EM3502, EM3550
Compact Power and Energy Meter
Installation Guide

ZL0092-0A

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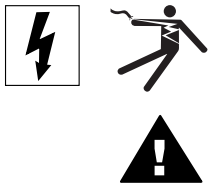
Schneider Electric

HAZARD CATEGORIES AND SPECIAL SYMBOLS

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, can result in death or serious injury.

⚠ CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, can result in minor or moderate injury.

CAUTION

CAUTION, used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, can result in property damage.

NOTE: Provides additional information to clarify or simplify a procedure.

PLEASE NOTE

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

FCC NOTICE

This equipment has been tested 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 is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

This Class B digital apparatus complies with Canadian ICES-003.

CONTENTS

SAFETY PRECAUTIONS

⚠ DANGER

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.
- Always use a properly rated voltage sensing device to confirm power is off.
- DO NOT DEPEND ON THIS PRODUCT FOR VOLTAGE INDICATION.
- Only install this product on insulated conductors.
- Install device in an appropriate electrical and fire enclosure per local regulations.
- ESD sensitive equipment. Ground yourself and discharge any static charge before handling this device.
- Any covers that may be displaced during the installation must be reinstalled before powering the unit.
- Do not install on the load side of a Variable Frequency Drive (VFD), aka Variable Speed Drive (VSD) or Adjustable Frequency Drive (AFD).

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

INSTALLATION OVERVIEW

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

A. DIN Rail Mounting

1. Disconnect and lock out power. Use a properly rated voltage sensing device to confirm power is off.
2. Attach mounting clips to the underside of the housing by sliding them into the slots from the inside. The stopping pegs must face the housing, and the outside edge of the clip must be flush with the outside edge of the housing.
3. Snap the clips onto the DIN rail.
4. To prevent horizontal shifting across the DIN rail, use two end stop clips.

B. Screw Mounting

1. Disconnect and lock out power. Use a properly rated voltage sensing device to confirm power is off.
2. Attach the mounting clips to the underside of the housing by sliding them into the slots from the outside. The stopping pegs must face the housing, and the screw hole must be exposed on the outside of the housing.
3. Use three #8 screws (not supplied) to mount the meter to the inside of the enclosure.

NOTE: For detailed instructions, please see the “Installation” section later in this guide.

SPECIFICATIONS

Table 1 Specifications

Type	Description
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 90 V_{L-N} to 600 VAC_{L-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 90 V_{L-N} (156 V_{L-L}) for stated accuracy; UL Maximums: 600 V_{L-L} (347 V_{L-N}); CE Maximums: 300 V_{L-N} (520 V_{L-L})
Metering Over-Range	+20%
Impedance	2.5 $M\Omega_{L-N}$ /5 $M\Omega_{L-L}$
Frequency Range	45 to 65 Hz
Input Current Characteristics	
CT Scaling	Primary: Adjustable from 5 A to 32,000 A
Measurement Input Range	0 to 0.333 VAC or 0 to 1.0 VAC (+20% over-range)
Impedance	10.6 kΩ (1/3 V mode) or 32.1 kΩ (1 V mode)
Control Power	
AC	5 VA max.; 90 V min.; UL Maximums: 600 V_{L-L} (347 V_{L-N}); CE Maximums: 300 V_{L-N} (520 V_{L-L})
DC*	3 W max.; UL and CE: 125 to 300 VDC
Ride Through Time	100 msec at 120 VAC
Output	
Alarm Contacts (all models)	N.C., static output; (30 VAC/DC, 100 mA max. @ 25°C, derate 0.56 mA per °C above 25°C)
Real Energy Pulse Contacts (all models) and Reactive Energy Pulse Contacts (EM3502 only)	N.O., static output; (30 VAC/DC, 100 mA max. @ 25°C, derate 0.56 mA per °C above 25°C)
RS-485 Port (EM3550)	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	3.5 in-lb (0.4 N·m) nominal/4.4 in-lb (0.5 N·m) max.
Terminal Block Wire Size	14 to 24 AWG
Rail	T35 (35mm) DIN Rail per EN50022

Type	Description
Environmental Conditions	
Operating Temperature	-30° to 70°C (-22° to 158°F)
Storage Temperature	-40° to 85°C (-40° 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-N} /600 VAC_{L-L}
CE	CAT III; for distribution systems up to 300 V_{L-N}/480 VAC_{L-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

* External DC current limiting is required, see fuse recommendations.

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. Consideration must be given to the enclosure, the correct use of ventilation, thermal properties of the equipment and the relationship with the environment.

Provide a disconnect device to disconnect the 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 disconecting 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.

CE c UL us N998

INTRODUCTION

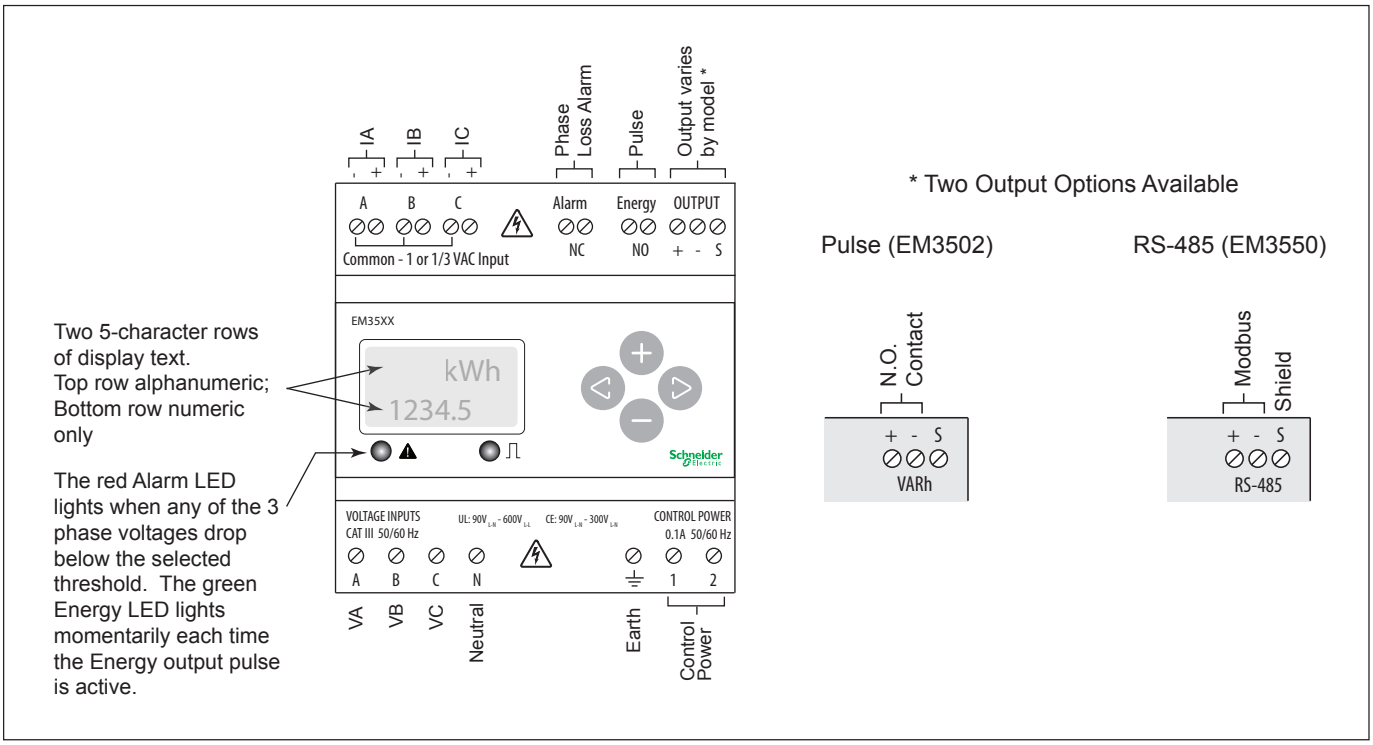
The EM3502 and EM3550 DIN Rail Power Meters provide a solution for measuring energy data with a single device. Inputs include Control Power, CT, and 3-phase voltage. The EM3502 model includes a pulse output, while the EM3550 model offers both pulse output and Modbus communication. The LCD screen on the faceplate allows instant output viewing.

The meter is housed in a plastic enclosure suitable for installation on T35 DIN rail according to EN50022. The EM Series 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.

Parts of the EM Series

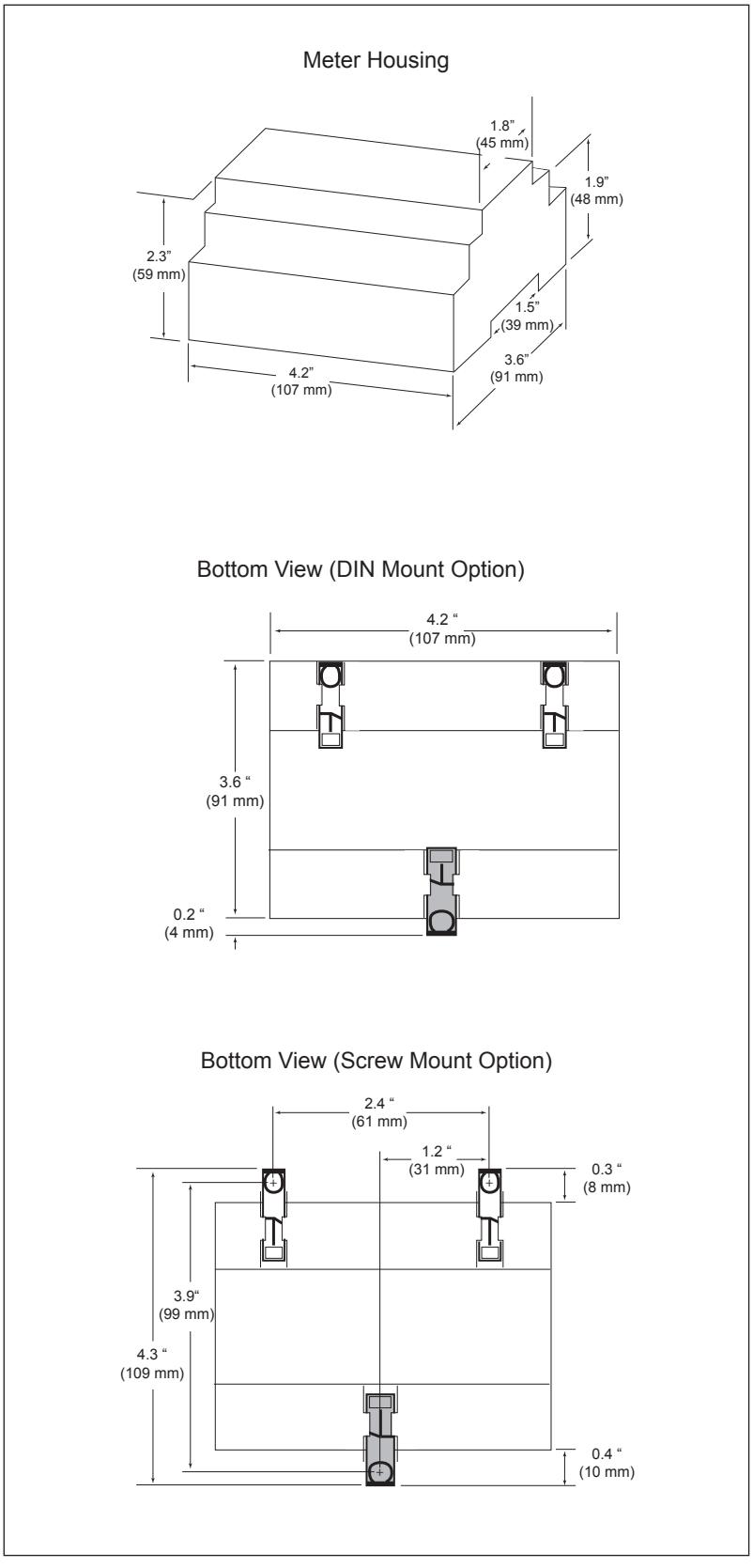
Figure 1 shows the parts of the EM Series Compact Power and Energy Meter.

Figure 1 EM Series Meter



DIMENSIONS

Figure 2 EM Series Dimensions



DATA OUTPUT

Table 2 Data Output

Full Data Set (FDS):
Power (kW)
Energy (kWh)
Configurable for CT & PT ratios, system type, and passwords
Diagnostic alerts
Current: 3-phase average
Volts: 3-phase average
Current: by phase
Volts: by phase line-line and line-neutral
Power: real, reactive, and apparent 3-phase total and per phase
Power Factor: 3-phase average and per phase
Frequency
Power Demand: most recent and peak
Demand Configuration: fixed, rolling block, and external sync (Modbus only)

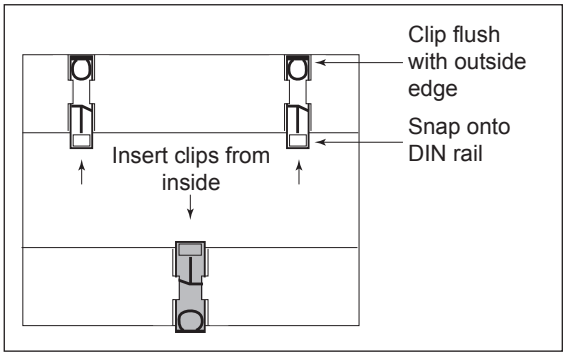
INSTALLATION

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

A. DIN Rail Mounting

1. Disconnect and lock out power. Use a properly rated voltage sensing device to confirm power is off.
2. Attach mounting clips to the underside of the housing by sliding them into the slots from the inside. The stopping pegs must face the housing, and the outside edge of the clip must be flush with the outside edge of the housing.
3. Snap the clips onto the DIN rail. See diagram of the underside of the housing (Figure 3).

Figure 3 Attach mounting clips for DIN rail

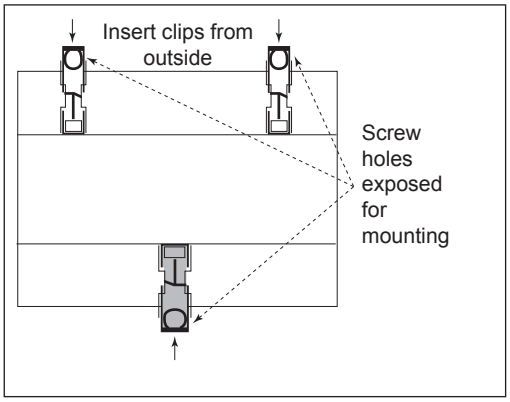


4. To prevent horizontal shifting across the DIN rail, use two end stop clips.

B. Screw Mounting

1. Disconnect and lock out power. Use a properly rated voltage sensing device to confirm power is off.
2. Attach the mounting clips to the underside of the housing by sliding them into the slots from the outside. The stopping pegs must face the housing, and the screw hole must be exposed on the outside of the housing.
3. Use three #8 screws (not supplied) to mount the meter to the inside of the enclosure. See diagram of the underside of the housing (Figure 4).

Figure 4 Attach clips for screw mounting



SUPPORTED SYSTEM TYPES

The meter has a number of different possible system wiring configurations (see Wiring Diagrams). 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.

Table 3 Supported system types

	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

WIRING

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

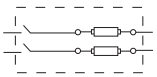
- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E in the USA or applicable local codes.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying equipment before working on or inside the equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Read, understand, and follow the instructions before installing this product.

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

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.

Table 5 Wiring Symbols

Symbol	Description
	Voltage Disconnect Switch
	Fuse (installer is responsible for ensuring compliance with local requirements. No fuses are included with the meter.)
	Earth ground
	Current Transducer
	Potential Transformer
	Protection device 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.

CAUTION

RISK OF EQUIPMENT DAMAGE

- This product is designed only for use with 1V or 0.33V current transducers (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.

WIRING DIAGRAMS

⚠ WARNING

RISK OF ELECTRIC SHOCK

CT negative terminals are referenced to the meter's neutral and may be at elevated voltages
- Do not contact meter terminals while the unit is connected
- Do not connect or short other circuits to the CT terminals

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

Diagram 1: 1-Phase Line-to-Neutral 2- Wire System 1 CT

Use System Type 10 (1L + 1n)

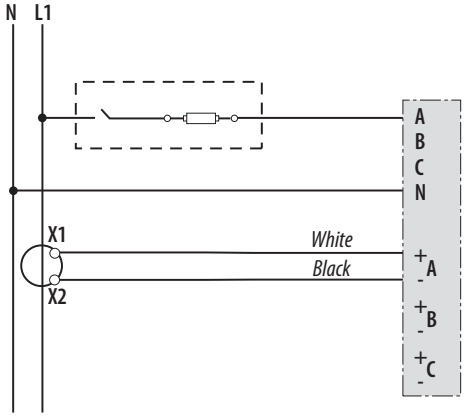


Diagram 2: 1-Phase Line-to-Line 2-Wire System 1 CT

Use System Type 11 (2L)

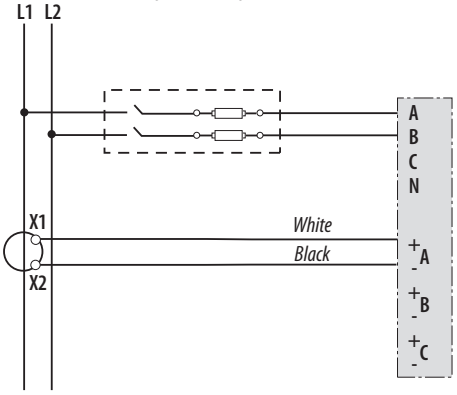


Diagram 3: 1-Phase Direct Voltage Connection 2 CT

Use System Type 12 (2L + 1n)

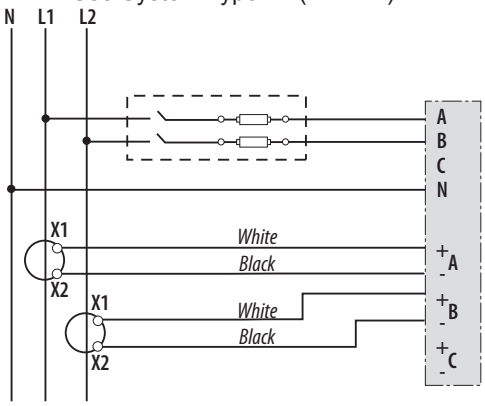


Diagram 4: 3-Phase 3-Wire 3 CT no PT

Use System Type 31 (3L)

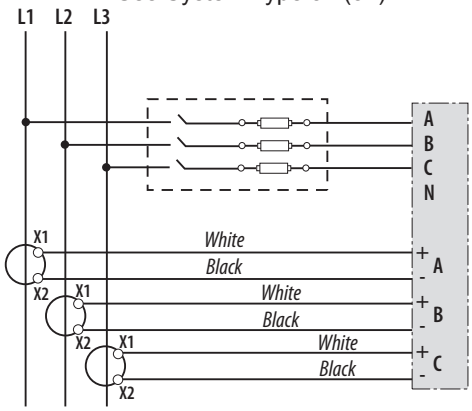


Diagram 5: 3-Phase 4-Wire Wye Direct Voltage Input Connection 3 CT

Use System Type 40 (3L + 1n)

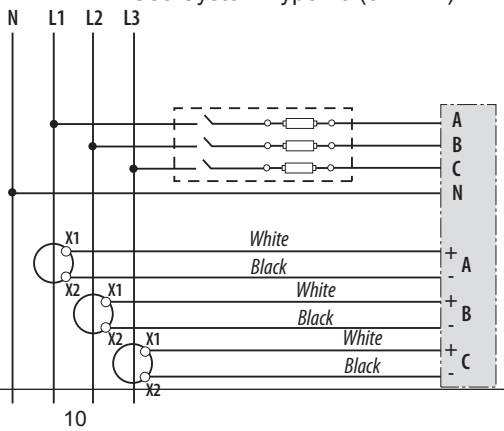
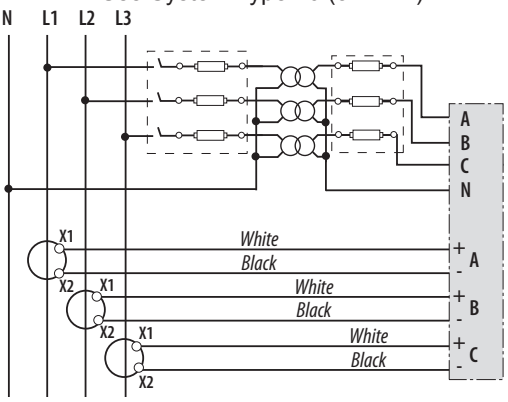


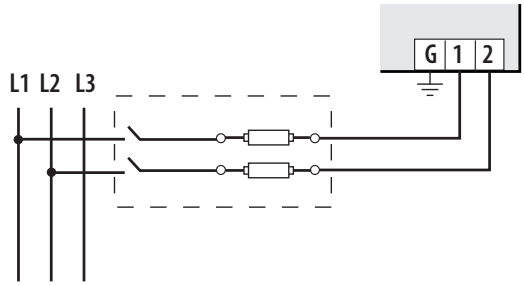
Diagram 6: 3-Phase 4-Wire Wye Connection 3 CT 3 PT

Use System Type 40 (3L + 1n)



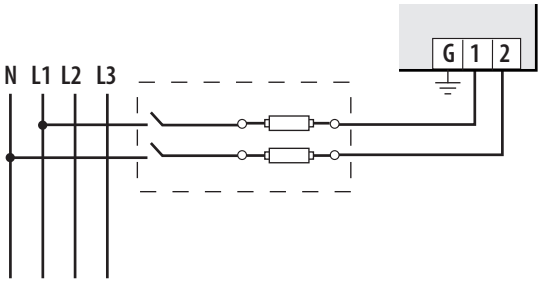
CONTROL POWER

Direct Connect Control Power (Line to Line)



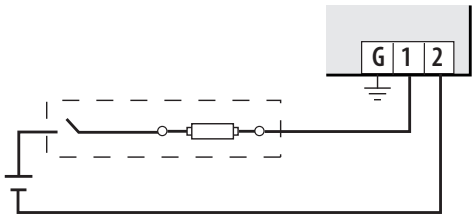
Line to Line from 90 VAC to 600 VAC (UL) (520VAC for CE). In UL installations the lines may be floating (such as a delta). If any lines are tied to an earth (such as a corner grounded delta), see the Line to Neutral installation limits. In CE compliant installations, the lines must be neutral (earth) referenced at less than 300 VAC_{L-N}

Direct Connect Control Power (Line to Neutral)



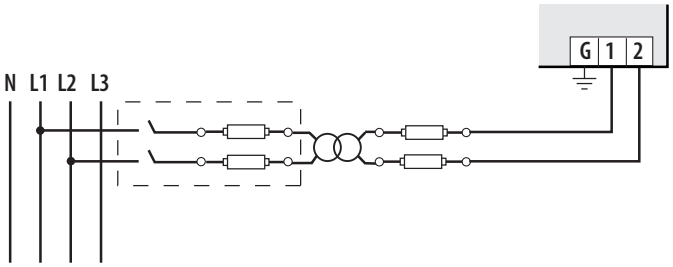
Line to Neutral from 90 VAC to 347 VAC (UL) or 300 VAC (CE)

Direct Connect Control Power (DC Control Power)



DC Control Power from 125 VDC to 300 VDC (UL and CE max.)

Control Power Transformer (CPT) Connection



The Control Power Transformer may be wired L-N or L-L. Output to meet meter input requirements

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:

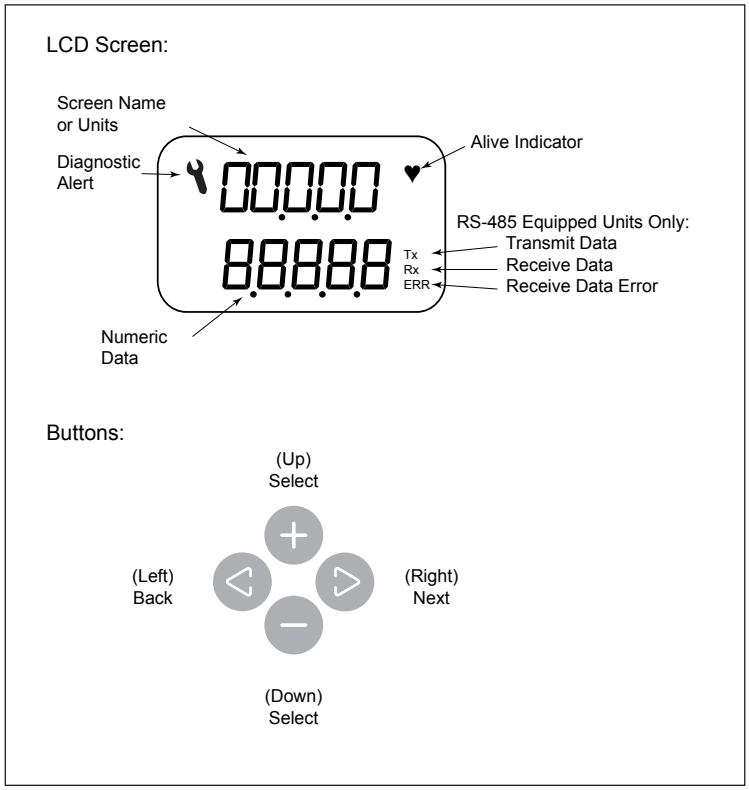
- Select current interrupt capacity based on the installation category and fault current capability.
- Select over-current protection with a time delay.
- The voltage rating should be sufficient for the input voltage applied.
- Provide overcurrent protection and disconnecting means to protect the wiring. For DC installations, external circuit protection must be provided. Suggested: 0.5 A, time delay fuses.
- The earth connection is required for electromagnetic compatibility (EMC) and is not a protective earth ground.

WIRING NOTES

- Use 14-24 gauge wire for all connections.
- When tightening terminals, ensure that the correct torque is applied: 3.5 - 4.4 in·lb (0.4-0.5 N·m).

DISPLAY SCREEN DIAGRAM

Figure 5 Display Screen



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.

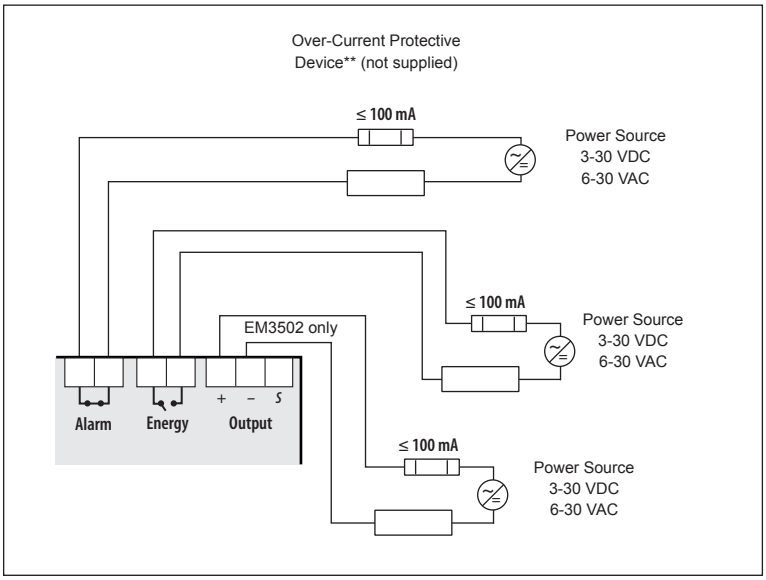
1. Press the ⊕ or ⊖ button repeatedly until SETUP screen appears.
2. Press ⊳ to the PASWD screen.
3. Press ⊳ through the digits. Press ⊕ or ⊖ to select the password (the default is 00000). Exit the screen to the right.
4. Press ⊕ or ⊖ to select the parameter to configure.
5. If the unit has an RS-485 interface, the first Setup screen is S COM (set communications).
   a. Press ⊳ to the ADDR screen and through the address digits. Press ⊕ or ⊖ to select the Modbus address.
   b. Press ⊳ to the BAUD screen. Press ⊕ or ⊖ to select the baud rate.
   c. Press ⊳ to the PAR screen. Press ⊕ or ⊖ to select the parity.
   d. Press ⊳ back to the S COM screen.
6. Press ⊖ 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. Press ⊳ to the CT V screen. Press ⊕ or ⊖ to select the voltage mode Current Transducer output voltage (default is 0.33).
   b. Press ⊳ to the CT SZ screen and through the digits. Use the ⊕ or ⊖ buttons to select the CT size in amps.
   c. Press ⊳ back to the S CT screen.
7. Press ⊖ to the S SYS (Set System) screen.
   a. Press ⊳ to the SYSTM screen. Press ⊕ or ⊖ to select the System Type (see wiring diagrams).
   b. Press ⊳ back to the S SYS screen.
8. (Optional) Press ⊖ to the S PT (Set Potential Transformer) screen. If PTs are not used, then skip this step.
   a. Press ⊳ to the RATIO screen and through the digits. Press ⊕ or ⊖ to select the Potential Transformer step down ratio.
   b. Press ⊳ back to the S PT screen.
9. Press ⊖ to the S V (Set System Voltage) screen.
   a. Press ⊳ to the VLL (or VLN if system is 1L-1n) screen and through the digits. Press ⊕ or ⊖ to select the Line to Line System Voltage.
   b. Press ⊳ back to the S V screen.
10. Press ⊲ 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, press ⊕ or ⊖ to find the ALERT screen.
    b. Press ⊳ through the screens to see which alert is on.

For full setup instructions, see the configuration instructions on the following pages.

SOLID-STATE PULSE OUTPUT

The EM3502 and EM3550 have one normally open (N.O.) KY Form A output and one normally closed (N.C.) solid-state output.* One is dedicated to energy (Wh), and the other to Alarm. The EM3502 also provides an additional (N.O.) reactive energy (VARh) contact. See the Setup section for configuration information.

Figure 6 Solid State Pulse Outputs



The solid state pulse outputs are rated for 30 VAC/DC nom.

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

* While the relay used for the Phase Loss contact is Normally Closed (contacts are closed when the meter is not powered), closure indicates the presence of an alarm; either loss of phase, when the meter is powered, or loss of power when the meter is not. The contacts are open when the meter is powered and no phase loss alarm conditions are present.

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

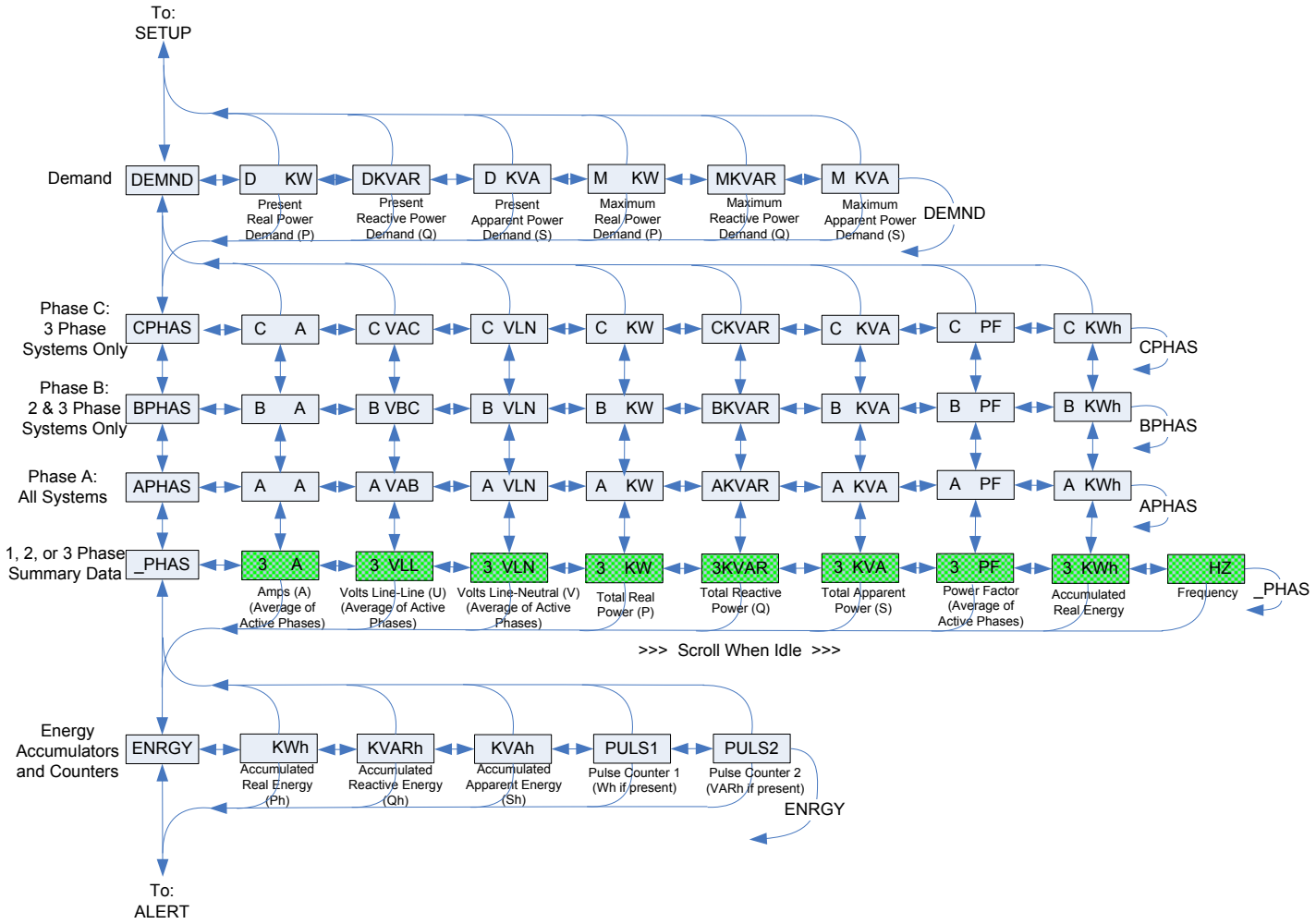
UI MENU ABBREVIATIONS DEFINED

The user can set the display mode to IEC or IEEE notation in the SETUP menu.

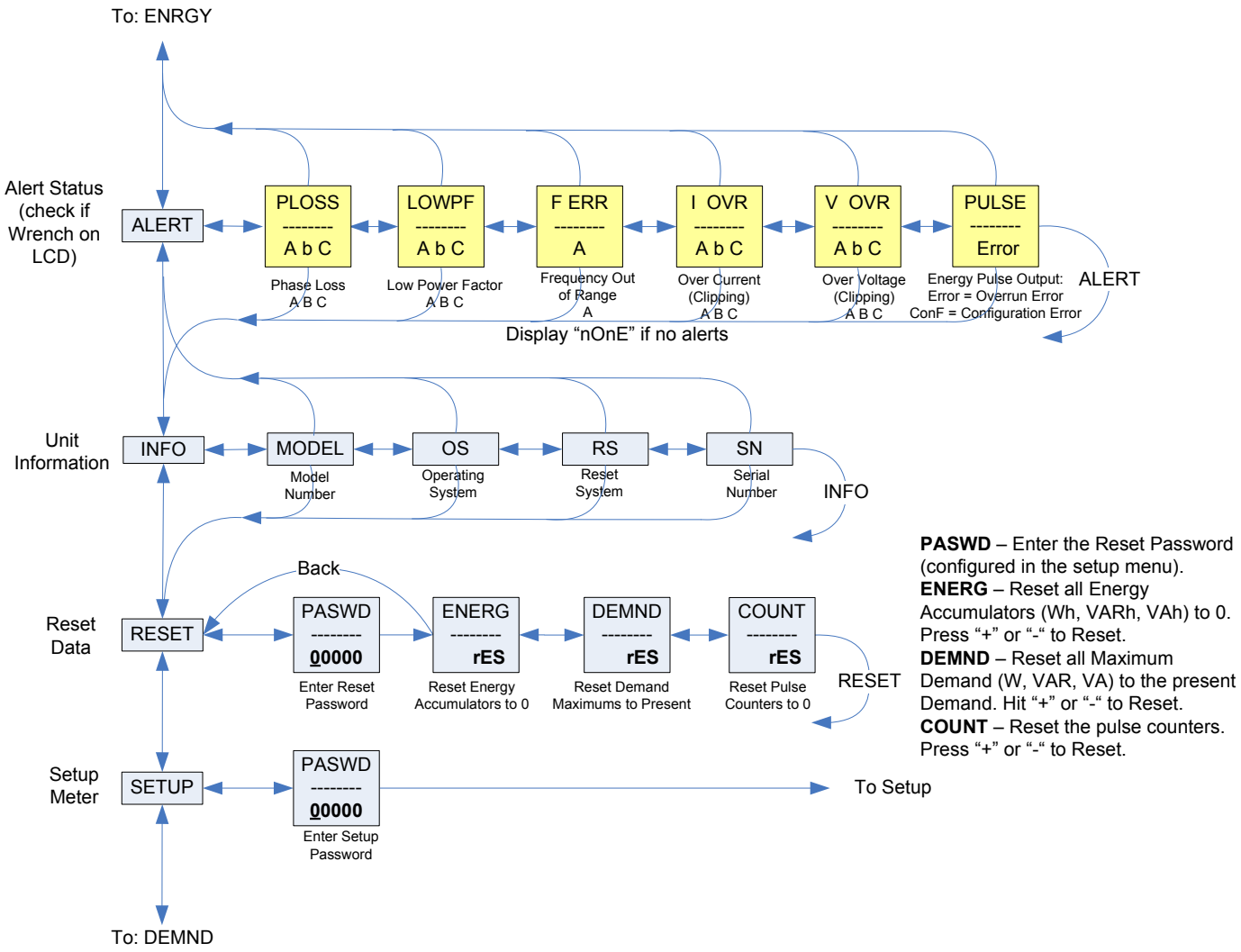
Table 6 IEC and IEEE Abbreviations

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

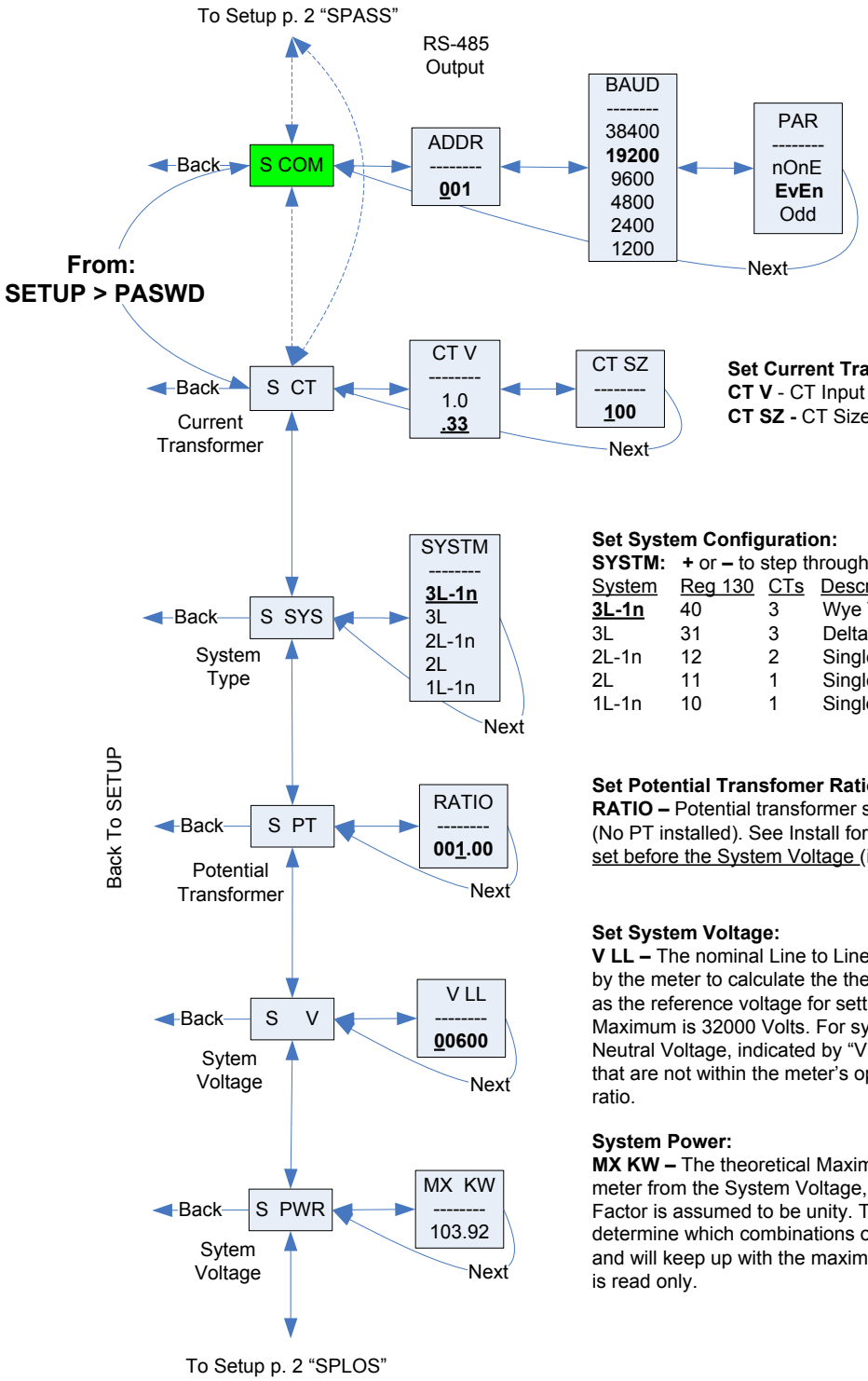
USER INTERFACE FOR DATA CONFIGURATION



ALERT/RESET INFORMATION



USER INTERFACE FOR SETUP



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

Set Current Transducer:
CT V - CT Input Voltage: + or **–** to Select 1.0 or 0.33V.
CT SZ - CT Size: in Amps. Maximum is 32000 Amps.

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

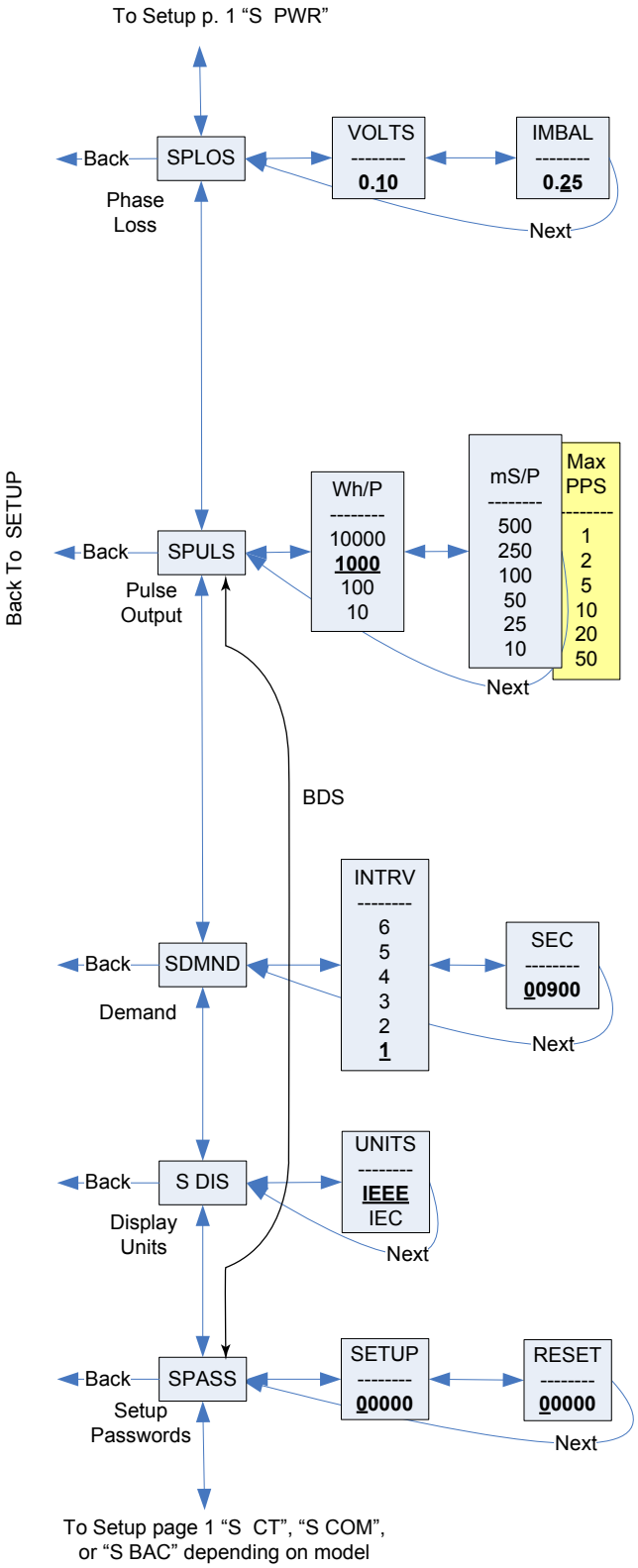
System	Reg 130	CTs	Description
3L-1n	40	3	Wye Three Phase: A, B, & C with Neutral (Default).
3L	31	3	Delta Three Phase: A, B & C; no Neutral
2L-1n	12	2	Single Split Phase: A & B with Neutral
2L	11	1	Single Phase: A & B; no Neutral
1L-1n	10	1	Single Phase: A to Neutral

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).

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.

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.



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.

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 the 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.

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).

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

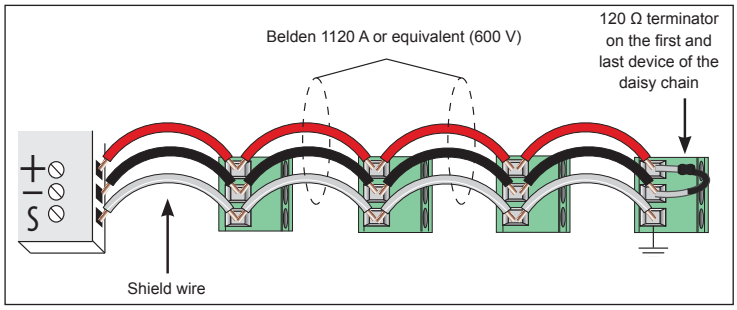
Set Passwords:
SETUP - The Password to enter the SETUP menu.
RESET - The Password to enter the RESET menu.

RS-485 COMMUNICATIONS (EM3550 ONLY)

Daisy-chaining Devices to the Power Meter

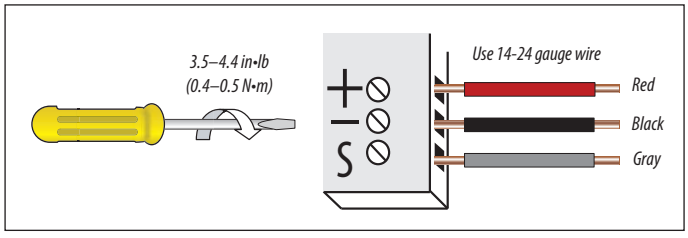
The RS-485 slave port allows the power meter to be connected in a daisy chain with up to 63 2-wire devices.

Figure 7 Daisy-chaining multiple devices



- 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 kΩ pull up to +5V, and RS-485- has a 47 kΩ 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 120 Ω termination resistors at each end of the bus (not included).
- Shield is not internally connected to Earth Ground.
- Connect Shield to Earth Ground somewhere on the RS-485 bus.
- Use 14-24 gauge wire for all connections.
- When tightening terminals, ensure that the correct torque is applied: 3.5 - 4.4 in·lb (0.4-0.5 N·m).

Figure 8 Torque requirements



STANDARD MODBUS DEFAULT SETTINGS

Table 7 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)	100 A	131
CT Secondary Ratio	0.33 V	132
PT Ratio	1:1 (none)	133
System Voltage	600 V L-L	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	1 (kWh/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	Even	–

MODBUS POINT MAP (EM3550 ONLY)

The EM3550 Full Data Set (FDS) features data outputs such as demand calculations, per phase VA and VAR, and VAh VARh accumulators. For security reasons, configuration and resets on all EM35xx models are protected by a user configurable passcode. The meter supports variable CTs and PTs, allowing a much wider range of operation from 90V x 5A up to 32000V x 32000A. To promote this, the meter permits variable scaling of the 16-bit integer registers via the scale registers. The 32-bit floating point registers do not need to be scaled.

Integer registers begin at 001 (0x001), floating point registers begin at 257 (0x101), and configuration registers begin at 129 (0x081). Values not supported in a particular System Type configuration report QNAN (0x8000 in Integer Registers, 0x7FC00000 in Floating Point Registers).

Supported Modbus Commands

NOTE: ID String information varies from model to model. Text shown here is an example.

Table 8 Supported Modbus Commands

Command	Description
0x03	Read Holding Registers
0x04	Read Input Registers
0x06	Preset Single Register
0x10	Preset Multiple Registers
0x11	Report ID
	Return string: byte0: address byte1: 0x11 byte2: #bytes following w/out crc byte3: ID byte = 247 byte4: status = 0xFF if the operating system is used; status = 0x00 if the reset system is used bytes5+: ID string = “Schneider Electric EM3550 Power Meter Full Data Set” or “Schneider Electric EM3550 Power Meter - RESET SYSTEM RUNNING RS Version x.xxx” last 2 bytes: CRC
0x2B	Read Device Identification, BASIC implementation (0x00, 0x01 and 0x02 data), Conformity Level 1.
	Object values: 0x01: “Schneider Electric EM” 0x02: “ 3550” 0x03: “Vxx.yyy”, where xx.yyy is the OS version number (reformatted version of the Modbus register #7001, (Firmware Version, Operating System). If register #7001 == 12345, then the 0x03 data would be “V12.345”).

Legend

The following table lists the addresses assigned to each data point. For floating point format variables, each data point appears twice because two 16-bit addresses are required to hold a 32-bit float value.

Table 9 Point Map Legend

R/W	R=read only; R/W=read from either int or float formats, write only to integer format.	
NV	Value is stored in non-volatile memory. The value will still be available if the meter experiences a power loss and reset.	
Format	UInt	Unsigned 16-bit integer.
	SInt	Signed 16-bit integer.
	ULong	Unsigned 32-bit integer; Upper 16-bits (MSR) in lowest-numbered / first listed register (001/002 = MSR/LSR).
	Float	32-bit floating point; Upper 16-bits (MSR) in lowest-numbered / first listed register (257/258 = MSR/LSR). Encoding is per IEEE standard 754 single precision.
Units	Lists the physical units that a register holds.	
Scale Factor	Some Integer values must be multiplied by a constant scale factor (typically a fraction), to be read correctly. This is done to allow integer numbers to represent fractional numbers.	
Range	Defines the limit of the values that a register can contain.	

Table 10 Modbus Point Map Registers

REGISTER	R/W	NV	Format	Units	Scale	Range	Description	
001	R	NV	ULong	kWh	E	0-0xFFFF	Real Energy Consumption (MSR)	Clear via reset register
002						0-0xFFFF	Real Energy Consumption (LSR)	
003	R		UInt	kW	W	0-32767	Total Instantaneous Real Power (3 Phase Total)	
004	R		UInt	kVAR	W	0-32767	Total Instantaneous Reactive Power (3 Phase Total)	
005	R		UInt	kVA	W	0-32767	Total Instantaneous Apparent Power (3 Phase Total)	
006	R		UInt	Ratio	0.0001	0-10000	Total Power Factor (Total KW / Total KVA)	
007	R		UInt	Volt	V	0-32767	Voltage, L-L, Average of 3 Phases	
008	R		UInt	Volt	V	0-32767	Voltage, L-N, Average of 3 Phases	
009	R		UInt	Amp	I	0-32767	Current, Average of 3 Phases	
010	R		UInt	kW	W	0-32767	Real Power, Phase A	
011	R		UInt	kW	W	0-32767	Real Power, Phase B	
012	R		UInt	kW	W	0-32767	Real Power, Phase C	
013	R		UInt	Ratio	0.0001	0-10000	Power Factor, Phase A	
014	R		UInt	Ratio	0.0001	0-10000	Power Factor, Phase B	
015	R		UInt	Ratio	0.0001	0-10000	Power Factor, Phase C	
016	R		UInt	Volt	V	0-32767	Voltage, Phase A-B	
017	R		UInt	Volt	V	0-32767	Voltage, Phase B-C	
018	R		UInt	Volt	V	0-32767	Voltage, Phase A-C	
019	R		UInt	Volt	V	0-32767	Voltage, Phase A-N	
020	R		UInt	Volt	V	0-32767	Voltage, Phase B-N	
021	R		UInt	Volt	V	0-32767	Voltage, Phase C-N	
022	R		UInt	Amp	I	0-32767	Current, Instantaneous, Phase A	
023	R		UInt	Amp	I	0-32767	Current, Instantaneous, Phase B	
024	R		UInt	Amp	I	0-32767	Current, Instantaneous, Phase C	
025	R		UInt				Reserved; returns 0x8000 (QNAN)	
026	R		UInt	Hz	0.01	4500-6500	Frequency (derived from Phase A)	
027	R	NV	ULong	KVAh	E	0-0xFFFF	Apparent Energy Consumption (MSR)	Clear via reset register
028						0-0xFFFF	Apparent Energy Consumption (LSR)	
029	R	NV	ULong	KVARh	E	0-0xFFFF	Reactive Energy Consumption (MSR)	Clear via reset register
030						0-0xFFFF	Reactive Energy Consumption (LSR)	
031	R		UInt	kVA	W	0-32767	Apparent Power, Phase A	
032	R		UInt	kVA	W	0-32767	Apparent Power, Phase B	
033	R		UInt	kVA	W	0-32767	Apparent Power, Phase C	
034	R		UInt	kVAR	W	0-32767	Reactive Power, Phase A	
035	R		UInt	kVAR	W	0-32767	Reactive Power, Phase B	
036	R		UInt	kVAR	W	0-32767	Reactive Power, Phase C	
037	R		UInt	kW	W	0-32767	Total Real Power Present Demand	
038	R		UInt	kVAR	W	0-32767	Total Reactive Power Present Demand	
039	R		UInt	kVA	W	0-32767	Total Apparent Power Present Demand	
040	R	NV	UInt	kW	W	0-32767	Total Real Power Max. Demand	
041	R	NV	UInt	kVAR	W	0-32767	Total Reactive Power Max. Demand	
042	R	NV	UInt	kVA	W	0-32767	Total Apparent Power Max. Demand	

REGISTER	R/W	NV	Format	Units	Scale	Range	Description		
043	R	NV	ULong			0-0xFFFF	Pulse Counter 1 (Real Energy)	MSR	Contact Closure Counters. Valid for both pulse inputs and outputs. EM3550 counts are shown in (). See register 144 (energy per pulse) for the Wh per pulse count. Clear via register 129. Inputs are user defined.
044								LSR	
045	R	NV	ULong			0-0xFFFF	Pulse Counter 2 (Reactive Energy)	MSR	
046								LSR	
047	R	NV	ULong	kWh	E	0-0xFFFF	Real Energy Consumption Phase A	MSR	Clear via reset register.
048								LSR	
049	R	NV	ULong	kWh	E	0-0xFFFF	Real Energy Consumption Phase B	MSR	
050								LSR	
051	R	NV	ULong	kWh	E	0-0xFFFF	Real Energy Consumption Phase C	MSR	
052								LSR	
Configuration									
129	R/W		UInt			N/A	Command Register: - Write 30078 (0x757E) to clear all energy accumulators to 0. - Write 21211 (0x52DB) to begin new demand sub-interval calculation cycle. Takes effect at the end of the next 1 second calculation cycle. Write no more frequently than every 10 seconds. - Write 21212 (0x52DC) to reset max demand values to present demand values. Takes effect at the end of the next 1 second calculation cycle. Write no more frequently than every 10 seconds. - Write 16498 (0x4072) to clear pulse counters to 0. - Read (returns 0).		
130	R/W	NV	UInt			10, 11, 12, 31, 40	Single Phase: A + N Single Phase: A + B Single Split Phase: A + B + N 3 phase Δ, A + B + C, no N 3 phase Y, A + B + C + N		System Type Note: only the indicated phases are monitored for phase loss
131	R/W	NV	UInt	Amps		1-32000	CT Ratio – Primary		Current inputs
132	R/W	NV	UInt			1, 3	CT Ratio – Secondary Interface (1 or 1/3 V, may not be user configurable)		
133	R/W	NV	UInt		100	0.01-320.00	PT Ratio: The meter scales this value by 100 (i.e. entering 200 yields a potential transformer ratio of 2:1). The default is 100 (1.00:1), which is with no PT attached. Set this value before setting the system voltage (below).		
134	R/W	NV	UInt			82-32000	System Voltage: This voltage is line to line, except for system type 10 which is line to neutral. The meter uses this value to calculate the full scale power for the analog outputs and pulse configuration (below), and as full scale for phase loss (register 142). The meter will refuse voltages that are outside the range of 82-660 volts when divided by the PT Ratio (above).		
135	R	NV	UInt	kW	W	1-32767	Theoretical Maximum System Power: This read-only value is the theoretical maximum power the meter can expect to see on a service. This value is 100% of scale on the analog output (0-5 VDC or 4-20 mA), if equipped. The meter recalculates this value if the user changes the CT size, system type, or system voltage. This integer value has the same scale as other integer power registers (see register 140 for power scaling).		
136	R		UInt				Reserved (returns 0)		
137	R/W	NV	UInt			0,1	Display Units: 0 = IEC (U, V, P, Q, S), 1 = IEEE (default: VLL, VLN, W, VAR, VA)		
138	R		SInt		-4 0.0001 -3 0.001 -2 0.01 -1 0.1 0 1.0 1 10.0 2 100.0 3 1000.0 4 10000.0		Scale Factor I (Current)		Scale Factors Note: These registers contain a signed integer that scales the corresponding integer registers. Floating point registers are not scaled. Scaling is recalculated when the meter configuration is changed.
139	R		SInt				Scale Factor V (Voltage)		
140	R		SInt				Scale Factor W (Power)		
141	R		SInt				Scale Factor E (Energy)		

REGISTER	R/W	NV	Format	Units	Scale	Range	Description	
142	R/W	NV	UInt	%		1-99	Phase Loss Voltage Threshold in percent of system voltage (register 134). Default is 10 (%). Any phase (as configured in register 130) that drops below this threshold triggers a phase loss alert, i.e. if the system voltage is set to 480 V L-L, the L-N voltage for each phase should be 277 V. When the threshold is set to 10%, if any phase drops more than 10% below 277 V, (less than 249 V), or if any L-L voltage drops more than 10% below 480 V (less than 432 V) the corresponding phase loss alarm bit in register 146 will be true.	Phase Loss Output Note: The phases tested are determined by the system type.
143	R/W	NV	UInt	%		1-99	Phase Loss Imbalance Threshold in percent. Default is 25% phase to phase difference. For a 3-phase Y (3 + N) system type (40 in register 130), both line to neutral and line to line voltages are tested. In a 3-phase system type (31 in register 130), only line to line voltages are examined. In a single split-phase (2 + N) system type (12 in register 130), just the line to neutral voltage are compared.	
144	R/W	NV	UInt	Wh		10000, 1000, 100, 10	Wh (& VARh, if equipped with FDS) Energy per Pulse Output Contact Closure. If the meter cannot find a pulse duration that will keep up with the max. system power (register 135), it will reject the new value. Try a larger value.	kWh Pulse Contacts Note: The kWh pulse contact can keep up with a maximum power (watts) of 1800000 x Wh pulse weight ÷ contact closure duration (in msec).
145	R	NV	UInt	ms		500, 250, 100, 50, 25, 10	Pulse Contact Closure Duration in msec. Read-only. Set to the slowest duration that will keep up with the theoretical max. system power (register 135). The open time ≥ the closure time, so the max. pulse rate (pulses per sec) is the inverse of double the pulse time.	
146	R		UInt				Diagnostic Alert Bitmap. 1 = Active: Bit 0: Phase A voltage out of range Bit 1: Phase B voltage out of range Bit 2: Phase C voltage out of range Bit 3: Phase A current out of range Bit 4: Phase B current out of range Bit 5: Phase C current out of range Bit 6: Frequency out of the range of 45 – 65 Hz or there is insufficient voltage to determine frequency. Bit 7: Reserved for future use Bit 8: Phase loss A Bit 9: Phase loss B Bit 10: Phase loss C Bit 11: Low power factor on A with one or more phases having a PF less than 0.5 due to mis-wiring of phases Bit 12: Low power factor on B Bit 13: Low power factor on C Bit 14: Energy pulse output overrun error. The pulse outputs are unable to keep up with the total real power (registers 3 and 261/262). To fix, increase the pulse energy register (register 144) and reset the energy accumulators (see reset register 129). Bit 15: Energy pulse output configuration error (present pulse energy setting may not keep up with the theoretical max. system power; see register 135). To fix, increase the pulse energy (register 144).	
147	R	NV	UInt			0-32767	Count of energy accumulator resets	
148	R		UInt				Reserved (returns 0)	

REGISTER	R/W	NV	Format	Units	Scale	Range	Description	
149	R/W	NV	UInt			1-6	Number of sub-intervals per demand interval. Sets the number of sub-intervals that make a single demand interval. For block demand, set this to 1.	Demand Calculation
150	R/W	NV	UInt	Seconds		0, 10-32767	Sub-interval length in seconds. For sync-to-comms, set this to 0 and use the reset register (129) to externally restart the sub-interval.	
151	R/W		UInt			1-32767	Reserved (returns 0)	
152	R/W	NV	UInt			0-32767	Power up counter.	
153	R	NV	UInt			0-32767	Output Configuration. EM3502 and EM3550 units have a have a N.O. (normally open, form A) energy contact and N.C. (normally closed, form B) phase loss contact. While the relay used for the phase loss contact is N.C. (contacts are closed when the meter is not powered), closure indicates the presence of an alarm; either loss of phase, when the meter is powered, or loss of power when the meter is not. The contacts are open when the meter is powered and no phase alarm conditions are present. 3rd Output: 0 = RS-485 2 = VAR Pulse	
154	R		UInt				Reserved (returns 0)	
Floating Point Data								
257/258	R	NV	Float	kWh			Real Energy Consumption (clear via reset register)	
259/260	R	NV	Float	kWh			Real Energy Consumption (clear via reset register)	
261/262	R		Float	kW			Total Instantaneous Real Power	
263/264	R		Float	kVAR			Total Instantaneous Reactive Power	
265/266	R		Float	kVA			Total Instantaneous Apparent Power	
267/268	R		Float	Ratio		0.0-1.0	Total Power Factor (Total kW / Total kVA)	
269/270	R		Float	Volt			Voltage, L-L, Average of 3 Phases	
271/272	R		Float	Volt			Voltage, L-N, Average of 3 Phases	
273/274	R		Float	Amp			Current, Average of 3 Phases	
275/276	R		Float	kW			Real Power, Phase A	
277/278	R		Float	kW			Real Power, Phase B	
279/280	R		Float	kW			Real Power, Phase C	
281/282	R		Float	Ratio		0.0-1.0	Power Factor, Phase A	
283/284	R		Float	Ratio		0.0-1.0	Power Factor, Phase B	
285/286	R		Float	Ratio		0.0-1.0	Power Factor, Phase C	
287/288	R		Float	Volt			Voltage, Phase A-B	
289/290	R		Float	Volt			Voltage, Phase B-C	
291/292	R		Float	Volt			Voltage, Phase A-C	
293/294	R		Float	Volt			Voltage, Phase A-N	
295/296	R		Float	Volt			Voltage, Phase B-N	
297/298	R		Float	Volt			Voltage, Phase C-N	
299/300	R		Float	Amp			Current, Instantaneous, Phase A	
301/302	R		Float	Amp			Current, Instantaneous, Phase B	
303/304	R		Float	Amp			Current, Instantaneous, Phase C	
305/306	R		Float				Reserved, returns 0x7FC00000 (QNAN)	
307/308	R		Float	Hz		45.0-65.0	Frequency (derived from Phase A)	
309/310	R	NV	Float	kVAh			Apparent Energy Consumption	
311/312	R	NV	Float	kVARh			Reactive Energy Consumption	
313/314	R		Float	kVA			Apparent Power, Phase A	
315/316	R		Float	kVA			Apparent Power, Phase B	
317/318	R		Float	kVA			Apparent Power, Phase C	
319/320	R		Float	kVAR			Reactive Power, Phase A	
321/322	R		Float	kVAR			Reactive Power, Phase B	

REGISTER	R/W	NV	Format	Units	Scale	Range	Description	
323/324	R		Float	kVAR			Reactive Power, Phase C	
325/326	R		Float	kW			Total Real Power Present Demand	
327/328	R		Float	kVAR			Total Reactive Power Present Demand	
329/330	R	NV	Float	kVA			Total Apparent Power Present Demand	
331/332	R	NV	Float	kW			Total Real Power Max Demand	
333/334	R	NV	Float	kVAR			Total Reactive Power Max Demand	
335/336	R	NV	Float	kVA			Total Apparent Power Max Demand	
337/338	R		Float			0 - 4294967040	Pulse Counter 1 (Real Energy)	Contact Closure Counters. Valid for both pulse inputs and outputs. EM counts are shown in (). See register 144 (energy per pulse) for the Wh per pulse count. Clear via register 129. Inputs are user defined. These values are derived from the 32 bit integer counter and will roll over to 0 when the integer counters do.
339/340	R		Float			0 - 4294967040		
341/342	R	NV	Float	kWh			Real Energy Consumption, Phase A	Clear via reset register.
343/344	R	NV	Float	kWh			Real Energy Consumption, Phase B	
345/346	R	NV	Float	kWh			Real Energy Consumption, Phase C	

Invalid or Quiet Not A Number (QNAN) conditions are indicated by 0x8000 (negative zero) for 16 bit integers and 0x7FC00000 for 32 bit floating point numbers.

Floating point numbers are encoded per the IEEE 754 32-bit specifications.

TROUBLESHOOTING

Table 11 Troubleshooting

Problem	Cause	Solution
The maintenance wrench icon appears in the power meter display.	There is a problem with the inputs to the power 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 power meter setup parameters (CT and PT ratings, system type, etc.) (see Setup section).
	Incorrect voltage inputs	Check power meter voltage input terminals to verify adequate voltage.
	Power 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 Diagrams section).
Cannot communicate with power meter from a remote personal computer.	Power meter address is incorrect.	Verify that the meter is correctly addressed (see Setup section).
	Power meter baud rate is incorrect.	Verify that the baud rate of the meter matches that of all other devices on its communications link (see Setup section).
	Communications lines are improperly connected.	Verify the power meter communications connections (see Communications section). 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.

CHINA ROHS COMPLIANCE INFORMATION (EFUP TABLE)

部件名称	产品中有毒有害物质或元素的名称及含量Substances					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr(VI))	多溴联苯(PBB)	多溴二苯醚(PBDE)
电子线路板	X	O	O	O	O	O

O = 表示该有毒有害物质在该部件所有均质材料中的含量均在 SJ/T11363-2006 标准规定的限量要求以下.

X = 表示该有毒有害物质至少在该部件的某一均质材料中的含量超出SJ/T11363-2006标准规定的限量要求.

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EM3502, 3550
Installation Guide

Schneider Electric
295 Tech Park Dr. Suite 100
La Vergne TN, 37086

For technical support:
Global-PMC-Tech-support@schneider-electric.com
(00) + 1 250 544 3010

Contact your local Schneider Electric sales representative for assistance or go to
www.schneider-electric.com

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