EasyLogic™ PM2200 series

User manual

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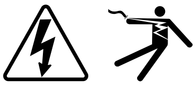
www.schneider-electric.com

Legal Information

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 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 a hazardous situation which, if not avoided, **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.

Notices

FCC

This equipment has been tested and found to comply with the limits for a Class A 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 commercial 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.

The user is cautioned that any changes or modifications not expressly approved by Schneider Electric could void the user's authority to operate the equipment.

This digital apparatus complies with CAN ICES-3 (A) /NMB-3(A).

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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.
- 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.
- 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 rely solely on data displayed on the display or in software to determine if this device is functioning correctly or complying with all applicable standards.
- Do not use data displayed on the display or in software as a substitute for proper workplace practices or equipment maintenance.

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

Introduction

Meter overview

The PM2200 series meters are digital meters that offer comprehensive 3-phase electrical instrumentation and load management facilities in a compact and rugged package.

The meters offer value for the demanding needs of your energy monitoring and cost management applications. All meters in the PM2200 series range comply with Class 1, or Class 0.5S accuracy standards and feature high quality, reliability and affordability in a compact and easy to install format.

Meter Features

The PM2200 series meter supports many features, a few of the features are listed below:

- Self guided LCD display and navigation
- Energy accounting and balancing
- Measurement of both True PF and Displacement PF
- Active, reactive, and apparent energy readings
- Min/Max values of instantaneous parameters with timestamp.
- Cyber security: The meter enables disabling the RS-485 port through front panel keys against unauthorized access. This feature can also be used for toggling between the RTU devices in case of limited availability of nodes in software system.

You can use the meter as a stand-alone device, but its extensive capabilities are fully realized when used as part of an energy management system.

For applications, feature details and the most current and complete specifications of the PM2200 meters, see the EasyLogic PM2000 series technical datasheet at www.schneider-electric.com.

Feature summary

Parameter	**PM2210**	**PM2220**	**PM2230**
Accuracy Class for Wh	Class 1	Class 1	Class 0.5S
Accuracy Class for VARh	1.0	1.0	1.0
Sampling rate per cycle	64	64	64
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 3 phase total	True PF	True PF Displacement PF	True PF Displacement PF
Frequency	✓	✓	✓
Power: • Active power (kW) - Phase wise and total • Apparent power (kVA) - Phase wise and total • Reactive power (kVAR) - Phase wise and total	✓	✓	✓
3 Phase unbalance	Current	Current Voltage	Current Voltage

Parameter	PM2210	PM2220	PM2230
Demand parameters (kW, kVA, kVAR, I) • Last demand • Present demand • Predictive demand • Peak demand: Timestamp for peak demand*	✓ (no timestamp)	✓	✓
Energy: kWh, kVAh, kVARh (4 Quadrant) • Delivered (Import / Forward) • Received (Export / Reverse)	Delivered Received	Delivered Received Total* Net* Last cleared (Old)*	Delivered Received Total* Net* Last cleared (Old)*
THD: • Voltage L-N • Voltage L-L • Current per phase	✓	✓	✓
Individual Harmonics	—	Up to 15th odd harmonics	Up to 31st odd harmonics
Min / Max with timestamp • V L-L average • V L-N average • Current average • Frequency • Active power, Total • Apparent power, Total • Reactive power, Total • Power factor, Total	—	✓	✓
Communication	POP	RS-485 Modbus RTU	RS-485 Modbus RTU
Expandable Analog IO modules (1 input & 1 output)	—	—	✓
Expandable Analog IO modules (2 inputs & 2 outputs)	—	—	✓
Expandable Digital IO modules (2 inputs & 2 outputs)	—	—	✓
Data Logging • Energy (W, VA, VAR): Delivered / Received • Power: Active / Apparent / Reactive • Demand (W, VA, VAR, A): Last / Present / Predictive	—	—	✓

* Indicates features that can be read through communication only

Measured parameters

Energy

The meter provides bi-directional, 4-quadrant, Class 1 / Class 0.5S accurate energy metering.

The meter stores all accumulated active, reactive, and apparent energy parameters in nonvolatile memory:

- kWh, kVARh, kVAh delivered
- kWh, kVARh, kVAh received
- kWh, kVARh, kVAh delivered + received
- kWh, kVARh, kVAh delivered – received

Demand

The meter provides last, present, predicted, and maximum (peak) demand values, and a timestamp when the maximum (peak) demand occurred.

The meter supports standard demand calculation methods, including sliding block, fixed block, rolling block, thermal and synchronized.

Peak demand registers can be reset manually (password protected).

Demand measurements include:

- W, VAR, VA demand total
- Amps demand average

Instantaneous

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

- Per phase and average voltage (line-to-line, line-to-neutral)
- Per phase and average current, and neutral current
- Per phase and total power (VA, W, Var)
- True and displacement power factor
- System frequency

Power quality

The meter provides complete harmonic distortion metering, recording, and real-time reporting, up to the 15th harmonic for PM2220 and up to 31st harmonic for PM2230 for all voltage and current inputs.

The following power quality measurements are available:

- PM2220: Individual odd harmonics up to 15th order (Voltage and current, per phase)
- PM2230: Individual odd harmonics up to 31st order (Voltage and current, per phase)
- Total harmonic distortion (THD%) for current and voltage (displays line-to-line or line-to-neutral, based on selected system configuration)

Data recording

The meter stores each new minimum and new maximum value with date and timestamp for all instantaneous values and for each phase.

The meter also records the following:

- Alarms (with 1s timestamping)
- Parameters configured for data logging
- Data, alarm history, and diagnostics logs

Input/output

The meter supports optional input and output capabilities.

Other measurements

Additional measurements recorded by the meter include several timers.

These timers include:

- I/O timer shows how long an input or output has been ON.
- Operating timer shows how long the meter has been powered.

- Load timer shows how much time a load has been running, based on the specified minimum current for the load timer setpoint setting.

Data display and analysis tools

Power Monitoring Expert

StruxureWare™ 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 StruxureWare™ Power Monitoring Expert online help for instructions on how to add your meter into its system for data collection and analysis.

PowerScada Expert

StruxureWare™ PowerScada Expert is a complete real-time monitoring and control solution for large facility and critical infrastructure operations.

It communicates with your meter for data acquisition and real-time control. You can use PowerScada Expert for:

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

See the StruxureWare™ PowerScada Expert online help for instructions on how to add your meter into its system for data collection and analysis.

Meter configuration

Meter configuration can be performed through the display or PowerLogic™ ION Setup.

ION Setup is a meter configuration tool that can be downloaded for free at www.schneider-electric.com.

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

Firmware consideration

This user manual is written to be used with meter firmware 1.00.00 or later.

Harware References

PM2200 meter models and accessories

The meter is available in several different models with optional accessories that provide various mounting options.

Meter models

Model	Commercial reference	Description
PM2210	METSEPM2210	Front panel mount, 96 x 96 mm form factor, EasyLogic VAF Power and Energy meter with THD and POP. Complies with accuracy class 1.
PM2220	METSEPM2220	Front panel mount, 96 x 96 mm form factor, EasyLogic VAF Power and Energy meter with RS-485 communication and odd harmonics up to 15^{th} order. Complies with accuracy class 1.
PM2230	METSEPM2230	Front panel mount, 96 x 96 mm form factor, EasyLogic VAF Power and Energy meter with RS-485 communication and odd harmonics up to 31^{st} order. Complies with accuracy class 0.5S.

Meter accessories

Model	Commercial reference	Description
2 Channel Digital Input Output Module	METSEPM2KDGTLIO22	Digital I/O module with 2 channel input and output.
2 Channel Analog Input Output Module	METSEPM2KANLGIO22	Analog I/O module with 2 channel input and output.
1 Channel Analog Input Output Module	METSEPM2KANLGIO11	Analog I/O module with single channel input and output.

NOTE: The I/O modules are supported by PM2230/PM2130 meter models only.

See the PM2000 series catalog pages, available from www.schneider-electric.com, or consult your local Schneider Electric representative for information about mounting adapters available for your meter.

Supplemental information

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

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

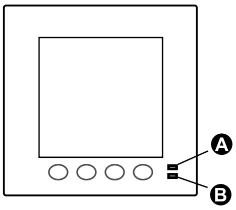
See your product’s technical datasheet at www.schneider-electric.com for the most up-to-date and complete specifications.

See your product’s catalog pages at www.schneider-electric.com for information about your device, its options and accessories.

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

LED indicators

The LED indicators alert or inform you of meter activity.



A	Alarm / energy pulsing LED
B	Heartbeat / serial communications LED

Alarm / energy pulsing LED

The alarm / energy pulsing LED can be configured for alarm notification or energy pulsing.

When configured for alarm notification, this LED blinks every one second indicating that a high, medium or low priority alarm is tripped. The LED provides a visual indication of an active alarm condition or an inactive but unacknowledged high priority alarm.

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 power 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.

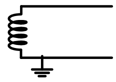
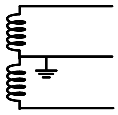
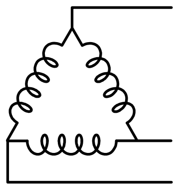
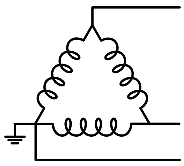
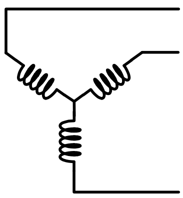
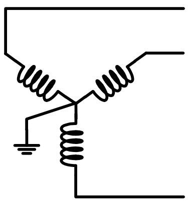
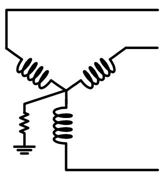
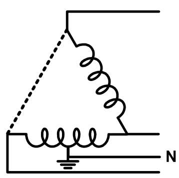
Meter wiring considerations

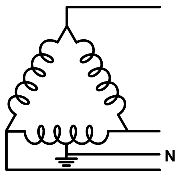
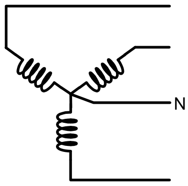
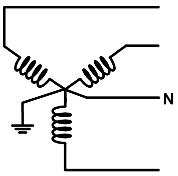
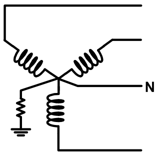
Direct connect voltage limits

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 II / III the maximum voltage on the meter voltage measurement inputs should not exceed 277 V L-N / 480 V L-L for CAT III and 347 V L-N / 600 V L-L for CAT II.

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	Installation category II	
Single-phase 2-wire line-to-neutral	1P.LN	1PH 2Wire L-N		≤ 277 V L-N	≤ 347 V L-N	1 VT
Single-phase 2-wire line-to-line	1P.LL	1PH 2Wire L-L		480 V L-L	600 V L-L	1 VT
Single-phase 3-wire line-to-line with neutral	1P.3L	1PH 3Wire L-L with N		≤ 277 V L-N / 480 V L-L	≤ 347 V L-N / 600 V L-L	2 VT
3-phase 3-wire Delta ungrounded	3P.3L	3PH 3Wire Ungrounded Delta		480 V L-L	600 V L-L	2 VT
3-phase 3-wire Delta corner grounded		3PH 3Wire Corner Grounded Delta		480 V L-L	600 V L-L	2 VT
3-phase 3-wire Wye ungrounded		3PH 3Wire Ungrounded Wye		480 V L-L	600 V L-L	2 VT
3-phase 3-wire Wye grounded		3PH 3Wire Grounded Wye		480 V L-L	600 V L-L	2 VT
3-phase 3-wire Wye resistance-grounded		3PH 3Wire Resistance Grounded Wye		480 V L-L	600 V L-L	2 VT
3-phase 4-wire open Delta center-tapped	3P.4L	3PH 4Wire Center-Tapped Open Delta		240 V L-N / 480 V L-L	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	Installation category II	
3-phase 4-wire Delta center-tapped		3PH 4Wire Center-Tapped Delta		240 V L-N / 480 V L-L	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	≤ 347 V L-N / 600 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	≤ 347 V L-N / 600 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	≤ 347 V L-N / 600 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.

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 twisted pair or 1.5 twisted pair RS-485 cable to wire the devices. Use one twisted pair to connect the (+) and (-) terminals, and use the other insulated wire to connect the C terminals

The total distance for devices connected on an RS-485 bus should not exceed 1200 m (4000 ft).

RS-485 terminals

C	Common. This provides the voltage reference (zero volts) for the data plus and data minus signals
	Shield. Connect the bare wire to this terminal to help suppress signal noise that may be present. Ground the shield wiring at one end only (either at the master or the last slave device, but not both.
-	Data minus. This transmits/receives the inverting data signals.
+	Data plus. This transmits/receives the non-inverting data signals.

NOTE: If some devices in your RS-485 network do not have the C terminal, use the bare wire in the RS-485 cable to connect the C terminal from the meter to the shield terminal on the devices that do not have the C terminal.

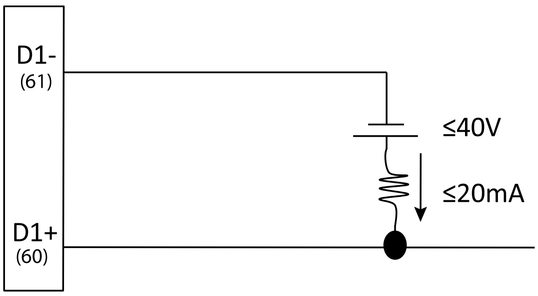
Pulse output

The meter is equipped with one pulse output port (D1+, D1-).

You can configure the pulse outputs for use in the following application:

- energy pulsing applications, where a receiving device determines energy usage by counting the k_h pulses coming from the meter's pulse output port.

One pulse output can handle voltage less than or equal to 40 V DC (20 mA maximum). For higher voltage applications, use an external relay in the switching circuit.



I/O Modules

The PM2230 meter supports additional I/O modules. This section supplements the option module installation sheets and provides additional information regarding physical characteristics and capabilities of the I/O module.

The I/O modules come in the following variants:

- Single channel analog I/O module
- Two channel analog I/O module
- Two channel digital I/O module

Configuring optional I/O module using ION Setup

You can configure the optional I/O module using ION Setup.

The available analog and digital I/O modules can be connected to the base of your meter.

Calculate your zero scale and full scale values based on the analog source and the input range of your meter.

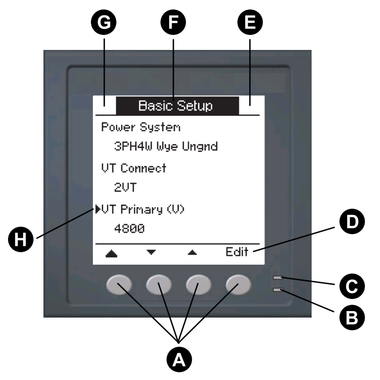
Make sure that the input port that you want to use is properly configured and connected to a valid external signal source.

1. Start ION Setup and connect to your meter.
2. Open **I/O Setup** and select the required input or output parameter you want to configure.
3. Select an input or output channel and click **Edit**. The setup screen is displayed.
4. Configure the parameter and click **OK**.
   Below are the associated parameter lists for analog IO:
   - Current: Phase wise
   - Current Average
   - Current Unbalance: Phase wise
   - Current Unbalance Worst
   - Voltage L-L: Phase wise
   - Voltage L-L Avg
   - Voltage L-N: Phase wise
   - Voltage L-N Avg
   - Voltage Unbalance L-L: Phase wise
   - Voltage Unbalance L-L Worst
   - Voltage Unbalance L-N: Phase wise
   - Voltage Unbalance L-N Worst
   - Active Power: Phase wise
   - Active Power Total
   - Reactive Power: Phase wise
   - Reactive Power Total
   - Apparent Power: phase wise
   - Apparent Power Total
   - PF Total
   - Frequency

Meter Display

Display overview

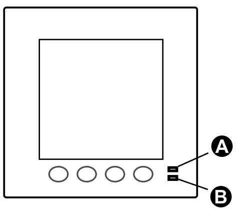
The display (integrated or remote) lets you use the meter to perform various tasks such as setting up the meter, displaying data screens, acknowledging alarms, or performing resets.



A	Navigation / menu selection buttons
B	Heartbeat / communications LED (green)
C	Alarm / energy pulsing LED (orange)
D	Navigation symbols or menu options
E	Right notification area
F	Screen title
G	Left notification area
H	Cursor

LED indicators

The LED indicators alert or inform you of meter activity.



A	Alarm / energy pulsing LED
B	Heartbeat / serial communications LED

Alarm / energy pulsing LED

The alarm / energy pulsing LED can be configured for alarm notification or energy pulsing.

When configured for alarm notification, this LED blinks every one second indicating that a high, medium or low priority alarm is tripped. The LED provides a visual indication of an active alarm condition or an inactive but unacknowledged high priority alarm.

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 power meter's accuracy.

Heartbeat / serial communications LED

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

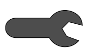
The LED blinks at a slow, steady rate to indicate the meter is operational. The LED flashes at a variable, faster rate when the meter is communicating over a Modbus serial communications port.

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.

Notification icons

To alert you about meter state or events, notification icons appear at the top left or top right corner of the display screen.

Icon	Description
	The wrench icon indicates that the power meter is in an overvoltage condition or requires maintenance. It could also indicate that the energy LED is in an overrun state.
	The alarm icon indicates an alarm condition has occurred.

Meter display language

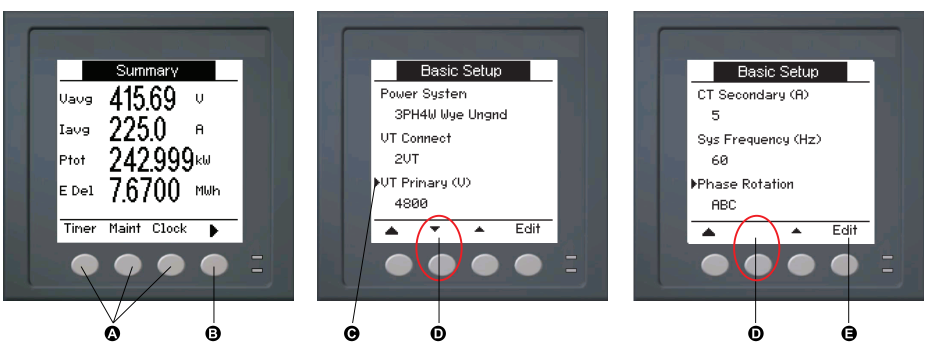
If your meter is equipped with a display screen, you can configure the meter to display the measurements in one of several languages.

The following languages are available:

- English
- French
- Spanish
- German
- Portuguese
- Russian
- Chinese

Meter screen navigation

The meter's buttons and display screen allow you to navigate data and setup screens, and to configure the meter's setup parameters.



A	Press the button below the appropriate menu to view that screen
B	Press the right arrow to view more screens
C	In setup mode, a small right arrow indicates the selected option
D	In setup mode, a small down arrow indicates that there are additional parameters to display. The down arrow disappears when there are no more parameters to display.
E	In setup mode, press the button under **Edit** to change that setting

Navigation symbols

Navigation symbols indicate the functions of the associated buttons on your meter's display.

Symbol	Description	Actions
▶	Right arrow	Scroll right and display more menu items or move cursor one character to the right
▲	Up arrow	Exit screen and go up one level
▼	Small down arrow	Move cursor down the list of options or display more items below
▲	Small up arrow	Move cursor up the list of items or display more items above
◀	Left arrow	Move cursor one character to the left
+	Plus sign	Increase the highlighted value or show the next item in the list.
–	Minus sign	Show the previous item in the list

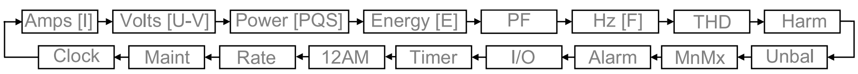
When you reach the last screen, press the right arrow again to cycle through the screen menus.

Meter screen menus overview

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.

Level 1 screen menus - IEEE title [IEC title]



Setting up the display

You can change the display screen's settings, such as contrast, backlight timeout, and screen timeout .

1. Navigate to **Maint > Setup**.
2. Enter the setup password (default is "0"), then press **OK**.
3. Navigate to **HMI > Disp**.
4. Move the cursor to point to the parameter you want to modify, then press **Edit**.
5. Modify the parameter as required, then press **OK**.
6. Move the cursor to point to the next parameter you want to modify, press **Edit**, make your changes, then press **OK**.
7. Press the up arrow to exit.

8. Press **Yes** to save your changes.

Display settings available using the display

Parameter	Values	Description
Contrast	1 - 9	Increase or decrease the value to increase or decrease the display contrast.
Bcklght Timeout (min)	0 - 60	Set how long (in minutes) before the backlight turns off after a period of inactivity. Setting this to “0” disables the backlight timeout feature (i.e., backlight is always on).
Screen Timeout (min)	0 - 60	Set how long (in minutes) before the screen turns off after a period of inactivity. Setting this to “0” disables the screen timeout feature (i.e., display is always on).

To configure the display using ION Setup, see the “PM2000” topic in the ION Setup online help or in the ION Setup device configuration guide, available for download at www.schneider-electric.com.

Basic setup

Configuring basic setup parameters using the display

You can configure basic meter parameters using the display.

Proper configuration of the meter's 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.

If standard (1-sec) alarms have been configured and you make subsequent changes to the meter's basic setup, all alarms are disabled to prevent undesired alarm operation.

NOTICE

UNINTENDED EQUIPMENT OPERATION

- Verify all standard alarms settings are correct and make adjustments as necessary.
- Re-enable all configured alarms.

Failure to follow these instructions can result in equipment damage.

After saving the changes, confirm all configured standard alarm settings are still valid, reconfigure them as required, and re-enable the alarms.

1. Navigate to **Maint > Setup**.
2. Enter the setup password (default is "0"), then press **OK**.
3. Navigate to **Meter > Basic**.
4. Move the cursor to point to the parameter you want to modify, then press **Edit**.
5. Modify the parameter as required, then press **OK**.
6. Move the cursor to point to the next parameter you want to modify, press **Edit**, make your changes, then press **OK**.

7. Press **Yes** to save your changes.

Basic setup parameters available using the display

Values	Description
Power System Select the power system type (power transformer) the meter is wired to.	
1PH2W LN	Single-phase 2-wire line-to-neutral
1PH2W LL	Single-phase 2-wire line-to-line
1PH3W LL with N	Single-phase 3-wire line-to-line with neutral
3PH3W Dlt Ungnd	3-phase 3-wire ungrounded delta
3PH3W Dlt Crnr Gnd	3-phase 3-wire corner grounded delta
3PH3W Wye Ungnd	3-phase 3-wire ungrounded wye
3PH3W Wye Gnd	3-phase 3-wire grounded wye
3PH3W Wye Res Gnd	3-phase 3-wire resistance-grounded wye
3PH4W Opn Dlt Ctr Tp	3-phase 4-wire center-tapped open delta
3PH4W Dlt Ctr Tp	3-phase 4-wire center-tapped delta
3PH4W Wye Ungnd	3-phase 4-wire ungrounded wye
3PH4W Wye Gnd	3-phase 4-wire grounded wye
3PH4W Wye Res Gnd	3-phase 4-wire resistance-grounded wye
VT Connect Select how many voltage transformers (VT) are connected to the electrical power system.	
Direct Con	Direct connect; no VTs used
2VT	2 voltage transformers
3VT	3 voltage transformers
VT Primary (V)	
1 to 1,000,000	Enter the size of the VT primary, in Volts.
VT Secondary (V)	
100, 110, 115, 120	Select the size of the VT secondary, in Volts.
CT on Terminal Define how many current transformers (CT) are connected to the meter, and which terminals they are connected to.	
I1	1 CT connected to I1 terminal
I2	1 CT connected to I2 terminal
I3	1 CT connected to I3 terminal
I1 I2	2 CT connected to I1, I2 terminals
I2 I3	2 CT connected to I1, I3 terminals
I1 I3	2 CT connected to I2, I3 terminals
I1 I2 I3	3 CT connected to I1, I2, I3 terminals
CT Primary (A)	
1 to 32767	Enter the size of the CT primary, in Amps.
CT Secondary (A)	
1, 5	Select the size of the CT secondary, in Amps.
Sys Frequency (Hz)	
50, 60	Select the frequency of the electrical power system, in Hz.
Phase Rotation	
ABC, CBA	Select the phase rotation of the 3-phase system.

Configuring advanced setup parameters using the display

You can configure a subset of advanced parameters using the display.

1. Navigate to **Maint > Setup**.
2. Enter the setup password (default is “0”), then press **OK**.
3. Navigate to **Meter > Advan**.
4. Move the cursor to point to the parameter you want to modify, then press **Edit**.
5. Modify the parameter as required, then press **OK**.
6. Move the cursor to point to the next parameter you want to modify, press **Edit**, make your changes, then press **OK**.
7. Press **Yes** to save your changes.

Advanced setup parameters available using the display

Parameter	Values	Description
Label	—	This label identifies the device, e.g., “Power Meter”. You cannot use the display to edit this parameter. Use ION Setup to change the device label.
Load Timer Setpt (A)	0 - 9	Specifies the minimum average current at the load before the timer starts. The meter begins counting the number of seconds the load timer is on (i.e., whenever the readings are equal to or above this average current threshold.
Pk I dmd for TDD (A)	0 - 9	Specifies the minimum peak current demand at the load for inclusion in total demand distortion (TDD) calculations. If the load current is below the minimum peak current demand threshold, the meter does not use the readings to calculate TDD. Set this to “0” (zero) if you want the power meter to use the metered peak current demand for this calculation.

Setting the rate

The Rate setup screens allow you to set the different rate parameters.

1. Navigate to **Maint > Setup**.
2. Enter the setup password (default is “0”), then press **OK**.
3. Navigate to **Rate**.
4. Move the cursor to point to **Rate1** or **Rate2** to modify, then press **Edit**.
5. Move the cursor to point to **Channel** or **Factor per (k__h)** to modify, then press **Edit**.
6. Modify the parameter as required, then press **OK**.
7. Press up arrow and press **Yes** to save your changes.

8. Press the up arrow to exit.

Parameter	Values	Description
Label	Rate1: CO2 Emission Rate2: Energy Cost	You can edit the label using ION Setup
Channel	None, Active Del, Active Rec, Active Del + Rec, Reactive Del, Reactive Rec, Reactive Del + Rec, Apparent Del, Apparent Rec, Apparent Del + Rec	Select a channel from the list.
Factor per (k__ h)	0.000 to 99999.999	You can edit the factor value between 0.000 to 99999.999.

To configure the Rate using ION Setup, see the “PM2000 series meter” topic in the ION Setup online help or in the ION Setup device configuration guide, available for download at www.schneider-electric.com.

Setting up regional settings

You can change the regional settings to localize the meter screens and display data in a different language, using local standards and conventions.

NOTE: In order to display a different language other than those listed in the Language setup parameter, you need to download the appropriate language file to the meter using the firmware upgrade process.

1. Navigate to **Maint > Setup**.
2. Enter the setup password (default is “0”), then press **OK**.
3. Navigate to **HMI > Region**.
4. Move the cursor to point to the parameter you want to modify, then press **Edit**.
5. Modify the parameter as required, then press **OK**.
6. Move the cursor to point to the next parameter you want to modify, press **Edit**, make your changes, then press **OK**.
7. Press the up arrow to exit.
8. Press **Yes** to save your changes.

Regional settings available using the display

Parameter	Values	Description
Language	English US, French, Spanish, German, Portuguese, Chinese, Russian	Select the language you want the meter to display.
Date Format	MM/DD/YY, YY/MM/DD, DD/MM/YY	Set how you want the date to be displayed, e.g., month/day/year.
Time Format	24Hr, AM/PM	Set how you want the time to be displayed, e.g., 17:00:00 or 5:00:00 PM.
HMI Mode	IEC, IEEE	Select the standards convention used to display menu names or meter data.

Setting up the screen passwords

It is recommended that you change the default password in order to prevent unauthorized personnel from accessing password-protected screens such as the diagnostics and reset screens.

This can only be configured through the front panel. The factory-default setting for all passwords is “0” (zero).

1. Navigate to **Maint > Setup**.
2. Enter the setup password (default is “0”), then press **OK**.
3. Navigate to **HMI > Pass**.
4. Move the cursor to point to the parameter you want to modify, then press **Edit**.

Parameter	Values	Description
Setup	0000 - 9999	Sets the password for accessing the meter setup screens (Maint > Setup).
Energy Resets	0000 - 9999	Sets the password for resetting the meter’s accumulated energy values.
Demand Resets	0000 - 9999	Sets the password for resetting the meter’s recorded peak demand values.
Min/Max Resets	0000 - 9999	Sets the password for resetting the meter’s recorded minimum and maximum values.

5. Modify the parameter as required, then press **OK**.
6. Move the cursor to point to the next parameter you want to modify, press **Edit**, make your changes, then press **OK**.
7. Press the up arrow to exit.
8. Press **Yes** to save your changes.

Lost password

Visit www.schneider-electric.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.

Setting the clock

The Clock setup screens allow you to set the meter’s date and time.

1. Navigate to **Maint > Setup**.
2. Enter the setup password (default is “0”), then press **OK**.
3. Navigate to **Clock**.
4. Move the cursor to point to the parameter you want to modify, then press **Edit**.
5. Modify the parameter as required, then press **OK**.
6. Press **Yes** to save your changes.
7. Move the cursor to point to the next parameter you want to modify, press **Edit**, make your changes, then press **OK**.
8. Press the up arrow to exit.

9. Press **Yes** to save your changes.

Parameter	**Values**	**Description**
Date	DD/MM/YY, MM/DD/YY, YY/MM/DD	Set the current date using the format displayed on screen, where DD = day, MM = month and YY = year.
Time	HH:MM:SS (24 hour format), HH:MM:SS AM or PM	Use the 24-hour format to set the current time in UTC (GMT).
Meter Time	GMT, Local	Select GMT to display the current time in UTC (Greenwich Mean Time zone). To display local time, set this parameter to Local, then use GMT Offset (h) to display local time in the proper time zone.

To configure the clock using ION Setup, see the “PM2000 series meter” topic in the ION Setup online help or in the ION Setup device configuration guide, available for download at www.schneider-electric.com.

Alarms

Alarms overview

An alarm is the meter's means of notifying you when an alarm condition is detected, such as an error or an event that falls outside of normal operating conditions.

You can configure your meter to generate and display high, medium and low priority alarms when predefined events are detected in the meter's measured values or operating states. Your meter also logs the alarm event information. Your meter comes with many alarms. Some alarms are preconfigured, while others need to be configured before your meter can generate alarms. Your meter's default alarms can be customized, as needed, such as changing the priority. You can create custom alarms using the advanced features of your meter.

Alarm types

Your meters supports a number of different alarm types.

Type	Number
Unary	4
Digital	2
Standard	14

Unary alarms

A unary alarm is the simplest type of alarm — it monitors a single behavior, event or condition.

Available unary alarms

Your meter has a set of 4 unary alarms.

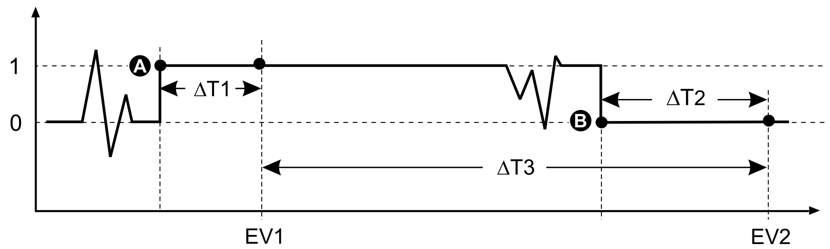
Alarm label	Description
Meter Power Up	Meter powers on after losing control power.
Meter Reset	Meter resets for any reason.
Meter Diagnostic	Meter's self-diagnostic feature detects a problem.
Phase Reversal	Meter detects a phase rotation different than expected.

Digital alarms

Digital alarms monitor the ON or OFF state of the meter's digital inputs.

Digital alarm with setpoint delay

To prevent false triggers from erratic signals, you can set up pickup and dropout time delays for the digital alarm.



A	Pickup setpoint (1 = ON)	ΔT2	Dropout time delay (in seconds)
B	Dropout setpoint (0 = OFF)	EV2	End of alarm condition
ΔT1	Pickup time delay (in seconds)	ΔT3	Alarm duration (in seconds)
EV1	Start of alarm condition		

NOTE: To prevent filling the alarm log with nuisance alarm trips, the digital alarm is automatically disabled if the digital input changes state more than 4 times in one second or more than 10 times in ten seconds.

Available digital alarms

Your meter has a set of 2 digital alarms.

Alarm label	Description
Digital Alarm S1	Digital input 1
Digital Alarm S2	Digital input 2

Standard alarms

Standard alarms are setpoint-driven alarms monitor certain behaviors, events or unwanted conditions in your electrical system.

Standard alarms have a detection rate equal to the 50/60 meter cycle, which is nominally 1 second if the meter's frequency setting is configured to match the system frequency (50 or 60 Hz).

Many of the standard alarms are three-phase alarms. Alarm setpoints are evaluated for each of the three phases individually, but the alarm is reported as a single alarm. The alarm pickup occurs when the first phase exceeds the alarm pickup magnitude for the pickup time delay. The alarm is active as long as any phase remains in an alarm state. The alarm dropout occurs when the last phase drops below the dropout magnitude for the dropout time delay.

Example of over and under setpoint (standard) alarm operation

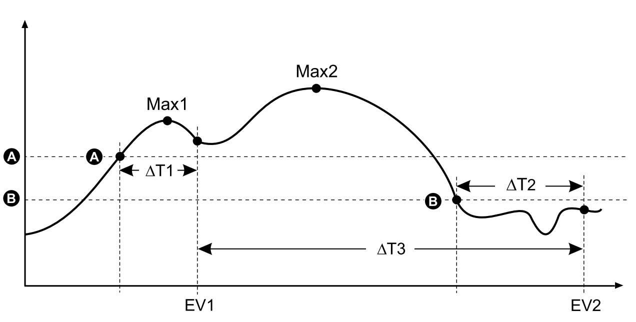
The meter supports over and under setpoint conditions on standard alarms.

A setpoint condition occurs when the magnitude of the signal being monitored crosses the limit specified by the pickup setpoint setting and stays within that limit for a minimum time period specified by the pickup time delay setting.

The setpoint condition ends when the magnitude of the signal being monitored crosses the limit specified by dropout setpoint setting and stays within that limit for a minimum time period specified by dropout time delay setting.

Over setpoint

When the value rises above the pickup setpoint setting and remains there long enough to satisfy the pickup time delay period (ΔT1), the alarm condition is set to ON. When the value falls below the dropout setpoint setting and remains there long enough to satisfy the dropout time delay period (ΔT2), the alarm condition is set to OFF.

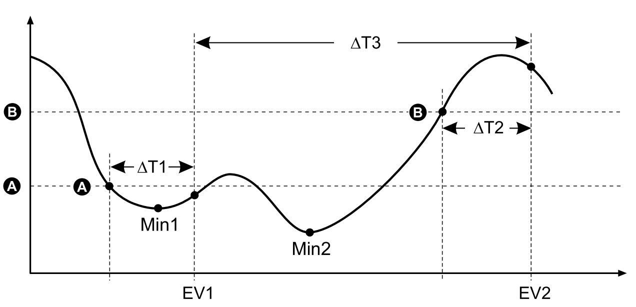


A	Pickup setpoint
B	Dropout setpoint
ΔT1	Pickup time delay period (in seconds)
EV1	Start of alarm condition
ΔT2	Dropout time delay (in seconds)
EV2	End of alarm condition
ΔT3	Alarm duration (in seconds)
Max1	Maximum value recorded during pickup period
Max2	Maximum value recorded during alarm period

The meter records the date and time when the alarm event starts (EV1) and when it ends (EV2). The meter also performs any task assigned to the event, such as operating a digital output. The meter also records maximum values (Max1, Max2) before, during or after the alarm period.

Under setpoint

When the value falls below the pickup setpoint setting and remains there long enough to satisfy the pickup time delay period (ΔT1), the alarm condition is set to ON. When the value rises above the dropout setpoint setting and remains there long enough to satisfy the dropout time delay period (ΔT2), the alarm condition is set to OFF.



A	Pickup setpoint
B	Dropout setpoint
ΔT1	Pickup time delay period (in seconds)
EV1	Start of alarm condition
ΔT2	Dropout time delay (in seconds)
EV2	End of alarm condition
ΔT3	Alarm duration (in seconds)
Min1	Maximum value recorded during pickup period
Min2	Maximum value recorded during alarm period

The meter records the date and time when the alarm event starts (EV1) and when it ends (EV2). The meter also performs any task assigned to the event, such as operating a digital output. The meter also records minimum values (Min1, Min2) before, during or after the alarm period.

Maximum allowable setpoint

The meter is programmed to help prevent user data entry errors, with set limits for the standard alarms.

The maximum setpoint value you can enter for some of the standard alarms depends on the voltage transformer ratio (VT ratio), current transformer ratio (CT ratio), system type (i.e., number of phases) and/or the maximum voltage and maximum current limits programmed at the factory.

NOTE: VT ratio is the VT primary divided by the VT secondary and CT ratio is the CT primary divided by the CT secondary.

Standard alarm	Maximum setpoint value
Over Phase Current	(maximum current) x (CT ratio)
Under Phase Current	(maximum current) x (CT ratio)
Over Voltage L-L	(maximum voltage) x (VT ratio)
Under Voltage L-L	(maximum voltage) x (VT ratio)
Over Voltage L-N	(maximum voltage) x (VT ratio)
Under Voltage L-N	(maximum voltage) x (VT ratio)
Over Active Power	(maximum voltage) x (maximum current) x (number of phases)
Over Reactive Power	(maximum voltage) x (maximum current) x (number of phases)
Over Apparent Power	(maximum voltage) x (maximum current) x (number of phases)

Available standard alarms

Your meter has a set of standard alarms.

NOTE: Some alarms do not apply to all power system configurations. For example, line-to-neutral voltage alarms cannot be enabled on 3-phase delta systems. Some alarms use the system type and the VT or CT ratio to determine the maximum allowed setpoint.

Alarm label		Valid range and resolution		Units
ION Setup	Display	ION Setup	Display	
Over Phase Current	Over Current, Ph	0.000 to 99999.000	0 to 99999	A
Under Phase Current	Under Current, Ph	0.000 to 99999.000	0 to 99999	A
Over Voltage L-L	Over Voltage, L-L	0.00 to 999999.00	0 to 999999	V
Under Voltage L-L	Under Voltage, L-L	0.00 to 999999.00	0 to 9999999	V
Over Voltage L-N	Over Voltage, L-N	0.00 to 999999.00	0 to 9999999	V
Under Voltage L-N	Under Voltage L-N	0.00 to 999999.00	0 to 9999999	V
Over Active Power	Over kW	0.0 to 9999999.0	0 to 9999999	kW
Over Reactive Power	Over kVAR	0.0 to 9999999.0	0 to 9999999	kVAR
Over Apparent Power	Over kVA	0.0 to 9999999.0	0 to 9999999	kVA
Leading True PF	Lead PF, True	-1.00 to -0.01 and 0.01 to 1.00		—
Lagging True PF	Lag PF, True	-1.00 to -0.01 and 0.01 to 1.00		—
Over Frequency	Over Frequency	0.000 to 99.000		Hz
Under Frequency	Under Frequency	0.000 to 99.000		Hz
Over Voltage THD	Over Voltage THD	0.000 to 99		%

Power factor (PF) alarms

You can set up a Leading PF or Lagging PF alarm to monitor when the circuit's power factor goes above or below the threshold you specify.

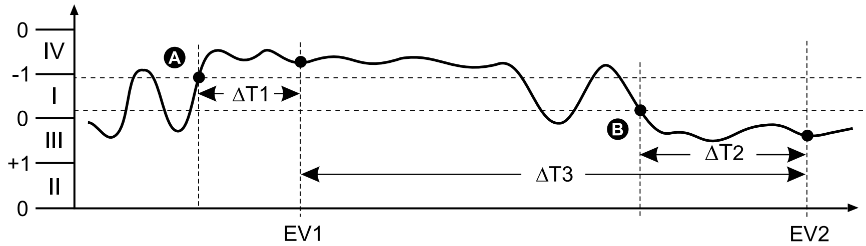
The Leading PF and Lagging PF alarms use the power factor quadrants as the values on the y-axis, with quadrant II on the lowest end of the scale, followed by quadrant III, quadrant I, and finally quadrant IV on the highest end of the scale.

Quadrant	PF values	Lead/Lag
II	0 to -1	Leading (capacitive)
III	-1 to 0	Lagging (inductive)

Quadrant	PF values	Lead/Lag
I	0 to 1	Lagging (inductive)
IV	1 to 0	Leading (capacitive)

Leading PF alarm

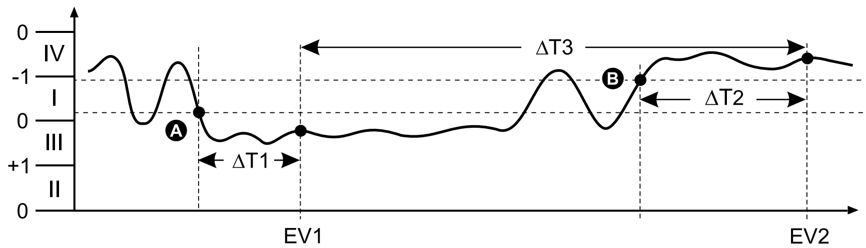
The Leading PF alarm monitors an over setpoint condition.



A	Pickup setpoint	ΔT2	Dropout time delay (in seconds)
B	Dropout setpoint	EV2	End of alarm condition
ΔT1	Pickup delay period (in seconds)	ΔT3	Alarm duration (in seconds)
EV1	Start of alarm condition		

Lagging PF alarm

The Lagging PF alarm monitors an under setpoint condition.



A	Pickup setpoint	ΔT2	Dropout time delay (in seconds)
B	Dropout setpoint	EV2	End of alarm condition
ΔT1	Pickup delay period (in seconds)	ΔT3	Alarm duration (in seconds)
EV1	Start of alarm condition		

Alarm priorities

Each alarm has a priority level that you can use to distinguish between events that require immediate action and those that do not require action.

Alarm priority	Alarm display notification and recording method			
	Alarm LED	**Alarm icon**	**Alarm details**	**Alarm logging**
High	Blinks while the alarm is active.	Blinks while the alarm is active. Alarm icon remains displayed until acknowledged.	Click **Details** to display what caused the alarm to pickup or drop off. Click **Ack** to acknowledge the alarm.	Recorded in alarm log.
Medium	Blinks while the alarm is active.	Blinks while the alarm is active.	Click **Details** to display what caused the alarm to pickup or drop off.	Recorded in alarm log.

Alarm priority	Alarm display notification and recording method			
	Alarm LED	**Alarm icon**	**Alarm details**	**Alarm logging**
Low	Blinks while the alarm is active.	Blinks while the alarm is active.	Click **Details** to display what caused the alarm to pickup or drop off.	Recorded in alarm log.
None	No activity	None	None	Recorded in event log only.

NOTE: The alarm LED notification only occurs if the alarm / energy pulsing LED is configured for alarming.

Multiple alarm considerations

If multiple alarms with different priorities are active at the same time, the display shows the alarms in the order they occurred.

Alarm setup overview

You can use ION Setup to configure unary, digital or standard (1-Sec) alarms.

If you make changes to the basic meter setup, all alarms are disabled to prevent undesired alarm operation.

NOTICE
UNINTENDED EQUIPMENT OPERATION • Verify all alarm settings are correct and make adjustments as necessary. • Re-enable all configured alarms. **Failure to follow these instructions can result in incorrect alarm functions.**

Built-in error-checking

ION Setup dynamically checks incorrect setup combinations. When you enable an alarm, you must set up the pickup and dropout limits to acceptable values first in order to exit the setup screen.

Setting up alarms using ION Setup

You can use ION Setup to create and set up alarms.

1. Start ION Setup and connect to your meter.
2. Open the **Alarming** screen.
3. Select the alarm you want to configure and click **Edit**.
4. Configure the setup parameters as explained in the different alarm setup sections.

   See the ION Setup Device Configuration guide for more information.

Unary alarm setup parameters

Configure the unary alarm setup parameters as required.

ION Setup controls are shown in parentheses.

Setting	Option or range	Description
Enable	Yes (checked) or No (cleared)	This enables or disables the alarm.
Priority	High, Medium, Low, None	This sets the alarm priority and notification options.
Select Dig Output (Outputs)	None Digital Output D1 Digital Output D2 Digital Output D1 & D2	Select the digital output(s) you want to control when the alarm is triggered.

Digital alarm setup parameters

Configure the digital alarm setup parameters as required.

ION Setup controls are shown in parentheses.

Setting	Option or range	Description
Enable	Yes (checked) or No (cleared)	This enables or disables the alarm.
Priority	High, Medium, Low, None	This sets the alarm priority and notification options.
Pickup Setpoint (Setpoint Pickup)	On, Off	Use this setting to control when to trip the alarm, based on the state of the digital input (On or Off).
Pickup Time Delay (Delay)	0 to 999999	This specifies the number of seconds the digital input must be in the alarm pickup state before the alarm is tripped.
Dropout Time Delay (Setpoint Dropout Delay)	0 to 999999	This specifies the number of seconds the digital input must be out of the alarm pickup state before the alarm turns off.
Select Dig Output (Outputs)	None Digital Output D1 Digital Output D2 Digital Output D1 & D2	Select the digital output(s) you want to control when the alarm is triggered.

Standard (1-Sec) alarm setup parameters

Configure the standard alarm setup parameters as required.

ION Setup controls are shown in parentheses.

NOTE: It is recommended that you use ION Setup to configure standard (1-Sec) alarms. ION Setup supports a higher resolution to allow you to specify more decimal places when setting up the pickup setpoint and dropout setpoint values for certain measurements.

Setting	Option or range	Description
Enable	Yes (checked) or No (cleared)	This enables or disables the alarm.
Priority	High, Medium, Low, None	This sets the alarm priority and notification options.
Pickup Setpoint (Pickup Limit)	Varies depending on the standard alarm you are setting up	This is the value (magnitude) you define as the setpoint limit for triggering the alarm. For “over” conditions, this means the value has gone above the Pickup limit. For “under” conditions, this means the value has gone below the Pickup limit.
Pickup Time Delay (Delay)	0 to 999999	This specifies the number of seconds the signal must stay above the pickup setpoint (for “over” conditions), or below the pickup setpoint (for “under” conditions) before the alarm is tripped.
Dropout Setpoint (Dropout Limit)	Varies depending on the standard alarm you are setting up	This is the value (magnitude) you define as the limit for dropping out of the alarm condition. For “over” conditions, this means

Setting	Option or range	Description
		the value has gone below the Dropout limit. For "under" conditions, this means the value has gone above the Pickup limit.
Dropout Time Delay (Delay)	0 to 999999	This specifies the number of seconds the signal must stay below the dropout setpoint (for "over" conditions), or above the dropout setpoint (for "under" conditions) before the alarm condition is ended.
PU Set Point Lead/Lag (Lead, Lag)	Lead or Lag	Applies to PF (power factor) alarms only. Use this to set the PF value and quadrant to set the pickup setpoint for an over PF condition (PF Leading) or under PF condition (PF Lagging).
DO Set Point Lead/Lag (Lead, Lag)	Lead or Lag	Applies to PF (power factor) alarms only. Use this to set the PF value and quadrant to set the dropout setpoint for an over PF condition (PF Leading) or under PF condition (PF Lagging).
Select Dig Output (Outputs)	None Digital Output D1 Digital Output D2 Digital Output D1 & D2	Select the digital output(s) you want to control when the alarm is triggered.

LED alarm indicator

You can use the meter's alarm / energy pulsing LED as an alarm indicator.

When set to detect alarms, the LED blinks to indicate an alarm condition.

Configuring the LED for alarms using the display

You can use the meter display to configure the alarm / energy pulsing LED for alarming.

1. Navigate to the **Maint > Setup > LED**.
2. Set the mode to **Alarm**, then press **OK**.
3. Press the up arrow to exit. Press **Yes** to save your changes.

Configuring the LED for alarms using ION Setup

You can use the ION Setup to configure your meter's LED for alarming.

1. Open ION Setup and connect to your meter. See the ION Setup Help for instructions.
2. Navigate to **Energy Pulsing**.
3. Select **Front Panel LED** and click **Edit**.
4. Set the control mode to **Alarm** and click **OK**.
5. Click **Send** to save your changes.

Alarm display and notification

The meter notifies you when an alarm condition is detected.

Alarm icon

When a low, medium or high priority alarm is tripped, this symbol appears at the top right corner of the display screen, indicating that an alarm is active:

For high priority alarms, the alarm icon remains displayed until you acknowledge the alarm.

Alarm / energy pulsing LED

If configured for alarming, the alarm / energy pulsing LED also flashes to indicate the meter has detected an alarm condition.

Alarm screens

If your meter is equipped with a display, you can use the buttons to navigate to the alarm setup or display screens.

Active alarms

When a pickup event occurs, the active alarm list appears on the meter display's Active Alarms screen. Press **Detail** to see more event information.

Alarm details

Details about the alarms can be viewed using:

- the active alarms (Active), alarm history (Hist), alarm counters (Count) and unacknowledged alarms (Unack) screens on the meter display, or

Active alarms list and alarm history log

Each occurrence of a low, medium or high priority alarm is stored in the active alarms list and recorded in the alarm history log.

The active alarm list holds 40 entries at a time. The list works as a circular buffer, replacing old entries as new entries over 40 are entered into the active alarms list. The information in the active alarms list is volatile and reinitializes when the meter resets.

The alarm history log holds 40 entries. The log also works as a circular buffer, replacing old entries with new entries. The information in the alarm history log is nonvolatile and is retained when the meter resets.

Viewing active alarm details using the display

When an alarm condition becomes true (alarm = ON), the alarm is displayed on the active alarms screen.

Alarms are displayed sequentially in the order of their occurrence, regardless of priority. The alarm details show the date and time of the alarm event, the type of event (for example, pickup or unary), which phase the alarm condition was detected on, and the value that caused the alarm condition.

NOTE: Alarm details are not available if the alarm priority is set to None.

The alarm details (for low, medium and high priority alarms) are also recorded in the alarm history log.

1. Navigate to **Alarm > Active**.
2. Select the alarm you want to view (the latest ones appear on top).
3. Press **Detail**.

   NOTE: For unacknowledged high priority alarms, the Ack option appears on this screen. Press **Ack** to acknowledge the alarm, or return to the previous screen if you do not want to acknowledge the alarm.

Viewing alarm history details using the display

The alarm history log keeps a record of active alarms and past alarms.

When an active alarm condition becomes false (alarm = OFF), the event is recorded in the alarm history log and alarm notification (alarm icon, alarm LED) is turned off.

Alarms are displayed sequentially in the order of their occurrence, regardless of priority. The alarm details show the date and time of the alarm event, the type of event (for example, dropout or unary), which phase the alarm condition was detected on, and the value that caused the alarm condition to turn ON or OFF.

NOTE: Alarm details are not available if the alarm priority is set to None.

1. Navigate to **Alarm > Hist**.
2. Select the alarm you want to view (the latest ones appear on top).
3. Press **Detail**.

   NOTE: For unacknowledged high priority alarms, the **Ack** option appears on this screen. Press **Ack** to acknowledge the alarm, or return to the previous screen if you do not want to acknowledge the alarm.

Alarms counters

Every occurrence of each type of alarm is counted and recorded in the meter.

Alarms rollover value

The alarm counters roll over to zero after reaching the value 9999.

Resetting alarms using ION Setup

Use ION Setup to reset alarms.

You can also reset alarms using the meter display.

1. Connect to your meter in ION Setup.
2. Open the **Meter Resets** screen.
3. Select the alarm parameters to clear and click **Reset**.

Meter logging

Logs overview

This chapter briefly describes the following logs of the meter:

- Alarm log
- User-defined data log

Logs are files stored in the non-volatile memory of the meter and are referred to as "on-board logs".

Setting up the data log

You can select up to 13 items to record in the data log and the frequency (logging interval) that you want those values updated.

Use ION Setup to configure data logging.

NOTICE
DATA LOSS Save the contents of the data log before configuring it. **Failure to follow these instructions can result in data loss.**

1. Start ION Setup and open your meter in setup screens mode (**View > Setup Screens**). See the ION Setup Help for instructions.
2. Double-click **Data Log #1**.
3. Set up the logging frequency and measurements/data to log.
4. Click **Send** to save the changes to the meter.

Parameter	**Values**	**Description**
Status	Enable, Disable	Set this parameter to enable or disable data logging in the meter.
Interval	15 minutes, 30 minutes, 60 minutes	Select a time value to set the logging frequency.
Channels	Items available for logging can vary based on the meter type.	Select an item to record from the "Available" column, then click the double-right arrow button to move the item to the "Selected" column. To remove an item, select it from the "Selected" column then click the double-left arrow button.

Saving the data log contents using ION Setup

You can use ION Setup to save the contents of the data log.

1. Start ION Setup and open your meter in data screens mode (**View > Data Screens**. See the ION Setup help for instructions.
2. Double-click **Data Log #1** to retrieve the records.

3. Once the records have finished uploading, right-click anywhere in the viewer and select **Export CSV** from the popup menu to export the entire log.

   NOTE: To export only selected records in the log, click the first record you want to export, hold down the SHIFT key and click the last record you want to export, then select **Export CSV** from the popup menu.

4. Navigate to the folder where you want to save the data log file, then click **Save**.

Alarm log

Alarm records are stored in the meter's alarm history log.

By default, the meter can log the occurrence of any alarm condition. Each time an alarm occurs it is entered into the alarm log. The alarm log in the meter stores the pickup and dropout points of alarms along with the date and time associated with these alarms. You can view and save the alarm log to disk, and reset the alarm log to clear the data out of the meter's memory.

The meter stores alarm log data in non-volatile memory. The size of the alarm log is fixed at 40 records.

Measurements and calculations

Meter Initialization

Meter Initialization is a special command that clears the meter's energy, power, demand values, 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 64 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.

Energy measurements

The meter provides fully bi-directional, 4-quadrant energy metering.

The meter stores all accumulated active, reactive and apparent energy measurements in nonvolatile memory:

- kWh, kVARh, kVAh (delivered and received)
- kWh, kVARh, kVAh net (delivered - received)
- kWh, kVARh, kVAh absolute (delivered + received)

All energy parameters represent the total for all three phases.

Min/max values

When the readings reach their lowest or highest value, the meter updates and saves these min/max (minimum and maximum) quantities with date and time of occurrence in non-volatile memory.

The meter's real-time readings are updated once every 50 cycles for 50 Hz systems, or once every 60 cycles for 60 Hz systems.

Power demand

Power demand is a measure of average power consumption over a fixed time interval.

NOTE: If not specified, references to "demand" are assumed to mean "power demand."

The meter measures instantaneous consumption and can calculate demand using various methods.

Power demand calculation methods

Power demand is calculated by dividing the energy accumulated during a specified period by the length of that period.

How the meter performs this calculation depends on the method and time parameters you select (for example, timed rolling block demand with a 15-minute interval and 5-minute subinterval).

To be compatible with electric utility billing practices, the meter provides the following types of power demand calculations:

- Block interval demand
- Synchronized demand
- Thermal demand

You can configure the power demand calculation method from the display or software.

Block interval demand

For block interval demand method types, you specify a period of time interval (or block) that the meter uses for the demand calculation.

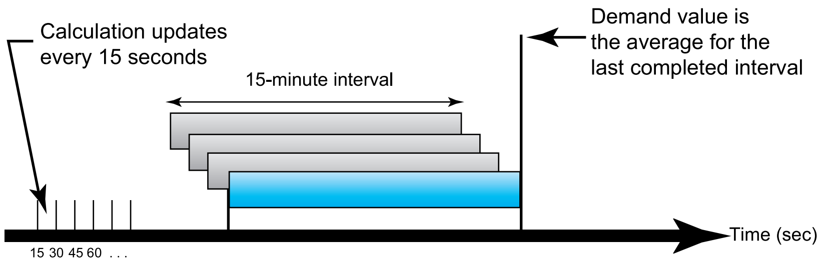
Select/configure how the meter handles that interval from one of these different methods:

Type	Description
Timed Sliding Block	Select an interval from 1 to 60 minutes (in 1-minute increments). If the interval is between 1 and 15 minutes, the demand calculation *updates every 15 seconds*. If the interval is between 16 and 60 minutes, the demand calculation *updates every 60 seconds*. The meter displays the demand value for the last completed interval.
Timed Block	Select an interval from 1 to 60 minutes (in 1-minute increments). The meter calculates and updates the demand at the end of each interval.
Timed Rolling Block	Select an interval and a subinterval. The subinterval must divide evenly into the interval (for example, three 5-minute subintervals for a 15-minute interval). Demand is *updated at the end of each subinterval*. The meter displays the demand value for the last completed interval.

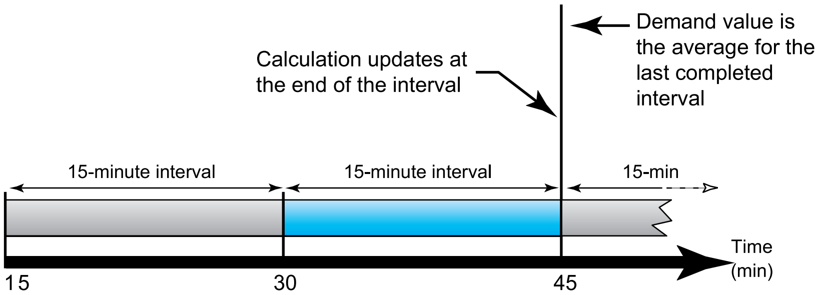
Block interval demand example

The following illustration shows the different ways power demand is calculated using the block interval method. In this example, the interval is set to 15 minutes.

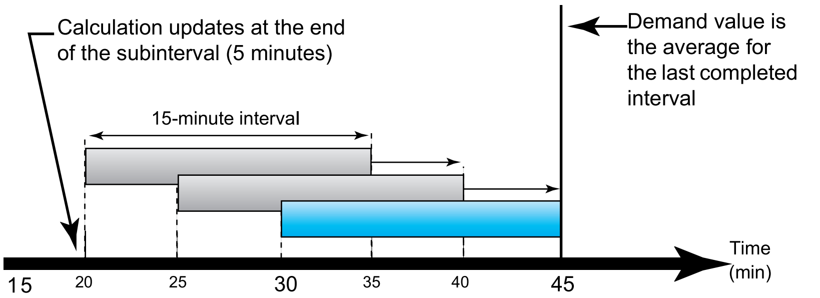
Timed Sliding Block



Timed Block



Timed Rolling Block



Synchronized demand

You can configure the demand calculations to be synchronized using an external pulse input, a command sent over communications, or the device's internal real-time clock.

Type	Description
Command synchronized demand	This method allows you to synchronize the demand intervals of multiple meters on a communications network. For example, if a programmable logic controller (PLC) input is monitoring a pulse at the end of a demand interval on a utility revenue meter, you can program the PLC to issue a command to multiple meters whenever the utility meter starts a new demand interval. Each time the command is issued, the demand readings of each meter are calculated for the same interval.
Clock synchronized demand	This method allows you to synchronize the demand interval to the meter's internal real-time clock. This helps you synchronize the demand to a particular time, typically on the hour (for example, at 12:00 am). If you select another time of day when the demand intervals are to be synchronized, the time must be specified in minutes from midnight. For example, to synchronize at 8:00 am, select 480 minutes.

NOTE: For these demand types, you can choose block or rolling block options. If you select a rolling block demand option, you need to specify a subinterval.

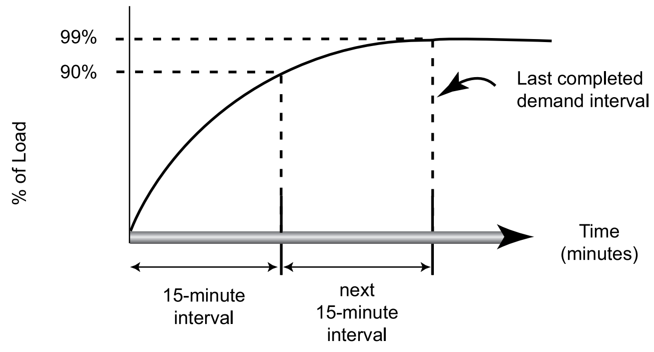
Thermal demand

Thermal demand calculates the demand based on a thermal response, which imitates the function of thermal demand meters.

The demand calculation updates at the end of each interval. You can set the demand interval from 1 to 60 minutes (in 1-minute increments).

Thermal demand example

The following illustration shows the thermal demand calculation. In this example, the interval is set to 15 minutes. The interval is a window of time that moves across the timeline. The calculation updates at the end of each interval.



Current demand

The meter calculates current demand using the block interval, synchronized or thermal demand methods.

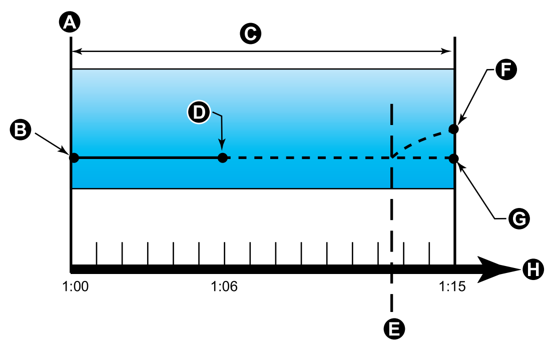
You can set the demand interval from 1 to 60 minutes in 1 minute increments (for example, 15 minutes).

Predicted demand

The meter calculates predicted demand for the end of the present interval for kW, kVAR, and kVA demand, taking into account the energy consumption so far within the present (partial) interval and the present rate of consumption.

Predicated demand is updated according to the update rate of your meter.

The following illustration shows how a change in load can affect predicted demand for the interval. In this example, the interval is set to 15 minutes.



A	Beginning of interval	E	Change in load
B	Demand for last completed interval	F	Predicted demand if load is added during interval; predicted demand increases to reflect increased demand
C	15-minute interval	G	Predicted demand if no load is added
D	Partial interval	H	Time

Peak demand

The meter records the peak (or maximum) values for kWD, kVARD, and kVAD power (or peak demand).

The peak for each value is the highest average reading since the meter was last reset. These values are maintained in the meter's non-volatile memory.

The meter also stores the date and time when the peak demand occurred.

Timer

The meter supports an active load timer, meter operation timer, and run hour.

The timer data can be read through register map.

Active load timer

Active load timer shows how much time a load has been running, based on the specified minimum current for the load timer setpoint setting.

Meter operation timer

Meter operating timer shows how long the meter has been powered up.

Run Time

Run time shows 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 and 31st harmonic (PM2130 only), and calculates 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.

Harmonic content calculations

Harmonic content (H_C) is equal to the RMS value of all the non-fundamental harmonic components in one phase of the power system.

The meter uses the following equation to calculate H_C:

$$HC = \sqrt{(H_2)^2 + (H_3)^2 + (H_4)^2 \ldots}$$

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).

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% data on the front panel, while the phase wise THD% data can be read through communication.

1. Navigate to **THD**.
2. Press **Amps**, **V L-L**, or **V L-N** to view current or voltage THD%.

3. Press Up arrow to exit the page.

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.

Meter battery

The internal battery in the meter keeps its clock running and helps maintain the time even when the meter is powered down.

The life expectancy of the meter’s internal battery is estimated to be over 3 years at 25 °C under typical operating conditions.

Viewing firmware version, model and serial number

You can view the meter’s firmware version, model and serial number from the display panel.

1. Navigate to **Maint > Diag**.
2. Press **Info** to view meter model, serial number, date of manufacturing, OS version, and RS version.
3. Press Up to exit.

Firmware upgrades

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

- 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

Technical assistance

Visit www.schneider-electric.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.

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

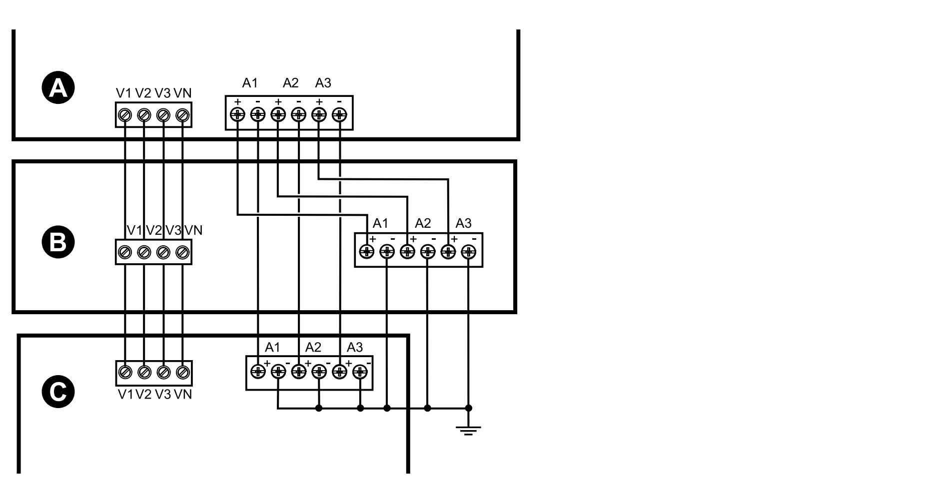
HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- 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.

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.

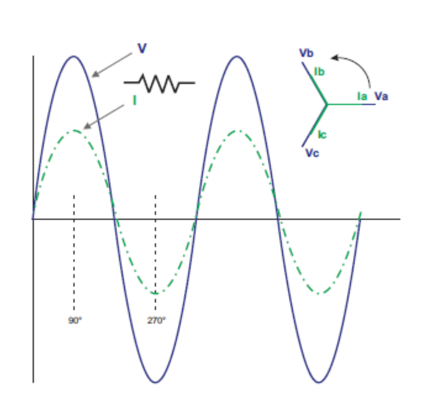
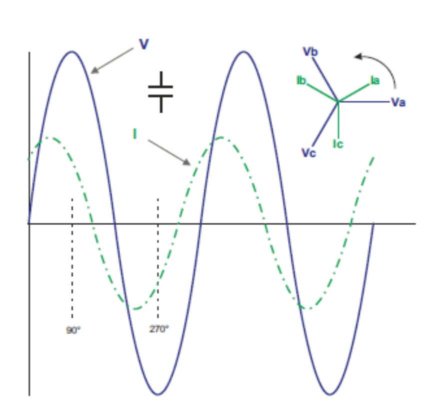
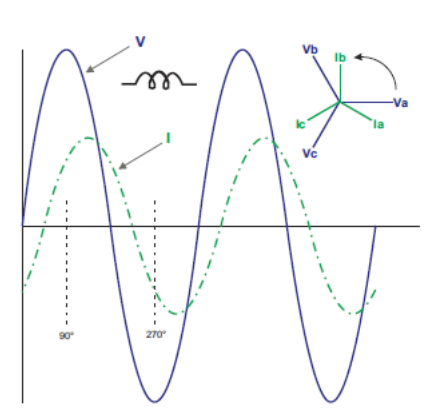
In a balanced 3-phase alternating current (AC) power system source, the AC voltage waveforms on the current-carrying conductors are equal but offset by one-third of a period (a phase angle shift of 120 degrees between the three voltage waveforms).

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)
		

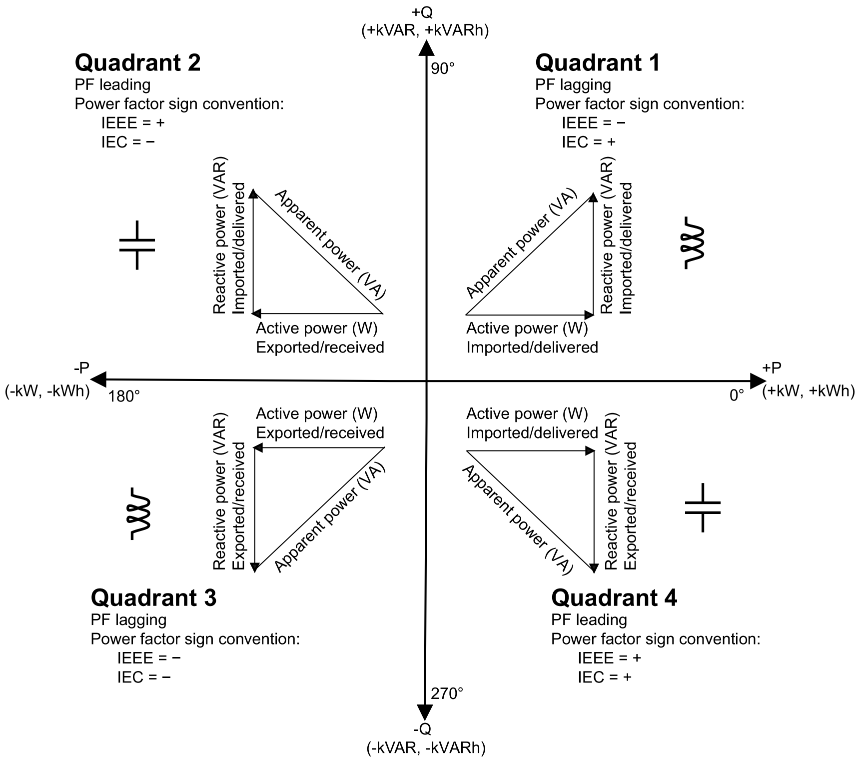
Real, reactive and apparent power (PQS)

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 and displacement PF

The meter supports true power factor and displacement power factor values:

- True power factor includes harmonic content.
- Displacement power factor only considers the fundamental frequency.

NOTE: Unless specified, the power factor displayed by the meter is true power factor.

Power factor sign convention

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

You can set the power factor sign (PF sign) convention that is used on the display to either IEC or IEEE.

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 (-).

PF sign convention: IEEE

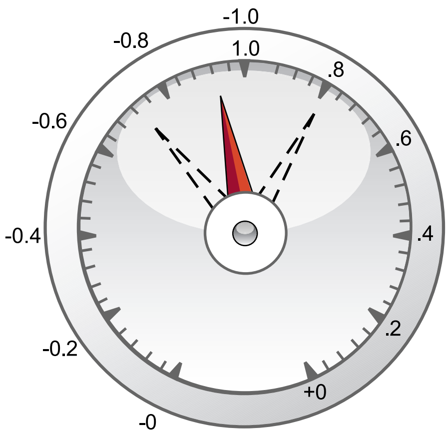
PF sign is correlates with the PF lead/lag convention, in other words, the effective load type (inductive or capacitive):

- For a capacitive load (PF leading, quadrant 2 and 4), the PF sign is positive (+).
- For an inductive load (PF lagging, quadrant 1 and 3), the PF sign is negative (-).

Power factor min/max convention

The meter uses a specific convention for determining the power factor minimum and maximum values.

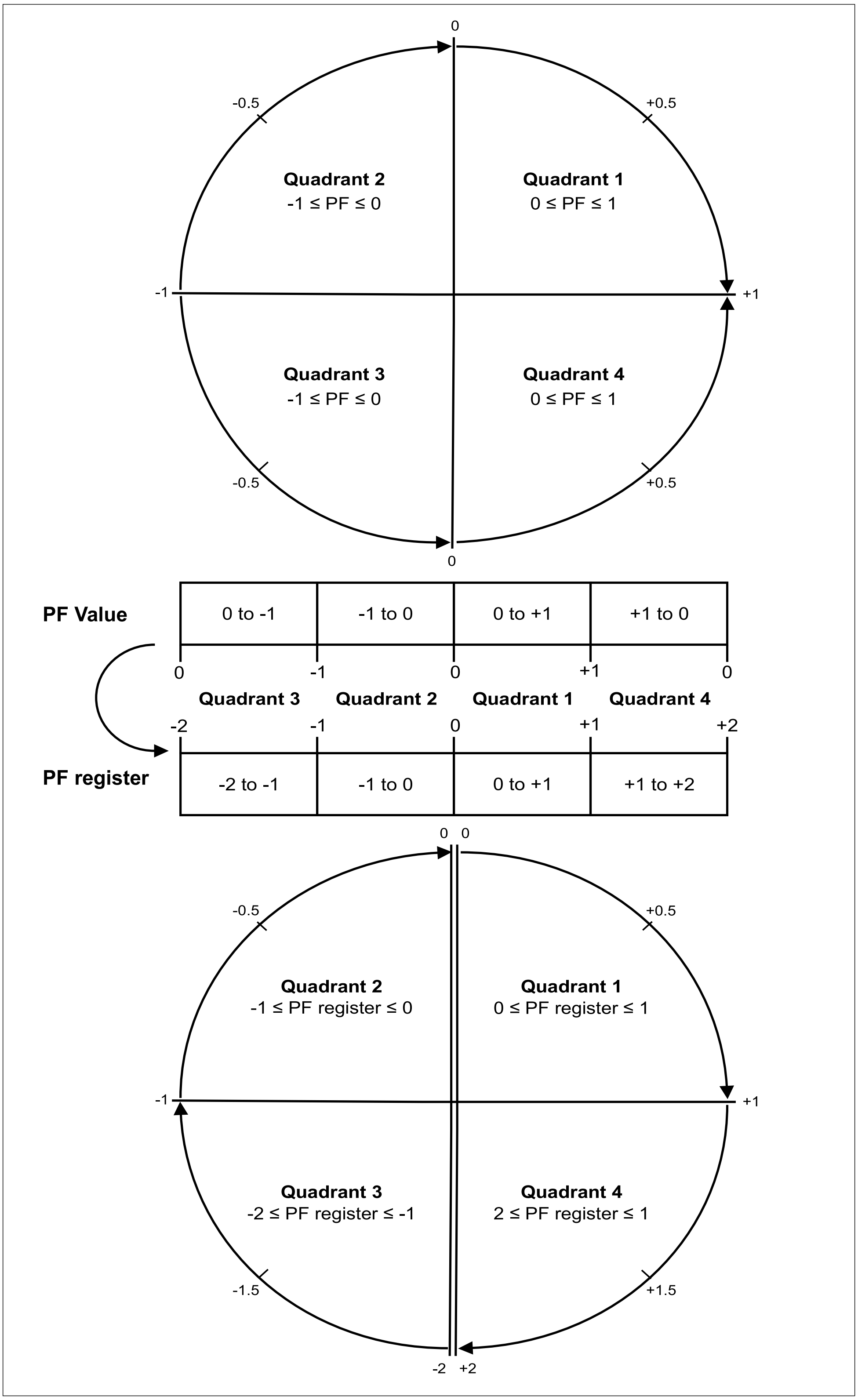
- For negative PF readings, the minimum PF value is the measurement closest to -0 for PF readings between -0 to -1. For positive PF readings, the minimum PF value is the measurement closest to +1 for PF readings between +1 to +0.
- For negative PF readings, the maximum PF value is the measurement closest to -1 for PF readings between -0 to -1. For positive PF readings, the maximum PF value is the measurement closest to +0 for PF readings between +1 to +0.



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	PF register range	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)

Meter specifications

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 Meter body: IP30
Panel thickness maximum	6.0 mm (0.25 in) maximum
Mounting position	Vertical
Display type	LCD display: Monochrome graphical LCD
Keypad	4 button with intuitive navigation
Front panel LED indicators	Green LED (heartbeat / serial communications activity) Amber LED (alarm / energy pulse output)
Weight	~ 300 gms
Dimensions W x H x D	96 x 96 x 73 mm max
Protection features	Password protected for set-up parameters

Electrical characteristics

Measurement accuracy

Current, Phase	± 0.5% for Class 1.0 and Class 0.5S
Voltage L-N, L-L	± 0.5% for Class 1.0 and Class 0.5S
Power Factor	± 0.01 count for Class 1.0 and Class 0.5S
Power	PM2210, PM2220: • Active power: ± 1% for Class 1.0 and Class 0.5S • Reactive power: ± 1% for Class 1.0 and Class 0.5S • Apparent power: ± 1% for Class 1.0 and Class 0.5S PM2230: • Active power: ± 0.5% for Class 1.0 and Class 0.5S • Reactive power: ± 1% for Class 1.0 and Class 0.5S • Apparent power: ± 0.5% for Class 1.0 and Class 0.5S
Frequency	± 0.05% for Class 1.0 and Class 0.5S
Active Energy	Class 0.5S as per IEC 62053-22 and Class 1.0 as per IEC 62053-21 for both 5 A and 1 A* nominal CT. ** For 1 A CT nominal, additional error of ±1% from 50 mA to 150 mA, ±2% for current > 10 mA to < 50 mA*
Reactive Energy	Class 1.0 as per IEC 62053-24 for 5 A nominal CT
THD and Individual Harmonic V & A	± 5% FS for THD and individual harmonics up to 15th order

Voltage inputs

VT primary	999 kV L-L max, starting voltage depends on VT ratio
V nominal	277 V L-N / 480 V L-L
Measured V with full range	35 - 480 V L-L (20 - 277 V L-N), CAT III 35 - 600 V L-L (20 - 347 V L-N), CAT II

Voltage inputs

Permanent overload	750 V AC L-L
Impedance	≥ 5 MΩ
Frequency	50 / 60 Hz nominal ± 5%
VA burden	< 0.2 VA at 240 V AC L-N

Current inputs

CT ratings	Primary adjustable 1 A to 32767 A Secondary 1 A or 5 A I-nominal
Measured current	5 mA to 6 A
Withstand	Continuous 12 A; 50 A at 10 sec/hr, 500 A at 1 sec/hr
Impedance	< 0.3 mΩ
Frequency	50 / 60 Hz nominal
VA Burden	< 0.024 VA at 6 A

AC control power - PM2210/PM2220

Operating range	44 - 277 V L-N ± 10%
Burden	< 6 VA at 277 V L-N
Frequency range	45 - 65 Hz ± 5%
Ride-through time	100 ms typical at 230 V AC and maximum burden 100 ms typical at 277 V AC and maximum burden

AC control power - PM2230

Operating range	80 - 277 V L-N ± 10%
Burden	< 8 VA at 277 V L-N
Frequency range	45 - 65 Hz ± 5%
Ride-through time	100 ms typical at 230 V AC and maximum burden 100 ms typical at 277 V AC and maximum burden

DC control power - PM2210/PM2220

Operating range	44 - 277 V DC ± 10%
Burden	< 2 W at 277 V DC
Ride-through time	50 ms typical at 125 V DC and maximum burden

DC control power - PM2230

Operating range	100 - 277 V DC ± 10%
Burden	< 3.3 W at 277 V DC
Ride-through time	50 ms typical at 125 V DC and maximum burden

Displays update

Instantaneous	1 s
Demand	15 s
Harmonics	5 s

Wiring configuration

User programmable	1ph 2W, L-N 1ph 2W, L-L 1ph 3W, L-L with N (2 phase) 3ph 3W, Delta, Ungrounded 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 Grounded 3ph 4W, Wye, Resistance Grounded

Environmental characteristics

Operating temperature	-10 °C to +60 °C (14 °F to 140 °F)
Storage temperature	-25 °C to +70 °C (-13 °F to 158 °F)
Humidity rating	5% to 95% RH at 50 °C (122 °F) (non-condensing)
Pollution degree	2
Altitude	< 2000 m (6562 ft)
Location	Not suitable for wet locations
Product life	> 7 years

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 FCC Part 15 Class A/CE

* - Tested as per IEC 61326-1 standard for Emission

Safety

Europe	CE, as per IEC 61010-1 Ed-3
US and Canada	cULus per UL 61010-1 CAN / CSA-C22.2 No. 61010-1, for 600 V AC
Measurement category (Voltage and Current inputs)	CAT III up to 480 V L-L CAT II up to 600 V L-L
Overvoltage category (Control power)	CAT III up to 300 V L-N
Dielectric	As per IEC / UL 61010-1 Ed-3
Protective Class	II, Double insulated for user accessible parts
Other certification	C-Tick (RCM)

RS-485 communications

Number of ports	1
Maximum cable length	1200 m (4000 ft)
Maximum number of devices (unit loads)	Up to 32 devices on the same bus
Parity	Even, Odd, None (1 stop bit for Odd or Even parity; 2 stop bits for None)
Baud rate	4800, 9600, 19200, 38400
Isolation	2.5 kV RMS, double insulated

Pulse output

Pulse output (POP)	Max 40 V DC, 20 mA 20 ms ON time Configurable pulse weight from 1 to 9999000 (pulse/ k_h)

Real-time clock

Battery backup time	3 years

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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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