400/120 Volts: Pt-n value is 1440, Pt-d value is 120, Pt-Multiplier value is 10

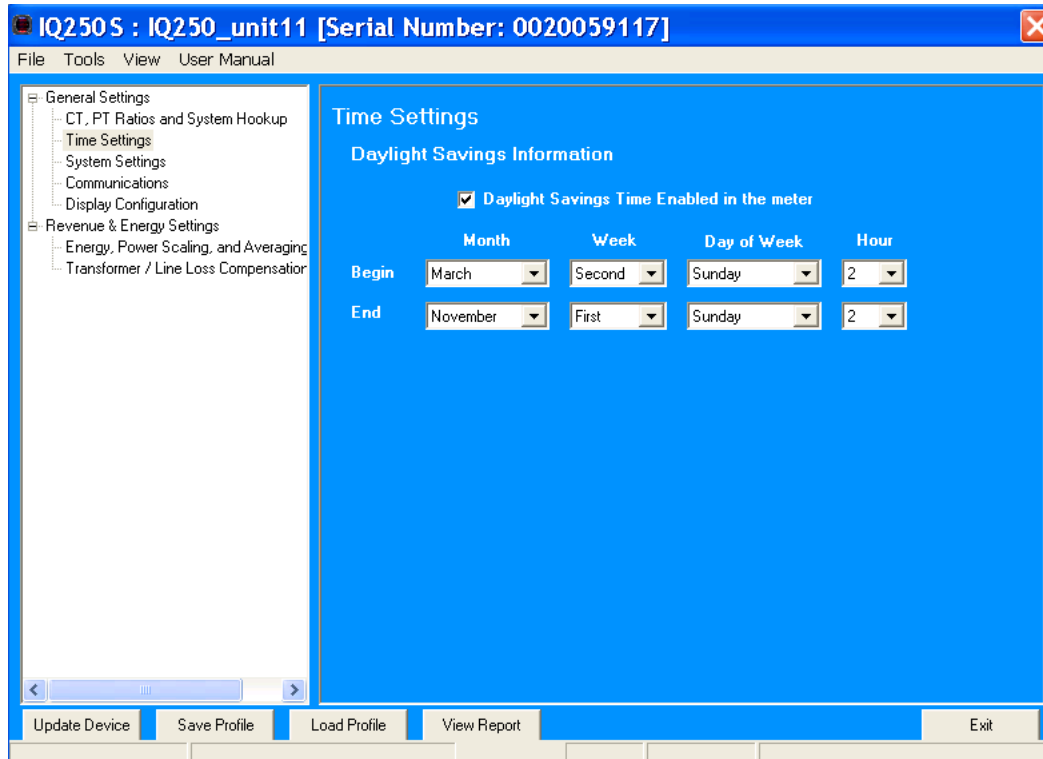
138,000/69 Volts: Pt-n value is 1380, Pt-d value is 69, Pt-Multiplier value is 100

345,000/115 Volts: Pt-n value is 3450, Pt-d value is 115, Pt-Multiplier value is 100

345,000/69 Volts: Pt-n value is 345, Pt-d value is 69, Pt-Multiplier value is 1000

**NOTE:** Settings are the same for Wye and Delta configurations.

### Time Settings

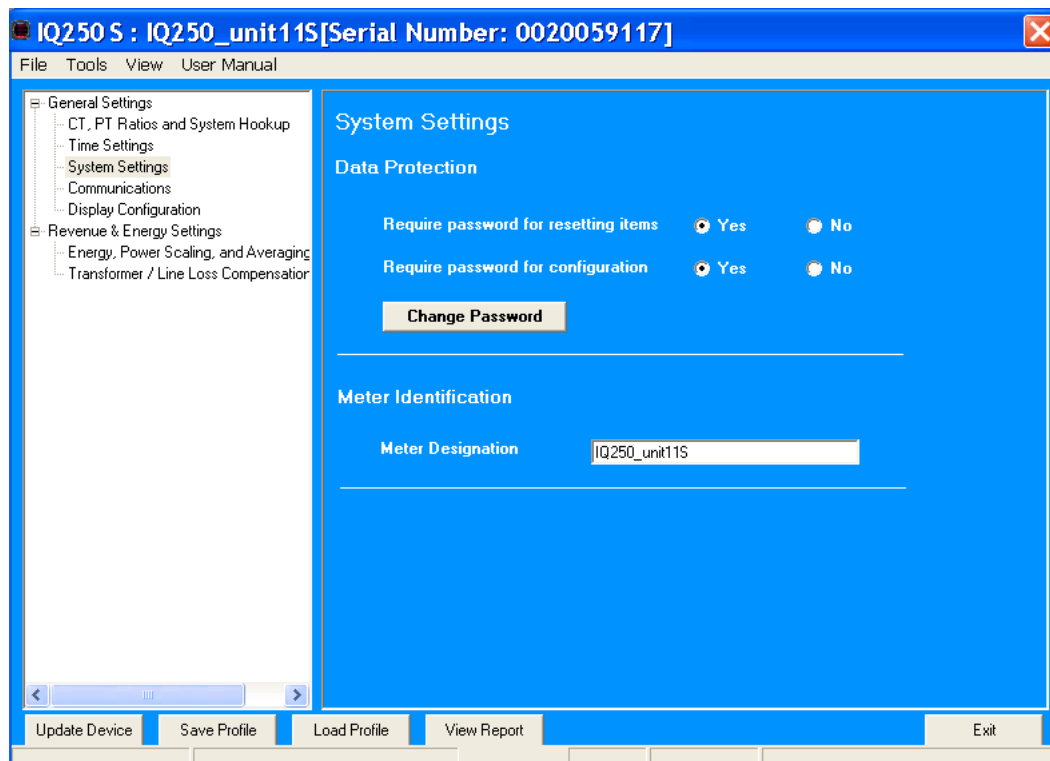


Use this setting to enable or disable Daylight Savings Time for the IQ 250S, and to set the beginning and ending times for Daylight Savings Time. You can also set the Time Zone and enable Clock Sync if supported by your meter.

1. From the Tree Menu, click General Settings>Time Settings.
2. Check or uncheck the box to Enable or Disable Daylight Savings time.
3. Use the entry fields to set the start and end times for the Daylight Savings Time feature, if enabled. Select the values you want from the Month, Week, Day of the Week, and Hour fields.
4. Select the time Zone and Clock Sync options from the pull-down menus.

**NOTE:** The Hour field uses a 24-Hour clock.

## System Settings



From the Tree Menu, click General Settings>System Settings. From this screen, you can do the following:

- Enable or Disable Password for Resetting and/or Configuration: click the radio button next to Yes or No. Enabling Password protection prevents unauthorized tampering with devices.

**IMPORTANT!** You must set up a password before enabling Password Protection. Click the Change button next to Change Password if you have not already set up a password.

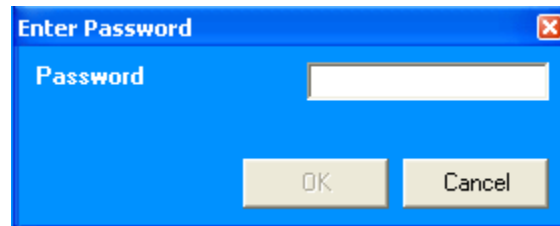
When you click the Change button next to Change Password in the Settings screen, you will see the Enter the New Password screen.

The dialog box is titled "Enter the new password". It contains two text input fields: "New Password" and "Retype New Password". Below the fields are two buttons: "Change" and "Cancel".

1. Type in the new password (0 - 9999).

2. Retype the password.
3. Click Change. The new password is saved and the meter restarts.

**NOTE:** If Password Protection has already been enabled for configuration and you attempt to change the password, you will see the Enter Password screen (shown below) after you click Change. Enter the old password and click OK to proceed with the password change.



You can enable or disable a Password for Resetting (Reset Max/Min Energy Settings) and Configuration (Device Profile) in the Systems Settings screen (see previous page).

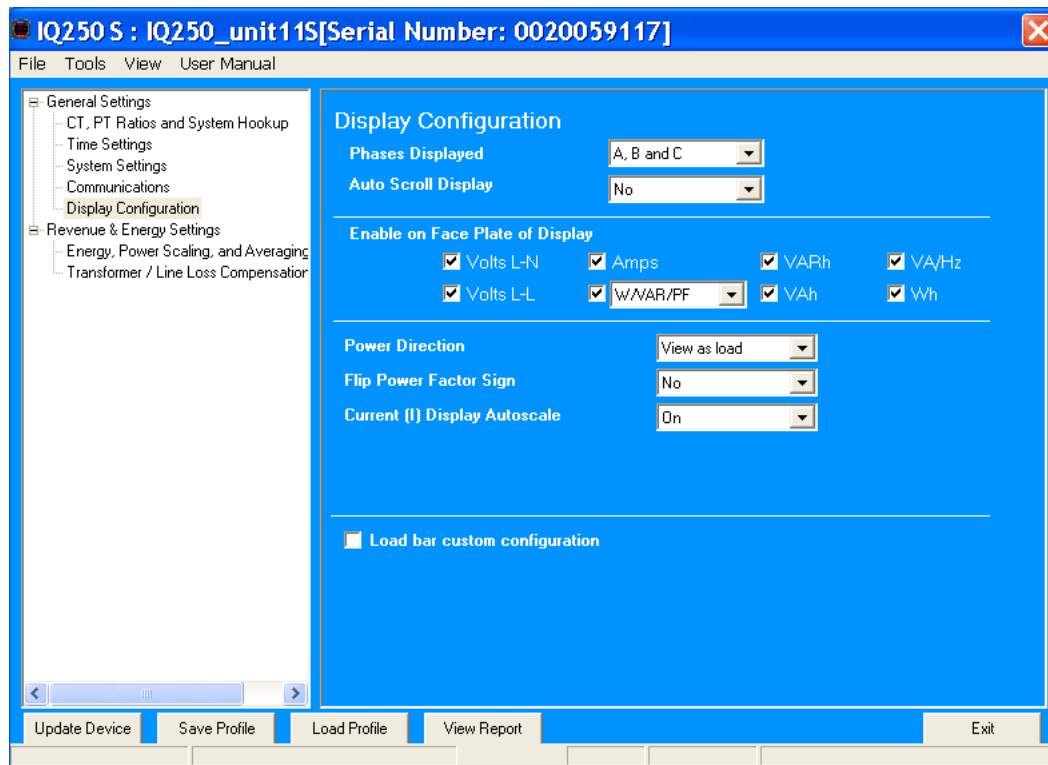
**NOTE:** If you enable a Password for Resetting, you must also enable it for Configuration.

**IMPORTANT!** You must set up a password before enabling Password Protection. Click the Change button next to Change Password if you have not already set up a password and follow the above instructions.

When anyone attempts to make a change that is under Password protection, the Enter Password screen opens. (See the example screen above.) If the correct Password is not entered, the change does not take place.

## Display Configuration

The settings on this screen determine the display configuration of the meter's faceplate.



The screen fields and acceptable entries are as follows:

- **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 Display:** Yes or No. This field enables or disables the scrolling of selected readings on the faceplate. If enabled, the readings scroll every 5 seconds.
- **Enable on Face Plate of Display:** Check the boxes of the Readings you want displayed on the faceplate of the meter. You must select at least one reading.
- **Power Direction:** View as Load or View as Generator
- **Flip Power Factor Sign:** Yes or No.
- **Current Display Auto-Scale:** On or Off (no decimal places)

- Load Bar Custom Configuration: Click this bar to add Current scaling. Additional fields open on the screen - see the figure below.

☒ Load bar custom configuration

Note: The Primary full scale Current for load bar = Current Scale \* CT Multiplier

Current Scale

Primary Full Scale 0.00

Enter the Current scale you want to use, The Primary Full Scale field will reflect your entry (as it says on the screen, Primary Full Scale Current for the Load Bar is equal to the Current scale multiplied by the CT multiplier.

### Energy, Power Scaling, and Averaging

Use this setting to configure:

- The display of Power in the meter
- The display and storage of Energy in the meter
- The interval over which Average values are computed.

### **Functional Overview of Energy Settings and Averaging**

#### Energy Scaling

Energy Setting includes:

- Digits (the number of digits in the reading)
- Decimals (the number of decimal places in the reading)
- Energy Scale: the scale of the reading – unit; kilo (number times 1000); Mega (number times 1 million).

Energy settings allow you to balance the resolution (or accuracy) of the energy stored, with the interval over which energy rollover occurs. For example, the maximum resolution for a k scale reading is: 99999.999k.

To calculate the speed at which the energy will rollover, you must know the Energy Full Scale, which is computed from the CT and PT Full Scale values (see Section 9.2.4.1). The formula for calculating Energy Full Scale is:

Wye system:  $\text{CT Full Scale} \times \text{PT Full Scale} \times 3$

Delta system:  $\text{CT Full Scale} \times \text{PT Full Scale} \times 3 \times 3$

For example, for a CT Full Scale of 2000, PT Full Scale of 14400, Wye system:

$$2000 \times 14400 \times 3 = 86400000$$

In this example, the energy will increment at 86400000 Watts per hour, or 24000 Watts per second.

This value allows you to determine the number of digits, decimal places, and energy scale you want to configure for the Energy settings, when you take into account the rollover time. To determine the number of hours before rollover, use this formula:

$[\text{Max Resolution}]/[\text{Full Scale}] = \text{\#Hours}$ , where Max Resolution = maximum digits and decimals for the Energy scale in use.

Using the example from above, with an energy scale of Mega, the formula would be:

$$99999.999 \text{ M} / 86.4 \text{ M} = 1157.4074 \text{ hours or about 48 days until rollover.}$$

**NOTE:** To increase the number of days until rollover, you can:

- Increase the number of digits (to 8)
- Decrease the number of decimal places (to 0)
- Increase the Energy Scale (to M).

#### Demand Averaging

Demand is the average rate of energy use over time. The IQ 250S supports two types of demand averaging: Fixed demand and Sliding demand:

- Fixed demand records the average demand for time intervals that you define (usually 5, 15 or 30 minutes).

- Sliding demand functions like multiple, overlapping Fixed demand. You define the subintervals at which an average of demand is calculated. An example of Sliding demand 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.

From the Tree Menu, click Energy Settings> Energy, Power Scaling, and Averaging.

**IQ250 S : IQ250\_unit11S[Serial Number: 0020059117]**

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Transformer / Line Loss Compensation

**Energy, Power Scaling, and Averaging Method**

**Energy Settings**

Energy Digits: 8  
Energy Decimal Places: 3  
Energy Scale: Mega [M]

**Power Settings**

Power Scale: Auto  
Apparent Power (VA) Calculation Method: Arithmetic Sum

**Demand Averaging**

Type: Fixed  
Interval (Minutes): 15

Update Device Save Profile Load Profile View Report Exit

The screen fields and acceptable entries are as follows:

- Energy Settings

Energy Digits: 5; 6; 7; 8

Energy Decimal Places: 0 - 6

Energy Scale: unit; kilo (K); Mega (M)

For example: a reading for Digits: 8; Decimals: 3; Scale: K would be formatted:  
00123.456k

**NOTE:** Your selection in the Energy Settings fields determines the precision of energy stored for display and polling. Refer to the Functional Overview at the beginning of this section for more information.

- Power Settings:

Power Scale: Auto; unit; kilo (K); Mega (M)

Apparent Power (VA) Calculation Method: Arithmetic Sum or Vector Sum

- Demand Averaging:

Type: Fixed or Sliding

Interval (Fixed demand) or Sub-Interval (Sliding demand) in minutes: 5; 15; 30; 60

Number of Subintervals: 1; 2; 3; 4

Interval Window: This field is display only. It is the product of the values entered in the Sub-Interval and Number of Subintervals fields.

**NOTE:** You will only see the Number of Subintervals and Interval Window fields if you select Sliding Demand.

### Transformer/Line Loss Compensation

Transformer/Line Loss Compensation allows you to add or subtract losses to meter registration.

From the Tree Menu, click Revenue & Energy Settings>Transformer/Line Loss Compensation.

IQ250 S : IQ250\_unit11S[Serial Number: 0020059117]

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Transformer / Line Loss Compensation

Transformer / Line Loss Compensation

Percent Loss of Watts

|               | Positive Watts | Negative Watts |
|---------------|----------------|----------------|
| Due to Iron   | 0.00           | 0.00           |
| Due to Copper | 0.00           | 0.00           |

Percent Loss of VARS

|               | Positive Watts | Negative Watts |
|---------------|----------------|----------------|
| Due to Iron   | 0.00           | 0.00           |
| Due to Copper | 0.00           | 0.00           |

Disabled

Add to Watts and VAR

TLC Calculator

Update Device Save Profile Load Profile View Report Exit

This screen displays the current values for the meter's Transformer Loss Compensation. The screen fields and acceptable entries are as follows

- Percent Loss of Watts due to Iron and Copper/Positive Watts and Negative Watts
- Percent Loss of VARS due to Iron and Copper/Positive and Negative Watts
- Drop-down menu #1. Choose from: Disabled, Fe Only, Cu Only, Both Fe and Cu.
- Drop-down menu #2. Choose from: Add to Watts and VAR; Add to Watts and Subtract from VAR; Subtract from Watts and Add to VAR; Add to Watts and VAR; Subtract from Watts and VAR.

1. Click **TLC Calculator** to find the values to enter into the Percent Loss fields. The TLC Calculator button launches an Excel Spreadsheet that makes the calculations for you once you enter the required data.

**WARNING!** Eaton Meter Configuration Software automatically launches the Excel Spreadsheet

when you click the TLC Calculator button. If you do not have Excel software installed on your computer, a Warning message is displayed instead of the worksheet.

**EXCEL NOTE:** For most Excel users, the spreadsheet does run until you give the application permission to run the Macros contained in the sheet. You give permission by changing the Excel Security Setting from High to Medium, as follows:

- a. From the Excel toolbar, click Tools>Security>Options.
  - b. On the Security Tab page, click the Macro Security button.
  - c. Select Medium Security.
4. Enter the percent Loss of Watts and VARS for copper and iron in the appropriate fields.

### Configuring Limits (IQ 250S)

Use this screen to assign Limits for the meter.

#### Functional Overview for Limits:

Limits are transition points used to divide acceptable and unacceptable measurements. When a value goes above or below the limit, an out-of-limit condition occurs. You can set and configure up to eight Limits for the IQ 250S meter.

Once they are configured, you can view the out-of-Limits (or Alarm) conditions in the Limits Polling screen.

You can assign the eight limits to readings from three groups of parameters:

- Readings (Instantaneous Voltage; Instantaneous Current; Total and Per Phase Power and Power Factor; Frequency; and Neutral Current)
- Demand (Current; Per Phase, Total Power and Power Factor)

From the Tree Menu, click Power Quality and Alarm Settings>Limits.

**IQ 250S: IQ 250S 20 [Serial Number:0020061514]**

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 Transformer / Line Loss Compensation  
 Power Quality and Alarm Settings  
 Limits

### Limits

| Limit ID | Assigned Channel (Double Click to Edit) | Setting | Setpoint       |         | Return Hysteresis |         |
|----------|-----------------------------------------|---------|----------------|---------|-------------------|---------|
|          |                                         |         | % of Fullscale | Primary | % of Fullscale    | Primary |
| 1        | Volts A-B                               | Above   | 110.0          | 660.00  | 110.0             | 660.00  |
|          |                                         | Below   | 90.0           | 540.00  | 90.0              | 540.00  |
| 2        | Volts B-C                               | Above   | 110.0          | 660.00  | 110.0             | 660.00  |
|          |                                         | Below   | 90.0           | 540.00  | 90.0              | 540.00  |
| 3        | Volts C-A                               | Above   | 110.0          | 660.00  | 110.0             | 660.00  |
|          |                                         | Below   | 90.0           | 540.00  | 90.0              | 540.00  |
| 4        | I A                                     | Above   | 110.0          | 5.50    | 110.0             | 5.50    |
|          |                                         | Below   | 90.0           | 4.50    | 90.0              | 4.50    |
| 5        | I B                                     | Above   | 110.0          | 5.50    | 110.0             | 5.50    |
|          |                                         | Below   | 90.0           | 4.50    | 90.0              | 4.50    |
| 6        | I C                                     | Above   | 110.0          | 5.50    | 110.0             | 5.50    |
|          |                                         | Below   | 90.0           | 4.50    | 90.0              | 4.50    |
| 7        | Watts Total                             | Above   | 110.0          | 9900.00 | 110.0             | 9900.00 |
|          |                                         | Below   | 90.0           | 8100.00 | 90.0              | 8100.00 |
| 8        | Frequency                               | Above   | 110.0          | 66.00   | 110.0             | 66.00   |
|          |                                         | Below   | 90.0           | 54.00   | 90.0              | 54.00   |

Full Scales (100% equals the following for the given reading type)

|           |         |              |         |
|-----------|---------|--------------|---------|
| Voltage   | 600.00  | Power        | 3000.00 |
| Current   | 5.00    | Power Total  | 9000.00 |
| Frequency | 60.00Hz | Power Factor | 1.000   |

Update Device Save Profile Load Profile View Report Exit

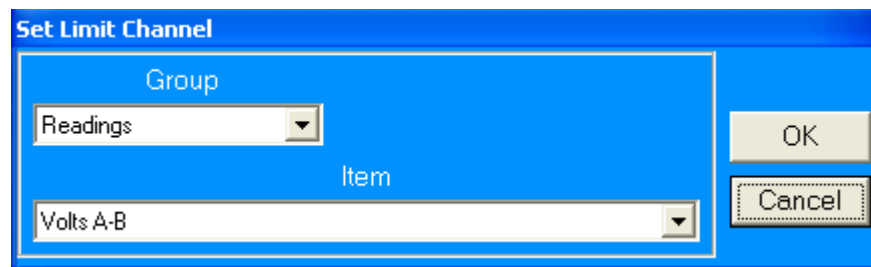
Update Successful Error Update SHK2 Cmd Session Mode cmd failed [0]

The current settings for Limits are shown in the screen.

The bottom of the screen shows the Full Scale values for:

- Voltage
- Current
- Frequency
- Power
- Power Total
- Power Factor
- Phase Angles

1. Select a limit by double-clicking on the Assigned Channel field.
2. You will see the screen shown below.



Select a Group and an Item for the Limit.

3. Click OK.
4. To Configure a Limit, double-click on the Field to set the following values:
  - Above and Below Setpoint:% of Full Scale (the point at which the reading goes out of limit)  
  
Examples:  
  
100% of 120V Full Scale = 120V  
  
90% of 120V Full Scale = 108V
  - Above and Below Return Hysteresis: the point at which the reading goes back within limit  
(see figure below)

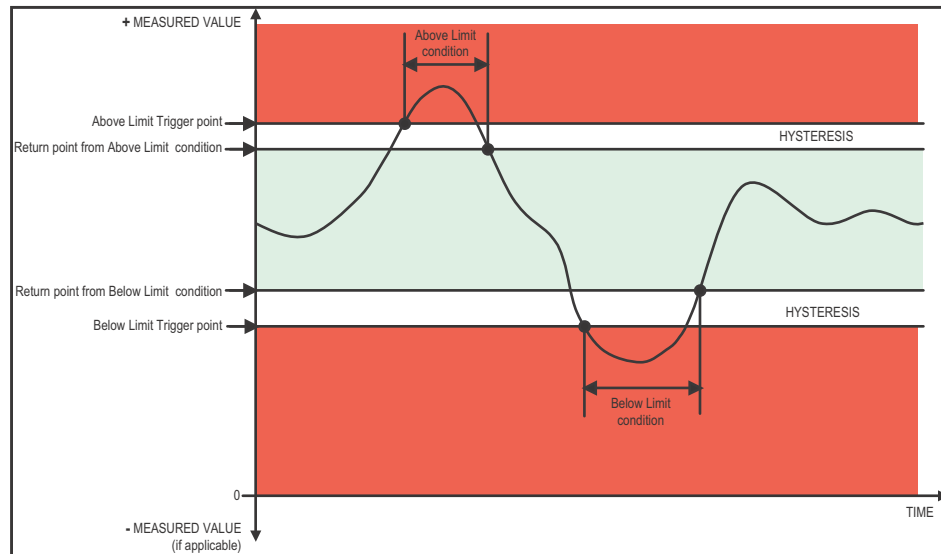
Examples:

Above Setpoint = 110%; Below Setpoint = 90%

(Out of Limit above 132V);(Out of Limit below 108V)

Above Return Hysteresis = 105%; Below Return Hysteresis = 95%

(Stay out of Limit until below 126V)(Stay out of Limit until above 114V)



#### NOTES:

- The Primary fields are display only. They show what the set point and return Hysteresis value are for each limit.
- If the Above Return Hysteresis is greater than the Above Set Point, the Above Limit is Disabled; if the Below Return Hysteresis is less than the Below Set Point, the Below Limit is Disabled. You may want to use this feature to disable either the Above Limit or Below Limit condition for a reading.
- If you are entering negative limits, be aware that the negative value affects the way the above and below limits function, since negative numbers are processed as signed values.

### Configuring Historical Logs (IQ250S)

Use this setting to select the parameters to be stored in each of the IQ 250S meter's three Historical Logs.

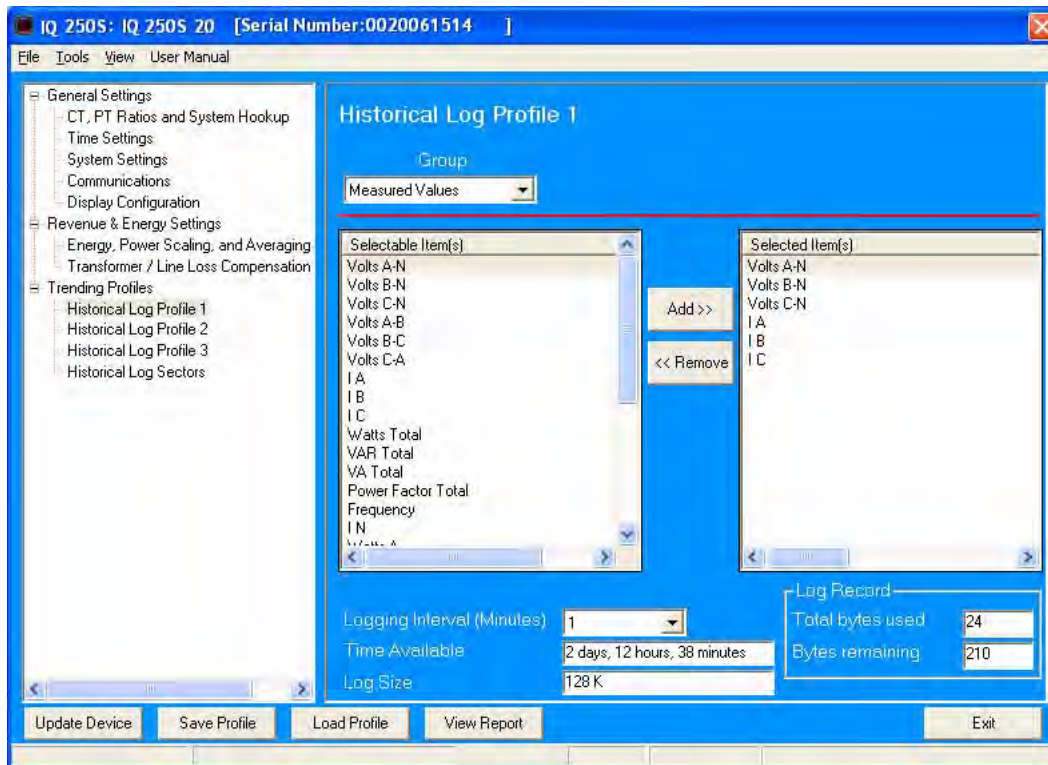
#### **Functional Overview of Historical Logs:**

Having three historical logs affords you the flexibility of programming each log with unique parameters. For example, you might program Historical Log 1 to record Power Quality parameters (for example, Limits/Alarms), Log 2 to record Demand parameters, and Log 3 to record Energy parameters.

Historical Log parameters can be selected from eight groups:

- Measured Values (Instantaneous Voltage; Instantaneous Current; Total and Per Phase Power and Power Factor; Frequency; Neutral Current; Symmetrical Components and Voltage Unbalances)
- Demand (Current; Per Phase, Total Power and Power Factor)
- Maximums (Maximum values for all of the readings listed above)
- Minimums (Minimum values for all of the readings listed above)
- Energy (Watt-hours, VA-hours, VAR-hours)
- Short Term Min (Min value within the Demand Interval)
- Short Term Max (Max value within the Demand Interval)
- Uncompensated ((Watt-hours, VA-hours, VAR-hours)

From the Tree Menu, click Trending Profiles>Historical Log Profile (1-3).



This screen lets you select items to be stored in the historical log you selected. The Group field determines the items that are available for selection.

1. Select a Group. The possible selections are: Measured Values, Demand, Maximums, Minimums, Energy, Short Term Min, Short Term Max, and Uncompensated.
2. Select items for your log:
  - a. Highlight the item(s) you want in the Selectable Items box.
  - b. Click Add. The item(s) are added to the Selected Items box.
  - c. To remove item(s), highlight them in the Selected Items box and click Remove.
4. Set the Logging Interval (Minutes). The available choices are: 1, 3, 5, 10, 15, 30, 60. The Logging Interval determines when the meter takes a snapshot.

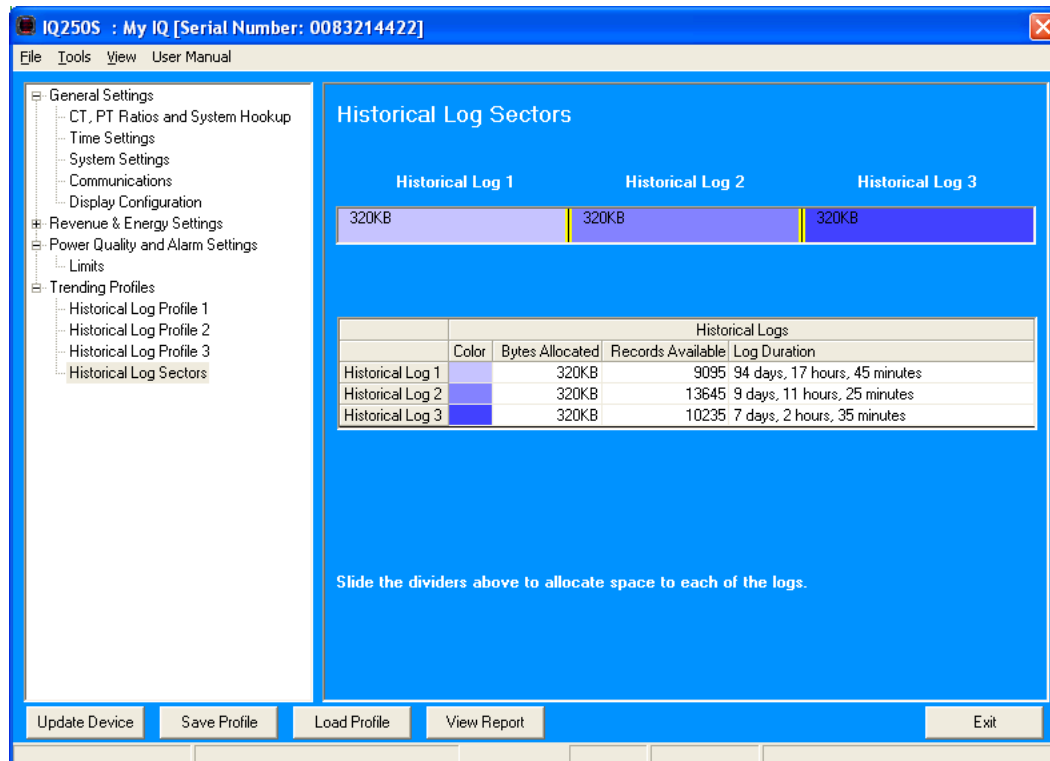
**NOTE:** There are two display fields at the bottom of the Historical Log Profile screen. They show the Total Bytes Used and the Bytes Remaining for this historical log. These fields are updated as

you make selections on the screen. The total number of bytes available per log record is approximately 234.

### Configuring Historical Log Sectors (IQ250S)

Use this setting to increase or decrease the amount of records each of the IQ 250S meter's three Historical logs can store, and the duration each log can run, before becoming filled.

From the Tree Menu, click Trending Profiles>Historical Log Sectors.



The screen shows the current space allocation for the meter's Historical logs, including:

- The number of bytes allocated to each log
- The number of records available for each log
- The duration of each log

To change the current allocation for a log:

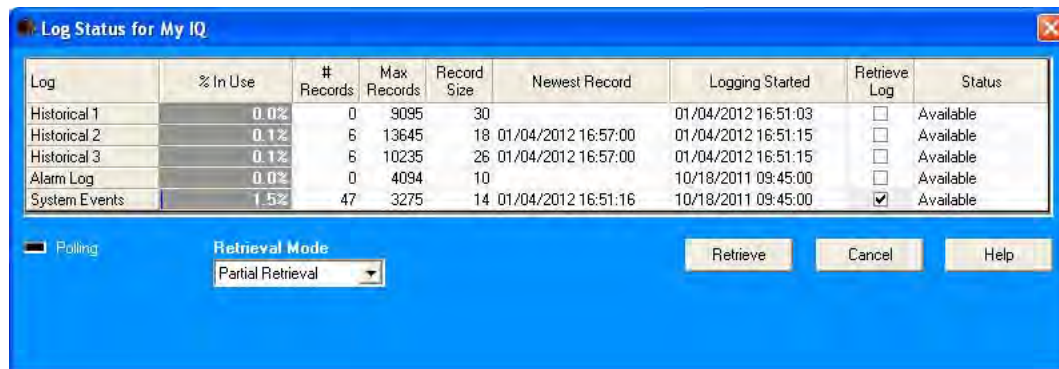
1. Click on one of the double yellow lines dividing the individual logs.

2. You will see a line with arrows on each side. Drag the line in either direction to increase or decrease the log allocation. The display fields for the logs will reflect any changes you make to the allocation.

#### Viewing Log Status/Retrieving Logs (IQ 250S)

Follow these steps to view Log status and/or retrieve logs.

1. Click Logs>Statistics or Logs>Retrieve Log(s) from Device from the Title bar (or click the Log Status or Retrieve Logs icons). You will see the screen shown below.



2. This screen shows the following information for all of the IQ 250S meter's logs:

- % in Use - the amount of the log that is currently being used
- # of Records - the number of records currently in the log
- Max Records - the maximum number of records the log can hold
- Record Size - the current record size in Bytes
- Newest Record - the date and time stamp of the most recent record in the log
- Logging Started - the date and time that logging began
- Retrieve Log - a checkbox that lets you select log retrieval
- Status - whether the log is Available or Not Available for retrieval

3. To retrieve a log, click its Retrieve Log checkbox.

**NOTE:** The System Events log is always retrieved when a log is retrieved: its box is always checked.

4. Use the pull-down menu for Retrieval Mode to select one of two options:

- Partial Retrieval (this is the default Retrieval mode)
- Time Range Retrieval

**NOTES:**

- In Partial Retrieval mode, only the newest records are retrieved. This increases retrieval speed, since records that have previously been retrieved are ignored. When the log is full, it will roll over. Partial Retrieval mode should be used for Billing and continuous logging.
- The Time Range Retrieval mode is useful if you want to retrieve specific events. If you select Use Time Range from the pull-down menu, date range fields will display, allowing you to select the time range for data retrieval. Only records (within the specified time range) that are newer than the latest records in the log database can be retrieved for any selected logs. For this reason, Time Range Retrieval should not be used for Billing or continuous logging purposes. The only way to retrieve earlier records using Time Range Retrieval is to delete the existing log database(s) before retrieving the log(s).

5. Click Retrieve.

- a. You will see a screen that shows the percent retrieved for each log, the time elapsed since retrieval began, and any messages.
- b. After the logs have been retrieved, you will see a screen which shows you the Mode, Start time, and Status of Log Conversion.
- c. The Log Viewer opens.

**NOTES:**

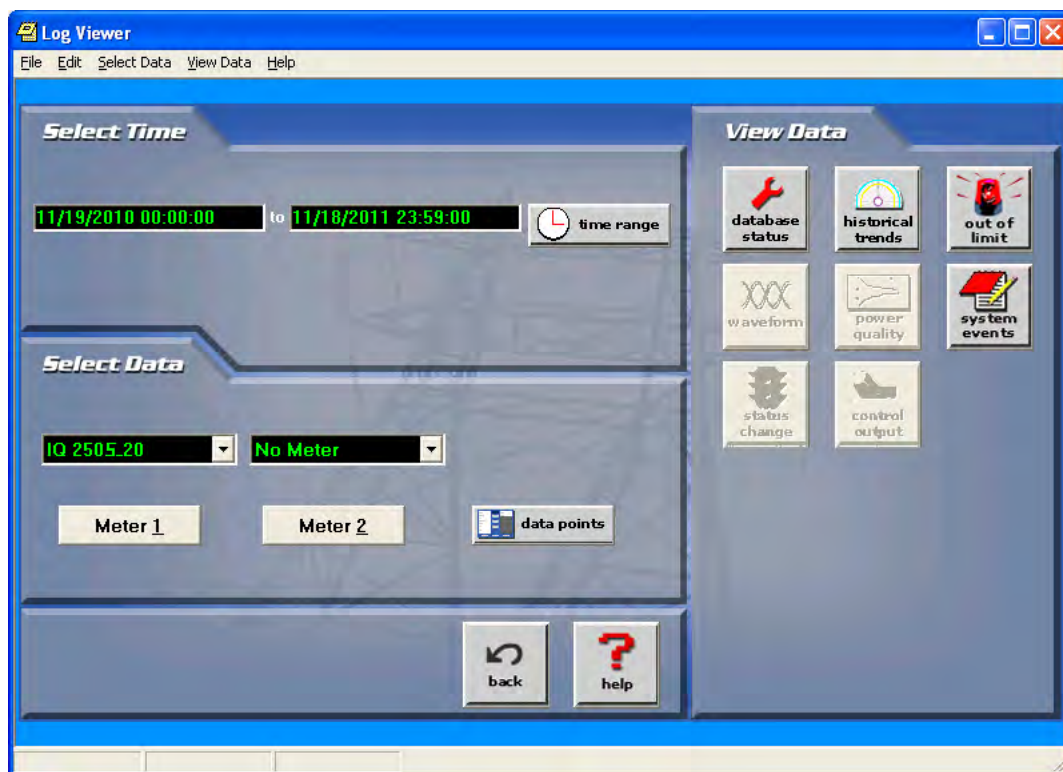
- Only one person at a time can download a log. If someone else is downloading a log, it will be unavailable until the download is complete.
- Retrieve logs as often as you want. Each time you retrieve a log file, Eaton Meter Configuration Software appends only the newest records and captures to the existing database.

### Using the Log Viewer (IQ 250S)

To access Log Viewer, either:

- Retrieve logs from a connected meter, as shown in the previous section.
- Click the Open Log icon from the Eaton Meter Configuration Software's Main screen. The Retrieved Logs directory opens, allowing you to pick a previously stored log file.
- Run Log Viewer from the Windows® Start menu.

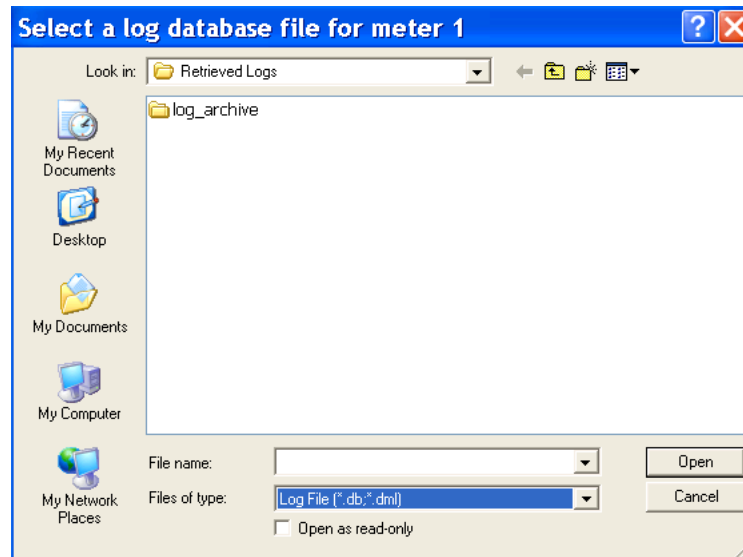
You will see the Log Viewer's main screen, shown below.



1. Choose the log data file(s) you want to view in either of the following ways:

- If you have retrieved logs through Eaton Meter Configuration Software, the meter's designated label is shown in the field above the Meter 1 button. Click the Log's button on the right side of the screen to view a log. (The buttons of unavailable logs are grayed out and unselectable.)

- If you want to view a previously retrieved log, click either Meter button (1 or 2). Log Viewer opens a window prompting you to select a log database (.db). See the example screen below.



2. Select the file you want and click Open.

**NOTE:** You can choose a different log file (.db) for Meter 1 and for Meter 2.

3. Select the data points you want to view by clicking the Data Points button in Log Viewer's Main screen. You will see the screen shown below. Note that the number of data points you see reflects the number of parameters in the log.



4. From the Available Data Points column, click on the data points you want to include when viewing the log file.
  - To select multiple points, hold down the Ctrl key while clicking.
  - To select points in sequence, hold down the Shift key while clicking.
  - Click the Add button to move the Data Points to the Selected Data Points column.
  - Click the Restore button to return the selection to its previous setting.
5. When you finish your selection, click OK to return to Log Viewer's main screen.
6. Select the portion of the log you want to view by specifying a time range. Log Viewer bases its time/date format on your computer's Regional Settings (Windows® Control Panel). Click the Time Range button. You will see the following screen.

Select a Time Range, current system date is November 17...

**Time Range Selection Options**

☒ **Between** 10/25/2011 12:00:00 AM and 11/17/2011 11:59:59 PM

☐ During the previous hour(s) 1

☐ During the previous day(s) 1

☐ During the previous week(s) 1

☐ During the previous month(s) 1

☐ During the previous year(s) 1

OK Cancel Help

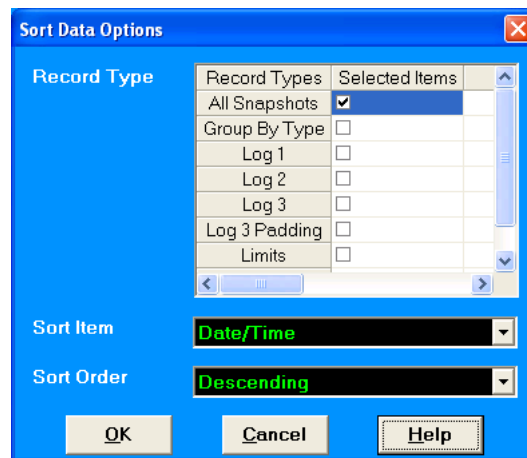
- To select a specific time range, click the Between radio button and enter a date and time in each field. You can also use the arrows to open a calendar for the date and to increment the time field.
- To select a range of hours, days, months or years only, click the appropriate radio button and use the arrows to select the range.

7. Click OK. The time range you selected is displayed in the Log Viewer's main screen.
8. Click on the Historical Trends button or View Data>Snapshots. Log Viewer displays trending data for the selected log file based on the time range and data points you chose. See the example screen shown below.

| Date/Time                  | Record Type | Volts A-N | Volts B-N | Watts, 3-P |
|----------------------------|-------------|-----------|-----------|------------|
| 10/25/2011 11:36:00.000 AM | Log 2       |           |           |            |
| 10/25/2011 11:36:00.000 AM | Log 3       |           |           |            |
| 10/25/2011 11:35:00.000 AM | Log 2       |           |           |            |
| 10/25/2011 11:35:00.000 AM | Log 1       |           |           |            |
| 10/25/2011 11:34:00.000 AM | Log 2       |           |           |            |
| 10/25/2011 11:34:00.000 AM | Log 1       |           |           |            |
| 10/25/2011 11:33:00.000 AM | Log 1       |           |           |            |
| 10/25/2011 11:33:00.000 AM | Log 1       |           |           |            |
| 10/25/2011 11:32:00.000 AM | Log 1       |           |           |            |
| 10/25/2011 11:32:00.000 AM | Log 1       |           |           |            |
| 10/25/2011 11:31:00.000 AM | Log 1       |           |           |            |
| 10/25/2011 11:31:00.000 AM | Log 3       |           |           |            |
| 10/25/2011 11:30:00.000 AM | Log 1       | 123.37    | 0.00      |            |
| 10/25/2011 11:30:00.000 AM | Log 2       |           |           |            |
| 10/25/2011 11:30:00.000 AM | Log 1       |           |           |            |
| 10/25/2011 11:29:00.000 AM | Log 1       |           |           |            |
| 10/25/2011 11:29:00.000 AM | Log 3       |           |           |            |

- The name of the log file and the type of data point are listed in the top row.
- You can move the columns, so that the most important data is most accessible. Right-click on the column title and drag it to the desired location on the table.
- To save the data to your clipboard, right-click with the cursor positioned anywhere in the table.

- To sort the data by Date/Time or data point, in either ascending or descending order, click the Sort button and use the pull-down menus to make your selection. See the screen shown below.



9. To display Trending data as either an XY, Circular, or Advanced graph, click the Graph button. You will see the following screen.



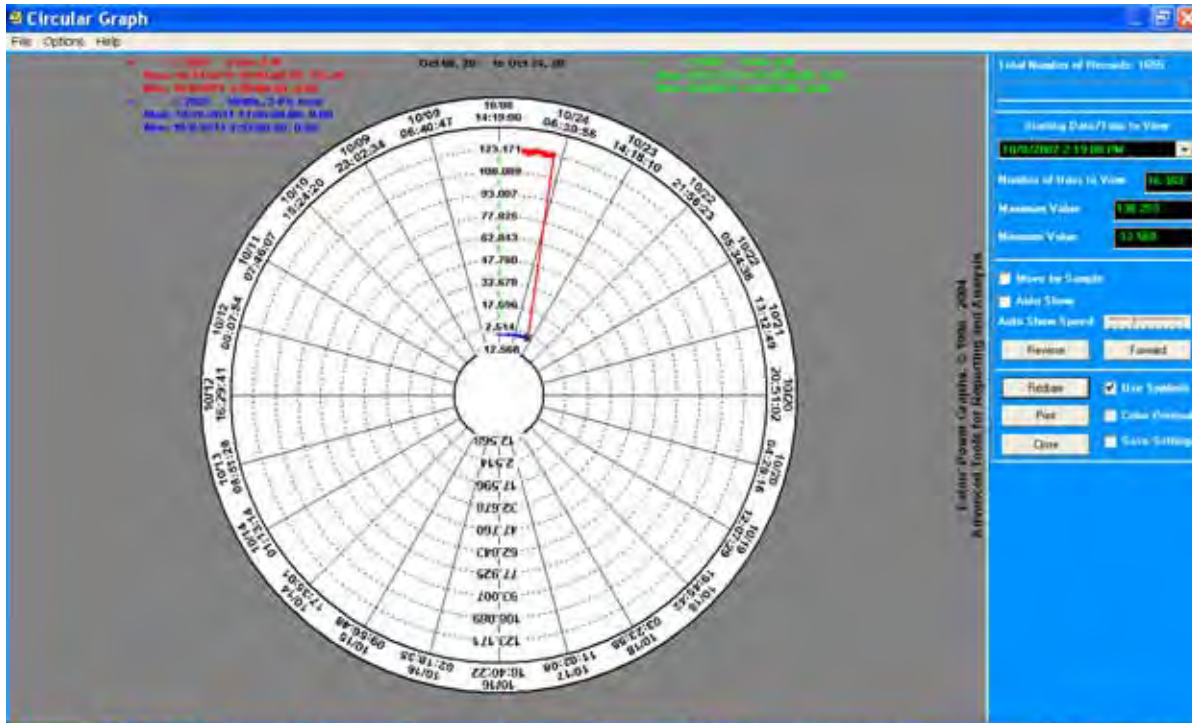
The Available Items column lists the log's data points. (To add a new data point, return to Log Viewer's main screen and click the Data Points button.)

- Click on the data points you want to graph.
- Click the Add button. The items appear in the Graph Items column.

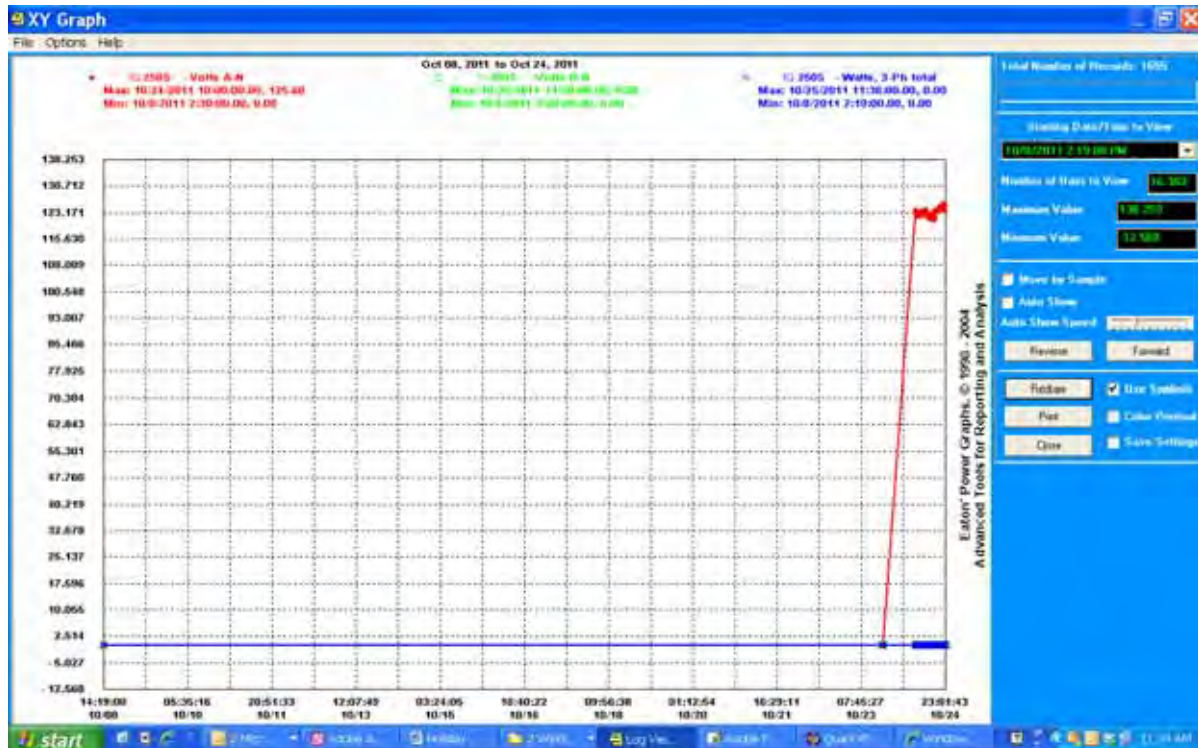
- To select multiple data points, hold down the Ctrl key while clicking.
- To select data points in sequence, hold down the Shift key while clicking.

**NOTE:** Only six data points in total can be graphed at one time. If there are two open log files, you can only select three data points per file.

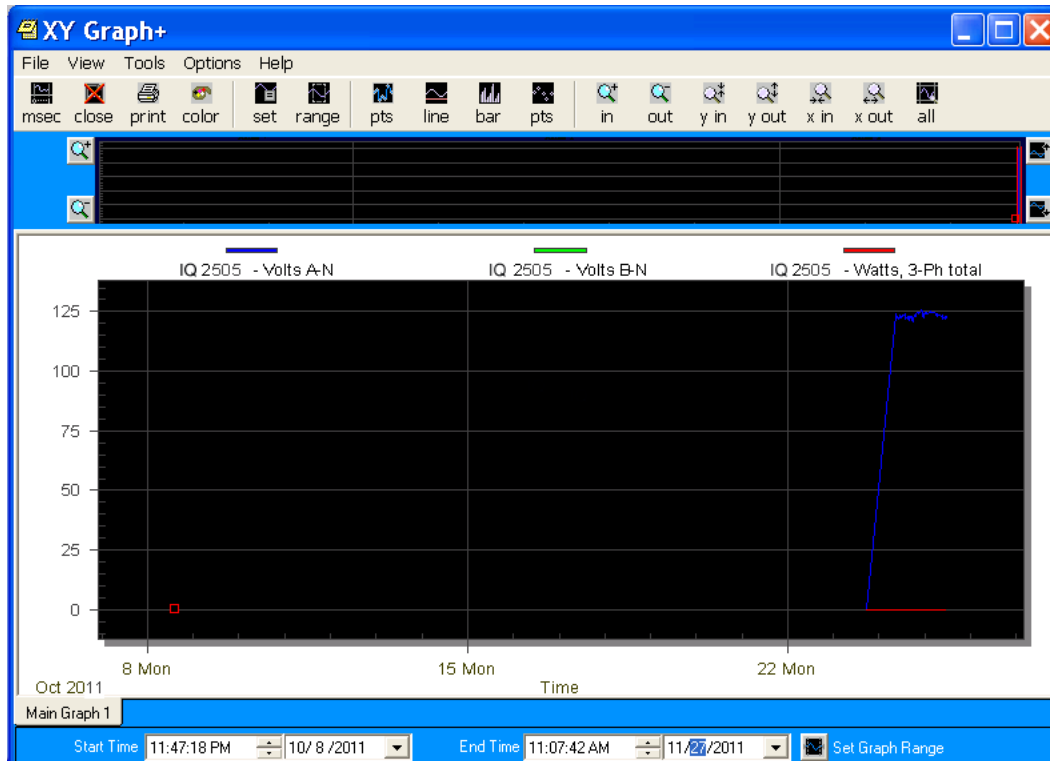
- c. To view the graph, click either the Circular, XY, or Advanced Graph buttons. See the example graphs below and on the next page.



Circular Graph



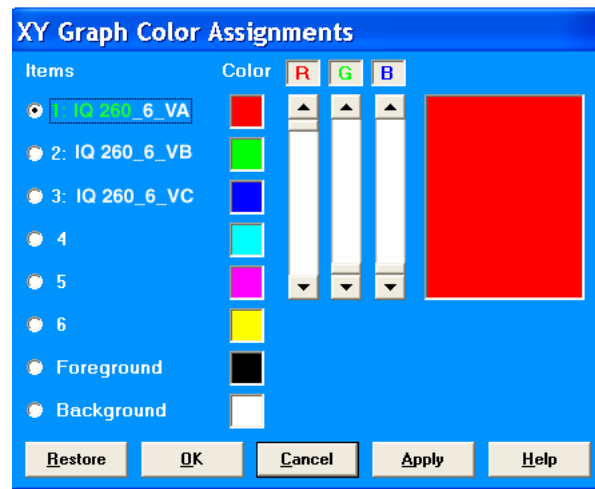
XY Graph



Advanced Graph

The following instructions pertain to all of the graphs:

- To change the starting point of the graph, choose a new date/time segment from the Starting Date/Time to View pull-down menu.
- To change the amount of time represented on the graph, enter a value in the Number of Days to View field and press Enter or click on the Redraw button.
- To change the scale of the graph, enter a value in the Minimum Value and Maximum Value fields and press Enter or the Redraw button.
- To view one sample at a time, click in the Move by Sample box; then click on the Forward or Reverse buttons each time you would like to view the next (or previous) sample.
- To view a continuous, sample-by-sample rendering of the graph, click the Move by Sample box and the Auto Show box. Select a speed by sliding the Auto Show Speed bar left or right; click on the Forward or Reverse buttons to determine the direction of the Auto Show. To stop Auto Show, deselect the Auto Show box.
- To print the graph on a color printer, check the Color Printout box and click Print.
- To print the graph on a black-and-white printer, click the Use Symbols box and click Print.
- To copy the graph data to the computer's clipboard, select Copy from the File menu. Paste the data into a spreadsheet, such as Excel®.
- To export the graph's data, select Export Data from the File menu.
- To change the graph's color assignments, select Select Colors from the Options menu. You will see the screen shown on the next page.

**NOTES:**

- The Advanced Graph also has a Color button which opens the Color Assignments screen.
- The Color Assignments screen is slightly different for the Advanced Graph.
- The small squares under the Color heading represent the color currently assigned to each component of the graph.
- To make adjustments to an Item's color, click the radio button beside it and create a new color by moving the red, green and blue sliders. Create black by moving all sliders down, white by moving all sliders up. The large square on the right shows the color you have created.
- Click OK to return to the graph; Log Viewer redraws the graph using the new color scheme.
- Click the Restore button to return all color schemes to their default values.

10. When you are finished using the Log Viewer, click the X button or File>Exit to close the screen.

**NOTE:** You can also view the Limits log (listing any alarms) and System Events log (listing firmware changes, logging start and stop times, Runtime start, stop, and end times, resets, change of meter's programmable settings and other system events.) From the Log Viewer's Main screen:

- Click the Out of Limit button to view the Limits log (you need to download this log or select an already downloaded log first. See the instructions beginning on page 5-35).
- Click the System Events button to view the System Events log.

#### 5.2.4: Polling the IQ 150S/250S Submeter

The Real Time Poll features of Eaton Meter Configuration software are used to continuously view instantaneous values within an IQ 150S/250S meter. The software provides tabular views of metered values, circuit measurements, interval data, and pulse data.

The Real Time Poll features are divided into three groups, accessed by clicking Real-Time Poll in the Title Bar:

- Real Time Readings
- Revenue, Energy and Demand Readings
- Power Quality

When you click Real Time Readings; Revenue, Energy and Demand Readings; and Power Quality, you will see a sub-menu that allows you to select individual polling screens.

**NOTE:** Clicking the Polling icon on the Title Bar is the same as selecting Instantaneous Polling from the Real-Time Poll>Real Time Readings menu; clicking the Phasors icon on the Title Bar is the same as selecting Phasors from the Real-Time Poll>Power Quality menu.

## Instantaneous Polling

Click Real-Time Poll>Real Time Readings>Instantaneous Polling. You will see the screen shown below.

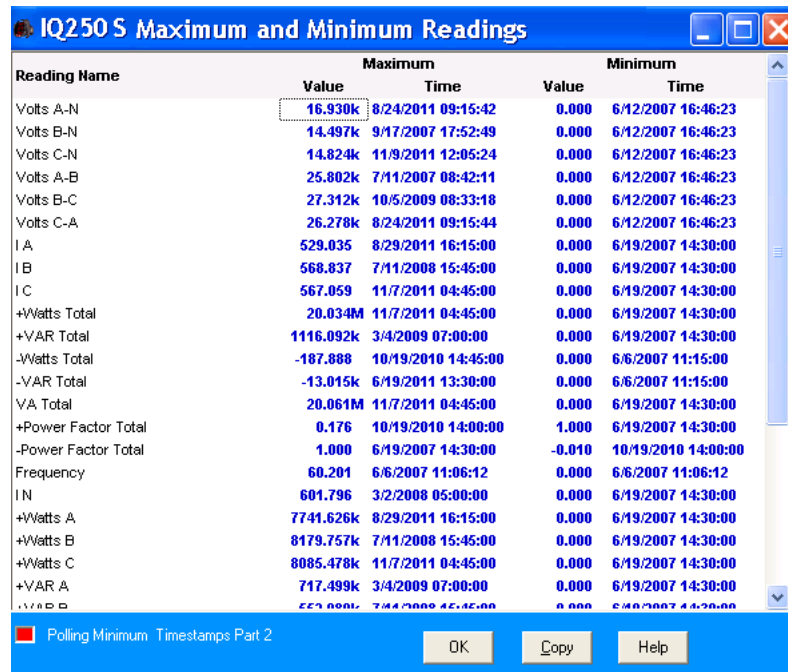
**NOTE:** This screen capture is for an IQ 150S meter. If you are connected to an IQ 250S meter you won't see the THD% section of the screen.

| Polling                                                 |               |             |               |         |                     |      |         |         |      |
|---------------------------------------------------------|---------------|-------------|---------------|---------|---------------------|------|---------|---------|------|
| Volts                                                   |               | Current (I) |               |         | THD(%)              |      | Voltage |         |      |
|                                                         | Instantaneous |             | Instantaneous | Maximum |                     |      |         | Current |      |
| A-N                                                     | 125.88        | A           | 0.00          | 0.00    |                     | A    | 1.17    | 0.00    |      |
| B-N                                                     | 125.11        | B           | 0.00          | 0.00    |                     | B    | 1.17    | 0.00    |      |
| C-N                                                     | 125.12        | C           | 0.00          | 0.00    |                     | C    | 1.14    | 0.00    |      |
| A-B                                                     | 0.00          | Hz          | 0.00          | 0.00    |                     |      |         |         |      |
| B-C                                                     | 0.00          |             |               |         |                     |      |         |         |      |
| C-A                                                     | 0.00          |             |               |         |                     |      |         |         |      |
|                                                         |               | Frequency   | 58.947        |         |                     |      |         |         |      |
| Real Power (W)                                          |               |             |               |         |                     |      |         |         |      |
|                                                         | Total         | A           | B             | C       |                     |      |         |         |      |
| Inst                                                    | 0.00          | 0.00        | 0.00          | 0.00    |                     |      |         |         |      |
| +Average                                                | 0.00          | 0.00        | 0.00          | 0.00    |                     |      |         |         |      |
| -Average                                                | 0.00          | 0.00        | 0.00          | 0.00    |                     |      |         |         |      |
| +Maximum                                                | 0.00          | 0.00        | 0.00          | 0.00    |                     |      |         |         |      |
| -Maximum                                                | 0.00          | 0.00        | 0.00          | 0.00    |                     |      |         |         |      |
| Reactive Power (vars)                                   |               |             |               |         | Apparent Power (VA) |      |         |         |      |
|                                                         | Total         | A           | B             | C       | Total               | A    | B       | C       |      |
| Inst                                                    | 0.00          | 0.00        | 0.00          | 0.00    | 0.00                | 0.00 | 0.00    | 0.00    | 0.00 |
| +Average                                                | 0.00          | 0.00        | 0.00          | 0.00    | 0.00                | 0.00 | 0.00    | 0.00    | 0.00 |
| -Average                                                | 0.00          | 0.00        | 0.00          | 0.00    |                     |      |         |         |      |
| +Maximum                                                | 0.00          | 0.00        | 0.00          | 0.00    | 0.00                | 0.00 | 0.00    | 0.00    | 0.00 |
| -Maximum                                                | 0.00          | 0.00        | 0.00          | 0.00    |                     |      |         |         |      |
| <div><div>OK</div><div>Print</div><div>Help</div></div> |               |             |               |         |                     |      |         |         |      |

- Click Print to print a copy of the screen.
- Click Help to view instructions for this screen.
- Click OK to return to the main screen.

## Poll Max and Min Readings

Click Real-Time Poll>Real Time Readings>Poll Max and Min Readings. You will see the screen shown below.



| Reading Name        | Maximum   |                     | Minimum |                     |
|---------------------|-----------|---------------------|---------|---------------------|
|                     | Value     | Time                | Value   | Time                |
| Volts A-N           | 16.930k   | 8/24/2011 09:15:42  | 0.000   | 6/12/2007 16:46:23  |
| Volts B-N           | 14.497k   | 9/17/2007 17:52:49  | 0.000   | 6/12/2007 16:46:23  |
| Volts C-N           | 14.824k   | 11/9/2011 12:05:24  | 0.000   | 6/12/2007 16:46:23  |
| Volts A-B           | 25.802k   | 7/11/2007 08:42:11  | 0.000   | 6/12/2007 16:46:23  |
| Volts B-C           | 27.312k   | 10/5/2009 08:33:18  | 0.000   | 6/12/2007 16:46:23  |
| Volts C-A           | 26.278k   | 8/24/2011 09:15:44  | 0.000   | 6/12/2007 16:46:23  |
| IA                  | 529.035   | 8/29/2011 16:15:00  | 0.000   | 6/19/2007 14:30:00  |
| IB                  | 568.837   | 7/11/2008 15:45:00  | 0.000   | 6/19/2007 14:30:00  |
| IC                  | 567.059   | 11/7/2011 04:45:00  | 0.000   | 6/19/2007 14:30:00  |
| +Watts Total        | 20.034M   | 11/7/2011 04:45:00  | 0.000   | 6/19/2007 14:30:00  |
| +VAR Total          | 1116.092k | 3/4/2009 07:00:00   | 0.000   | 6/19/2007 14:30:00  |
| -Watts Total        | -187.888  | 10/19/2010 14:45:00 | 0.000   | 6/6/2007 11:15:00   |
| -VAR Total          | -13.015k  | 6/19/2011 13:30:00  | 0.000   | 6/6/2007 11:15:00   |
| VA Total            | 20.061M   | 11/7/2011 04:45:00  | 0.000   | 6/19/2007 14:30:00  |
| +Power Factor Total | 0.176     | 10/19/2010 14:00:00 | 1.000   | 6/19/2007 14:30:00  |
| -Power Factor Total | 1.000     | 6/19/2007 14:30:00  | -0.010  | 10/19/2010 14:00:00 |
| Frequency           | 60.201    | 6/6/2007 11:06:12   | 0.000   | 6/6/2007 11:06:12   |
| IN                  | 601.796   | 3/2/2008 05:00:00   | 0.000   | 6/19/2007 14:30:00  |
| +Watts A            | 7741.626k | 8/29/2011 16:15:00  | 0.000   | 6/19/2007 14:30:00  |
| +Watts B            | 8179.757k | 7/11/2008 15:45:00  | 0.000   | 6/19/2007 14:30:00  |
| +Watts C            | 8085.478k | 11/7/2011 04:45:00  | 0.000   | 6/19/2007 14:30:00  |
| +VAR A              | 717.499k  | 3/4/2009 07:00:00   | 0.000   | 6/19/2007 14:30:00  |
| +VAR B              | 553.890k  | 7/11/2008 15:45:00  | 0.000   | 6/19/2007 14:30:00  |

Polling Minimum Timestamps Part 2

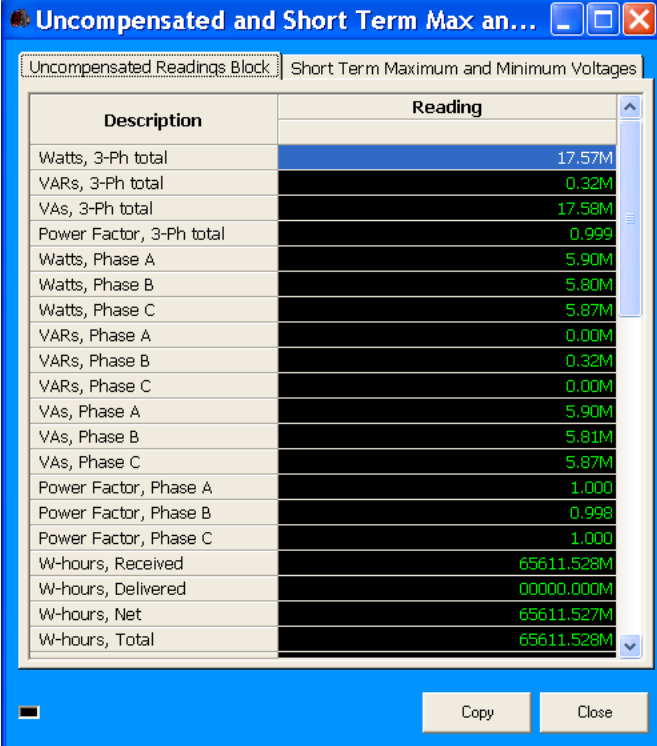
OK Copy Help

This screen displays the maximum and minimum values and the time of their occurrence for all of the IQ 150S/250S Real-Time readings. Use the scroll bar to view readings not displayed on the screen.

- Click Copy to copy the readings to the clipboard. You can then paste them into another document, for example, an Excel file.
- Click OK to close the screen.

## Uncompensated and Short Term Max and Min Readings

Click Real-Time Poll>Real Time Readings>Uncompensated and Short Term Max and Min Readings. You will see the screen shown below.



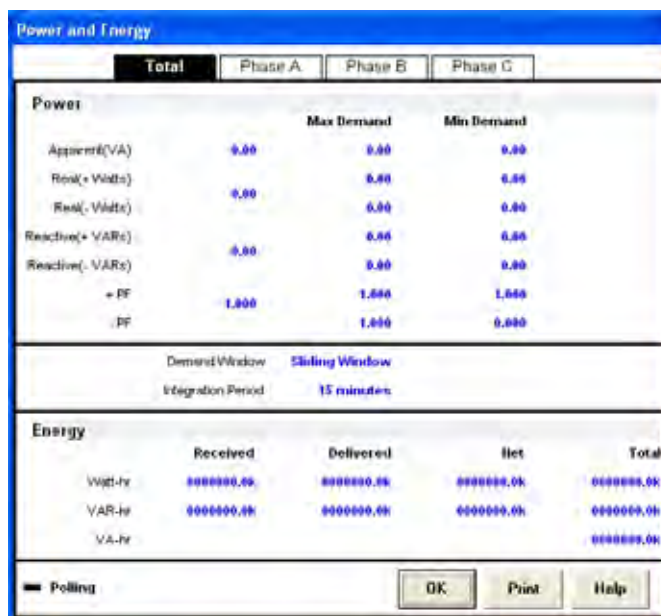
| Description              | Reading    |
|--------------------------|------------|
| Watts, 3-Ph total        | 17.57M     |
| VARs, 3-Ph total         | 0.32M      |
| VAs, 3-Ph total          | 17.58M     |
| Power Factor, 3-Ph total | 0.999      |
| Watts, Phase A           | 5.90M      |
| Watts, Phase B           | 5.80M      |
| Watts, Phase C           | 5.87M      |
| VARs, Phase A            | 0.00M      |
| VARs, Phase B            | 0.32M      |
| VARs, Phase C            | 0.00M      |
| VAs, Phase A             | 5.90M      |
| VAs, Phase B             | 5.81M      |
| VAs, Phase C             | 5.87M      |
| Power Factor, Phase A    | 1.000      |
| Power Factor, Phase B    | 0.998      |
| Power Factor, Phase C    | 1.000      |
| W-hours, Received        | 65611.528M |
| W-hours, Delivered       | 00000.000M |
| W-hours, Net             | 65611.527M |
| W-hours, Total           | 65611.528M |

The initial display shows the uncompensated readings for the meter. Click the Short Term Maximum and Minimum Voltages to see those readings.

- Click Copy to copy the readings to the clipboard. You can then paste them into another document, for example, an Excel file.
- Click Close to close the screen.

## Power and Energy

Click Real-Time Poll>Revenue, Energy and Demand Readings>Power and Energy. You will see the screen shown below.



This screen displays the power and energy for Total power and all three phases.

1. Click the tabs at the top of the screen to select the view you want:

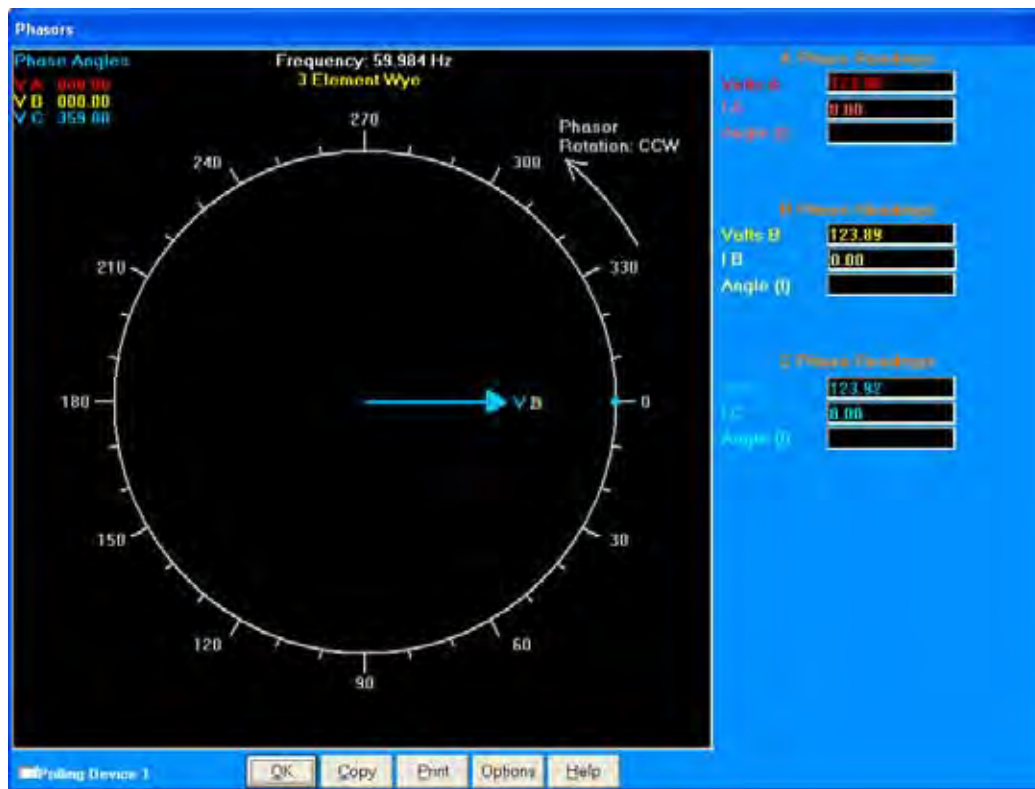
- Total
- Phase A
- Phase B
- Phase C

2. Click Print to print the readings.

3. Click OK to close the screen.

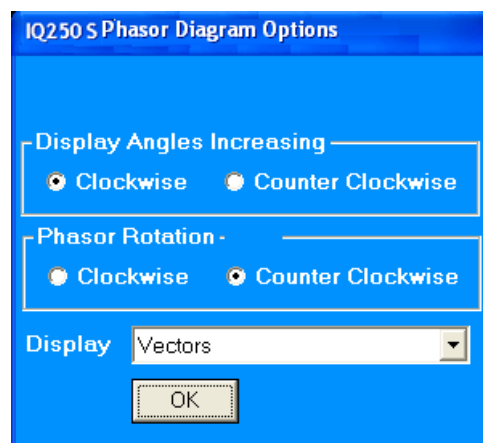
## Poll Phasors

Click Real Time Poll>Power Quality>Phasors. You will see the screen shown below.



The Phasors screen displays the Phase relationships of the currently connected meter.

1. To adjust the Phasor display, click Options at the bottom of the screen. You will see the screen shown below.



- a. In the Display Angles Increasing and Phasor Rotation boxes, select either Clockwise or Counter Clockwise.
  - b. From the pull-down menu at the bottom of the screen, select Vectors, Triangles, or Vectors and Triangles to change the graphic representation of the data.
2. Click OK to save your selections and return to the Phasors screen.
  3. From the Phasors screen:
    - Click Copy to save a copy of the screen to the clipboard.
    - Click Print to send a copy of the graph to a printer.
    - Click Help to view instructions for this screen.
  4. Click OK to return to the main screen.

## Poll Limits (IQ 250S)

Click Real-Time Poll>Power Quality and Alarms>Limits. You will see the screen shown below.



| Limit ID | Label       | Value | Status  |         | Limit 1 |          |            | Limit 2 |          |            |
|----------|-------------|-------|---------|---------|---------|----------|------------|---------|----------|------------|
|          |             |       | Limit 1 | Limit 2 | Setting | Point    | Hysteresis | Setting | Point    | Hysteresis |
| Limit 1  | Volts A-B   | 0.00  | In      | Out     | Above   | 660.000  | 660.000    | Below   | 540.000  | 540.000    |
| Limit 2  | Volts B-C   | 0.00  | In      | Out     | Above   | 660.000  | 660.000    | Below   | 540.000  | 540.000    |
| Limit 3  | Volts C-A   | 0.00  | In      | Out     | Above   | 660.000  | 660.000    | Below   | 540.000  | 540.000    |
| Limit 4  | I A         | 0.00  | In      | Out     | Above   | 5.500    | 5.500      | Below   | 4.500    | 4.500      |
| Limit 5  | I B         | 0.00  | In      | Out     | Above   | 5.500    | 5.500      | Below   | 4.500    | 4.500      |
| Limit 6  | I C         | 0.00  | In      | Out     | Above   | 5.500    | 5.500      | Below   | 4.500    | 4.500      |
| Limit 7  | Watts Total | 0.00  | In      | Out     | Above   | 9900.000 | 9900.000   | Below   | 8100.000 | 8100.000   |
| Limit 8  | Frequency   | 59.99 | In      | In      | Above   | 66.000   | 66.000     | Below   | 54.000   | 54.000     |

This screen shows the current status of any Limits programmed in the Device Profile.

**NOTE:** See instructions for configuring Limits, earlier in this chapter.

1. The displayed fields are:

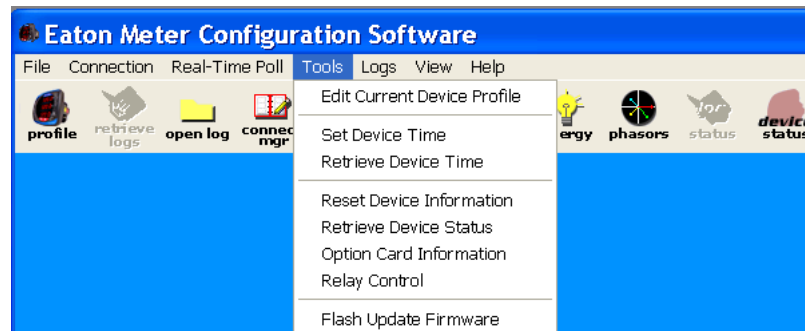
- Limit ID – the identification of the limit
- Label - the item the Limit is set for
- Value – the current reading for this item
- Status/Limit1/Limit2 – whether the current reading is “In” or “Out” for the Above (Limit 1) and Below (Limit 2) Setpoints
- Limit 1/Setting/Point/Hysteresis – Above: the point above which the reading goes out of limit (Setpoint) and the point at which it returns to within limit (Hysteresis)
- Limit 2/Setting/Point/Hysteresis – Below: the point below which the reading goes out of limit (Setpoint) and the point at which it returns to within limit (Hysteresis).

2. Click Print to print the screen.

3. Click OK to close the screen.

### 5.2.5: Using the IQ 150S/250S Tools Menu

The Tools Menu allows you to access specific functions for the IQ 150S/250S meter. Click Tools from the Title Bar to display the Tools Menu.



#### Accessing the Device Profile Screen

Click the first option, Edit Current Device Profile, to open the Device Profile screen. This menu option performs the same function as clicking the Profile icon in the Title Bar.

#### Setting Device Time

Click Tools>Set Device Time. You will see the screen shown below.

The screenshot shows a dialog box titled 'Set On-Board Clock'. It has a blue background. The 'Date' section contains three input fields for 'Month' (05), 'Day' (01), and 'Year' (2011). The 'Time' section contains three input fields for 'Hour' (16), 'Minute' (01), and 'Second' (24). Below these fields is a checkbox labeled 'Use PC Time' which is checked. At the bottom of the dialog are two buttons: 'Send' and 'Cancel'.

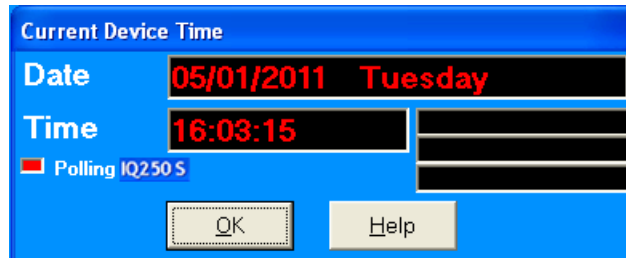
This screen allows you to set the meter's internal clock and/or synchronize it to your PC's time. The meter's clock is used for logging and other time retrieval purposes.

- You can enter a new Month, Day, and Year in the Date fields.
- Check the box next to Use PC Time to synchronize the meter to your PC; uncheck the box if you want to reset the time manually. You can then enter the Hour, Minute, and Seconds you want in the Time fields.

- Click Send to send the new date and/or time to the meter; click Cancel to close the screen.

### Retrieving Device Time

Click Tools>Retrieve Device Time. You will see the screen shown below.

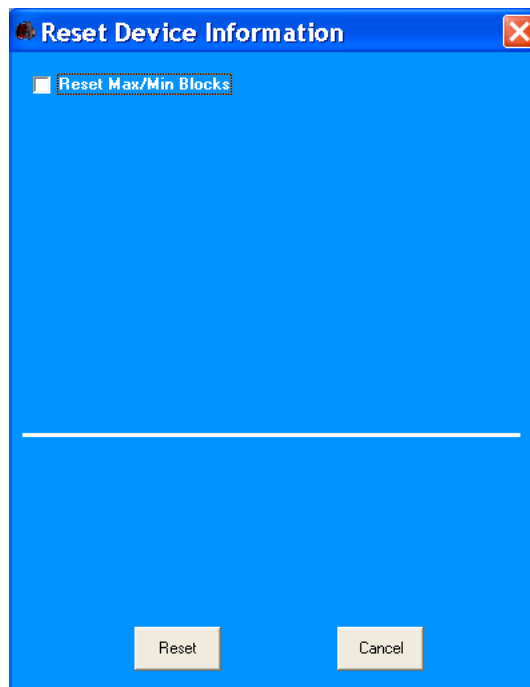


This screen displays the meter's internal time. If Daylight Savings Time is enabled, 'DST' displays in one of the fields to the right of the Time field.

Click OK to close the screen.

### Reset Device Information

Click this option to reset Max/Min values. You will see the screen shown below. Click the checkbox and click Reset to reset max/min values; click Cancel to close the screen without resetting.

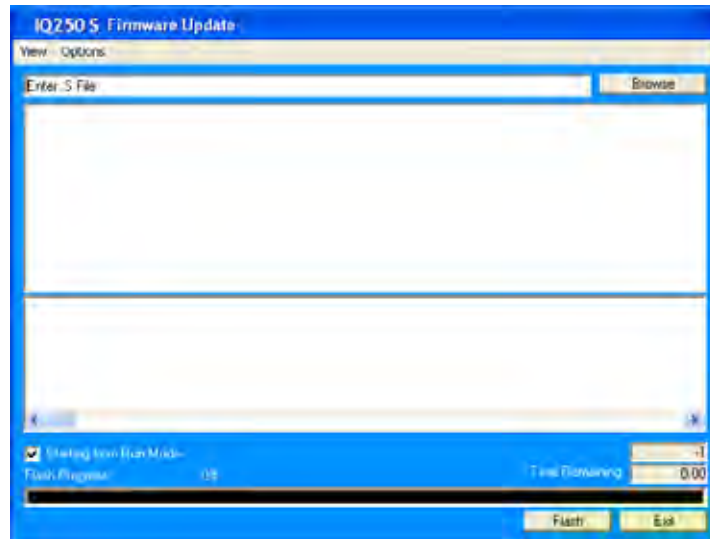


### Retrieve Device Status

Click this option to see the Device status screen for the meter. this is the same screen that displays when you first connect to the meter.

### Flash Update Firmware

Click this option to upgrade the meter's firmware. You will see the screen shown below.



1. Click Browse to locate the flash file.
2. Click OK to update the firmware with the flash file.
3. When flashing is complete, click Exit to close the screen.

NOTE: Flash updating of firmware can only be done at a Baud Rate of 57600.

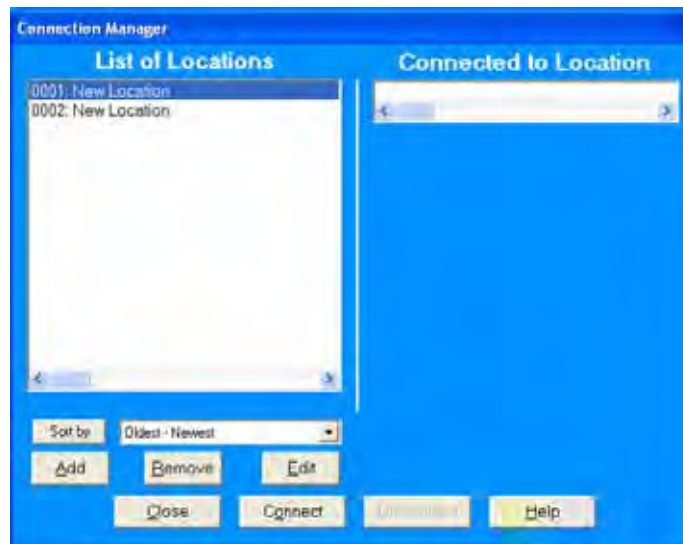
### 5.2.6: Performing Other Tasks with Eaton Meter Configuration Software

The following sections contain instructions for other tasks you can perform using the Eaton Meter Configuration software.

#### Connection Manager

Use Connection Manager to add or remove connection locations and/or devices at locations.

1. Click Connection>Connection Manager or click on the Connect Mgr icon. You will see the screen shown below.



List of Locations:

On the left side of the Connection Manager screen is a List of Locations. These are the locations of one or more meters to which you can connect. You can add a location and/or a device; edit a location and/or device; or remove a location and/or device.

- To add a location:

- a. Click the Add button. You will see the Connection Manager Location Editor screen. On this screen, you program the Communication settings for each new location.

**Connection Manager Location Editor**

Location Name:

☒ **Serial Port**    ☐ **Network**

Com Port:

Baud Rate:     Data Bits:

Flow Control:     Stop Bits:

Parity:

Echo Mode:

☐ Use Modem    ☐ Use Password

Phone Number:

Setup String:

Password:

☐ Use Data Switch String(s)

Connect:

Disconnect:

**Devices At Location**

| Device Address | Device Name | Description |
|----------------|-------------|-------------|
| 1              | Device 1    | Device 1    |

- b. Type a name for the new location.
- c. Click Serial Port or Network.
- d. Enter Communication settings:
- Com Port: COM 1 - 99
  - Baud Rate: 1200 - 115200
  - Flow Control: None or Hardware
  - Data Bits: 8 (or 7)
  - Parity: None (Even, Odd)
- e. To add a device:

- Click Add Serial (to add a Serial Port connected device) or Add Net (to add a Network connected device) in the Devices at Location box. You can add up to 255 devices (Serial Port and/or Network connected) at one location.

**NOTES:**

- All devices must have the same connection parameters: Baud, Parity and Flow Control.
- Multiple devices slow down polling.
- If you are connecting to a device through the Power Xpert® Gateway, the protocol must be Modbus TCP.

f. To edit a device:

- Select the device from the Devices at Location box. (Scroll down to find all devices.)
- Click Edit. You will see the Connection Manager Location Device Editor screen, shown below.

The screenshot shows the 'Connection Manager Location Device Editor' window with the 'Network' tab selected. The 'Device Properties' section includes fields for Address (1), Name (Device 1), Description (Device 1), Protocol (Modbus RTU), Device Type (IQ 105/150S/250/250S/200, P9M 2000), and Comm Port (1). At the bottom are 'Close' and 'Help' buttons.

The screenshot shows the 'Connection Manager Location Device Editor' window with the 'Serial' tab selected. The 'Device Properties' section includes fields for Address (1), Name (Device 1), Description (Device 1), Protocol (Modbus RTU), Device Type (IQ 105/150S/250/250S/200, P9M 2000), IP Address (172.20.167.33), and Network Port (502). At the bottom are 'Close' and 'Help' buttons.

- Use this screen to program the device properties for each device at a location. If the device has a Serial Port device connection, you will see the example screen on the left; if the device has a Network device connection, you will see the example screen on the right.

**NOTE:** Click the Network or Serial button at the top of the screen to switch connection screens.

- Enter Device Properties:

- Address: 1 - 247 (Unique Address)
  - Name: Device Name
  - Description: (Type and Number, for example)
  - Protocol: Modbus RTU, ASCII, or Modbus TCP
  - Device Type: IQ Meter
  - Comm Port: 1 or 2 (Serial Port Only)
  - IP Address: 100.10.10.10 (for example) (Network Only)
  - Port Number: 502 (Default) (Network Only)
- Click Close to save settings and return to the Connection Manager Location Editor screen.
- g. To remove a device, select the device from the Devices at Location box and click Remove.
- h. Click Close to return to the Connection Manager screen.
- To edit a location:
    - a. Select a location from the List of Locations box.
    - b. Click the Edit button. The Connection Manager Location Editor screen appears, displaying the current settings for the location.
    - c. Make any changes to settings and/or devices at the location.
    - d. Click Close to exit the screen.
  - To remove a location:
    - a. Select a location from the List of Locations box.
    - b. Click Remove.
    - c. Click Yes in the Confirmation window.

- To sort the list of locations:
  - a. Select a sort method (A-Z, Z-A, Newest-Oldest or Oldest-Newest) from the pull-down menu.
  - b. Click Sort By.
- To connect to a location:
  - a. Select the location you want to connect to from the List of Locations box. **NOTE:** You may only connect to one location at a time. To change to a different location, you must disconnect from the current location by selecting it and clicking Disconnect.
  - b. Click Connect. When the connection is made, the selected location appears in the Connected To Locations section of the screen.
  - c. Click Close. The Device Status screen opens, confirming the connection. The computer Status bar at the bottom of the screen also confirms the computer's connection parameters.

**NOTE:** If the connection fails, a popup screen alerts you. Check that all cables are secure, that the RS232 cable is connected to the correct Com Port on the computer, and that the computer is set to use the same baud rate and protocol as the meter to which the computer is connected.

#### **Disconnecting from an IQ 150S/250S meter**

To disconnect from a meter or from a location, do one of the following:

- Click on the Disconnect icon in the Title Bar.
- Select Connection>Disconnect from the Title Bar.
- From the Connection Manager screen, select the location from the Connected to Location field and click the Disconnect button.

### Changing the Primary Device/Address

Use this feature to select another meter as the primary device.

1. Click Connect>Change Primary Device/Address. You will see the screen shown below.

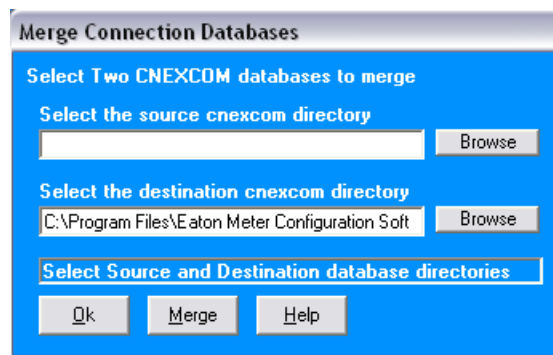


2. Enter the address of the device you want to designate as the new Primary Device.
3. Click OK.

### Merging Connection Databases

Use this feature to combine two sets of cnexcom databases.

1. Click Connection>Merge Connection Databases. You will see the screen shown below. It allows you to select the two databases to merge.



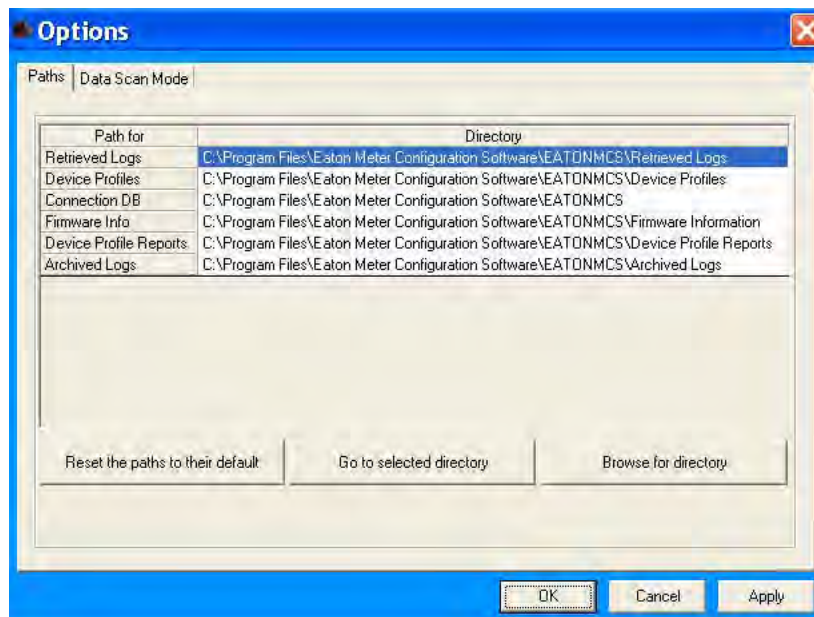
2. Click the Browse button next to each field to pick the databases. The Source cnexcom database will be merged into the Destination cnexcom database.
3. Click the Merge button to proceed with the merge; click OK to exit the screen.

## Using the Options Screen

1. Click View>Options. You will see the screen shown below. Use this screen to access the following features:

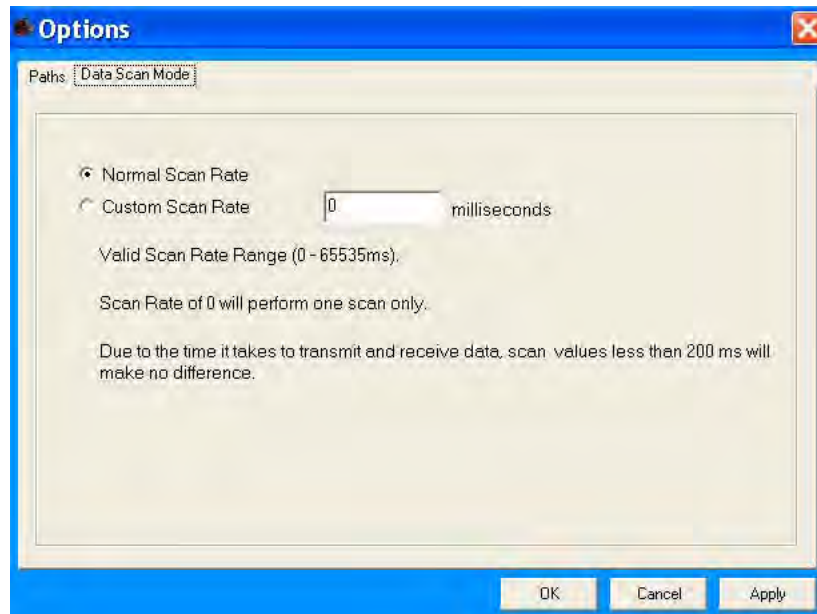
- Paths for Eaton Meter Configuration software files
- Data Scan mode

Use the tabs at the top of the screen to access these features.



2. The first display is the Paths screen, shown above. Use this screen to view or change the paths the Eaton Meter Configuration software uses for data.

3. Click the Data Scan Mode tab to see the screen shown below. Use this screen to select normal scan rate or to enter a custom scan rate.



4. Click:

- Apply to apply your selection(s) and keep the Options screen open
- OK to apply your selection and close the Options screen
- Cancel to close the Options screen without saving any selections that have not been applied

### Using the Help Menu

The Help menu, accessed by clicking Help in the Title Bar, allows you to:

- View this manual online: click Help>this User Manual.
- View information about the Eaton Meter Configuration software, including version number: click Help>About Eaton Meter Configuration Software.

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## 6: Ethernet Configuration

### 6.1: Introduction

The IQ 150S/250S submeter has an option for a WiFi (Wireless) or RJ45 Ethernet connection. This option allows the submeter to be set up for use in a LAN (Local Area Network), using standard WiFi base stations. Configuration for these connections is easily accomplished through your PC using Telnet connections. Then you can access the submeter to perform meter functions directly through any computer on your LAN: the IQ 150S/250S meter does not need to be directly connected (wired) to these computers for it to be accessed.

This chapter outlines the procedures you use to set up the IQ 150S/250S submeter to function via its Ethernet configuration.

### 6.2: Factory Default Settings

The settings shown in Section 6.2.1 are the default settings for the IQ 150S/250S submeter: they are the settings programmed into your meter when it is shipped to you. You may need to modify some of these settings when you set up your Ethernet configuration.

#### NOTES:

- Change Settings 1 and 6 ONLY. Settings 2, 3, and 4 must be the same as shown in Section 6.2.1. If they are not, reset them to the values shown in Section 6.2.1.
- If setting 3 is not CP0..! Defaults (In), the procedure for Network Module Hardware Initialization (Section 6.3.4) will not work.

### 6.2.1: Modbus/TCP to RTU Bridge Setup

#### 1) Network/IP Settings:

Network Mode.....Wired Only

IP Address .....10.0.0.1

Default Gateway .....not set

Netmask .....255.255.255.0

#### 2) Serial & Mode Settings:

Protocol .....Modbus/RTU,Slave(s) attached

Serial Interface ..... 57600,8,N,1,RS232,CH1

#### 3) Modem/Configurable Pin Settings:

CP0..! Defaults (In) CP1..! GPIO (In) CP2..! GPIO (In)

CP3..! GPIO (In) CP4..! GPIO (In) CP5..! GPIO (In)

CP6..! GPIO (In) CP7..! GPIO (In) CP8..! GPIO (In)

CP9..! GPIO (In) CP10..! GPIO (In)

RTS Output ..... Fixed High/Active

#### 4) Advanced Modbus Protocol settings:

Slave Addr/Unit Id Source .. Modbus/TCP header

Modbus Serial Broadcasts ...Disabled (Id=0 auto-mapped to 1)

MB/TCP Exception Codes ....Yes (return 00AH and 00BH)

Char, Message Timeout ..... 00050msec, 05000msec

#### 6) WLAN Settings:

WLAN ..... Disabled, network:LTRX\_IBSS

Topology..... AdHoc, Country: US, Channel: 11

Security..... none

TX Data rate..... 11 Mbps auto fallback

Power management..... not supported in ad hoc mode

D)efault settings, S)ave, Q)uit without save

Select Command or parameter set (1..6) to change:

### **6.3: Configure Network Module**

These procedures detail how to set up the IQ 150S/250S meter on the Network Module.

Only one person at a time can be logged into the network port. This eliminates the possibility of several people trying to configure the Ethernet interface simultaneously.

### **6.3.1: Configuration Requirements**

- You may want to consult your Network Administrator before performing these procedures, since some functions may be restricted to the Network Administrator.
- If you have only one Ethernet adapter (network card), the screen displays only that configuration. You will use this Ethernet adapter to access the IQ 150S/250S meter's Network Module. You may have to configure the Ethernet adapter in order to use it with the IQ 150S/250S meter's Network Module, using the instructions in Section 6.4.2.
- If you have multiple Ethernet adapters (network cards) installed on your computer, you must choose, configure and use the correct one to access the Network Module.
- The Ethernet Adapter must be set up for point-to-point connection in order for it to connect to the IQ 150S/250S meter's Network module, as follows:

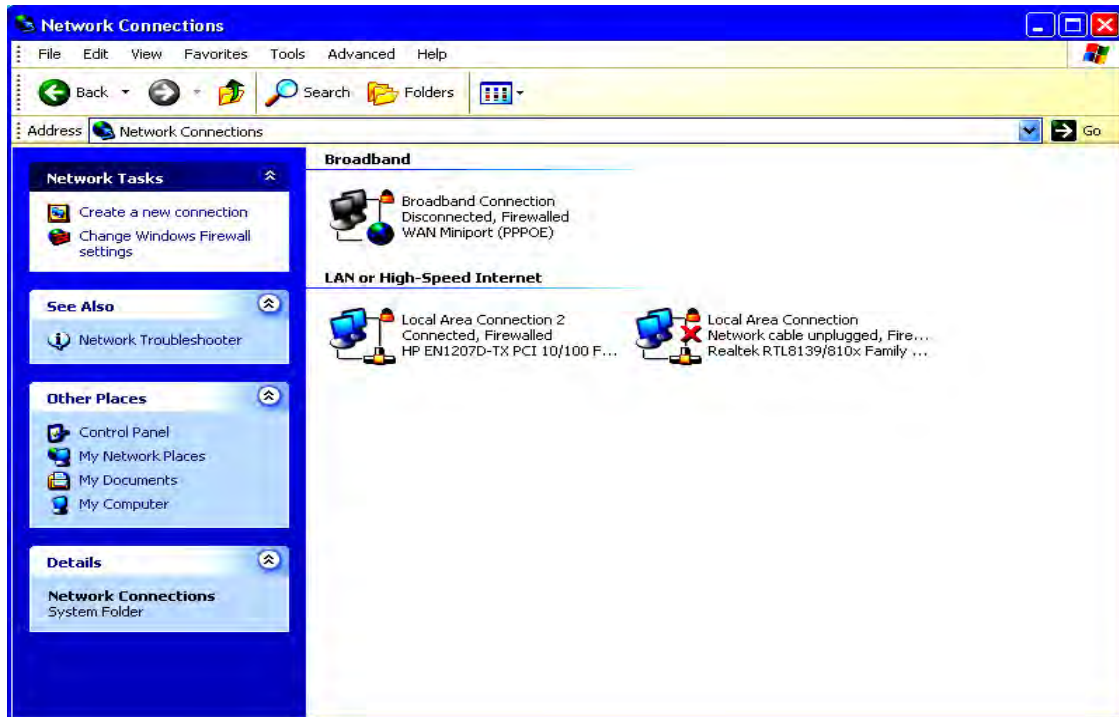
IP Address should be 10.0.0.2

Subnet Mask should be 255.255.255.0

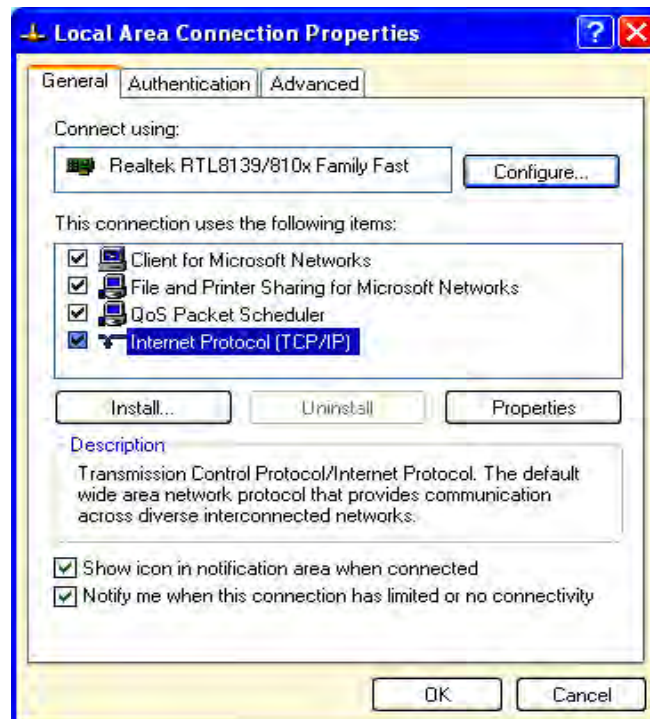
These settings can be made in the Ethernet Adapter. Follow the procedure in Section 6.3.2.

### 6.3.2: Configuring the Ethernet Adapter

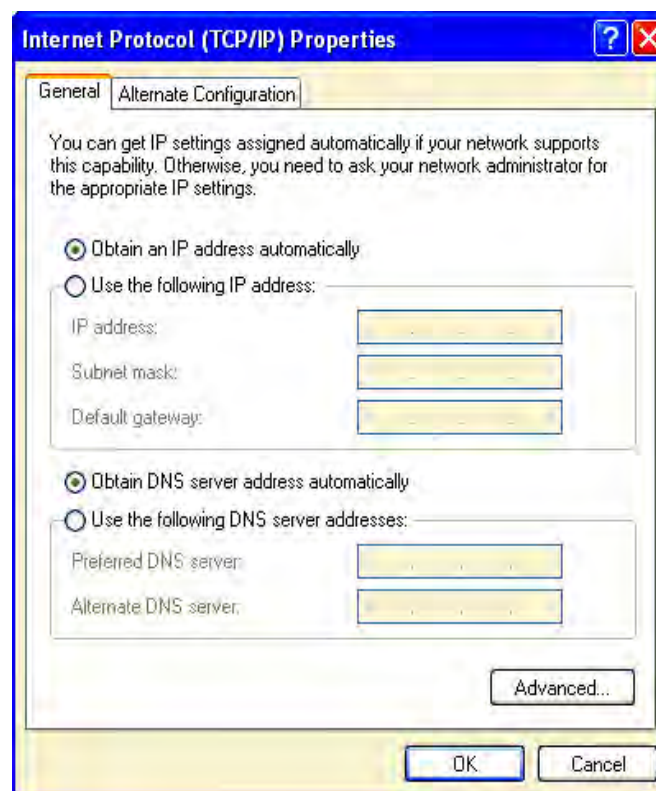
1. From the PC's Start Menu, select **Settings>Network Connections** or **Control Panel>Network Connections**. You will see a screen like the one shown below.



2. Right click on the Local Area Network connection you will be using to connect to the IQ 150S/250S submeter, and select Properties from the pull-down menu. You will see the screen shown on the next page.



3. Select Internet Protocol [TCP/IP] from the middle of the screen and click the Properties button. You will see the screen shown below.



4. Click the Use the Following IP Address radio button. The screen changes to allow you to enter the IP Address and Subnet Mask.
  - a. Enter 10.0.0.2 in the IP Address field.
  - b. Enter 255.255.255.0 in the Subnet Mask field.
3. Click the **OK** button.
4. You can now close the Local Area Connection Properties and Network Connection windows.

### 6.3.3: Detailed Configuration Parameters

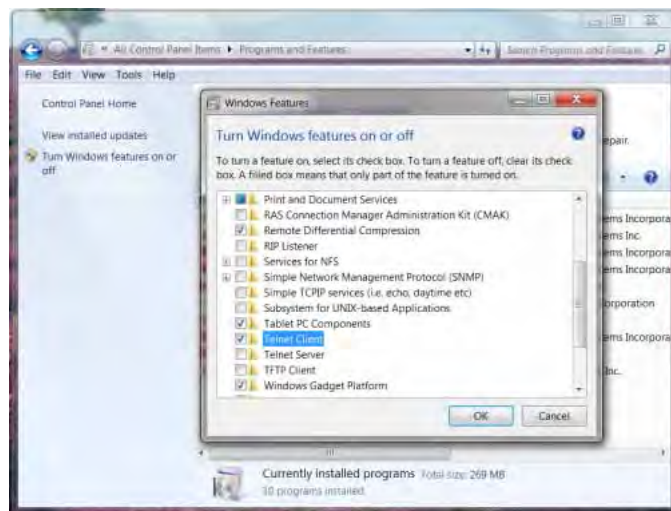
Certain parameters must be configured before the Ethernet interface can function on a network. The following procedure can be locally or remotely configured.

Use a Telnet connection to configure the unit over the network. The Ethernet interface's configuration is stored in meter memory and is retained without power. The configuration can be changed at any time. The Ethernet interface performs a reset after the configuration has been changed and stored.

Establish a Telnet connection to port 9999:

**NOTE:** If your PC is running Windows 7, you need to enable Telnet before using it.

1. Open the Control Panel.
2. Select Programs and Features.
3. Select Turn Windows features on or off.
4. Check the box for Telnet Client.
5. Click OK. The Telnet client is now available.



1. From the Windows Start menu, click **Run** and type 'cmd'.
2. Click the **OK** button to bring up Windows's Command Prompt window.
3. In the Command Prompt window, type:  
**telnet 10.0.0.1 9999** and press the **Enter** key.

**NOTE:** Be sure to include a space between the IP address and 9999.

Microsoft Windows XP [Version 5.1.2600]  
(C) Copyright 1985-2001 Microsoft Corp.

C:\Documents and Settings\Administrator>telnet 10.0.0.1 9999

The following parameters appear, for example:

Serial Number 5415404 MAC Address 00:20:4A:54:3C:2C  
Software Version V01.2 (000719)  
Press Enter to go into Setup Mode

4. Press **Enter** again, quickly.

5. After entering Setup Mode (confirm by pressing Enter), you can configure the parameters for the software you are using by entering one of the numbers on the Change Setup Menu, or you can confirm default values by pressing **Enter**. Be sure to store new configurations when you are finished. The Ethernet Interface will then perform a power reset and the Factory Default Settings will display again (refer to Section 6.2.1).

### 6.3.4: Setup Details

This section illustrates how each section of settings appears on the screen, if you press Y (Yes) to change one or more of the settings.

**CAUTION!** Change Settings 1 and 6 ONLY. Settings 2, 3, and 4 must be the same as shown in Section 6.2.1. If they are not, reset them to the values shown in Section 6.2.1.

#### Network IP Settings Detail (1) (Set device with static IP Address.)

Network Mode: 0=Wired only, 1=Wireless Only <0> ? 1

IP Address <010> 192.<000> 168.<000> .<000> .<001>

Set Gateway IP Address <N> ? Y

Gateway IP Address : <192> .<168> .<000> .<001>

Set Netmask <N for default> <Y> ? Y

<255> .<255> .<255> .<000>

Change telnet config password <N> ? N

#### Serial & Mode Settings (2) (Make sure these settings match those shown in Section 6.2.1.)

Attached Device (1=Slave 2=Master) (1) ? 1

Serial Protocol (1=Modbus/RTU 2=Modbus/ASCII) (1) ? 1

Use serial connector (1=CH1 2=CH2) (1) ? 1

Interface Type (1=RS232 2=RS422/RS485+4-wire 3=RS485+2-wire) (1) ? 1

Enter serial parameters (57600,8,N,1) 57600, 8, N, 1

**Modem/Configurable Pin Settings (3) (Make sure these settings match those shown in Section 6.2.1.)**

**CAUTION!** You must configure this setting correctly in order to be able to use the Network Module Hardware Initialization procedure (Section 6.4).

Press 3. The following appears on the screen:

CP0 Function (hit space to toggle) GPIO (In)

Press the Space bar until the following appears on the screen:

CP0 Function (hit space to toggle) Defaults(In)

Press **Enter**. The following appears on the screen:

Invert (active low) (Y) ?

Press **Y**.

Ignore other settings (press **Enter** through the rest of Setting 3).

**Advanced Modbus Protocol settings (4) (Make sure these settings match those shown in Section 6.2.1.)**

Slave address (0 for auto, or 1..255 fixed otherwise) (0) ? 0

Allow Modbus Broadcasts (1=Yes 2=No) (2) ? 2

Use MB/TCP 00BH/00AH Exception Responses (1=No 2=Yes) (2) ? 2

Disable Modbus/TCP pipeline (1=No 2=Yes) (1) ? 1

Character Timeout (0 for auto, or 10-6950 msec) (50) 50

Message Timeout (200-65000 msec) (5000) 5000

Serial TX delay after RX (0-1275 msec) (0) 0

Swap 4x/0H to get 3x/1x (N) ? N

Local slave address for GPIO (0 to disable, or 1..255) (0) ? 0

**WLAN Settings Detail (6) (The settings shown are recommended by Eaton for use with IQ 150S/250S submeter.)**

Topology: 0=Infrastructure, 1=Ad-Hoc <1> ? 0

Network name <SSID> <LTRX\_IBSS> ? Eaton\_IQ150S\_250S

Security suite: 0=none, 1=WEP, 2=WPA, 3=WPA2/802.11i <0> ? 0

TX Data rate: 0=fixed, 1=auto fallback <1> ? 1

TX Data rate: 0=1, 1=2, 2=5.5, 3=11, 4=18, 5=24, 6=36, 7=54 Mbps <3> ? 7

Enable power management <N> ? Y

**IMPORTANT NOTES:**

- The settings for the Wireless Access Point should be IDENTICAL to the settings for LWAN, shown above. For programming, see the User's Manual for the Wireless Access Point in use.
- See Section 6.3.4.1 for information on using an Encryption key.

**Exiting the screen**

**CAUTION! DO NOT PRESS 'D.'**

Press 'S' to Save the settings you've entered.

### 6.3.4.1: Encryption Key

Eaton recommends that you use 128-bit encryption when setting up your Ethernet configuration.

In the WLAN Settings (6), set Security WEP (1), Authentication shared (1), WEP128 (1) and Change Key (Y).

When Change Key (Y) is entered, you are required to enter an Encryption Key. You can manually enter 26 hexadecimal characters (required for 128-bit encryption) or you can use a WEP Key provider online (example: [www.powerdog.com/wepkey.cgi](http://www.powerdog.com/wepkey.cgi)). WEP Key providers should note on their website that their encryption algorithm is for the Wired Equivalent Privacy portion of IEEE 802.11b/g.

### WEP Key Provider Steps

1. Input 26 alphanumeric characters as your Passphrase.

PASSPHRASE TO HEXADECIMAL WEP KEYS

Enter the passphrase below.

1009egbck001036ab

Generate keys

**IMPORTANT!** Remember your Passphrase.

2. Click the **Generate Keys** button. Your Hexadecimal WEP Keys appear.

PASSPHRASE TO HEXADECIMAL WEP KEYS

The passphrase 1009egbck001036ab produces the following keys:

**64-BIT (40-BIT KEYS)**

1. AA43FB768D
2. 637D8DB9CE
3. AFDE50AF61
4. 0c35E73E25

**128-BIT (104-BIT) KEY**

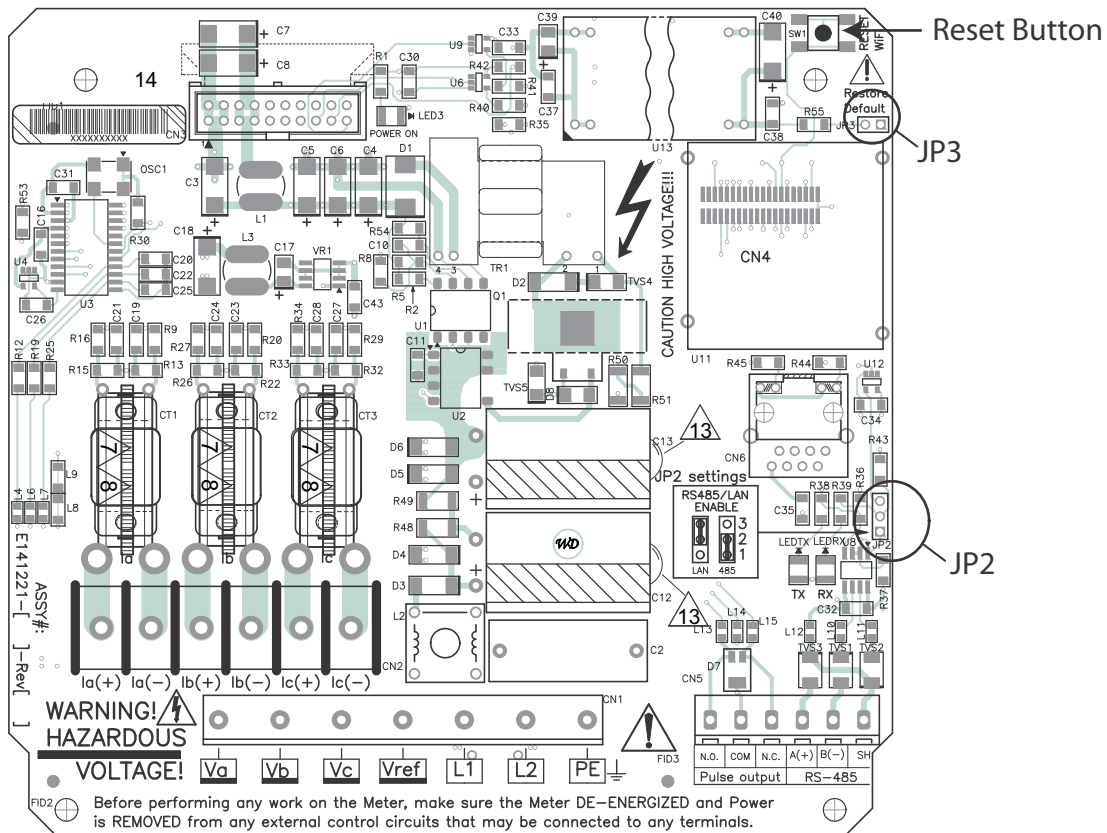
041D7773D8B2C1D97BE9531DC

3. Input the 128-bit Key in the Change Key section of the WLAN Settings (6).
4. Continue inputting settings.
5. Press 'S' to Save your settings.

## 6.4: Network Module Hardware Initialization

If you don't know your current Network Module settings, or if the settings are lost, you can use this method to initialize the hardware with known settings you can then work with.

**Main Board**



1. Place a shorting block on JP3 and press the **Reset** button on the main board.  
**NOTE:** JP3 is located on the right hand side, upper corner of the main board. The shorting block can be "borrowed" from JP2, located at the middle, right hand side. See the figure shown above.
2. After you press the **Reset** button, move the jumper back to JP2.
3. Make sure your settings are the same as those in Section 6.2.1. Follow the steps in Section 6.3 to configure the Network Module.

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## 7: Using the Submeter

### 7.1: Introduction

The IQ 150S/250S submeter can be configured and a variety of functions can be accomplished by using the Elements and the Buttons on the submeter face. This chapter reviews front panel navigation. See Appendix A for complete Navigation maps.

#### 7.1.A: Understanding Submeter Face Elements

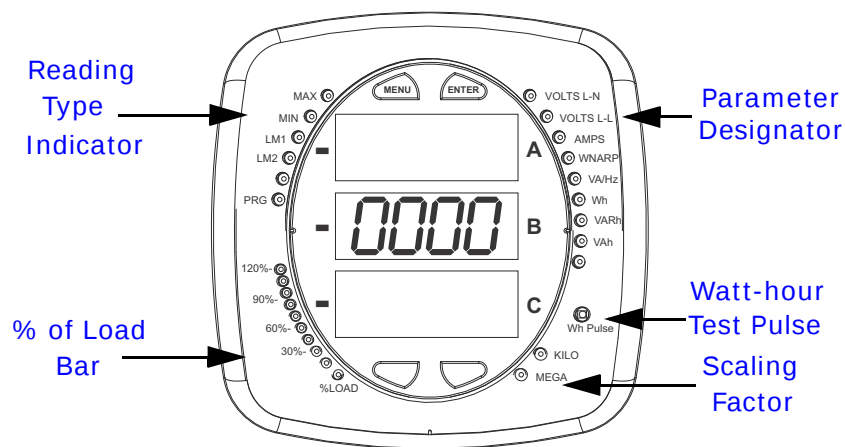


Figure 7.1: Faceplate with Elements

The meter face features the following elements:

- Reading Type Indicator: e.g., Max (The meter shown above is an IQ 250S - the LM1 and LM2 indicators are not one the IQ 150S meter.)
- Parameter Designator: e.g., Volts L-N
- 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 (Refer to Section 7.3 for additional information.)

### 7.1.B: Understanding Submeter Face Buttons

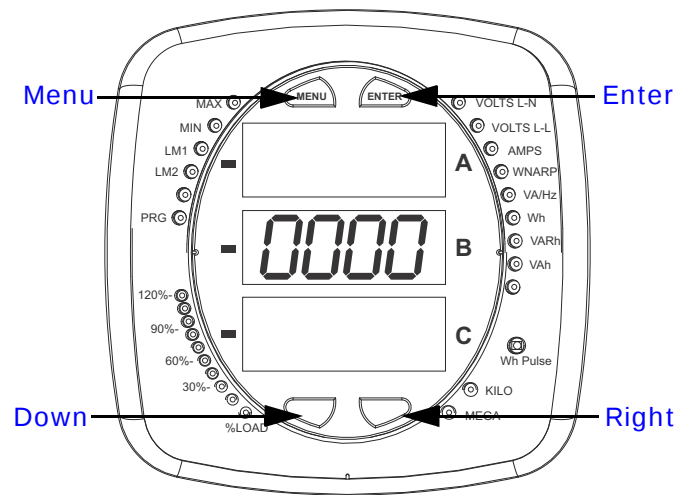


Figure 7.2: Faceplate with Buttons

The meter face has **Menu**, **Enter**, **Down** and **Right** buttons, which let you 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 (IQ 250S)

## 7.2: Using the Front Panel

You can access four modes using the IQ 150S/250S submeter's front panel buttons:

- Operating mode (Default)
- Reset mode
- Configuration mode
- Information mode - Information mode displays a sequence of screens that show model information, such as Frequency, Amps, etc.

Use the **Menu**, **Enter**, **Down** and **Right** buttons to navigate through each mode and its related screens.

### NOTES:

- See Appendix A for the complete display mode Navigation maps.
- The meter can also be configured using software; see Chapter 5 for instructions.

### 7.2.1: Understanding Startup and Default Displays

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

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

After startup, if auto-scrolling is enabled, the IQ 150S/250S meter scrolls the parameter readings on the right side of the front panel. The Kilo or Mega LED lights, showing the scale for the Wh, VARh and VAh readings. Figure 7.3 shows an example of a Wh reading.

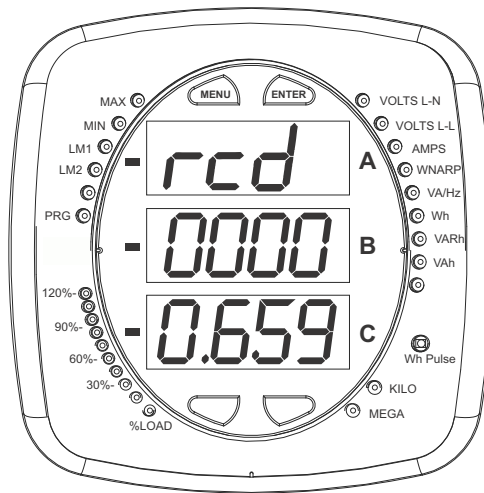


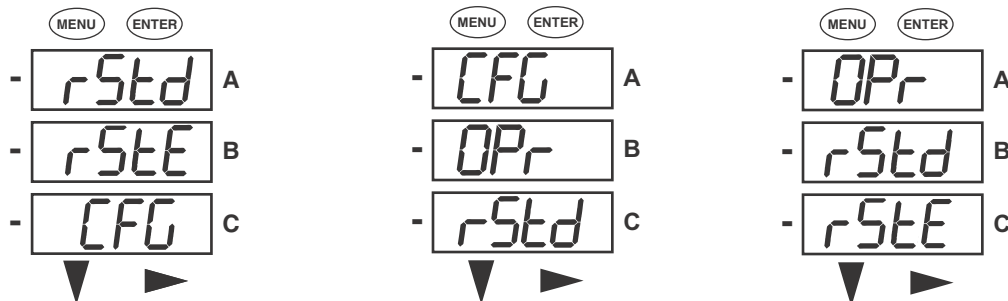
Figure 7.3: Display Showing Watt-hr Reading

The IQ 150S/250S meter continues to provide scrolling readings until one of the buttons on the front panel is pressed, causing the meter to enter one of the other Modes.

### 7.2.2: 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.

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

### 7.2.3: Using Reset Mode

Reset mode has two options:

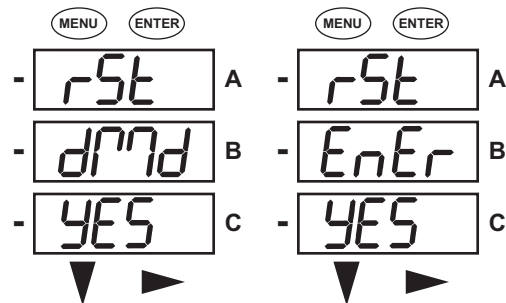
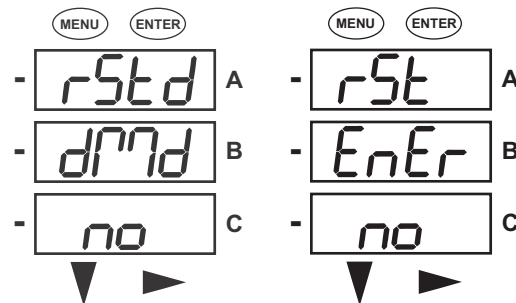
- Reset: Demand (rStd): resets the Max and Min values.
- Reset: Energy (rStE): resets the energy accumulator fields.

1. 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 5 for information on Password protection). To enter a password, follow the instructions in Section 7.2.4.



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

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

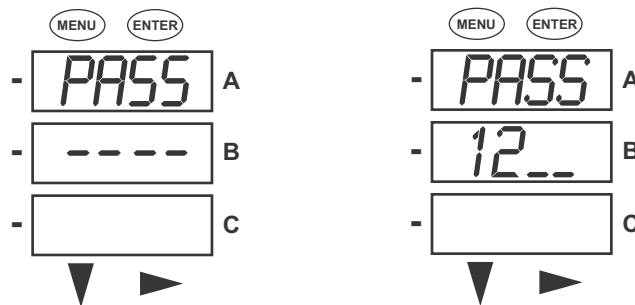
### 7.2.4: Entering a Password

If Password protection has been enabled in the software for reset and/or configuration (see Chapter 5 for more 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.

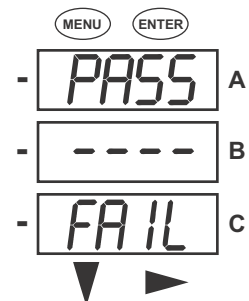
1. Press the **Down** button to scroll numbers from 0 to 9 for the flashing dash. When the correct number appears for that dash, use the **Right** button to move to the next dash.

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



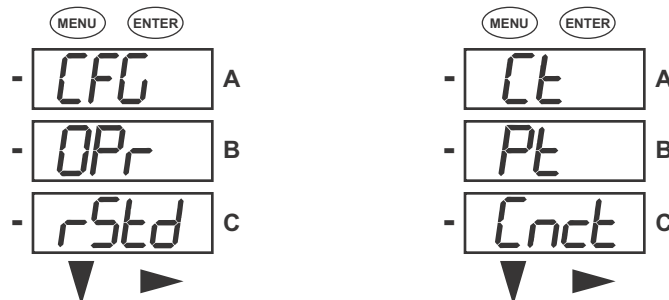
### 7.2.5: Using Configuration Mode

Configuration mode follows Reset: Energy on the Main Menu.

#### To access Configuration mode

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

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



Press **Enter** when CFG is in A window - Parameter screen appears -

Press **Down**- Press **Enter** when

Parameter you want is in A window

6. The parameter screen appears, showing the current settings. To change the settings:

- Use either the **Down** button or the **Right** button to select an option.
- To enter a number value, use the **Down** button to select the number value for a digit and the **Right** button to move to the next digit.

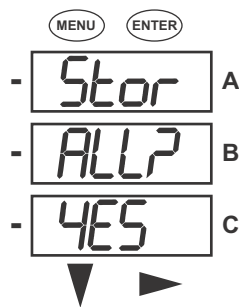
**NOTE:** When you try to change the current setting and Password protection is enabled for the meter, the Password screen appears. See Section 7.2.4 for instructions on entering a password.

7. Once you have entered the new setting, press the **Menu** button twice.

8. The Store ALL YES screen appears. You can either:

- Press the **Enter** button to save the new setting.
- Press the **Right** button to access the Store ALL no screen; then press the **Enter** button to cancel the Save.

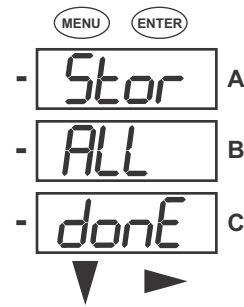
9. If you have saved the settings, the Store ALL done screen appears and the meter resets.



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



Press the **Enter** button to Cancel the Save.



The settings have been saved.

### 7.2.5.1: Configuring the Scroll Feature

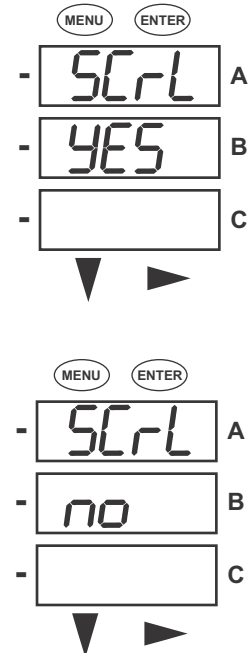
When in Auto Scroll mode, the meter performs a scrolling display, showing each parameter for 7 seconds, with a 1 second pause between parameters. The parameters that the meter displays have been selected through Eaton Meter Configuration software (refer to Chapter 5 for instructions).

#### 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).
4. The CT- n screen appears (this is the next Configuration mode parameter).

#### NOTES:

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



### 7.2.5.2: 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 Section 7.2.4 for instructions on doing so.

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.

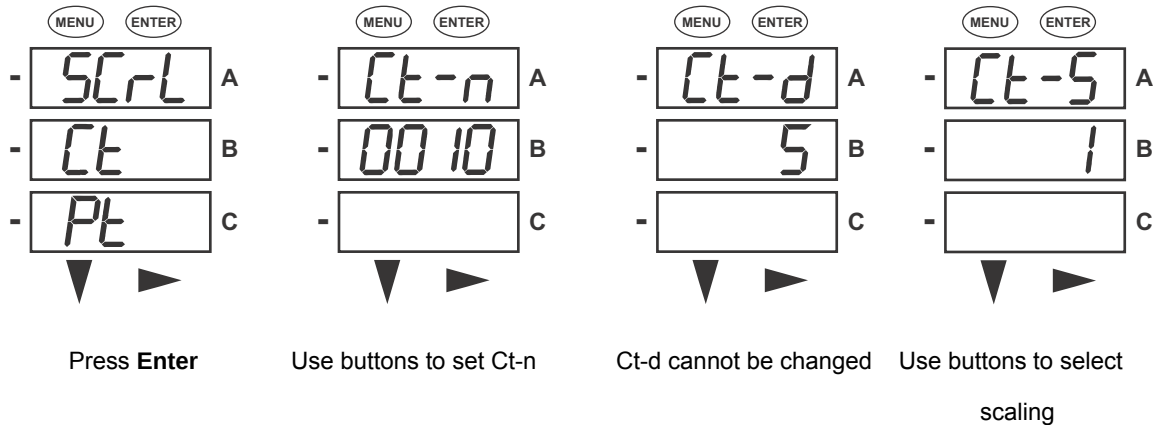
800/5 Amps: Set the Ct-n value for 800 and the Ct-S value for 1.

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.

**7.2.5.3: 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 Section 7.2.4 for instructions on doing so.

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 PT Settings:

277/277 Volts: Pt-n value is 277, Pt-d value is 277, Pt-S value is 1.

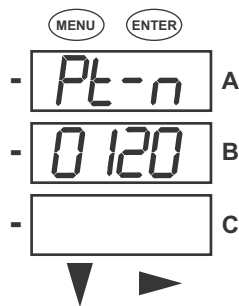
14,400/120 Volts: Pt-n value is 1440, Pt-d value is 120, Pt-S value is 10.

138,000/69 Volts: Pt-n value is 1380, Pt-d value is 69, Pt-S value is 100.

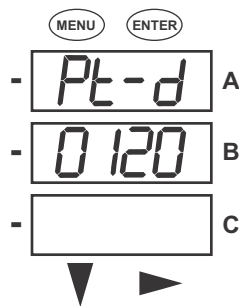
345,000/115 Volts: Pt-n value is 3450, Pt-d value is 115, Pt-S value is 100.

345,000/69 Volts: Pt-n value is 345, Pt-d value is 69, Pt-S value is 1000.

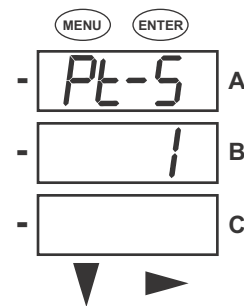
**NOTE:** Pt-n and Pt-S are dictated by primary voltage; Pt-d is secondary voltage.



Use buttons to set Pt-n



Use buttons to set Pt-d



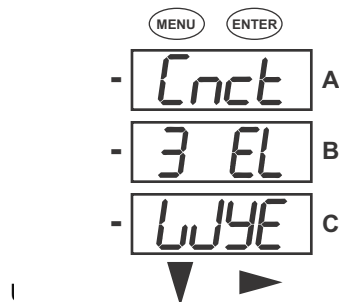
Use buttons to select scaling

### 7.2.5.4: 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 Section 7.2.4 for instructions on doing so.

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.



### 7.2.5.5: 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), 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:

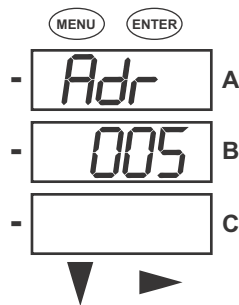
From the Prot screen:

Press the **Right** button or the **Down** button to select the setting you want.

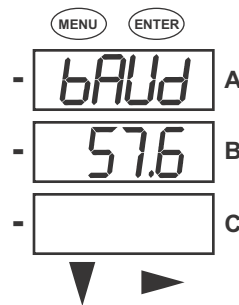
**NOTE:** If you are prompted to enter a password, refer to Section 7.2.4 for instructions on doing so.

2. When you have finished making your selections, press the **Menu** button twice.

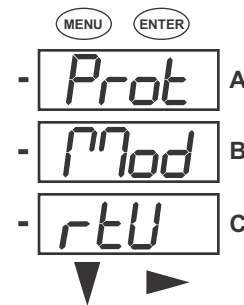
3. The STOR ALL YES screen appears. Press **Enter** to save the settings.



Use buttons to enter Address



Use buttons to select Baud Rate



Use buttons to select Protocol

### 7.2.6: Using Operating Mode

Operating mode is the IQ150S/250S submeter's default mode, that is, the standard front panel display. After starting up, 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

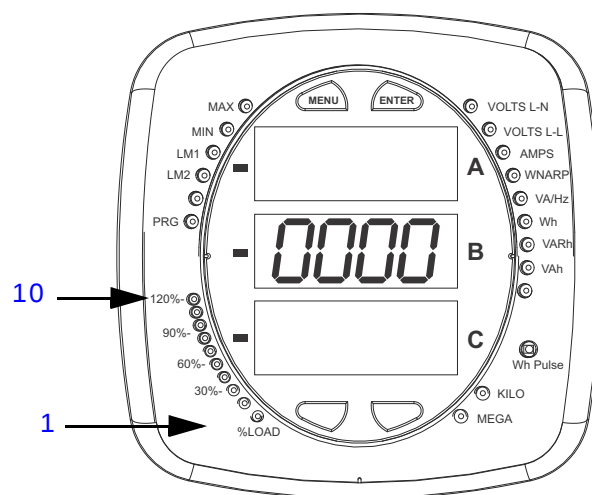
|           |           |                  |                  |                  |              |
|-----------|-----------|------------------|------------------|------------------|--------------|
| VOLTS L-N | VOLTS_LN  | VOLTS_LN_MAX     | VOLTS_LN_MIN     |                  | VOLTS_LN_THD |
| VOLTS 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      |                  |                  |                  |              |

### 7.3: Understanding the % of Load Bar

The 10-segment LED bar graph at the bottom left of the IQ 150S/250S meter's front panel provides a graphic representation of Amps. The segments light according to the load, as shown in the table below.

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

| 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 %              |



## 7.4: 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 IQ 150S/250S submeter is a traceable revenue meter, it 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.

- Refer to Figure 7.5 for an example of how this process works.
- Refer to Table 7.1 for the Wh/Pulse constants for accuracy testing.

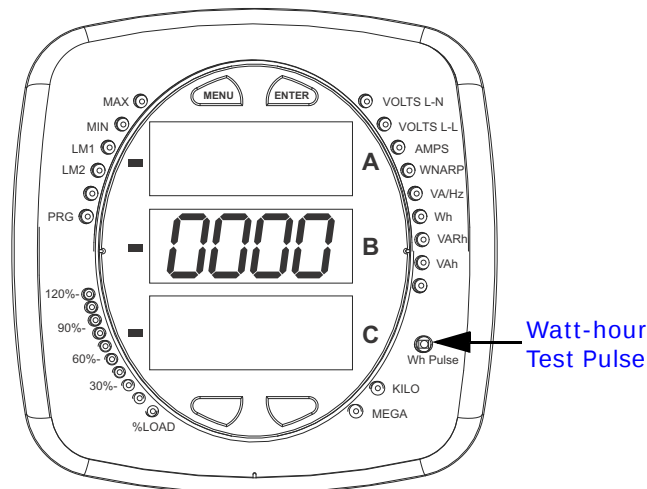


Figure 7.4: Watt-hour Test Pulse

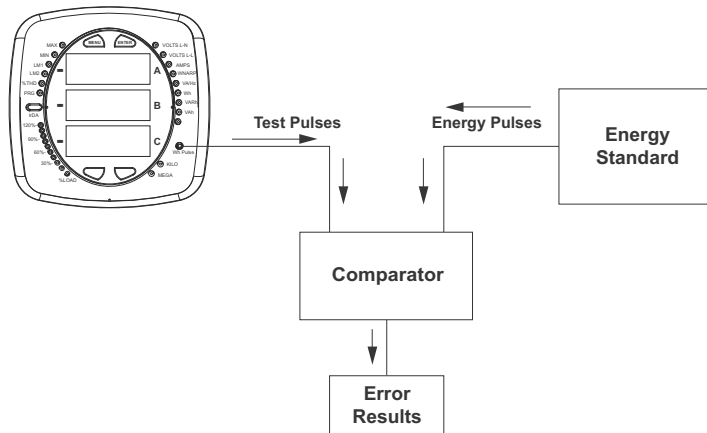


Figure 7.5: Using the Watt-hour Test Pulse

| Meter   | Input Voltage Level | Class 10 Models | Class 2 Models |
|---------|---------------------|-----------------|----------------|
| IQ 150S | Below 150V          | 0.2505759630    | 0.0501151926   |
|         | Above 150V          | 1.0023038521    | 0.2004607704   |
| IQ 250S | Below 150V          | 0.500017776     | 0.1000035555   |
|         | Above 150V          | 2.000071103     | 0.400014221    |

Table 7.1: Infrared &amp; KYZ Pulse Constants for Accuracy Testing - Kh Watt-hour per pulse

**NOTES:**

- Minimum pulse width for the IQ 150S is 40 milliseconds; minimum pulse width for the IQ 250S is 90 milliseconds.
- Refer to Chapter 2, Section 2.2, for Wh Pulse specifications.

## A: IQ 150S/250S Meter Navigation Maps

### A.1: Introduction

You can configure the IQ 150S/250S meter and perform related tasks using the buttons on the meter face. Chapter 7 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 5).

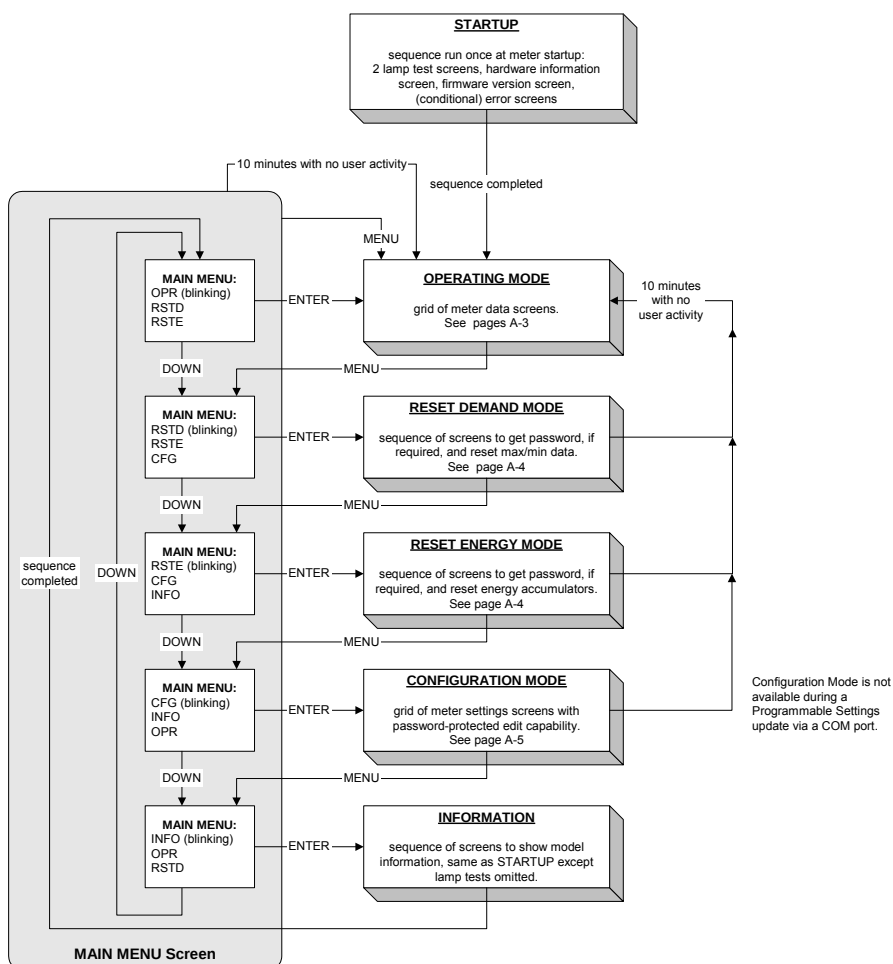
### A.2: Navigation Maps (Sheets 1 to 4)

The IQ 150S/250S meter's 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 automatically return to Operating mode after 10 minutes with no user activity.

#### **IQ 150S/250S meter Navigation map titles**

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

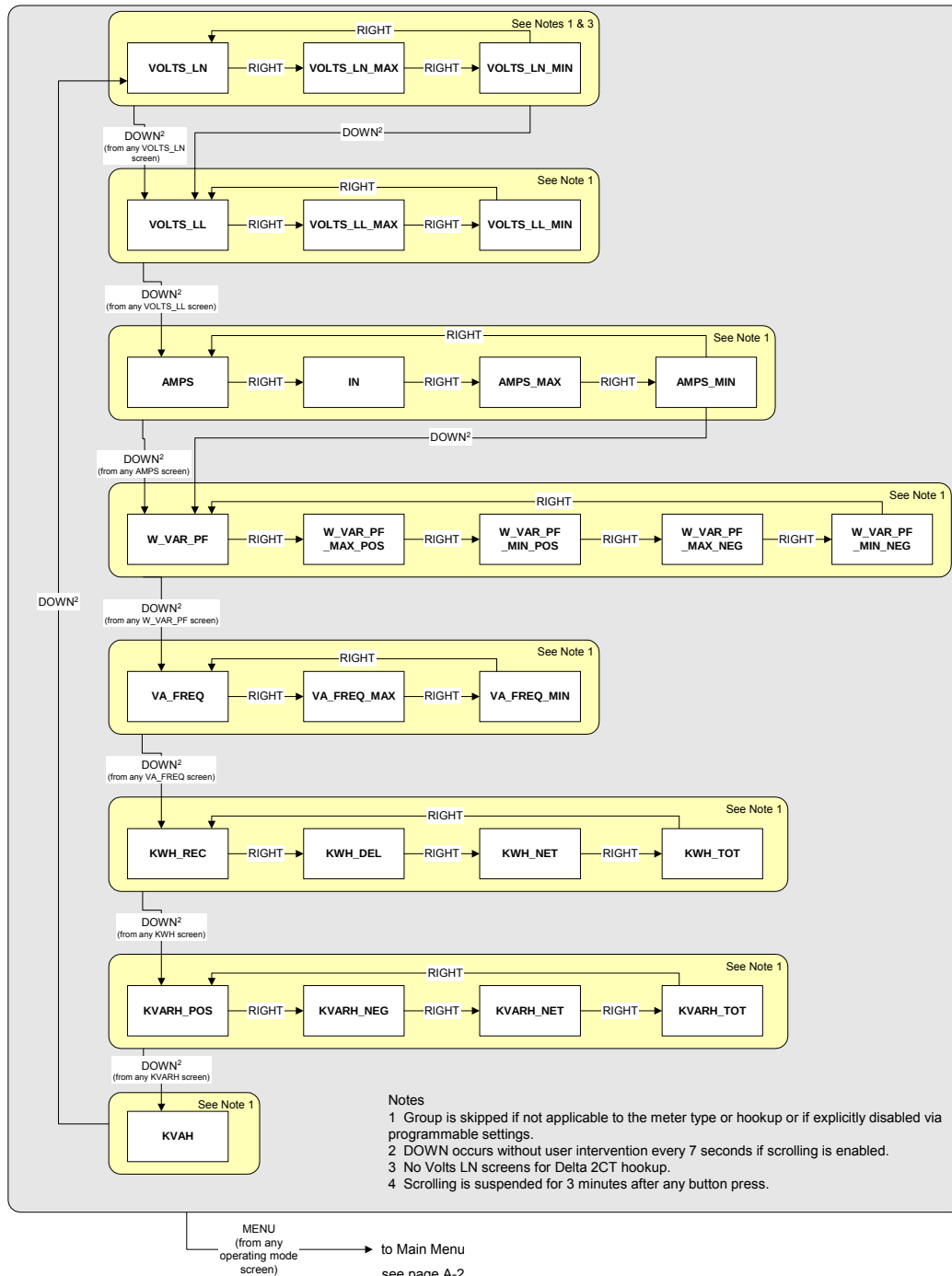
## Main Menu Screens (Sheet 1)



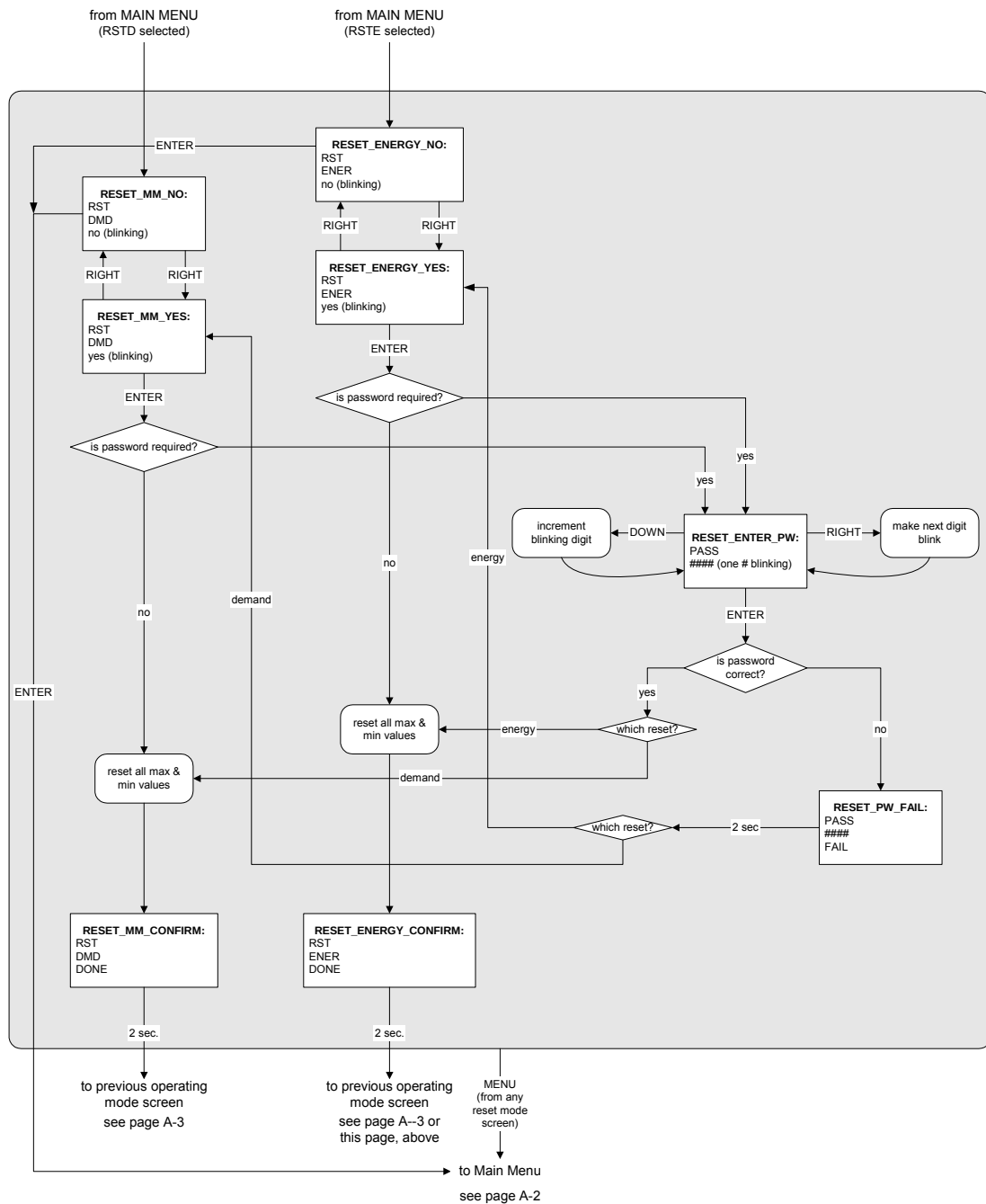
MAIN MENU screen scrolls through 4 choices, showing 3 at a time. The top choice is always the "active" one, which is indicated by blinking the legend.

| SYMBOLS                        | BUTTONS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|--------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| single screen                  | MENU Returns to previous menu from any screen in any mode                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| all screens for a display mode | ENTER Indicates acceptance of the current screen and advances to the next one                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| group of screens               | DOWN, RIGHT Navigation:<br>No digits or legends are blinking. On a menu, down advances to the next menu selection, right does nothing. In a grid of screens, down advances to the next row, right advances to the next column. Rows, columns, and menus all navigate circularly. A digit or legend is blinking to indicate that it is eligible for change. When a digit is blinking, down increases the digit value, right moves to the next digit. When a legend is blinking, either button advances to the next choice legend. |
| action taken                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| button                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

## Operating Mode Screens (Sheet 2)



**Reset Mode Screens (Sheet 3)**



See Note 1

**CONFIG\_MENU:**  
SCRL (blinking)  
CT  
PT

ENTER → **SCROLL\_EDIT:**  
SCRL  
yes or no  
(choice blinking if edit)

DOWN or RIGHT<sup>3</sup> → toggle scroll setting

DOWN → **CONFIG\_MENU:**  
CT (blinking)  
PT  
CNCT

ENTER → **CTN\_EDIT:**  
CT-N  
####  
(one # blinking if edit)

increment blinking digit (DOWN), blink next digit (RIGHT)

ENTER → **CTD\_SHOW:**  
CT-D  
1 or 5

ENTER → **CT\_MULT\_EDIT:**  
CT-S  
1 or 10 or 100  
(choice blinking if edit)

DOWN or RIGHT → show next choice

DOWN → **CONFIG\_MENU:**  
PT (blinking)  
CNCT  
PORT

ENTER → **PTN\_EDIT:**  
PT-N  
####  
(one # blinking if edit)

increment blinking digit (DOWN), blink next digit (RIGHT)

ENTER → **PTD\_EDIT:**  
PT-D  
####  
(one # blinking if edit)

increment blinking digit (DOWN), blink next digit (RIGHT)

ENTER → **PT\_MULT\_EDIT:**  
PT-S  
1 or 10 or 100 or 1000  
(choice blinking if edit)

DOWN or RIGHT → show next choice

DOWN → **CONFIG\_MENU:**  
CNCT (blinking)  
PORT  
PASS<sup>2</sup>

ENTER → **CONNECT\_EDIT:**  
CNCT  
1 of 3 choices  
(choice blinking if edit)

DOWN or RIGHT → show next choice

CNCT choices:  
3 EL WYE,  
2 CT DEL,  
2.5EL WYE

DOWN → **CONFIG\_MENU:**  
PORT (blinking)  
PASS<sup>2</sup>  
SCRL

ENTER → **ADDRESS\_EDIT:**  
ADR  
###  
(one # blinking if edit)

increment blinking digit (DOWN), blink next digit (RIGHT)

ENTER → **BAUD\_EDIT:**  
BAUD  
##.#  
(choice blinking if edit)

DOWN or RIGHT → show next choice

ENTER → **PROTOCOL\_EDIT:**  
PROT  
1 of 3 choices  
(choice blinking if edit)

DOWN or RIGHT → show next choice

PROT choices:  
MOD RTU,  
MOD ASCII,  
DNP

DOWN<sup>2</sup> → **CONFIG\_MENU:**  
PASS<sup>2</sup> (blinking)  
SCRL  
CT

ENTER → **PASSWORD\_EDIT:**  
PASS  
#### (one # blinking)

increment blinking digit (DOWN), blink next digit (RIGHT)

**Notes:**

- Initial access is view-only. View access shows the existing settings. At the first attempt to change a setting (DOWN or RIGHT pressed), password is requested (if enabled) and access changes to edit. Edit access blinks the digit or list choice eligible for change and lights the PRG LED.
- Skip over password edit screen and menu selection if access is view-only or if password is disabled.
- Scroll setting may be changed with view or edit access.
- ENTER accepts an edit; MENU abandons it.

**CONFIG\_MENU** screen scrolls through 6 choices, showing 3 at a time. The top choice is always the "active" one, indicated by blinking the legend.

any changes? → yes → **SAVE\_YES:**  
STOR  
ALL?  
yes (blinking)

no → MENU → to Main Menu see page A-2

ENTER → save new configuration → **SAVE\_CONFIRM:**  
STOR  
ALL  
DONE

2 sec. → reboot → to previous operating mode screen see page A-3 or A-4

RIGHT → **SAVE\_NO:**  
STOR  
ALL?  
no (blinking)

ENTER → to previous operating mode screen see page A-3 or A-4

first DOWN or RIGHT in view access (if password required) → **CFG\_ENTER\_PW:**  
PASS  
### (one # blinking)

increment blinking digit (DOWN), blink next digit (RIGHT)

ENTER → is password correct? → yes → to the originating EDIT screen

no → to previous operating mode screen see page A-3 or A-4

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## B: IQ 150S/250S Meter Modbus Map

### B.1: Introduction

The Modbus Map for the IQ 150S/250S Meter gives details and information about the possible readings of the meter and about the programming of the meter. The IQ 150S/250S can be programmed using the buttons on the face plate of the meter (Chapter 7). The meter can also be programmed using software. For programming instructions, see Section 5.2.

### B.2: Modbus Register Map Sections

The IQ 150S/250S Modbus Register Map includes the following sections:

Fixed Data Section, Registers 1- 47, details the Meter's Fixed Information described in Section 7.2.

Meter Data Section, Registers 1000 - 5003, details the Meter's Readings, including Primary Readings, Energy Block, Demand Block, Maximum and Minimum Blocks, Phase Angle Block and Status Block. Operating Mode readings are described in Section 7.2.6.

Commands Section, Registers 20000 - 26011, details the Meter's Resets Block, Programming Block, Other Commands Block and Encryption Block.

Programmable Settings Section, Registers 30000 - 30067, details the Meter's Basic Setups.

Secondary Readings Section, Registers 40001 - 40100, details the Meter's Secondary Readings Setups.

IQ 250S Only - Log Retrieval Section, Registers 49997 - 51127, details log and retrieval. See Section B.5 for instructions on retrieving logs.

### B.3: Data Formats

|                |                                                                                                           |
|----------------|-----------------------------------------------------------------------------------------------------------|
| ASCII:         | ASCII characters packed 2 per register in high, low order and without any termination characters.         |
| SINT16/UINT16: | 16-bit signed/unsigned integer.                                                                           |
| SINT32/UINT32: | 32-bit signed/unsigned integer spanning 2 registers. The lower-addressed register is the high order half. |

FLOAT:

32-bit IEEE floating point number spanning 2 registers. The lower-addressed register is the high order half (i.e., contains the exponent).

## B.4: Floating Point Values

Floating Point Values are represented in the following format:

|          |   |          |   |   |   |   |   |   |   |          |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|----------|---|----------|---|---|---|---|---|---|---|----------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Register | 0 |          |   |   |   |   |   |   |   |          |   |   |   |   |   |   | 1 |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| Byte     | 0 |          |   |   |   |   |   |   | 1 |          |   |   |   |   |   |   | 0 |   |   |   |   |   |   |   | 1 |   |   |   |   |   |   |   |
| Bit      | 7 | 6        | 5 | 4 | 3 | 2 | 1 | 0 | 7 | 6        | 5 | 4 | 3 | 2 | 1 | 0 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| Meaning  | s | e        | e | e | e | e | e | e | e | m        | m | m | m | m | m | m | m | m | m | m | m | m | m | m | m | m | m | m | m | m | m | m |
| sign     |   | exponent |   |   |   |   |   |   |   | mantissa |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |

The formula to interpret a Floating Point Value is:

$$-1^{sign} \times 2^{exponent-127} \times 1.mantissa = 0x0C4E11DB9$$

$$-1^{sign} \times 2^{137-127} \times 1.1000010001110110111001$$

$$-1 \times 2^{10} \times 1.75871956$$

$$-1800.929$$

| Register | 0x0C4E1 |             |   |   |   |   |   |   |       |                            |   |   |   |   |   |   | 0x01DB9 |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |
|----------|---------|-------------|---|---|---|---|---|---|-------|----------------------------|---|---|---|---|---|---|---------|---|---|---|---|---|---|---|--------|---|---|---|---|---|---|---|
| Byte     | 0x0C4   |             |   |   |   |   |   |   | 0x0E1 |                            |   |   |   |   |   |   | 0x01D   |   |   |   |   |   |   |   | 0x0B9v |   |   |   |   |   |   |   |
| Bit      | 7       | 6           | 5 | 4 | 3 | 2 | 1 | 0 | 7     | 6                          | 5 | 4 | 3 | 2 | 1 | 0 | 7       | 6 | 5 | 4 | 3 | 2 | 1 | 0 | 7      | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|          | 1       | 1           | 0 | 0 | 0 | 1 | 0 | 0 | 1     | 1                          | 1 | 0 | 0 | 0 | 0 | 1 | 0       | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 1      | 0 | 1 | 1 | 1 | 0 | 0 | 1 |
| Meaning  | s       | e           | e | e | e | e | e | e | e     | m                          | m | m | m | m | m | m |         |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |
|          | m       | m           | m | m | m | m | m | m | m     | m                          | m | m | m | m | m | m |         |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |
| sign     |         | exponent    |   |   |   |   |   |   |       | mantissa                   |   |   |   |   |   |   |         |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |
| 1        |         | 0x089 + 137 |   |   |   |   |   |   |       | 0b011000010001110110111001 |   |   |   |   |   |   |         |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |

Formula Explanation:

$$C4E11DB9 \text{ (hex)} \quad 11000100 \ 11100001 \ 00011101 \ 10111001$$

(binary)

The sign of the mantissa (and therefore the number) is 1, which represents a negative value.

The Exponent is 10001001 (binary) or 137 decimal.

The Exponent is a value in excess 127. So, the Exponent value is 10.

The Mantissa is 11000010001110110111001 binary.

With the implied leading 1, the Mantissa is (1).611DB9 (hex).

The Floating Point Representation is therefore -1.75871956 times 2 to the 10.

Decimal equivalent: -1800.929

**NOTES:**

- Exponent = the whole number before the decimal point.
- Mantissa = the positive fraction after the decimal point.

## **B.5: Retrieving Logs Using the IQ 250S Meter's Modbus Map**

This section describes the log interface system of the IQ 250S meter from a programming point of view. It is intended for programmers implementing independent drivers for log retrieval from the meter. It describes the meaning of the meter's Modbus Registers related to log retrieval and conversion, and details the procedure for retrieving a log's records.

**NOTES:**

- All references assume the use of Modbus function codes 0x03, 0x06, and 0x10, where each register is a 2 byte MSB (Most Significant Byte) word, except where otherwise noted.
- The carat symbol (^) notation is used to indicate mathematical "power." For example, 2<sup>8</sup> means 28; which is 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2, which equals 256.

### B.5.1: Data Formats

Time stamp: Stores a date from 2000 to 2099. Time stamp has a Minimum resolution of 1 second.

| Byte  | 0            | 1     | 2    | 3    | 4      | 5      |
|-------|--------------|-------|------|------|--------|--------|
| Value | Year         | Month | Day  | Hour | Minute | Second |
| Range | 0-99 (+2000) | 1-12  | 1-31 | 0-23 | 0-59   | 0-59   |
| Mask  | 0x7F         | 0x0F  | 0x1F | 0x1F | 0x3F   | 0x3F   |

The high bits of each time stamp byte are used as flags to record meter state information at the time of the time stamp. These bits should be masked out, unless needed.

### B.5.2: IQ 250S Meter Logs

The IQ 2500S meter has 5 logs: System Event, Alarm (Limits), and 3 Historical logs. Each log is described below.

1. **System Event (0):** The System Event log is used to store events which happen in, and to, the meter. Events include Startup, Reset Commands, Log Retrievals, etc. The System Event Log Record takes 20 bytes, 14 bytes of which are available when the log is retrieved.

| Byte  | 0         | 1 | 2 | 3 | 4 | 5 | 6     | 7     | 8   | 9    | 10     | 11     | 12     | 13     |
|-------|-----------|---|---|---|---|---|-------|-------|-----|------|--------|--------|--------|--------|
| Value | timestamp |   |   |   |   |   | Group | Event | Mod | Chan | Param1 | Param2 | Param3 | Param4 |

**NOTE:** The complete Systems Events table is shown in Section B.5.5, step 1, on page B-19.

2. **Alarm Log (1):** The Alarm Log records the states of the 8 Limits programmed in the meter.

- Whenever a limit goes out (above or below), a record is stored with the value that caused the limit to go out.
- Whenever a limit returns within limit, a record is stored with the "most out of limit" value for that limit while it was out of limit.

The Alarm Log Record uses 16 bytes, 10 bytes of which are available when the log is retrieved.

| Byte  | 0         | 1 | 2 | 3 | 4 | 5 | 6         | 7      | 8      | 9 |
|-------|-----------|---|---|---|---|---|-----------|--------|--------|---|
| Value | timestamp |   |   |   |   |   | direction | limit# | Value% |   |

The limit # byte is broken into a type and an ID.

|       |      |   |   |   |   |          |   |   |
|-------|------|---|---|---|---|----------|---|---|
| Bit   | 0    | 1 | 2 | 3 | 4 | 5        | 6 | 7 |
| Value | type | 0 | 0 | 0 | 0 | Limit ID |   |   |

3. **Historical Log 1 (2):** The Historical Log records the values of its assigned registers at the programmed interval.

**NOTE:** See Section B.5.3, Number 1, for details on programming and interpreting the log.

|       |           |   |   |   |   |   |              |   |   |   |
|-------|-----------|---|---|---|---|---|--------------|---|---|---|
| Byte  | 0         | 1 | 2 | 3 | 4 | 5 | 6            | - | - | N |
| Value | timestamp |   |   |   |   |   | values . . . |   |   |   |

4. **Historical Log 2 (3):** Same as Historical Log 1.

5. **Historical Log 3 (4):** Same as Historical Log 1.

### B.5.3: Block Definitions

This section describes the Modbus Registers involved in retrieving and interpreting an IQ 250S meter's Log. Other sections refer to certain 'values' contained in this section. See the corresponding value in this section for details.

#### NOTES:

- "Register" is the Modbus Register Address in 0-based Hexadecimal notation. To convert it to 1-based decimal notation, convert from hex16 to decimal10 and add 1. For example: 0x03E7 = 1000.
- "Size" is the number of Modbus Registers (2 byte) in a block of data.

#### Historical Log Programmable Settings:

The Historical Logs are programmed using a list of Modbus Registers that will be copied into the Historical Log record. In other words, Historical Log uses a direct copy of the Modbus Registers to control what is recorded at the time of record capture.

To supplement this, the programmable settings for the Historical Logs contain a list of descriptors, which group registers into items. Each item descriptor lists the data type of the item, and the num-

ber of bytes for that item. By combining these two lists, the Historical Log record can be interpreted.

For example: Registers 0x03E7 and 0x03E8 are programmed to be recorded by the historical log. The matching descriptor gives the data type as float, and the size as 4 bytes. These registers program the log to record "Primary Readings Volts A-N."

#### Historical Log Blocks:

Start Register: 0x7917 (Historical Log 1)  
 0x79D7 (Historical Log 2)  
 0x7A97 (Historical Log 3)

Block Size: 192 registers per log (384 bytes)

The Historical Log programmable settings are comprised of 3 blocks, one for each log. Each is identical to the others, so only Historical Log 1 is described here. All register addresses in this section are given as the Historical Log 1 address (0x7917).

Each Historical Log Block is composed of 3 sections: The header, the list of registers to log, and the list of item descriptors.

#### Header:

Registers: 0x7917 - 0x7918

Size: 2 registers

| Byte  | 0           | 1         | 2 | 3        |
|-------|-------------|-----------|---|----------|
| Value | # Registers | # Sectors |   | Interval |

- **# Registers:** The number of registers to log in the record. The size of the record in memory is  $[12 + (\# \text{ Registers} \times 2)]$ . The size during normal log retrieval is  $[6 + (\# \text{ Registers} \times 2)]$ . If this value is 0, the log is disabled. Valid values are {0-117}.
- **# Sectors:** The number of Flash Sectors allocated to this log. Each sector is 64kb, minus a sector header of 20 bytes. 15 sectors are available for allocation between Historical Logs 1, 2, and 3. The sum of all Historical Logs may be less than 15. If this value is 0, the log is disabled. Valid values are {0-15}.

- Interval: The interval at which the Historical Log's Records are captured. This value is an enumeration:

|      |           |
|------|-----------|
| 0x01 | 1 minute  |
| 0x02 | 3 minute  |
| 0x04 | 5 minute  |
| 0x08 | 10 minute |
| 0x10 | 15 minute |
| 0x20 | 30 minute |
| 0x40 | 60 minute |

#### Register List:

Registers: 0x7919 - 0x798D

Size: 1 register per list item, 117 list items

The Register List controls what Modbus Registers are recorded in each record of the Historical Log. Since many items, such as Voltage, Energy, etc., take up more than 1 register, multiple registers need to be listed to record those items.

For example: Registers 0x03E7 and 0x03E8 are programmed to be recorded by the historical log. These registers program the log to record "Primary Readings Volts A-N."

- Each unused register item should be set to 0x0000 or 0xFFFF to indicate that it should be ignored.
- The actual size of the record, and the number of items in the register list which are used, is determined by the # registers in the header.
- Each register item is the Modbus Address in the range of 0x0000 to 0xFFFF.

#### Item Descriptor List:

Registers: 0x798E - 0x79C8

Size: 1 byte per item, 117 bytes (59 registers)

While the Register List describes what to log, the Item Descriptor List describes how to interpret that information. Each descriptor describes a group of register items, and what they mean.

Each descriptor is composed of 2 parts:

- **Type:** The data type of this descriptor, such as signed integer, IEEE floating point, etc. This is the high nibble of the descriptor byte, with a value in the range of 0-14. If this value is 0xFF, the descriptor should be ignored.

|      |                                                                                                                          |
|------|--------------------------------------------------------------------------------------------------------------------------|
| 0    | ASCII: An ASCII string, or byte array                                                                                    |
| 1    | Bitmap: A collection of bit flags                                                                                        |
| 2    | Signed Integer: A 2's Complement integer                                                                                 |
| 3    | Float: An IEEE floating point                                                                                            |
| 4    | Energy: Special Signed Integer, where the value is adjusted by the energy settings in the meter's Programmable Settings. |
| 5    | Unsigned Integer                                                                                                         |
| 6    | Signed Integer 0.1 scale: Special Signed Integer, where the value is divided by 10 to give a 0.1 scale.                  |
| 7-14 | Unused                                                                                                                   |
| 15   | Disabled: used as end list marker.                                                                                       |

- **Size:** The size in bytes of the item described. This number is used to determine the pairing of descriptors with register items.

For example: If the first descriptor is 4 bytes, and the second descriptor is 2 bytes, then the first 2 register items belong to the 1st descriptor, and the 3rd register item belongs to the 2nd descriptor.

**NOTE:** As can be seen from the example, above, there is not a 1-to-1 relation between the register list and the descriptor list. A single descriptor may refer to multiple register items.

| Register Items | Descriptors   |
|----------------|---------------|
| 0x03C7/        | Float, 4 byte |

0x03C8

0x1234

Signed Int, 2 byte

**NOTE:** The sum of all descriptor sizes must equal the number of bytes in the data portion of the Historical Log record.

Log Status Block:

The Log Status Block describes the current status of the log in question. There is one header block for each of the logs. Each log's header has the following base address:

| Log           | Base Address |
|---------------|--------------|
| Alarms:       | 0xC737       |
| System:       | 0xC747       |
| Historical 1: | 0xC757       |
| Historical 2: | 0xC767       |
| Historical 3: | 0xC777       |

| Bytes | Value                   | Type   | Range                | # Bytes |
|-------|-------------------------|--------|----------------------|---------|
| 0-3   | Max Records             | UINT32 | 0 to 4,294,967,294   | 4       |
| 4-7   | Number of Records Used  | UINT32 | 1 to 4,294,967,294   | 4       |
| 8-9   | Record Size in Bytes    | UINT16 | 4 to 250             | 2       |
| 10-11 | Log Availability        | UINT16 |                      | 2       |
| 12-17 | Timestamp, First Record | TSTAMP | 1Jan2000 - 31Dec2099 | 6       |
| 18-23 | Timestamp, Last Record  | TSTAMP | 1Jan2000 - 31Dec2099 | 6       |
| 24-31 | Reserved                |        |                      | 8       |

- **Max Records:** The maximum number of records the log can hold given the record size, and sector allocation. The data type is an unsigned integer from 0 -  $2^{32}$ .

- **Records Used:** The number of records stored in the log. This number will equal the MaxRecords when the log has filled. This value will be set to 1 when the log is reset. The data type is an unsigned integer from 1 -  $2^{32}$ .

**NOTE:** The first record in every log before it has rolled over is a "dummy" record, filled with all 0xFF's. When the log is filled and rolls over, this record is overwritten.

- **Record Size:** The number of bytes in this record, including the timestamp. The data type is an unsigned integer in the range of 14 - 242.
- **Log Availability:** A flag indicating if the log is available for retrieval, or if it is in use by another port.

|        |                                                                                              |
|--------|----------------------------------------------------------------------------------------------|
| 0      | Log Available for retrieval                                                                  |
| 1      | Not used                                                                                     |
| 2      | In use by COM2 (RS485)                                                                       |
| 0xFFFF | Log Not Available - the log cannot be retrieved.<br>This indicates that the log is disabled. |

**NOTE:** To query the port by which you are currently connected, use the Port ID register:

|           |            |
|-----------|------------|
| Register: | 0x1193     |
| Size:     | 1 register |

**Description:** A value from 1-4, which enumerates the port that the requestor is currently connected on.

**NOTES:**

- When Log Retrieval is engaged, the Log Availability value will be set to the port that engaged the log. The Log Availability value will stay the same until either the log has been disengaged, or 5 minutes have passed with no activity. It will then reset to 0 (available).
- Each log can only be retrieved by one port at a time.
- Only one log at a time can be retrieved.
- **First Timestamp:** Timestamp of the oldest record.

- Last Timestamp: Timestamp of the newest record.

#### Log Retrieval Block:

The Log Retrieval Block is the main interface for retrieving logs. It is comprised of 2 parts: the header and the window. The header is used to program the particular data the meter presents when a log window is requested. The window is a sliding block of data that can be used to access any record in the specified log.

**Session Com Port:** The IQ 250S meter's Com Port which is currently retrieving logs. Only one Com Port can retrieve logs at any one time.

|            |                           |
|------------|---------------------------|
| Registers: | 0xC34E - 0xC34E           |
| Size:      | 1 register                |
| 0          | No Session Active         |
| 1          | (Not used by the IQ 250S) |
| 2          | COM2 (RS485)              |

To get the current Com Port, see the NOTE on querying the port, on the previous page.

**Log Retrieval Header:**

The Log Retrieval Header is used to program the log to be retrieved, the record(s) of that log to be accessed, and other settings concerning the log retrieval.

Registers: 0xC34F - 0xC350

Size: 2 registers

| Bytes | Value                                 | Type   | Format            | Description                                                                            | # Bytes |
|-------|---------------------------------------|--------|-------------------|----------------------------------------------------------------------------------------|---------|
| 0-1   | Log Number, Enable, Scope             | UINT16 | nnnnnnnn e(ssssss | nnnnnnnn - log to retrieve,<br>e - retrieval session enable<br>ssssss - retrieval mode | 2       |
| 2-3   | Records per Window, Number of Repeats | UINT16 | wwwwwww nnnnnnn   | www-<br>www - records per window,<br>nnnnnn - repeat count                             | 2       |

- Log Number: The log to be retrieved. Write this value to set which log is being retrieved.

|   |                  |
|---|------------------|
| 0 | System Events    |
| 1 | Alarms           |
| 2 | Historical Log 1 |
| 3 | Historical Log 2 |
| 4 | Historical Log 3 |



- **Number of Repeats:** Specifies the number of repeats to use for the Modbus Function Code 0x23 (35). Since the meter must pre-build the response to each log window request, this value must be set once, and each request must use the same repeat count. Upon reading the last register in the specified window, the record index will increment by the number of repeats, if auto-increment is enabled. Section B.5.4.2 has additional information on Function Code 0x23.

|     |                                                           |
|-----|-----------------------------------------------------------|
| 0   | Disables auto-increment                                   |
| 1   | No Repeat count, each request will only get 1 window.     |
| 2-8 | 2-8 windows returned for each Function Code 0x23 request. |

| Bytes | Value                            | Type   | Format                                 | Description                                                    | # Bytes |
|-------|----------------------------------|--------|----------------------------------------|----------------------------------------------------------------|---------|
| 0-3   | Offset of First Record in Window | UINT32 | ssssssss nnnnnnnn<br>nnnnnnnn nnnnnnnn | ssssssss - window status nn...nn - 24-bit record index number. | 4       |
| 4-249 | Log Retrieve Window              | UINT16 |                                        |                                                                | 246     |

#### Log Retrieval Window Block:

The Log Retrieval Window block is used to program the data you want to retrieve from the log. It also provides the interface used to retrieve that data.

Registers: 0xC351 - 0xC3CD

Size: 125 registers

- **Window Status:** The status of the current window. Since the time to prepare a window may exceed an acceptable modbus delay (1 second), this acts as a state flag, signifying when the window is ready for retrieval. When this value indicates that the window is not ready, the data in the window should be ignored. Window Status is Read-only, any writes are ignored.

|      |                     |
|------|---------------------|
| 0    | Window is Ready     |
| 0xFF | Window is Not Ready |

- Record Number: The record number of the first record in the data window. Setting this value controls which records will be available in the data window.
- When the log is engaged, the first (oldest) record is "latched." This means that record number 0 will always point to the oldest record at the time of latching, until the log is disengaged (unlocked).
- To retrieve the entire log using auto-increment, set this value to 0, and retrieve the window repeatedly, until all records have been retrieved.

**NOTES:**

- When auto-increment is enabled, this value will automatically increment so that the window will "page" through the records, increasing by RecordsPerWindow each time that the last register in the window is read.
  - When auto-increment is not enabled, this value must be written-to manually, for each window to be retrieved.
- Log Retrieval Data Window: The actual data of the records, arranged according to the above settings.

**B.5.4: Log Retrieval**

Log Retrieval is accomplished in 3 basic steps:

1. Engage the log.
2. Retrieve each of the records.
3. Disengage the log.

**B.5.4.1: Auto-Increment**

In Eaton's traditional Modbus retrieval system, you write the index of the block of data to retrieve, then read that data from a buffer (window). To improve the speed of retrieval, the index can be automatically incremented each time the buffer is read.

In the IQ 250S meter, when the last register in the data window is read, the record index is incremented by the Records per Window.

**B.5.4.2: Modbus Function Code 0x23****QUERY**

| <u>Field Name</u>   | <u>Example (Hex)</u> |
|---------------------|----------------------|
| Slave Address       | 01                   |
| Function            | 23                   |
| Starting Address Hi | C3                   |
| Starting Address Lo | 51                   |
| # Points Hi         | 00                   |
| # Points Lo         | 7D                   |
| Repeat Count        | 04                   |

**RESPONSE**

| <u>Field Name</u> | <u>Example (Hex)</u> |
|-------------------|----------------------|
| Slave Address     | 01                   |
| Function          | 23                   |
| # Bytes Hi        | 03                   |
| # Bytes Lo        | E0                   |
| Data              | ...                  |

Function Code 0x23 is a user defined Modbus function code, which has a format similar to Function Code 0x03, except for the inclusion of a "repeat count." The repeat count (RC) is used to indicate that the same N registers should be read RC number of times. (See the Number of Repeats bullet on page B-14.)

**NOTES:**

- By itself this feature would not provide any advantage, as the same data will be returned RC times. However, when used with auto-incrementing, this function condenses up to 8 requests into 1 request, which decreases communication time, as fewer transactions are being made.
- Keep in mind that the contents of the response data is the block of data you requested, repeated N times. For example, when retrieving log windows, you normally request both the window index, and the window data. This means that the first couple of bytes of every repeated block will contain the index of that window.
- In the IQ 250S meter repeat counts are limited to 8 times for Modbus RTU, and 4 times for Modbus ASCII.

The response for Function Code 0x23 is the same as for Function Code 0x03, with the data blocks in sequence.

**IMPORTANT!** Before using Function Code 0x23, always check to see if the current connection supports it. Some relay devices do not support user defined function codes; if that is the case, the message will stall. Other devices don't support 8 repeat counts.

### B.5.4.3: Log Retrieval Procedure

The following procedure documents how to retrieve a single log from the oldest record to the newest record, using the "normal" record type (see **Scope**). All logs are retrieved using the same method. See Section B.5.4.4 for a Log Retrieval example.

**NOTES:**

- This example uses auto-increment.
- In this example, Function Code 0x23 is not used.
- You will find referenced topics in Section B.5.3. Block Definitions.
- Modbus Register numbers are listed in brackets.

1. Engage the Log:

- a. Read the Log Status Block.

- i.. Read the contents of the specific logs' status block [0xC737+, 16 reg] (see Log Headers).
- ii. Store the # of Records Used, the Record Size, and the Log Availability.
- iii. If the Log Availability is not 0, stop Log Retrieval; this log is not available at this time. If Log Availability is 0, proceed to step 1b (Engage the log).

This step is done to ensure that the log is available for retrieval, as well as retrieving information for later use.

- b. Engage the log: write log to engage to Log Number, 1 to Enable, and the desired mode to Scope (default 0 (Normal)) [0xC34F, 1 reg]. This is best done as a single-register write.

This step will latch the first (oldest) record to index 0, and lock the log so that only this port can retrieve the log, until it is disengaged.

- c. Verify the log is engaged: read the contents of the specific logs' status block [0xC737+, 16 reg] again to see if the log is engaged for the current port (see Log Availability). If the Log is not engaged for the current port, repeat step 1b (Engage the log).
- d. Write the retrieval information.

- i. Compute the number of records per window, as follows:

$$\text{RecordsPerWindow} = (246 \setminus \text{RecordSize})$$

- If using 0x23, set the repeat count to 2-8. Otherwise, set it to 1.
- Since we are starting from the beginning for retrieval, the first record index is 0.

- ii. Write the Records per window, the Number of repeats (1), and Record Index (0) [0xC350, 3 reg].

This step tells the IQ 250S meter what data to return in the window.

## 2. Retrieve the records:

- a. Read the record index and window: read the record index, and the data window [0xC351, 125 reg].

- If the meter Returns a Slave Busy Exception, repeat the request.
- If the Window Status is 0xFF, repeat the request.
- If the Window Status is 0, go to step 2b (Verify record index).

**NOTES:**

- We read the index and window in 1 request to minimize communication time, and to ensure that the record index matches the data in the data window returned.
  - Space in the window after the last specified record (RecordSize x RecordPerWindow) is padded with 0xFF, and can be safely discarded.
- b. Verify that the record index incremented by Records Per Window. The record index of the retrieved window is the index of the first record in the window. This value will increase by Records Per Window each time the window is read, so it should be 0, N, N x 2, N x 3 . . . for each window retrieved.
- If the record index matches the expected record index, go to step 2c (Compute next expected record index).
  - If the record index does not match the expected record index, then go to step 1d (Write the retrieval information), where the record index will be the same as the expected record index. This will tell the IQ 250S meter to repeat the records you were expecting.
- c. Compute next Expected Record Index.
- If there are no remaining records after the current record window, go to step 3 (Disengage the log).
  - Compute the next expected record index by adding Records Per Window, to the current expected record index. If this value is greater than the number of records, resize the window so it only contains the remaining records and go to step 1d (Write the retrieval information), where the Records Per Window will be the same as the remaining records.
3. Disengage the log: write the Log Number (of log being disengaged) to the Log Index and 0 to the Enable bit [0xC34F, 1 reg].

#### B.5.4.4: Log Retrieval Example

The following example illustrates a log retrieval session. The example makes the following assumptions:

- Log Retrieved is Historical Log 1 (Log Index 2).
- Auto-Incrementing is used.
- Function Code 0x23 is not used (Repeat Count of 1).
- The Log contains Volts-AN, Volts-BN, Volts-CN (12 bytes).
- 100 Records are available (0-99).
- COM Port 2 (RS485) is being used (see Log Availability).
- There are no Errors.
- Retrieval is starting at Record Index 0 (oldest record).
- Protocol used is Modbus RTU. The checksum is left off for simplicity.
- The IQ 250S meter is at device address 1.
- No new records are recorded to the log during the log retrieval process.

1. Read [0xC757, 16 reg], Historical Log 1 Header Block.

**Send:** 0103 C757 0010

**Command:**

Register Address: 0xC757

# Registers: 16

-----

**Receive:** 010320 00000100 00000064 0012 0000  
060717101511 060718101511  
0000000000000000

**Data:**

Max Records: 0x100 = 256 records maximum.

Num Records: 0x64 = 100 records currently logged.

Record Size: 0x12 = 18 bytes per record.

Log Availability: 0x00 = 0, not in use, available for retrieval.

First Timestamp: 0x060717101511 = July 23, 2006, 16:21:17

Last Timestamp: 0x060717101511 = July 24, 2006, 16:21:17

**NOTE:** This indicates that Historical Log 1 is available for retrieval.

2. Write 0x0280 -> [0xC34F, 1 reg], Log Enable.

**Send:** 0106 C34F 0280

**Command:**

Register Address: 0xC34F

# Registers: 1 (Write Single Register Command)

**Data:**

Log Number: 2 (Historical Log 1)

Enable: 1 (Engage log)

Scope: 0 (Normal Mode)

-----

**Receive:** 0106C34F0280 (echo)

**NOTE:** This engages the log for use on this COM Port, and latches the oldest record as record index 0.

3. Read [0xC757, 16 reg], Availability is 0.

**Send:** 0103 C757 0010

**Command:**

Register Address: 0xC757

# Registers: 16

-----

**Receive:** 010320 00000100 00000064 0012 0002  
060717101511 060718101511  
0000000000000000

**Data:**

Max Records: 0x100 = 256 records maximum.

Num Records: 0x64 = 100 records currently logged.

Record Size: 0x12 = 18 bytes per record.

Log Availability: 0x02 = 2, In use by COM2, RS485 (the current port)

First Timestamp: 0x060717101511 = July 23, 2006, 16:21:17

Last Timestamp: 0x060717101511 = July 24, 2006, 16:21:17

**NOTE:** This indicates that the log has been engaged properly in step 2. Proceed to retrieve the log.

4. Compute #RecPerWin as  $(246 \div 18) = 13$ . Write 0x0D01 0000 0000 -> [0xC350, 3 reg] Write Retrieval Info. Set Current Index as 0.

**Send:** 0110 C350 0003 06 0D01 00 000000

**Command:**

Register Address: 0xC350

# Registers: 3, 6 bytes

**Data:**

Records per Window: 13. Since the window is 246 bytes, and the record is 18 bytes,  $246 \div 18 = 13.66$ , which means that 13 records evenly fit into a single window. This is 234 bytes, which means later on, we only need to read 234 bytes (117 registers) of the window to retrieve the records.

# of Repeats: 1. We are using auto-increment (so not 0), but not function code 0x23.

Window Status: 0 (ignore)

Record Index: 0, start at the first record.

-----

**Receive:** 0110C3500003 (command ok)

**NOTES:**

- This sets up the window for retrieval; now we can start retrieving the records.
- As noted above, we compute the records per window as  $246 \div 18 = 13.66$ , which is rounded to 13 records per window. This allows the minimum number of requests to be made to the meter, which increases retrieval speed.

5. Read [0xC351, 125 reg], first 2 reg is status/index, last 123 reg is window data. Status OK.

**Send:** 0103 C351 007D

**Command:**

Register Address: 0xC351

# Registers: 0x7D, 125 registers

-----  
**Receive:** 0103FA 00000000  
060717101511FFFFFFFFFFFFFFFFFFFFFFFFFFFF  
06071710160042FAAACF42FAAD1842FAA9A8 . . .

**Data:**

Window Status: 0x00 = the window is ready.

Index: 0x00 = 0, The window starts with the 0'th record,  
which is the oldest record.

Record 0: The next 18 bytes is the 0'th record (filler).

Timestamp: 0x060717101511, = July 23, 2006, 16:21:17

Data: This record is the "filler" record. It is used by the  
meter so that there is never 0 records. It should  
be ignored. It can be identified by the data being  
all 0xFF.

**NOTE:** Once a log has rolled over, the 0'th record  
will be a valid record, and the filler record will  
disappear.

Record 1: The next 18 bytes is the 1'st record.

Timestamp: 0x060717101600 July 23, 2006, 16:22:00

Data:

Volts AN: 0x42FAAACF, float = 125.33~

Volts BN: 0x42FAAD18, float = 125.33~

Volts CN: 0x42FAA9A8, float = 125.33~

. . . 13 records

**NOTES:**

- This retrieves the actual window. Repeat this command as many times as necessary to retrieve all of the records when auto-increment is enabled.
- Note the filler record. When a log is reset (cleared) in the meter, the meter always adds a first "filler" record, so that there is always at least 1 record in the log. This "filler" record can be identified by the data being all 0xFF, and it being index 0. If a record has all 0xFF for data, the timestamp is valid, and the index is NOT 0, then the record is legitimate.
- When the "filler" record is logged, its timestamp may not be "on the interval." The next record taken will be on the next "proper interval," adjusted to the hour. For example, if the interval is 1 minute, the first "real" record will be taken on the next minute (no seconds). If the interval is 15 minutes, the next record will be taken at :15, :30, :45, or :00 - whichever of those values is next in sequence.

6. Compare the index with Current Index.

**NOTES:**

- The Current Index is 0 at this point, and the record index retrieved in step 5 is 0: thus we go to step 8.
- If the Current Index and the record index do not match, go to step 7. The data that was received in the window may be invalid, and should be discarded.

7. Write the Current Index to [0xC351, 2 reg].

**Send:** 0110 C351 0002 04 00 00000D

**Command:**

Register Address: 0xC351

# Registers: 2, 4 bytes

**Data:**

Window Status: 0 (ignore)

Record Index: 0x0D = 13, start at the 14th record.

-----

**Receive:** 0110C3510002 (command ok)

**NOTES:**

- This step manually sets the record index, and is primarily used when an out-of-order record index is returned on a read (step 6).
- The example assumes that the second window retrieval failed somehow, and we need to recover by requesting the records starting at index 13 again.

8. For each record in the retrieved window, copy and save the data for later interpretation.

9. Increment Current Index by RecordsPerWindow.

**NOTES:**

- This is the step that determines how much more of the log we need to retrieve.
- On the first N passes, Records Per Window should be 13 (as computed in step 4), and the current index should be a multiple of that (0, 13, 26, . . .). This amount will decrease when we reach the end (see step 10).
- If the current index is greater than or equal to the number of records (in this case 100), then all records have been retrieved; go to step 12. Otherwise, go to step 10 to check if we are nearing the end of the records.

10. If number records - current index < RecordsPerWindow, decrease to match.

**NOTES:**

- Here we bounds-check the current index, so we don't exceed the records available.
- If the number of remaining records (#records - current index) is less than the Records per Window, then the next window is the last, and contains less than a full window of records. Make records per window equal to remaining records (#records-current index). In this example, this

occurs when current index is 91 (the 8'th window). There are now 9 records available (100-91), so make Records per Window equal 9.

11. Repeat steps 5 through 10.

**NOTES:**

- Go back to step 5, where a couple of values have changed.

| Pass | CurIndex | FirstRecIndex | RecPerWindow |
|------|----------|---------------|--------------|
| 0    | 0        | 0             | 13           |
| 1    | 13       | 13            | 13           |
| 2    | 26       | 26            | 13           |
| 3    | 39       | 39            | 13           |
| 4    | 52       | 52            | 13           |
| 5    | 65       | 65            | 13           |
| 6    | 78       | 78            | 13           |
| 7    | 91       | 91            | 9            |
| 8    | 100      | -----         | -----        |

- At pass 8, since Current Index is equal to the number of records (100), log retrieval should stop; go to step 12 (see step 9 Notes).

12. No more records available, clean up.

13. Write 0x0000 -> [0xC34F, 1 reg], disengage the log.

**Send:** 0106 C34F 0000

**Command:**

Register Address: 0xC34F

# Registers: 1 (Write Single Register Command)

**Data:**

Log Number: 0 (ignore)

Enable: 0 (Disengage log)

Scope: 0 (ignore)

-----

**Receive:** 0106C34F0000 (echo)

**NOTES:**

- This disengages the log, allowing it to be retrieved by other COM ports.
- The log will automatically disengage if no log retrieval action is taken for 5 minutes.

## B.6: Modbus Register Map

The IQ 150S and 250S meters' Modbus register maps begin on the following page. The first map is for the IQ 150S, and the second is for the IQ 250S.

| Modbus Address                                          |             | Description <sup>1</sup> | Format | Range <sup>6</sup> | Units or Resolution | Comments                                  | # Reg |
|---------------------------------------------------------|-------------|--------------------------|--------|--------------------|---------------------|-------------------------------------------|-------|
| Hex                                                     | Decimal     |                          |        |                    |                     |                                           |       |
|                                                         |             |                          |        |                    |                     |                                           |       |
| Fixed Data Section                                      |             |                          |        |                    |                     |                                           |       |
| Identification Block                                    |             |                          |        |                    |                     | read-only                                 |       |
| 0000 - 0007                                             | 1 - 8       | Reserved                 |        |                    | none                |                                           | 8     |
| 0008 - 000F                                             | 9 - 16      | Meter Serial Number      | ASCII  | 16 char            | none                |                                           | 8     |
| 0010 - 0010                                             | 17 - 17     | Meter Type               | UINT16 | bit-mapped         | -----t -----        | t = transducer model (1=yes, 0=no)        | 1     |
| 0011 - 0012                                             | 18 - 19     | Firmware Version         | ASCII  | 4 char             | none                |                                           | 2     |
| 0013 - 0013                                             | 20 - 20     | Map Version              | UINT16 | 0 to 65535         | none                |                                           | 1     |
| 0014 - 0014                                             | 21 - 21     | Meter Configuration      | UINT16 | bit-mapped         | ----- --ffffff      | ffffff = calibration frequency (50 or 60) | 1     |
| 0015 - 0015                                             | 22 - 22     | ASIC Version             | UINT16 | 0-65535            | none                |                                           | 1     |
| 0016 - 0026                                             | 23 - 39     | Reserved                 |        |                    |                     |                                           | 17    |
| 0027 - 002E                                             | 40 - 47     | Reserved                 |        |                    |                     |                                           | 8     |
|                                                         |             |                          |        |                    |                     | Block Size:                               | 47    |
| Meter Data Section <sup>2</sup>                         |             |                          |        |                    |                     |                                           |       |
| Primary Readings Block, 6 cycles (IEEE Floating Point)  |             |                          |        |                    |                     | read-only                                 |       |
| 0383 - 0384                                             | 900 - 901   | Watts, 3-Ph total        | FLOAT  | -9999 M to +9999 M | watts               |                                           | 2     |
| 0385 - 0386                                             | 902 - 903   | VARs, 3-Ph total         | FLOAT  | -9999 M to +9999 M | VARs                |                                           | 2     |
| 0387 - 0388                                             | 904 - 905   | VAs, 3-Ph total          | FLOAT  | -9999 M to +9999 M | VAs                 |                                           | 2     |
|                                                         |             |                          |        |                    |                     | Block Size:                               | 6     |
| Primary Readings Block, 60 cycles (IEEE Floating Point) |             |                          |        |                    |                     | read-only                                 |       |
| 03E7 - 03E8                                             | 1000 - 1001 | Volts A-N                | FLOAT  | 0 to 9999 M        | volts               |                                           | 2     |
| 03E9 - 03EA                                             | 1002 - 1003 | Volts B-N                | FLOAT  | 0 to 9999 M        | volts               |                                           | 2     |
| 03EB - 03EC                                             | 1004 - 1005 | Volts C-N                | FLOAT  | 0 to 9999 M        | volts               |                                           | 2     |
| 03ED - 03EE                                             | 1006 - 1007 | Volts A-B                | FLOAT  | 0 to 9999 M        | volts               |                                           | 2     |
| 03EF - 03F0                                             | 1008 - 1009 | Volts B-C                | FLOAT  | 0 to 9999 M        | volts               |                                           | 2     |
| 03F1 - 03F2                                             | 1010 - 1011 | Volts C-A                | FLOAT  | 0 to 9999 M        | volts               |                                           | 2     |
| 03F3 - 03F4                                             | 1012 - 1013 | Amps A                   | FLOAT  | 0 to 9999 M        | amps                |                                           | 2     |
| 03F5 - 03F6                                             | 1014 - 1015 | Amps B                   | FLOAT  | 0 to 9999 M        | amps                |                                           | 2     |
| 03F7 - 03F8                                             | 1016 - 1017 | Amps C                   | FLOAT  | 0 to 9999 M        | amps                |                                           | 2     |
| 03F9 - 03FA                                             | 1018 - 1019 | Watts, 3-Ph total        | FLOAT  | -9999 M to +9999 M | watts               |                                           | 2     |
| 03FB - 03FC                                             | 1020 - 1021 | VARs, 3-Ph total         | FLOAT  | -9999 M to +9999 M | VARs                |                                           | 2     |
| 03FD - 03FE                                             | 1022 - 1023 | VAs, 3-Ph total          | FLOAT  | -9999 M to +9999 M | VAs                 |                                           | 2     |
| 03FF - 0400                                             | 1024 - 1025 | Power Factor, 3-Ph total | FLOAT  | -1.00 to +1.00     | none                |                                           | 2     |
| 0401 - 0402                                             | 1026 - 1027 | Frequency                | FLOAT  | 0 to 65.00         | Hz                  |                                           | 2     |

| Modbus Address                              |             | Description <sup>1</sup>      | Format | Range <sup>6</sup>              | Units or Resolution    | Comments                                                                                    | # Reg |
|---------------------------------------------|-------------|-------------------------------|--------|---------------------------------|------------------------|---------------------------------------------------------------------------------------------|-------|
| Hex                                         | Decimal     |                               |        |                                 |                        |                                                                                             |       |
| 0403 - 0404                                 | 1028 - 1029 | Neutral Current               | FLOAT  | 0 to 9999 M                     | amps                   |                                                                                             | 2     |
|                                             |             |                               |        |                                 |                        | Block Size:                                                                                 | 30    |
| Primary Energy Block                        |             |                               |        |                                 |                        | read-only                                                                                   |       |
| 044B - 044C                                 | 1100 - 1101 | W-hours, Received             | SINT32 | 0 to 99999999 or 0 to -99999999 | Wh per energy format   | * Wh received & delivered always have opposite signs                                        | 2     |
| 044D - 044E                                 | 1102 - 1103 | W-hours, Delivered            | SINT32 | 0 to 99999999 or 0 to -99999999 | Wh per energy format   | * Wh received is positive for "view as load", delivered is positive for "view as generator" | 2     |
| 044F - 0450                                 | 1104 - 1105 | W-hours, Net                  | SINT32 | -99999999 to 99999999           | Wh per energy format   |                                                                                             | 2     |
| 0451 - 0452                                 | 1106 - 1107 | W-hours, Total                | SINT32 | 0 to 99999999                   | Wh per energy format   | * 5 to 8 digits                                                                             | 2     |
| 0453 - 0454                                 | 1108 - 1109 | VAR-hours, Positive           | SINT32 | 0 to 99999999                   | VARh per energy format | * decimal point implied, per energy format                                                  | 2     |
| 0455 - 0456                                 | 1110 - 1111 | VAR-hours, Negative           | SINT32 | 0 to -99999999                  | VARh per energy format | * resolution of digit before decimal point = units, kilo, or mega, per energy format        | 2     |
| 0457 - 0458                                 | 1112 - 1113 | VAR-hours, Net                | SINT32 | -99999999 to 99999999           | VARh per energy format |                                                                                             | 2     |
| 0459 - 045A                                 | 1114 - 1115 | VAR-hours, Total              | SINT32 | 0 to 99999999                   | VARh per energy format |                                                                                             | 2     |
| 045B - 045C                                 | 1116 - 1117 | VA-hours, Total               | SINT32 | 0 to 99999999                   | VAh per energy format  | * see note 10                                                                               | 2     |
|                                             |             |                               |        |                                 |                        | Block Size:                                                                                 | 18    |
| Primary Demand Block (IEEE Floating Point)  |             |                               |        |                                 |                        | read-only                                                                                   |       |
| 07CF - 07D0                                 | 2000 - 2001 | Amps A, Average               | FLOAT  | 0 to 9999 M                     | amps                   |                                                                                             | 2     |
| 07D1 - 07D2                                 | 2002 - 2003 | Amps B, Average               | FLOAT  | 0 to 9999 M                     | amps                   |                                                                                             | 2     |
| 07D3 - 07D4                                 | 2004 - 2005 | Amps C, Average               | FLOAT  | 0 to 9999 M                     | amps                   |                                                                                             | 2     |
| 07D5 - 07D6                                 | 2006 - 2007 | Positive Watts, 3-Ph, Average | FLOAT  | -9999 M to +9999 M              | watts                  |                                                                                             | 2     |
| 07D7 - 07D8                                 | 2008 - 2009 | Positive VARs, 3-Ph, Average  | FLOAT  | -9999 M to +9999 M              | VARs                   |                                                                                             | 2     |
| 07D9 - 07DA                                 | 2010 - 2011 | Negative Watts, 3-Ph, Average | FLOAT  | -9999 M to +9999 M              | watts                  |                                                                                             | 2     |
| 07DB - 07DC                                 | 2012 - 2013 | Negative VARs, 3-Ph, Average  | FLOAT  | -9999 M to +9999 M              | VARs                   |                                                                                             | 2     |
| 07DD - 07DE                                 | 2014 - 2015 | VAs, 3-Ph, Average            | FLOAT  | -9999 M to +9999 M              | VAs                    |                                                                                             | 2     |
| 07DF - 07E0                                 | 2016 - 2017 | Positive PF, 3-Ph, Average    | FLOAT  | -1.00 to +1.00                  | none                   |                                                                                             | 2     |
| 07E1 - 07E2                                 | 2018 - 2019 | Negative PF, 3-PF, Average    | FLOAT  | -1.00 to +1.00                  | none                   |                                                                                             | 2     |
|                                             |             |                               |        |                                 |                        | Block Size:                                                                                 | 20    |
| Primary Minimum Block (IEEE Floating Point) |             |                               |        |                                 |                        | read-only                                                                                   |       |
| 0BB7 - 0BB8                                 | 3000 - 3001 | Volts A-N, Minimum            | FLOAT  | 0 to 9999 M                     | volts                  |                                                                                             | 2     |
| 0BB9 - 0BBA                                 | 3002 - 3003 | Volts B-N, Minimum            | FLOAT  | 0 to 9999 M                     | volts                  |                                                                                             | 2     |
| 0BBB - 0BBC                                 | 3004 - 3005 | Volts C-N, Minimum            | FLOAT  | 0 to 9999 M                     | volts                  |                                                                                             | 2     |
| 0BBD - 0BBE                                 | 3006 - 3007 | Volts A-B, Minimum            | FLOAT  | 0 to 9999 M                     | volts                  |                                                                                             | 2     |
| 0BBF - 0BC0                                 | 3008 - 3009 | Volts B-C, Minimum            | FLOAT  | 0 to 9999 M                     | volts                  |                                                                                             | 2     |

| Modbus Address                              |             | Description <sup>1</sup>                        | Format | Range <sup>6</sup>  | Units or Resolution | Comments   | # Reg |
|---------------------------------------------|-------------|-------------------------------------------------|--------|---------------------|---------------------|------------|-------|
| Hex                                         | Decimal     |                                                 |        |                     |                     |            |       |
| 0BC1 - 0BC2                                 | 3010 - 3011 | Volts C-A, Minimum                              | FLOAT  | 0 to 9999 M         | volts               |            | 2     |
| 0BC3 - 0BC4                                 | 3012 - 3013 | Amps A, Minimum Avg Demand                      | FLOAT  | 0 to 9999 M         | amps                |            | 2     |
| 0BC5 - 0BC6                                 | 3014 - 3015 | Amps B, Minimum Avg Demand                      | FLOAT  | 0 to 9999 M         | amps                |            | 2     |
| 0BC7 - 0BC8                                 | 3016 - 3017 | Amps C, Minimum Avg Demand                      | FLOAT  | 0 to 9999 M         | amps                |            | 2     |
| 0BC9 - 0BCA                                 | 3018 - 3019 | Positive Watts, 3-Ph, Minimum Avg Demand        | FLOAT  | 0 to +9999 M        | watts               |            | 2     |
| 0BCB - 0BCC                                 | 3020 - 3021 | Positive VARs, 3-Ph, Minimum Avg Demand         | FLOAT  | 0 to +9999 M        | VARs                |            | 2     |
| 0BCD - 0BCE                                 | 3022 - 3023 | Negative Watts, 3-Ph, Minimum Avg Demand        | FLOAT  | 0 to +9999 M        | watts               |            | 2     |
| 0BCF - 0BD0                                 | 3024 - 3025 | Negative VARs, 3-Ph, Minimum Avg Demand         | FLOAT  | 0 to +9999 M        | VARs                |            | 2     |
| 0BD1 - 0BD2                                 | 3026 - 3027 | VAs, 3-Ph, Minimum Avg Demand                   | FLOAT  | -9999 M to +9999 M  | VAs                 |            | 2     |
| 0BD3 - 0BD4                                 | 3028 - 3029 | Positive Power Factor, 3-Ph, Minimum Avg Demand | FLOAT  | -1.00 to +1.00      | none                |            | 2     |
| 0BD5 - 0BD6                                 | 3030 - 3031 | Negative Power Factor, 3-Ph, Minimum Avg Demand | FLOAT  | -1.00 to +1.00      | none                |            | 2     |
| 0BD7 - 0BD8                                 | 3032 - 3033 | Frequency, Minimum                              | FLOAT  | 0 to 65.00          | Hz                  |            | 2     |
|                                             |             |                                                 |        |                     |                     | Block Size | 34    |
| Primary Maximum Block (IEEE Floating Point) |             |                                                 |        |                     |                     | read-only  |       |
| 0C1B - 0C1C                                 | 3100 - 3101 | Volts A-N, Maximum                              | FLOAT  | 0 to 9999 M         | volts               |            | 2     |
| 0C1D - 0C1E                                 | 3102 - 3103 | Volts B-N, Maximum                              | FLOAT  | 0 to 9999 M         | volts               |            | 2     |
| 0C1F - 0C20                                 | 3104 - 3105 | Volts C-N, Maximum                              | FLOAT  | 0 to 9999 M         | volts               |            | 2     |
| 0C21 - 0C22                                 | 3106 - 3107 | Volts A-B, Maximum                              | FLOAT  | 0 to 9999 M         | volts               |            | 2     |
| 0C23 - 0C24                                 | 3108 - 3109 | Volts B-C, Maximum                              | FLOAT  | 0 to 9999 M         | volts               |            | 2     |
| 0C25 - 0C26                                 | 3110 - 3111 | Volts C-A, Maximum                              | FLOAT  | 0 to 9999 M         | volts               |            | 2     |
| 0C27 - 0C28                                 | 3112 - 3113 | Amps A, Maximum Avg Demand                      | FLOAT  | 0 to 9999 M         | amps                |            | 2     |
| 0C29 - 0C2A                                 | 3114 - 3115 | Amps B, Maximum Avg Demand                      | FLOAT  | 0 to 9999 M         | amps                |            | 2     |
| 0C2B - 0C2C                                 | 3116 - 3117 | Amps C, Maximum Avg Demand                      | FLOAT  | 0 to 9999 M         | amps                |            | 2     |
| 0C2D - 0C2E                                 | 3118 - 3119 | Positive Watts, 3-Ph, Maximum Avg Demand        | FLOAT  | 0 to +9999 M        | watts               |            | 2     |
| 0C2F - 0C30                                 | 3120 - 3121 | Positive VARs, 3-Ph, Maximum Avg Demand         | FLOAT  | 0 to +9999 M        | VARs                |            | 2     |
| 0C31 - 0C32                                 | 3122 - 3123 | Negative Watts, 3-Ph, Maximum Avg Demand        | FLOAT  | 0 to +9999 M        | watts               |            | 2     |
| 0C33 - 0C34                                 | 3124 - 3125 | Negative VARs, 3-Ph, Maximum Avg Demand         | FLOAT  | 0 to +9999 M        | VARs                |            | 2     |
| 0C35 - 0C36                                 | 3126 - 3127 | VAs, 3-Ph, Maximum Avg Demand                   | FLOAT  | -9999 M to +9999 M  | VAs                 |            | 2     |
| 0C37 - 0C38                                 | 3128 - 3129 | Positive Power Factor, 3-Ph, Maximum Avg Demand | FLOAT  | -1.00 to +1.00      | none                |            | 2     |
| 0C39 - 0C3A                                 | 3130 - 3131 | Negative Power Factor, 3-Ph, Maximum Avg Demand | FLOAT  | -1.00 to +1.00      | none                |            | 2     |
| 0C3B - 0C3C                                 | 3132 - 3133 | Frequency, Maximum                              | FLOAT  | 0 to 65.00          | Hz                  |            | 2     |
|                                             |             |                                                 |        |                     |                     | Block Size | 34    |
| Reserved Block <sup>7, 13</sup>             |             |                                                 |        |                     |                     | read-only  |       |
| 0F9F - 0F9F                                 | 4000 - 4000 | Reserved                                        | UINT16 | 0 to 9999, or 65535 | 0.1%                |            | 1     |
| 0FA0 - 0FA0                                 | 4001 - 4001 | Reserved                                        | UINT16 | 0 to 9999, or 65535 | 0.1%                |            | 1     |
| 0FA1 - 0FA1                                 | 4002 - 4002 | Reserved                                        | UINT16 | 0 to 9999, or 65535 | 0.1%                |            | 1     |
| 0FA2 - 0FA2                                 | 4003 - 4003 | Reserved                                        | UINT16 | 0 to 9999, or 65535 | 0.1%                |            | 1     |

| Modbus Address                  |             | Description <sup>1</sup> | Format | Range <sup>6</sup> | Units or Resolution | Comments                                                                                                                                                                                                                | # Reg |
|---------------------------------|-------------|--------------------------|--------|--------------------|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| Hex                             | Decimal     |                          |        |                    |                     |                                                                                                                                                                                                                         |       |
| 0FA3 - 0FA3                     | 4004 - 4004 | Reserved                 |        |                    |                     |                                                                                                                                                                                                                         | 1     |
| 0FA4 - 0FA4                     | 4005 - 4005 | Reserved                 |        |                    |                     |                                                                                                                                                                                                                         | 1     |
| 0FA5 - 0FA5                     | 4006 - 4006 | Reserved                 |        |                    |                     |                                                                                                                                                                                                                         | 1     |
| 0FA6 - 0FA6                     | 4007 - 4007 | Reserved                 |        |                    |                     |                                                                                                                                                                                                                         | 1     |
| 0FA7 - 0FA7                     | 4008 - 4008 | Reserved                 |        |                    |                     |                                                                                                                                                                                                                         | 1     |
| 0FA8 - 0FA8                     | 4009 - 4009 | Reserved                 |        |                    |                     |                                                                                                                                                                                                                         | 1     |
| 0FA9 - 0FA9                     | 4010 - 4010 | Reserved                 |        |                    |                     |                                                                                                                                                                                                                         | 1     |
| 0FAA - 0FAA                     | 4011 - 4011 | Reserved                 |        |                    |                     |                                                                                                                                                                                                                         | 1     |
| 0FAB - 0FAB                     | 4012 - 4012 | Reserved                 |        |                    |                     |                                                                                                                                                                                                                         | 1     |
| 0FAC - 0FAC                     | 4013 - 4013 | Reserved                 |        |                    |                     |                                                                                                                                                                                                                         | 1     |
| 0FAD - 0FAD                     | 4014 - 4014 | Reserved                 |        |                    |                     |                                                                                                                                                                                                                         | 1     |
| 0FAE - 0FAE                     | 4015 - 4015 | Reserved                 |        |                    |                     |                                                                                                                                                                                                                         | 1     |
| 0FAF - 0FAF                     | 4016 - 4016 | Reserved                 |        |                    |                     |                                                                                                                                                                                                                         | 1     |
| 0FB0 - 0FB0                     | 4017 - 4017 | Reserved                 |        |                    |                     |                                                                                                                                                                                                                         | 1     |
| 0FB1 - 0FB8                     | 4018 - 4025 | Reserved                 |        |                    |                     |                                                                                                                                                                                                                         | 8     |
| 0FB9 - 0FBC                     | 4026 - 4029 | Reserved                 |        |                    |                     |                                                                                                                                                                                                                         | 4     |
| 0FBD - 0FC4                     | 4030 - 4037 | Reserved                 |        |                    |                     |                                                                                                                                                                                                                         | 8     |
| 0FC5 - 0FC8                     | 4038 - 4041 | Reserved                 |        |                    |                     |                                                                                                                                                                                                                         | 4     |
|                                 |             |                          |        |                    |                     | Block Size:                                                                                                                                                                                                             | 42    |
| Phase Angle Block <sup>14</sup> |             |                          |        |                    |                     | read-only                                                                                                                                                                                                               |       |
| 1003 - 1003                     | 4100 - 4100 | Phase A Current          | SINT16 | -1800 to +1800     | 0.1 degree          |                                                                                                                                                                                                                         | 1     |
| 1004 - 1004                     | 4101 - 4101 | Phase B Current          | SINT16 | -1800 to +1800     | 0.1 degree          |                                                                                                                                                                                                                         | 1     |
| 1005 - 1005                     | 4102 - 4102 | Phase C Current          | SINT16 | -1800 to +1800     | 0.1 degree          |                                                                                                                                                                                                                         | 1     |
| 1006 - 1006                     | 4103 - 4103 | Angle, Volts A-B         | SINT16 | -1800 to +1800     | 0.1 degree          |                                                                                                                                                                                                                         | 1     |
| 1007 - 1007                     | 4104 - 4104 | Angle, Volts B-C         | SINT16 | -1800 to +1800     | 0.1 degree          |                                                                                                                                                                                                                         | 1     |
| 1008 - 1008                     | 4105 - 4105 | Angle, Volts C-A         | SINT16 | -1800 to +1800     | 0.1 degree          |                                                                                                                                                                                                                         | 1     |
|                                 |             |                          |        |                    |                     | Block Size:                                                                                                                                                                                                             | 6     |
| Status Block                    |             |                          |        |                    |                     | read-only                                                                                                                                                                                                               |       |
| 1387 - 1387                     | 5000 - 5000 | Meter Status             | UINT16 | bit-mapped         | --exnpch ssssssss   | exnpch = EEPROM block OK flags<br>(e=energy, x=max, n=min, p=programmable<br>settings, c=calibration, h=header),<br>ssssssss = state (1=Run, 2=Limp, 10=Prog<br>Set Update via buttons, 12=Prog Set<br>Update via COM2) | 1     |
| 1388 - 1388                     | 5001 - 5001 | Reserved                 |        |                    |                     |                                                                                                                                                                                                                         | 1     |
| 1389 - 138A                     | 5002 - 5003 | Time Since Reset         | UINT32 | 0 to 4294967294    | 4 msec              | wraps around after max coun                                                                                                                                                                                             | 2     |
|                                 |             |                          |        |                    |                     | Block Size:                                                                                                                                                                                                             | 4     |

| Modbus Address                |               | Description <sup>1</sup>                              | Format | Range <sup>6</sup>    | Units or Resolution | Comments                                                                             | #   |
|-------------------------------|---------------|-------------------------------------------------------|--------|-----------------------|---------------------|--------------------------------------------------------------------------------------|-----|
| Hex                           | Decimal       |                                                       |        |                       |                     |                                                                                      | Reg |
|                               |               |                                                       |        |                       |                     |                                                                                      |     |
| Commands Section <sup>4</sup> |               |                                                       |        |                       |                     |                                                                                      |     |
| Resets Block <sup>2</sup>     |               |                                                       |        |                       |                     | write-only                                                                           |     |
| 4E1F - 4E1F                   | 20000 - 20000 | Reset Max/Min Blocks                                  | UINT16 | password <sup>5</sup> |                     |                                                                                      | 1   |
| 4E20 - 4E20                   | 20001 - 20001 | Reset Energy Accumulators                             | UINT16 | password <sup>5</sup> |                     |                                                                                      | 1   |
|                               |               |                                                       |        |                       |                     | Block Size:                                                                          | 2   |
| Meter Programming Block       |               |                                                       |        |                       |                     | read/conditional write                                                               |     |
| 55EF - 55EF                   | 22000 - 22000 | Initiate Programmable Settings Update                 | UINT16 | password <sup>5</sup> |                     | meter enters PS update mode                                                          | 1   |
| 55F0 - 55F0                   | 22001 - 22001 | Terminate Programmable Settings Update <sup>3</sup>   | UINT16 | any value             |                     | meter leaves PS update mode via reset                                                | 1   |
| 55F1 - 55F1                   | 22002 - 22002 | Calculate Programmable Settings Checksum <sup>3</sup> | UINT16 |                       |                     | meter calculates checksum on RAM copy of PS block                                    | 1   |
| 55F2 - 55F2                   | 22003 - 22003 | Programmable Settings Checksum <sup>3</sup>           | UINT16 |                       |                     | read/write checksum register; PS block saved in EEPROM on write <sup>5</sup>         | 1   |
| 55F3 - 55F3                   | 22004 - 22004 | Write New Password <sup>5</sup>                       | UINT16 | 0000 to 9999          |                     | write-only register; always reads zero                                               | 1   |
|                               |               |                                                       |        |                       |                     |                                                                                      |     |
| 59D7 - 59D7                   | 23000 - 23000 | Initiate Meter Firmware Reprogramming                 | UINT16 | password <sup>5</sup> |                     |                                                                                      | 1   |
|                               |               |                                                       |        |                       |                     | Block Size:                                                                          | 6   |
| Other Commands Block          |               |                                                       |        |                       |                     | read/write                                                                           |     |
| 61A7 - 61A7                   | 25000 - 25000 | Force Meter Restart                                   | UINT16 | password <sup>5</sup> |                     | causes a watchdog reset, always reads 0                                              | 1   |
|                               |               |                                                       |        |                       |                     | Block Size:                                                                          | 1   |
| Encryption Block              |               |                                                       |        |                       |                     | read/write                                                                           |     |
| 658F - 659A                   | 26000 - 26011 | Perform a Secure Operation                            | UINT16 |                       |                     | encrypted command to read password or change meter type                              | 12  |
|                               |               |                                                       |        |                       |                     | Block Size:                                                                          | 12  |
| Programmable Settings Section |               |                                                       |        |                       |                     |                                                                                      |     |
| Basic Setups Block            |               |                                                       |        |                       |                     | write only in PS update mode                                                         |     |
| 752F - 752F                   | 30000 - 30000 | CT multiplier & denominator                           | UINT16 | bit-mapped            | dddddddd mmmmmmm    | high byte is denominator (1 or 5, read-only), low byte is multiplier (1, 10, or 100) | 1   |
| 7530 - 7530                   | 30001 - 30001 | CT numerator                                          | UINT16 | 1 to 9999             | none                |                                                                                      | 1   |
| 7531 - 7531                   | 30002 - 30002 | PT numerator                                          | UINT16 | 1 to 9999             | none                |                                                                                      | 1   |
| 7532 - 7532                   | 30003 - 30003 | PT denominator                                        | UINT16 | 1 to 9999             | none                |                                                                                      | 1   |

| Modbus Address |               | Description <sup>1</sup>                 | Format | Range <sup>6</sup> | Units or Resolution | Comments                                                                                                                                                                                                                                                                                                                                                                           | # Reg |
|----------------|---------------|------------------------------------------|--------|--------------------|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| Hex            | Decimal       |                                          |        |                    |                     |                                                                                                                                                                                                                                                                                                                                                                                    |       |
| 7533 - 7533    | 30004 - 30004 | PT multiplier & hookup                   | UINT16 | bit-mapped         | mmmmmmmm MMMMhhhh   | MMMMmmmmmmmm is PT multiplier (1, 10, 100, 1000),<br>hhhh is hookup enumeration (0 = 3 element wye[9S], 1 = delta 2 CTs[5S], 3 = 2.5 element wye[6S])                                                                                                                                                                                                                              | 1     |
| 7534 - 7534    | 30005 - 30005 | Averaging Method                         | UINT16 | bit-mapped         | --iiiiii b----sss   | iiii = interval (5,15,30,60)<br>b = 0-block or 1-rolling<br>sss = # subintervals (1,2,3,4)                                                                                                                                                                                                                                                                                         | 1     |
| 7535 - 7535    | 30006 - 30006 | Power & Energy Format                    | UINT16 | bit-mapped         | pppp--nn -eee-ddd   | pppp = power scale (0-unit, 3-kilo, 6-mega, 8-auto)<br>nn = number of energy digits (5-8 --> 0-3)<br>eee = energy scale (0-unit, 3-kilo, 6-mega)<br>ddd = energy digits after decimal point (0-6)<br>See note 10.                                                                                                                                                                  | 1     |
| 7536 - 7536    | 30007 - 30007 | Operating Mode Screen Enables            | UINT16 | bit-mapped         | 00000000 eeeeeeee   | eeeeeeee = op mode screen rows on(1) or off(0), rows top to bottom are bits low order to high order                                                                                                                                                                                                                                                                                | 1     |
| 7537 - 753D    | 30008 - 30014 | Reserved                                 |        |                    |                     |                                                                                                                                                                                                                                                                                                                                                                                    | 7     |
| 753E - 753E    | 30015 - 30015 | User Settings Flags                      | UINT16 | bit-mapped         | --g--nn srp--wf-    | g = enable alternate full scale bargraph current (1=on, 0=off)<br>nn = number of phases for voltage & current screens (3=ABC, 2=AB, 1=A, 0=ABC)<br>s = scroll (1=on, 0=off)<br>r = password for reset in use (1=on, 0=off)<br>p = password for configuration in use (1=on, 0=off)<br>w = pwr dir (0-view as load, 1-view as generator)<br>f = flip power factor sign (1=yes, 0=no) | 1     |
| 753F - 753F    | 30016 - 30016 | Full Scale Current (for load % bargraph) | UINT16 | 0 to 9999          | none                | If non-zero and user settings bit g is set, this value replaces CT numerator in the full scale current calculation.                                                                                                                                                                                                                                                                | 1     |
| 7540 - 7547    | 30017 - 30024 | Meter Designation                        | ASCII  | 16 char            | none                |                                                                                                                                                                                                                                                                                                                                                                                    | 8     |

| Modbus Address                     |               | Description <sup>1</sup> | Format | Range <sup>6</sup> | Units or Resolution  | Comments                                                                          | #   |
|------------------------------------|---------------|--------------------------|--------|--------------------|----------------------|-----------------------------------------------------------------------------------|-----|
| Hex                                | Decimal       |                          |        |                    |                      |                                                                                   | Reg |
| 7548 - 7548                        | 30025 - 30025 | Reserved                 |        |                    |                      | dddd = reply delay (* 50 msec)                                                    | 1   |
| 7549 - 7549                        | 30026 - 30026 | COM2 setup               | UINT16 | bit-mapped         | --- dddd - ppp - bbb | ppp = protocol (1-Modbus RTU, 2-Modbus ASCII, 3-DNP)                              | 1   |
| 754A - 754A                        | 30027 - 30027 | COM2 address             | UINT16 | 1 to 247           | none                 |                                                                                   | 1   |
| 754B - 754B                        | 30028 - 30028 | Reserved                 |        |                    |                      |                                                                                   | 1   |
| 754C - 754C                        | 30029 - 30029 | Reserved                 |        |                    |                      |                                                                                   | 1   |
| 754D - 754D                        | 30030 - 30030 | Reserved                 |        |                    |                      |                                                                                   | 1   |
| 754E - 754E                        | 30031 - 30031 | Reserved                 |        |                    |                      |                                                                                   | 1   |
| 754F - 754F                        | 30032 - 30032 | Reserved                 |        |                    |                      |                                                                                   | 1   |
| 7550 - 7554                        | 30033 - 30037 |                          |        |                    |                      |                                                                                   | 5   |
| 7555 - 7559                        | 30038 - 30042 |                          |        |                    |                      |                                                                                   | 5   |
| 755A - 755E                        | 30043 - 30047 |                          |        |                    |                      |                                                                                   | 5   |
| 755F - 7563                        | 30048 - 30052 |                          |        |                    |                      |                                                                                   | 5   |
| 7564 - 7568                        | 30053 - 30057 |                          |        |                    |                      |                                                                                   | 5   |
| 7569 - 756D                        | 30058 - 30062 |                          |        |                    |                      |                                                                                   | 5   |
| 756E - 7572                        | 30063 - 30067 |                          |        |                    |                      |                                                                                   | 5   |
|                                    |               |                          |        |                    |                      | Block Size:                                                                       | 68  |
| <b>12-Bit RTU Readings Section</b> |               |                          |        |                    |                      |                                                                                   |     |
| <b>12-Bit RTU Block</b>            |               |                          |        |                    |                      | <b>read-only except as noted</b>                                                  |     |
| 9C40 - 9C40                        | 40001 - 40001 | System Sanity Indicator  | UINT16 | 0 or 1             | none                 | 0 indicates proper meter operation                                                | 1   |
| 9C41 - 9C41                        | 40002 - 40002 | Volts A-N                | UINT16 | 2047 to 4095       | volts                | 2047= 0, 4095= +150                                                               | 1   |
| 9C42 - 9C42                        | 40003 - 40003 | Volts B-N                | UINT16 | 2047 to 4095       | volts                |                                                                                   | 1   |
| 9C43 - 9C43                        | 40004 - 40004 | Volts C-N                | UINT16 | 2047 to 4095       | volts                | volts = 150 * (register - 2047) / 2047                                            | 1   |
| 9C44 - 9C44                        | 40005 - 40005 | Amps A                   | UINT16 | 0 to 4095          | amps                 | 0= -10, 2047= 0, 4095= +10                                                        | 1   |
| 9C45 - 9C45                        | 40006 - 40006 | Amps B                   | UINT16 | 0 to 4095          | amps                 |                                                                                   | 1   |
| 9C46 - 9C46                        | 40007 - 40007 | Amps C                   | UINT16 | 0 to 4095          | amps                 | amps = 10 * (register - 2047) / 2047                                              | 1   |
| 9C47 - 9C47                        | 40008 - 40008 | Watts, 3-Ph total        | UINT16 | 0 to 4095          | watts                | 0= -3000, 2047= 0, 4095= +3000                                                    | 1   |
| 9C48 - 9C48                        | 40009 - 40009 | VARs, 3-Ph total         | UINT16 | 0 to 4095          | VARs                 | watts, VARs, VAs =                                                                | 1   |
| 9C49 - 9C49                        | 40010 - 40010 | VAs, 3-Ph total          | UINT16 | 2047 to 4095       | VAs                  | 3000 * (register - 2047) / 2047                                                   | 1   |
| 9C4A - 9C4A                        | 40011 - 40011 | Power Factor, 3-Ph total | UINT16 | 1047 to 3047       | none                 | 1047= -1, 2047= 0, 3047= +1<br>pf = (register - 2047) / 1000                      | 1   |
| 9C4B - 9C4B                        | 40012 - 40012 | Frequency                | UINT16 | 0 to 2730          | Hz                   | 0= 45 or less, 2047= 60, 2730= 65 or more<br>freq = 45 + ((register / 4095) * 30) | 1   |
| 9C4C - 9C4C                        | 40013 - 40013 | Volts A-B                | UINT16 | 2047 to 4095       | volts                | 2047= 0, 4095= +300                                                               | 1   |
| 9C4D - 9C4D                        | 40014 - 40014 | Volts B-C                | UINT16 | 2047 to 4095       | volts                |                                                                                   | 1   |
| 9C4E - 9C4E                        | 40015 - 40015 | Volts C-A                | UINT16 | 2047 to 4095       | volts                | volts = 300 * (register - 2047) / 2047                                            | 1   |

| Modbus Address    |               | Description <sup>1</sup>  | Format | Range <sup>6</sup>    | Units or Resolution    | Comments                                                                             | # Reg |
|-------------------|---------------|---------------------------|--------|-----------------------|------------------------|--------------------------------------------------------------------------------------|-------|
| Hex               | Decimal       |                           |        |                       |                        |                                                                                      |       |
| 9C4F - 9C4F       | 40016 - 40016 | CT numerator              | UINT16 | 1 to 9999             | none                   | CT = numerator * multiplier / denominator                                            | 1     |
| 9C50 - 9C50       | 40017 - 40017 | CT multiplier             | UINT16 | 1, 10, 100            | none                   |                                                                                      | 1     |
| 9C51 - 9C51       | 40018 - 40018 | CT denominator            | UINT16 | 1 or 5                | none                   |                                                                                      | 1     |
| 9C52 - 9C52       | 40019 - 40019 | PT numerator              | UINT16 | 1 to 9999             | none                   | PT = numerator * multiplier / denominator                                            | 1     |
| 9C53 - 9C53       | 40020 - 40020 | PT multiplier             | UINT16 | 1, 10, 100            | none                   |                                                                                      | 1     |
| 9C54 - 9C54       | 40021 - 40021 | PT denominator            | UINT16 | 1 to 9999             | none                   |                                                                                      | 1     |
| 9C55 - 9C56       | 40022 - 40023 | W-hours, Positive         | UINT32 | 0 to 99999999         | Wh per energy format   | * 5 to 8 digits                                                                      | 2     |
| 9C57 - 9C58       | 40024 - 40025 | W-hours, Negative         | UINT32 | 0 to 99999999         | Wh per energy format   | * decimal point implied, per energy format                                           | 2     |
| 9C59 - 9C5A       | 40026 - 40027 | VAR-hours, Positive       | UINT32 | 0 to 99999999         | VARh per energy format | * resolution of digit before decimal point = units, kilo, or mega, per energy format | 2     |
| 9C5B - 9C5C       | 40028 - 40029 | VAR-hours, Negative       | UINT32 | 0 to 99999999         | VARh per energy format |                                                                                      | 2     |
| 9C5D - 9C5E       | 40030 - 40031 | VA-hours                  | UINT32 | 0 to 99999999         | VAh per energy format  |                                                                                      | 2     |
| 9C5F - 9C5F       | 40032 - 40032 | Neutral Current           | UINT16 | 0 to 4095             | amps                   | see Amps A/B/C above                                                                 | 1     |
| 9C60 - 9CA2       | 40033 - 40099 | Reserved                  | N/A    | N/A                   | none                   |                                                                                      | 67    |
| 9CA3 - 9CA3       | 40100 - 40100 | Reset Energy Accumulators | UINT16 | password <sup>6</sup> |                        | write-only register; always reads as 0                                               | 1     |
|                   |               |                           |        |                       |                        | Block Size:                                                                          | 100   |
| <b>End of Map</b> |               |                           |        |                       |                        |                                                                                      |       |

## Data Formats

|                 |                                                                                                                                            |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| ASCII           | ASCII characters packed 2 per register in high, low order and without any termination characters.                                          |
| SINT16 / UINT16 | 16-bit signed / unsigned integer.                                                                                                          |
| SINT32 / UINT32 | 32-bit signed / unsigned integer spanning 2 registers. The lower-addressed register is the high order half.                                |
| FLOAT           | 32-bit IEEE floating point number spanning 2 registers. The lower-addressed register is the high order half (i.e., contains the exponent). |

## Notes

- 1 All registers not explicitly listed in the table read as 0. Writes to these registers will be accepted but won't actually change the register (since it doesn't exist).
- 2 Meter Data Section items read as 0 until first readings are available or if the meter is not in operating mode. Writes to these registers will be accepted but won't actually change the register.
- 3 Register valid only in programmable settings update mode. In other modes these registers read as 0 and return an illegal data address exception if a write is attempted.
- 4 Meter command registers always read as 0. They may be written only when the meter is in a suitable mode. The registers return an illegal data address exception if a write is attempted in an incorrect mode.
- 5 If the password is incorrect, a valid response is returned but the command is not executed. Use 5555 for the password if passwords are disabled in the programmable settings.

**(continued)**

- 6 M denotes a 1,000,000 multiplier.
- 7 Not used.
- 8 Writing this register causes data to be saved permanently in EEPROM. If there is an error while saving, a slave device failure exception is returned and programmable settings mode automatically terminates via reset.
- 9 Reset commands make no sense if the meter state is LIMP. An illegal function exception will be returned.
- 10 Energy registers should be reset after a format change.
- 11 Not used.
- 12 Not used.
- 13 Not used.
- 14 All 3 voltage angles are measured for Wye and Delta hookups. For 2.5 Element, Vac is measured and Vab & Vbc are calculated. If a voltage phase is missing, the two voltage angles in which it participates are set to zero. A and C phase current angles are measured for all hookups. B phase current angle is measured for Wye and is zero for other hookups. If a voltage phase is missing, its cu angle is zero.
- 15 If any register in the programmable settings section is set to a value other than the acceptable value then the meter will stay in LIMP mode. Please read the comments section or the range for each register in programmable settings section for acceptable values.

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## Modbus Address

| Fixed Data Section   |         |                      |    |                       |                |                     |                     |                                                                            |       |  |
|----------------------|---------|----------------------|----|-----------------------|----------------|---------------------|---------------------|----------------------------------------------------------------------------|-------|--|
| Identification Block |         |                      |    |                       |                | read-only           |                     |                                                                            |       |  |
| Hex                  | Decimal | Description (Note 1) |    | Format                | Range (Note 6) | Units or Resolution | Comments            |                                                                            | # Reg |  |
| 0000                 | - 0007  | 1 -                  | 8  | Meter Name            | ASCII          | 16 char             | none                |                                                                            | 8     |  |
| 0008                 | - 000F  | 9 -                  | 16 | Meter Serial Number   | ASCII          | 16 char             | none                |                                                                            | 8     |  |
| 0010                 | - 0010  | 17 -                 | 17 | Meter Type            | UINT16         | bit-mapped          | -----st -----vvv    | t = 0<br>s= 1<br>vvv = V-switch;<br>V33 = standard 200S                    | 1     |  |
| 0011                 | - 0012  | 18 -                 | 19 | Firmware Version      | ASCII          | 4 char              | none                |                                                                            | 2     |  |
| 0013                 | - 0013  | 20 -                 | 20 | Map Version           | UINT16         | 0 to 65535          |                     |                                                                            | 1     |  |
| 0014                 | - 0014  | 21 -                 | 21 | Meter Configuration   | UINT16         | bit-mapped          | -----ccc -----fffff | ccc = CT denominator (1 or 5).<br>fffff = calibration frequency (50 or 60) | 1     |  |
| 0015                 | - 0015  | 22 -                 | 22 | ASIC Version          | UINT16         | 0-65535             | none                |                                                                            | 1     |  |
| 0016                 | - 0017  | 23 -                 | 24 | Boot Firmware Version | ASCII          | 4 char              | none                |                                                                            | 2     |  |
| 0018                 | - 0018  | 25 -                 | 25 | Reserved              |                |                     |                     |                                                                            | 1     |  |
| 0019                 | - 0019  | 26 -                 | 26 | Reserved              |                |                     |                     |                                                                            | 1     |  |
| 001A                 | - 001D  | 27 -                 | 30 | Meter Type Name       | ASCII          | 8 char              | none                |                                                                            | 4     |  |
| 001E                 | - 0026  | 31 -                 | 39 | Reserved              |                |                     |                     | Reserved                                                                   | 9     |  |
| 0027                 | - 002E  | 40 -                 | 47 | Reserved              |                |                     |                     | Reserved                                                                   | 8     |  |
|                      |         |                      |    |                       |                |                     |                     | Block Size:                                                                | 47    |  |

| Meter Data Section (Note 2) |        |         |        |                          |  |           |                    |                     |                                                                                                |       |
|-----------------------------|--------|---------|--------|--------------------------|--|-----------|--------------------|---------------------|------------------------------------------------------------------------------------------------|-------|
| Primary Readings Block      |        |         |        |                          |  | read-only |                    |                     |                                                                                                |       |
| Hex                         |        | Decimal |        | Description (Note 1)     |  | Format    | Range (Note 6)     | Units or Resolution | Comments                                                                                       | # Reg |
| 03E7                        | - 03E8 | 1000    | - 1001 | Volts A-N                |  | FLOAT     | 0 to 9999 M        | volts               |                                                                                                | 2     |
| 03E9                        | - 03EA | 1002    | - 1003 | Volts B-N                |  | FLOAT     | 0 to 9999 M        | volts               |                                                                                                | 2     |
| 03EB                        | - 03EC | 1004    | - 1005 | Volts C-N                |  | FLOAT     | 0 to 9999 M        | volts               |                                                                                                | 2     |
| 03ED                        | - 03EE | 1006    | - 1007 | Volts A-B                |  | FLOAT     | 0 to 9999 M        | volts               |                                                                                                | 2     |
| 03EF                        | - 03F0 | 1008    | - 1009 | Volts B-C                |  | FLOAT     | 0 to 9999 M        | volts               |                                                                                                | 2     |
| 03F1                        | - 03F2 | 1010    | - 1011 | Volts C-A                |  | FLOAT     | 0 to 9999 M        | volts               |                                                                                                | 2     |
| 03F3                        | - 03F4 | 1012    | - 1013 | Amps A                   |  | FLOAT     | 0 to 9999 M        | amps                |                                                                                                | 2     |
| 03F5                        | - 03F6 | 1014    | - 1015 | Amps B                   |  | FLOAT     | 0 to 9999 M        | amps                |                                                                                                | 2     |
| 03F7                        | - 03F8 | 1016    | - 1017 | Amps C                   |  | FLOAT     | 0 to 9999 M        | amps                |                                                                                                | 2     |
| 03F9                        | - 03FA | 1018    | - 1019 | Watts, 3-Ph total        |  | FLOAT     | -9999 M to +9999 M | watts               |                                                                                                | 2     |
| 03FB                        | - 03FC | 1020    | - 1021 | VARs, 3-Ph total         |  | FLOAT     | -9999 M to +9999 M | VARs                |                                                                                                | 2     |
| 03FD                        | - 03FE | 1022    | - 1023 | VAs, 3-Ph total          |  | FLOAT     | -9999 M to +9999 M | VAs                 |                                                                                                | 2     |
| 03FF                        | - 0400 | 1024    | - 1025 | Power Factor, 3-Ph total |  | FLOAT     | -1.00 to +1.00     | none                |                                                                                                | 2     |
| 0401                        | - 0402 | 1026    | - 1027 | Frequency                |  | FLOAT     | 0 to 65.00         | Hz                  |                                                                                                | 2     |
| 0403                        | - 0404 | 1028    | - 1029 | Neutral Current          |  | FLOAT     | 0 to 9999 M        | amps                |                                                                                                | 2     |
| 0405                        | - 0406 | 1030    | - 1031 | Watts, Phase A           |  | FLOAT     | -9999 M to +9999 M | watts               |                                                                                                | 2     |
| 0407                        | - 0408 | 1032    | - 1033 | Watts, Phase B           |  | FLOAT     | -9999 M to +9999 M | watts               |                                                                                                | 2     |
| 0409                        | - 040A | 1034    | - 1035 | Watts, Phase C           |  | FLOAT     | -9999 M to +9999 M | watts               |                                                                                                | 2     |
| 040B                        | - 040C | 1036    | - 1037 | VARs, Phase A            |  | FLOAT     | -9999 M to +9999 M | VARs                |                                                                                                | 2     |
| 040D                        | - 040E | 1038    | - 1039 | VARs, Phase B            |  | FLOAT     | -9999 M to +9999 M | VARs                |                                                                                                | 2     |
| 040F                        | - 0410 | 1040    | - 1041 | VARs, Phase C            |  | FLOAT     | -9999 M to +9999 M | VARs                | Per phase power and PF have values only for WYE hookup and will be zero for all other hookups. | 2     |
| 0411                        | - 0412 | 1042    | - 1043 | VAs, Phase A             |  | FLOAT     | -9999 M to +9999 M | VAs                 |                                                                                                | 2     |
| 0413                        | - 0414 | 1044    | - 1045 | VAs, Phase B             |  | FLOAT     | -9999 M to +9999 M | VAs                 |                                                                                                | 2     |
| 0415                        | - 0416 | 1046    | - 1047 | VAs, Phase C             |  | FLOAT     | -9999 M to +9999 M | VAs                 |                                                                                                | 2     |
| 0417                        | - 0418 | 1048    | - 1049 | Power Factor, Phase A    |  | FLOAT     | -1.00 to +1.00     | none                |                                                                                                | 2     |
| 0419                        | - 041A | 1050    | - 1051 | Power Factor, Phase B    |  | FLOAT     | -1.00 to +1.00     | none                |                                                                                                | 2     |
| 041B                        | - 041C | 1052    | - 1053 | Power Factor, Phase C    |  | FLOAT     | -1.00 to +1.00     | none                |                                                                                                | 2     |
| 041D                        | - 0425 | 1054    | - 1062 | Reserved                 |  |           |                    |                     | Reserved Block Size:                                                                           | 9     |
|                             |        |         |        |                          |  |           |                    |                     |                                                                                                | 63    |

Per phase power and PF have values only for WYE hookup and will be zero for all other hookups.

| Primary Energy Block |         |                                          |        |                                 |                        |                                                                                             | read-only |     |
|----------------------|---------|------------------------------------------|--------|---------------------------------|------------------------|---------------------------------------------------------------------------------------------|-----------|-----|
| Hex                  | Decimal | Description (Note 1)                     | Format | Range (Note 5)                  | Units or Resolution    | Comments                                                                                    | #         | Reg |
| 05DB                 | 05DC    | 1500 - 1501 W-hours, Received            | SINT32 | 0 to 99999999 or 0 to -99999999 | Wh per energy format   | * Wh received & delivered always have opposite signs                                        | 2         |     |
| 05DD                 | 05DE    | 1502 - 1503 W-hours, Delivered           | SINT32 | 0 to 99999999 or 0 to -99999999 | Wh per energy format   | * Wh received is positive for "view as load", delivered is positive for "view as generator" | 2         |     |
| 05DF                 | 05E0    | 1504 - 1505 W-hours, Net                 | SINT32 | -99999999 to 99999999           | Wh per energy format   | * 5 to 8 digits                                                                             | 2         |     |
| 05E1                 | 05E2    | 1506 - 1507 W-hours, Total               | SINT32 | 0 to 99999999                   | Wh per energy format   |                                                                                             | 2         |     |
| 05E3                 | 05E4    | 1508 - 1509 VAR-hours, Positive          | SINT32 | 0 to 99999999                   | VARh per energy format | * decimal point implied, per energy format                                                  | 2         |     |
| 05E5                 | 05E6    | 1510 - 1511 VAR-hours, Negative          | SINT32 | 0 to -99999999                  | VARh per energy format |                                                                                             | 2         |     |
| 05E7                 | 05E8    | 1512 - 1513 VAR-hours, Net               | SINT32 | -99999999 to 99999999           | VARh per energy format | * resolution of digit before decimal point = units, kilo, or mega, per energy format        | 2         |     |
| 05E9                 | 05EA    | 1514 - 1515 VAR-hours, Total             | SINT32 | 0 to 99999999                   | VARh per energy format |                                                                                             | 2         |     |
| 05EB                 | 05EC    | 1516 - 1517 VA-hours, Total              | SINT32 | 0 to 99999999                   | VAh per energy format  | * see note 10                                                                               | 2         |     |
| 05ED                 | 05EE    | 1518 - 1519 W-hours, Received, Phase A   | SINT32 | 0 to 99999999 or 0 to -99999999 | Wh per energy format   |                                                                                             | 2         |     |
| 05EF                 | 05F0    | 1520 - 1521 W-hours, Received, Phase B   | SINT32 | 0 to 99999999 or 0 to -99999999 | Wh per energy format   |                                                                                             | 2         |     |
| 05F1                 | 05F2    | 1522 - 1523 W-hours, Received, Phase C   | SINT32 | 0 to 99999999 or 0 to -99999999 | Wh per energy format   |                                                                                             | 2         |     |
| 05F3                 | 05F4    | 1524 - 1525 W-hours, Delivered, Phase A  | SINT32 | 0 to 99999999 or 0 to -99999999 | Wh per energy format   |                                                                                             | 2         |     |
| 05F5                 | 05F6    | 1526 - 1527 W-hours, Delivered, Phase B  | SINT32 | 0 to 99999999 or 0 to -99999999 | Wh per energy format   |                                                                                             | 2         |     |
| 05F7                 | 05F8    | 1528 - 1529 W-hours, Delivered, Phase C  | SINT32 | 0 to 99999999 or 0 to -99999999 | Wh per energy format   |                                                                                             | 2         |     |
| 05F9                 | 05FA    | 1530 - 1531 W-hours, Net, Phase A        | SINT32 | -99999999 to 99999999           | Wh per energy format   |                                                                                             | 2         |     |
| 05FB                 | 05FC    | 1532 - 1533 W-hours, Net, Phase B        | SINT32 | -99999999 to 99999999           | Wh per energy format   |                                                                                             | 2         |     |
| 05FD                 | 05FE    | 1534 - 1535 W-hours, Net, Phase C        | SINT32 | -99999999 to 99999999           | Wh per energy format   |                                                                                             | 2         |     |
| 05FF                 | 0600    | 1536 - 1537 W-hours, Total, Phase A      | SINT32 | 0 to 99999999                   | Wh per energy format   |                                                                                             | 2         |     |
| 0601                 | 0602    | 1538 - 1539 W-hours, Total, Phase B      | SINT32 | 0 to 99999999                   | Wh per energy format   |                                                                                             | 2         |     |
| 0603                 | 0604    | 1540 - 1541 W-hours, Total, Phase C      | SINT32 | 0 to 99999999                   | Wh per energy format   |                                                                                             | 2         |     |
| 0605                 | 0606    | 1542 - 1543 VAR-hours, Positive, Phase A | SINT32 | 0 to 99999999                   | VARh per energy format |                                                                                             | 2         |     |
| 0607                 | 0608    | 1544 - 1545 VAR-hours, Positive, Phase B | SINT32 | 0 to 99999999                   | VARh per energy format |                                                                                             | 2         |     |
| 0609                 | 060A    | 1546 - 1547 VAR-hours, Positive, Phase C | SINT32 | 0 to 99999999                   | VARh per energy format |                                                                                             | 2         |     |
| 060B                 | 060C    | 1548 - 1549 VAR-hours, Negative, Phase A | SINT32 | 0 to -99999999                  | VARh per energy format |                                                                                             | 2         |     |
| 060D                 | 060E    | 1550 - 1551 VAR-hours, Negative, Phase B | SINT32 | 0 to -99999999                  | VARh per energy format |                                                                                             | 2         |     |
| 060F                 | 0610    | 1552 - 1553 VAR-hours, Negative, Phase C | SINT32 | 0 to -99999999                  | VARh per energy format |                                                                                             | 2         |     |
| 0611                 | 0612    | 1554 - 1555 VAR-hours, Net, Phase A      | SINT32 | -99999999 to 99999999           | VARh per energy format |                                                                                             | 2         |     |
| 0613                 | 0614    | 1556 - 1557 VAR-hours, Net, Phase B      | SINT32 | -99999999 to 99999999           | VARh per energy format |                                                                                             | 2         |     |
| 0615                 | 0616    | 1558 - 1559 VAR-hours, Net, Phase C      | SINT32 | -99999999 to 99999999           | VARh per energy format |                                                                                             | 2         |     |
| 0617                 | 0618    | 1560 - 1561 VAR-hours, Total, Phase A    | SINT32 | 0 to 99999999                   | VARh per energy format |                                                                                             | 2         |     |
| 0619                 | 061A    | 1562 - 1563 VAR-hours, Total, Phase B    | SINT32 | 0 to 99999999                   | VARh per energy format |                                                                                             | 2         |     |
| 061B                 | 061C    | 1564 - 1565 VAR-hours, Total, Phase C    | SINT32 | 0 to 99999999                   | VARh per energy format |                                                                                             | 2         |     |
| 061D                 | 061E    | 1566 - 1567 VA-hours, Phase A            | SINT32 | 0 to 99999999                   | VAh per energy format  |                                                                                             | 2         |     |
| 061F                 | 0620    | 1568 - 1569 VA-hours, Phase B            | SINT32 | 0 to 99999999                   | VAh per energy format  |                                                                                             | 2         |     |
| 0621                 | 0622    | 1570 - 1571 VA-hours, Phase C            | SINT32 | 0 to 99999999                   | VAh per energy format  |                                                                                             | 2         |     |
|                      |         |                                          |        |                                 |                        | Block Size:                                                                                 | 72        |     |

| Primary Demand Block |         |      |                                       |        |                    |                     | read-only   |       |
|----------------------|---------|------|---------------------------------------|--------|--------------------|---------------------|-------------|-------|
| Hex                  | Decimal | Year | Description (Note 1)                  | Format | Range (Note 6)     | Units or Resolution | Comments    | # Reg |
| 07CF                 | 07D0    | 2000 | 2001 Amps A, Average                  | FLOAT  | 0 to 9999 M        | amps                |             | 2     |
| 07D1                 | 07D2    | 2002 | 2003 Amps B, Average                  | FLOAT  | 0 to 9999 M        | amps                |             | 2     |
| 07D3                 | 07D4    | 2004 | 2005 Amps C, Average                  | FLOAT  | 0 to 9999 M        | amps                |             | 2     |
| 07D5                 | 07D6    | 2006 | 2007 Positive Watts, 3-Ph, Average    | FLOAT  | -9999 M to +9999 M | watts               |             | 2     |
| 07D7                 | 07D8    | 2008 | 2009 Positive VARs, 3-Ph, Average     | FLOAT  | -9999 M to +9999 M | VARs                |             | 2     |
| 07D9                 | 07DA    | 2010 | 2011 Negative Watts, 3-Ph, Average    | FLOAT  | -9999 M to +9999 M | watts               |             | 2     |
| 07DB                 | 07DC    | 2012 | 2013 Negative VARs, 3-Ph, Average     | FLOAT  | -9999 M to +9999 M | VARs                |             | 2     |
| 07DD                 | 07DE    | 2014 | 2015 VAs, 3-Ph, Average               | FLOAT  | -9999 M to +9999 M | VAs                 |             | 2     |
| 07DF                 | 07E0    | 2016 | 2017 Positive PF, 3-Ph, Average       | FLOAT  | -1.00 to +1.00     | none                |             | 2     |
| 07E1                 | 07E2    | 2018 | 2019 Negative PF, 3-PF, Average       | FLOAT  | -1.00 to +1.00     | none                |             | 2     |
| 07E3                 | 07E4    | 2020 | 2021 Neutral Current, Average         | FLOAT  | 0 to 9999 M        | amps                |             | 2     |
| 07E5                 | 07E6    | 2022 | 2023 Positive Watts, Phase A, Average | FLOAT  | -9999 M to +9999 M | watts               |             | 2     |
| 07E7                 | 07E8    | 2024 | 2025 Positive Watts, Phase B, Average | FLOAT  | -9999 M to +9999 M | watts               |             | 2     |
| 07E9                 | 07EA    | 2026 | 2027 Positive Watts, Phase C, Average | FLOAT  | -9999 M to +9999 M | watts               |             | 2     |
| 07EB                 | 07EC    | 2028 | 2029 Positive VARs, Phase A, Average  | FLOAT  | -9999 M to +9999 M | VARs                |             | 2     |
| 07ED                 | 07EE    | 2030 | 2031 Positive VARs, Phase B, Average  | FLOAT  | -9999 M to +9999 M | VARs                |             | 2     |
| 07EF                 | 07F0    | 2032 | 2033 Positive VARs, Phase C, Average  | FLOAT  | -9999 M to +9999 M | VARs                |             | 2     |
| 07F1                 | 07F2    | 2034 | 2035 Negative Watts, Phase A, Average | FLOAT  | -9999 M to +9999 M | watts               |             | 2     |
| 07F3                 | 07F4    | 2036 | 2037 Negative Watts, Phase B, Average | FLOAT  | -9999 M to +9999 M | watts               |             | 2     |
| 07F5                 | 07F6    | 2038 | 2039 Negative Watts, Phase C, Average | FLOAT  | -9999 M to +9999 M | watts               |             | 2     |
| 07F7                 | 07F8    | 2040 | 2041 Negative VARs, Phase A, Average  | FLOAT  | -9999 M to +9999 M | VARs                |             | 2     |
| 07F9                 | 07FA    | 2042 | 2043 Negative VARs, Phase B, Average  | FLOAT  | -9999 M to +9999 M | VARs                |             | 2     |
| 07FB                 | 07FC    | 2044 | 2045 Negative VARs, Phase C, Average  | FLOAT  | -9999 M to +9999 M | VARs                |             | 2     |
| 07FD                 | 07FE    | 2046 | 2047 VAs, Phase A, Average            | FLOAT  | -9999 M to +9999 M | VAs                 |             | 2     |
| 07FF                 | 0800    | 2048 | 2049 VAs, Phase B, Average            | FLOAT  | -9999 M to +9999 M | VAs                 |             | 2     |
| 0801                 | 0802    | 2050 | 2051 VAs, Phase C, Average            | FLOAT  | -9999 M to +9999 M | VAs                 |             | 2     |
| 0803                 | 0804    | 2052 | 2053 Positive PF, Phase A, Average    | FLOAT  | -1.00 to +1.00     | none                |             | 2     |
| 0805                 | 0806    | 2054 | 2055 Positive PF, Phase B, Average    | FLOAT  | -1.00 to +1.00     | none                |             | 2     |
| 0807                 | 0808    | 2056 | 2057 Positive PF, Phase C, Average    | FLOAT  | -1.00 to +1.00     | none                |             | 2     |
| 0809                 | 080A    | 2058 | 2059 Negative PF, Phase A, Average    | FLOAT  | -1.00 to +1.00     | none                |             | 2     |
| 080B                 | 080C    | 2060 | 2061 Negative PF, Phase B, Average    | FLOAT  | -1.00 to +1.00     | none                |             | 2     |
| 080D                 | 080E    | 2062 | 2063 Negative PF, Phase C, Average    | FLOAT  | -1.00 to +1.00     | none                |             | 2     |
|                      |         |      |                                       |        |                    |                     | Block Size: | 64    |

| Uncompensated Readings Block |         |                                          |        |                                    |                        | read-only                                                                                   |       |
|------------------------------|---------|------------------------------------------|--------|------------------------------------|------------------------|---------------------------------------------------------------------------------------------|-------|
| Hex                          | Decimal | Description (Note 1)                     | Format | Range (Note 6)                     | Units or Resolution    | Comments                                                                                    | # Reg |
| 0BB7                         | 0BB8    | 3009 - 3001 Watts, 3-Ph total            | FLOAT  | -9999 M to +9999 M                 | watts                  |                                                                                             | 2     |
| 0BB9                         | 0BBA    | 3002 - 3003 VARs, 3-Ph total             | FLOAT  | -9999 M to +9999 M                 | VARs                   |                                                                                             | 2     |
| 0BBB                         | 0BBC    | 3004 - 3005 VAs, 3-Ph total              | FLOAT  | -9999 M to +9999 M                 | VAs                    |                                                                                             | 2     |
| 0BBD                         | 0BBE    | 3006 - 3007 Power Factor, 3-Ph total     | FLOAT  | -1.00 to +1.00                     | none                   |                                                                                             | 2     |
| 0BBF                         | 0BC0    | 3008 - 3009 Watts, Phase A               | FLOAT  | -9999 M to +9999 M                 | watts                  |                                                                                             | 2     |
| 0BC1                         | 0BC2    | 3010 - 3011 Watts, Phase B               | FLOAT  | -9999 M to +9999 M                 | watts                  |                                                                                             | 2     |
| 0BC3                         | 0BC4    | 3012 - 3013 Watts, Phase C               | FLOAT  | -9999 M to +9999 M                 | watts                  |                                                                                             | 2     |
| 0BC5                         | 0BC6    | 3014 - 3015 VARs, Phase A                | FLOAT  | -9999 M to +9999 M                 | VARs                   |                                                                                             | 2     |
| 0BC7                         | 0BC8    | 3016 - 3017 VARs, Phase B                | FLOAT  | -9999 M to +9999 M                 | VARs                   |                                                                                             | 2     |
| 0BC9                         | 0BCA    | 3018 - 3019 VARs, Phase C                | FLOAT  | -9999 M to +9999 M                 | VARs                   |                                                                                             | 2     |
| 0BCB                         | 0BCC    | 3020 - 3021 VAs, Phase A                 | FLOAT  | -9999 M to +9999 M                 | VAs                    |                                                                                             | 2     |
| 0BCD                         | 0BCE    | 3022 - 3023 VAs, Phase B                 | FLOAT  | -9999 M to +9999 M                 | VAs                    |                                                                                             | 2     |
| 0BCF                         | 0BD0    | 3024 - 3025 VAs, Phase C                 | FLOAT  | -9999 M to +9999 M                 | VAs                    |                                                                                             | 2     |
| 0BD1                         | 0BD2    | 3026 - 3027 Power Factor, Phase A        | FLOAT  | -1.00 to +1.00                     | none                   |                                                                                             | 2     |
| 0BD3                         | 0BD4    | 3028 - 3029 Power Factor, Phase B        | FLOAT  | -1.00 to +1.00                     | none                   |                                                                                             | 2     |
| 0BD5                         | 0BD6    | 3030 - 3031 Power Factor, Phase C        | FLOAT  | -1.00 to +1.00                     | none                   |                                                                                             | 2     |
| 0BD7                         | 0BD8    | 3032 - 3033 W-hours, Received            | SINT32 | 0 to 99999999 or<br>0 to -99999999 | Wh per energy format   |                                                                                             | 2     |
| 0BD9                         | 0BDA    | 3034 - 3035 W-hours, Delivered           | SINT32 | 0 to 99999999 or<br>0 to -99999999 | Wh per energy format   | * Wh received & delivered always have opposite signs                                        | 2     |
| 0BDB                         | 0BDC    | 3036 - 3037 W-hours, Net                 | SINT32 | -99999999 to 99999999              | Wh per energy format   | * Wh received is positive for "view as load", delivered is positive for "view as generator" | 2     |
| 0BDD                         | 0BDE    | 3038 - 3039 W-hours, Total               | SINT32 | 0 to 99999999                      | Wh per energy format   | * 5 to 8 digits                                                                             | 2     |
| 0BDF                         | 0BE0    | 3040 - 3041 VAR-hours, Positive          | SINT32 | 0 to 99999999                      | VARh per energy format | * decimal point implied, per energy format                                                  | 2     |
| 0BE1                         | 0BE2    | 3042 - 3043 VAR-hours, Negative          | SINT32 | 0 to -99999999                     | VARh per energy format |                                                                                             | 2     |
| 0BE3                         | 0BE4    | 3044 - 3045 VAR-hours, Net               | SINT32 | -99999999 to 99999999              | VARh per energy format | * resolution of digit before decimal point = units, kilo, or mega, per energy format        | 2     |
| 0BE5                         | 0BE6    | 3046 - 3047 VAR-hours, Total             | SINT32 | 0 to 99999999                      | VARh per energy format |                                                                                             | 2     |
| 0BE7                         | 0BE8    | 3048 - 3049 VA-hours, Total              | SINT32 | 0 to 99999999                      | VAh per energy format  | * see note 10                                                                               | 2     |
| 0BE9                         | 0BEA    | 3050 - 3051 W-hours, Received, Phase A   | SINT32 | 0 to 99999999 or<br>0 to -99999999 | Wh per energy format   |                                                                                             | 2     |
| 0BEB                         | 0BEC    | 3052 - 3053 W-hours, Received, Phase B   | SINT32 | 0 to 99999999 or<br>0 to -99999999 | Wh per energy format   |                                                                                             | 2     |
| 0BED                         | 0BEE    | 3054 - 3055 W-hours, Received, Phase C   | SINT32 | 0 to 99999999 or<br>0 to -99999999 | Wh per energy format   |                                                                                             | 2     |
| 0BEF                         | 0BF0    | 3056 - 3057 W-hours, Delivered, Phase A  | SINT32 | 0 to 99999999 or<br>0 to -99999999 | Wh per energy format   |                                                                                             | 2     |
| 0BF1                         | 0BF2    | 3058 - 3059 W-hours, Delivered, Phase B  | SINT32 | 0 to 99999999 or<br>0 to -99999999 | Wh per energy format   |                                                                                             | 2     |
| 0BF3                         | 0BF4    | 3060 - 3061 W-hours, Delivered, Phase C  | SINT32 | 0 to 99999999 or<br>0 to -99999999 | Wh per energy format   |                                                                                             | 2     |
| 0BF5                         | 0BF6    | 3062 - 3063 W-hours, Net, Phase A        | SINT32 | -99999999 to 99999999              | Wh per energy format   |                                                                                             | 2     |
| 0BF7                         | 0BF8    | 3064 - 3065 W-hours, Net, Phase B        | SINT32 | -99999999 to 99999999              | Wh per energy format   |                                                                                             | 2     |
| 0BF9                         | 0BFA    | 3066 - 3067 W-hours, Net, Phase C        | SINT32 | -99999999 to 99999999              | Wh per energy format   |                                                                                             | 2     |
| 0BFB                         | 0BFC    | 3068 - 3069 W-hours, Total, Phase A      | SINT32 | 0 to 99999999                      | Wh per energy format   |                                                                                             | 2     |
| 0BFD                         | 0BFE    | 3070 - 3071 W-hours, Total, Phase B      | SINT32 | 0 to 99999999                      | Wh per energy format   |                                                                                             | 2     |
| 0BFF                         | 0C00    | 3072 - 3073 W-hours, Total, Phase C      | SINT32 | 0 to 99999999                      | Wh per energy format   |                                                                                             | 2     |
| 0C01                         | 0C02    | 3074 - 3075 VAR-hours, Positive, Phase A | SINT32 | 0 to 99999999                      | VARh per energy format |                                                                                             | 2     |
| 0C03                         | 0C04    | 3076 - 3077 VAR-hours, Positive, Phase B | SINT32 | 0 to 99999999                      | VARh per energy format |                                                                                             | 2     |
| 0C05                         | 0C06    | 3078 - 3079 VAR-hours, Positive, Phase C | SINT32 | 0 to 99999999                      | VARh per energy format |                                                                                             | 2     |
| 0C07                         | 0C08    | 3080 - 3081 VAR-hours, Negative, Phase A | SINT32 | 0 to -99999999                     | VARh per energy format |                                                                                             | 2     |
| 0C09                         | 0C0A    | 3082 - 3083 VAR-hours, Negative, Phase B | SINT32 | 0 to -99999999                     | VARh per energy format |                                                                                             | 2     |
| 0C0B                         | 0C0C    | 3084 - 3085 VAR-hours, Negative, Phase C | SINT32 | 0 to -99999999                     | VARh per energy format |                                                                                             | 2     |
| 0C0D                         | 0C0E    | 3086 - 3087 VAR-hours, Net, Phase A      | SINT32 | -99999999 to 99999999              | VARh per energy format |                                                                                             | 2     |
| 0C0F                         | 0C10    | 3088 - 3089 VAR-hours, Net, Phase B      | SINT32 | -99999999 to 99999999              | VARh per energy format |                                                                                             | 2     |
| 0C11                         | 0C12    | 3090 - 3091 VAR-hours, Net, Phase C      | SINT32 | -99999999 to 99999999              | VARh per energy format |                                                                                             | 2     |
| 0C13                         | 0C14    | 3092 - 3093 VAR-hours, Total, Phase A    | SINT32 | 0 to 99999999                      | VARh per energy format |                                                                                             | 2     |
| 0C15                         | 0C16    | 3094 - 3095 VAR-hours, Total, Phase B    | SINT32 | 0 to 99999999                      | VARh per energy format |                                                                                             | 2     |
| 0C17                         | 0C18    | 3096 - 3097 VAR-hours, Total, Phase C    | SINT32 | 0 to 99999999                      | VARh per energy format |                                                                                             | 2     |
| 0C19                         | 0C1A    | 3098 - 3099 VA-hours, Phase A            | SINT32 | 0 to 99999999                      | VAh per energy format  |                                                                                             | 2     |
| 0C1B                         | 0C1C    | 3100 - 3101 VA-hours, Phase B            | SINT32 | 0 to 99999999                      | VAh per energy format  |                                                                                             | 2     |
| 0C1D                         | 0C1E    | 3102 - 3103 VA-hours, Phase C            | SINT32 | 0 to 99999999                      | VAh per energy format  |                                                                                             | 2     |
|                              |         |                                          |        |                                    |                        | Block Size:                                                                                 | 104   |

| Phase Angle Block                |         |                                                             |        |                      |                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                        | read-only |     |
|----------------------------------|---------|-------------------------------------------------------------|--------|----------------------|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-----|
| Hex                              | Decimal | Description (Note 1)                                        | Format | Range (Note 6)       | Units or Resolution | Comments                                                                                                                                                                                                                                                                                                                                                                                                                                               | #         | Reg |
| 1003                             | 4103    | 4100 Phase A Current                                        | SINT16 | -1800 to +1800       | 0.1 degree          |                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           | 1   |
| 1004                             | 4104    | 4101 Phase B Current                                        | SINT16 | -1800 to +1800       | 0.1 degree          |                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           | 1   |
| 1005                             | 4105    | 4102 Phase C Current                                        | SINT16 | -1800 to +1800       | 0.1 degree          |                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           | 1   |
| 1006                             | 4106    | 4103 Angle, Volts A-B                                       | SINT16 | -1800 to +1800       | 0.1 degree          |                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           | 1   |
| 1007                             | 4107    | 4104 Angle, Volts B-C                                       | SINT16 | -1800 to +1800       | 0.1 degree          |                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           | 1   |
| 1008                             | 4108    | 4105 Angle, Volts C-A                                       | SINT16 | -1800 to +1800       | 0.1 degree          |                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           | 1   |
|                                  |         |                                                             |        |                      |                     | Block Size:                                                                                                                                                                                                                                                                                                                                                                                                                                            |           | 6   |
| Status Block                     |         |                                                             |        |                      |                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                        | read-only |     |
| Hex                              | Decimal | Description (Note 1)                                        | Format | Range (Note 6)       | Units or Resolution | Comments                                                                                                                                                                                                                                                                                                                                                                                                                                               | #         | Reg |
| 1193                             | 4500    | 4500 Port ID                                                | UINT16 | 1 to 4               | none                | Identifies which Shark COM port a master is connected to; 1 for COM1, 2 for COM2, etc.                                                                                                                                                                                                                                                                                                                                                                 |           | 1   |
| 1194                             | 4501    | 4501 Meter Status                                           | UINT16 | bit-mapped           | mmmpch-- -ffeeccc   | mmm = measurement state (0=off, 1=running normally, 2=limp mode, 3=warmup, 6&7=boot, others unused) See note 16.<br>pch = NVMEM block OK flags (p=profile, c=calibration, h=header), flag is 1 if OK<br>ff = flash state (0=initializing, 1=logging disabled by Vswitch, 3=logging)<br>ee = edit state (0=startup, 1=normal, 2=privileged command session, 3=profile update mode)<br>ccc = port enabled for edit(0=none, 1-4=COM1-COM4, 7=front panel) |           | 1   |
| 1195                             | 4502    | 4502 Limits Status                                          | UINT16 | bit-mapped           | 87654321 87654321   | high byte is setpt 1, 0=in, 1=out<br>low byte is setpt 2, 0=in, 1=out<br>see notes 11, 12, 17                                                                                                                                                                                                                                                                                                                                                          |           | 1   |
| 1196                             | 4503    | 4504 Time Since Reset                                       | UINT32 | 0 to 4294967294      | 4 msec              | wraps around after max count                                                                                                                                                                                                                                                                                                                                                                                                                           |           | 2   |
| 1198                             | 4505    | 4507 Meter On Time                                          | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           | 3   |
| 119B                             | 4508    | 4510 Current Date and Time                                  | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           | 3   |
| 119E                             | 4511    | 4511 Reserved                                               |        |                      |                     | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                               |           | 1   |
| 119F                             | 4512    | 4512 Current Day of Week                                    | UINT16 | 1 to 7               | 1 day               | 1=Sun, 2=Mon, etc.                                                                                                                                                                                                                                                                                                                                                                                                                                     |           | 1   |
|                                  |         |                                                             |        |                      |                     | Block Size:                                                                                                                                                                                                                                                                                                                                                                                                                                            |           | 13  |
|                                  |         |                                                             |        |                      |                     | Block Size:                                                                                                                                                                                                                                                                                                                                                                                                                                            |           | 876 |
| Short term Primary Minimum Block |         |                                                             |        |                      |                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                        | read-only |     |
| Hex                              | Decimal | Description (Note 1)                                        | Format | Range (Note 6)       | Units or Resolution | Comments                                                                                                                                                                                                                                                                                                                                                                                                                                               | #         | Reg |
| 1F27                             | 7976    | 7977 Volts A-N, previous Demand interval Short Term Minimum | FLOAT  | 0 to 9999 M          | volts               | Minimum instantaneous value measured during the demand interval before the one most recently completed.                                                                                                                                                                                                                                                                                                                                                |           | 2   |
| 1F29                             | 7978    | 7979 Volts B-N, previous Demand interval Short Term Minimum | FLOAT  | 0 to 9999 M          | volts               |                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           | 2   |
| 1F2B                             | 7980    | 7981 Volts C-N, previous Demand interval Short Term Minimum | FLOAT  | 0 to 9999 M          | volts               |                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           | 2   |
| 1F2D                             | 7982    | 7983 Volts A-B, previous Demand interval Short Term Minimum | FLOAT  | 0 to 9999 M          | volts               |                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           | 2   |
| 1F2F                             | 7984    | 7985 Volts B-C, previous Demand interval Short Term Minimum | FLOAT  | 0 to 9999 M          | volts               | Minimum instantaneous value measured during the most recently completed demand interval.                                                                                                                                                                                                                                                                                                                                                               |           | 2   |
| 1F31                             | 7986    | 7987 Volts C-A, previous Demand interval Short Term Minimum | FLOAT  | 0 to 9999 M          | volts               |                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           | 2   |
| 1F33                             | 7988    | 7989 Volts A-N, Short Term Minimum                          | FLOAT  | 0 to 9999 M          | volts               |                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           | 2   |
| 1F35                             | 7990    | 7991 Volts B-N, Short Term Minimum                          | FLOAT  | 0 to 9999 M          | volts               |                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           | 2   |
| 1F37                             | 7992    | 7993 Volts C-N, Short Term Minimum                          | FLOAT  | 0 to 9999 M          | volts               |                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           | 2   |
| 1F39                             | 7994    | 7995 Volts A-B, Short Term Minimum                          | FLOAT  | 0 to 9999 M          | volts               |                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           | 2   |
| 1F3B                             | 7996    | 7997 Volts B-C, Short Term Minimum                          | FLOAT  | 0 to 9999 M          | volts               |                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           | 2   |
| 1F3D                             | 7998    | 7999 Volts C-A, Short Term Minimum                          | FLOAT  | 0 to 9999 M          | volts               |                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           | 2   |
|                                  |         |                                                             |        |                      |                     | Block Size:                                                                                                                                                                                                                                                                                                                                                                                                                                            |           | 24  |

| Primary Minimum Block |         |                                                      |        |                    |                     |                         | read-only |    |
|-----------------------|---------|------------------------------------------------------|--------|--------------------|---------------------|-------------------------|-----------|----|
| Hex                   | Decimal | Description (Note 1)                                 | Format | Range (Note 6)     | Units or Resolution | Comments                | # Reg     |    |
| 1F3F                  | 8000    | 8001 Volts A-N, Minimum                              | FLOAT  | 0 to 9999 M        | volts               |                         | 2         |    |
| 1F41                  | 8002    | 8003 Volts B-N, Minimum                              | FLOAT  | 0 to 9999 M        | volts               |                         | 2         |    |
| 1F43                  | 8004    | 8005 Volts C-N, Minimum                              | FLOAT  | 0 to 9999 M        | volts               |                         | 2         |    |
| 1F45                  | 8006    | 8007 Volts A-B, Minimum                              | FLOAT  | 0 to 9999 M        | volts               |                         | 2         |    |
| 1F47                  | 8008    | 8009 Volts B-C, Minimum                              | FLOAT  | 0 to 9999 M        | volts               |                         | 2         |    |
| 1F49                  | 8010    | 8011 Volts C-A, Minimum                              | FLOAT  | 0 to 9999 M        | volts               |                         | 2         |    |
| 1F4B                  | 8012    | 8013 Amps A, Minimum Avg Demand                      | FLOAT  | 0 to 9999 M        | amps                |                         | 2         |    |
| 1F4D                  | 8014    | 8015 Amps B, Minimum Avg Demand                      | FLOAT  | 0 to 9999 M        | amps                |                         | 2         |    |
| 1F4F                  | 8016    | 8017 Amps C, Minimum Avg Demand                      | FLOAT  | 0 to 9999 M        | amps                |                         | 2         |    |
| 1F51                  | 8018    | 8019 Positive Watts, 3-Ph, Minimum Avg Demand        | FLOAT  | 0 to +9999 M       | watts               |                         | 2         |    |
| 1F53                  | 8020    | 8021 Positive VARs, 3-Ph, Minimum Avg Demand         | FLOAT  | 0 to +9999 M       | VARs                |                         | 2         |    |
| 1F55                  | 8022    | 8023 Negative Watts, 3-Ph, Minimum Avg Demand        | FLOAT  | 0 to +9999 M       | watts               |                         | 2         |    |
| 1F57                  | 8024    | 8025 Negative VARs, 3-Ph, Minimum Avg Demand         | FLOAT  | 0 to +9999 M       | VARs                |                         | 2         |    |
| 1F59                  | 8026    | 8027 VAs, 3-Ph, Minimum Avg Demand                   | FLOAT  | -9999 M to +9999 M | VAs                 |                         | 2         |    |
| 1F5B                  | 8028    | 8029 Positive Power Factor, 3-Ph, Minimum Avg Demand | FLOAT  | -1.00 to +1.00     | none                |                         | 2         |    |
| 1F5D                  | 8030    | 8031 Negative Power Factor, 3-Ph, Minimum Avg Demand | FLOAT  | -1.00 to +1.00     | none                |                         | 2         |    |
| 1F5F                  | 8032    | 8033 Frequency, Minimum                              | FLOAT  | 0 to 65.00         | Hz                  |                         | 2         |    |
| 1F61                  | 8034    | 8035 Neutral Current, Minimum Avg Demand             | FLOAT  | 0 to 9999 M        | amps                |                         | 2         |    |
| 1F63                  | 8036    | 8037 Positive Watts, Phase A, Minimum Avg Demand     | FLOAT  | -9999 M to +9999 M | watts               |                         | 2         |    |
| 1F65                  | 8038    | 8039 Positive Watts, Phase B, Minimum Avg Demand     | FLOAT  | -9999 M to +9999 M | watts               |                         | 2         |    |
| 1F67                  | 8040    | 8041 Positive Watts, Phase C, Minimum Avg Demand     | FLOAT  | -9999 M to +9999 M | watts               |                         | 2         |    |
| 1F69                  | 8042    | 8043 Positive VARs, Phase A, Minimum Avg Demand      | FLOAT  | -9999 M to +9999 M | VARs                |                         | 2         |    |
| 1F6B                  | 8044    | 8045 Positive VARs, Phase B, Minimum Avg Demand      | FLOAT  | -9999 M to +9999 M | VARs                |                         | 2         |    |
| 1F6D                  | 8046    | 8047 Positive VARs, Phase C, Minimum Avg Demand      | FLOAT  | -9999 M to +9999 M | VARs                |                         | 2         |    |
| 1F6F                  | 8048    | 8049 Negative Watts, Phase A, Minimum Avg Demand     | FLOAT  | -9999 M to +9999 M | watts               |                         | 2         |    |
| 1F71                  | 8050    | 8051 Negative Watts, Phase B, Minimum Avg Demand     | FLOAT  | -9999 M to +9999 M | watts               |                         | 2         |    |
| 1F73                  | 8052    | 8053 Negative Watts, Phase C, Minimum Avg Demand     | FLOAT  | -9999 M to +9999 M | watts               |                         | 2         |    |
| 1F75                  | 8054    | 8055 Negative VARs, Phase A, Minimum Avg Demand      | FLOAT  | -9999 M to +9999 M | VARs                |                         | 2         |    |
| 1F77                  | 8056    | 8057 Negative VARs, Phase B, Minimum Avg Demand      | FLOAT  | -9999 M to +9999 M | VARs                |                         | 2         |    |
| 1F79                  | 8058    | 8059 Negative VARs, Phase C, Minimum Avg Demand      | FLOAT  | -9999 M to +9999 M | VARs                |                         | 2         |    |
| 1F7B                  | 8060    | 8061 VAs, Phase A, Minimum Avg Demand                | FLOAT  | -9999 M to +9999 M | VAs                 |                         | 2         |    |
| 1F7D                  | 8062    | 8063 VAs, Phase B, Minimum Avg Demand                | FLOAT  | -9999 M to +9999 M | VAs                 |                         | 2         |    |
| 1F7F                  | 8064    | 8065 VAs, Phase C, Minimum Avg Demand                | FLOAT  | -9999 M to +9999 M | VAs                 |                         | 2         |    |
| 1F81                  | 8066    | 8067 Positive PF, Phase A, Minimum Avg Demand        | FLOAT  | -1.00 to +1.00     | none                |                         | 2         |    |
| 1F83                  | 8068    | 8069 Positive PF, Phase B, Minimum Avg Demand        | FLOAT  | -1.00 to +1.00     | none                |                         | 2         |    |
| 1F85                  | 8070    | 8071 Positive PF, Phase C, Minimum Avg Demand        | FLOAT  | -1.00 to +1.00     | none                |                         | 2         |    |
| 1F87                  | 8072    | 8073 Negative PF, Phase A, Minimum Avg Demand        | FLOAT  | -1.00 to +1.00     | none                |                         | 2         |    |
| 1F89                  | 8074    | 8075 Negative PF, Phase B, Minimum Avg Demand        | FLOAT  | -1.00 to +1.00     | none                |                         | 2         |    |
| 1F8B                  | 8076    | 8077 Negative PF, Phase C, Minimum Avg Demand        | FLOAT  | -1.00 to +1.00     | none                |                         | 2         |    |
| 1F8D                  | 8078    | 8078 Reserved                                        |        |                    |                     |                         | 1         |    |
| 1F8E                  | 8079    | 8079 Reserved                                        |        |                    |                     |                         | 1         |    |
| 1F8F                  | 8080    | 8080 Reserved                                        |        |                    |                     |                         | 1         |    |
| 1F90                  | 8081    | 8081 Reserved                                        |        |                    |                     |                         | 1         |    |
| 1F91                  | 8082    | 8082 Reserved                                        |        |                    |                     |                         | 1         |    |
| 1F92                  | 8083    | 8083 Reserved                                        |        |                    |                     |                         | 1         |    |
| 1F93                  | 8084    | 8092 Reserved                                        |        |                    |                     | Reserved<br>Block Size: | 9         | 93 |

| Primary Minimum Timestamp Block |         |                                                                |        |                      |                     | read-only   |       |
|---------------------------------|---------|----------------------------------------------------------------|--------|----------------------|---------------------|-------------|-------|
| Hex                             | Decimal | Description (Note 1)                                           | Format | Range (Note 6)       | Units or Resolution | Comments    | # Reg |
| 20CF                            | 20D1    | 8409 - 8402 Volts A-N, Min Timestamp                           | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |             | 3     |
| 20D2                            | 20D4    | 8403 - 8405 Volts B-N, Min Timestamp                           | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |             | 3     |
| 20D5                            | 20D7    | 8406 - 8408 Volts C-N, Min Timestamp                           | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |             | 3     |
| 20D8                            | 20DA    | 8409 - 8411 Volts A-B, Min Timestamp                           | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |             | 3     |
| 20DB                            | 20DD    | 8412 - 8414 Volts B-C, Min Timestamp                           | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |             | 3     |
| 20DE                            | 20E0    | 8415 - 8417 Volts C-A, Min Timestamp                           | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |             | 3     |
| 20E1                            | 20E3    | 8418 - 8420 Amps A, Min Avg Dmd Timestamp                      | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |             | 3     |
| 20E4                            | 20E6    | 8421 - 8423 Amps B, Min Avg Dmd Timestamp                      | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |             | 3     |
| 20E7                            | 20E9    | 8424 - 8426 Amps C, Min Avg Dmd Timestamp                      | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |             | 3     |
| 20EA                            | 20EC    | 8427 - 8429 Positive Watts, 3-Ph, Min Avg Dmd Timestamp        | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |             | 3     |
| 20ED                            | 20EF    | 8430 - 8432 Positive VARs, 3-Ph, Min Avg Dmd Timestamp         | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |             | 3     |
| 20F0                            | 20F2    | 8433 - 8435 Negative Watts, 3-Ph, Min Avg Dmd Timestamp        | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |             | 3     |
| 20F3                            | 20F5    | 8436 - 8438 Negative VARs, 3-Ph, Min Avg Dmd Timestamp         | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |             | 3     |
| 20F6                            | 20F8    | 8439 - 8441 VAs, 3-Ph, Min Avg Dmd Timestamp                   | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |             | 3     |
| 20F9                            | 20FB    | 8442 - 8444 Positive Power Factor, 3-Ph, Min Avg Dmd Timestamp | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |             | 3     |
| 20FC                            | 20FE    | 8445 - 8447 Negative Power Factor, 3-Ph, Min Avg Dmd Timestamp | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |             | 3     |
| 20FF                            | 2101    | 8448 - 8450 Frequency, Min Timestamp                           | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |             | 3     |
| 2102                            | 2104    | 8451 - 8453 Neutral Current, Min Avg Dmd Timestamp             | TSTAMP | 1Jan2000 - 31Dec2100 | 1 sec               |             | 3     |
| 2105                            | 2107    | 8454 - 8456 Positive Watts, Phase A, Min Avg Dmd Timestamp     | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |             | 3     |
| 2108                            | 210A    | 8457 - 8459 Positive Watts, Phase B, Min Avg Dmd Timestamp     | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |             | 3     |
| 210B                            | 210D    | 8460 - 8462 Positive Watts, Phase C, Min Avg Dmd Timestamp     | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |             | 3     |
| 210E                            | 2110    | 8463 - 8465 Positive VARs, Phase A, Min Avg Dmd Timestamp      | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |             | 3     |
| 2111                            | 2113    | 8466 - 8468 Positive VARs, Phase B, Min Avg Dmd Timestamp      | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |             | 3     |
| 2114                            | 2116    | 8469 - 8471 Positive VARs, Phase C, Min Avg Dmd Timestamp      | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |             | 3     |
| 2117                            | 2119    | 8472 - 8474 Negative Watts, Phase A, Min Avg Dmd Timestamp     | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |             | 3     |
| 211A                            | 211C    | 8475 - 8477 Negative Watts, Phase B, Min Avg Dmd Timestamp     | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |             | 3     |
| 211D                            | 211F    | 8478 - 8480 Negative Watts, Phase C, Min Avg Dmd Timestamp     | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |             | 3     |
| 2120                            | 2122    | 8481 - 8483 Negative VARs, Phase A, Min Avg Dmd Timestamp      | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |             | 3     |
| 2123                            | 2125    | 8484 - 8486 Negative VARs, Phase B, Min Avg Dmd Timestamp      | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |             | 3     |
| 2126                            | 2128    | 8487 - 8489 Negative VARs, Phase C, Min Avg Dmd Timestamp      | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |             | 3     |
| 2129                            | 212B    | 8490 - 8492 VAs, Phase A, Min Avg Dmd Timestamp                | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |             | 3     |
| 212C                            | 212E    | 8493 - 8495 VAs, Phase B, Min Avg Dmd Timestamp                | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |             | 3     |
| 212F                            | 2131    | 8496 - 8498 VAs, Phase C, Min Avg Dmd Timestamp                | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |             | 3     |
| 2132                            | 2134    | 8499 - 8501 Positive PF, Phase A, Min Avg Dmd Timestamp        | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |             | 3     |
| 2135                            | 2137    | 8502 - 8504 Positive PF, Phase B, Min Avg Dmd Timestamp        | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |             | 3     |
| 2138                            | 213A    | 8505 - 8507 Positive PF, Phase C, Min Avg Dmd Timestamp        | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |             | 3     |
| 213B                            | 213D    | 8508 - 8510 Negative PF, Phase A, Min Avg Dmd Timestamp        | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |             | 3     |
| 213E                            | 2140    | 8511 - 8513 Negative PF, Phase B, Min Avg Dmd Timestamp        | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |             | 3     |
| 2141                            | 2143    | 8514 - 8516 Negative PF, Phase C, Min Avg Dmd Timestamp        | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |             | 3     |
| 2144                            | 2146    | 8517 - 8519 Reserved                                           |        |                      |                     |             | 3     |
| 2147                            | 2149    | 8520 - 8522 Reserved                                           |        |                      |                     |             | 3     |
| 214A                            | 214C    | 8523 - 8525 Reserved                                           |        |                      |                     |             | 3     |
| 214D                            | 214F    | 8526 - 8528 Reserved                                           |        |                      |                     |             | 3     |
| 2150                            | 2152    | 8529 - 8531 Reserved                                           |        |                      |                     |             | 3     |
| 2153                            | 2155    | 8532 - 8534 Reserved                                           |        |                      |                     |             | 3     |
| 2156                            | 2167    | 8535 - 8552 Reserved                                           |        |                      |                     | Reserved    | 18    |
|                                 |         |                                                                |        |                      |                     | Block Size: | 153   |

| Short term Primary Maximum Block |         |                                                             |        |                    |                     |                                                                                                         | read-only |  |
|----------------------------------|---------|-------------------------------------------------------------|--------|--------------------|---------------------|---------------------------------------------------------------------------------------------------------|-----------|--|
| Hex                              | Decimal | Description (Note 1)                                        | Format | Range (Note 6)     | Units or Resolution | Comments                                                                                                | # Req     |  |
| 230F                             | 2310    | 8979 Volts A-N, previous Demand interval Short Term Maximum | FLOAT  | 0 to 9999 M        | volts               | Maximum instantaneous value measured during the demand interval before the one most recently completed. |           |  |
| 2311                             | 2312    | 8978 Volts B-N, previous Demand interval Short Term Maximum | FLOAT  | 0 to 9999 M        | volts               |                                                                                                         |           |  |
| 2313                             | 2314    | 8980 Volts C-N, previous Demand interval Short Term Maximum | FLOAT  | 0 to 9999 M        | volts               |                                                                                                         |           |  |
| 2315                             | 2316    | 8982 Volts A-B, previous Demand interval Short Term Maximum | FLOAT  | 0 to 9999 M        | volts               |                                                                                                         |           |  |
| 2317                             | 2318    | 8984 Volts B-C, previous Demand interval Short Term Maximum | FLOAT  | 0 to 9999 M        | volts               |                                                                                                         |           |  |
| 2319                             | 231A    | 8986 Volts C-A, previous Demand interval Short Term Maximum | FLOAT  | 0 to 9999 M        | volts               |                                                                                                         |           |  |
| 231B                             | 231C    | 8988 Volts A-N, Maximum                                     | FLOAT  | 0 to 9999 M        | volts               | Maximum instantaneous value measured during the most recently completed demand interval.                | 2         |  |
| 231D                             | 231E    | 8990 Volts B-N, Maximum                                     | FLOAT  | 0 to 9999 M        | volts               |                                                                                                         | 2         |  |
| 232F                             | 2320    | 8992 Volts C-N, Maximum                                     | FLOAT  | 0 to 9999 M        | volts               |                                                                                                         | 2         |  |
| 2321                             | 2322    | 8994 Volts A-B, Maximum                                     | FLOAT  | 0 to 9999 M        | volts               |                                                                                                         | 2         |  |
| 2323                             | 2324    | 8996 Volts B-C, Maximum                                     | FLOAT  | 0 to 9999 M        | volts               |                                                                                                         | 2         |  |
| 2325                             | 2326    | 8998 Volts C-A, Maximum                                     | FLOAT  | 0 to 9999 M        | volts               |                                                                                                         | 2         |  |
|                                  |         |                                                             |        |                    |                     | Block Size:                                                                                             | 12        |  |
| Primary Maximum Block            |         |                                                             |        |                    |                     |                                                                                                         | read-only |  |
| Hex                              | Decimal | Description (Note 1)                                        | Format | Range (Note 6)     | Units or Resolution | Comments                                                                                                | # Req     |  |
| 2327                             | 2328    | 9000 Volts A-N, Maximum                                     | FLOAT  | 0 to 9999 M        | volts               |                                                                                                         | 2         |  |
| 2329                             | 232A    | 9002 Volts B-N, Maximum                                     | FLOAT  | 0 to 9999 M        | volts               |                                                                                                         | 2         |  |
| 232B                             | 232C    | 9004 Volts C-N, Maximum                                     | FLOAT  | 0 to 9999 M        | volts               |                                                                                                         | 2         |  |
| 232D                             | 232E    | 9006 Volts A-B, Maximum                                     | FLOAT  | 0 to 9999 M        | volts               |                                                                                                         | 2         |  |
| 232F                             | 2330    | 9008 Volts B-C, Maximum                                     | FLOAT  | 0 to 9999 M        | volts               |                                                                                                         | 2         |  |
| 2331                             | 2332    | 9010 Volts C-A, Maximum                                     | FLOAT  | 0 to 9999 M        | volts               |                                                                                                         | 2         |  |
| 2333                             | 2334    | 9012 Amps A, Maximum Avg Demand                             | FLOAT  | 0 to 9999 M        | amps                |                                                                                                         | 2         |  |
| 2335                             | 2336    | 9014 Amps B, Maximum Avg Demand                             | FLOAT  | 0 to 9999 M        | amps                |                                                                                                         | 2         |  |
| 2337                             | 2338    | 9016 Amps C, Maximum Avg Demand                             | FLOAT  | 0 to 9999 M        | amps                |                                                                                                         | 2         |  |
| 2339                             | 233A    | 9018 Positive Watts, 3-Ph, Maximum Avg Demand               | FLOAT  | 0 to +9999 M       | watts               |                                                                                                         | 2         |  |
| 233B                             | 233C    | 9020 Positive VARs, 3-Ph, Maximum Avg Demand                | FLOAT  | 0 to +9999 M       | VARs                |                                                                                                         | 2         |  |
| 233D                             | 233E    | 9022 Negative Watts, 3-Ph, Maximum Avg Demand               | FLOAT  | 0 to +9999 M       | watts               |                                                                                                         | 2         |  |
| 233F                             | 2340    | 9024 Negative VARs, 3-Ph, Maximum Avg Demand                | FLOAT  | 0 to +9999 M       | VARs                |                                                                                                         | 2         |  |
| 2341                             | 2342    | 9026 VARs, 3-Ph, Maximum Avg Demand                         | FLOAT  | -9999 M to +9999 M | VAs                 |                                                                                                         | 2         |  |
| 2343                             | 2344    | 9028 Positive Power Factor, 3-Ph, Maximum Avg Demand        | FLOAT  | -1.00 to +1.00     | none                |                                                                                                         | 2         |  |
| 2345                             | 2346    | 9030 Negative Power Factor, 3-Ph, Maximum Avg Demand        | FLOAT  | -1.00 to +1.00     | none                |                                                                                                         | 2         |  |
| 2347                             | 2348    | 9032 Frequency, Maximum                                     | FLOAT  | 0 to 65.00         | Hz                  |                                                                                                         | 2         |  |
| 2349                             | 234A    | 9034 Neutral Current, Maximum Avg Demand                    | FLOAT  | 0 to 9999 M        | amps                |                                                                                                         | 2         |  |
| 234B                             | 234C    | 9036 Positive Watts, Phase A, Maximum Avg Demand            | FLOAT  | -9999 M to +9999 M | watts               |                                                                                                         | 2         |  |
| 234D                             | 234E    | 9038 Positive Watts, Phase B, Maximum Avg Demand            | FLOAT  | -9999 M to +9999 M | watts               |                                                                                                         | 2         |  |
| 234F                             | 2350    | 9040 Positive Watts, Phase C, Maximum Avg Demand            | FLOAT  | -9999 M to +9999 M | watts               |                                                                                                         | 2         |  |
| 2351                             | 2352    | 9042 Positive VARs, Phase A, Maximum Avg Demand             | FLOAT  | -9999 M to +9999 M | VARs                |                                                                                                         | 2         |  |
| 2353                             | 2354    | 9044 Positive VARs, Phase B, Maximum Avg Demand             | FLOAT  | -9999 M to +9999 M | VARs                |                                                                                                         | 2         |  |
| 2355                             | 2356    | 9046 Positive VARs, Phase C, Maximum Avg Demand             | FLOAT  | -9999 M to +9999 M | VARs                |                                                                                                         | 2         |  |
| 2357                             | 2358    | 9048 Negative Watts, Phase A, Maximum Avg Demand            | FLOAT  | -9999 M to +9999 M | watts               |                                                                                                         | 2         |  |
| 2359                             | 235A    | 9050 Negative Watts, Phase B, Maximum Avg Demand            | FLOAT  | -9999 M to +9999 M | watts               |                                                                                                         | 2         |  |
| 235B                             | 235C    | 9052 Negative Watts, Phase C, Maximum Avg Demand            | FLOAT  | -9999 M to +9999 M | watts               |                                                                                                         | 2         |  |
| 235D                             | 235E    | 9054 Negative VARs, Phase A, Maximum Avg Demand             | FLOAT  | -9999 M to +9999 M | VARs                |                                                                                                         | 2         |  |
| 235F                             | 2360    | 9056 Negative VARs, Phase B, Maximum Avg Demand             | FLOAT  | -9999 M to +9999 M | VARs                |                                                                                                         | 2         |  |
| 2361                             | 2362    | 9058 Negative VARs, Phase C, Maximum Avg Demand             | FLOAT  | -9999 M to +9999 M | VARs                |                                                                                                         | 2         |  |
| 2363                             | 2364    | 9060 VAs, Phase A, Maximum Avg Demand                       | FLOAT  | -9999 M to +9999 M | VAs                 |                                                                                                         | 2         |  |
| 2365                             | 2366    | 9062 VAs, Phase B, Maximum Avg Demand                       | FLOAT  | -9999 M to +9999 M | VAs                 |                                                                                                         | 2         |  |
| 2367                             | 2368    | 9064 VAs, Phase C, Maximum Avg Demand                       | FLOAT  | -9999 M to +9999 M | VAs                 |                                                                                                         | 2         |  |
| 2369                             | 236A    | 9066 Positive PF, Phase A, Maximum Avg Demand               | FLOAT  | -1.00 to +1.00     | none                |                                                                                                         | 2         |  |
| 236B                             | 236C    | 9068 Positive PF, Phase B, Maximum Avg Demand               | FLOAT  | -1.00 to +1.00     | none                |                                                                                                         | 2         |  |
| 236D                             | 236E    | 9070 Positive PF, Phase C, Maximum Avg Demand               | FLOAT  | -1.00 to +1.00     | none                |                                                                                                         | 2         |  |
| 236F                             | 2370    | 9072 Negative PF, Phase A, Maximum Avg Demand               | FLOAT  | -1.00 to +1.00     | none                |                                                                                                         | 2         |  |
| 2371                             | 2372    | 9074 Negative PF, Phase B, Maximum Avg Demand               | FLOAT  | -1.00 to +1.00     | none                |                                                                                                         | 2         |  |
| 2373                             | 2374    | 9076 Negative PF, Phase C, Maximum Avg Demand               | FLOAT  | -1.00 to +1.00     | none                |                                                                                                         | 2         |  |
| 2375                             | 2375    | 9078 Reserved                                               |        |                    |                     |                                                                                                         | 1         |  |
| 2376                             | 2376    | 9079 Reserved                                               |        |                    |                     |                                                                                                         | 1         |  |
| 2377                             | 2377    | 9080 Reserved                                               |        |                    |                     |                                                                                                         | 1         |  |
| 2378                             | 2378    | 9081 Reserved                                               |        |                    |                     |                                                                                                         | 1         |  |
| 2379                             | 2379    | 9082 Reserved                                               |        |                    |                     |                                                                                                         | 1         |  |
| 237A                             | 237A    | 9083 Reserved                                               |        |                    |                     |                                                                                                         | 1         |  |
| 237B                             | 2383    | 9084 Reserved                                               |        |                    |                     | Reserved                                                                                                | 9         |  |
|                                  |         |                                                             |        |                    |                     | Block Size:                                                                                             | 93        |  |

| Primary Maximum Timestamp Block |         |                                                         |        |                      |                     | read-only               |           |
|---------------------------------|---------|---------------------------------------------------------|--------|----------------------|---------------------|-------------------------|-----------|
| Hex                             | Decimal | Description (Note 1)                                    | Format | Range (Note 6)       | Units or Resolution | Comments                | # Reg     |
| 24B7                            | 9400    | 9402 Volts A-N, Max Timestamp                           | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |                         | 3         |
| 24BA                            | 9403    | 9405 Volts B-N, Max Timestamp                           | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |                         | 3         |
| 24BD                            | 9406    | 9408 Volts C-N, Max Timestamp                           | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |                         | 3         |
| 24C0                            | 9409    | 9411 Volts A-B, Max Timestamp                           | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |                         | 3         |
| 24C3                            | 9412    | 9414 Volts B-C, Max Timestamp                           | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |                         | 3         |
| 24C6                            | 9415    | 9417 Volts C-A, Max Timestamp                           | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |                         | 3         |
| 24C9                            | 9418    | 9420 Amps A, Max Avg Dmd Timestamp                      | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |                         | 3         |
| 24CC                            | 9421    | 9423 Amps B, Max Avg Dmd Timestamp                      | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |                         | 3         |
| 24CF                            | 9424    | 9426 Amps C, Max Avg Dmd Timestamp                      | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |                         | 3         |
| 24D2                            | 9427    | 9429 Positive Watts, 3-Ph, Max Avg Dmd Timestamp        | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |                         | 3         |
| 24D5                            | 9430    | 9432 Positive VARs, 3-Ph, Max Avg Dmd Timestamp         | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |                         | 3         |
| 24D8                            | 9433    | 9435 Negative Watts, 3-Ph, Max Avg Dmd Timestamp        | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |                         | 3         |
| 24DB                            | 9436    | 9438 Negative VARs, 3-Ph, Max Avg Dmd Timestamp         | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |                         | 3         |
| 24DE                            | 9439    | 9441 VAs, 3-Ph, Max Avg Dmd Timestamp                   | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |                         | 3         |
| 24E1                            | 9442    | 9444 Positive Power Factor, 3-Ph, Max Avg Dmd Timestamp | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |                         | 3         |
| 24E4                            | 9445    | 9447 Negative Power Factor, 3-Ph, Max Avg Dmd Timestamp | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |                         | 3         |
| 24E7                            | 9448    | 9450 Frequency, Max Timestamp                           | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |                         | 3         |
| 24EA                            | 9451    | 9453 Neutral Current, Max Avg Dmd Timestamp             | TSTAMP | 1Jan2000 - 31Dec2100 | 1 sec               |                         | 3         |
| 24ED                            | 9454    | 9456 Positive Watts, Phase A, Max Avg Dmd Timestamp     | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |                         | 3         |
| 24F0                            | 9457    | 9459 Positive Watts, Phase B, Max Avg Dmd Timestamp     | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |                         | 3         |
| 24F3                            | 9460    | 9462 Positive Watts, Phase C, Max Avg Dmd Timestamp     | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |                         | 3         |
| 24F6                            | 9463    | 9465 Positive VARs, Phase A, Max Avg Dmd Timestamp      | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |                         | 3         |
| 24F9                            | 9466    | 9468 Positive VARs, Phase B, Max Avg Dmd Timestamp      | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |                         | 3         |
| 24FC                            | 9469    | 9471 Positive VARs, Phase C, Max Avg Dmd Timestamp      | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |                         | 3         |
| 24FF                            | 9472    | 9474 Negative Watts, Phase A, Max Avg Dmd Timestamp     | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |                         | 3         |
| 2502                            | 9475    | 9477 Negative Watts, Phase B, Max Avg Dmd Timestamp     | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |                         | 3         |
| 2505                            | 9478    | 9480 Negative Watts, Phase C, Max Avg Dmd Timestamp     | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |                         | 3         |
| 2508                            | 9481    | 9483 Negative VARs, Phase A, Max Avg Dmd Timestamp      | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |                         | 3         |
| 250B                            | 9484    | 9486 Negative VARs, Phase B, Max Avg Dmd Timestamp      | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |                         | 3         |
| 250E                            | 9487    | 9489 Negative VARs, Phase C, Max Avg Dmd Timestamp      | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |                         | 3         |
| 2511                            | 9490    | 9492 VAs, Phase A, Max Avg Dmd Timestamp                | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |                         | 3         |
| 2514                            | 9493    | 9495 VAs, Phase B, Max Avg Dmd Timestamp                | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |                         | 3         |
| 2517                            | 9496    | 9498 VAs, Phase C, Max Avg Dmd Timestamp                | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |                         | 3         |
| 251A                            | 9499    | 9501 Positive PF, Phase A, Max Avg Dmd Timestamp        | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |                         | 3         |
| 251D                            | 9502    | 9504 Positive PF, Phase B, Max Avg Dmd Timestamp        | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |                         | 3         |
| 2520                            | 9505    | 9507 Positive PF, Phase C, Max Avg Dmd Timestamp        | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |                         | 3         |
| 2523                            | 9508    | 9510 Negative PF, Phase A, Max Avg Dmd Timestamp        | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |                         | 3         |
| 2526                            | 9511    | 9513 Negative PF, Phase B, Max Avg Dmd Timestamp        | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |                         | 3         |
| 2529                            | 9514    | 9516 Negative PF, Phase C, Max Avg Dmd Timestamp        | TSTAMP | 1Jan2000 - 31Dec2099 | 1 sec               |                         | 3         |
| 252C                            | 9517    | 9519 Reserved                                           |        |                      |                     |                         | 3         |
| 252F                            | 9520    | 9522 Reserved                                           |        |                      |                     |                         | 3         |
| 2532                            | 9523    | 9525 Reserved                                           |        |                      |                     |                         | 3         |
| 2535                            | 9526    | 9528 Reserved                                           |        |                      |                     |                         | 3         |
| 2538                            | 9529    | 9531 Reserved                                           |        |                      |                     |                         | 3         |
| 253B                            | 9532    | 9534 Reserved                                           |        |                      |                     |                         | 3         |
| 253E                            | 9535    | 9552 Reserved                                           |        |                      |                     | Reserved<br>Block Size: | 18<br>153 |

| Commands Section (Note 4) |         |                      |       |                                                   |                |                      |                                                                                                                                                                                     |   |     |
|---------------------------|---------|----------------------|-------|---------------------------------------------------|----------------|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|-----|
| Resets Block (Note 9)     |         |                      |       |                                                   |                | write-only           |                                                                                                                                                                                     |   |     |
| Hex                       | Decimal | Description (Note 1) |       | Format                                            | Range (Note 6) | Units or Resolution  | Comments                                                                                                                                                                            | # | Reg |
| 4E1F                      | 4E1F    | 20000                | 20000 | Reset Max/Min Blocks                              | UINT16         | password (Note 5)    |                                                                                                                                                                                     |   | 1   |
| 4E20                      | 4E20    | 20001                | 20001 | Reset Energy Accumulators                         | UINT16         | password (Note 5)    |                                                                                                                                                                                     |   | 1   |
| 4E21                      | 4E21    | 20002                | 20002 | Reset Alarm Log (Note 21)                         | UINT16         | password (Note 5)    | Reply to a reset log command indicates that the command was accepted but not necessarily that the reset is finished. Poll log status block to determine this.                       |   | 1   |
| 4E22                      | 4E22    | 20003                | 20003 | Reset System Log (Note 21)                        | UINT16         | password (Note 5)    |                                                                                                                                                                                     |   | 1   |
| 4E23                      | 4E23    | 20004                | 20004 | Reset Historical Log 1 (Note 21)                  | UINT16         | password (Note 5)    |                                                                                                                                                                                     |   | 1   |
| 4E24                      | 4E24    | 20005                | 20005 | Reset Historical Log 2 (Note 21)                  | UINT16         | password (Note 5)    |                                                                                                                                                                                     |   | 1   |
| 4E25                      | 4E25    | 20006                | 20006 | Reset Historical Log 3 (Note 21)                  | UINT16         | password (Note 5)    |                                                                                                                                                                                     |   | 1   |
| 4E26                      | 4E26    | 20007                | 20007 | Reserved                                          |                |                      |                                                                                                                                                                                     |   | 1   |
| 4E27                      | 4E2E    | 20008                | 20015 | Reserved                                          |                |                      | Set to 0.                                                                                                                                                                           |   | 2   |
| 4E29                      | 4E2A    | 20010                | 20011 | Reserved                                          |                |                      | Reserved                                                                                                                                                                            |   | 2   |
| 4E2B                      | 4E2B    | 20012                | 20012 | Reserved                                          |                |                      |                                                                                                                                                                                     |   | 1   |
| 4E2C                      | 4E2C    | 20013                | 20013 | Reserved                                          |                |                      |                                                                                                                                                                                     |   | 1   |
| 4E2D                      | 4E2D    | 20014                | 20014 | Reserved                                          |                |                      |                                                                                                                                                                                     |   | 1   |
| 4E2E                      | 4E2E    | 20015                | 20015 | Reserved                                          |                |                      |                                                                                                                                                                                     |   | 1   |
|                           |         |                      |       |                                                   |                |                      | Block Size:                                                                                                                                                                         |   | 16  |
| Privileged Commands Block |         |                      |       |                                                   |                | conditional write    |                                                                                                                                                                                     |   |     |
| Hex                       | Decimal | Description (Note 1) |       | Format                                            | Range (Note 6) | Units or Resolution  | Comments                                                                                                                                                                            | # | Reg |
| 5207                      | 5207    | 21000                | 21000 | Initiate Meter Firmware Reprogramming             | UINT16         | password (Note 5)    |                                                                                                                                                                                     |   | 1   |
| 5208                      | 5208    | 21001                | 21001 | Force Meter Restart                               | UINT16         | password (Note 5)    | causes a watchdog reset, always reads 0                                                                                                                                             |   | 1   |
| 5209                      | 5209    | 21002                | 21002 | Open Privileged Command Session                   | UINT16         | password (Note 5)    | meter will process command registers (this register through 'Close Privileged Command Session' register below) for 5 minutes or until the session is closed, whichever comes first. |   | 1   |
| 520A                      | 520A    | 21003                | 21003 | Initiate Programmable Settings Update             | UINT16         | password (Note 5)    | meter enters PS update mode                                                                                                                                                         |   | 1   |
| 520B                      | 520B    | 21004                | 21004 | Calculate Programmable Settings Checksum (Note 3) | UINT16         | 0000 to 9999         | meter calculates checksum on RAM copy of PS block                                                                                                                                   |   | 1   |
| 520C                      | 520C    | 21005                | 21005 | Programmable Settings Checksum (Note 3)           | UINT16         | 0000 to 9999         | read/write checksum register; PS block saved in nonvolatile memory on write (Note 8)                                                                                                |   | 1   |
| 520D                      | 520D    | 21006                | 21006 | Write New Password (Note 3)                       | UINT16         | 0000 to 9999         | write-only register; always reads zero                                                                                                                                              |   | 1   |
| 520E                      | 520E    | 21007                | 21007 | Terminate Programmable Settings Update (Note 3)   | UINT16         | any value            | meter leaves PS update mode via reset                                                                                                                                               |   | 1   |
| 520F                      | 5211    | 21008                | 21010 | Set Meter Clock                                   | TSTAMP         | 1Jan2000 - 31Dec2099 | saved only when 3rd register is written                                                                                                                                             |   | 3   |
| 5212                      | 5212    | 21011                | 21011 | Reserved                                          |                |                      | Reserved                                                                                                                                                                            |   | 1   |
| 5213                      | 5219    | 21012                | 21018 | Reserved                                          |                |                      | Reserved                                                                                                                                                                            |   | 7   |
| 521A                      | 521A    | 21019                | 21019 | Close Privileged Command Session                  | UINT16         | any value            | ends an open command session                                                                                                                                                        |   | 1   |
|                           |         |                      |       |                                                   |                |                      | Block Size:                                                                                                                                                                         |   | 20  |
| Encryption Block          |         |                      |       |                                                   |                | read/write           |                                                                                                                                                                                     |   |     |
| Hex                       | Decimal | Description (Note 1) |       | Format                                            | Range (Note 6) | Units or Resolution  | Comments                                                                                                                                                                            | # | Reg |
| 658F                      | 659A    | 26008                | 26011 | Perform a Secure Operation                        | UINT16         |                      | encrypted command to read password or change meter type                                                                                                                             |   | 12  |
|                           |         |                      |       |                                                   |                |                      | Block Size:                                                                                                                                                                         |   | 12  |

| Programmable Settings Section |        |         |         |                                           |  |        |                |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |       |
|-------------------------------|--------|---------|---------|-------------------------------------------|--|--------|----------------|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| Basic Setups Block            |        |         |         | write only in PS update mode              |  |        |                |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |       |
| Hex                           |        | Decimal |         | Description (Note 1)                      |  | Format | Range (Note 6) | Units or Resolution   | Comments                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | # Req |
| 752F                          | - 752F | 30000   | - 30000 | CT multiplier & denominator               |  | UINT16 | bit-mapped     | ddddddddd mmmmmmm     | high byte is denominator (1 or 5, read-only),<br>low byte is multiplier (1, 10, or 100)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 1     |
| 7530                          | - 7530 | 30001   | - 30001 | CT numerator                              |  | UINT16 | 1 to 9999      | none                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1     |
| 7531                          | - 7531 | 30002   | - 30002 | PT numerator                              |  | UINT16 | 1 to 9999      | none                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1     |
| 7532                          | - 7532 | 30003   | - 30003 | PT denominator                            |  | UINT16 | 1 to 9999      | none                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1     |
| 7533                          | - 7533 | 30004   | - 30004 | PT multiplier & hookup                    |  | UINT16 | bit-mapped     | mmmmmmmm<br>mmmmhhhh  | mm...mm = PT multiplier (1, 10, 100, or 1000)<br>hhhh = hookup enumeration (0 = 3 element wye[9S], 1 = delta 2 CTs[5S], 3 = 2.5 element wye[6S])                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1     |
| 7534                          | - 7534 | 30005   | - 30005 | Averaging Method                          |  | UINT16 | bit-mapped     | -----iiiiii b-----sss | iiiiii = interval (5,15,30,60)<br>b = 0=block or 1=rolling<br>sss = # subintervals (1,2,3,4)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1     |
| 7535                          | - 7535 | 30006   | - 30006 | Power & Energy Format                     |  | UINT16 | bit-mapped     | pppppiinn fee-ddd     | pppp = power scale (0=unit, 3=kilo, 6=mega, 8=auto)<br>ii = power digits after decimal point (0-3),<br>applies only if f=1 and pppp is not auto<br>nn = number of energy digits (5-8 --> 0-3)<br>eee = energy scale (0=unit, 3=kilo, 6=mega)<br>f = decimal point for power<br>(0=data-dependant placement,<br>1=fixed placement per ii value)<br>ddd = energy digits after decimal point (0-6)<br>See note 10.                                                                                                                                                                                                                                                                                                           | 1     |
| 7536                          | - 7536 | 30007   | - 30007 | Operating Mode Screen Enables             |  | UINT16 | bit-mapped     | -----x eeeeeeee       | eeeeeeee = op mode screen rows on/off, rows top to bottom are bits low order to high order<br>x = set to suppress PF on W/VAR/PF screens                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1     |
| 7537                          | - 7537 | 30008   | - 30008 | Daylight Saving On Rule                   |  | UINT16 | bit-mapped     | hhhhhwww -dddmmmm     | applies only if daylight savings in User Settings Flags = on; specifies when to make changeover<br>hhhhh = hour, 0-23<br>www = week, 1-4 for 1st - 4th, 5 for last<br>ddd = day of week, 1-7 for Sun - Sat<br>mmmm = month, 1-12<br>Example: 2AM on the 4th Sunday of March<br>hhhhh=2, www=4, ddd=1, mmmm=3                                                                                                                                                                                                                                                                                                                                                                                                              | 1     |
| 7538                          | - 7538 | 30009   | - 30009 | Daylight Saving Off Rule                  |  | UINT16 | bit-mapped     | hhhhhwww -dddmmmm     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1     |
| 7539                          | - 753D | 30010   | - 30014 | Reserved                                  |  |        |                |                       | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 5     |
| 753E                          | - 753E | 30015   | - 30015 | User Settings Flags                       |  | UINT16 | bit-mapped     | --g-inn sprdywfa      | g = enable alternate full scale bar graph current<br>(1=on, 0=off)<br>i = fixed scale and format current display<br>0=normal autoscaled current display<br>1=always show amps with no decimal places<br>nn = number of phases for voltage & current screen<br>(3=ABC, 2=AB, 1=A, 0=ABC)<br>s = scroll (1=on, 0=off)<br>r = password for reset in use (1=on, 0=off)<br>p = password for configuration in use (1=on, 0=off)<br>d = daylight saving time changes (0=off, 1=on)<br>y = diagnostic events in system log (1=yes, 0=no)<br>w = power direction<br>(0=view as load, 1=view as generator)<br>f = flip power factor sign (1=yes, 0=no)<br>a = apparent power computation method<br>(0=arithmetic sum, 1=vector sum) | 1     |
| 753F                          | - 753F | 30016   | - 30016 | Full Scale Current (for load % bar graph) |  | UINT16 | 0 to 9999      | none                  | If non-zero and user settings bit g is set, this value replaces CT numerator in the full scale current calculation. (See Note 12)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 1     |

| Basic Setups Block - continued |         |                      |                                                                |                           |                     | write only in PS update mode                                                                                                                                                                                                                                                                                                                              |       | # Reg |
|--------------------------------|---------|----------------------|----------------------------------------------------------------|---------------------------|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-------|
| Hex                            | Decimal | Description (Note 1) | Format                                                         | Range (Note 6)            | Units or Resolution | Comments                                                                                                                                                                                                                                                                                                                                                  |       |       |
| 7540                           | 7547    | 30017 - 30024        | Meter Designation                                              | ASCII                     | 16 char             | none                                                                                                                                                                                                                                                                                                                                                      | 8     |       |
| 7548                           | 7548    | 30025 - 30025        | COM1 setup                                                     | UINT16                    | bit-mapped          | ----dddd -0100110<br>dddd = reply delay (* 50 msec)<br>ppp = protocol (1-Modbus RTU, 2-Modbus ASCII, 3-DNP)<br>bbb = baud rate (1-9600, 2-19200, 4-38400, 6-57600)                                                                                                                                                                                        | 1     |       |
| 7549                           | 7549    | 30026 - 30026        | COM2 setup                                                     | UINT16                    | bit-mapped          | ----dddd -ppp-bbb                                                                                                                                                                                                                                                                                                                                         | 1     |       |
| 754A                           | 754A    | 30027 - 30027        | COM2 address                                                   | UINT16                    | 1 to 247            | none                                                                                                                                                                                                                                                                                                                                                      | 1     |       |
| 754B                           | 754B    | 30028 - 30028        | Limit #1 Identifier                                            | UINT16                    | 0 to 65535          | use Modbus address as the identifier (see notes 7, 11, 12)                                                                                                                                                                                                                                                                                                | 1     |       |
| 754C                           | 754C    | 30029 - 30029        | Limit #1 Out High Setpoint                                     | SINT16                    | -200.0 to +200.0    | 0.1% of full scale<br>Setpoint for the "above" limit (LM1), see notes 11-12.                                                                                                                                                                                                                                                                              | 1     |       |
| 754D                           | 754D    | 30030 - 30030        | Limit #1 In High Threshold                                     | SINT16                    | -200.0 to +200.0    | 0.1% of full scale<br>Threshold at which "above" limit clears; normally less than or equal to the "above" setpoint; see notes 11-12.                                                                                                                                                                                                                      | 1     |       |
| 754E                           | 754E    | 30031 - 30031        | Limit #1 Out Low Setpoint                                      | SINT16                    | -200.0 to +200.0    | 0.1% of full scale<br>Setpoint for the "below" limit (LM2), see notes 11-12.                                                                                                                                                                                                                                                                              | 1     |       |
| 754F                           | 754F    | 30032 - 30032        | Limit #1 In Low Threshold                                      | SINT16                    | -200.0 to +200.0    | 0.1% of full scale<br>Threshold at which "below" limit clears; normally greater than or equal to the "below" setpoint; see notes 11-12.                                                                                                                                                                                                                   | 1     |       |
| 7550                           | 7554    | 30033 - 30037        | Limit #2                                                       | SINT16                    | same as Limit #1    | same as Limit #1                                                                                                                                                                                                                                                                                                                                          | 5     |       |
| 7555                           | 7559    | 30038 - 30042        | Limit #3                                                       | SINT16                    |                     |                                                                                                                                                                                                                                                                                                                                                           | 5     |       |
| 755A                           | 755E    | 30043 - 30047        | Limit #4                                                       | SINT16                    |                     |                                                                                                                                                                                                                                                                                                                                                           | 5     |       |
| 755F                           | 7563    | 30048 - 30052        | Limit #5                                                       | SINT16                    |                     |                                                                                                                                                                                                                                                                                                                                                           | 5     |       |
| 7564                           | 7568    | 30053 - 30057        | Limit #6                                                       | SINT16                    |                     |                                                                                                                                                                                                                                                                                                                                                           | 5     |       |
| 7569                           | 756D    | 30058 - 30062        | Limit #7                                                       | SINT16                    |                     |                                                                                                                                                                                                                                                                                                                                                           | 5     |       |
| 756E                           | 7572    | 30063 - 30067        | Limit #8                                                       | SINT16                    |                     |                                                                                                                                                                                                                                                                                                                                                           | 5     |       |
| 7573                           | 7582    | 30068 - 30083        | Reserved                                                       |                           |                     | Reserved                                                                                                                                                                                                                                                                                                                                                  | 16    |       |
| 7583                           | 75C2    | 30084 - 30147        | Reserved                                                       |                           |                     | Reserved                                                                                                                                                                                                                                                                                                                                                  | 64    |       |
| 75C3                           | 75C3    | 30148 - 30148        | watts loss due to iron when watts positive                     | UINT16                    | 0 to 99.99          | 0.0001                                                                                                                                                                                                                                                                                                                                                    | 1     |       |
| 75C4                           | 75C4    | 30149 - 30149        | watts loss due to copper when watts positive                   | UINT16                    | 0 to 99.99          | 0.0001                                                                                                                                                                                                                                                                                                                                                    | 1     |       |
| 75C5                           | 75C5    | 30150 - 30150        | var loss due to iron when watts positive                       | UINT16                    | 0 to 99.99          | 0.0001                                                                                                                                                                                                                                                                                                                                                    | 1     |       |
| 75C6                           | 75C6    | 30151 - 30151        | var loss due to copper when watts positive                     | UINT16                    | 0 to 99.99          | 0.0001                                                                                                                                                                                                                                                                                                                                                    | 1     |       |
| 75C7                           | 75C3    | 30152 - 30152        | watts loss due to iron when watts negative                     | UINT16                    | 0 to 99.99          | 0.0001                                                                                                                                                                                                                                                                                                                                                    | 1     |       |
| 75C8                           | 75C48   | 30153 - 30153        | watts loss due to copper when watts negative                   | UINT16                    | 0 to 99.99          | 0.0001                                                                                                                                                                                                                                                                                                                                                    | 1     |       |
| 75C9                           | 75C9    | 30154 - 30154        | var loss due to iron when watts negative                       | UINT16                    | 0 to 99.99          | 0.0001                                                                                                                                                                                                                                                                                                                                                    | 1     |       |
| 75CA                           | 75CA    | 30155 - 30155        | var loss due to copper when watts negative                     | UINT16                    | 0 to 99.99          | 0.0001                                                                                                                                                                                                                                                                                                                                                    | 1     |       |
| 75CB                           | 75CB    | 30156 - 30156        | transformer loss compensation user settings flag               | UINT16                    | bit-mapped          | ----- -chvw<br>c - 0 disable compensation for losses due to copper,<br>1 enable compensation for losses due to copper<br>f - 0 disable compensation for losses due to iron,<br>1 enable compensation for losses due to iron<br>w - 0 add watt compensation,<br>1 subtract watt compensation<br>v - 0 add var compensation,<br>1 subtract var compensation | 1     |       |
| 75CC                           | 75E5    | 30157 - 30182        | Reserved                                                       |                           |                     | Reserved                                                                                                                                                                                                                                                                                                                                                  | 26    |       |
| 75E6                           | 75E6    | 30183 - 30183        | Programmable Settings Update Counter                           | UINT16                    | 0-65535             | Increments each time programmable settings are changed; occurs when new checksum is calculated.                                                                                                                                                                                                                                                           | 1     |       |
| 75E7                           | 7626    | 30184 - 30247        | Reserved for Software Use                                      |                           |                     | Reserved                                                                                                                                                                                                                                                                                                                                                  | 64    |       |
|                                |         |                      |                                                                |                           |                     | Block Size:                                                                                                                                                                                                                                                                                                                                               | 248   |       |
| Log Setups Block               |         |                      |                                                                |                           |                     | write only in PS update mode                                                                                                                                                                                                                                                                                                                              |       |       |
| Hex                            | Decimal | Description (Note 1) | Format                                                         | Range (Note 6)            | Units or Resolution | Comments                                                                                                                                                                                                                                                                                                                                                  | # Reg |       |
| 7917                           | 7917    | 31000 - 31000        | Historical Log #1 Sizes                                        | UINT16                    | bit-mapped          | eeeeeeee ssssssss<br>high byte is number of registers to log in each record (0-117),<br>low byte is number of flash sectors for the log (see note 19)                                                                                                                                                                                                     | 1     |       |
| 7918                           | 7918    | 31001 - 31001        | Historical Log #1 Interval                                     | UINT16                    | bit-mapped          | 00000000 hgfdcbca<br>only 1 bit set: a=1 min, b=3 min, c=5 min, d=10 min, e=15 min, f=30 min, g=60 min, h=EOI pulse                                                                                                                                                                                                                                       | 1     |       |
| 7919                           | 7919    | 31002 - 31002        | Historical Log #1, Register #1 Identifier                      | UINT16                    | 0 to 65535          | use Modbus address as the identifier (see note 7)                                                                                                                                                                                                                                                                                                         | 1     |       |
| 791A                           | 798D    | 31003 - 31118        | Historical Log #1, Register #2 - #117 Identifiers              | UINT16                    | 0 to 65535          | same as Register #1 Identifier                                                                                                                                                                                                                                                                                                                            | 116   |       |
| 798E                           | 79D6    | 31119 - 31191        | Historical Log #1 Software Buffer                              |                           |                     | Reserved for software use.                                                                                                                                                                                                                                                                                                                                | 73    |       |
| 79D7                           | 7A96    | 31192 - 31383        | Historical Log #2 Sizes, Interval, Registers & Software Buffer | same as Historical Log #1 |                     |                                                                                                                                                                                                                                                                                                                                                           | 192   |       |
| 7A97                           | 7B56    | 31384 - 31575        | Historical Log #3 Sizes, Interval, Registers & Software Buffer | same as Historical Log #1 |                     |                                                                                                                                                                                                                                                                                                                                                           | 192   |       |
| 7B57                           | 7B76    | 31576 - 31607        | Reserved                                                       |                           |                     | Reserved                                                                                                                                                                                                                                                                                                                                                  | 31    |       |
|                                |         |                      |                                                                |                           |                     | Block Size:                                                                                                                                                                                                                                                                                                                                               | 608   |       |
| 7CFF                           | 7F3E    | 32000 - 32575        | Reserved                                                       |                           |                     |                                                                                                                                                                                                                                                                                                                                                           | 576   |       |
| 80E7                           | 8326    | 33000 - 33064        | Reserved                                                       |                           |                     |                                                                                                                                                                                                                                                                                                                                                           | 576   |       |

| 12-Bit Readings Section |         |                      |        |                |                              |                           |                   |                        |                                                                                      |               |
|-------------------------|---------|----------------------|--------|----------------|------------------------------|---------------------------|-------------------|------------------------|--------------------------------------------------------------------------------------|---------------|
| 12-Bit Block            |         |                      |        |                |                              | read-only except as noted |                   |                        |                                                                                      |               |
| Hex                     | Decimal | Description (Note 1) | Format | Range (Note 6) | Units or Resolution          | Comments                  | # Reg             |                        |                                                                                      |               |
| 9C40                    | -9C40   | 40001                | -      | 40001          | System Sanity Indicator      | UINT16                    | 0 or 1            | none                   | 0 indicates proper meter operation                                                   | 1             |
| 9C41                    | -9C41   | 40002                | -      | 40002          | Volts A-N                    | UINT16                    | 2047 to 4095      | volts                  | 2047= 0, 4095= +150                                                                  | 1             |
| 9C42                    | -9C42   | 40003                | -      | 40003          | Volts B-N                    | UINT16                    | 2047 to 4095      | volts                  | volts = 150 * (register - 2047) / 2047                                               | 1             |
| 9C43                    | -9C43   | 40004                | -      | 40004          | Volts C-N                    | UINT16                    | 2047 to 4095      | volts                  |                                                                                      | 1             |
| 9C44                    | -9C44   | 40005                | -      | 40005          | Amps A                       | UINT16                    | 0 to 4095         | amps                   | 0= -10, 2047= 0, 4095= +10                                                           | 1             |
| 9C45                    | -9C45   | 40006                | -      | 40006          | Amps B                       | UINT16                    | 0 to 4095         | amps                   | amps = 10 * (register - 2047) / 2047                                                 | 1             |
| 9C46                    | -9C46   | 40007                | -      | 40007          | Amps C                       | UINT16                    | 0 to 4095         | amps                   |                                                                                      | 1             |
| 9C47                    | -9C47   | 40008                | -      | 40008          | Watts, 3-Ph total            | UINT16                    | 0 to 4095         | watts                  | 0= -3000, 2047= 0, 4095= +3000                                                       | 1             |
| 9C48                    | -9C48   | 40009                | -      | 40009          | VARs, 3-Ph total             | UINT16                    | 0 to 4095         | VARs                   | watts, VARs, VAs =                                                                   | 1             |
| 9C49                    | -9C49   | 40010                | -      | 40010          | VAs, 3-Ph total              | UINT16                    | 2047 to 4095      | VAs                    | 3000 * (register - 2047) / 2047                                                      | 1             |
| 9C4A                    | -9C4A   | 40011                | -      | 40011          | Power Factor, 3-Ph total     | UINT16                    | 1047 to 3047      | none                   | 1047= -1, 2047= 0, 3047= +1<br>pf = (register - 2047) / 1000                         | 1             |
| 9C4B                    | -9C4B   | 40012                | -      | 40012          | Frequency                    | UINT16                    | 0 to 2730         | Hz                     | 0= 45 or less, 2047= 60, 2730= 65 or more<br>((register / 4095) * 30)                | freq = 45 + 1 |
| 9C4C                    | -9C4C   | 40013                | -      | 40013          | Volts A-B                    | UINT16                    | 2047 to 4095      | volts                  | 2047= 0, 4095= +300                                                                  | 1             |
| 9C4D                    | -9C4D   | 40014                | -      | 40014          | Volts B-C                    | UINT16                    | 2047 to 4095      | volts                  | volts = 300 * (register - 2047) / 2047                                               | 1             |
| 9C4E                    | -9C4E   | 40015                | -      | 40015          | Volts C-A                    | UINT16                    | 2047 to 4095      | volts                  |                                                                                      | 1             |
| 9C4F                    | -9C4F   | 40016                | -      | 40016          | CT numerator                 | UINT16                    | 1 to 9999         | none                   | CT = numerator * multiplier / denominator                                            | 1             |
| 9C50                    | -9C50   | 40017                | -      | 40017          | CT multiplier                | UINT16                    | 1, 10, 100        | none                   |                                                                                      | 1             |
| 9C51                    | -9C51   | 40018                | -      | 40018          | CT denominator               | UINT16                    | 1 or 5            | none                   |                                                                                      | 1             |
| 9C52                    | -9C52   | 40019                | -      | 40019          | PT numerator                 | UINT16                    | 1 to 9999         | none                   | PT = numerator * multiplier / denominator                                            | 1             |
| 9C53                    | -9C53   | 40020                | -      | 40020          | PT multiplier                | UINT16                    | 1, 10, 100, 1000  | none                   |                                                                                      | 1             |
| 9C54                    | -9C54   | 40021                | -      | 40021          | PT denominator               | UINT16                    | 1 to 9999         | none                   |                                                                                      | 1             |
| 9C55                    | -9C55   | 40022                | -      | 40023          | W-hours, Positive            | UINT32                    | 0 to 99999999     | Wh per energy format   | * 5 to 8 digits                                                                      | 2             |
| 9C57                    | -9C58   | 40024                | -      | 40029          | W-hours, Negative            | UINT32                    | 0 to 99999999     | Wh per energy format   | * decimal point implied, per energy format                                           | 2             |
| 9C59                    | -9C5A   | 40026                | -      | 40027          | VAR-hours, Positive          | UINT32                    | 0 to 99999999     | VARh per energy format | * resolution of digit before decimal point = units, kilo, or mega, per energy format | 2             |
| 9C5B                    | -9C5C   | 40028                | -      | 40029          | VAR-hours, Negative          | UINT32                    | 0 to 99999999     | VARh per energy format |                                                                                      | 2             |
| 9C5D                    | -9C5E   | 40030                | -      | 40031          | VA-hours                     | UINT32                    | 0 to 99999999     | VAh per energy format  | * see note 10                                                                        | 2             |
| 9C5F                    | -9C60   | 40032                | -      | 40033          | W-hours, Positive, Phase A   | UINT32                    | 0 to 99999999     | Wh per energy format   |                                                                                      | 2             |
| 9C61                    | -9C62   | 40034                | -      | 40035          | W-hours, Positive, Phase B   | UINT32                    | 0 to 99999999     | Wh per energy format   |                                                                                      | 2             |
| 9C63                    | -9C64   | 40036                | -      | 40037          | W-hours, Positive, Phase C   | UINT32                    | 0 to 99999999     | Wh per energy format   |                                                                                      | 2             |
| 9C65                    | -9C66   | 40038                | -      | 40039          | W-hours, Negative, Phase A   | UINT32                    | 0 to 99999999     | Wh per energy format   |                                                                                      | 2             |
| 9C67                    | -9C68   | 40040                | -      | 40041          | W-hours, Negative, Phase B   | UINT32                    | 0 to 99999999     | Wh per energy format   |                                                                                      | 2             |
| 9C69                    | -9C6A   | 40042                | -      | 40043          | W-hours, Negative, Phase C   | UINT32                    | 0 to 99999999     | Wh per energy format   |                                                                                      | 2             |
| 9C6B                    | -9C6C   | 40044                | -      | 40045          | VAR-hours, Positive, Phase A | UINT32                    | 0 to 99999999     | VARh per energy format |                                                                                      | 2             |
| 9C6D                    | -9C6E   | 40046                | -      | 40047          | VAR-hours, Positive, Phase B | UINT32                    | 0 to 99999999     | VARh per energy format |                                                                                      | 2             |
| 9C6F                    | -9C70   | 40048                | -      | 40049          | VAR-hours, Positive, Phase C | UINT32                    | 0 to 99999999     | VARh per energy format |                                                                                      | 2             |
| 9C71                    | -9C72   | 40050                | -      | 40051          | VAR-hours, Negative, Phase A | UINT32                    | 0 to 99999999     | VARh per energy format |                                                                                      | 2             |
| 9C73                    | -9C74   | 40052                | -      | 40053          | VAR-hours, Negative, Phase B | UINT32                    | 0 to 99999999     | VARh per energy format |                                                                                      | 2             |
| 9C75                    | -9C76   | 40054                | -      | 40055          | VAR-hours, Negative, Phase C | UINT32                    | 0 to 99999999     | VARh per energy format |                                                                                      | 2             |
| 9C77                    | -9C78   | 40056                | -      | 40057          | VA-hours, Phase A            | UINT32                    | 0 to 99999999     | VAh per energy format  |                                                                                      | 2             |
| 9C79                    | -9C7A   | 40058                | -      | 40059          | VA-hours, Phase B            | UINT32                    | 0 to 99999999     | VAh per energy format  |                                                                                      | 2             |
| 9C7B                    | -9C7C   | 40060                | -      | 40061          | VA-hours, Phase C            | UINT32                    | 0 to 99999999     | VAh per energy format  |                                                                                      | 2             |
| 9C7D                    | -9C7D   | 40062                | -      | 40062          | Watts, Phase A               | UINT16                    | 0 to 4095         | watts                  |                                                                                      | 1             |
| 9C7E                    | -9C7E   | 40063                | -      | 40063          | Watts, Phase B               | UINT16                    | 0 to 4095         | watts                  |                                                                                      | 1             |
| 9C7F                    | -9C7F   | 40064                | -      | 40064          | Watts, Phase C               | UINT16                    | 0 to 4095         | watts                  |                                                                                      | 1             |
| 9C80                    | -9C80   | 40065                | -      | 40065          | VARs, Phase A                | UINT16                    | 0 to 4095         | VARs                   | 0= -3000, 2047= 0, 4095= +3000                                                       | 1             |
| 9C81                    | -9C81   | 40066                | -      | 40066          | VARs, Phase B                | UINT16                    | 0 to 4095         | VARs                   | watts, VARs, VAs =                                                                   | 1             |
| 9C82                    | -9C82   | 40067                | -      | 40067          | VARs, Phase C                | UINT16                    | 0 to 4095         | VARs                   | 3000 * (register - 2047) / 2047                                                      | 1             |
| 9C83                    | -9C83   | 40068                | -      | 40068          | VAs, Phase A                 | UINT16                    | 2047 to 4095      | VAs                    |                                                                                      | 1             |
| 9C84                    | -9C84   | 40069                | -      | 40069          | VAs, Phase B                 | UINT16                    | 2047 to 4095      | VAs                    |                                                                                      | 1             |
| 9C85                    | -9C85   | 40070                | -      | 40070          | VAs, Phase C                 | UINT16                    | 2047 to 4095      | VAs                    |                                                                                      | 1             |
| 9C86                    | -9C86   | 40071                | -      | 40071          | Power Factor, Phase A        | UINT16                    | 1047 to 3047      | none                   | 1047= -1, 2047= 0, 3047= +1<br>pf = (register - 2047) / 1000                         | 1             |
| 9C87                    | -9C87   | 40072                | -      | 40072          | Power Factor, Phase B        | UINT16                    | 1047 to 3047      | none                   |                                                                                      | 1             |
| 9C88                    | -9C88   | 40073                | -      | 40073          | Power Factor, Phase C        | UINT16                    | 1047 to 3047      | none                   |                                                                                      | 1             |
| 9C89                    | -9CA2   | 40074                | -      | 40099          | Reserved                     | N/A                       | N/A               | none                   | Reserved                                                                             | 26            |
| 9CA3                    | -9CA3   | 40100                | -      | 40100          | Reset Energy Accumulators    | UINT16                    | password (Note 5) | none                   | write-only register; always reads as 0<br>Block Size:                                | 100           |

| Log Retrieval Section |         |                      |         |                                                                       |                |                                |                                     |                                                                                                                                                                                                                                                                                                                                                                      |       |  |
|-----------------------|---------|----------------------|---------|-----------------------------------------------------------------------|----------------|--------------------------------|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--|
| Log Retrieval Block   |         |                      |         |                                                                       |                |                                | read/write except as noted          |                                                                                                                                                                                                                                                                                                                                                                      |       |  |
| Hex                   | Decimal | Description (Note 1) |         | Format                                                                | Range (Note 6) | Units or Resolution            | Comments                            |                                                                                                                                                                                                                                                                                                                                                                      | # Req |  |
| C34C                  | - C34D  | 49997                | - 49998 | Log Retrieval Session Duration                                        | UINT32         | 0 to 4294967294                | 4 msec                              | 0 if no session active; wraps around after max count                                                                                                                                                                                                                                                                                                                 | 2     |  |
| C34E                  | - C34E  | 49999                | - 49999 | Log Retrieval Session Com Port                                        | UINT16         | 0 to 4                         |                                     | 0 if no session active, 1-4 for session active on COM1 - COM4                                                                                                                                                                                                                                                                                                        | 1     |  |
| C34F                  | - C34F  | 50000                | - 50000 | Log Number, Enable, Scope                                             | UINT16         | bit-mapped                     | nnnnnnnn esssssss                   | high byte is the log number (0-system, 1-alarm, 2-history1, 3-history2, 4-history3, 5-I/O changes, 11-waveform, (11 reserved for future use)<br>e is retrieval session enable(1) or disable(0)<br>sssssss is what to retrieve (0-normal record, 1-timestamps only, 2-complete memory image (no data validation if image))                                            | 1     |  |
| C350                  | - C350  | 50001                | - 50001 | Records per Window or Batch, Record Scope Selector, Number of Repeats | UINT16         | bit-mapped                     | wwwwww snnnnnn                      | high byte is records per window if s=0 or records per batch if s=1, low byte is number of repeats for function 35 or 0 to suppress auto-incrementing; max number of repeats is 8 (RTU) or 4 (ASCII) total windows, a batch is all the windows                                                                                                                        | 1     |  |
| C351                  | - C352  | 50002                | - 50003 | Offset of First Record in Window                                      | UINT32         | bit-mapped                     | sssssss nnnnnnn<br>nnnnnnnn nnnnnnn | sssssss is window status (0 to 7-window number, 0xFF-not ready); this byte is read-only.<br>nn...nn is a 24-bit record number. The log's first record is latched as a reference point when the session is enabled. This offset is a record index relative to that point. Value provided is the relative index of the whole or partial record that begins the window. | 2     |  |
| C353                  | - C3CD  | 50004                | - 50126 | Log Retrieve Window                                                   | UINT16         | see comments                   | none                                | mapped per record layout and retrieval scope, read-only                                                                                                                                                                                                                                                                                                              | 123   |  |
|                       |         |                      |         |                                                                       |                |                                |                                     | Block Size:                                                                                                                                                                                                                                                                                                                                                          | 130   |  |
| Log Status Block      |         |                      |         |                                                                       |                |                                | read only                           |                                                                                                                                                                                                                                                                                                                                                                      |       |  |
| Hex                   | Decimal | Description (Note 1) |         | Format                                                                | Range (Note 6) | Units or Resolution            | Comments                            |                                                                                                                                                                                                                                                                                                                                                                      | # Req |  |
| C737                  | - C738  | 51000                | - 51001 | Alarm Log Status Block                                                |                |                                |                                     |                                                                                                                                                                                                                                                                                                                                                                      |       |  |
| C737                  | - C738  | 51000                | - 51001 | Log Size in Records                                                   | UINT32         | 0 to 4,294,967,294             | record                              |                                                                                                                                                                                                                                                                                                                                                                      | 2     |  |
| C739                  | - C73A  | 51002                | - 51003 | Number of Records Used                                                | UINT32         | 1 to 4,294,967,294             | record                              |                                                                                                                                                                                                                                                                                                                                                                      | 2     |  |
| C73B                  | - C73B  | 51004                | - 51004 | Record Size in Bytes                                                  | UINT16         | 14 to 242                      | byte                                |                                                                                                                                                                                                                                                                                                                                                                      | 1     |  |
| C73C                  | - C73C  | 51005                | - 51005 | Log Availability                                                      | UINT16         |                                | none                                | 0=available,<br>1-4=in use by COM1-4,<br>0xFFFF=not available (log size=0)                                                                                                                                                                                                                                                                                           | 1     |  |
| C73D                  | - C73F  | 51006                | - 51008 | Timestamp, First Record                                               | TSTAMP         | 1Jan2000 - 31Dec2099           | 1 sec                               |                                                                                                                                                                                                                                                                                                                                                                      | 3     |  |
| C740                  | - C742  | 51009                | - 51011 | Timestamp, Last Record                                                | TSTAMP         | 1Jan2000 - 31Dec2099           | 1 sec                               |                                                                                                                                                                                                                                                                                                                                                                      | 3     |  |
| C743                  | - C746  | 51012                | - 51015 | Reserved                                                              |                |                                |                                     | Reserved                                                                                                                                                                                                                                                                                                                                                             | 4     |  |
|                       |         |                      |         |                                                                       |                |                                |                                     | Individual Log Status Block Size:                                                                                                                                                                                                                                                                                                                                    | 16    |  |
| C747                  | - C756  | 51016                | - 51031 | System Log Status Block                                               |                | same as alarm log status block |                                     |                                                                                                                                                                                                                                                                                                                                                                      | 16    |  |
| C757                  | - C766  | 51032                | - 51047 | Historical Log 1 Status Block                                         |                | same as alarm log status block |                                     |                                                                                                                                                                                                                                                                                                                                                                      | 16    |  |
| C767                  | - C776  | 51048                | - 51063 | Historical Log 2 Status Block                                         |                | same as alarm log status block |                                     |                                                                                                                                                                                                                                                                                                                                                                      | 16    |  |
| C777                  | - C786  | 51064                | - 51079 | Historical Log 3 Status Block                                         |                | same as alarm log status block |                                     |                                                                                                                                                                                                                                                                                                                                                                      | 16    |  |
| C787                  | - C796  | 51080                | - 51095 | Reserved                                                              |                |                                |                                     |                                                                                                                                                                                                                                                                                                                                                                      | 16    |  |
| C797                  | - C7B6  | 51096                | - 51127 | Reserved                                                              |                |                                |                                     |                                                                                                                                                                                                                                                                                                                                                                      | 32    |  |
|                       |         |                      |         |                                                                       |                |                                |                                     | Block Size:                                                                                                                                                                                                                                                                                                                                                          | 128   |  |
| End of Map            |         |                      |         |                                                                       |                |                                |                                     |                                                                                                                                                                                                                                                                                                                                                                      |       |  |

| Data Formats    |                                                                                                                                                                                                                                |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ASCII           | ASCII characters packed 2 per register in high, low order and without any termination characters.                                                                                                                              |
| SINT16 / UINT16 | 16-bit signed / unsigned integer.                                                                                                                                                                                              |
| SINT32 / UINT32 | 32-bit signed / unsigned integer spanning 2 registers. The lower-addressed register is the high order half.                                                                                                                    |
| FLOAT           | 32-bit IEEE floating point number spanning 2 registers. The lower-addressed register is the high order half (i.e., contains the exponent).                                                                                     |
| TSTAM           | 3 adjacent registers, 2 bytes each. First (lowest-addressed) register high byte is year (0-99), low byte is month (1-12). Middle register high byte is day(1-31), low byte is hour (0-23 plus DST bit).                        |
| P               | DST (daylight saving time) bit is bit 6 (0x40). Third register high byte is minutes (0-59), low byte is seconds (0-59). For example, 9:35:07AM on October 12, 2049 would be 0x310A, 0x0C49, 0x2307, assuming DST is in effect. |

| Notes |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1     | All registers not explicitly listed in the table read as 0. Writes to these registers will be accepted but won't actually change the register (since it doesn't exist).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 2     | Meter Data Section items read as 0 until first readings are available or if the meter is not in operating mode. Writes to these registers will be accepted but won't actually change the register.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 3     | Register valid only in programmable settings update mode. In other modes these registers read as 0 and return an illegal data address exception if a write is attempted.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 4     | Meter command registers always read as 0. They may be written only when the meter is in a suitable mode. The registers return an illegal data address exception if a write is attempted in an incorrect mode.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 5     | If the password is incorrect, a valid response is returned but the command is not executed. Use 5555 for the password if passwords are disabled in the programmable settings.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 6     | M denotes a 1,000,000 multiplier.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 7     | Each identifier is a Modbus register. For entities that occupy multiple registers (FLOAT, SINT32, etc.) all registers making up the entity must be listed, in ascending order. For example, to log phase A volts, VAs, and VA hours, the register list would be 0x3E7, 0x3E8, 0x411, 0x412, 0x61D, 0x61E and the number of registers (0x7917 high byte) would be 7.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 8     | Writing this register causes data to be saved permanently in nonvolatile memory. Reply to the command indicates that it was accepted but not whether or not the save was successful. This can only be determined after the meter has restarted.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 9     | Reset commands make no sense if the meter state is LIMP. An illegal function exception will be returned.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 10    | Energy registers should be reset after a format change.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 11    | Entities to be monitored against limits are identified by Modbus address. Entities occupying multiple Modbus registers, such as floating point values, are identified by the lower register address. If any of the 8 limits is unused, set its identifier to zero. If the indicated Modbus register is not used or is a nonsensical entity for limits, it will behave as an unused limit.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 12    | There are 2 setpoints per limit, one above and one below the expected range of values. LM1 is the "too high" limit, LM2 is "too low". The entity goes "out of limit" on LM1 when its value is greater than the setpoint. It remains "out of limit" until the value drops below the in threshold. LM2 works similarly, in the opposite direction. If limits in only one direction are of interest, set the in threshold on the "wrong" side of the setpoint. Limits are specified as % of full scale, where full scale is automatically set appropriately for the entity being monitored:<br>current FS = CT numerator * CT multiplier<br>voltage FS = PT numerator * PT multiplier<br>3 phase power FS = CT numerator * CT multiplier * PT numerator * PT multiplier * 3 [ * SQRT(3) for delta hookup]<br>single phase FS = CT numerator * CT multiplier * PT numerator * PT multiplier [ * SQRT(3) for delta hookup]<br>frequency FS = 60 (or 50)<br>power factor FS = 1.0<br>percentage FS = 100.0<br>angle FS = 180.0 |
| 13    | n/a                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 14    | n/a                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 15    | A block of data and control registers is allocated for each option slot. Interpretation of the register data depends on what card is in the slot.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 16    | Measurement states: Off occurs during programmable settings updates; Run is the normal measuring state; Limp indicates that an essential non-volatile memory block is corrupted; and Warmup occurs briefly (approximately 4 seconds) at startup while the readings stabilize. Run state is required for measurement, historical logging, demand interval processing, limit alarm evaluation, and min/max comparisonss. Resetting min/max or energy is allowed only in run and off states; warmup will return a busy exception. In limp state, the meter reboots at 5 minute intervals in an effort to clear the problem.                                                                                                                                                                                                                                                                                                                                                                                                 |
| 17    | Limits evaluation for all entities except demand averages commences immediately after the warmup period. Evaluation for demand averages, maximum demands, and minimum demands commences at the end of the first demand interval after startup.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 18    | n/a                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 19    | There are 15, 29, or 45 flash sectors available in a common pool for distribution among the 3 historical logs. The pool size, number of sectors for each log, and the number of registers per record together determine the maximum number of records a log can hold. S = number of sectors assigned to the log.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 20    | n/a                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 21    | Logs cannot be reset during log retrieval. Busy exception will be returned.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

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## C: IQ 150S Meter DNP Map

### C.1: Introduction

The IQ 150S meter's DNP map shows the client-server relationship in the meter's use of DNP Protocol.

### C.2: DNP Implementation

#### PHYSICAL LAYER

The IQ 150S meter can use RS485 as the physical layer. This is accomplished by connecting a PC to the meter using the meter's RS485 connection (see Chapter 5).

#### RS485

RS485 provides multi-drop network communication capabilities. Multiple meters can be placed on the same bus, allowing for a Master device to communicate with any of the other devices. Appropriate network configuration and termination should be evaluated for each installation to insure optimal performance (see Chapter 5).

#### Communication Parameters

IQ 150S meters communicate in DNP 3.0 using the following communication settings:

- 8 Data Bits
- No Parity
- 1 Stop Bit
- Baud Rates: 9600, 19200, 38400, 57600

### C.3: Data Link Layer

The Data Link Layer for IQ 150S meters is subject to the following considerations:

#### **Control Field**

The Control Byte contains several bits and a Function Code.

#### Control Bits

Communication directed to the meter should be Primary Master messages (DIR = 1, PRM = 1). Response will be primary Non-Master messages (DIR = 0, PRM = 1). Acknowledgment will be Secondary Non-Master messages (DIR = 0, PRM = 0).

#### **Function Codes**

IQ 150S meters support all of the Function Codes for DNP 3.0.

#### Reset of Data Link (Function 0)

Before confirmed communication with a master device, the Data Link Layer must be reset. This is necessary after a meter has been restarted, either by applying power to the meter or reprogramming the meter. The meter must receive a RESET command before confirmed communication can take place. Unconfirmed communication is always possible and does not require a RESET.

#### User Data (Function 3)

After receiving a request for USER DATA, the meter generates a Data Link CONFIRMATION, signaling the reception of the request, before the actual request is processed. If a response is required, it is also sent as UNCONFIRMED USER DATA.

#### Unconfirmed User Data (Function 4)

After receiving a request for UNCONFIRMED USER DATA, if a response is required, it is sent as UNCONFIRMED USER DATA.

#### Address

DNP 3.0 allows for addresses from 0 - 65534 (0x0000 - 0xFFFFE) for individual device identification, with the address 65535 (0xFFFF) defined as an all stations address. IQ 150S/250S meters' addresses are programmable from 0 - 247 (0x0000 - 0x00F7), and address 65535 (0xFFFF) is recognized as the all stations address.

## C.4: Transport Layer

The Transport Layer as implemented on IQ 150S meters is subject to the following considerations:

### Transport Header

Multiple-frame messages are not allowed for IQ 150S meters. Each Transport Header should indicate it is both the first frame (FIR = 1) as well as the final frame (FIN = 1).

## C.5: Application Layer

The Application Layer contains a header (Request or Response Header, depending on direction) and data.

### **Application Headers**

Application Headers contain the Application Control Field and the Function Code.

### **Application Control Field**

Multiple-fragment messages are not allowed for IQ 150S meters. Each Application Header should indicate it is both the first fragment (FIR = 1) as well as the final fragment (FIN = 1).

Application-Level confirmation is not used by IQ 150S meters.

### **Function Codes**

The following Function codes are implemented on IQ 150S meters.

### Read (Function 1)

Objects supporting the READ function are:

- Binary Outputs (Object 10)
- Counters (Object 20)
- Analog Inputs (Object 30)
- Class (Object 60)

These Objects can be read either by requesting a specific Variation available as listed in this appendix, or by requesting Variation 0. READ requests for Variation 0 of an Object is fulfilled with the Variation listed in this appendix.

#### Write (Function 2)

Objects supporting the WRITE function are:

- Internal Indications (Object 80)

#### Direct Operate (Function 5)

Objects supporting the DIRECT OPERATE function are:

- Control Relay Output Block (Object 12)

#### Direct Operate - No Acknowledgment (Function 6)

Objects supporting the DIRECT OPERATE - NO ACKNOWLEDGMENT function are:

- Change to MODBUS RTU Protocol

#### Response (Function 129)

Application responses from IQ 150S meters use the RESPONSE function.

### **Application Data**

Application Data contains information about the Object and Variation, as well as the Qualifier and Range.

## **C.5.1: Object and Variation**

The following Objects (Obj.) and Variations (Var.) are supported by IQ 150S meters:

- Binary Output Status (Object 10, Variation 2) †
- Control Relay Output Block (Object 12, Variation 1)
- 32-Bit Binary Counter Without Flag (Object 20, Variation 5) †
- 16-Bit Analog Input Without Flag (Object 30, Variation 4) †
- Class 0 Data (Object 60, Variation 1) †

- Internal Indications (Object 80, Variation 1)

† READ requests for Variation 0 are honored with the above Variations.

### **C.5.1.1: Binary Output Status (Obj. 10, Var. 2)**

Binary Output Status supports the following function:

#### **Read (Function 1)**

A READ request for Variation 0 is responded to with Variation 2.

Binary Output Status is used to communicate the following data measured by IQ 150S meter:

#### **Energy Reset State**

Change to MODBUS RTU Protocol State

#### Energy Reset State (Point 0)

IQ 150S meters accumulate power generated or consumed over time as Hour Readings, which measure positive VA Hours and positive and negative W Hours and VAR Hours. These readings can be reset using a Control Relay Output Block object (Object 12). The Binary Output Status point reports whether the Energy Readings are in the process of being reset, or are accumulating. Normally, readings are being accumulated - the state of this point reads as '0'. If readings are in the process of being reset, the state of this point reads as '1'.

#### Change to Modbus RTU Protocol State (Point 1)

IQ 150S meters can of change from DNP Protocol to Modbus RTU Protocol. This enables the user to update the Device Profile of the meter (this does not change the meter's Protocol setting). A meter reset brings communication back to DNP. A status reading of "1" equals Open, or de-energized. A reading of "0" equals Closed, or energized.

### C.5.1.2: Control Relay Output Block (Obj. 12, Var. 1)

Control Relay Output Block supports the following functions:

#### **Direct Operate (Function 5)**

#### **Direct Operate - No Acknowledgment (Function 6)**

Control Relay Output Blocks are used for the following purposes:

#### **Energy Reset**

Change to MODBUS RTU Protocol

#### Energy Reset (Point 0)

As stated previously, IQ 150S meters accumulate power generated or consumed over time as Hour Readings, which measure positive VA Hours and positive and negative W Hours and VAR Hours. These readings may be reset using Point 0.

#### Change to Modbus RTU Protocol (Point 1)

Refer to Section C.5.1.1 on the previous page for the Change to Modbus Protocol information.

Use of the DIRECT OPERATE (Function 5) function will operate only with the settings of Pulsed ON (Code = 1 of Control Code Field) once (Count = 0x01) for ON 1 millisecond and OFF 0 milliseconds.

### C.5.1.3: 32-Bit Binary Counter Without Flag (Obj. 20, Var. 5)

Counters support the following functions:

#### Read (Function 1)

A READ request for Variation 0 is responded to with Variation 5.

Counters are used to communicate the following data measured by IQ 150S/250S meters:

#### Hour Readings

Hour Readings (Points 0 - 4)

| Point | Readings  | Unit |
|-------|-----------|------|
| 0     | +W hour   | Wh   |
| 1     | -W hour   | Wh   |
| 2     | +VAR hour | VARh |
| 3     | -VAR hour | VARh |
| 4     | +VA hour  | VAh  |

**NOTE:** These readings may be cleared by using the Control Relay Output Block (see previous Section C.5.1.2).

### C.5.1.4: 16-Bit Analog Input Without Flag (Obj. 30, Var. 4)

Analog Inputs support the following functions:

#### Read (Function 1)

A READ request for Variation 0 is responded to with Variation 4.

Analog Inputs are used to communicate the following data measured by IQ 150S meters:

- Health Check
- Phase-to-Neutral Voltage
- Phase-to-Phase Voltage
- Phase Current

- Total Power
- Three Phase Total VAs
- Three Phase Power Factor Total
- Frequency
- Three Phase +Watts Max Avg Demand
- Three Phase +VARs Max Avg Demand
- Three Phase -Watts Max Avg Demand
- Three Phase -VARs Max Avg Demand
- Three Phase VAs Max Avg Demand
- Angle, Phase Power
- Angle, Phase-to-Phase Voltage
- CT Numerator, Multiplier, Denominator
- PT Numerator, Multiplier, Denominator

#### Health Check (Point 0)

The Health Check point is used to indicate problems detected by the IQ 150S meter. A value of zero (0x0000) indicates the meter does not detect a problem. Non-zero values indicate a detected anomaly.

Phase-to-Neutral Voltage (Points 1 - 3)

| Point | Reading          |
|-------|------------------|
| 1     | Phase AN Voltage |
| 2     | Phase BN Voltage |
| 3     | Phase CN Voltage |

These points are formatted as 2's complement fractions. They represent a fraction of a 150V Secondary input. Inputs of above 150V Secondary are pinned at 150V Secondary.

Phase-to-Phase Voltage (Points 4 - 6)

| Point | Reading          |
|-------|------------------|
| 4     | Phase AB Voltage |
| 5     | Phase BC Voltage |
| 6     | Phase CA Voltage |

These points are formatted as 2's complement fractions. They represent a fraction of a 300V Secondary input. Inputs of above 30 V Secondary are pinned at 300V Secondary.

Phase Current (Points 7 - 9)

| Point | Reading         |
|-------|-----------------|
| 7     | Phase A Current |
| 8     | Phase B Current |
| 9     | Phase C Current |

These points are formatted as 2's complement fractions. They represent a fraction of a 10A Secondary input. Inputs of above 10A Secondary are pinned at 10A Secondary.

Total Power (Points 10 - 11)

| Point | Reading    |
|-------|------------|
| 10    | Total Watt |

| Point | Reading   |
|-------|-----------|
| 11    | Total VAR |

These points are formatted as 2's complement fractions. They represent a fraction of 4500W Secondary in normal operation, or 3000W Secondary in Open Delta operation. Inputs above/below +/- 4500 or +/-3000W Secondary are pinned at +/-4500 or +/-3000W Secondary, respectively.

Total VA (Point 12)

| Point | Reading  |
|-------|----------|
| 12    | Total VA |

This point is formatted as a 2's complement fraction. It represents a fraction of 4500W Secondary in normal operation, or 3000W Secondary in Open Delta operation. Inputs above/below +/-4500 or +/-3000W Secondary are pinned at +/-4500 or +/-3000W Secondary, respectively.

Power Factor (Point 13)

| Point | Reading            |
|-------|--------------------|
| 13    | Power Factor Total |

This point is formatted as a 2's complement integer. It represents Power Factors from -1.000 (0x0FC18) to +1.000 (0x003E8). In Open Delta operation, Total Power Factor (Point 13) is always zero.

Frequency (Point 14)

| Point | Reading   |
|-------|-----------|
| 14    | Frequency |

This point is formatted as a 2's complement fraction. It represents the Frequency as measured on Phase A Voltage in units of cHz (centiHertz, 1/100 Hz). Inputs below 45.00 Hz are pinned at 0 (0x0000); inputs above 75.00 Hz are pinned at 9999 (0x270F).

Maximum Demands of Total Power (Points 15 - 19)

| Point | Reading                             |
|-------|-------------------------------------|
| 15    | Maximum Positive Demand Total Watts |
| 16    | Maximum Positive Demand Total VARs  |
| 17    | Maximum Negative Demand Total Watts |
| 18    | Maximum Negative Demand Total VARs  |
| 19    | Maximum Average Demand VAs          |

These points are formatted as 2's complement fractions. They represent a fraction of 4500W Secondary in normal operation, or 3000W Secondary in Open Delta operation. Inputs above/below +/- 4500 or +/-3000W Secondary are pinned at +/-4500 or +/-3000W Secondary, respectively.

Phase Angle (Points 20 - 25)

| Point | Reading               |
|-------|-----------------------|
| 20    | Phase A Current Angle |
| 21    | Phase B Current Angle |
| 22    | Phase C Current Angle |
| 23    | Volts A-B Angle       |
| 24    | Volts B-C Angle       |
| 25    | Volts C-A Angle       |

These points are formatted as 2's complement integers. They represent angles from -180.00 (0x0F8F8) to +180.00 (0x00708).

CT & PT Ratios (Points 26 - 31)

| Point | Reading              |
|-------|----------------------|
| 26    | CT Ratio Numerator   |
| 27    | CT Ratio Multiplier  |
| 28    | CT Ratio Denominator |
| 29    | PT Ratio Numerator   |
| 30    | PT Ratio Multiplier  |

| Point | Reading              |
|-------|----------------------|
| 31    | PT Ratio Denominator |

These points are formatted as 2's complement integers. They can be used to convert from units in terms of the Secondary of a CT or PT into units in terms of the Primary of a CT or PT. The ratio of Numerator divided by Denominator is the ratio of Primary to Secondary.

IQ 150S meters typically use Full Scales relating Primary Current to 5A and Primary Voltage to 120V. However, these Full scales can range from mAs to thousands of kAs, and from mVs, to thousands of kVs. Following are example settings:

#### CT Example Settings

200 Amps: Set the Ct-n value for 200 and the Ct-S value for 1.

800 Amps: Set the Ct-n value for 800 and the Ct-S value for 1.

2,000 Amps: Set the Ct-n value for 2000 and the Ct-S value for 1.

10,000 Amps: Set the Ct-n value for 1000 and the Ct-S value for 10.

**NOTE:** CT Denominator is fixed at 5 for 5A units; CT Denominator is fixed at 1 for 1A units.

#### PT Example Settings

277 Volts (Reads 277 Volts): Pt-n value is 277, Pt-d value is 277, Pt-S value is 1.

120 Volts (Reads 14,400 Volts): Pt-n value is 1440, Pt-d value is 120, Pt-S value is 10.

69 Volts (Reads 138,000 Volts): Pt-n value is 1380, Pt-d value is 69, Pt-S value is 100.

115 Volts (Reads 347,000 Volts): Pt-n value is 3470, Pt-d value is 115, Pt-S value is 100.

69 Volts (Reads 347,000 Volts): Pt-n value is 347, Pt-d value is 69, Pt-S value is 1000.

### C.5.1.5: Class 0 Data (Obj. 60, Var. 1)

Class 0 Data supports the following functions:

#### **Read (Function 1)**

A request for Class 0 Data from a IQ 150S meter returns three Object Headers. Specifically, it returns 16-Bit Analog Input Without Flags (Object 30, Variation 4), Points 0 - 31, followed by 32-Bit Counters Without Flags (Object 20, Variation 5), Points 0 - 4, followed by Binary Output Status (Object 10, Variation 2), Points 0 - 1. (There is NO Object 1.)

A request for Object 60, Variation 0 is treated as a request for Class 0 Data.

### C.5.1.6: Internal Indications (Obj. 80, Var. 1)

Internal Indications support the following functions:

#### **Write (Function 2)**

Internal Indications may be indexed by Qualifier Code 0.

#### **Device Restart (Point 0)**

This bit is set whenever the meter resets. The polling device may clear this bit by Writing (Function 2) to Object 80, Point 0.

## C.6: IQ 150S Meter DNP Mapping (DNP-1 to DNP-2)

The IQ 150S DNP Point Map follows.

Binary Output States, Control Relay Outputs, Binary Counters (Primary) and Analog Inputs are described on Page 1.

Internal Indication is described on Page 2.

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| Object                                                       | Point | Var | Description                   | Format | Range         | Multiplier                                                                                                                                                    | Units  | Comments                                                                                                                                                                                                                         |
|--------------------------------------------------------------|-------|-----|-------------------------------|--------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Binary Output States <span>Read via Class 0 only</span>      |       |     |                               |        |               |                                                                                                                                                               |        |                                                                                                                                                                                                                                  |
| 10                                                           | 0     | 2   | Reset Energy Counters         | BYTE   | Always 1      | N/A                                                                                                                                                           | none   |                                                                                                                                                                                                                                  |
| 10                                                           | 1     | 2   | Change to Modbus RTU Protocol | BYTE   | Always 1      | N/A                                                                                                                                                           | none   |                                                                                                                                                                                                                                  |
|                                                              |       |     |                               |        |               |                                                                                                                                                               |        |                                                                                                                                                                                                                                  |
| Control Relay Outputs                                        |       |     |                               |        |               |                                                                                                                                                               |        |                                                                                                                                                                                                                                  |
| 12                                                           | 0     | 1   | Reset Energy Counters         | N/A    | N/A           | N/A                                                                                                                                                           | none   | Responds to Function 5 (Direct Operate), Qualifier Code 17x or 28x, Control Code 3, Count 0, On 0 msec, Off 1 msec ONLY.                                                                                                         |
| 12                                                           | 1     | 1   | Change to Modbus RTU Protocol | N/A    | N/A           | N/A                                                                                                                                                           | none   | Responds to Function 6 (Direct Operate - No Ack), Qualifier Code 17x, Control Code 3, Count 0, On 0 msec, Off 1 msec ONLY.                                                                                                       |
|                                                              |       |     |                               |        |               |                                                                                                                                                               |        |                                                                                                                                                                                                                                  |
| Binary Counters (Primary) <span>Read via Class 0 only</span> |       |     |                               |        |               |                                                                                                                                                               |        |                                                                                                                                                                                                                                  |
| 20                                                           | 0     | 4   | W-hours, Positive             | UINT32 | 0 to 99999999 | multiplier = 10 <sup>(n-d)</sup> , where n and d are derived from the energy format. n = 0, 3, or 6 per energy format scale and d = number of decimal places. | W hr   | example:<br>energy format = 7.2K and W-hours counter = 1234567<br>n=3 (K scale), d=2 ( 2 digits after decimal point), multiplier = 10 <sup>(3-2)</sup> = 10 <sup>1</sup> = 10, so energy is 1234567 * 10 Whrs, or 12345.67 KWhrs |
| 20                                                           | 1     | 4   | W-hours, Negative             | UINT32 | 0 to 99999999 |                                                                                                                                                               | W hr   |                                                                                                                                                                                                                                  |
| 20                                                           | 2     | 4   | VAR-hours, Positive           | UINT32 | 0 to 99999999 |                                                                                                                                                               | VAR hr |                                                                                                                                                                                                                                  |
| 20                                                           | 3     | 4   | VAR-hours, Negative           | UINT32 | 0 to 99999999 |                                                                                                                                                               | VAR hr |                                                                                                                                                                                                                                  |
| 20                                                           | 4     | 4   | VA-hours, Total               | UINT32 | 0 to 99999999 |                                                                                                                                                               | VA hr  |                                                                                                                                                                                                                                  |
|                                                              |       |     |                               |        |               |                                                                                                                                                               |        |                                                                                                                                                                                                                                  |
| Analog Inputs (Secondary) <span>Read via Class 0 only</span> |       |     |                               |        |               |                                                                                                                                                               |        |                                                                                                                                                                                                                                  |
| 30                                                           | 0     | 5   | Meter Health                  | SINT16 | 0 or 1        | N/A                                                                                                                                                           | none   | 0 = OK                                                                                                                                                                                                                           |
| 30                                                           | 1     | 5   | Volts A-N                     | SINT16 | 0 to 32767    | (150 / 32768)                                                                                                                                                 | V      | Values above 150V secondary read 32767.                                                                                                                                                                                          |
| 30                                                           | 2     | 5   | Volts B-N                     | SINT16 | 0 to 32767    | (150 / 32768)                                                                                                                                                 | V      |                                                                                                                                                                                                                                  |
| 30                                                           | 3     | 5   | Volts C-N                     | SINT16 | 0 to 32767    | (150 / 32768)                                                                                                                                                 | V      |                                                                                                                                                                                                                                  |
| 30                                                           | 4     | 5   | Volts A-B                     | SINT16 | 0 to 32767    | (300 / 32768)                                                                                                                                                 | V      | Values above 300V secondary read 32767.                                                                                                                                                                                          |
| 30                                                           | 5     | 5   | Volts B-C                     | SINT16 | 0 to 32767    | (300 / 32768)                                                                                                                                                 | V      |                                                                                                                                                                                                                                  |
| 30                                                           | 6     | 5   | Volts C-A                     | SINT16 | 0 to 32767    | (300 / 32768)                                                                                                                                                 | V      |                                                                                                                                                                                                                                  |
| 30                                                           | 7     | 5   | Amps A                        | SINT16 | 0 to 32767    | (10 / 32768)                                                                                                                                                  | A      | Values above 10A secondary read 32767.                                                                                                                                                                                           |
| 30                                                           | 8     | 5   | Amps B                        | SINT16 | 0 to 32767    | (10 / 32768)                                                                                                                                                  | A      |                                                                                                                                                                                                                                  |
| 30                                                           | 9     | 5   | Amps C                        | SINT16 | 0 to 32767    | (10 / 32768)                                                                                                                                                  | A      |                                                                                                                                                                                                                                  |

| Object              | Point | Var | Description                              | Format | Range            | Multiplier     | Units  | Comments                                                                          |
|---------------------|-------|-----|------------------------------------------|--------|------------------|----------------|--------|-----------------------------------------------------------------------------------|
| 30                  | 10    | 5   | Watts, 3-Ph total                        | SINT16 | -32768 to +32767 | (4500 / 32768) | W      |                                                                                   |
| 30                  | 11    | 5   | VARs, 3-Ph total                         | SINT16 | -32768 to +32767 | (4500 / 32768) | VAR    |                                                                                   |
| 30                  | 12    | 5   | VAs, 3-Ph total                          | SINT16 | 0 to +32767      | (4500 / 32768) | VA     |                                                                                   |
| 30                  | 13    | 5   | Power Factor, 3-Ph total                 | SINT16 | -1000 to +1000   | 0.001          | none   |                                                                                   |
| 30                  | 14    | 5   | Frequency                                | SINT16 | 0 to 9999        | 0.01           | Hz     |                                                                                   |
| 30                  | 15    | 5   | Positive Watts, 3-Ph, Maximum Avg Demand | SINT16 | -32768 to +32767 | (4500 / 32768) | W      |                                                                                   |
| 30                  | 16    | 5   | Positive VARs, 3-Ph, Maximum Avg Demand  | SINT16 | -32768 to +32767 | (4500 / 32768) | VAR    |                                                                                   |
| 30                  | 17    | 5   | Negative Watts, 3-Ph, Maximum Avg Demand | SINT16 | -32768 to +32767 | (4500 / 32768) | W      |                                                                                   |
| 30                  | 18    | 5   | Negative VARs, 3-Ph, Maximum Avg Demand  | SINT16 | -32768 to +32767 | (4500 / 32768) | VAR    |                                                                                   |
| 30                  | 19    | 5   | VAs, 3-Ph, Maximum Avg Demand            | SINT16 | -32768 to +32767 | (4500 / 32768) | VA     |                                                                                   |
| 30                  | 20    | 5   | Angle, Phase A Current                   | SINT16 | -1800 to +1800   | 0.1            | degree |                                                                                   |
| 30                  | 21    | 5   | Angle, Phase B Current                   | SINT16 | -1800 to +1800   | 0.1            | degree |                                                                                   |
| 30                  | 22    | 5   | Angle, Phase C Current                   | SINT16 | -1800 to +1800   | 0.1            | degree |                                                                                   |
| 30                  | 23    | 5   | Angle, Volts A-B                         | SINT16 | -1800 to +1800   | 0.1            | degree |                                                                                   |
| 30                  | 24    | 5   | Angle, Volts B-C                         | SINT16 | -1800 to +1800   | 0.1            | degree |                                                                                   |
| 30                  | 25    | 5   | Angle, Volts C-A                         | SINT16 | -1800 to +1800   | 0.1            | degree |                                                                                   |
| 30                  | 26    | 5   | CT numerator                             | SINT16 | 1 to 9999        | N/A            | none   | CT ratio =<br>(numerator * multiplier) / denominator                              |
| 30                  | 27    | 5   | CT multiplier                            | SINT16 | 1, 10, or 100    | N/A            | none   |                                                                                   |
| 30                  | 28    | 5   | CT denominator                           | SINT16 | 1 or 5           | N/A            | none   | PT ratio =<br>(numerator * multiplier) / denominator                              |
| 30                  | 29    | 5   | PT numerator                             | SINT16 | 1 to 9999        | N/A            | none   |                                                                                   |
| 30                  | 30    | 5   | PT multiplier                            | SINT16 | 1, 10, or 100    | N/A            | none   |                                                                                   |
| 30                  | 31    | 5   | PT denominator                           | SINT16 | 1 to 9999        | N/A            | none   |                                                                                   |
| 30                  | 32    | 5   | Neutral Current                          | SINT16 | 0 to 32767       | (10 / 32768)   | A      | For 1A model, multiplier is (2 / 32768) and values above 2A secondary read 32767. |
| Internal Indication |       |     |                                          |        |                  |                |        |                                                                                   |
| 80                  | 0     | 1   | Device Restart Bit                       | N/A    | N/A              | N/A            | none   | Clear via Function 2 (Write), Qualifier Code 0.                                   |

## D: IQ 250S Meter DNP Map

### D.1: Overview

This Appendix describes the functionality of the IQ250S meter's version of the DNP protocol. A DNP programmer needs this information to retrieve data from the IQ 250S meter. The DNP version used by the IQ 250S is a reduced set of the Distributed Network Protocol Version 3.0 subset 2; it gives enough functionality to get critical measurements from the IQ 250S meter.

The IQ 250S meter's DNP version supports Class 0 object/qualifiers 0,1,2,6, only. No event generation is supported. The IQ 250S meter always acts as a secondary device (slave) in DNP communication.

### D.2: Physical Layer

The IQ250S meter's DNP version uses serial communication. Port 2 (RS485 compliant port) is used. Speed and data format is transparent for the IQ250S meter's DNP version: they can be set to any supported value.

### D.3: Data Link Layer

The IQ 250S meter can be assigned a value from 1 to 65534 as the target device address. The data link layer follows the standard frame FT3 used by DNP Version 3.0 protocol, but only 4 functions are implemented: Reset Link, Reset User, Unconfirmed User Data, and Link Status, as depicted in the following table.

| Function              | Function Code |
|-----------------------|---------------|
| Reset Link            | 0             |
| Reset User            | 1             |
| Unconfirmed User Data | 4             |
| Link Status           | 9             |

Table D.1: Supported Link Functions

[dst] and [src] are the device address of the IQ 250S meter and Master device, respectively. Refer to Section D.7 for more detail on supported frames for the data link layer.

In order to establish optimal communication with the IQ 250S meter, we recommend that you perform the Reset Link and Reset User functions. The Link Status is not mandatory, but can be performed as well. The inter-character time-out for DNP is 1 second. If this amount of time, or more, elapses between two consecutive characters within a FT3 frame, the frame will be dropped.

#### D.4: Application Layer

The IQ 250S meter's DNP version supports the Read, Write, Direct Operate and Direct Operate Unconfirmed functions.

- The Read function (code 01) provides a means for reading the critical measurement data from the meter. This function should be posted to read object 60 variation 1, which will read all the available Class 0 objects from the DNP register map. See the register map in Section C.6. In order to retrieve all objects with their respective variations, the qualifier must be set to ALL (0x06). See Section D.7 for an example showing a read Class 0 request data from the meter.
- The Write function (code 02) provides a means for clearing the Device restart bit in the Internal Indicator register only. This is mapped to Object 80, point 0 with variation 1. When clearing the restart device indicator use qualifier 0. Section D.7 shows the supported frames for this function.
- The Direct Operate function (code 05) is intended for resetting the energy counters and the Demand counters (minimum and maximum energy registers). These actions are mapped to Object 12, points 0 and 2, which act as control relays. The relays must be operated (On) in 0 msec and released (Off) in 1 msec only. Qualifiers 0x17 or x28 are supported for writing the energy reset. Sample frames are shown in Section D.7.
- The Direct Operate Unconfirmed (or Unacknowledged) function (code 06) is intended for asking the communication port to switch to Modbus RTU protocol from DNP. This switching acts as a control relay mapped into Object 12, point 1 in the meter. The relay must be operated with qualifier 0x17, code 3 count 0, with 0 milliseconds on and 1 millisecond off, only. After sending this request the current communication port will accept Modbus RTU frames only. To make this port go back to DNP protocol, the unit must be powered down and up. Section D.7 shows the constructed frame to perform DNP to Modbus RTU protocol change.

## D.5: Error Reply

In the case of an unsupported function, or any other recognizable error, an error reply is generated from the IQ 250S meter to the Primary station (the requester). The Internal Indicator field will report the type of error: unsupported function or bad parameter.

The broadcast acknowledge and restart bit are also signaled in the Internal Indicator field, but they do not indicate an error condition.

## D.6: IQ 250S Meter's DNP Register Map

### Object 10 - Binary Output States

| Object | Point | Var | Description                     | Format | Range    | Multiplier | Units | Comments                                        |
|--------|-------|-----|---------------------------------|--------|----------|------------|-------|-------------------------------------------------|
| 10     | 0     | 2   | Reset Energy Counters           | BYTE   | Always 1 | N/A        | None  | Read by Class 0 or with qualifier 0, 1, 2, or 6 |
| 10     | 1     | 2   | Change to Modbus RTU Protocol   | BYTE   | Always 1 | N/A        | None  | Read by Class 0 or with qualifier 0, 1, 2, or 6 |
| 10     | 2     | 2   | Reset Demand Cntrs (Max / Min ) | BYTE   | Always 1 | N/A        | None  | Read by Class 0 or with qualifier 0, 1, 2, or 6 |

### Object 12 - Control Relay Outputs

| Object | Point | Var | Description                       | Format | Range | Multiplier | Units | Comments                                                                                                                   |
|--------|-------|-----|-----------------------------------|--------|-------|------------|-------|----------------------------------------------------------------------------------------------------------------------------|
| 12     | 0     | 1   | Reset Energy Counters             | N/A    | N/A   | N/A        | none  | Responds to Function 5 (Direct Operate), Qualifier Code 17x or 28x, Control Code 3, Count 0, On 0 msec, Off 1 msec ONLY.   |
| 12     | 1     | 1   | Change to Modbus RTU Protocol     | N/A    | N/A   | N/A        | none  | Responds to Function 6 (Direct Operate - No Ack), Qualifier Code 17x, Control Code 3, Count 0, On 0 msec, Off 1 msec ONLY. |
| 12     | 2     | 1   | Reset Demand Counters (Max / Min) | N/A    | N/A   | N/A        | none  | Responds to Function 5 (Direct Operate), Qualifier Code 17x or 28x, Control Code 3, Count 0, On 0 msec, Off 1 msec ONLY.   |

**Object 20 - Binary Counters (Primary Readings) - Read via Class 0 or with qualifier 0, 1, 2, or 6**

| Object | Point | Var | Description         | Format | Range         | Multiplier                                                                                                                                          | Units | Comments                                                                                                                                                                                             |
|--------|-------|-----|---------------------|--------|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 20     | 0     | 5   | W-hours, Positive   | UINT32 | 0 to 99999999 | Multiplier = $10(n-d)$ , where n and d are derived from the energy format. n = 0, 3, or 6 per energy format scale and d = number of decimal places. | Whr   | example: energy format = 7.2K and W-hours counter = 1234567 n=3 (K scale), d=2 ( 2 digits after decimal point), multiplier = $10(3-2)$ = 101 = 10, so energy is 1234567 * 10 Whrs, or 12345.67 KWhrs |
| 20     | 1     | 5   | W-hours, Negative   | UINT32 | 0 to 99999999 |                                                                                                                                                     | Whr   |                                                                                                                                                                                                      |
| 20     | 2     | 5   | VAR-hours, Positive | UINT32 | 0 to 99999999 |                                                                                                                                                     | VARhr |                                                                                                                                                                                                      |
| 20     | 3     | 5   | VAR-hours, Negative | UINT32 | 0 to 99999999 |                                                                                                                                                     | VARhr |                                                                                                                                                                                                      |
| 20     | 4     | 5   | VA-hours, Total     | UINT32 | 0 to 99999999 |                                                                                                                                                     | VAhr  |                                                                                                                                                                                                      |

**Object 30 - Analog Inputs (Secondary Readings) - Read via Class 0 or with qualifier 0, 1, 2, or 6**

| Object | Point | Var | Description  | Format | Range      | Multiplier    | Units | Comments                                |
|--------|-------|-----|--------------|--------|------------|---------------|-------|-----------------------------------------|
| 30     | 0     | 4   | Meter Health | sint16 | 0 or 1     | N/A           | None  | 0 = OK                                  |
| 30     | 1     | 4   | Volts A-N    | sint16 | 0 to 32767 | (150 / 32768) | V     | Values above 150V secondary read 32767. |
| 30     | 2     | 4   | Volts B-N    | sint16 | 0 to 32767 | (150 / 32768) | V     |                                         |
| 30     | 3     | 4   | Volts C-N    | sint16 | 0 to 32767 | (150 / 32768) | V     |                                         |
| 30     | 4     | 4   | Volts A-B    | sint16 | 0 to 32767 | (300 / 32768) | V     | Values above 300V secondary read 32767. |
| 30     | 5     | 4   | Volts B-C    | sint16 | 0 to 32767 | (300 / 32768) | V     |                                         |
| 30     | 6     | 4   | Volts C-A    | sint16 | 0 to 32767 | (300 / 32768) | V     |                                         |
| 30     | 7     | 4   | Amps A       | sint16 | 0 to 32767 | (10 / 32768)  | A     | Values above 10A secondary read 32767.  |

| Object | Point | Var | Description                              | Format | Range            | Multiplier     | Units  | Comments |
|--------|-------|-----|------------------------------------------|--------|------------------|----------------|--------|----------|
| 30     | 8     | 4   | Amps B                                   | sint16 | 0 to 32767       | (10 / 32768)   | A      |          |
| 30     | 9     | 4   | Amps C                                   | sint16 | 0 to 32767       | (10 / 32768)   | A      |          |
| 30     | 10    | 4   | Watts, 3-Ph total                        | sint16 | -32768 to +32767 | (4500 / 32768) | W      |          |
| 30     | 11    | 4   | VARs, 3-Ph total                         | sint16 | -32768 to +32767 | (4500 / 32768) | VAR    |          |
| 30     | 12    | 4   | VAs, 3-Ph total                          | sint16 | 0 to +32767      | (4500 / 32768) | VA     |          |
| 30     | 13    | 4   | Power Factor, 3-Ph total                 | sint16 | -1000 to +1000   | 0.001          | None   |          |
| 30     | 14    | 4   | Frequency                                | sint16 | 0 to 9999        | 0.01           | Hz     |          |
| 30     | 15    | 4   | Positive Watts, 3-Ph, Maximum Avg Demand | sint16 | -32768 to +32767 | (4500 / 32768) | W      |          |
| 30     | 16    | 4   | Positive VARs, 3-Ph, Maximum Avg Demand  | sint16 | -32768 to +32767 | (4500 / 32768) | VAR    |          |
| 30     | 17    | 4   | Negative Watts, 3-Ph, Maximum Avg Demand | sint16 | -32768 to +32767 | (4500 / 32768) | W      |          |
| 30     | 18    | 4   | Negative VARs, 3-Ph, Maximum Avg Demand  | sint16 | -32768 to +32767 | (4500 / 32768) | VAR    |          |
| 30     | 19    | 4   | VAs, 3-Ph, Maximum Avg Demand            | sint16 | -32768 to +32767 | (4500 / 32768) | VA     |          |
| 30     | 20    | 4   | Angle, Phase A Current                   | sint16 | -1800 to +1800   | 0.1            | degree |          |
| 30     | 21    | 4   | Angle, Phase B Current                   | sint16 | -1800 to +1800   | 0.1            | degree |          |
| 30     | 22    | 4   | Angle, Phase C Current                   | sint16 | -1800 to +1800   | 0.1            | degree |          |
| 30     | 23    | 4   | Angle, Volts A-B                         | sint16 | -1800 to +1800   | 0.1            | degree |          |
| 30     | 24    | 4   | Angle, Volts B-C                         | sint16 | -1800 to +1800   | 0.1            | degree |          |
| 30     | 25    | 4   | Angle, Volts C-A                         | sint16 | -1800 to +1800   | 0.1            | degree |          |

| Object | Point | Var | Description     | Format | Range         | Multiplier   | Units | Comments                                                                         |
|--------|-------|-----|-----------------|--------|---------------|--------------|-------|----------------------------------------------------------------------------------|
| 30     | 26    | 4   | CT numerator    | sint16 | 1 to 9999     | N/A          | none  | CT ratio = (numerator * multiplier) / denominator                                |
| 30     | 27    | 4   | CT multiplier   | sint16 | 1, 10, or 100 | N/A          | none  |                                                                                  |
| 30     | 28    | 4   | CT denominator  | sint16 | 1 or 5        | N/A          | none  |                                                                                  |
| 30     | 29    | 4   | PT numerator    | SINT16 | 1 to 9999     | N/A          | none  | PT ratio = (numerator * multiplier) / denominator                                |
| 30     | 30    | 4   | PT multiplier   | SINT16 | 1, 10, or 100 | N/A          | none  |                                                                                  |
| 30     | 31    | 4   | PT denominator  | SINT16 | 1 to 9999     | N/A          | none  |                                                                                  |
| 30     | 32    | 4   | Neutral Current | SINT16 | 0 to 32767    | (10 / 32768) | A     | For 1A model, multiplier is (2 / 32768) and values above 2A secondary read 32767 |

#### Object 80 - Internal Indicator

| Object | Point | Var | Description        | Format | Range | Multiplier | Units | Comments                                        |
|--------|-------|-----|--------------------|--------|-------|------------|-------|-------------------------------------------------|
| 80     | 7     | 1   | Device Restart Bit | N/A    | N/A   | N/A        | none  | Clear via Function 2 (Write), Qualifier Code 0. |

## D.7: DNP Message Layouts

### Legend

All numbers are in hexadecimal base. In addition the following symbols are used.

|     |                                                                                                    |
|-----|----------------------------------------------------------------------------------------------------|
| dst | 16 bit frame destination address                                                                   |
| src | 16 bit frame source address                                                                        |
| crc | DNP Cyclic redundant checksum (polynomial $x^{16}+x^{13}+x^{12}+x^{11}+x^{10}+x^7+x^6+x^5+x^2+1$ ) |
| x   | transport layer data sequence number                                                               |
| y   | application layer data sequence number                                                             |

**Link Layer related frames**Reset Link

|         |    |    |    |    |     |     |     |
|---------|----|----|----|----|-----|-----|-----|
| Request | 05 | 64 | 05 | C0 | dst | src | crc |
| Reply   | 05 | 64 | 05 | 00 | src | dst | crc |

Reset User

|         |    |    |    |    |     |     |     |
|---------|----|----|----|----|-----|-----|-----|
| Request | 05 | 64 | 05 | C1 | dst | src | crc |
| Reply   | 05 | 64 | 05 | 00 | src | dst | crc |

Link Status

|         |    |    |    |    |     |     |     |
|---------|----|----|----|----|-----|-----|-----|
| Request | 05 | 64 | 05 | C9 | dst | src | crc |
| Reply   | 05 | 64 | 05 | 0B | src | dst | crc |

**Application Layer related frames**Clear Restart

|         |    |    |    |           |     |     |     |    |     |     |
|---------|----|----|----|-----------|-----|-----|-----|----|-----|-----|
| Request | 05 | 64 | 0E | C4        | dst |     | src |    | crc |     |
|         | Cx | Cy | 02 | 50        | 01  | 00  | 07  | 07 | 00  | crc |
| Reply   | 05 | 64 | 0A | 44        | src |     | dst |    | crc |     |
|         | Cx | Cy | 81 | int. ind. |     | crc |     |    |     |     |

Class 0 Data

|                                          |      |    |       |           |       |      |       |      |       |      |       |      |             |      |       |     |    |     |     |  |  |  |  |  |  |  |  |
|------------------------------------------|------|----|-------|-----------|-------|------|-------|------|-------|------|-------|------|-------------|------|-------|-----|----|-----|-----|--|--|--|--|--|--|--|--|
| Request                                  | 05   | 64 | 0B    | C4        | dst   |      | src   |      | crc   |      |       |      |             |      |       |     |    |     |     |  |  |  |  |  |  |  |  |
|                                          | Cx   | Cy | 01    | 3C        | 01    | 06   | crc   |      |       |      |       |      |             |      |       |     |    |     |     |  |  |  |  |  |  |  |  |
|                                          |      |    |       |           |       |      |       |      |       |      |       |      |             |      |       |     |    |     |     |  |  |  |  |  |  |  |  |
| Request<br>(alternate)                   | 05   | 64 | 14    | C4        | dst   |      | src   |      | crc   |      |       |      |             |      |       |     |    |     |     |  |  |  |  |  |  |  |  |
|                                          | Cx   | Cy | 01    | 3C        | 02    | 06   | 3C    | 03   | 06    | 3C   | 04    | 06   | 3C          | 01   | 06    | crc |    |     |     |  |  |  |  |  |  |  |  |
|                                          |      |    |       |           |       |      |       |      |       |      |       |      |             |      |       |     |    |     |     |  |  |  |  |  |  |  |  |
| Reply<br>(same for<br>either<br>request) | 05   | 64 | 72    | 44        | src   |      | dst   |      | crc   |      |       |      |             |      |       |     |    |     |     |  |  |  |  |  |  |  |  |
|                                          | Cx   | Cy | 81    | int. ind. |       | 14   | 05    | 00   | 00    | 04   | pt 0  |      |             |      | pt 1  |     |    |     | crc |  |  |  |  |  |  |  |  |
|                                          | pt 1 |    |       | pt 2      |       |      | pt 3  |      |       |      | pt 4  |      |             |      | 1E    |     | 04 | crc |     |  |  |  |  |  |  |  |  |
|                                          | 00   | 00 | 20    | pt 0      |       | pt 1 |       | pt 2 |       | pt 3 |       | pt 4 |             | pt 5 |       | pt6 |    | crc |     |  |  |  |  |  |  |  |  |
|                                          | pt6  |    | pt 7  |           | pt 8  |      | pt 9  |      | pt 10 |      | pt 11 |      | pt 12       |      | pt 13 |     |    |     | crc |  |  |  |  |  |  |  |  |
|                                          |      |    | pt 15 |           | pt 16 |      | pt 17 |      | pt 18 |      | pt 19 |      | pt 20       |      | pt 21 |     |    |     | crc |  |  |  |  |  |  |  |  |
|                                          |      |    | pt 23 |           | pt 24 |      | pt 25 |      | pt 26 |      | pt 27 |      | pt 28       |      | pt 29 |     |    |     | crc |  |  |  |  |  |  |  |  |
|                                          |      |    | pt 31 |           | pt 32 |      | 0A 02 |      | 00 00 |      | 02    |      | pt0 pt1 pt2 |      | crc   |     |    |     |     |  |  |  |  |  |  |  |  |

Reset Energy

|         |    |    |    |           |     |     |     |    |    |    |    |    |    |    |    |    |     |
|---------|----|----|----|-----------|-----|-----|-----|----|----|----|----|----|----|----|----|----|-----|
| Request | 05 | 64 | 18 | C4        | dst | src | crc |    |    |    |    |    |    |    |    |    |     |
|         | Cx | Cy | 05 | 0C        | 01  | 17  | 01  | 00 | 03 | 00 | 00 | 00 | 00 | 00 | 01 | 00 | crc |
|         | 00 | 00 | 00 | crc       |     |     |     |    |    |    |    |    |    |    |    |    |     |
| Reply   | 05 | 64 | 1A | 44        | src | dst | crc |    |    |    |    |    |    |    |    |    |     |
|         | Cx | Cy | 81 | int. ind. | 0C  | 01  | 17  | 01 | 00 | 03 | 00 | 00 | 00 | 00 | 00 | 00 | crc |
|         | 01 | 00 | 00 | 00        | 00  | crc |     |    |    |    |    |    |    |    |    |    |     |

|                        |    |    |    |           |     |     |     |     |    |    |    |    |    |    |    |    |     |
|------------------------|----|----|----|-----------|-----|-----|-----|-----|----|----|----|----|----|----|----|----|-----|
| Request<br>(alternate) | 05 | 64 | 1A | C4        | dst | src | crc |     |    |    |    |    |    |    |    |    |     |
|                        | Cx | Cy | 05 | 0C        | 01  | 28  | 01  | 00  | 00 | 00 | 03 | 00 | 00 | 00 | 00 | 00 | crc |
|                        | 01 | 00 | 00 | 00        | 00  | crc |     |     |    |    |    |    |    |    |    |    |     |
| Reply                  | 05 | 64 | 1C | 44        | src | dst | crc |     |    |    |    |    |    |    |    |    |     |
|                        | Cx | Cy | 81 | int. ind. | 0C  | 01  | 28  | 01  | 00 | 00 | 00 | 03 | 00 | 00 | 00 | 00 | crc |
|                        | 00 | 00 | 01 | 00        | 00  | 00  | 00  | crc |    |    |    |    |    |    |    |    |     |

Switch to Modbus

|          |    |    |    |     |     |     |     |    |    |    |    |    |    |    |    |    |     |
|----------|----|----|----|-----|-----|-----|-----|----|----|----|----|----|----|----|----|----|-----|
| Request  | 05 | 64 | 18 | C4  | dst | src | crc |    |    |    |    |    |    |    |    |    |     |
|          | Cx | Cy | 06 | 0C  | 01  | 17  | 01  | 01 | 03 | 00 | 00 | 00 | 00 | 00 | 01 | 00 | crc |
|          | 00 | 00 | 00 | crc |     |     |     |    |    |    |    |    |    |    |    |    |     |
| No Reply |    |    |    |     |     |     |     |    |    |    |    |    |    |    |    |    |     |

Reset Demand (Maximums & Minimums)

|         |    |    |    |           |     |     |     |    |    |    |    |    |    |    |    |    |     |
|---------|----|----|----|-----------|-----|-----|-----|----|----|----|----|----|----|----|----|----|-----|
| Request | 05 | 64 | 18 | C4        | dst | src | crc |    |    |    |    |    |    |    |    |    |     |
|         | Cx | Cy | 05 | 0C        | 01  | 17  | 01  | 02 | 03 | 00 | 00 | 00 | 00 | 00 | 01 | 00 | crc |
|         | 00 | 00 | 00 | crc       |     |     |     |    |    |    |    |    |    |    |    |    |     |
| Reply   | 05 | 64 | 1A | 44        | src | dst | crc |    |    |    |    |    |    |    |    |    |     |
|         | Cx | Cy | 81 | int. ind. | 0C  | 01  | 17  | 01 | 02 | 03 | 00 | 00 | 00 | 00 | 00 | 00 | crc |
|         | 01 | 00 | 00 | 00        | 00  | crc |     |    |    |    |    |    |    |    |    |    |     |

|                        |    |    |    |           |     |     |     |     |    |    |    |    |    |    |    |    |     |
|------------------------|----|----|----|-----------|-----|-----|-----|-----|----|----|----|----|----|----|----|----|-----|
| Request<br>(alternate) | 05 | 64 | 1A | C4        | dst | src | crc |     |    |    |    |    |    |    |    |    |     |
|                        | Cx | Cy | 05 | 0C        | 01  | 28  | 01  | 02  | 00 | 00 | 03 | 00 | 00 | 00 | 00 | 00 | crc |
|                        | 01 | 00 | 00 | 00        | 00  | crc |     |     |    |    |    |    |    |    |    |    |     |
| Reply                  | 05 | 64 | 1C | 44        | src | dst | crc |     |    |    |    |    |    |    |    |    |     |
|                        | Cx | Cy | 81 | int. ind. | 0C  | 01  | 28  | 01  | 02 | 00 | 00 | 03 | 00 | 00 | 00 | 00 | crc |
|                        | 00 | 00 | 01 | 00        | 00  | 00  | 00  | crc |    |    |    |    |    |    |    |    |     |

Error Reply

|       |    |    |    |           |     |     |     |  |  |  |  |  |  |  |  |  |  |
|-------|----|----|----|-----------|-----|-----|-----|--|--|--|--|--|--|--|--|--|--|
| Reply | 05 | 64 | 0A | 44        | src | dst | crc |  |  |  |  |  |  |  |  |  |  |
|       | Cx | Cy | 81 | int. ind. | crc |     |     |  |  |  |  |  |  |  |  |  |  |

## D.8: Internal Indication Bits

Bits implemented in the IQ 250S meter are listed below. All others are always reported as zeroes.

### **Bad Function**

Occurs if the function code in a User Data request is not Read (0x01), Write (0x02), Direct Operate (0x05), or Direct Operate, No Ack (0x06).

### **Object Unknown**

Occurs if an unsupported object is specified for the Read function. Only objects 10, 20, 30, and 60 are supported.

### **Out of Range**

Occurs for most other errors in a request, such as requesting points that don't exist or direct operate requests in unsupported formats.

### **Buffer Overflow**

Occurs if a read request or a read response is too large for its respective buffer. In general, if the request overflows, there will be no data in the response while if the response overflows at least the first object will be returned. The largest acceptable request has a length field of 26, i.e. link header plus 21 bytes more, not counting checksums. The largest possible response has 7 blocks plus the link header.

### **Restart**

### **All Stations**

These 2 bits are reported in accordance with standard practice.

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