Energy Meter Installation and Operation Manual

EMERSON
Climate Technologies

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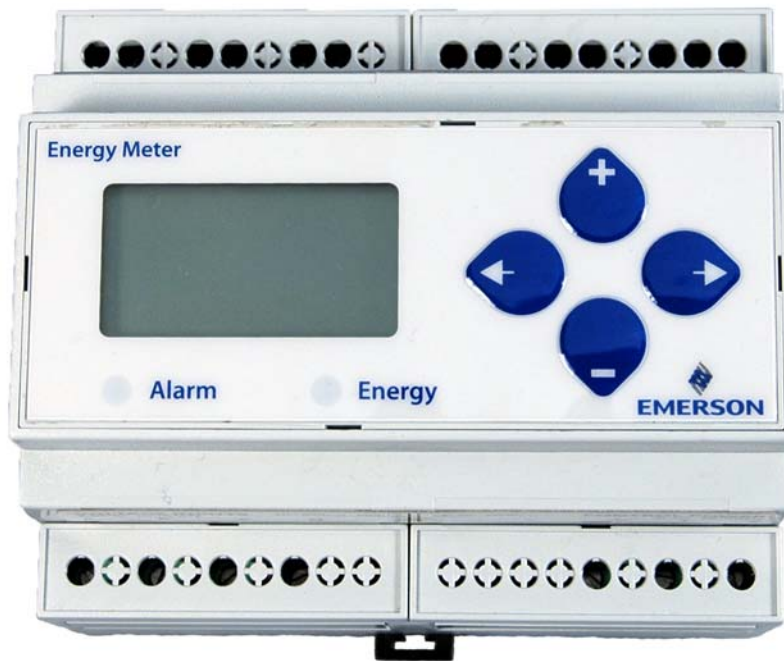
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1   Introduction

The Energy Meter *(P/N 250-5000)* provides a solution for measuring energy data with a single device. Inputs include Control Power, CT, and 3-phase voltage. The Energy Meter supports multiple output options, including solid state relay contacts, Modbus, and pulse. The LCD screen on the faceplate allows instant output viewing.

The meter is housed in a plastic enclosure suitable for installation on T35 DIN rail according to EN50022. The Energy Meter can be mounted with any orientation over the entire ambient temperature range, either on a DIN rail or in a panel. The meter is not sensitive to CT orientation to reduce installation errors.

For use in a Pollution Degree 2 or better environment only. A Pollution Degree 2 environment must control conductive pollution and the possibility of condensation or high humidity. Consider the enclosure, the correct use of ventilation, thermal properties of the equipment, and the relationship with the environment. Installation category: CAT II or CAT III.

Provide a disconnect device to disconnect the Energy Meter from the supply source. Place this device in close proximity to the equipment and within easy reach of the operator, and mark it as the disconnecting device. The disconnecting device shall meet the relevant requirements of IEC 60947-1 and IEC 60947-3 and shall be suitable for the application. In the US and Canada, disconnecting fuse holders can be used. Provide overcurrent protection and disconnecting device for supply conductors with approved current limiting devices suitable for protecting the wiring. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the device may be impaired.

WARNING! HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

• Follow safe electrical work practices. See NFPA 70E in the USA, or applicable local codes.

• This equipment must only be installed and serviced by qualified electrical personnel.

• Read, understand and follow the instructions before installing this product.

• Turn off all power supplying equipment before working on or inside the equipment.

• Any covers that may be displaced during the installation must be reinstalled before powering the unit.

• Use a properly rated voltage sensing device to confirm power is off.

DO NOT DEPEND ON THIS PRODUCT FOR VOLTAGE INDICATION

Failure to follow these instructions will result in death or serious injury.

1.1.   Specifications

Measurement Accuracy:	
Real Power and Energy	IEC 62053-22 Class 0.5S, ANSI C12.20 0.5%
Reactive Power and Energy	IEC 62053-23 Class 2, 2%
Current	0.4% (+0.015% per °C deviation from 25°C) from 5% to 100% of range; 0.8% (+0.015% per °C deviation from 25°C) from 1% to 5% of range
Voltage	0.4% (+0.015% per °C deviation from 25°C) from $90V_{L\text{-}L}$ to $600VAC_{L\text{-}L}$
Sample Rate	2520 samples per second
Data Update Rate	1 sec
Type of Measurement	True RMS up to the 21st harmonic 60 Hz One to three phase AC system

Input Voltage Characteristics:	
Measured AC Voltage	Minimum $90V_{L\text{-}N}$ ($156V_{L\text{-}L}$) for stated accuracy; UL Maximums: $600V_{L\text{-}L}$ ($347V_{L\text{-}N}$) CE Maximums: $300V_{L\text{-}N}$ ($520V_{L\text{-}L}$)
Metering Over-Range	+20%
Impedance	$2.5\ M\Omega_{L\text{-}N}$ / $5\ M\Omega_{L\text{-}L}$
Frequency Range	45 to 65 Hz

Input Current Characteristics:	
CT Scaling	Primary: Adjustable from 5A to 32,000A
Measurement Input Range	0 to 0.333VAC or 0 to 1.0VAC (+20% over-range)
Impedance	$10.6k\Omega$ (1/3 V mode) or $32.1k\Omega$ (1 V mode)

Control Power:	
AC	5VA max.; 90V min. UL Maximums: $600V_{L\text{-}L}$ ($347V_{L\text{-}N}$) CE Maximums: $300V_{L\text{-}N}$ ($520V_{L\text{-}L}$)
DC*	3W max.; UL and CE: 125 to 300VDC
Ride Through Time	100 msec at 120VAC

Output:	
Alarm Contacts (all models)	N.C., static output (30VAC/DC, 100mA max. @ 25°C, derate 0.56mA per °C above 25°C)

Table 1-1 - Energy Meter Specifications

Real Energy Pulse Contacts (all models) AND	N.O., static output
Reactive Energy Pulse Contacts	(30VAC/DC, 100mA max. @ 25°C, derate 0.56mA per °C above 25°C)
RS-485 Port	2-wire, 1200 to 38400 baud, Modbus RTU

Mechanical Characteristics:	
Weight	0.62 lb (0.28 kg)
IP Degree of Protection (IEC 60529)	IP40 front display; IP20 Meter
Display Characteristics	Back-lit blue LCD
Terminal Block Screw Torque	0.37 ft-lb (0.5 N.m) nominal/0.44 ft-lb (0.6 N.m) max.
Terminal Block Wire Size	26 to 14 AWG (0.13 to 2.08 mm²)
Rail	T35 (35mm) DIN Rail per EN50022

Environmental Conditions:	
Operating Temperature	-30°C to 70°C (86°F to 158°F)
Storage Temperature	-40°C to 85°C (-40°F to 185°F)
Humidity Range	<95% RH (non-condensing)
Altitude of Operation	3 km max.

Metering Category:	
US and Canada	CAT III; for distribution systems up to $347\ V_{L\text{-}N}$ / $600VAC_{L\text{-}L}$
CE	CAT III; for distribution systems up to $300\ V_{L\text{-}N}$ / $480VAC_{L\text{-}L}$
Dielectric Withstand	Per UL 508, EN61010
Conducted and Radiated Emissions	FCC part 15 Class B, EN55011/EN61000 Class B (residential and light industrial)
Conducted and Radiated Immunity	EN61000 Class A (heavy industrial)

Safety:	
US and Canada (cULus)	UL508 (open type device)/CSA 22.2 No. 14-05
Europe (CE)	EN61010-1:2001

Table 1-1 - Energy Meter Specifications

*External DC current limiting is required, see **Section 4.2.1.,** Fuse Recommendations.*

1.2. Notice

- This product is not intended for life or safety applications.

- Do not install this product in hazardous or classified locations.

- The installer is responsible for conformance to all applicable codes.

- Mount this product inside a suitable fire and electrical enclosure.

1.2.1. FCC Part 15 Information

NOTE: This equipment has been tested by the manufacturer and found to comply with the limits for a class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area may cause harmful interference in which case the user will be required to correct the interference at his own expense. Modifications to this product without the express authorization of Retail Solutions nullify this statement.
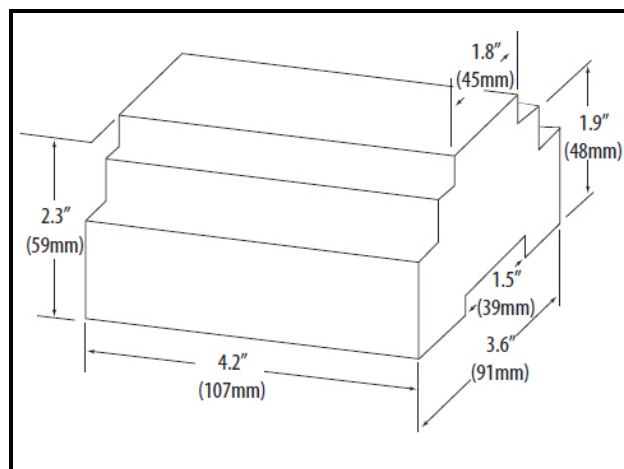
2 Overview
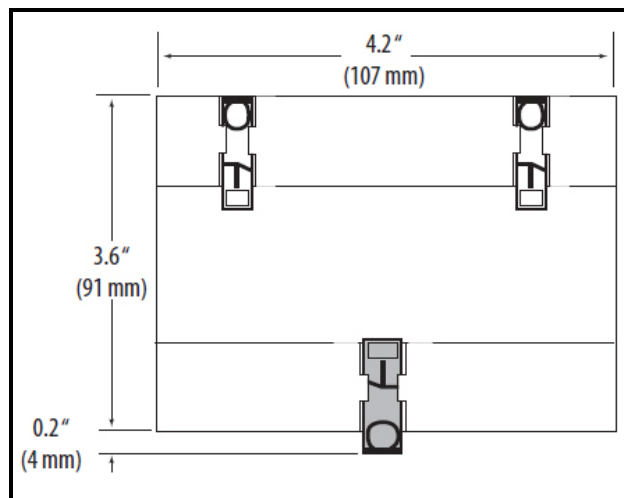
2.1. Dimensions

Figure 2-1 - Energy Meter Dimensions
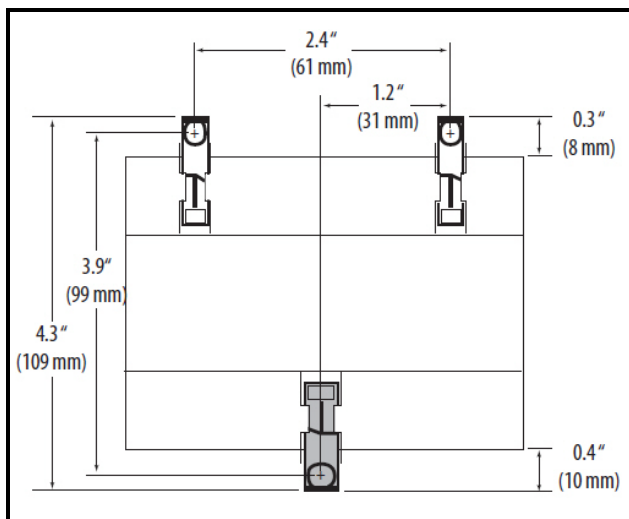

Figure 2-2 - Bottom View (DIN Mount Option)

Figure 2-3 - *Bottom View (Screw Mount Option)*
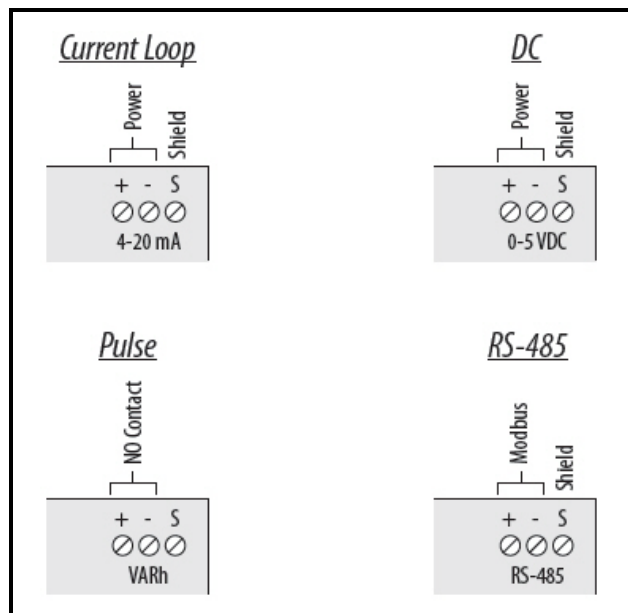
2.2.   Product Diagram

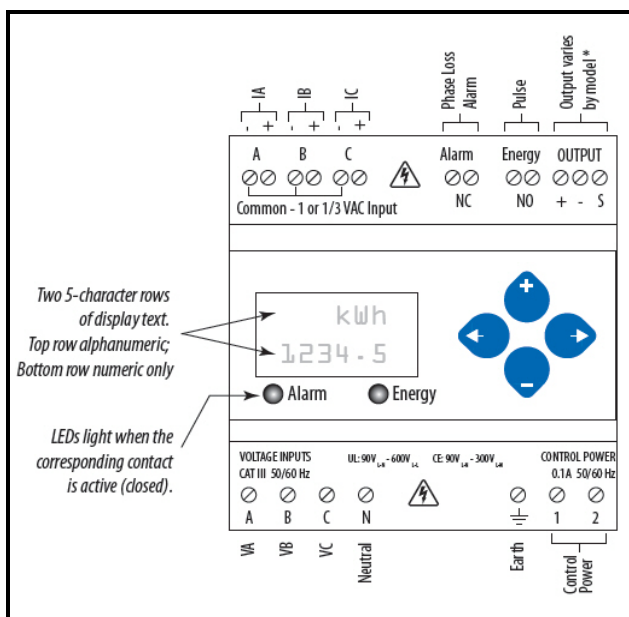*Figure 2-5* - *Four Output Options*

Figure 2-4 - *Energy Meter Interface*

3   Installation

> ⚠️ **WARNING!** *Disconnect power prior to instal-lation.*
>
> *Any covers that may be displaced during the installation must be reinstalled before powering the unit.*
>
> *Mount the Energy Meter in an appropriate electri-cal enclosure near equipment to be monitored.*
>
> *Exposure to VFD harmonics may cause permanent damage to this device.*

3.1.   Types of Mounting

The Energy Meter can be mounted in two ways: on standard 35 mm DIN rail or screw-mounted to the in-terior surface of the enclosure.

3.1.1.   DIN Rail Mounting

1. Attach mounting clips to the underside of the Ener-gy Meter by sliding them into the slots from the in-side. The outside edge of the clip must be flush with the outside edge of the Energy Meter.

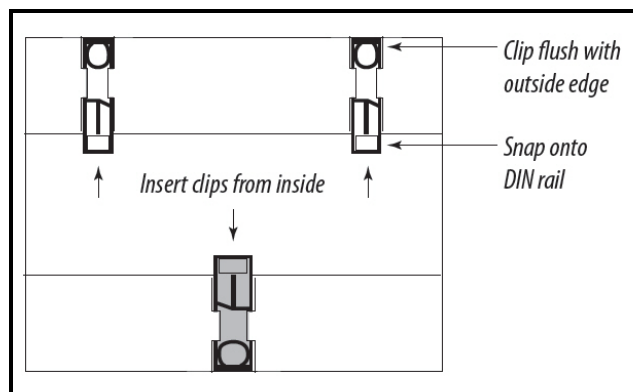2. Snap the clips onto the DIN rail. See diagram of the underside of the Energy Meter (below).

Figure 3-1 - DIN Rail Mounting

3. To prevent horizontal shifting across the DIN rail, use two AV02 end stop clips.

3.1.2.   Screw Mounting

1. Attach the mounting clips to the underside of the Energy Meter by sliding them into the slots from the outside. The screw hole must be exposed on the out-side of the housing.

2. Use three #8 screws (not supplied) to mount the En-ergy Meter to the inside of the enclosure. See dia-gram of the underside of the Energy Meter (below).
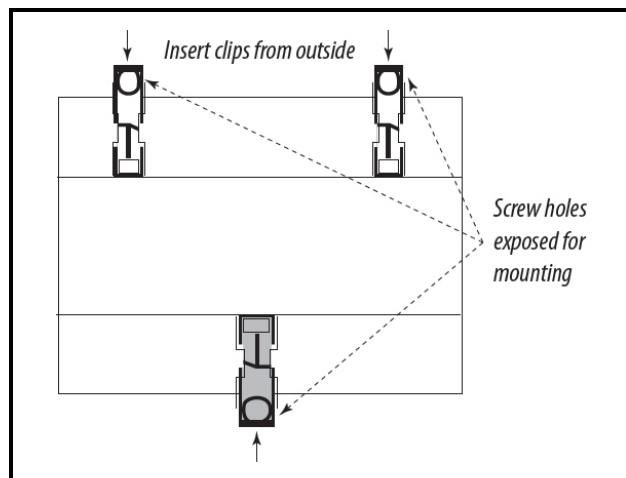

Figure 3-2 - Screw Mounting

3.2.   Supported System Types

The Energy Meter Series has a number of different possible system wiring configurations (see **Section 4, Wiring**). To configure the meter, set the System Type via the User Interface or Modbus register 130 (if so equipped). The System Type tells the meter which of its current and voltage inputs are valid, which are to be ignored, and if neutral is connected. Setting the correct System Type prevents unwanted energy accumulation on unused inputs, selects the formula to calculate the Theoretical Maximum System Power, and determines which phase loss algorithm is to be used. The phase loss algorithm is configured as a percent of the Line-to-Line System Voltage (except when in System Type 10) and also calculates the expected Line to Neutral voltages for system types that have Neutral (12 & 40).

Values that are not valid in a particular System Type will display as "----" on the User Interface or as QNAN in the Modbus registers.

	CTs		Voltage Connections			System Type		Phase Loss Measurements			Wiring Diagram
Number of wires	Qty	ID	Qty	ID	Type	Modbus Register 130	User Interface: SETUP>S SYS	VLL	VLN	Balance	Diagram number
Single-Phase Wiring											
2	1	A	2	A,N	L-N	10	1L+1n		AN		1
2	1	A	2	A,B	L-L	11	2L	AB			2
3	2	A,B	3	A,B,N	L-L with N	12	2L+1n	AB	AN,BN	AN-BN	3
Three-Phase Wiring											
3	3	A,B,C	3	A,B,C	Delta	31	3L	AB, BC, CA		AB-BC-CA	4
4	3	A,B,C	4	A,B,C,N	Grounded Wye	40	3L+1n	AB, BC, CA	AN, BN, CN	AN-BN-CN & AB-BC-CA	5, 6

Table 3-1 - *System Types*

4   Wiring

To avoid distortion, use parallel wires for control power and voltage inputs.

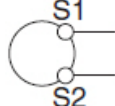The following symbols are used in the wiring diagrams on the following pages.
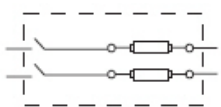
Symbol	Description
	Voltage Disconnect Switch
	Fuse (installer is responsible for ensuring compliance with local requirements. No fuses are included with the Energy Meter.)
	Earth ground
S1 / S2	Current Transducer
	Potential Transformer
	Protection containing a voltage disconnect switch with a fuse or disconnect circuit breaker. The protection device must be rated for the available short-circuit current at the connection point.

Table 4-1 -*Diagram Symbols*

⚠️ ***WARNING! This product is designed only for use with 1V or 0.33V current transformers (CTs).***

DO NOT USE CURRENT OUTPUT (e.g. 5A) CTs ON THIS PRODUCT.

Failure to follow these instructions can result in overheating and permanent equipment damage.
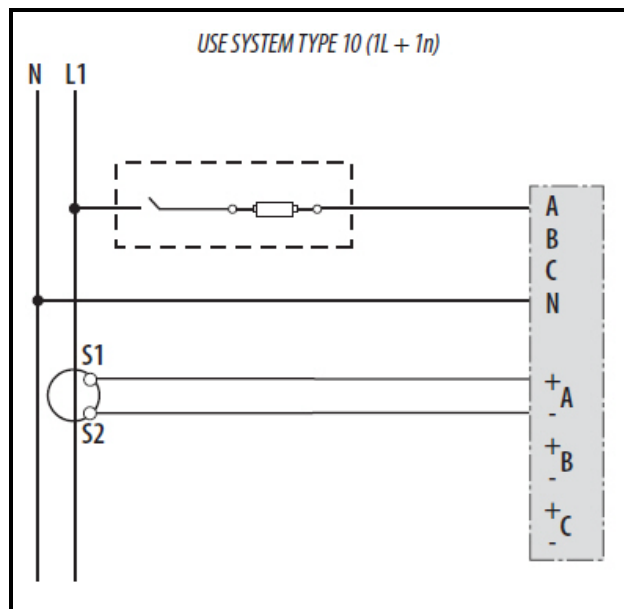
4.1.   Wiring Diagrams
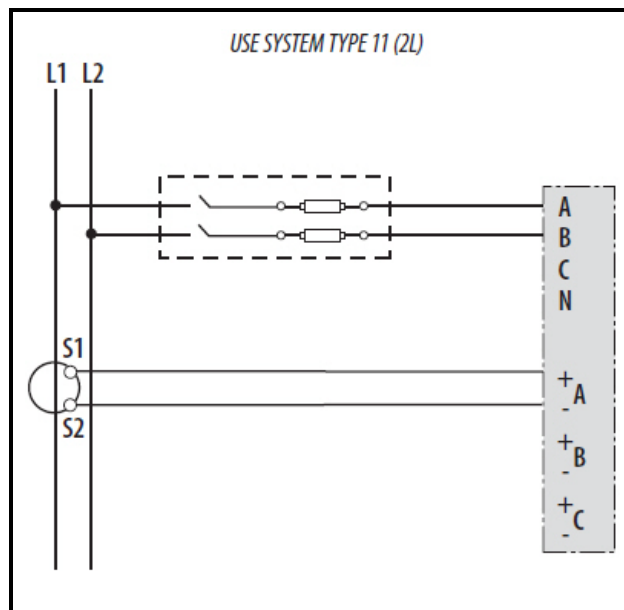

Figure 4-1 - *1-Phase Line-to-Neutral 2- Wire System 1 CT*

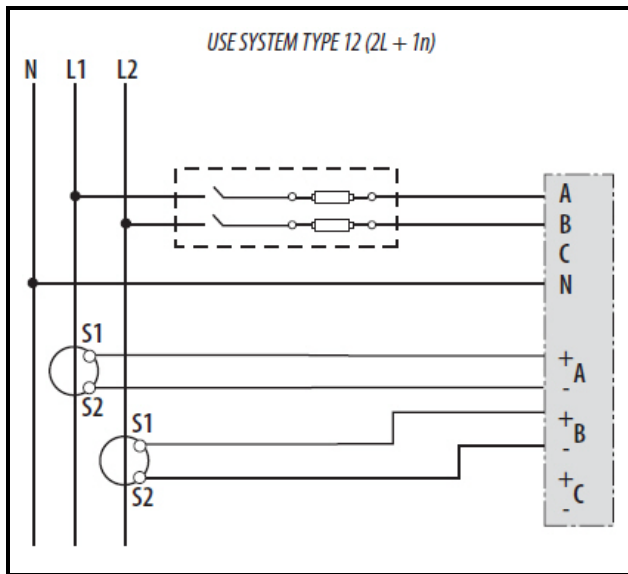*Figure 4-2* - *1-Phase Line-to-Line 2-Wire System 1 CT*

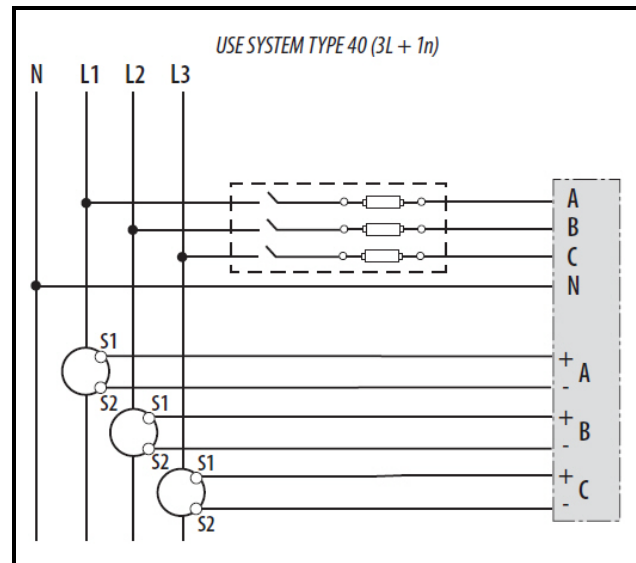**Figure 4-3** - *1-Phase Direct Voltage Connection 2 CT*

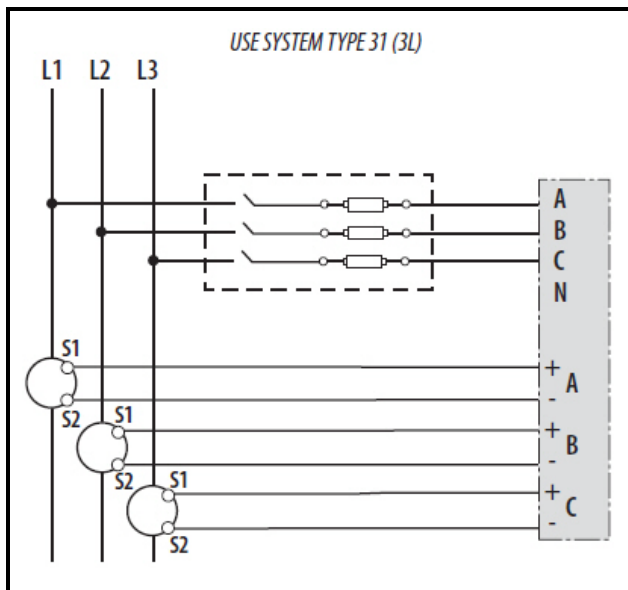**Figure 4-5** - *3-Phase 4-Wire Wye Direct Voltage Input Connection 3 CT*
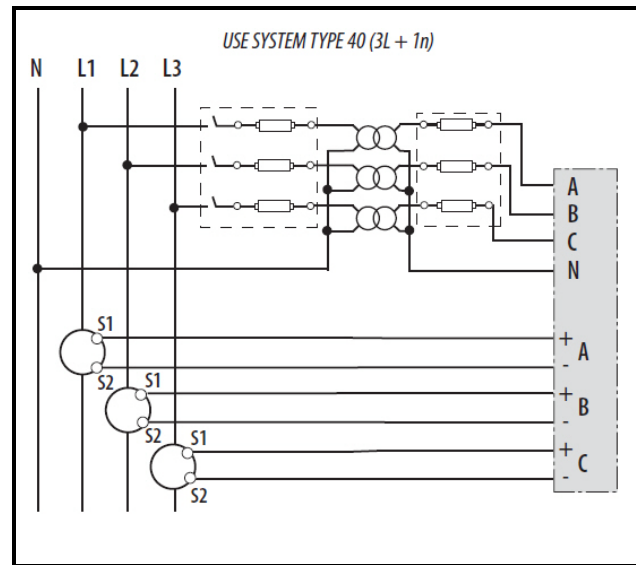

Figure 4-4 - *3-Phase 3-Wire 3 CT no PT*

Figure 4-6 - *3-Phase 4-Wire Wye Connection 3 CT 3 PT*

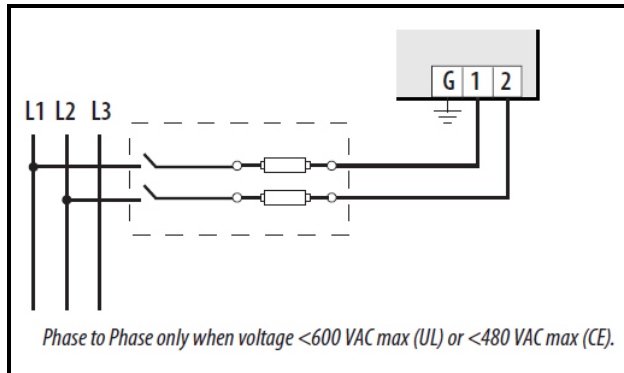> ⚠ **WARNING! CTs are referenced to the meter's neutral (N).**

4.2.   Control Power

Phase to Phase only when voltage <600 VAC max (UL) or <480 VAC max (CE).

Figure 4-7 - *Direct Connect Control Power (Phase to Phase)*

Phase to Neutral only when voltage <347 VAC max (UL) or <300+10% VAC max (CE).
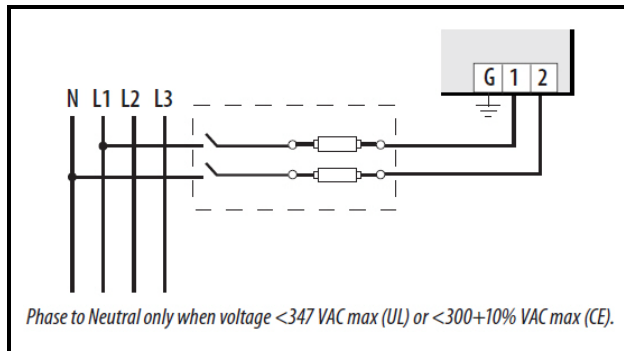
Figure 4-8 - *Direct Connect Control Power (Phase to Neutral)*

DC Control Power 100 VDC<V<300VDC (UL and CE)
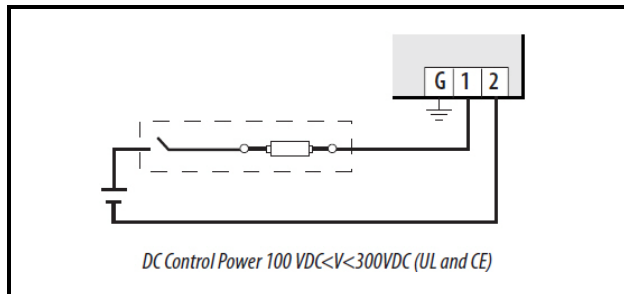
Figure 4-9 - *Control Power Transformer (CPT) Connection*

Control Power Transformer 120 or 240VAC. Secondary 50VA max.
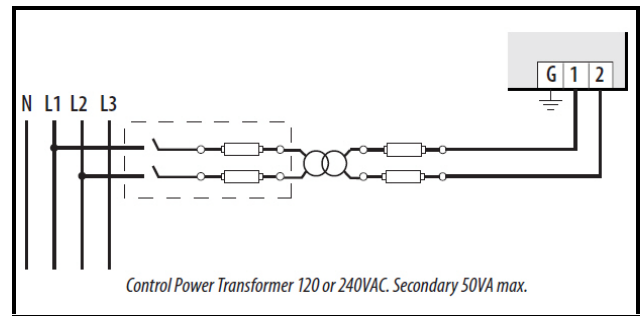
Figure 4-10 - *Control Power Transformer (CPT) Connection*

4.2.1.   Fuse Recommendations

Keep the fuses close to the power source (obey local and national code requirements).

For selecting fuses and circuit breakers, use the following criteria:

- Current interrupt capacity should be selected based on the installation category and fault current capability.
- Over-current protection should be selected with a time delay.
- The voltage rating should be sufficient for the input voltage applied.
- Provide overcurrent protection and disconnecting devices appropriate for the wiring.
- The earth connection is required for electromagnetic compatibility (EMC) and is not a protective earth ground.

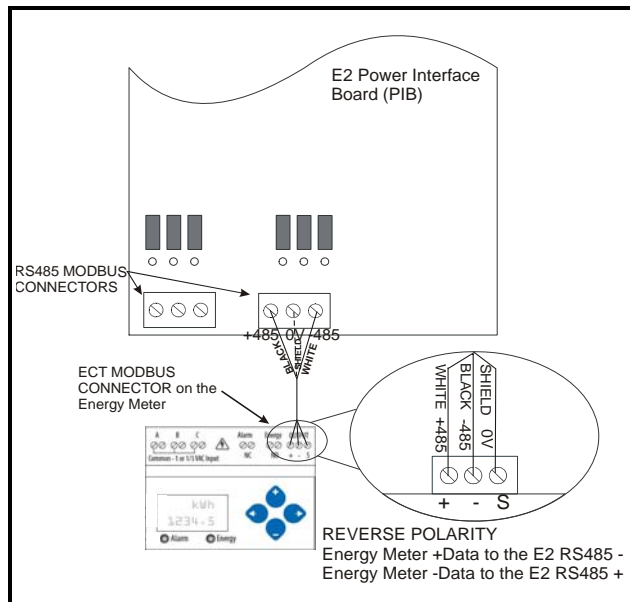## 4.3. Wiring Connection to E2

Figure 4-11 - *E2 MODBUS connection*

Connect the network cable to the three-terminal connector on the COM port that has been configured for the Energy Meter. The Energy Meter polarity markings are the inverse of E2; connect the Energy Meter +Data wire to the E2 RS485 - terminal and connect the Energy Meter -Data wire to the E2 RS485 + terminal. The shield cable should be connected to the right most terminal.

When the E2 is at one end of the daisy chain, terminate the E2 with all three jumpers in the terminated (UP) position.
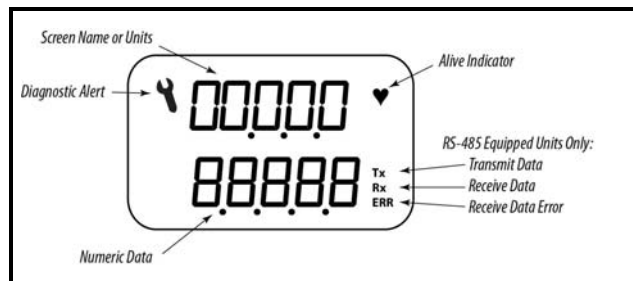
5 Display Screen Diagram

5.1. LCD Screen

Figure 5-1 - *Energy Meter Screen*
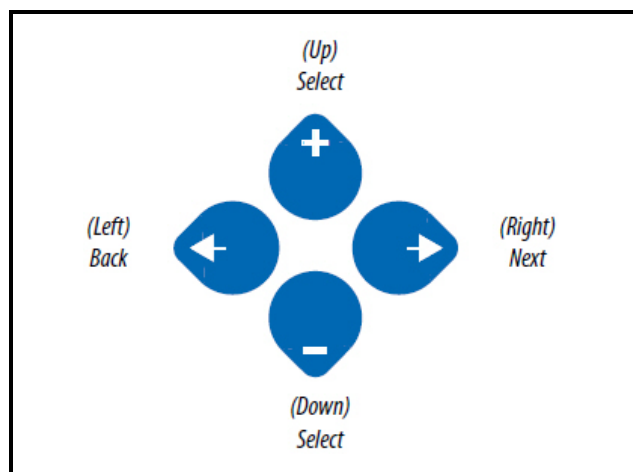
5.2. Buttons

Figure 5-2 - *Energy Meter Buttons*
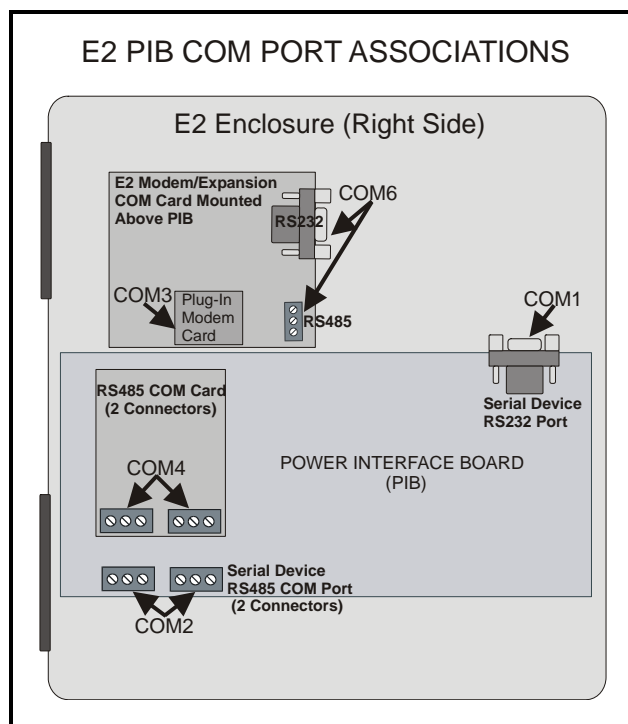
6 Network Setup and Commissioning

Figure 6-1 - Location of E2 COM Ports

Connecting an Energy Meter to an E2 requires the E2 to be version 3.0 or above. Contact Retail Solutions for upgrade information if the controller is a version before 3.0.

An E2 has up to three COM ports that can be assigned for MODBUS communication: COM2, an RS485 port on the E2 power interface board, and COM4 and COM6, which are optional ports requiring expansion cards.

COM ports can only be used for one function; in other words, if COM2 is set up as the I/O network, you cannot connect MODBUS devices to COM2. Ensure your E2 is equipped with an RS485 COM Card *(P/N 637-4890)* and configured in E2 General Services (Menu 7 3 1 , **Serial** tab) to enable COM4 or an E2 Expansion COM Card *(P/N 637-4871)* to enable COM6.

Connect the MODBUS network cable to the three-terminal connector on the COM port you wish to assign as MODBUS. Reverse polarity of +/- on RS485 cable from E2 to device.

6.1. Set Up Network Ports

Before communicating to an Energy Meter, the port on the E2 that has the cable connected to the Energy Meter must be configured to use the Energy Meter.

1. Log in to the E2 with Level 4 access.

2. Press Menu followed by 7 3 1 - **General Controller Info**.

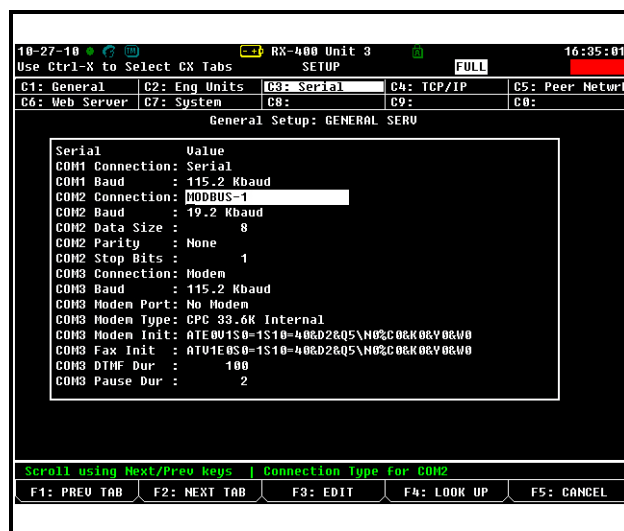3. Press Ctrl + 3 to open the **Serial** tab of the General Controller Info setup screens:

Figure 6-2 - Serial Communications Manager Screen

4. This screen will have a "Connection" field for all COM ports on the E2. Highlight the COM port connection field that will be used for MODBUS, and press F4 - **LOOK UP**. From the list of network types, select **MODBUS (1-3)**.

5. Four fields will become visible underneath the COM port connection field, which pertain to the way the device communicates:

6. **Baud -** Default setting is **19.2k**. The baud rate setting should be set to match the baud rate dip switch settings of all Energy Meter devices. (All devices connected to the same COM port should be set to the same baud rate.)

   • **Data Size -** Leave this field at the default value (**8**).

   • **Parity -** Leave this field at the default value (**None**). The parity settings should be set to match the parity dip switch settings of all Energy Meter devices. Refer to Table 2.

   • **Stop Bits -** Leave this field at the default value (**1**).

7. Press ⬛ to save changes and exit.

6.2. Adding an Energy Meter

To enable communications between E2 and the Energy Meter units, the devices must be added and addressed in E2.

1. Log in to the E2 with Level 4 access.

2. Press [Menu] [&7] [&7] [@2] - **Connected I/O Boards and Controllers**.
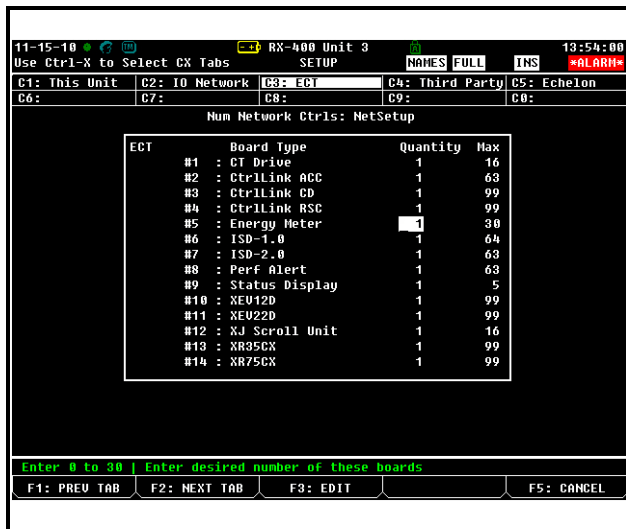

Figure 6-3 - Connected I/O Screen

3. In the Connected I/O screen, under the **ECT** tab, Enter the number of devices in the **Energy Meter** number field.

4. Press [⟲] to return to the Network Setup menu, then select [1] - **Network Summary**.

5. Locate the Energy Meter units you added to the network list (press [Page Up] and [Page Down] to scroll through the list). The default name for an Energy Meter increments up starting with **Energy001**. The two and three-letter designator does not apply here.
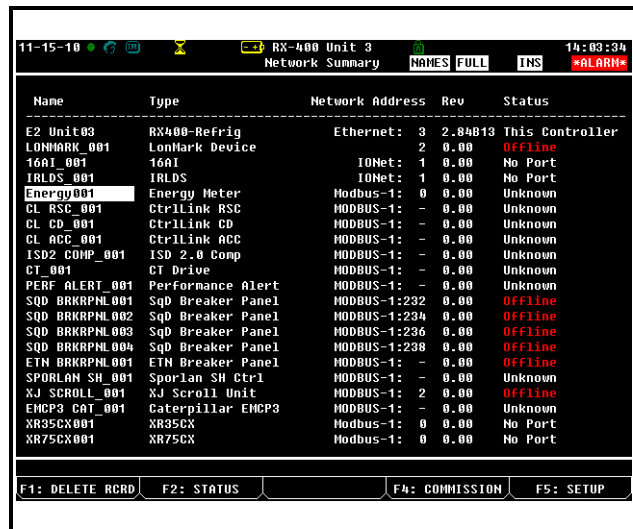

Figure 6-4 - Network Summary Screen

6. By default, each Energy Meter's board number in the network list is indicated by a **-** (dash). To set the address and begin communication, press [F4] to Commission. (If you have more than one MODBUS network, specify which network you want the device to belong to.) A screen will open that will allow you set the address:
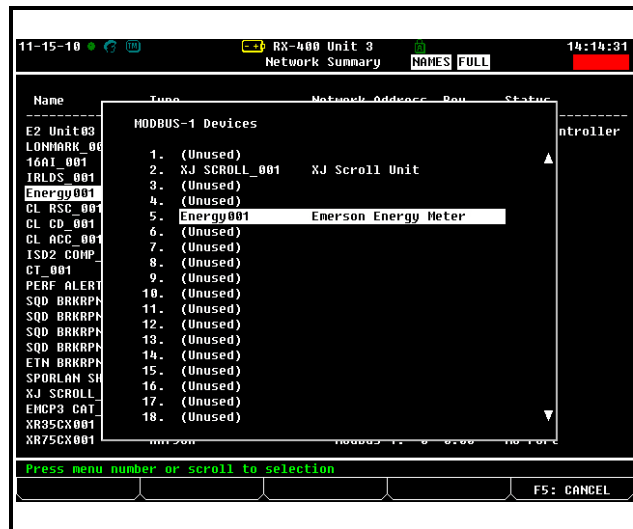
Figure 6-5 - Set the Address of the Energy Meter

7. In the list of MODBUS devices, choose the address number corresponding to the Energy Meter's dip switch/jumper setting, and press [Enter] to select it. If a network ID has already been selected, its name will be shown next to the network ID in this list. If the network ID you are trying to assign has already been used, you must set the network ID dip switch/jumper on this device to a different number that is
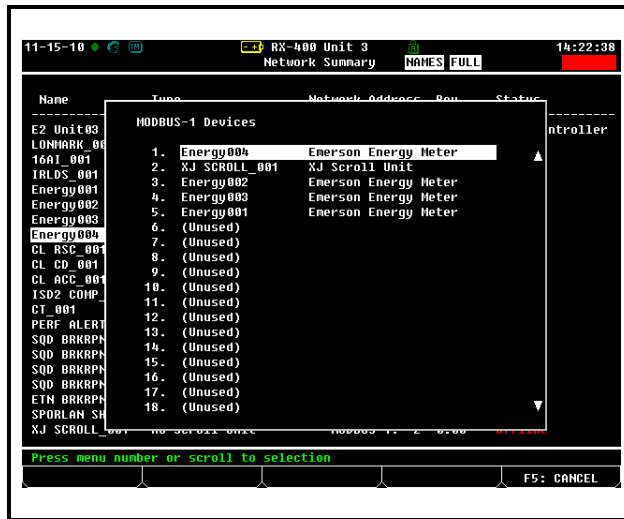
not being used.

Figure 6-6 - List of MODBUS Devices

8. Repeat *Steps 5* and *6* until each Energy Meter device has been commissioned.

9. When finished, press ⬇ to return to the Network Setup menu, then press 🔳 - **Network Summary** (*Figure 6-4*). Locate the Energy Meters you set up, and look at each device's status in the **Status** field. You will see one of the following messages:

• *Online* - The Energy Meter is communicating normally.

• *Offline* - The Energy Meter is not communicating, has not been commissioned, is not functional, or is not powered up. Verify the Energy Meter is powered up, wired correctly, and has the proper network address, baud rate, and parity.

• *Unknown* - The Energy Meter is not communicating or has not been commissioned. Verify the Energy Meter is powered up, wired correctly, and has the proper network address, baud rate, and parity.

• *No Port* - No port is set up in the E2 Serial Configuration Manager to be a MODBUS port.

• *Wrong FW Rev* - This message is likely caused by the Energy Meter having a firmware version older than the minimum revision required by E2 for communication. Replace the Energy Meter with a new

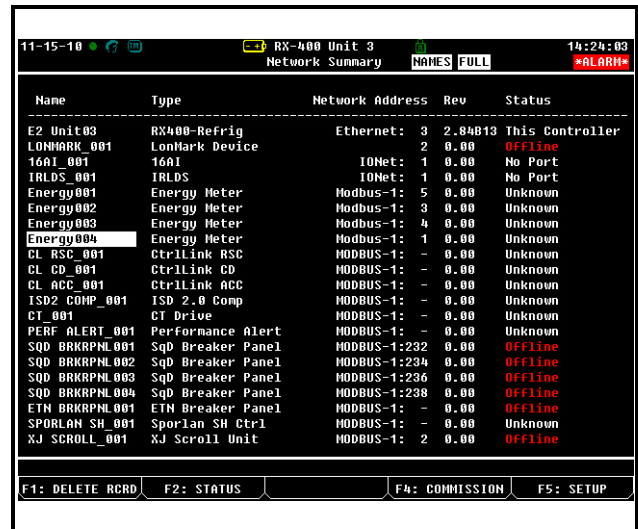controller that has the latest version of firmware.

Figure 6-7 - Network Summary Screen

6.3. RS-485 Communications

6.3.1. Daisy-chaining Devices to the Energy Meter

The RS-485 slave port allows the Energy Meter to be connected in a daisy chain with up to 63 two-wire devices. In this manual, communications link refers to a chain of devices that are connected by a communications cable.
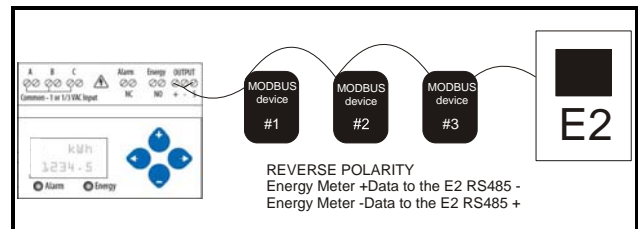
Figure 6-8 - Energy Meter Daisy Chain

NOTES:

• The Energy Meter polarity markings are the inverse of E2; connect the Energy Meter +Data wire to the E2 RS485 - terminal and connect the Energy Meter -Data wire to the E2 RS485 + terminal. The shield cable should be connected to the right most terminal.

• The terminal's voltage and current ratings are compliant with the requirements of the EIA RS-485 communications standard.

• The RS-485 transceivers are ¼ unit load or less.

• RS-485+ has a 47 kOhm pull up to +5V, and RS-485- has a 47 kOhm pull down to Shield (RS-485

signal ground).

- Wire the RS-485 bus as a daisy chain from device to device, without any stubs. Use a 150 ohm termination resistor at the end of the bus between the Energy Meter's + and **-** terminals (not included, or use Retail Solutions MODBUS termination block *P/N 535-2711*).

- Shield is not internally connected to Earth Ground.

- Connect Shield to Earth Ground somewhere on the RS-485 bus.

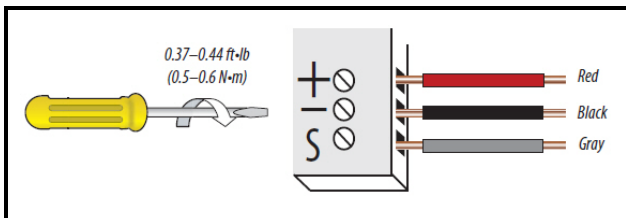- When tightening terminals, ensure that the correct torque is applied: 0.37-0.44 ft·lb (0.5-0.6 N·m).

Figure 6-9 *- Energy Meter Wiring*

7   Quick Setup Instructions

These instructions assume the meter is set to factory defaults. If it has been previously configured, all optional values should be checked.

1. Press the ⊕ or ⊖ button repeatedly until SETUP screen appears.

2. ▶ to the PASWD screen.

3. ▶ through the digits. Use the ⊕ or ⊖ buttons to select the password (the default is 00000). Exit the screen to the right.

4. Use the ⊕ or ⊖ buttons to select the parameter to configure (⊖ works best).

5. If the unit has an RS-485 interface, the first Setup screen is S COM (set communications).

   a. ▶ to the ADDR screen and through the address digits. Use the ⊕ or ⊖ buttons to select the Modbus address.

   b. ▶ to the BAUD screen. Use the ⊕ or ⊖ buttons to select the baud rate.

   c. ▶ to the PAR screen. Use the ⊕ or ⊖ buttons to select the parity.

   d. ▶ back to the S COM screen.

6. ⊖ to the S CT (Set Current Transducer) screen. If this unit does not have an RS-485 port, this will be the first screen.

   a. ▶ to the CT V screen. Use the ⊕ or ⊖ buttons to select the voltage mode Current Transducer output voltage.

   b. ▶ to the CT SZ screen and through the digits. Use the ⊕ or ⊖ buttons to select the CT size in amps.

   c. ▶ back to the S CT screen.

7. ⊖ to the S SYS (Set System) screen.

   a. ▶ to the SYSTM screen. Use the ⊕ or ⊖ buttons to select the System Type (see wiring diagrams).

   b. ▶ back to the S SYS screen.

8. (Optional) ⊖ to the S PT (Set Potential Transformer) screen. If PTs are not used, then skip this step.

   a. ▶ to the RATIO screen and through the digits. Use the ⊕ or ⊖ buttons to select the Potential

Transformer step down ratio.

   b. ▶ back to the S PT screen.

9. ⊖ to the S V (Set System Voltage) screen.

   a. ▶ to the VLL (or VLN if system is 1L-1n) screen and through the digits. Use the ⊕ or ⊖ buttons to select the Line to Line System Voltage.

   b. ▶ back to the S V screen.

10. Use the ◀ to exit the setup screen and then SETUP.

11. Check that the wrench is not displayed on the LCD.

   a. If the wrench is displayed, use the ⊕ or ⊖ buttons to find the ALERT screen.

   b. ▶ through the screens to see which alert is on.

For full setup instructions, see the configuration instructions in **Section 10,** *User Interface for Data Configuration*, **Section 11,** *Alert/Reset Information*, and **Section 12,** *User Interface for Setup*.

8   Solid-State Pulse Output

The Energy Meter has one normally open (NO) KZ Form A output and one normally closed (NC) KY solid-state output. One is dedicated to energy (Wh), and the other to Alarm. The Energy Meter also provides an additional NO reactive energy (VARh) contact. See the Setup section for configuration information.
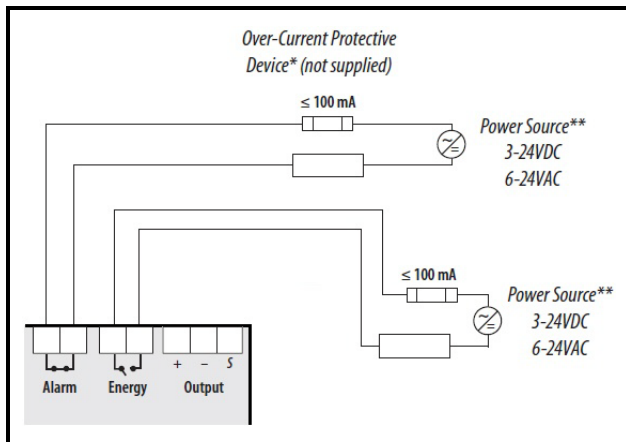
Figure 8-1 - Solid-State Pulse Output

The solid state pulse outputs are rated for 24VAC/DC max.

Maximum load current is 100mA at 25°C. Derate 0.56mA per °C above 25°C.

* The over-current protective device must be rated for the short circuit current at the connection point.

** All pulse outputs and communication circuits are only intended to be connected to nonhazardous voltage circuits (SELV or Class 2). Do not connect to hazardous voltages.

8.1.   Set Pulse

The System Type, CT size, PT Ratio and System Voltage must all be configured before setting the Pulse Energy. If any of these parameters are changed, the meter will hunt for a new Pulse Duration, but will not change the Pulse Energy. If it cannot find a solution, the meter will display the wrench icon, show

"ConF" in the ALARM -> PULSE screen, and enable Energy pulse output configuration error bit in the Modbus Diagnostic Alert Bitmap (if equipped).

Figure 8-2 - Setting Pulse Energy

8.2.   Set Pulse Energy – Wh/P

In Watt Hour (and VAR Hours, if present) per pulse. When moving down to a smaller energy, the meter will not allow the selection if it cannot find a pulse duration that will allow the pulse output to keep up with Theoretical Maximum System Power. When moving up to a larger energy, the meter will jump to the first value where it can find a valid solution.

8.3.   Minimum Duration Time – Milliseconds per Pulse (mS/P)

This read-only value is set by the meter to the slowest duration (in mS per closure) that will keep up with the Theoretical Maximum System Power. The open time is greater than or equal to the closure time. The maximum Pulses Per Second (PPS) is shown in yellow.

8.4.   MultiFlex I/O Board Pulse Limits - Standalone Version Only

The MultiFlex board can read pulses at a maximum of 5HZ or 5PPS. The Energy Meter is capable of pulsing faster than the 5PPS maximum that the MultiFlex board can read.

Pulses should be greater than 80mS in length at a maximum rate of 5HZ: Do not exceed 5PPS.

For Example:

- Values of 100, 250, or 500 will be read by the MultiFlex board.
- Values of 50, 25, or 10 will not be read by the MultiFlex board.

9   UI Menu Abbreviations

Main Menu		
IEC	IEEE	Description
D	D	Demand
MAX	M	Maximum Demand
P	W	Present Real Power
Q	VAR	Present Reactive Power
S	VA	Present Apparent Power
A	A	Amps
UAB, UBC, UAC	VAB, VBC, VAC	Voltage Line to Line
V	VLN	Voltage Line to Neutral
PF	PF	Power Factor
U	VLL	Voltage Line to Line
HZ	HZ	Frequency
KSh	KVAh	Accumulated Apparent Energy
KQh	KVARh	Accumulated Reactive Energy
KPh	KWh	Accumulated Real Energy
PLOSS	PLOSS	Phase Loss
LOWPF	LOWPF	Low Power Factor Error
F ERR	F ERR	Frequency Error
I OVR	I OVR	Over Current
V OVR	V OVR	Over Voltage
PULSE	PULSE	kWh Pulse Output Overrun (configuration error)
_PHASE	_PHASE	Summary Data for 1, 2, or 3 active phases
ALERT	ALERT	Diagnostic Alert Status
INFO	INFO	Unit Information
MODEL	MODEL	Model Number
OS	OS	Operating System
RS	RS	Reset System
SN	SN	Serial Number
RESET	RESET	Reset Data
PASWD	PASWD	Enter Reset or Setup Password
ENERG	ENERG	Reset Energy Accumulators
DEMND	DEMND	Reset Demand Maximums

Table 9-1 - UI Abbreviations

10   User Interface for Data Configuration

11   Alert/Reset Information

PASWD – Enter the Reset Password (configured in the setup menu).
ENERG – Reset all Energy Accumulators (Wh, VARh, VAh) to 0. Hit "+" or "-" to Reset.
DEMND – Reset all Maximum Demand (W, VAR, VA) to the present Demand. Hit "+" or "-" to Reset.
COUNT – Reset the pulse counters. Hit "+" or "-" to Reset.

12   User Interface for Setup

RS-485
Output

From:
SETUP > PASWD

Back To SETUP

Back ◄ **S COM**

ADDR

0**0**1

BAUD

38400
19200
9600
4800
2400
1200

PAR
----
nOnE
EvEn
Odd

Next

Set Communications Parameters:
ADDR - Modbus Address: 1 – 247.
   + increments the selected (blinking) digit.
   - selects the digit to the left.
BAUD - Baud Rate: 1200 – 38400 Baud
PAR - Parity: Odd, Even, None
   + or **−** to step through the options.

Back ◄ **S CT**
Current
Transformer

CT V

1.0
.33

CT SZ

100

Next

Set Current Transducer:
CT V - CT Input Voltage: **+** or **−** to Select 1.0 or .33V.
CT SZ - CT Size: in Amps. Maximum is 32000 Amps.

Back ◄ **S SYS**
System
Type

SYSTM

3L-1n
3L
2L-1n
2L
1L-1n

Next

Set System Configuration:
SYSTM: **+** or **−** to step through the following System Type options:

System	Reg 130	CTs	Description
3L-1n	40	3	Wye Three Phase: A, B, & C with Neutral (Default).
3L	31	3	Delta Three Phase: A, B & C; no Neutral
2L-1n	12	2	Single Split Phase: A & B with Neutral
2L	11	1	Single Phase: A & B; no Neutral
1L-1n	10	1	Single Phase: A to Neutral

Back ◄ **S PT**
Potential
Transformer

RATIO

00**1**.00

Next

Set Potential Transfomer Ratio:
RATIO – Potential transformer step down is RATIO:1. Default is 1:1
(No PT installed). See Install for wiring diagrams. This value must be
set before the System Voltage (if used).

Back ◄ **S V**
Sytem
Voltage

V LL

00600

Next

Set System Voltage:
V LL – The nominal Line to Line Voltage for the system. This is used
by the meter to calculate the theoretical maximum system power, and
as the reference voltage for setting the Phase Loss threshold.
Maximum is 32000 Volts. For system type 1+N (10), this is a Line to
Neutral Voltage, indicated by "V LN". Note: the meter will reject settings
that are not within the meter's operating range when divided by the PT
ratio.

Back ◄ **S PWR**
Sytem
Voltage

MX KW

103.92

Next

System Power:
MX KW – The theoretical Maximum System Power is calculated by the
meter from the System Voltage, CT size, and System Type. Power
Factor is assumed to be unity. The value of System Power is used to
determine which combinations of pulse weight and duration are valid
and will keep up with the maximum power the meter will see. This value
is read only.

Note: **Bold** is the Default.

To Setup p. 1 "S PWR"

Set Phase Loss:
VOLTS - Phase Loss Voltage: The fraction of the system voltage below which Phase Loss Alarm is on. For system types with neutral, the Line to Neutral voltage is also calculated and tested. If the System Voltage is 600 and the fraction is set to 0.10, then the Phase Loss threshold will be 60 volts.
IMBAL - Phase Loss Imbalance: The fractional difference in Line to Line voltages above which Phase Loss Alarm is on. For system types with neutral, the Line to Neutral voltages are also tested. For system types 1+N (10) and 2 (11) , imbalance is not tested.

```
         VOLTS          IMBAL
         --------       --------
Back ─ SPLOS            0.10            0.25
         Phase                          Next
         Loss
```

Set Pulse:
The System Type , CT size, PT Ratio, and System Voltage must all be configured before setting the Pulse Energy. If any of these parameters are changed, the meter will hunt for a new Pulse Duration, but will not change the Pulse Energy. If it cannot find a solution, the meter will display the wrench, show "ConF" in the ALARM -> PULSE screen, and enable Energy pulse output configuration error bit in the Modbus Diagnostic Alert Bitmap (if equipped).
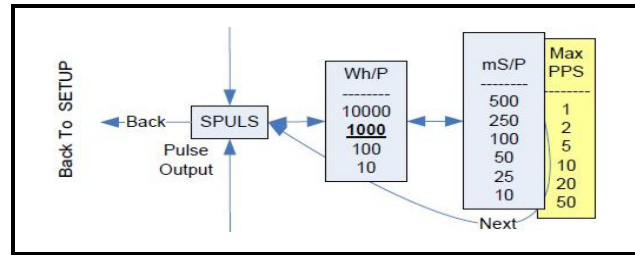**Wh/P - Set Pulse Energy:** In Watt Hours (& VAR Hours, if present) per Pulse. When moving down to a smaller energy, the meter will not allow the selection if it cannot find a pulse duration that will allow the pulse output to keep up with Theoretical Maximum System Power (see S_PWR screen). When moving up to a larger energy, the meter will jump to the first value where it can find a valid solution.
mS/P – Minimum Pulse Duration Time: This read only value is set by the meter to the slowest duration (in mS per closure) that will keep up with the Theoretical Maximum System Power. The open time is greater than or equal to the closure time. The maximum Pulses Per Second (PPS) is shown in yellow.

```
Back To SETUP

         Wh/P           mS/P    Max
         --------       -----   PPS
Back ─ SPULS   10000      500    1
         Pulse           1000    250    2
         Output          100     100    5
                         10      50     10
                                 25     20
                                 10     50
                         Next
```

Set Demand Interval:
INTRV - The number of Sub-Intervals (1 to 6) in a Demand Interval. Default is 1 (block demand).
SEC - Sub-Interval length in seconds. Default is 900 (15 minutes).   Set to 0 for external sync-to-comms (Modbus units only).

```
         INTRV
         --------
           6         SEC
           5         --------
Back ─ SDMND   4        00900
         Demand        3
           2         Next
           1
```

Set Display Units: **+/-** to switch between:
   IEEE – VLL VLN W VAR VA Units.
   IEC - U   V   P   Q   S Units.

```
         UNITS
         --------
Back ─ S DIS   IEEE
         Display       IEC
         Units        Next
```

Set Passwords:
SETUP - The Password to enter the SETUP menu.
RESET - The Password to enter the RESET menu.

```
         SETUP          RESET
         --------       --------
Back ─ SPASS   00000     00000
         Setup         Next
         Passwords
```

To Setup page 1 "S COM"

13 Energy Meter Standard MODBUS Default Settings

Setting	Value	Modbus Register
Setup Password	00000	–
Reset Password	00000	–
System Type	40 (3 + N) Wye	130
CT Primary Ratio (if CTs are not included)	100A	131
CT Secondary Ratio	1V	132
PT Ratio	1:1 (none)	133
System Voltage	600 V LL	134
Max. Theoretical Power (Analog Output: full scale (20mA or 5V))	104 kW	135
Display Mode	1 (IEEE)	137
Phase Loss	10% of System Voltage (60V), 25% Phase to Phase Imbalance	142, 143
Pulse Energy	1kWh/pulse	144
Demand: number of sub-intervals per interval	1 (block mode)	149
Demand: sub-interval length	900 sec (15 min)	150
Modbus Address	001	–
Modbus Baud Rate	19200 baud	–
Modbus Parity	None	–
Log Read Page	0	158
Logging Configuration Register	0	159
Log Register Pointer 1	1 (Real Energy MSR)	169
Log Register Pointer 2	2 (Real Energy LSR)	170
Log Register Pointer 3	29 (Reactive Energy MSR)	171
Log Register Pointer 4	30 (Reactive Energy LSR)	172
Log Register Pointer 5	37 (Real Demand)	173
Log Register Pointer 6	38 (Reactive Demand)	174
Log Register Pointer 7	39 (Apparent Demand)	175

Table 13-1 -*MODBUS Default Settings*

Setting	Value	Modbus Register
Log Register Pointer 8	155 (Month/Day)	176
Log Register Pointer 9	156 (Year/Hour)	177
Log Register Pointer 10	157 (Minutes/Seconds)	178

Table 13-1 -*MODBUS Default Settings*

14   Troubleshooting

Problem	Cause	Solution
The maintenance wrench icon appears in the Energy Meter display.	There is a problem with the inputs to the Energy Meter.	See the Alert sub-menu or the Diagnostic Alert Modbus Register 146
The display is blank after applying control power to the meter.	The meter is not receiving adequate power.	Verify that the meter control power is receiving the required voltage. Verify that the heart icon is blinking. Check the fuse.
The data displayed is inaccurate.	Incorrect setup values	Verify the values entered for Energy Meter setup parameters (CT and PT ratings, system type, etc.). See the *Quick Setup Instructions* section.
	Incorrect voltage inputs	Check Energy Meter voltage input terminals to verify adequate voltage.
	Energy Meter is wired improperly.	Check all CTs and PTs to verify correct connection to the same service, PT polarity, and adequate powering. See the *Wiring* section for more information.
Cannot communicate with Energy Meter from a remote personal computer.	Energy Meter address is incorrect.	Verify that the meter is correctly addressed. See the *User Interface for Setup* section.
	Energy Meter baud rate is incorrect.	Verify that the baud rate of the meter matches that of all other devices on its communications link. See the *Quick Setup Instructions* section.
	Communications lines are improperly connected.	Verify the Energy Meter communications connections (see *Network Setup and Commissioning*). Verify the terminating resistors are properly installed on both ends of a chain of units. Units in the middle of a chain should not have a terminator. Verify the shield ground is connected between all units.

Table 14-1 - Troubleshooting

15   Appendix of Compatible Current Transducers

Split Core Current Transducers		
Part Number	**Inside Diameter**	**Amperage**
251-7010	0.75"	100 AMP
251-7020	1.25"	200 AMP
251-7021	0.75"	200 AMP
251-7030	1.25"	300 AMP
251-7040	2.00"	400 AMP
251-7080	2.00"	800 AMP
251-7120	2.00"	1200 AMP
251-1000	0.75"	5 AMP
251-1001	0.75"	15 AMP
251-1002	0.75"	30 AMP
251-1003	0.75"	50 AMP
251-1004	1.25"	70 AMP
251-1005	1.25"	100 AMP
251-1006	1.25"	150 AMP
251-1007	1.25"	250 AMP
251-1008	1.25"	300 AMP
251-1009	1.25"	400 AMP
Solid Core Current Transducers		
Part Number	**Inside Diameter**	**Amperage**
251-1020	0.30"	5 AMP
251-1021	0.50"	15 AMP
251-1022	0.50"	30 AMP
251-1023	0.75"	50 AMP
251-1024	0.75"	70 AMP
251-1025	1.00"	50 AMP
251-1026	1.00"	70 AMP
251-1027	1.00"	100 AMP
251-1028	1.00"	150 AMP
251-1029	1.00"	200 AMP
251-1030	1.25"	70 AMP
251-1031	1.25"	100 AMP
251-1032	1.25"	200 AMP
251-1033	1.25"	250 AMP
251-1034	1.25"	300 AMP

Table 15-1 - *Compatible Transducers*