EasyLogic™ DM6220H / EM1220H / EM1250H meter

User manual

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www.se.com

Schneider Electric

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Safety information

Important information

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 manual 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 accompany this symbol to avoid possible injury or death.

⚠⚠DANGER

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

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

⚠WARNING

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

⚠CAUTION

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

NOTICE

NOTICE is used to address practices not related to physical injury.

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. A qualified person is one who has skills and knowledge related to the construction, installation, and operation of electrical equipment and has received safety training to recognize and avoid the hazards involved.

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Safety precautions

Installation, wiring, testing and service must be performed in accordance with all local and national electrical codes.

⚠⚠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, CSA Z462 or applicable local standards.
- Turn off all power supplying this device and the equipment in which it is installed before working on the device or equipment.
- Always use a properly rated voltage sensing device to confirm that all power is off.
- Follow guidelines in the Wiring section of the related Installation Sheet.
- Treat communications and I/O wiring connected to multiple devices as hazardous live until determined otherwise.
- Do not exceed the device's ratings for maximum limits.
- Never short the secondary of a potential/voltage transformer (PT/VT).
- Never open circuit a current transformer (CT).
- Always use grounded external CTs for current inputs.
- Do not use the data from the meter to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.

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

NOTE: See IEC 60950-1:2005, Annex W for more information on communications and I/O wiring connected to multiple devices.

⚠WARNING

UNINTENDED OPERATION

- Do not use this device for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.
- Do not use this device if a wrench icon appears on the top corner of the display screen or if the value under **Meter Status** is not "OK".

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

⚠WARNING

POTENTIAL COMPROMISE OF SYSTEM AVAILABILITY, INTEGRITY, AND CONFIDENTIALITY

- Change default passwords/passcodes to help prevent unauthorized access to device settings and information.
- Disable unused ports/services and default accounts, where possible, to minimize pathways for malicious attacks.
- Place networked devices behind multiple layers of cyber defenses (such as firewalls, network segmentation, and network intrusion detection and protection).
- Use cybersecurity best practices (for example: least privilege, separation of duties) to help prevent unauthorized exposure, loss, modification of data and logs, interruption of services, or unintended operation.

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

Introduction

Meter Overview

The meters offers comprehensive 3-phase instrumentation and load management facilities in a compact and rugged package.

The meter is required to monitor an electrical installation which complies with Class 0.5 and Class 1.0 accuracy standards and feature high quality, reliability and affordability in a compact and easy to install.

Main characteristics

- Easy to install: The device can be mounted on a panel using two retainer clips. This is a compact meter with 49 mm meter depth behind the panel that can connect up to 480 V + 10% AC L-L without voltage transformers for installation compliant with measurement category III, and double insulated.
- Easy to operate: The device has intuitive navigation with self-guided menus and heartbeat LED that indicate normal functioning of your device. It also conveys the communication status when connected to an RS-485 network.
- LCD display: The device has intuitive navigation with self-guided four buttons.
- Power and energy measurement(EM1220H and EM1250H): The device can measure, display, and record power or energy .
- Standard compliance:
  - Class 1.0 for active energy as per the test limits given in IEC 62053-21
  - Class 0.5 for active energy as per the test limits given in IEC 62053-22
  - Class 2.0 for reactive energy as per the test limits given in IEC 62053-23
  - Tested in accordance with IEC 62052-11 for energy test requirements
  - EMI / EMC tests as per IEC 61326-1
- CT nominal: 5 A or 1 A nominal current. CT reversal auto correction for energy consumption.
- Password: Field configured password to secure set up information and prevent tampering of integrated values.
- Cyber security: The device provides an option for disabling RS-485 port through front panel keys to prevent unauthorized access. This feature can also be used for maintenance and troubleshooting of complex communication network.
- Display: The device has an auto scale and auto range display capability that provides 4 digits for Instantaneous parameters and 9+3 digits for energy parameters.
- Energy counter(EM1250H / EM1220H) : Non-resettable energy counter to ensure integrity of energy readings.
- Suppression current: The meter can be configured to disregard the measurement of induced / auxiliary load current in the circuit (can be set from 5 to 99 mA).
- Favourite page(EM1250H / EM1220H): The device enables user selectable parameters to be set in favourite page.
- Tamper-resistance: Tamper cover with sealing features for protecting against tampering with voltage and current terminals.

Feature summary

Parameter	EM1220H	EM1250H	DM6220H
Accuracy Class for Wh	Class 1 Class 0.5	Class 1	–
Accuracy Class for VARh	2.0	± 2%	–
Accuracy Class for VAh	± 0.5%	± 1% ± 0.5%	–
Sampling rate per cycle	32	32	32
Current: • Per-phase and 3 phase average • Calculated neutral current	✓	✓	✓
Voltage: • V L-N - per-phase and 3 phase average • V L-L - per-phase and 3 phase average	✓	✓	✓
Power Factor • Per-phase and average	True PF	True PF	True PF
Frequency	✓	✓	✓
Power	✓	✓	–
Energy	✓	✓	–
3 Phase unbalance	Current Voltage	Current Voltage	Current Voltage
Meter On hours Load Run hours Power Interruptions	✓	✓	✓
Phase angle • Per-phase (between Voltage and Current)	✓	✓	✓
Communication	RS-485 Modbus RTU	RS-485 Modbus RTU	RS-485 Modbus RTU
Revolutions per minute (RPM)	✓	–	✓
Load percentage	✓	–	✓

Applications

The meters can be used in various cost management and network management application. Some of the import applications are mentioned below.

Cost management

- Energy accounting and balancing
- Control panels
- Power distribution boards
- Original equipment manufacturers (OEMs)
- Building management system
- Panel instrumentation
- Energy management system

Network management

- Power quality analysis (THD%)

- Measurement of power factor
- Phase angle between the voltage and current
- % unbalance among voltage and current
- Modbus RTU protocol RS-485 port for integration with energy management system

Data display and analysis tools

Power Monitoring Expert

EcoStruxure™ Power Monitoring Expert is a complete supervisory software package for power management applications.

The software collects and organizes data gathered from your facility's electrical network and presents it as meaningful, actionable information via an intuitive web interface.

Power Monitoring Expert communicates with devices on the network to provide:

- Real-time monitoring through a multi-user web portal
- Trend graphing and aggregation
- Power quality analysis and compliance monitoring
- Preconfigured and custom reporting

See the EcoStruxure™ Power Monitoring Expert online help for instructions on how to add your device into its system for data collection and analysis.

Power SCADA Operation

EcoStruxure™ Power SCADA Operation is a complete real-time monitoring and control solution for large facility and critical infrastructure operations.

It communicates with your device for data acquisition and real-time control. You can use Power SCADA Operation for:

- System supervision
- Real-time and historical trending, event logging
- PC-based custom alarms

See the EcoStruxure™ Power SCADA Operation online help for instructions on how to add your device into its system for data collection and analysis.

Meter configuration

Meter configuration can be performed through the display or ION Setup

ION Setup is a meter configuration tool that can be downloaded for free at www.se.com,If you already have an existing installation of ION Setup, it is recommended that you upgrade to the latest version in order to access new features or enhancements and properly configure features available on your device.

See the ION Setup online help or in the ION Setup device configuration guide. To download a copy, go to www.se.com and search for ION Setup device configuration guide.

Hardware reference

Meter types

The EM1220H / EM1250H / DM6220H is available in one of the physical form factor.

Meter model : DM6220H	
Commercial reference	**Description**
METSEDM6220HCL1	Class 1 panel mount meter, RS-485 and integrated display
METSEDM6220HCL1LVD	Class 1 panel mount meter with low voltage DC, RS-485 and integrated display

Meter model : EM1220H	
Commercial reference	**Description**
METSEEM1220HCL1	Class 1 panel mount meter, RS-485 and integrated display
METSEEM1220HCL5	Class 0.5 panel mount meter, RS-485 and integrated display
METSEEM1220HCL5LVD	Class 0.5 panel mount meter with low voltage DC, RS-485 and integrated display

Meter model : EM1250H	
Commercial reference	**Description**
METSEEM1250HCL1	Class 1 panel mount meter, RS-485 and integrated display

Supplemental information

This document is intended to be used in conjunction with the installation sheet that ships in the box with your device and accessories.

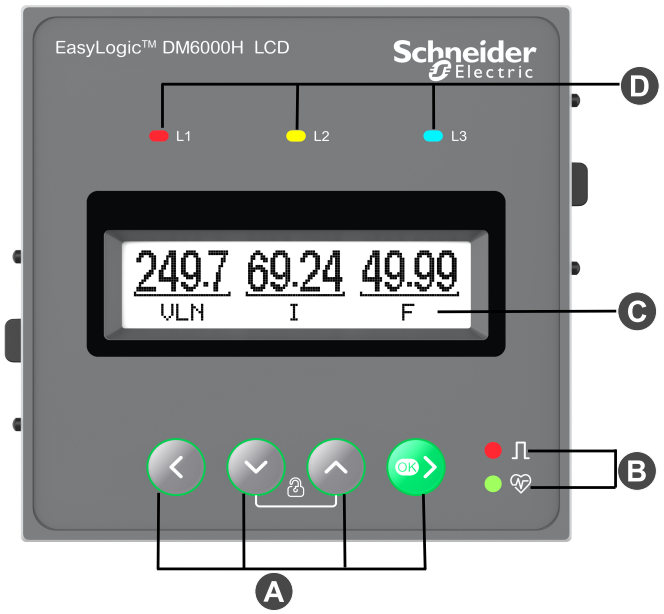
See your device's installation sheet for information related to installation.

See your product's catalog pages at www.se.com for information about your device, its options and accessories.

You can download updated documentation from www.se.com or contact your local Schneider Electric representative for the latest information about your product.

Physical description

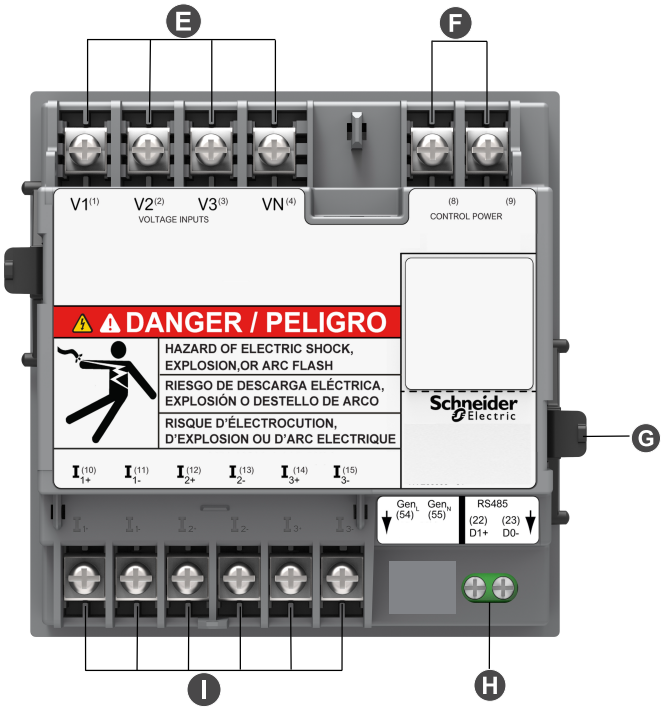
Front



The front panel has an LCD display and the following indicators and controls:

A	Menu selection buttons • *Smart keys, page 15*
B	The Calibration LED blinks as per the energy updating rate • *Energy pulsing LED, page 15* • *Heartbeat / serial communications LED, page 15*
C	LCD
D	Voltage Line Indicators (L1, L2, L3), indicates when a phase line is ON.

Rear



The rear of the digital meter and the following indicators and controls:

- Six terminals for current, one in and one out per phase
- Four terminals for voltage, for three phases and neutral
- Two terminals for control power
- Two terminals for the RS-485 communications port

E	Voltage inputs
F	Control power
G	Retainer clip
H	RS-485
I	Current inputs

Energy pulsing LED

The meter supports LED that can be configured for energy pulsing.

When configured for energy pulsing, this LED flashes at a rate proportional to the amount of energy consumed. This is typically used to verify the meter's accuracy.

Heartbeat / serial communications LED

The heartbeat / serial communications LED blinks to indicate the meter's operation and serial Modbus communications status.

The LED blinks at a slow, steady rate to indicate the meter is operational. The LED flashes at a variable, faster rate when the meter is communicating over a Modbus serial communications port.

You cannot configure this LED for other purposes.

NOTE: A heartbeat LED that remains lit and does not blink (or flash) can indicate a hardware problem.

Smart keys

The meter has four smart keys to navigate through the display pages. The display shows where you are headed.

Smart keys description

	**Right key / OK key** • Going **forward** into sub-parameter pages. • To enter into **Setup** page. This action requires password. • Selecting the parameter to edit under **Setup**.
	**Left key** • Going **back** to the main parameter pages. • Selecting **previous digit** on the left, under setup. • Exiting from editing **Setup** page.
	**Up key** • **Scrolling up** through display pages at the same level, **within the same function**. • **Increasing** the value of the selected digit or navigating to the next available selection.
	**Down key** • **Scrolling down** through other display pages at the same level, through all functions. • **Decreasing** the value of the selected digit or navigating to the next available selection.

Terminal covers

The voltage and current terminal covers help prevent tampering with the meter's voltage and current measurement inputs.

The terminal covers enclose the terminals, the conductor fixing screws and a length of the external conductors and their insulation. These covers are secured by tamper-resistant meter seals. Ensure you push the cover upwards till you hear a click to make the cover stand.

These covers are included for meter models where sealable voltage and current covers are required to protect against tampering of current and voltage input signals.

Meter mounting

For mounting instructions and safety precautions, see the installation sheet that was shipped with your device, or download a copy at www.se.com.

Meter wiring

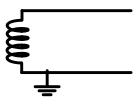
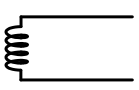
For wiring instructions and safety precautions, see the meter installation sheet that was shipped with your meter, or download a copy at www.se.com.

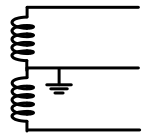
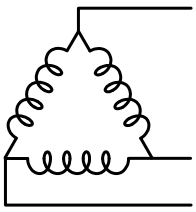
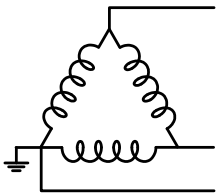
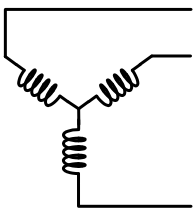
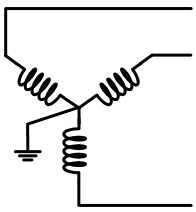
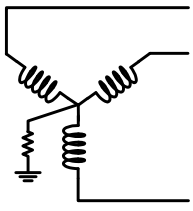
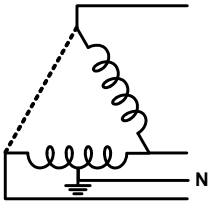
Measuring voltage limit

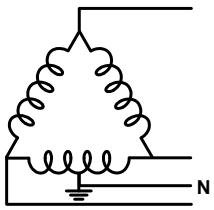
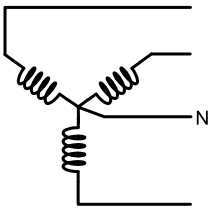
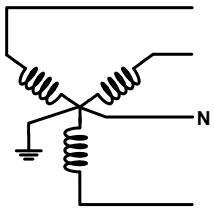
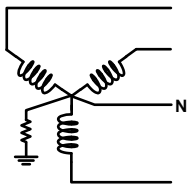
You can connect the meter's voltage inputs directly to the phase voltage lines of the power system if the power system's line-to-line or line-to-neutral voltages do not exceed the meter's direct connect maximum voltage limits.

The meter's voltage measurement inputs are rated by the manufacturer for up to 277 V L-N / 480 V L-L. However, the maximum voltage allowed for direct connection may be lower, depending on the local electrical codes and regulations. As per installation category III the maximum voltage on the meter voltage measurement inputs should not exceed 277 V L-N / 480 V L-L.

If your system voltage is greater than the specified direct connect maximum voltage, you must use VTs (voltage transformers) to step down the voltages.

Power system description	**Meter setting**		**Symbol**	**Direct connect maximum (UL / IEC)**	**# of VTs (if required)**
	Display (meter)	**Display (communication)**		**Installation category III**	
Single-phase 2-wire line-to-neutral	1PH2W LN	1PH 2Wire L-N		≤ 277 V L-N	1 VT
Single-phase 2-wire line-to-line	1PH2W LL	1PH 2Wire L-L		480 V L-L	1 VT

Power system description	Meter setting		Symbol	Direct connect maximum (UL / IEC)	# of VTs (if required)
	Display (meter)	Display (communication)		Installation category III	
Single-phase 3-wire line-to-line with neutral	1PH3W LL	1PH 3Wire L-L with N		≤ 277 V L-N / 480 V L-L	2 VT
3-phase 3-wire Delta ungrounded	3PH3W Dlt	3PH 3Wire Ungrounded Delta		480 V L-L	2 VT
3-phase 3-wire Delta corner grounded		3PH 3Wire Corner Grounded Delta		480 V L-L	2 VT
3-phase 3-wire Wye ungrounded		3PH 3Wire Ungrounded Wye		480 V L-L	2 VT
3-phase 3-wire Wye grounded		3PH 3Wire Grounded Wye		480 V L-L	2 VT
3-phase 3-wire Wye resistance-grounded		3PH 3Wire Resistance Grounded Wye		480 V L-L	2 VT
3-phase 4-wire open Delta center-tapped	3PH4W Wye	3PH 4Wire Center-Tapped Open Delta		240 V L-N / 480 V L-L	3 VT

Power system description	Meter setting		Symbol	Direct connect maximum (UL / IEC)	# of VTs (if required)
	Display (meter)	Display (communication)		Installation category III	
3-phase 4-wire Delta center-tapped		3PH 4Wire Center-Tapped Delta		240 V L-N / 480 V L-L	3 VT
3-phase 4-wire ungrounded Wye		3PH 4Wire Ungrounded Wye		≤ 277 V L-N / 480 V L-L	3 VT or 2 VT
3-phase 4-wire grounded Wye		3PH 4Wire Grounded Wye		≤ 277 V L-N / 480 V L-L	3 VT or 2 VT
3-phase 4-wire resistance-grounded Wye		3PH 4Wire Resistance Grounded Wye		≤ 277 V L-N / 480 V L-L	3 VT or 2 VT

Balanced system considerations

In situations where you are monitoring a balanced 3-phase load, you may choose to connect only one or two CTs on the phase(s) you want to measure, and then configure the meter so it calculates the current on the unconnected current input(s).

NOTE: For a balanced 4-wire Wye system, the meter's calculations assume that there is no current flowing through the neutral conductor.

Balanced 3-phase Wye system with 2 CTs

The current for the unconnected current input is calculated so that the vector sum for all three phases equal zero.

Balanced 3-phase Wye or Delta system with 1CT

The currents for the unconnected current inputs are calculated so that their magnitude and phase angle are identical and equally distributed, and the vector sum for all three phase currents equal zero.

NOTE: You must always use 3 CTs for 3-phase 4-wire center-tapped Delta or center-tapped open Delta systems.

Viewing meter data

Meter screen menus

All meter screens are grouped logically, according to their function. You can access any available meter screen by first selecting the Level 1 (top level) screen that contains it.

With the meter front panel, you can view parameter values; configure parameters; perform energy resets (EM1250H and EM1220H); perform LED checks; and view meter information. Each of these functions can be accomplished by pressing the Left, Up, Down, and OK buttons on the front panel.

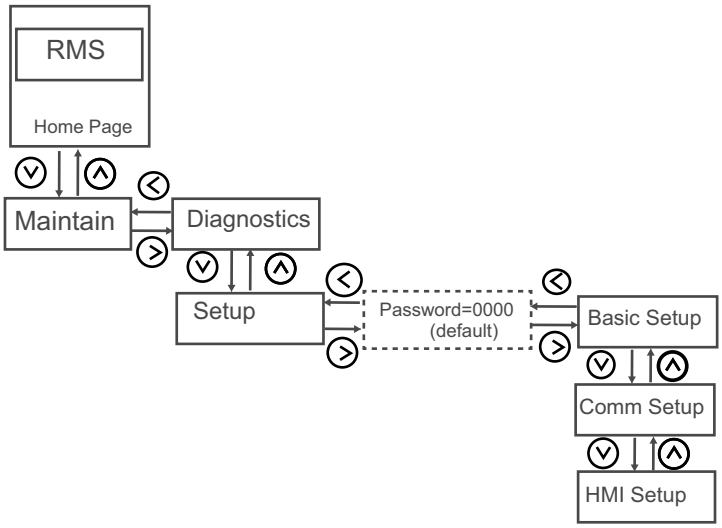
These button actions achieve different results according to the mode that the meter is in:

- Display mode (default): view parameter measurements
- Setup mode: configure a parameter
- Reset mode: reset measurements
- Lock mode: lock or unlock a screen

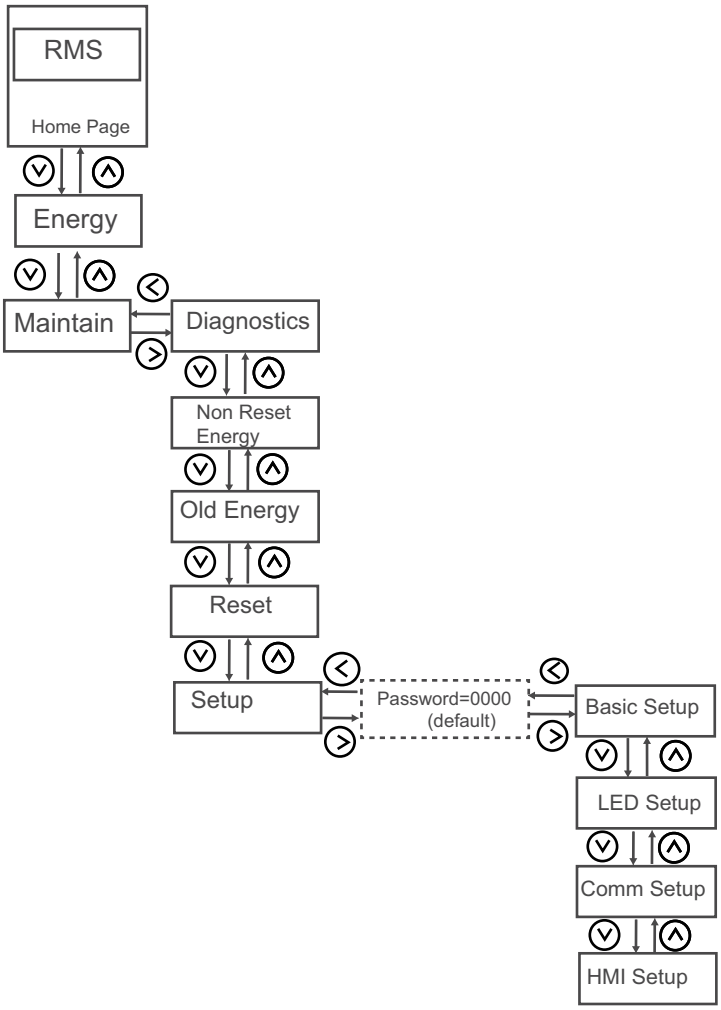
Overview

The section provides you information on viewing various parameter pages in the meter.

The meter navigation for DM6200H:



The meter navigation for EM1250H / EM1220H:



Information icons

Icon	Description
	RMS
	Energy and Non Reset Energy
	Diagnostics
	Old Energy
	Reset
	Setup

RMS page

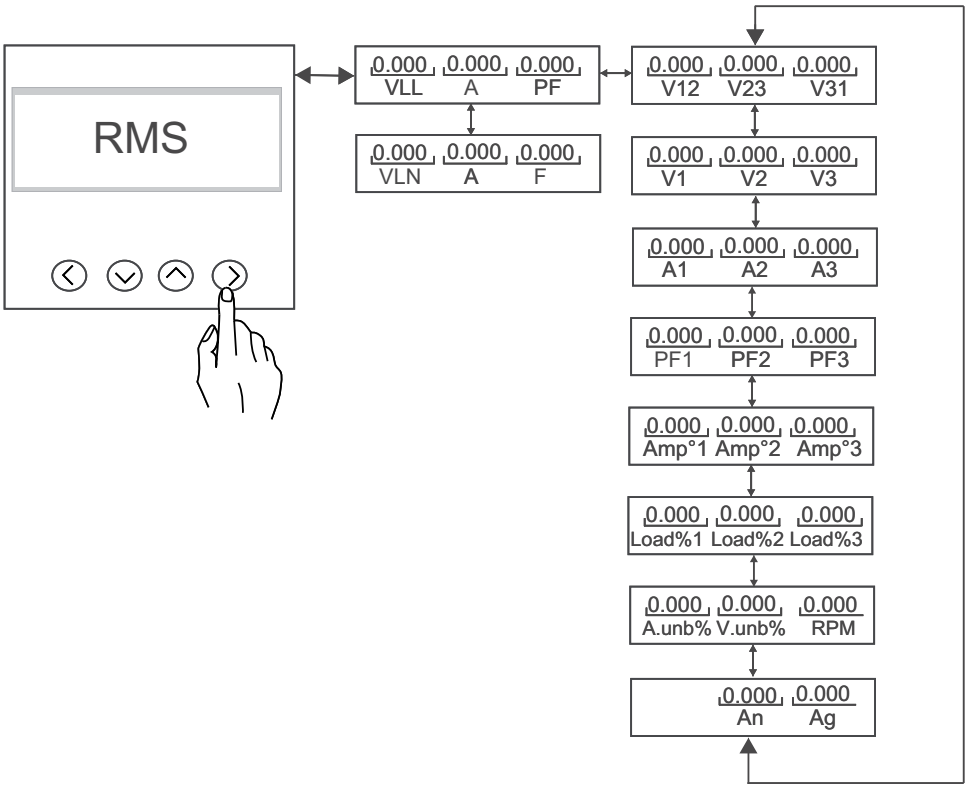
The meter provides highly accurate 1-second measurements, average values, including true RMS, per phase and total.

To view RMS parameters:

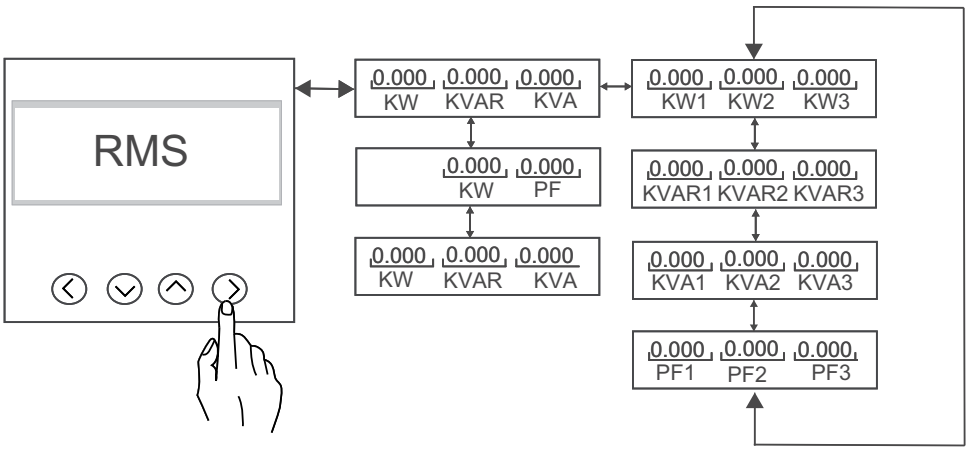
1. From the **Home (RMS)** page, use **Right / OK** button to navigate to **RMS**.
2. Press the **Up** or **Down** button to navigate to the next RMS parameter.
3. Press **Left** button to exit.

The navigation of RMS parameter

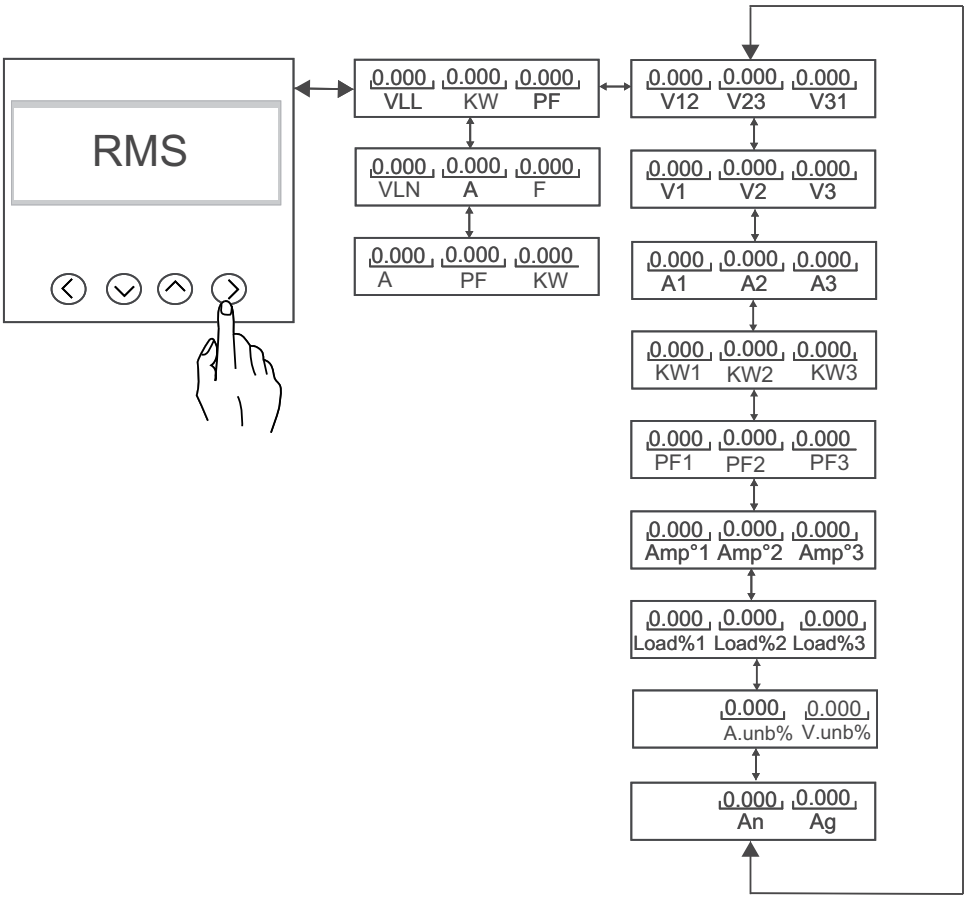
DM6200H



EM1250H



EM1250H



The list of RMS parameters are:

- Per-phase and average voltage (line-to-line, line-to-neutral)
- Per-phase and average current, and neutral current (calculated)
- Per-phase and average power factor
- Per-phase and total power (VA, W, VAR)
- System frequency
- Revolutions per minute (RPM)
- Unbalance (voltage, current)
- Per phase load percentage
- Per phase angle (between voltage and current)

Energy page

NOTE: Applicable for EM1250H and EM1220H .

EM1250H meter is bi-directional, 4-quadrant, Class 1 / Class 0.5 accurate energy metering. The meter stores all accumulated active(kWh), reactive(kVARh) and apparent(kVAh) energy parameters in non-volatile memory:

- Delivered: kWh, kVARh, kVAh
- Received: kWh, kVARh, kVAh
- Delivered + Received: kWh, kVARh, kVAh
- Delivered - Received: kWh, kVARh, kVAh

EM1220H meter is uni-directional, 4-quadrant, Class 1 / Class 0.5 accurate energy metering. The meter stores accumulated value of any one of the selected energy from active, reactive, or apparent energy in nonvolatile memory:

- Delivered: kWh / kVARh / kVAh

- Received: kWh / kVARh / kVAh
- Delivered + Received: kWh / kVARh / kVAh
- Delivered - Received: kWh / kVARh / kVAh

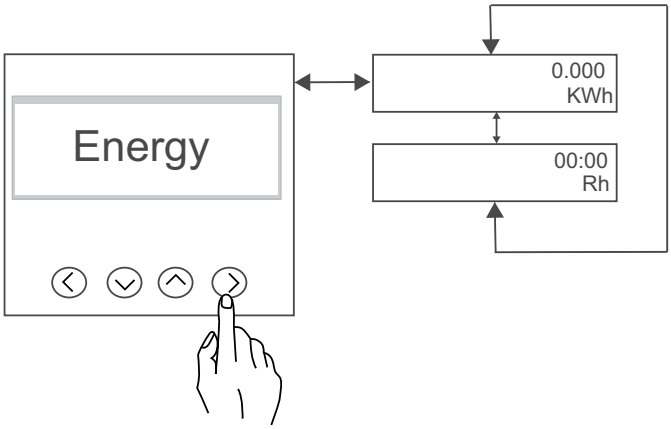
NOTE: Based on the energy scale selection, when any of energy parameters overflow at 999999999.999 all energy parameters value resets.

To view Energy parameters:

1. From the **Home** page, use **Up** or **Down** button to navigate to **Energy**.
2. Press **OK**.
3. Press the **Up** or **Down** button to navigate to the next **Energy** parameter.
4. Press **Left** button to exit.

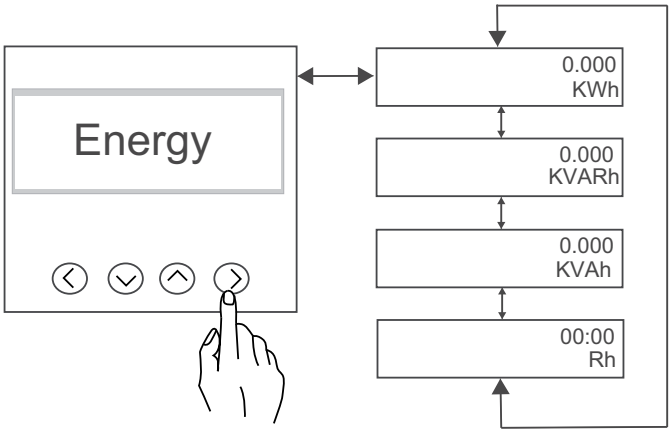
The navigation of energy parameter:

EM1220H



Name on display	Description
KWh	Active energy
Rh	Run hours

EM1250H



Name on display	Description
KWh	Active energy
KVARh	Reactive energy
KVAh	Apparent energy
Rh	Run hours

The status of energy with the commands:

Command	Accumulated energies
Reset sub systems	Clear
Initialization	Clear
Reset all energies	Clear
Reset all accumulated energies	Clear

Maintain page

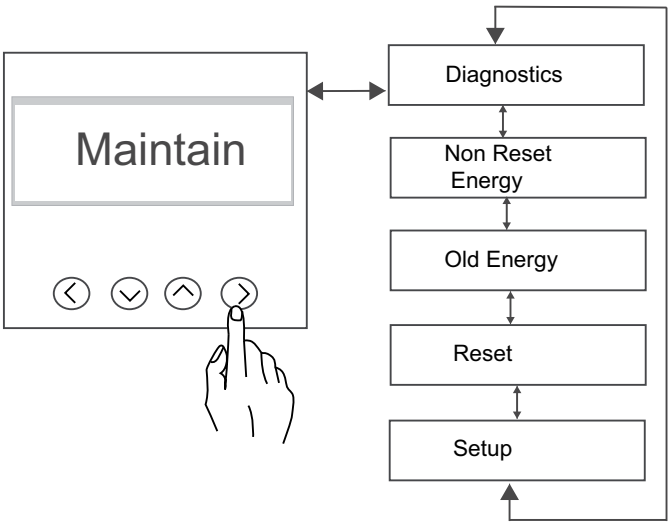
The meter provides diagnostics information, old energy, non reset energy, reset and setup menus.

To view Maintain parameters:

1. From the **Home** page, use **Up** or **Down** button to navigate to **Maintain**.
2. Press **OK**.
3. Press the **Up** or **Down** button to navigate to the next **Maintain** parameter.
4. Press **Left** button to exit.

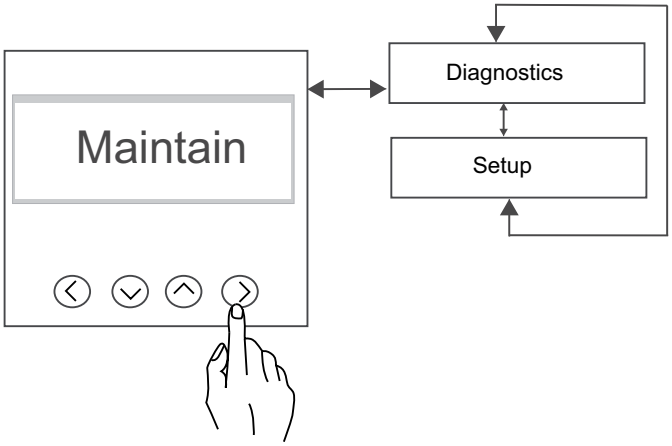
The navigation of Maintain page:

EM1220H / EM1250H



Name on display	Description
Diagnostics	You can view diagnostics parameters of the meter
Non Reset Energy	You can view non reset energy parameters
Old Energy	You can view old energy parameters
Reset	You can reset parameters
setup	You can view and edit setup parameters

DM6200H



Name on display	Description
Diagnostics	You can view diagnostics parameters of the meter
setup	You can view and edit setup parameters

Diagnostics page

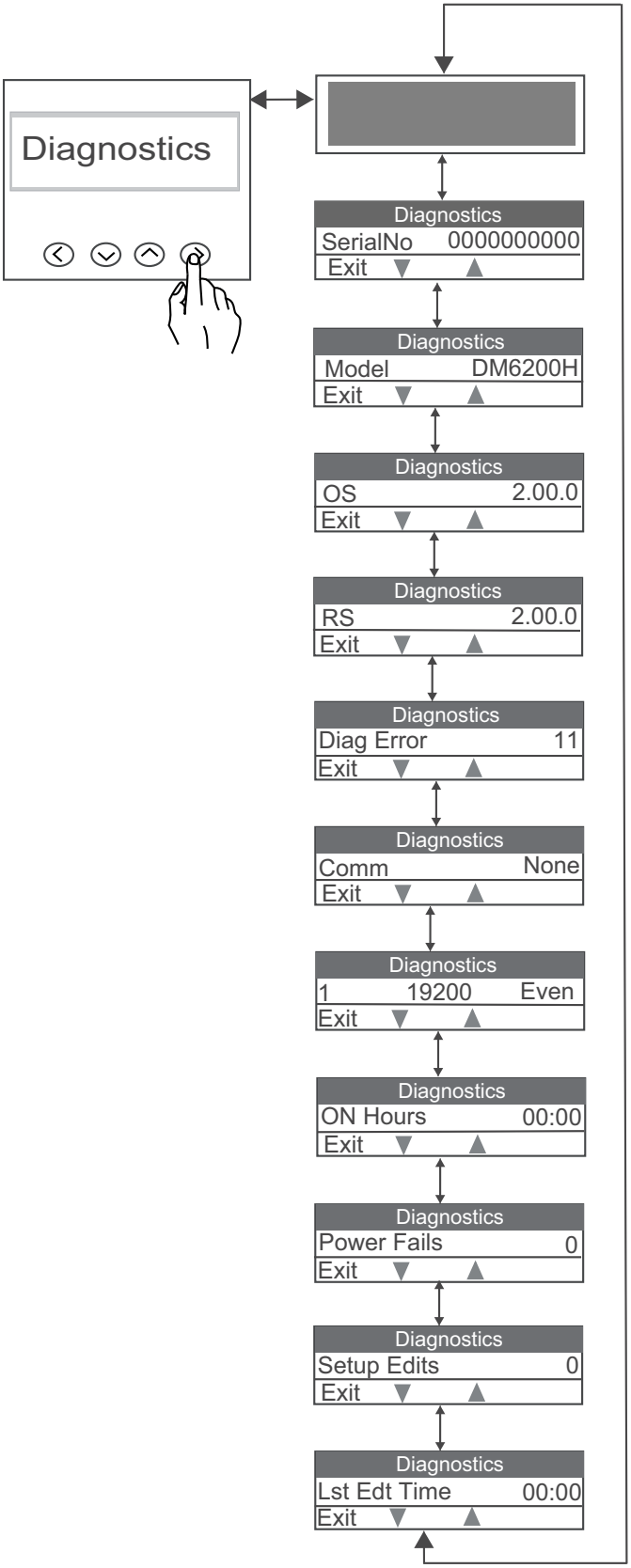
In Diagnostics, you can verify the view meter information.

To view Diagnostics parameters:

1. From the **Home** page, use **Up** or **Down** button to navigate to **Maintain**.
2. Press **OK**.
3. Press the **Up** or **Down** button to navigate to the **Diagnostics** page.
4. Press **OK**.
5. Press the **Up** or **Down** button to navigate to the next **Diagnostics** parameter.
6. Press **Left** button to exit.

The navigation of Diagnostics:

DM6200H / EM1220H / EM1250H



Name on display	Description
	Indicates that the display are operating correctly.
Serial number	Displays the meter serial number, for example .0500005174.
Meter Model	Displays the meter model number.

Name on display	Description
OS Version	Displays the operating system version number, for example OS 1.00.0.
RS Version	Displays the reset (boot code) version number, for example RS 1.00.0.
Diag Error	Displays the error codes of the meter for diagnostics.
Comm	Display the communication error code.
1, 19200, Even	Displays the ID, Baud, Parity.
On Hours	Displays the period for which the power meter's auxiliary supply is ON, regardless of the voltage and current inputs.
Power Fails	Display the number of times control power is interrupted.
System Edits	Display the count of system edit.
Lst Edt Time	Display the last edit time.

Non reset energy

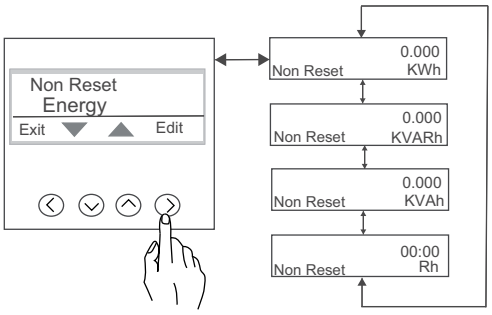
NOTE: Applicable for EM1250H and EM1220H.

The parameters are available through communication and display in Maintain and cannot be reset. The values will overflow automatically when they reach maximum value. **To view Non Reset parameters:**

1. From the **Home** page, use **Up** or **Down** button to navigate to **Maintain**.
2. Press **OK**.
3. Press the **Up** or **Down** button to navigate to the **Non Reset Energy** page.
4. Press **OK**.
5. Press the **Up** or **Down** button to navigate to the next **Non Reset Energy** parameter.
6. Press **Left** button to exit.

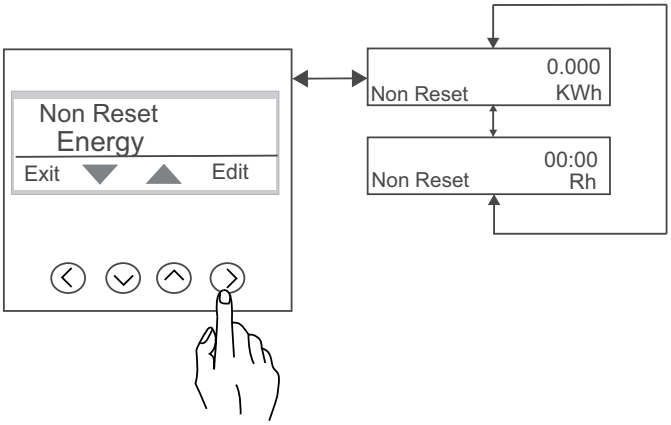
The navigation of Non Reset Energy:

EM1250H



Name on display	Description
KWh	Active energy
KVARh	Reactive energy
KVAh	Apparent energy
Rh	Run hours

EM1220H



Name on display	Description
KWh	Active energy
Rh	Run hours

The status of Non reset energies with the commands

Command	Non Reset energies
Reset sub systems	No clear(update with Accumulated energies)
Initialization	No clear(update with Accumulated energies)
Reset all accumulated energies	No clear(update with Accumulated energies)

Old energy

NOTE: Applicable for EM1220H and EM1250H.

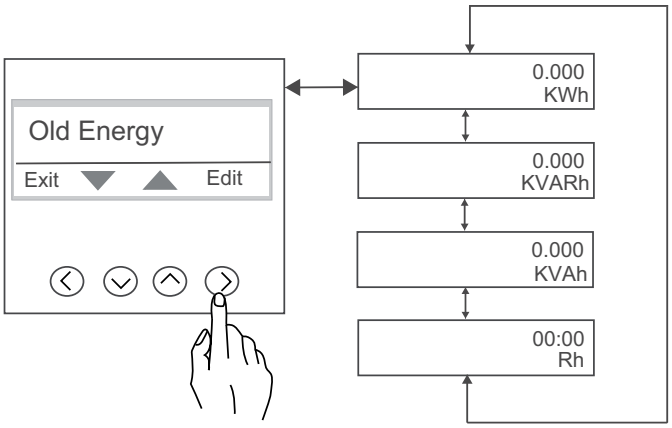
The parameters are available in communication and on meter display in Maintain page, which stores the accumulated energy of latest reset or overflow.

To view Old Energy parameters:

1. From the **Home** page, use **Up** or **Down** button to navigate to **Maintain**.
2. Press **OK**.
3. Press the **Up** or **Down** button to navigate to **Old Energy** page.
4. Press **OK**.
5. Press the **Up** or **Down** button to navigate to the next **Old Energy** parameter.
6. Press **Left** button to exit.

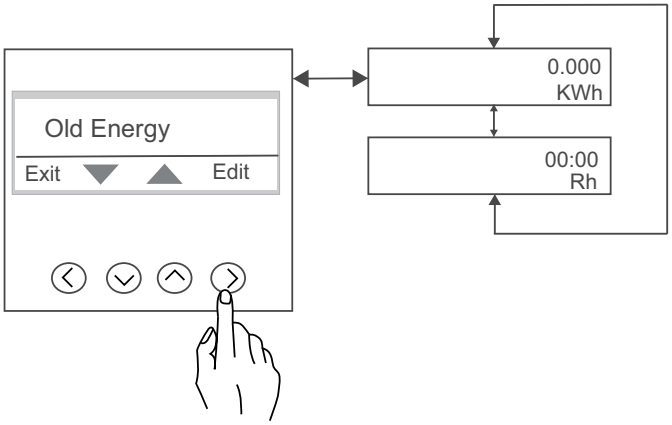
The navigation of Old Energy :

EM1250H



Name on display	Description
KWh	Active energy
KVARh	Reactive energy
KVAh	Apparent energy
Rh	Run hours

EM1220H



Name on display	Description
KWh	Active energy
Rh	Run hours

The status of Old Energy with the command

Command	Old energies
Reset sub systems	Clear
Initialization	Clear
Reset all accumulated energies	No clear(update with Accumulated energies)

Reset

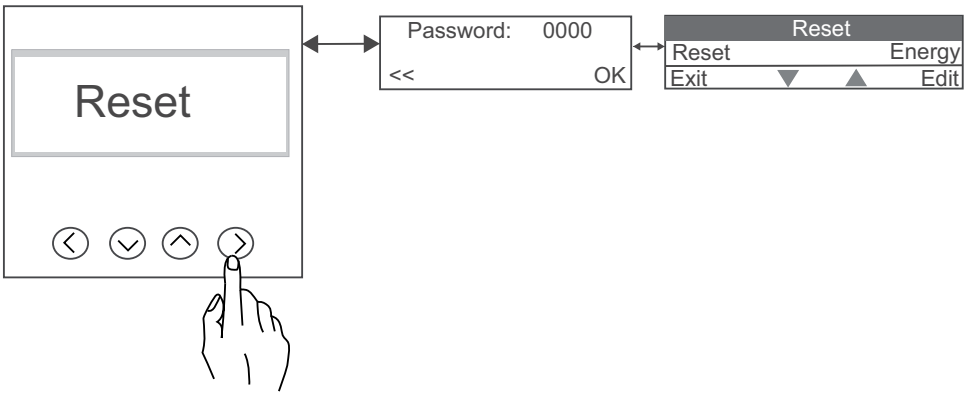
NOTE: Applicable for EM1220H and EM1250H meter

Reset screen enables you to reset energy values. The meter's display screen and buttons allow you to navigate to and edit the required parameters.

To enter into reset:

1. From the **Home** page, use **Up** or **Down** button to navigate to **Maintain**.
2. Press **OK**.
3. Use **Up** or **Down** button to navigate to **Reset**.
4. Press **OK**.
5. Enter the password. Default password is 0000.
6. Press **OK**.

The navigation of reset:



Parameters	Description
Energy	User can reset Energy parameters

Meter setup

Editing setup parameters

The following steps describe how to edit parameters in setup mode.

1. From the **Home** page, use **Up** or **Down** button to navigate to **Maintain**.
2. Press **OK**.
3. Press the **Up** or **Down** button to navigate to **Setup**.
4. Press **OK**.
5. Enter password. Default password is 0000.
6. Press **OK**.
7. Press the **Up** or **Down** button to select a parameter to edit.
8. Press **OK** button.
9. Increase or decrease the digit value or select a value from a pre-programmed list using the **Up** or **Down** button.
10. Press **OK** after making the required changes.
11. Press **Left** button.
12. Select **Yes** to save your settings.

    Done message displays.

NOTE: Select **No** to exit setup mode without saving any settings.

Button functions in editing setup parameters

Mode	Button	Function
Setup menu		*Flashing digit:* To decrease the numeric value. *Flashing value:* To view the previous value from the list.
		*Flashing digit:* To increase the numeric value. *Flashing value:* To view the next value from the list.
		*Flashing digit:* To move the position of the cursor to left.to Exiting from editing **Setup** page.
		To select a parameter to edit the values. To save the changes made to setup parameter.

Setup screen menus

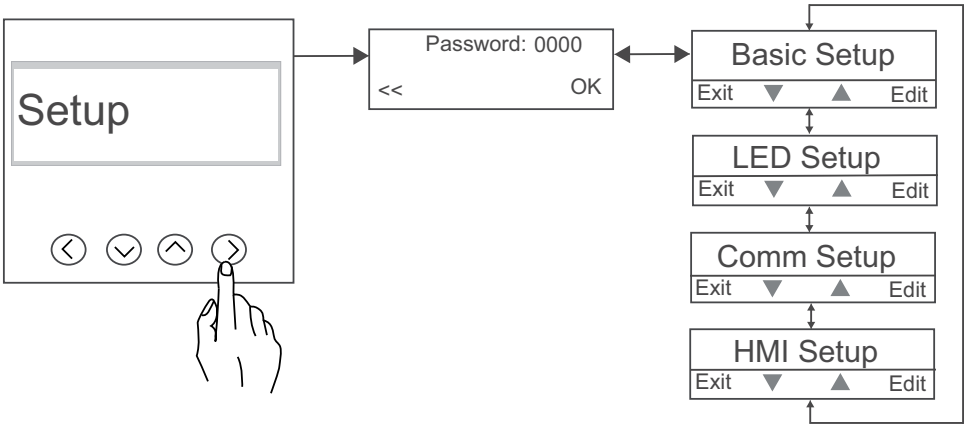
Setup screen enables you to configure various setup parameters

To enter into setup:

1. From the **Home** page, use **Up** or **Down** button to navigate to **Maintain**.
2. Press **OK**.
3. Use **Up** or **Down** button to navigate to **Setup**.
4. Press **OK**.

5. Enter the password. Default password is 0000.
6. Press **OK**.
7. Use **Up** or **Down** button to navigate to **Setup** pages.
8. Press **Left** button to exit.

The navigation of setup:



Setup Parameters	Description
Basic Setup	You can edit the basic setup parameters
LED Setup (EM1250H / EM1220H)	You can edit LED setup parameters
Comm Setup	You can edit Communication setup parameters
HMI Setup	You can edit HMI setup parameters

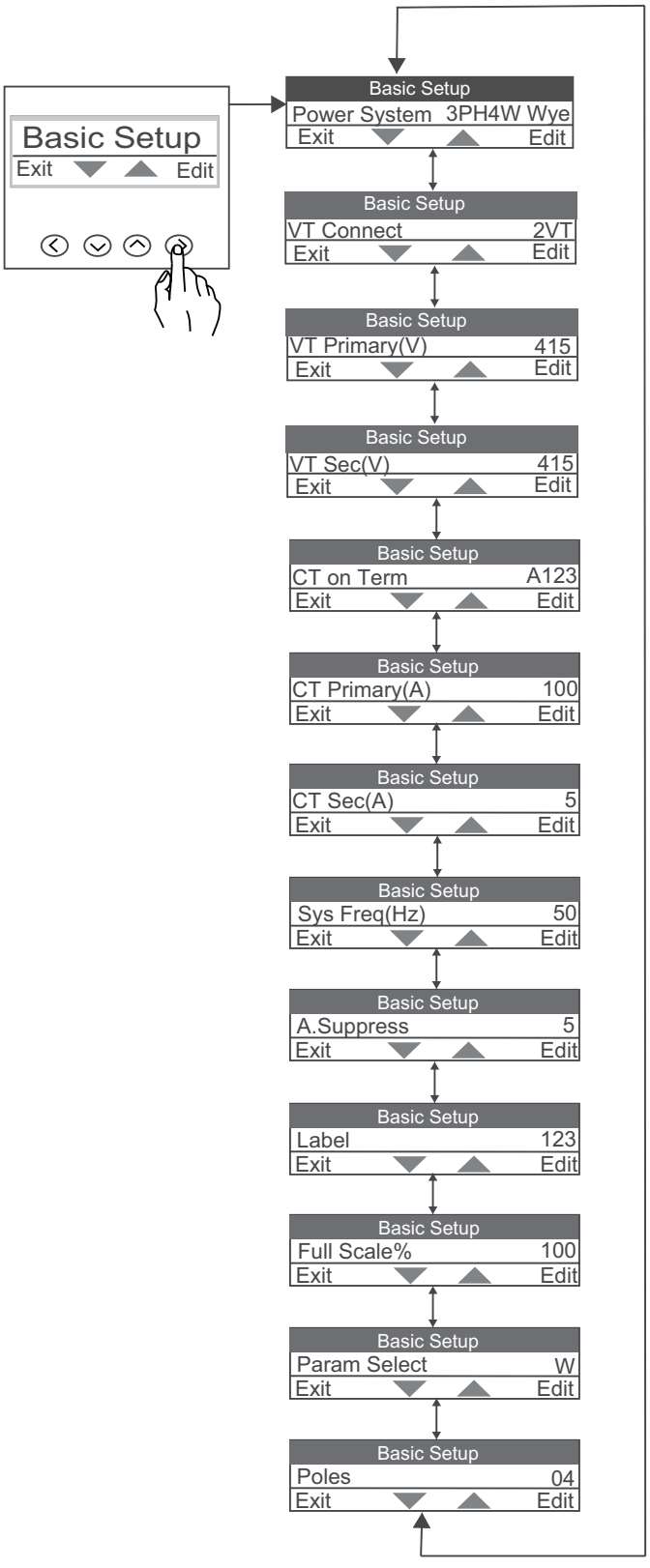
Basic setup

Basic setup parameters is essential for accurate measurement and calculations. Use the Basic setup screen to define the electrical power system that the meter is monitoring.

To enter into Basic Setup:

1. From the **Home** page, use **Up** or **Down** button to navigate to **Maintain**.
2. Press **OK**.
3. Use **Up** or **Down** button to navigate to **Setup**.
4. Press **OK**.
5. Enter the password. Default password is 0000.
6. Press **OK**.
7. Use **Up** or **Down** button to navigate to **Basic Setup**.
8. Press **OK** to enter **Basic Setup**.
9. Press **Left** button to exit **Basic Setup** after viewing parameters.

The navigation of Basic setup:



LED setup

NOTE: Applicable for EM1250H / EM1220H

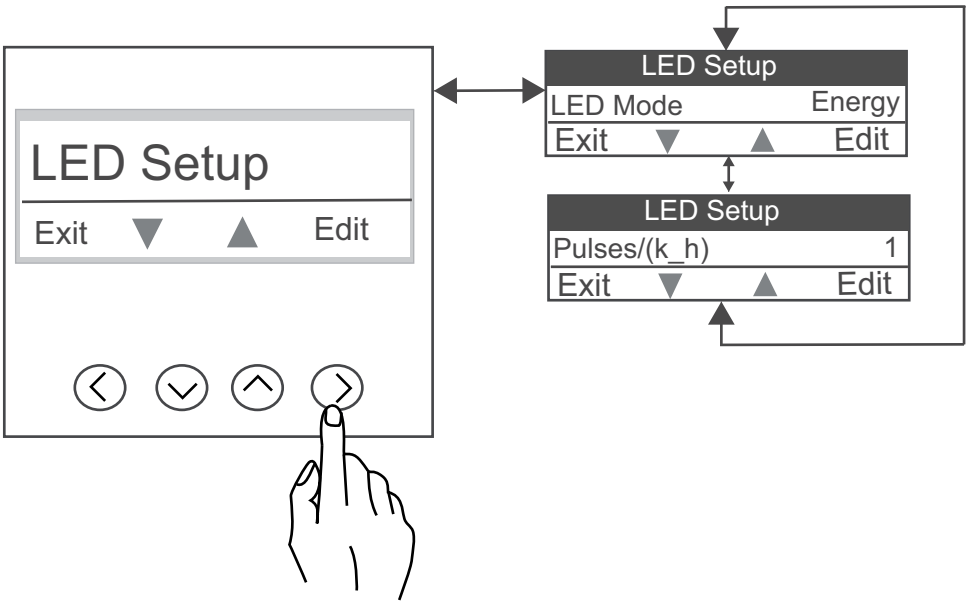
LED setup enables you to configure LED parameters. The meter's display screen and buttons allow you to navigate to and edit the required parameters.

To enter into LED Setup:

1. From the **Home** page, use **Up** or **Down** button to navigate to **Maintain**.
2. Press **OK**.

3. Use **Up** or **Down** button to navigate to **Setup**.
4. Press **OK**.
5. Enter the password. Default password is 0000.
6. Use **Up** or **Down** button to navigate to **LED Setup**.
7. Press **OK** to enter **LED Setup**.
8. Press **Left** button to exit **LED Setup** after viewing parameters.

The navigation of LED setup:



Comm(Communication) setup

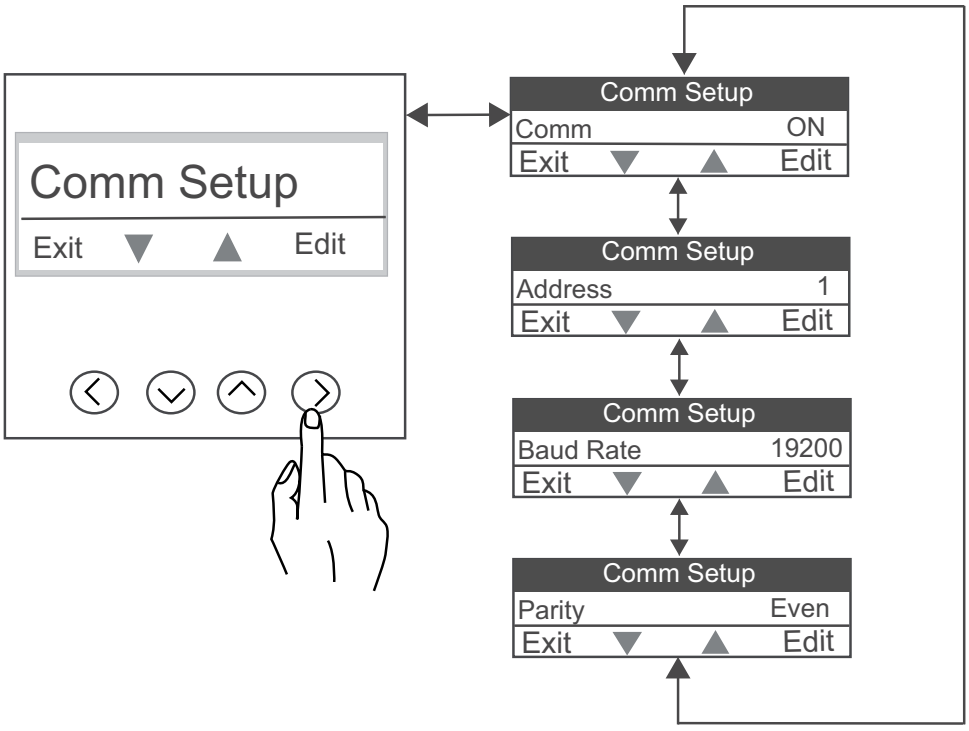
Communication setup enables you to configure communication, address, baud rate, and parity parameters

The meter's display screen and buttons allow you to navigate to and edit the required parameters.

To enter into Comm Setup:

1. From the **Home** page, use **Up** or **Down** button to navigate to **Maintain**.
2. Press **OK**.
3. Use **Up** or **Down** button to navigate to **Setup**.
4. Press **OK**.
5. Enter the password. Default password is 0000.
6. Use **Up** or **Down** button to navigate to **Comm Setup**.
7. Press **OK** to enter **Comm Setup**.
8. Press **Left** button to exit **Comm Setup** after viewing parameters.

The navigation of Communication setup:



HMI setup

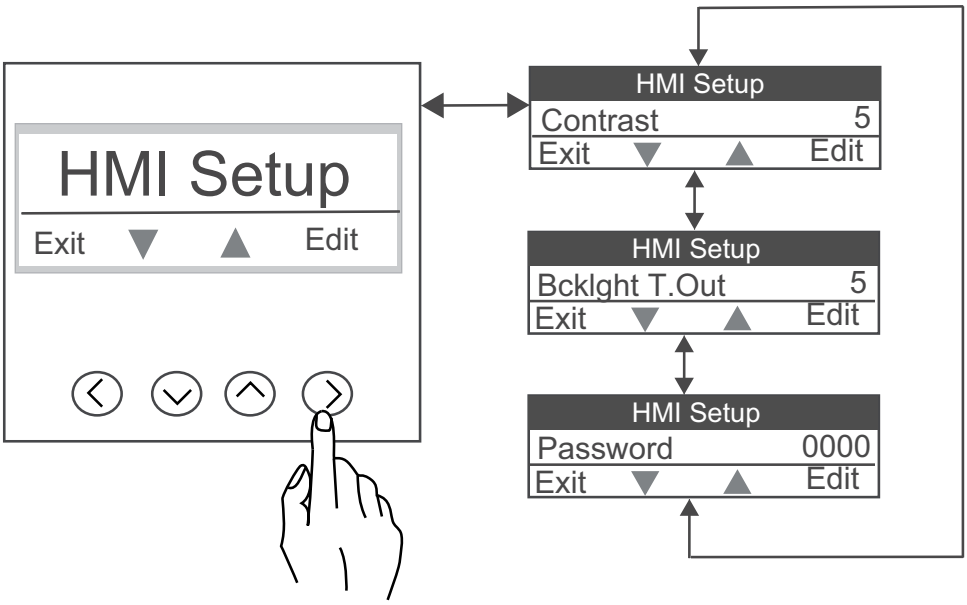
HMI setup enables you to configure contrast, backlight time-out and password parameters.

The meter's display screen and buttons allow you to navigate to and edit the required parameters.

To enter into HMI Setup:

1. From the **Home** page, use **Up** or **Down** button to navigate to **Maintain**.
2. Press **OK**.
3. Use **Up** or **Down** button to navigate to **Setup**.
4. Press **OK**.
5. Enter the password. Default password is 0000.
6. Use **Up** or **Down** button to navigate to **HMI Setup**.
7. Press **OK** to enter **HMI Setup**.
8. Press **Left** button to exit **HMI Setup** after viewing parameters.

The navigation of HMI setup:



Setup parameters

Name on display	Description	Input range	Default value
Basic Setup			
Power System	Power System Configurations	[1PH2W LN, 1PH2W LL, 1PH3W LL, 3PH3W Dlt, 3PH4W Wye]	3PH4W Wye
VT Connect	Voltage Transformer	[Direct Con, 2.VT, 3.VT, 1.VT] **NOTE:** The VT Connect parameters are enabled based on selected power system configuration.	Direct Con
VT Primary(V)	Primary Voltage (V L-L)	[100 V - 999000 V] **NOTE:** VT.Primary(V) is not enabled if VT Connect is Direct Con.	415
VT Sec(V)	Secondary Voltage (V L-L)	[100, 110, 115, 120, 415] **NOTE:** VT.Sec(V) is not enabled if VT Connect is Direct Con.	415
CT on Term	Current Transformer	[A.1, A.2, A.3, A.12, A.23, A.31, A.123] **NOTE:** The CT on Term parameters are enabled based on the selected power system and VT connect configuration.	A.123
CT Primary(A)	CT Primary	[1 A - 32767 A]	100
CT Sec(A)	CT Secondary	[1 A, 5 A]	5
Sys Freq(Hz)	System Frequency	[50 Hz, 60 Hz]	50
A.Suppress	A.Suppression (Minimum current at which meter starts functioning)	[5 - 99 mA]	5
Label	Phase labeling	[123, ABC, RST, PQR, RYB]	123
Full Scale%	Full scale value (Rescaling CT loading)	[1 - 100]	100
Param Select	Parameter selection	[VA, W, VAR]	W
Poles	To determine RPM of alternator / generator based on number of poles and network frequency	[02, 04, 06, 08, 10, 12, 14, 16]	04

LED Setup			
LED Mode	LED parameter	[OFF, Energy] **NOTE:** Pulses/(k_h) is enabled when LED Mode is Energy of [1 to 9999000]	OFF
Communication Setup			
COMM	Communication • ON / OFF: To enable / disable communications port. • Retrofit : For configuring legacy communication data models.	[ON, OFF, Retrofit,]	ON
Address	Unit ID	[1-247]	1
Baud Rate	BPS (Baud rate per second)	[4800, 9600, 19200, 38400]	19200
Parity	Parity	[Even, Odd, None]	Even
HMI Setup			
Contrast	Contrast	[0 - 9]	5
Bcklght T.Out	Backlight time out	[0 - 60]	5
Password	Password	[0000 - 9999]	0000

Lock / unlock

Lock enables you to set the meter screen to default screen. You can scroll to other display screens while a screen is locked. Once the manual scrolling is stopped, the meter displays the default (lock) screen after 4 minutes.

Locking / unlocking meter screen

The meter's display screen and buttons allow you to lock or unlock any screen.

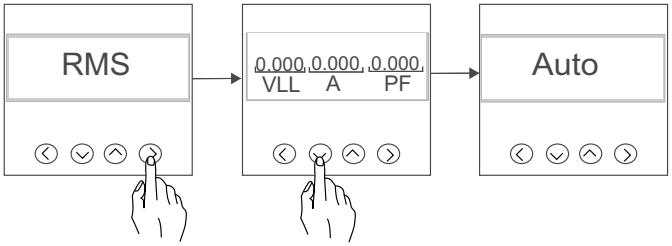
Press and hold the **Up** and **Down** buttons simultaneously for 2 seconds to lock or unlock a meter screen.

NOTE:

You can only lock the display parameters. You cannot enter the **Setup** or **Reset** when a meter screen is locked.

Auto scroll

Auto-scroll allows you to monitor a group of display pages sequentially, every ten seconds, without manual key operation. This is convenient for viewing from a distance.



NOTE: If you press any key during auto scroll, it will change to manual scroll operation.

Favourite page

The meter allows you to select 3 parameters and arrange them in required order to be displayed in favourite page. These parameters can be selected only through communication and are based on your requirements. Some parameter logs are of utmost importance and navigating to those parameters takes time. For ease of navigation and accessibility, the meter allows you to lock the page for easy reading. The selectable parameters are:

- V L-L
- V L-N
- A
- F
- W
- PF

Serial communications

The meter supports serial communication through the RS-485 port.

In an RS-485 network, there is one master device, typically an Ethernet to RS-485 gateway. It provides the means for RS-485 communications with multiple slave devices (for example, meters). For applications that require only one dedicated computer to communicate with the slave devices, an RS-232 to RS-485 converter can be used as the master device. In master device, recommended response time-out setting should be minimum 1 second.

RS-485 configuration

Before connecting your device to the RS-485 bus, use the meter's display, or ION Setup to configure your meter's default RS-485 settings.

Your meter has one RS-485 connection.

Your meter must have a unique unit identifier (address) and have the following settings match the rest of the devices on the RS-485 bus:

- Protocol
- Baud rate
- Parity

You can use a communications converter (USB to RS-485 or RS-232 to RS-485) to connect to your meter.

Serial protocols

Your meter supports the serial communication protocol on its RS-485 port.

- Modbus RTU

RS-485 wiring

Connect the devices on the RS-485 bus in a point-to-point configuration, with the (+) and (-) terminals from one device connected to the corresponding (+) and (-) terminals on the next device.

RS-485 cable

Use a shielded 2 wire or 1 twisted pair RS-485 cable to wire the devices. Use either shielded 2 wire or 1 twisted pair to connect the (+) and (-) terminals.

The total distance for devices connected on an RS-485 bus should not exceed 900 m (2953 ft).

NOTE: You can connect a maximum of 32 devices to a single RS-485 bus.

RS-485 terminals

-	Data minus. This transmits/receives the inverting data signals.
+	Data plus. This transmits/receives the non-inverting data signals.

RS-485 network configuration

After you have wired the RS-485 port and powered up the meter, you must configure the serial communications port in order to communicate with the meter.

Each device on the same RS-485 communications bus must have a unique address and all connected devices must be set to the same protocol, baud rate, and parity (data format).

NOTE: To communicate with the meter using ION Setup, you must set the serial site and all connected devices in the RS-485 network to the same parity setting.

For meters that do not have a display, you must first wire and configure each one separately before connecting these meters to the same RS-485 bus.

Remote meter setup

Overview

You can configure the meter's setup parameters through the meter's RS-485 communications port.

The meter is factory-configured with default RS-485 communications port settings. You must modify the default settings before connecting the meter to your RS-485 network. To configure the RS-485 port, you need:

- ION Setup

ION setup

Go to www.se.com and search for ION Setup to download a copy of the installation file.

If you already have an existing installation of ION Setup, it is recommended that you upgrade to the latest version in order to access new features or enhancements and properly configure features available on your device.

Refer to the online help to learn how to use ION Setup.

RS-485 port setup

The meter is factory-configured with default serial communications settings that you may need to modify before connecting the meter to the RS-485 bus.

The meter is factory-configured with the following default serial communications settings:

- Protocol = Modbus RTU
- Address = 1
- Baud rate = 19200
- Parity = Even

You can use a communications converter (USB to RS-485 or RS-232 to RS-485) device to connect to the meter.

Meter setup through RS-485

After the meter's RS-485 port is configured and connected to the RS-485 network, you can use ION Setup to configure all other meter setup parameters.

Using a serial communications converter to set up RS-485

You can use a communications converter (USB to RS-485 or RS-232 to RS-485) to connect to the meter.

NOTE: Configuring the serial communications settings using this method may cause ION Setup to lose communications when the changes are sent to your meter. You must reconfigure ION Setup to match the new settings to re-establish communications with your meter.

1. Configure the serial communications converter's settings to be compatible with the meter's default communications settings.
2. Connect the meter's RS-485 port to the serial communications converter.
3. Connect the communications converter to the computer.

4. Start ION Setup in Network mode.
5. Add a serial site and set its properties:
   - Comm link = Serial
   - Comm port = select which serial (or USB) port the communications converter is attached to
   - Baud rate = 19200
   - Format = select a format with even parity
6. Add a meter to the site and set its properties:
   - Type = Device name
   - Unit ID = 1
7. Use the setup screens to modify the meter's setup parameters.
8. Use the **RS-485 Base Comm** setup screen to modify the meter's serial communication settings.
9. Click **Send** to save your changes to the meter. You need to reconfigure ION Setup to match the changed settings in order to re-establish communications with your meter.
10. Exit ION Setup.

RS-485 port settings

Parameter	Values	Description
Protocol	Modbus RTU	Select the communications format used to transmit data. The protocol must be the same for all devices in a communications loop. ION Setup does not support ASCII 8, ASCII 7 or JBus protocols.
Address	1 to 247	Set the address for this device. The address must be unique for each device in a communications loop.
Baud rate	4800, 9600, 19200, 38400	Select the speed for data transmission. The baud rate must be the same for all devices in a communications loop.
Parity	Even, Odd, None	Select **None** if the parity bit is not used. The parity setting must be the same for all devices in a communications loop.

Meter configuration using ION Setup

Start ION Setup, create a site (or if applicable, use an existing site), then add your meter to the site.

Refer to the ION Setup device configuration guide for information about your meter. To download a copy, go to www.se.com and search for ION Setup device configuration guide.

Measurements and calculations

Meter initialization

Meter Initialization is a special command that clears the meter's energy, power, and meter operation timer.

It is common practice to initialize the meter after its configuration is completed, before adding it to an energy management system.

After configuring all the meter setup parameters, navigate through the different meter display screens and make sure the displayed data is valid then perform meter initialization.

NOTE: You can perform meter initialization using ION setup and secured command interface.

Real-time readings

The meter measures currents and voltages, and reports in real time the RMS (Root Mean Squared) values for all three phases and neutral.

The voltage and current inputs are continuously monitored at a sampling rate of 32 samples per cycle. This amount of resolution helps enable the meter to provide reliable measurements and calculated electrical values for various commercial, buildings and industrial applications.

Power and Energy measurements

The meter lets you configure any one power parameter (W, VA, or VAR) at a time. You can set it using the meter's display, through communication using ION Setup, or by any Modbus tool that supports FC16 (command number is 2959).

Energy accumulation in the meter depends on the selected power parameter (W, VA, or VAR). Integrated energy values, non reset energy and old values also depends on the selected power parameter.

NOTE:

- On changing the power parameter (either through meter display or communication), all the stored energy values (old and integrated) are reset to zero.
- Energy values can also be cleared through communication. Run Hours are displayed with 6 digit Hours and 2 Digit Minutes.

Timer

The meter supports meter on hours and load run hours (only Utility, Alternate source and Total).

The timer data can be read through register map.

Meter on hours

Meter on hours show how long the meter has been powered up.

Load run hours

Load run hours show how much time a load has been running, based on accumulated energy - received and delivered.

Power quality

Harmonics overview

This section describes the meter's power quality features and how to access power quality data. The meter measures voltage and current harmonics up to the 15th harmonic to calculate Total Harmonic Distortion (THD%).

Harmonics are integer multiples of the fundamental frequency of the power system. Harmonics information is required for compliance to system power quality standards such as EN50160 and meter power quality standards such as IEC 61000-4-30.

The meter measures fundamental and higher harmonics relative to the fundamental frequency. The meter's power system setting defines which phases are present and determines how line-to-line or line-to-neutral voltage harmonics and current harmonics are calculated.

Harmonics are used to identify whether the supplied system power meets required power quality standards, or if non-linear loads are affecting your power system. Power system harmonics can cause current flow on the neutral conductor, and damage to equipment such as increased heating in electric motors. Power conditioners or harmonic filters can be used to minimize unwanted harmonics.

Total harmonic distortion %

Total harmonic distortion (THD%) is a measure of the total per-phase voltage or current harmonic distortion present in the power system.

THD% provides a general indication of the quality of a waveform. THD% is calculated for each phase of both voltage and current.

THD% calculations

THD% is a quick measure of the total distortion present in a waveform and is the ratio of harmonic content (H_C) to the fundamental harmonic (H_1).

By default, the meter uses the following equation to calculate THD%:

$$THD = \frac{H_C}{H_1} \times 100\%$$

Displaying harmonics data

The meter displays voltage and current THD%, refer to .

Power and power factor

Power and power factor

The sampled measurements taken at the meter's voltage and current inputs provide data for calculating power and power factor.

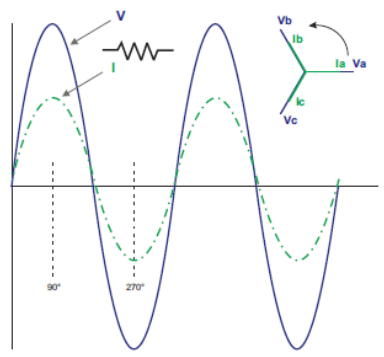
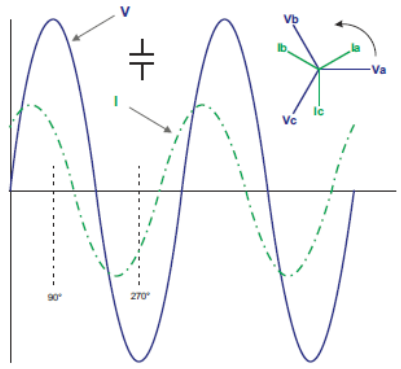
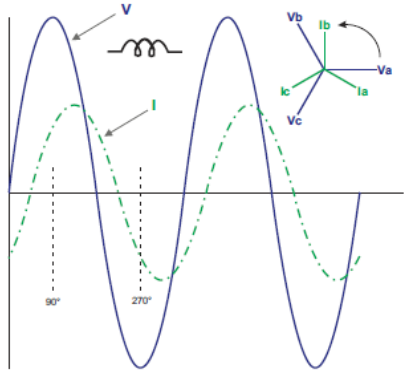
In a balanced 3-phase alternating current (AC) power system source, the AC voltage waveforms on the current-carrying conductors are equal but offset by one-third of a period (a phase angle shift of 120 degrees between the three voltage waveforms).

Current phase shift from voltage

Electrical current can lag, lead, or be in phase with the AC voltage waveform, and is typically associated with the type of load — inductive, capacitive or resistive.

For purely resistive loads, the current waveform is in phase with the voltage waveform. For capacitive loads, current leads voltage. For inductive loads, current lags voltage.

The following diagrams show how voltage and current waveforms shift based on load type under ideal (laboratory) conditions.

Current and voltage in phase (resistive)	Current leads voltage (capacitive)	Current lags voltage (inductive)
		

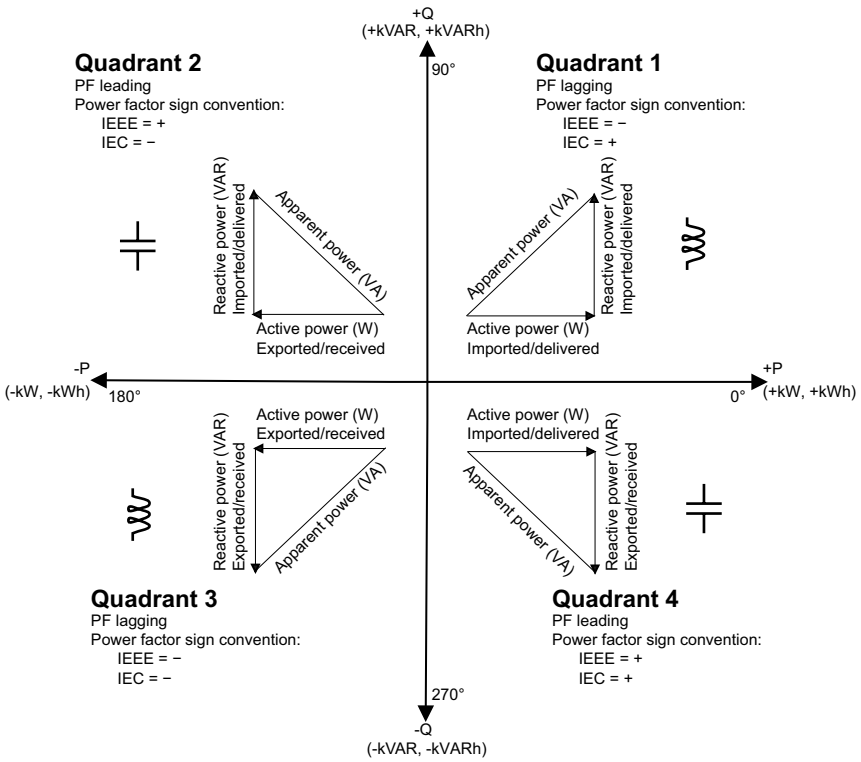
Real, reactive and apparent power (PQS)

A typical AC electrical system load has both resistive and reactive (inductive or capacitive) components.

Real power, also known as active power (P) is consumed by resistive loads. Reactive power (Q) is either consumed by inductive loads or generated by capacitive loads.

Apparent power (S) is the capacity of your measured power system to provide real and reactive power.

The units for power are watts (W or kW) for real power P, vars (VAR or kVAR) for reactive power Q, and volt-amps (VA or kVA) for apparent power S.



Power flow

Positive real power P(+) flows from the power source to the load. Negative real power P(-) flows from the load to the power source.

Power factor (PF)

Power factor (PF) is the ratio of real power (P) to apparent power (S).

Power factor is provided as a number between -1 and 1 or as a percentage from -100% to 100%, where the sign is determined by the convention.

$$PF = \frac{P}{S}$$

An ideal, purely resistive load has no reactive components, so its power factor is one (PF = 1, or unity power factor). Inductive or capacitive loads introduce a reactive power (Q) component to the circuit which causes the PF to become closer to zero.

True PF

The meter supports true power factor values:

- True power factor includes harmonic content.

Power factor sign convention

Power factor sign (PF sign) can be positive or negative, and is defined by the conventions used by IEC standards.

PF sign convention: IEC

PF sign correlates with the direction of real power (kW) flow.

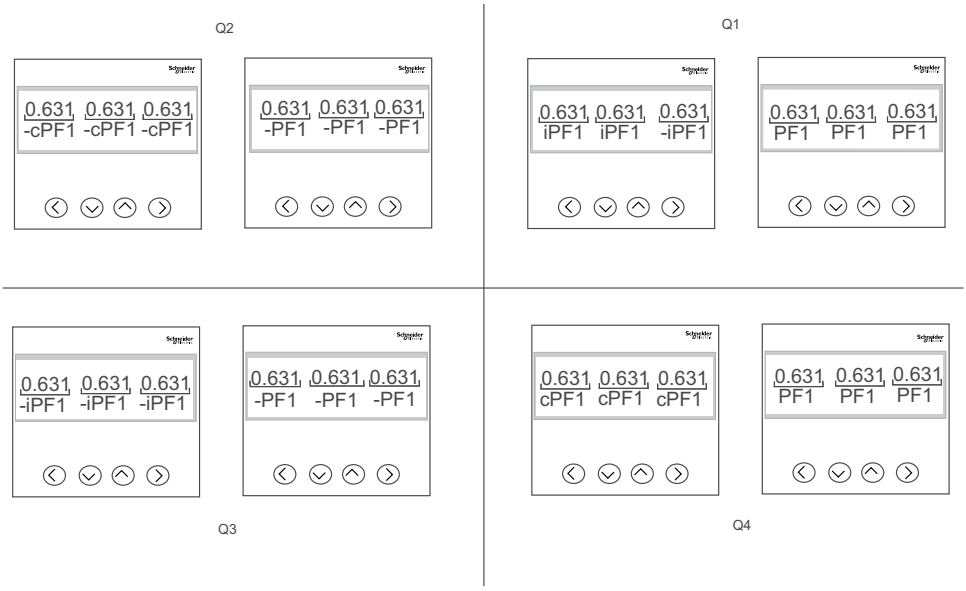
- Quadrant 1 and 4: Positive real power (+kW), the PF sign is positive (+).

- Quadrant 2 and 3: Negative real power (-kW), the PF sign is negative (-).

IEC -1 to +1 format

Quadrant	PF Range	HMI Representation with sign	PF in RS-485 Comm (Reg IEC format)
Quadrant 1	0 to +1	Inductive (+)	Positive Sign
Quadrant 2	-1 to 0	Capacitive (-)	Negative sign
Quadrant 3	0 to -1	Inductive (-)	Negative Sign
Quadrant 4	+1 to 0	Capacitive(+)	Positive Sign

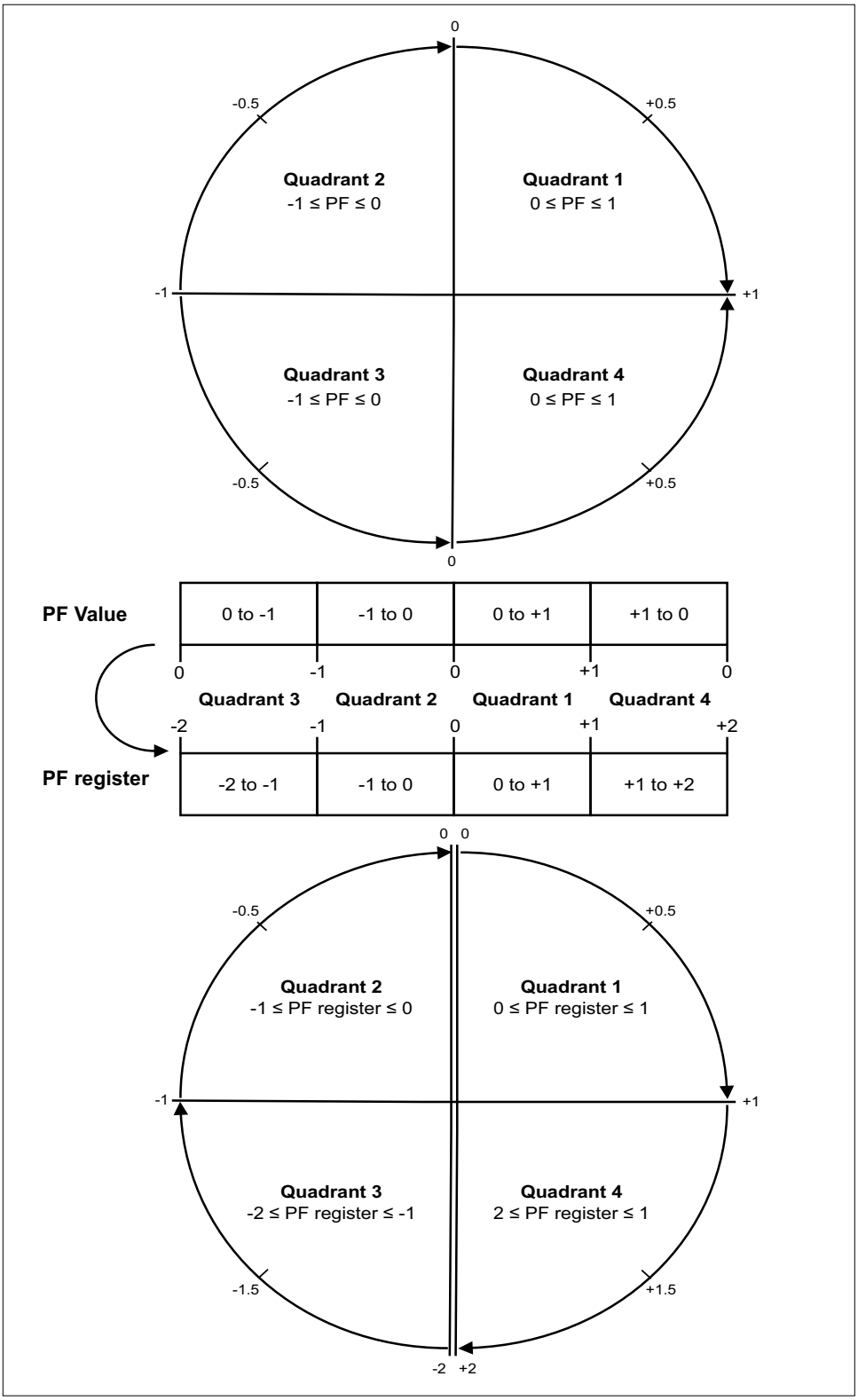
Sample screen



Power factor register format

The meter performs a simple algorithm to the PF value then stores it in the PF register.

Each power factor value (PF value) occupies one floating point register for power factor (PF register). The meter and software interpret the PF register for all reporting or data entry fields according to the following diagram:



The PF value is calculated from the PF register value using the following formulae:

Quadrant	PF range (in display)	PF register range (through communication)	PF formula
Quadrant 1	0 to +1	0 to +1	PF value = PF register value
Quadrant 2	-1 to 0	-1 to 0	PF value = PF register value
Quadrant 3	0 to -1	-2 to -1	PF value = (-2) - (PF register value)
Quadrant 4	+1 to 0	+1 to +2	PF value = (+2) - (PF register value)

Verifying accuracy

Overview of meter accuracy

All meters are tested and verified at the factory in accordance with International Electrotechnical Commission (IEC) and Institute of Electrical and Electronics Engineers (IEEE) standards.

Your meter typically does not require re-calibration. However, in some installations a final accuracy verification of the meters is required, especially if the meters will be used for revenue or billing applications.

Accuracy test requirements

The most common method for testing meter accuracy is to apply test voltages and currents from a stable power source and compare the meter's readings with readings from a reference device or energy standard.

Signal and power source

The meter maintains its accuracy during voltage and current signal source variations but its energy pulsing output needs a stable test signal to help produce accurate test pulses. The meter's energy pulsing mechanism needs approximately 10 seconds to stabilize after every source adjustment.

The meter must be connected to control power in order to conduct accuracy verification testing. Refer to your meter's installation documentation for power supply specifications.

⚠⚠DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Verify the device's power source meets the specifications for your device's power supply.

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

Control equipment

Control equipment is required for counting and timing the pulse outputs from an energy pulsing LED.

- Most standard test benches have an arm equipped with optical sensors to detect LED pulses (the photodiode circuitry converts detected light into a voltage signal).
- The reference device or energy standard typically has digital inputs that can detect and count pulses coming from an external source (i.e., the meter's pulse output).

  NOTE: The optical sensors on the test bench can be disrupted by strong sources of ambient light (such as camera flashes, florescent tubes, sunlight reflections, floodlights, etc.). This can cause test errors. Use a hood, if necessary, to block out ambient light.

Environment

The meter should be tested at the same temperature as the testing equipment. The ideal temperature is about 23 ºC (73 ºF). Make sure the meter is warmed up sufficiently before testing.

A warm-up time of 30 minutes is recommended before beginning energy accuracy verification testing. At the factory, the meters are warmed up to their typical operating temperature before calibration to help ensure that the meters will reach their optimal accuracy at operating temperature.

Most high precision electronic equipment requires a warm up time before it reaches its specified performance levels. Energy meter standards allow the manufacturers to specify meter accuracy derating due to ambient temperature changes and self-heating.

Your meter complies with and meets the requirements of these energy metering standards.

For a list of accuracy standards that your meter complies to, contact your local Schneider Electric representative or download the meter brochure from *www.schneider-electric.co.in*.

Reference device or energy standard

To help ensure the accuracy of the test, it is recommended that you use a reference device or reference energy standard with a specified accuracy that is 6 to 10 times more accurate than the meter under test. Before you start testing, the reference device or energy standard should be warmed up as recommended by its manufacturer.

NOTE: Verify the accuracy and precision of all measurement equipment used in accuracy testing (for example, voltmeters, ammeters, power factor meters).

Verifying accuracy test

The following tests are guidelines for accuracy testing your meter; your meter shop may have specific testing methods.

⚠⚠DANGER

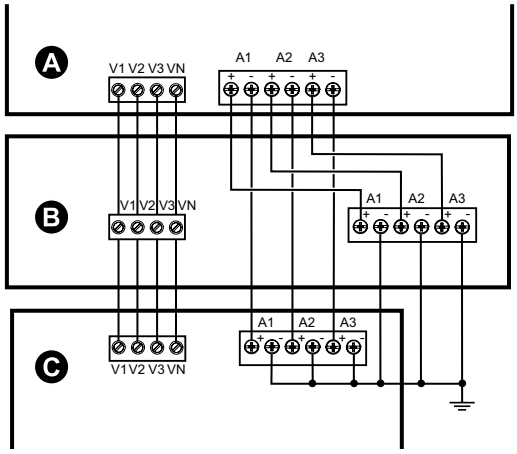
HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E in the USA, CSA Z462 or applicable local standards.
- Turn off all power supplying this device and the equipment in which it is installed before working on the device or equipment.
- Always use a properly rated voltage sensing device to confirm that all power is off.
- Do not exceed the device's ratings for maximum limits.
- Verify the device's power source meets the specifications for your device's power supply.

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

1. Turn off all power supplying this device and the equipment in which it is installed before working on the device or equipment.
2. Use a properly rated voltage sensing device to confirm that all power is off.

3. Connect the test voltage and current source to the reference device or energy standard. Ensure all voltage inputs to the meter under test are connected in parallel and all current inputs are connected in series.



A	Reference device or energy standard
B	Test voltage and current source
C	Meter under test

4. Connect the control equipment used for counting the standard output pulses using one of these methods:

Option	Description
Energy pulsing LED	Align the red light sensor on the standard test bench armature over the energy pulsing LED.
Pulse output	Connect the meter's pulse output to the standard test bench pulse counting connections.

NOTE: When selecting which method to use, be aware that energy pulsing LEDs and pulse outputs have different pulse rate limits.

5. Before performing the verification test, let the test equipment power up the meter and apply voltage for at least 30 seconds. This helps stabilize the internal circuitry of the meter.
6. Configure the meter's parameters for verifying accuracy testing.
7. Depending on the method selected for counting the energy pulses, configure the meter's energy pulsing LED or one of the pulse outputs to perform energy pulsing. Set the meter's energy pulse constant so it is in sync with the reference test equipment.
8. Perform accuracy verification on the test points. Run each test point for at least 30 seconds to allow the test bench equipment to read an adequate number of pulses. Allow 10 seconds of dwell time between test points.

Required pulses calculation for accuracy verification testing

Accuracy verification test equipment typically requires you to specify the number of pulses for a specific test duration.

The reference test equipment typically requires you to specify the number of pulses required for a test duration of "t" seconds. Normally, the number of pulses required is at least 25 pulses, and the test duration is greater than 30 seconds.

Use the following formula to calculate the required number of pulses:

Number of pulses = Ptot x K x t/3600

Where:

- Ptot = total instantaneous power in kilowatts (kW)
- K = the meter's pulse constant setting, in pulses per kWh
- t = test duration, in seconds (typically greater than 30 seconds)

Total power calculation for accuracy verification testing

Accuracy verification testing supplies the same test signal (total power) to both the energy reference/standard and the meter under test.

Total power is calculated as follows, where:

- Ptot = total instantaneous power in kilowatts (kW)
- VLN = test point line-to-neutral voltage in volts (V)
- I = test point current in amps (A)
- PF = power factor

The result of the calculation is rounded up to the nearest integer.

For a balanced 3–phase Wye system:

Ptot = 3 x VLN x I x PF x 1 kW/1000 W

NOTE: A balanced 3–phase system assumes that the voltage, current and power factor values are the same for all phases.

For a single-phase system:

Ptot = VLN x I x PF x 1 kW/1000W

Percentage error calculation for accuracy verification testing

Accuracy verification testing requires you to calculate the percentage error between the meter being tested and the reference/standard.

Calculate the percentage error for every test point using the following formula:

Energy error = (EM - ES) / ES x 100%

Where:

- EM = energy measured by the meter under test
- ES = energy measured by the reference device or energy standard.

NOTE: If accuracy verification reveals inaccuracies in your meter, they may be caused by typical sources of test errors. If there are no sources of test errors present, please contact your local Schneider Electric representative.

Accuracy verification test points

The meter should be tested at full and light loads and at lagging (inductive) power factors to help ensure testing over the entire range of the meter.

The test amperage and voltage input rating are labeled on the meter. Refer to the installation sheet or data sheet for your meter's nominal current, voltage and frequency specifications.

Watt-hour test point	Sample accuracy verification test point
Full load	100% to 200% of the nominal current, 100% of the nominal voltage and nominal frequency at unity power factor or one (1).
Light load	10% of the nominal current, 100% of the nominal voltage and nominal frequency at unity power factor or one (1).
Inductive load (lagging power factor)	100% of the nominal current, 100% of the nominal voltage and nominal frequency at 0.50 lagging power factor (current lagging voltage by 60° phase angle).

VAR-hour test point	Sample accuracy verification test point
Full load	100% to 200% of the nominal current, 100% of the nominal voltage and nominal frequency at zero power factor (current lagging voltage by 90° phase angle).
Light load	10% of the nominal current, 100% of the nominal voltage and nominal frequency at zero power factor (current lagging voltage by 90° phase angle).
Inductive load (lagging power factor)	100% of the nominal current, 100% of the nominal voltage and nominal frequency at 0.87 lagging power factor (current lagging voltage by 30° phase angle).

Energy pulsing considerations

The meter's energy pulsing LED and pulse outputs are capable of energy pulsing within specific limits.

Description	Energy pulsing LED	Pulse output
Maximum pulse frequency	35 Hz	20 Hz
Minimum pulse constant	1 pulse per k_h	
Maximum pulse constant	9,999,000 pulses per k_h	

The pulse rate depends on the voltage, current and PF of the input signal source, the number of phases, and the VT and CT ratios.

If Ptot is the instantaneous power (in kW) and K is the pulse constant (in pulses per kWh), then the pulse period is:

$$\text{Pulse period (in seconds)} = \frac{3600}{K \times Ptot} = \frac{1}{\text{Pulse frequency (Hz)}}$$

VT and CT considerations

Total power (Ptot) is derived from the values of the voltage and current inputs at the secondary side, and takes into account the VT and CT ratios.

The test points are always taken at the secondary side, regardless of whether VTs or CTs are used.

If VTs and CTs are used, you must include their primary and secondary ratings in the equation. For example, in a balanced 3-phase Wye system with VTs and CTs:

$$Ptot = 3 \times VLN \times \frac{VT_p}{VT_s} \times I \times \frac{CT_p}{CT_s} \times PF \times \frac{1\ kW}{1000\ W}$$

where Ptot = total power, VT_p = VT primary, VT_s = VT secondary, CT_p = CT primary, CT_s = CT secondary and PF = power factor.

Example calculations

This example calculation shows how to calculate power, pulse constants and maximum pulse frequency, and how to determine a pulse constant that reduces the maximum pulse frequency.

A balanced 3-phase Wye system uses 480:120 volt VTs and 120:5 amp CTs. The signals at the secondary side are 119 volts line-to-neutral and 5.31 amps, with a power factor of 0.85. The desired pulse output frequency is 20 Hz (20 pulses per second).

1. Calculate the typical total output power (Ptot):

$$Ptot = 3 \times 119 \times \frac{480}{120} \times 5.31 \times \frac{120}{5} \times 0.85 \times \frac{1\ kW}{1000\ W} = 154.71\ kW$$

2. Calculate the pulse constant (K):

$$K = \frac{3600 \times (\text{pulse frequency})}{Ptot} = \frac{3600\ \text{seconds/hour} \times 20\ \text{pulses/second}}{154.71\ kW}$$

$$K = 465.5\ \text{pulses / kWh}$$

3. At full load (120% of nominal current = 6 A) and power factor (PF = 1), calculate the maximum total output power (Pmax):

$$Pmax = 3 \times 119 \times \frac{480}{120} \times 6 \times \frac{100}{5} \times 1 \times \frac{1\ kW}{1000\ W} = 205.6\ kW$$

4. Calculate the maximum output pulse frequency at Pmax:

$$\text{Maximum pulse frequency} = \frac{K \times Pmax}{3600} = \frac{465.5\ \text{pulses / kWh} \times 205.6\ kW}{3600\ \text{seconds/hour}}$$

$$\text{Maximum pulse frequency} = 26.6\ \text{pulses/second} = 26.6\ Hz$$

5. Check the maximum pulse frequency against the limits for the LED and pulse outputs:
   - 26.6 Hz ≤ LED maximum pulse frequency (35 Hz)
   - 26.6 Hz > pulse output maximum pulse frequency (20 Hz)

   NOTE: The maximum pulse frequency is within the limits for LED energy pulsing. However, the maximum pulse frequency is greater than the limits for pulse output energy pulsing. Pulse output frequencies greater than 20 Hz will saturate the pulse output and cause it to stop pulsing. Therefore in this example, you can only use the LED for energy pulsing.

Adjustments to allow energy pulsing at the pulse outputs

If you want to use the pulse output, you must reduce the output pulse frequency so it is within the limits.

Using the values from the above example, the maximum pulse constant for the pulse output is:

$$Kmax = \frac{3600 \times (\text{pulse output maximum pulse frequency})}{Pmax} = \frac{3600 \times 20}{205.6}$$

$$Kmax = 350.14\ \text{pulses per kWh}$$

1. Set the pulse constant (K) to a value below Kmax, for example, 300 pulses/kWh. Calculate the new maximum output pulse frequency at Pmax:

$$\text{New maximum pulse frequency} = \frac{K \times Pmax}{3600} = \frac{300\ \text{pulses/kWh} \times 205.6\ kW}{3600\ \text{seconds/hour}}$$

$$\text{New maximum pulse frequency} = 17.1\ \text{pulses/second} = 17.1\ Hz$$

2. Check the new maximum pulse frequency against the limits for the LED and pulse outputs:
   - 17.1 Hz ≤ LED maximum pulse frequency (35 Hz)
   - 17.1 Hz ≤ pulse output maximum frequency (20 Hz)

   As expected, changing K to a value below Kmax allows you to use the pulse output for energy pulsing.
3. Set the new pulse constant (K) on your meter.

Typical sources of test errors

If you see excessive errors during accuracy testing, examine your test setup and test procedures to eliminate typical sources of measurement errors.

Typical sources of accuracy verification testing errors include:

- Loose connections of voltage or current circuits, often caused by worn-out contacts or terminals. Inspect terminals of test equipment, cables, test harness and the meter under test.
- Meter ambient temperature is significantly different than 23 °C (73 °F).
- Floating (ungrounded) neutral voltage terminal in any configuration with unbalanced phase voltages.
- Inadequate meter control power, resulting in the meter resetting during the test procedure.
- Ambient light interference or sensitivity issues with the optical sensor.
- Unstable power source causing energy pulsing fluctuations.
- Incorrect test setup: not all phases connected to the reference device or the energy standard. All phases connected to the meter under test should also be connected to the reference meter/standard.
- Moisture (condensing humidity), debris or pollution present in the meter under test.

Maintenance and upgrades

Maintenance overview

The meter does not contain any user-serviceable parts. If the meter requires service, contact your local Schneider Electric Technical Support representative.

NOTICE
METER DAMAGE • Do not open the meter case. • Do not attempt to repair any components of the meter. **Failure to follow these instructions can result in equipment damage.**

Do not open the meter. Opening the meter voids the warranty.

Troubleshooting LED indicators

Abnormal heartbeat / serial communications LED behavior could mean potential problems with the meter.

Problem	Probable causes	Possible solutions
LED flash rate does not change when data is sent from the host computer.	Communications wiring	If using a serial-to-RS-485 converter, trace and check that all wiring from the computer to the meter is properly terminated.
	Internal hardware problem	Perform a hard reset: turn off control power to the meter, then re-apply power. If the problem persists, contact Technical Support.
Heartbeat / serial communications LED remains lit and does not flash ON and OFF	Internal hardware problem	Perform a hard reset: turn off control power to the meter, then re-apply power. If the problem persists, contact Technical Support.
Heartbeat / serial communications LED flashes, but the display is blank.	Display setup parameters incorrectly set	Review display parameter setup.

If the problem is not fixed after troubleshooting, contact Technical Support for help and ensure you have your meter's firmware version, model and serial number information available.

Meter memory

The meter stores configuration and logging information in non-volatile memory and a long-life memory chip.

The meter uses its non-volatile memory (NVRAM) to retain all data and metering configuration values.

Firmware version, model, and serial number

You can view the meter's firmware version, model and serial number from the display panel, refer to*Diagnostics page, page 25*

Firmware upgrades

There are a number of reasons why you may want to upgrade your meter's firmware.

Some of the reasons are mentioned below. It is suggested to keep your meter firmware upgraded for optimum performance.

- Improve meter performance (e.g., optimize processing speed)
- Enhance existing meter features and functions
- Add new functionality to the meter
- Achieve compliance to new industry standards

Firmware upgrade using DLF3000

The meter contains firmware that can be upgraded using DLF3000.

1. Download the latest version of DLF3000 from www.se.com, then install it on your computer.

   NOTE: DLF3000 is a free Schneider Electric utility for downloading firmware to your meter.

2. Download your meter's firmware from www.se.com.
3. Start DLF3000.
4. Click **Add**. Navigate to the folder where you saved your meter's firmware.
5. Select the firmware file and click **Open**.
6. Select the firmware, then click **Next**.
7. If you haven't defined an upgrade system yet:
   - Click **New**, then type in the box to assign a system name.
   - Click **Add**, then type in the box to assign a communications connection name.
   - Select the communications driver as Serial Driver.
8. Click **Continue**.
9. Click **Add Device**.
   - Type in the box to assign a device name.
   - Select the device type from the list.
   - Select the connection name, i.e., the one you defined in the previous step.
10. Click **Next**.
11. Make sure the connection name, i.e., the one you defined in the previous step, is still selected. Enter the device address.
12. Select the protocol (e.g., Modbus).
13. Click **OK**.
14. Click **Next**.
15. Select the device name from the **Download Candidate Devices** pane, then click the right arrow button to move the selection to the **Download Target Devices** pane.
16. Select the meter firmware in the **Firmware to** field.
17. Click **Next**.

18. Click **Health Check** to confirm the meter is communicating. The Health Status shows **Passed** to indicate successful communications.
19. Click **Next**.
20. The Firmware Update Group shows the connection name, the firmware version and status (should be “Queued”). The Group Device List shows the device or devices being upgraded. Click **Download**.

    NOTE: A warning message displays, “Warning: Relays on PowerLogic™ Metering Devices will be de-energized if selected for download and will remain in this mode until a successful download is completed. Press **OK** to start the download.”
21. Click **OK**.
    - The Firmware Upgrade Group status changes to Active, then updates to show the current upgrade progress (in percent complete).
    - The Group Device List status shows “Entering Download Mode”, then changes to “Downloading” when the firmware is being downloaded to the meter. “Estimated Time Remaining” shows the firmware download progress.
    - You can also check the progress on meters display panel. The meter display shows “Download in progress” and a shows a dynamically increasing number for “Percent Complete” (up to 100%).
22. When the firmware upgrade is complete, the Firmware Update Group status shows Complete (Passed). The Group Device List status shows Successful Download. Click **Finished**.
23. To exit the download firmware program, click **Yes** when prompted to quit DLF.

    NOTE: A maximum of 6 devices can be upgraded in parallel through DLF.

Technical assistance

Visit www.se.com for support and assistance with lost passwords or other technical problems with the meter.

Make sure you include your meter’s model, serial number and firmware version in your email or have it readily available if calling Technical Support.

Security

Security overview

Your Schneider Electric product is equipped with security-enabling features.

These features arrive in a default state and can be configured for your installation needs. Please note that disabling or modifying settings within the scope of these individual features can impact the overall security robustness of the device and ultimately the security posture of your network in either positive or negative ways. Review the security intent and recommendations for the optimal use of your device's security features.

Products are hardened to increase security robustness. This is an ongoing process consisting of secure development practices, inclusion of security features and testing at our security test facilities. Following system hardening best practices is also necessary to help ensure your overall system security.

See the *Cybersecurity Hardening Best Practices* white paper for suggested best practices.

Security features on your device

Your device comes with security features that you can configure to help protect against unauthorized configuration and access to your device's data through its user interfaces or communications.

Passwords and user accounts

The meter has configurable password for the display.

Leaving the password at the default value makes it easier for a potential attacker to gain unauthorized access to your device. It is recommended that you change your password from the default value.

Password best practices

Recommended password best practices help to improve security on your meter.

- Change your meter's password from the default value.
- Make your meter's passwords as complex as possible.

  NOTE: Make sure that the user password you enter is compatible with the software used to communicate with your device.
- Schedule regular changes to your meter's passwords.
- Record your meter's passwords in a secure location.

If your meter's user access information is lost, you must return the meter to the factory, where your meter is reset to its factory defaults and all logged data is lost.

NOTICE
DATA LOSS Record your device's user and password information in a secure location. **Failure to follow these instructions can result in equipment damage.**

NOTICE

LOSS OF DATA OR PRODUCT CONFIGURATION

Do not let unauthorized personnel gain physical access to the device.

Failure to follow these instructions can result in data loss and loss of access to the device.

Command interface

Command interface

The command interface allows you to configure the power meter by sending specific commands using Modbus protocol. Reference the online Modbus register list for meter commands, results, and data types.

⚠⚠WARNING

UNINTENDED OPERATION

Do not use this device for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.

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

	Command block	Protected command interface	Unprotected command interface
		Register number	Register number
A	Command	5000	5250
B	Semaphore	5001	5251 (Ignored)
C	Parameters	5002 - 5124	5252 - 5374
	Meter results	**Register number**	**Register number**
D	Status	5125	5375
E	Result	5126	5376
F	Data	5127 - 5249	5377- 5499

- **A**: In the **Command** register, enter a meter command.
- **B**: In the **Semaphore** register, when using the protected command interface, enter the semaphore you are given (refer “Using the Protected Command Interface”). The semaphore register cannot be used with unprotected command interface.
- **C**: In the **Parameters** register, enter all parameters for a meter command.
- **D**: The **Status** register displays 0 when the power meter receives a command. Once the command is completed, the status register displays the same value as the command register.
- **E**: The **Result** register indicates if the command was successful, and if not, what is the error that occurred.

  F: The **Data** register displays the executed parameters of a successful command and the invalid parameters based on data type of an unsuccessful command.

There are two command interfaces, protected and unprotected, described in the following sections.

Using protected command interface

To issue a meter command using the protected command interface, you must have a command semaphore.

To get a semaphore, read the semaphore Modbus register. The power meter will return a zero or a nonzero number.

- If the meter shows zero, someone else owns the semaphore. You must wait for the semaphore to be available before sending a command.

- If the meter shows a nonzero number, you own the semaphore. Semaphore is provided once until it is released or has been inactive for approximately 4 minutes. Once you have the semaphore, subsequent reads of the semaphore register will return zero until you release the semaphore or it times out.

To send a meter command using the protected command interface:

1. Read the semaphore register and record the meter response. This is your semaphore.
2. Build the packet to be written to the command block.
3. Write the packet as a Modbus block write (enter the command number, semaphore, and parameters at the same time).

Protected command block example

Command block	Register number
Command	2039
Semaphore	5
Parameters	1

4. Monitor the meter response registers for validity and completion.

Protected meter response example

Meter response	Register number
Status	2039
Result	0
Data	1

5. Write the semaphore back to the semaphore register to release it for another master to use.

Specifications

The specifications contained in this section are subject to change without notice.

For installation and wiring information, refer to the meter installation sheet.

Mechanical characteristics

IP degree of protection (IEC 60529-1)	Front Display: IP51 Front Display: IP54 with gasket Meter body: IP30 (excluding terminals)
Panel thickness	6.0 mm (0.25 in) maximum
Mounting position	Vertical
Display type	LCD
Keypad	4 button
Front panel LED indicators	Red LED (energy pulse output) Green LED (heartbeat / serial communications activity)
Dimensions W x H x D	96 (H) x 96 (W) x 48 (D) mm

Electrical characteristics

Measurement accuracy:

Current, per-phase and average	± 0.5%
Voltage L-N, L-L	± 0.5%
Power Factor	± 0.01%
Power	Active power: ± 0.5% Reactive power: ± 2.0%
Frequency	± 0.05% for F-nominal 50 / 60 Hz ± 2 Hz ± 0.2% for frequency range from 30 to 48 Hz, 52 to 58 Hz and 62 to 70 Hz
Active energy	Class 0.5* and Class 1 ** Additional error of ± 2% between 10 mA to 50 mA, ± 1 % between 50 mA to 100 mA*
Reactive energy	Class 2.0
THD%: Voltage and Current	Class 5.0 as per IEC 61557-12 for THD%

Voltage inputs

VT primary	100 V L-L to 999 kV L-L maximum, starting voltage depends on the VT ratio
V nominal	Up to 277 V L-N / 480 V L-L (selectable VT secondary from 100, 110, 115, 120 to 415 V L-L)
Measured voltage with full range	35 to 600 V AC L-L
Permanent overload (withstand)	750 V L-L, continuous
Operating voltage range with accuracy	80 to 480 V L-L ± 10%, Category III
Impedance	≥ 5 MΩ
Frequency	50 / 60 Hz ± 2 Hz
VA burden	< 0.2 VA max at 240 V AC L-N, 50Hz

Current inputs

CT primary	1 A to 32767 A, programmable
CT secondary	1 A or 5 A
Operating current range with accuracy	10 mA to 6 A *Additional error of ± 2% between 10 mA to 50 mA, ± 1% between 50 mA to 100 mA)*
Measured Amps with full range	5 mA to 10 A
Suppression current (to disregard negligible load)	5 mA to 99 mA
Permanent overload (withstand)	Continuous 10 A, 10 s/hr 50 A, 1 s/hr 500 A
Impedance	0.3 mΩ
Frequency range	50 / 60 Hz ± 2 Hz
VA burden	≤ 0.1 VA at 5 A, 50 Hz

AC control power

Operating range	METSEDM6220HCL1 / METSEEM1220HCL1 / METSEEM1220HCL5 / METSEEM1250HCL1	48 to 277 V L-N AC ± 10%
Burden		<4 VA at 240 V L-N, 50 Hz
Frequency		45 to 65 Hz nominal
Ride-through time		120 ms at 240 V L-N, 50Hz

DC control power

Operating range	METSEDM6220HCL1 / METSEEM1220HCL1 / METSEEM1220HCL5 / METSEEM1250HCL1	48 to 277 V DC ± 10%
Burden		<2 W at 240 V DC
Operating range	METSEDM6220HCL1LVD / METSEEM1220HCL5LVD	10 to 32 V DC ±10%
Burden		<2 W at 24 V DC

Displays update

Instantaneous / RMS parameters	1 s
THD %, voltage and current	5 s

Power system configuration

Wiring configuration	**Using display:** 1PH, 2W, LN 1PH, 2W, LL 1PH, 3W, LL with N (2-phase) 3PH, 3W, Delta, Ungrounded 3PH, 4W, Wye Grounded	**Using ION Setup:** 3PH, 3W, Delta, Corner Grounded 3PH, 3W, Wye, Ungrounded 3PH, 3W, Wye Grounded 3PH, 3W, Wye, Resistance Grounded 3PH, 4W, Open Delta, Center-Tapped 3PH, 4W, Delta, Center-Tapped 3PH, 4W, Wye, Ungrounded 3PH, 4W, Wye, Resistance Grounded

Environmental characteristics

Operating temperature	-10º to 60º C (+14º to 140º F)
Storage temperature	-25º to 70º C (-13º to 158º F)
Humidity rating	5 to 95 % RH non-condensing at 37º C
Pollution degree	2
Attitude	≤ 2000 meters (6561 ft), Category III
Product life	7 years
Insulation category	Double insulation for user accessible parts
Location / mounting	Not suitable for wet locations For indoor use only Must be permanently connected and fixed

EMC (electromagnetic compatibility)*

Electrostatic discharge	IEC 61000-4-2
Immunity to radiated field	IEC 61000-4-3
Immunity to fast transients	IEC 61000-4-4
Immunity to impulse waves	IEC 61000-4-5
Conducted immunity	IEC 61000-4-6
Immunity to magnetic field	IEC 61000-4-8
Immunity to voltage dips	IEC 61000-4-11
Emissions (IEC61326-1)	Emissions CISPR 11 and FCC Part 15

** Tested as per IEC 61326-1 standard*

Safety

Europe	CE, as per IEC 61010 -1 and IEC 61326 - 1
US and Canada	cULus per UL 61010-1 CAN / CSA-C22.2 IEC 61010 - 1 - 12, for 480 V AC L-L
Measurement category (Voltage and Current inputs)	CAT III up to 480 V L-L
Over voltage category (Control power)	CAT III up to 300 V L-N
Dielectric	As per IEC / UL 61010 -1 3
Protective Class	II, Double insulated for user accessible parts
Green premium	EOL, REACH , PEP, RoHS complied

Communications

RS-485 port	Modbus RTU: 2-Wire, 4800, 9600,19200 or 38400 baud Parity - Even, Odd, None 1 stop bit if parity is Odd or Even, 2 stop bits if none
Isolation	2.5 kV RMS, double insulated

Other specifications

Protection features	Password protected for set-up parameters, energy clearing, and other integrated data
Display language	English

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As standards, specifications, and design change from time to time, please ask for confirmation of the information given in this publication.

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