PowerLogic™ Power Meter 210

Reference Manual

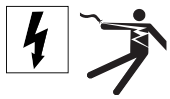
Instruction Bulletin

63230-510-205A1

Schneider Electric

HAZARD CATEGORIES AND SPECIAL SYMBOLS

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



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

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

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

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

CAUTION

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

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

PLEASE NOTE

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

FCC NOTICE

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

Consult the dealer or an experienced radio/TV technician for help.

SECTION 1— INTRODUCTION

POWER METER HARDWARE

Figure 1–1 below shows the parts of the PM210. Table 1–1 describes each part.

Figure 1–1: Parts of the PM210

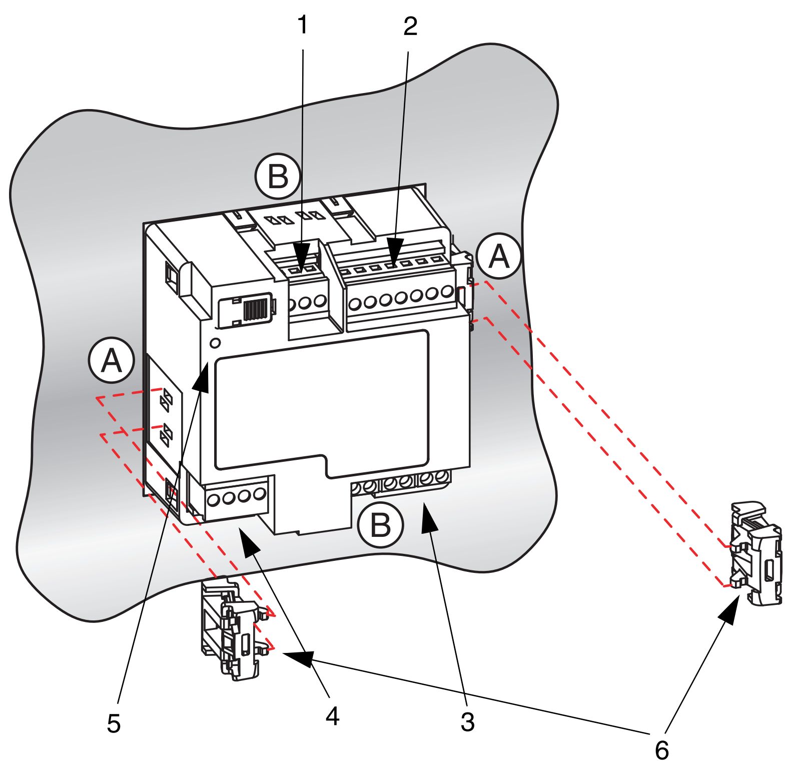


Table 1–1: Parts of the PM210

Number	Part	Description
1	Control power supply connector	Connection for control power to the power meter.
2	Voltage inputs	Voltage metering connections.
3	Current inputs	Current metering connections.
4	RS485 port (COM1)	The RS485 port is used for communications with a monitoring and control system. This port can be daisy-chained to multiple devices.
5	LED	Steady = OFF/ON. Flashing = communications indicator.
6	Retainer clips	Used to hold power meter in place.
A	Retainer slots, position A	Use for installation locations thinner than 3 mm (1/8 in.).
B	Retainer slots, position B	Use for installation locations 3 - 6 mm (1/8 to 1/4 in.).

Power Meter Parts and Accessories

Table 1–2: PM210 Models

Description	Model Number
Power Meter with Integrated Display	PM210 PM210MG

Box Contents

- One (1) power meter
- Two (2) retainer clips
- One (1) installation sheet
- One (1) RS485 Terminator (MCT2W)

Accessories

Model Number	Description	Contents
PM72DINRAILKIT	Din rail mounting kit	Two (2) DIN rail clips Four (4) Plastite #2x5/16" screws Note: For more information, refer to document no. 63230-501-229A1
PM7AND2HWKIT	Set of connectors replacement	One (1) Control Power Connector One (1) Voltage Inputs Connector One (1) Comms Connector One (1) Communications Terminator Two (2) Spring Holders

FIRMWARE

This instruction bulletin is written to be used with firmware version 3.050. See "Viewing Meter Information" on page 13 for instructions on how to determine the firmware version.

SECTION 2— SAFETY PRECAUTIONS

BEFORE YOU BEGIN

This section contains important safety precautions that must be followed before attempting to install, service, or maintain electrical equipment. Carefully read and follow the safety precautions outlined below.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. In the USA, see NFPA 70E.
- Only qualified electrical workers should install this equipment. Such work should be performed only after reading this entire set of instructions.
- NEVER work alone.
- Before performing visual inspections, tests, or maintenance on this equipment, disconnect all sources of electric power. Assume that all circuits are live until they have been completely de-energized, tested, and tagged. Pay particular attention to the design of the power system. Consider all sources of power, including the possibility of backfeeding.
- Turn off all power supplying the power meter and the equipment in which it is installed before working on it.
- Always use a properly rated voltage sensing device to confirm that all power is off.
- Before closing all covers and doors, carefully inspect the work area for tools and objects that may have been left inside the equipment.
- Use caution while removing or installing panels so that they do not extend into the energized bus; avoid handling the panels, which could cause personal injury.
- The successful operation of this equipment depends upon proper handling, installation, and operation. Neglecting fundamental installation requirements may lead to personal injury as well as damage to electrical equipment or other property.
- NEVER bypass external fusing.
- NEVER short the secondary of a PT.
- NEVER open circuit a CT; use the shorting block to short circuit the leads of the CT before removing the connection from the power meter.
- Before performing Dielectric (Hi-Pot) or Megger testing on any equipment in which the power meter is installed, disconnect all input and output wires to the power meter. High voltage testing may damage electronic components contained in the power meter.
- The power meter should be installed in a suitable electrical enclosure.

Failure to follow this instruction will result in death or serious injury

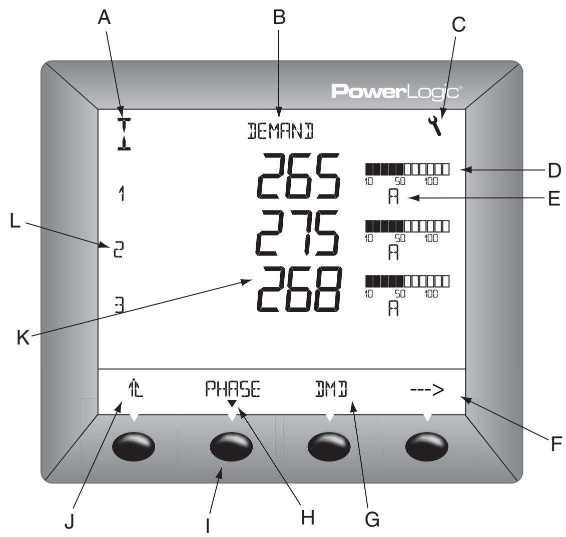
SECTION 3— OPERATION

OPERATING THE DISPLAY

The PM210 is equipped with a large, back-lit LCD display. It can display up to five lines of information plus a sixth row of menu options. Figure 3– 1 shows the different parts of the power meter display.

Figure 3– 1: PM210 Display

A. Type of measurement
B. Screen title
C. Maintenance icon
D. Bar Graph (%)
E. Units
F. Display more menu items
G. Menu item
H. Selected menu indicator
I. Button
J. Return to previous menu
K. Values
L. Phase



How the Buttons Work

The buttons are used to select menu items, display more menu items in a menu list, and return to previous menus. A menu item appears over one of the four buttons. Pressing a button selects the menu item and displays the menu item's screen. When you have reached the highest menu level, a black triangle appears beneath the selected menu item. To return to the previous menu level, press the button below ⮤. To cycle through the menu items in a menu list, press the button below ----▸. Table 3– 1 describes the button symbols.

Table 3– 1: Button Symbols

Navigation	
----▸	View more menu items on the current level.
⮤	Return to the previous menu level.
▼	Indicates the menu item is selected and there are no menu levels below the current level.
Change Values	
+	Change values or scroll through the available options. When the end of a range is reached, pressing + again returns to the first value or option.
◂--	Select the next position in a number.
OK	Move to the next editable field or exit the screen if the last editable field is selected.

NOTE:

- *Each time you read "press" in this manual, press and release the appropriate button beneath a menu item. For example, if you are asked to "Press PHASE," you would press and release the button below the PHASE menu item.*
- *Changes are automatically saved and take effect immediately.*

Changing Values

When a value is selected, it flashes to indicate that it can be modified. A value is changed by doing the following:

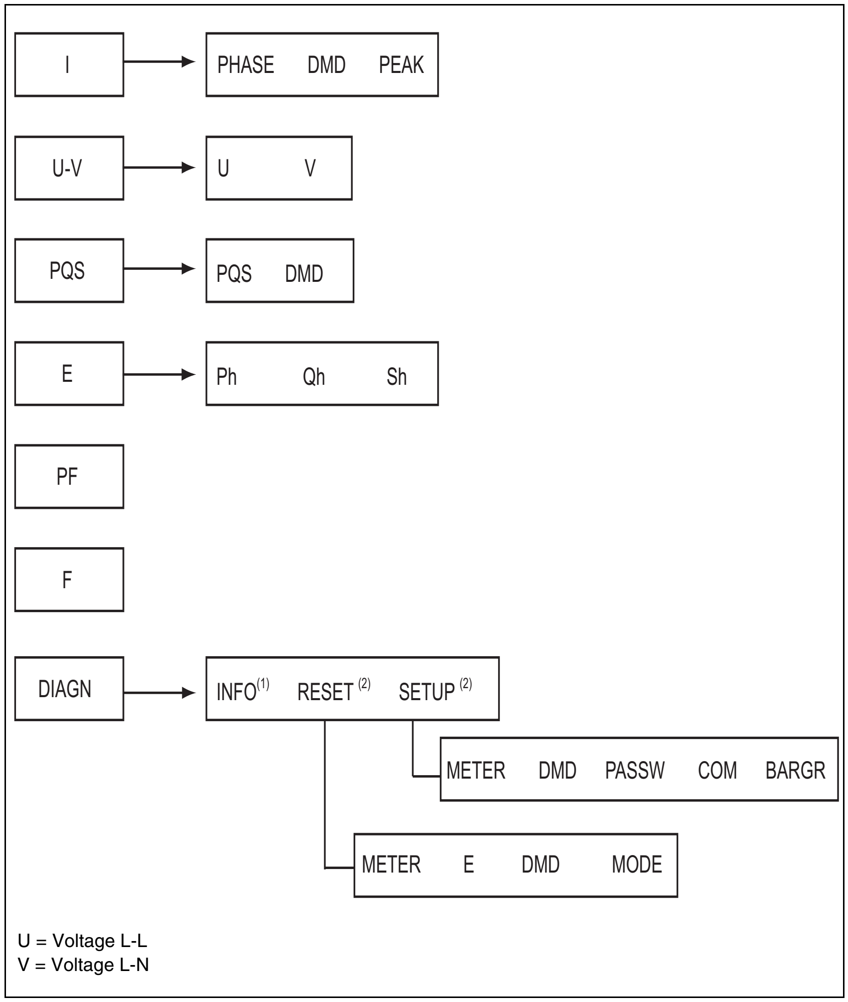
- Press ⁺ or ← to change numbers or scroll through available options.
- If you are entering more than one digit, press ← to move to the next digit in the number.
- To save your changes and move to the next field, press OK.

MENU OVERVIEW

Menu items are displayed below the horizontal line at the bottom of the screen. Figure 3– 2 below shows the menu items of the first two levels of the power meter menu hierarchy. Selecting a Level 1 menu item takes you to the next screen level containing the Level 2 menu items. Some Level 2 items have Level 3 items. The navigation buttons work consistently across all menu levels.

NOTE: The ----▸ is used to scroll through all menu items on a level.

Figure 3– 2: Abbreviated IEC Mode/Menu Items*



1 The INFO command includes model, firmware version, and serial number information.

2 Reset and Setup menu items require a password to navigate to the second level menu.

* The power meter can be configured to display either IEC or IEEE nomenclature. Figure 3– 2 shows IEC nomenclature.

SETTING UP THE POWER METER

The PM210 ships with many default values already set up in the meter. These values may be changed by navigating to the appropriate screen and entering new values. Other values may be changed using the Reset function. Use the instructions in the following sections to change values. See “Resetting the Power Meter” on page 11 for more information on the Reset function.

NOTE: New values are automatically saved when you exit the screen.

The PM210 screen is able to display nomenclatures for both IEC and IEEE modes. Table 3– 2 shows the nomenclature for each mode. The different nomenclatures do not affect any of the meter calculations. See “Set Up Visualization Mode” on page 11 for changing the meter mode.

Table 3– 2: PM210 Mode Nomenclatures

Menu Selections		IEC	IEEE
Current	Phase	I 1, 2, 3	AMPS ABC
Voltage	Phase to Phase Phase to Neutral	U - V 1-2, 2-3, 3-1 1-N, 2-N, 3-N	VL-L, VL-N A-B, B-C, C-A A-N, B-N, C-N
Power	3-Phase Demand (DMD)	PQS Pd, Qd, Sd	PWR Wd, VARd, VAd
Energy	3-Phase	E Ph, Qh, Sh	ENERG Wh, VARh, VAh
Power Factor	Total	PF ⊣⊢ or ~ooo~	PF ⊣⊢ or ~ooo~
Frequency		F	HZ
Diagnostics		DIAGN	

Set Up Power Meter

To begin PM210 setup, do the following:

1. Press ----▸ until you see DIAGN.
2. Press SETUP.
3. Enter your password. The default password is 00000.
4. Press OK.

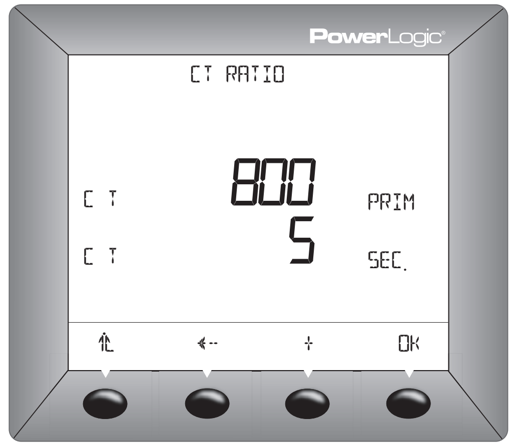
NOTE: The Power Meter defaults to its summary screen after 60 seconds or 1 minute of being in any of the SETUP menus without operation.

Follow the directions in the following sections to set up meter values.

NOTE: All screen displays show IEC nomenclature.

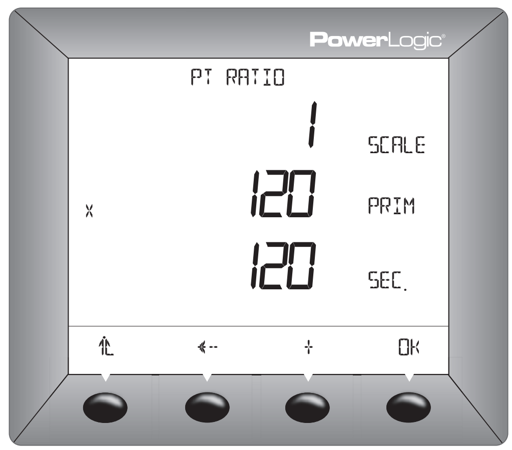
Set Up CTs

1. In SETUP mode, press ----▸ until METER is visible.
2. Press METER.
3. Press CT.
4. Enter the PRIM (primary CT) number.
5. Press OK.
6. Enter the SEC. (secondary CT) number.
7. Press OK to return to the METER SETUP screen.
8. Press ⮤ to return to the SETUP MODE screen.



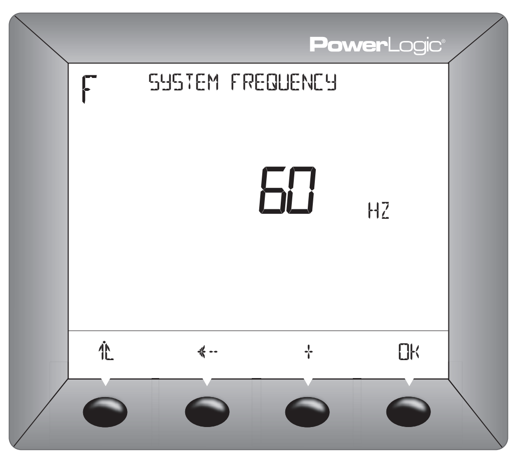
Set Up PTs

1. In SETUP mode, press ----▸ until METER is visible.
2. Press METER.
3. Press PT.
4. Enter the SCALE value: x1, x10, x100, NO PT (for direct connect).
5. Press OK.
6. Enter the PRIM (primary) value.
7. Press OK.
8. Enter the SEC. (secondary) value.
9. Press OK to return to the METER SETUP screen.
10. Press ⮤ to return to the SETUP MODE screen.



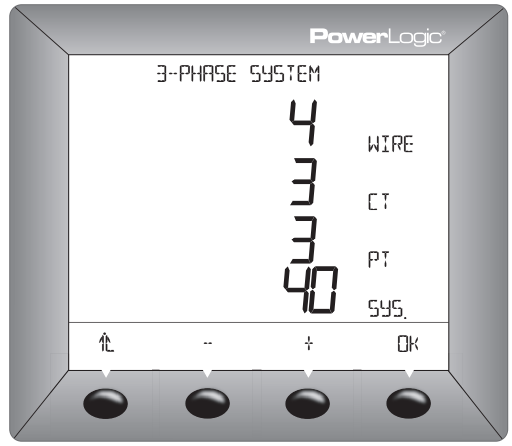
Set Up System Frequency

1. In SETUP mode, press ----▸ until METER is visible.
2. Press ----▸ until F (system frequency) is visible.
3. Press F.
4. Select the frequency.
5. Press OK to return to the METER SETUP screen.
6. Press ⮤ to return to the SETUP MODE screen.



Set Up Meter System Type

1. In SETUP mode, press ----▸ until METER is visible
2. Press METER.
3. Press ----▸ until SYS (system type) is visible.
4. Press SYS.
5. Select the SYS (system type): 10, 11, 12, 30, 31, 32, 40, 42, 44.
6. Press OK to return to the METER SETUP screen.
7. Press ⮬ to return to the SETUP MODE screen.

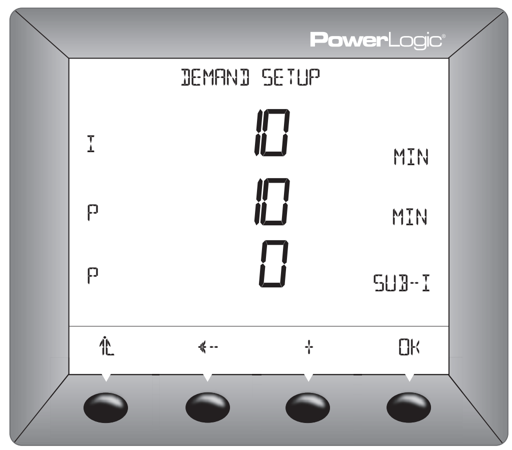


Set Up Demand Current and Power

1. In SETUP mode, press ----▸ until DMD (demand) is visible.
2. Press DMD (demand setup).
3. Enter the MIN (thermal demand interval in minutes) for I (current): 1 to 60.
4. Press OK.
5. Enter the MIN (demand interval in minutes) for P (power): 1 to 60.
6. Press OK.
7. Enter the SUB-I (number of sub-intervals) for P: 0 to 60.
8. Press OK to return to SETUP MODE screen.

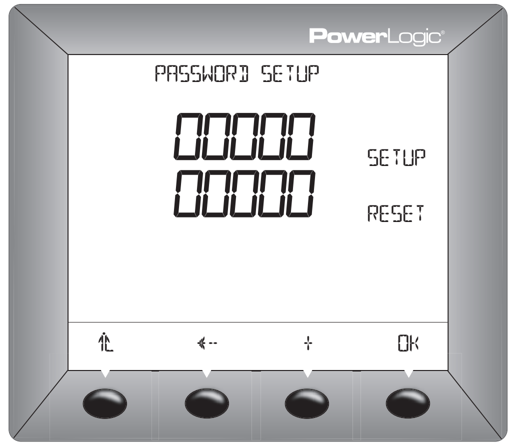
NOTE: The calculation method used for current is Thermal.
The calculation method used for power is based on SUB-I as follows:

- 0 = sliding block
- 1= block
- >1 = rolling block (The SUB-I value must divide evenly into the MIN value to the second. For example, you might set 2 subintervals for a 15-minute interval. The meter will calculate the subinterval period to be 7.5 minutes or 450 seconds. Demand is updated at each subinterval.



Set Up Passwords

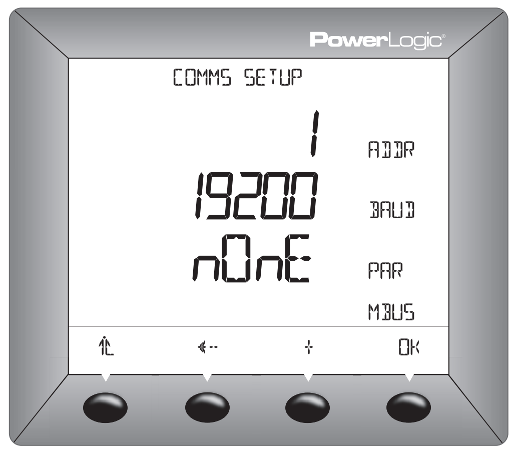
1. In SETUP mode, press ----▸ until PASSW (password) is visible.
2. Press PASSW.
3. Enter the SETUP password.
4. Press OK.
5. Enter the RESET (password to reset the power meter) password.
6. Press OK to return to the SETUP MODE screen.



Set Up Communications

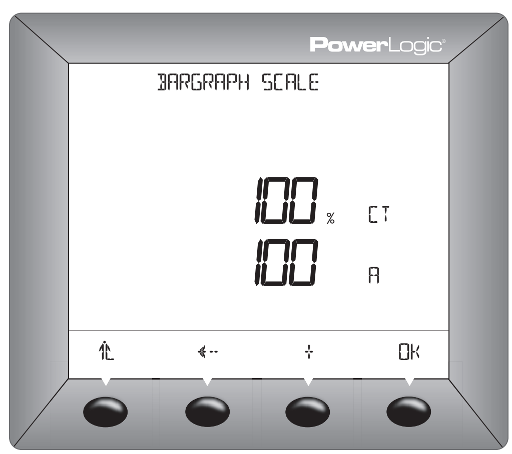
1. In SETUP mode, press ----▸ until COM is visible.
2. Press COM.
3. Enter the ADDR (meter address): 1 to 247.
4. Press OK.
5. Select the BAUD (baud rate): 2400, 4800, 9600, or 19200.
6. Press OK.
7. Select the parity: EVEN, ODD, or NONE.
8. Press OK to return to the SETUP MODE screen.

NOTE: Default values are displayed.



Set Up Bar Graph Scale

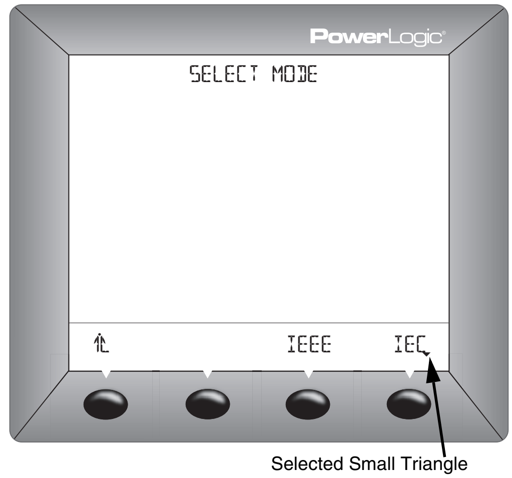
1. In SETUP mode, press ----▸ until BARG is visible.
2. Press BARG.
3. Enter the %CT (percent of CT primary to represent 100 on the bar graph).
4. Press OK to return to the SETUP MODE screen.



Set Up Visualization Mode

The PM210 Visualization Mode is set up using the RESET menu. Follow the “Power Meter Setup” instructions but select RESET instead of SETUP. The meter mode is only a visualization mode. It does not change or affect the way the PM210 performs its calculations.

1. In RESET mode, press ----▶ until MODE is visible.
2. Press MODE.
3. Select IEEE or IEC by pressing the corresponding button below the selection. A small triangle is displayed below the current selection.
4. Press ⮤ to return to the RESET MODE screen.



RESETTING THE POWER METER

Meter values can be re-initialized using the Reset function.

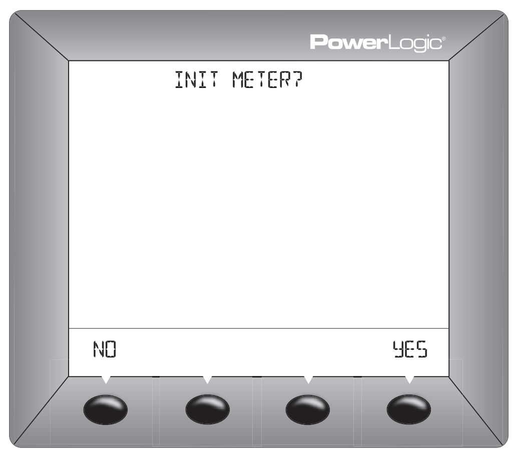
The following values are affected by this Reset:

- Energy Accumulators
- Demand Values

Initialize the Meter

To re-initialize the power meter, complete the following steps:

1. From the SUMMARY screen, press ----▶ until DIAGN is visible.
2. Press RESET.
3. Enter the RESET password (00000 is the default).
4. Press OK.
5. Press METER.
6. Press NO or YES.
7. Press ⮤ to return to the MAINTENANCE screen.

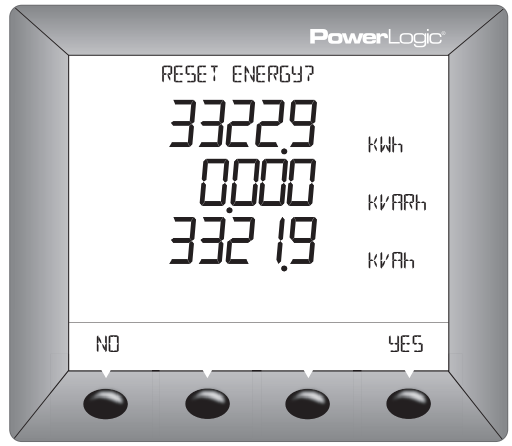


Reset Individual Values

Individual values for Energy and Demand can be reset without affecting other values. Below are instructions for resetting Energy and Demand values.

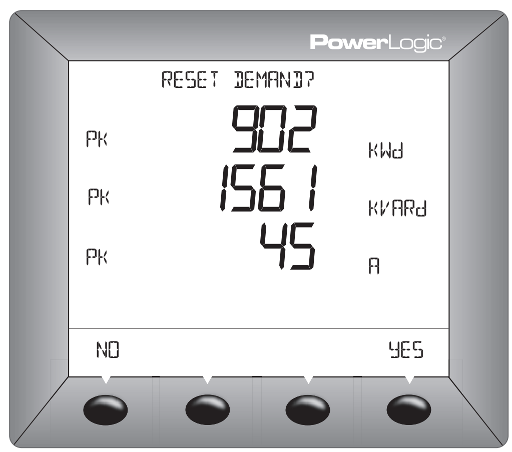
Reset Energy Values

1. From the SUMMARY screen, press ---▸ until DIAGN is visible.
2. Press RESET.
3. Enter the RESET password (00000 is the default).
4. Press OK.
5. Press E.
6. Press NO or YES.
7. Press ⇑ to return to the MAINTENANCE screen.



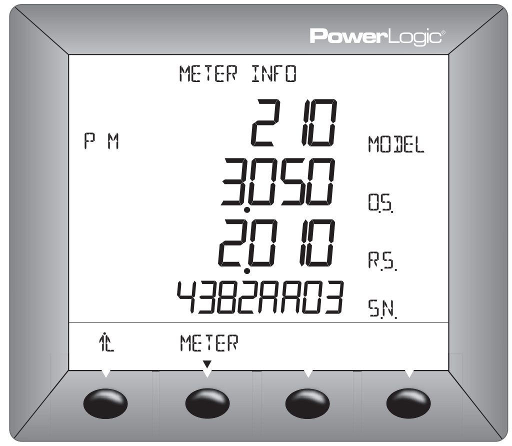
Reset Demand Values

1. From the SUMMARY screen, press ---▸ until DIAGN is visible.
2. Press RESET.
3. Enter the RESET password (00000 is the default).
4. Press OK.
5. Press ---▸ until DMD is visible
6. Press DMD.
7. Press NO or YES.
8. Press ⇑ to return to the MAINTENANCE screen.



VIEWING METER INFORMATION

1. Press ----▸ until DIAGN (diagnostics) is visible.
2. Press INFO.
3. View the meter information (model number, operating system firmware version, reset system firmware version, and power meter serial number).
4. Press ⇑L to return to the MAINTENANCE screen.



SECTION 4— METERING

POWER METER CHARACTERISTICS

The PM210 measures currents and voltages and reports in real time the rms values for all three phases and neutral. In addition, the power meter calculates power factor, real power, reactive power, and more. The table below lists the main or most important metering characteristics of the power meter.

Table 4– 1: PM210 Characteristics

Instantaneous rms Values	
Current	Per phase
Voltage	Per phase, L-L and L-N
Frequency	45 to 65 Hz
Active power	Total (signed)*
Reactive power	Total (signed)*
Apparent power	Total
Power factor	Total (signed)** 0.000 to 1
Energy Values	
Active energy (total)	$\pm 1.84 \times 10^{18}$ Wh (signed)*
Reactive energy (total)	$\pm 1.84 \times 10^{18}$ VARh (signed)*
Apparent energy (total)	0 to 1.84×10^{18} VAh
Demand Values	
Current	Per phase (Thermal)
Active, reactive, apparent power	Total (sliding block, rolling block, or block)
Maximum Demand Values	
Maximum current	Phase
Maximum active power	Total
Maximum reactive power	Total
Maximum apparent power	Total
Reset (password protected)	
Meter (initializes power meter)	Resets energy and maximum demand current and power
Energy values	kWh, kVAR, kVAh
Demand values	kWd, kVARd, kVAd
Visualization Modes (password protected)	
IEC or IEEE	Display (All calculations are the same under both visualization modes.)
Local or Remote Setup	
Type of distribution system	3-phase 3- or 4-wire with 1, 2, or 3 CTs, two- or single-phase
Rating of current transformers	Primary 1 to 32,767 A Secondary 5 or 1 A
Voltage	Primary 3,276,700 V max Secondary 100, 110, 115, 120
Calculation interval for demand currents	1 to 60 minutes
Calculation interval for demand power	1 to 60 minutes

*Signed values—Both power and energy in and out are considered. The power meter displays net values only.

**To read a signed value of power factor see Register 4048. The display shows either inductor or capacitor symbols

MODBUS RS485

Functions	
RS485	2-wire
Communication protocol	MODBUS RTU
Settings	
Communication address	1 to 247
Baud rate (communication speed)	2400, 4800, 9600, 19200 bauds
Parity	none, even, odd

DEMAND READINGS

The PM210 provides a variety of demand readings. Table 4– 2 lists the available demand readings and their reportable ranges.

Table 4– 2: Demand Readings

Demand Readings	Reportable Range
Demand Current, Per-Phase	
Last Complete Interval	0 to 32,767 A
Peak	0 to 32,767 A
Demand Real Power, 3Ø Total	
Last Complete Interval	±3276.70 MW
Peak	±3276.70 MW
Demand Reactive Power, 3Ø Total	
Last Complete Interval	±3276.70 MVAR
Peak	±3276.70 MVAR
Demand Apparent Power, 3Ø Total	
Last Complete Interval	0 to 3276.70 MVA
Peak	0 to 3276.70 MVA

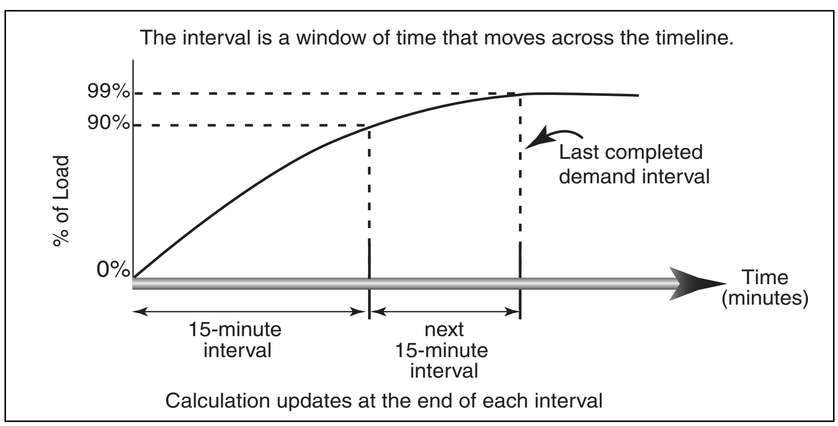
Demand Current Calculation Methods

The PM210 calculates demand current using the thermal demand method. The default interval is 15 minutes, but you can set the demand current interval between 1 and 60 minutes in 1-minute increments.

Thermal Demand

The thermal demand method calculates the demand based on a thermal response, which mimics thermal demand meters. The demand calculation updates at the end of each interval. You select the demand interval from 1 to 60 minutes (in 1-minute increments). In Figure 4– 1 the interval is set to 15 minutes for illustration purposes.

Figure 4– 1: Thermal Demand Example



Demand Power Calculation Methods

Demand power is accumulated power during a specified period divided by the length of that period. How the PM210 performs this calculation depends on the method you select. To be compatible with electric utility billing practices, the power meter provides block interval demand. The default demand calculation is set to rolling block with a 5-minute intervals and 5 subintervals.

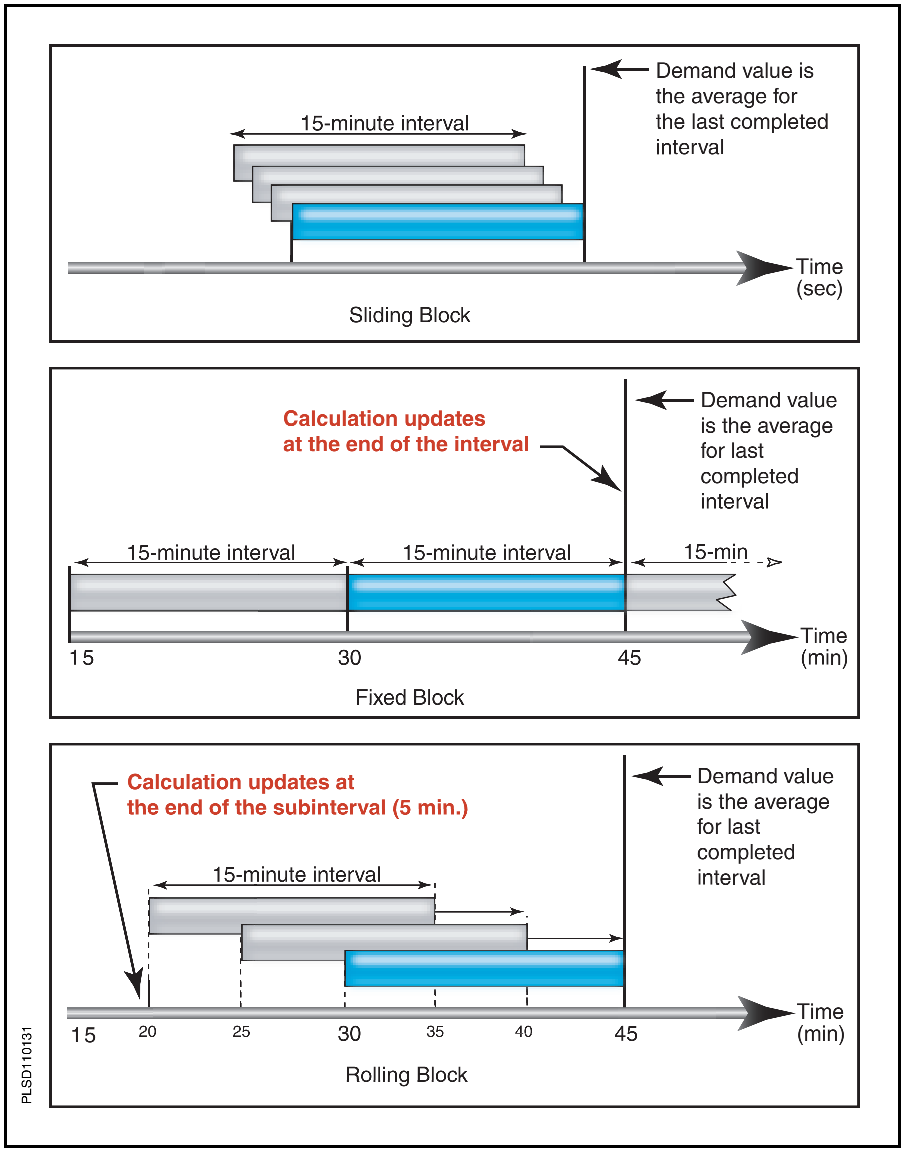
Block Interval Demand

In the block interval demand method, you select a “block” of time that the power meter uses for the demand calculation. You choose how the power meter handles that block of time (interval). Three different modes are possible:

- **Sliding Block**. In the sliding block interval, you select an interval from 1 to 60 minutes (in 1-minute increments). Selection for subinterval is not required, but configuration software automatically sets a subinterval. If the interval is ≤15 minutes, the subinterval is 15 seconds. If the interval is >15 minutes, the subinterval is 60 seconds. The power meter displays the demand value for the last completed interval.
- **Fixed Block**. In the fixed block interval, you select an interval from 1 to 60 minutes (in 1-minute increments). For the demand to be calculated as a fixed block, the subinterval value has to be set to 1. The power meter calculates and updates the demand at the end of each interval.
- **Rolling Block**. In the rolling block interval, you select an interval and a subinterval. The subinterval must divide evenly into the interval to the second. The value here has to be >1. For example, you might set 2 subintervals for a 15-minute interval. The meter will calculate the subinterval period to be 7.5 minutes or 450 seconds. Demand is *updated at each subinterval*. The power meter displays the demand value for the last completed interval.

Figure 4– 2 illustrates the three ways to calculate demand power using the block method. For illustration purposes, the interval is set to 15 minutes.

Figure 4– 2: Block Interval Demand Examples



Peak Demand

In nonvolatile memory, the PM210 maintains a running maximum for power and current demand values, called “peak demand.” The peak is the highest average for each of these readings: per phase current demand, kWD, kVARD, and kVAD since the last reset. Table 4– 2 on page 16 lists the available peak demand readings from the power meter.

You can reset peak demand values from the power meter display. From the Main Menu, select DIAGN > RESET > DMD.

You should reset peak demand after changes to basic meter setup, such as CT ratio or system type.

ENERGY READINGS

The PM210 calculates and stores net accumulated energy values for real, reactive energy. It considers both energy in and out of the load and displays net values. The PM210 also calculates and stores apparent energy.

You can view net accumulated energy from the display. The resolution of the energy value automatically changes through the range of 000.000 kWh to 000,000 MWh, (000.000 kVARh to 000,000 MVARh), and (000.000kVA to 000,000 MVA).

Energy values can be reported over communications in two formats: scaled long integer and floating point. The units are always kWh, KVARh, or kVAh. The long integer values are limited to ±2,147,483,647 x the scale factor. The floating point values are limited to $\pm 1.84 \times 10^{18}$.

SECTION 5— MAINTENANCE AND TROUBLESHOOTING

INTRODUCTION

The PM210 does not contain any user-serviceable parts. If the power meter requires service, contact your local sales representative. Do not open the power meter. Opening the power meter voids the warranty.

Register List

To obtain a list of the PM210's registers, please refer to the support area of www.powerlogic.com, contact Technical Support, or contact your sales representative.

Get Technical Support

Before contacting our Technical Support Center, please refer to the Troubleshooting section of this guide and make sure your power meter's firmware version is the latest available.

To verify your device's firmware version, from the display:

1. Press ---> until you see DIAGN
2. Press DIAGN
3. Press INFO

To download the latest firmware version, follow the instructions in the “Downloading Firmware” section.

If the problem persists, please refer to the *Technical Support Contacts* provided in the power meter shipping carton for a list of support phone numbers by country or go to www.powerlogic.com.

When you call, please provide us with the following information:

1. Model Number
2. Serial Number
3. Firmware aversion (OS and RS versions)

Downloading Firmware

We are constantly improving performance and adding new features by releasing new firmware at no cost for our customers. To verify the latest version of firmware available, please, call your sales representative or

1. Go to www.powerogic.com
2. From the Support area, look for PM210 firmware.
3. Follow the instructions on the web.

Troubleshooting

The information in Table 5– 1 describes potential problems and their possible causes. It also describes checks you can perform or possible solutions for each. After referring to this table, if you cannot resolve the problem, contact the your local Square D/Schneider Electric sales representative for assistance.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- This equipment must be installed and serviced only by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside.
- Always use a properly rated voltage sensing device to confirm that all power is off.
- Carefully inspect the work area for tools and objects that may have been left inside the equipment.
- Use caution while removing or installing panels so that they do not extend into the energized bus; avoid handling the panels, which could cause personal injury.

Failure to follow this instruction will result in death or serious injury

Table 5– 1: Troubleshooting

Potential Problem	Possible Cause	Possible Solution
The maintenance icon is flickering on the power meter display.	When the maintenance icon displays, it indicates the metered signals have reached saturation point or the frequency is out of range. For further detail refer to Register 4112.	• Verify voltage and current inputs range. The Voltage input metering range is 10-480 L-L VAC (direct) or 10-277 L-N VAC (direct) or up to 1.6 MV (with external VT). The Current input metering range is: 5 mA - 6 A. In addition, verify that the current and voltage inputs are free of noise.
The display is blank after applying control power to the power meter.	The power meter may not be receiving the necessary power.	• Verify that the power meter line (L) and neutral (N) terminals are receiving the necessary power. • Verify that the heartbeat LED is blinking. • Check the fuse.
The data being displayed is inaccurate or not what you expect.	Incorrect setup values.	Check that the correct values have been entered for power meter setup parameters (CT and PT ratings, System Type, Nominal Frequency, and so on).
	Incorrect voltage inputs.	Check power meter voltage input terminals to verify that adequate voltage is present.
	Power meter is wired improperly. See Appendix C—Instrument Transformer Wiring: Troubleshooting Guide on page 27 for more information on troubleshooting wiring problems.	Check that all CTs and PTs are connected correctly (proper polarity is observed) and that they are energized. Check shorting terminals.
Cannot communicate with power meter from a remote personal computer.	Power meter address is incorrect.	Check to see that the power meter is correctly addressed.
	Power meter baud rate (parity, stop bit) is incorrect.	Verify that the baud rate of the power meter matches the baud rate of all other devices on its communications link.
	Communications lines are improperly connected.	Verify the power meter communications connections.
	Communications lines are improperly terminated.	Check to see that a multipoint communications terminator is properly installed.
My High Density Metering (HDM) enclosures are displaying incorrect readings	The system type is incorrect.	Set the System Type as System 12.
	The power meter has been wired incorrectly.	If your HDM application includes: • Single phase circuits distributed from a 208/120 Vac 1-phase 3-wire service with no PTs • Single phase circuits distributed from a 480/277 Vac or 208/120Vac 3-phase 4-wire service with no PTs Set the System Type on the Setup Menu to 12 and connect your power meters as follows: When system 12 is set any two of the three current channels can be used. Ensure that each phase is wired to the proper phase input. For example: Circuits from A-B –wire phase A voltage and current to V1 and I1 and wire phase B voltage and current to V2 and I2. Circuits from C-A –wire phase C voltage and current to V3 and I3 and wire phase A voltage and current to V1 and I1. Circuits B-C –wire phase B voltage and current to V2 and I2 and wire phase C voltage and current to V3 and I3. **Note (Phases B-C)**: Voltage input V1 must be connected to phase A voltage to obtain frequency lock.

If after updating firmware and following the above recommendations, the condition persists, please call our Technical Support Center or contact your Sales Representative.

APPENDIX A—SPECIFICATIONS

POWER METER SPECIFICATIONS

Table A– 1: PM210 Specifications

Electrical Characteristics			
Type of measurement			True rms up to the 15th harmonic on three-phase AC system (3P, 3P + N) 32 samples per cycle
Measurement Accuracy	Current		±0.5% from 1A to 6A
	Voltage		±0.5% from 50 V to 277 V
	Power Factor		±0.0031 from 1A to 6A and from -0.50 to + 0.50 PF
	Power		±1.0%
	Frequency		±0.02 Hz from 45 to 65 Hz
	Real Energy		IEC 62053-21 Class 1.0; ANSI C12.16 Accuracy Class 1
	Reactive Energy		IEC 62053-23 Class 2
Data update rate			1 s
Input-voltage	Measured voltage		10 to 480 V AC (direct L-L) 10 to 277 V AC (direct L-N) Up to 1.6 MV AC (with external VT). The starting of the measuring voltage depends on the PT ratio.
	Metering over-range		1.2 Un
	Impedance		2 MΩ (L-L) / 1 MΩ (L-N)
	Frequency range		45 to 65 Hz
Input-current	CT ratings	Primary	Adjustable from 1 A to 32767 A
		Secondary	5 A or 1 A
	Measurement input range		10 mA to 6 A
	Permissible overload		15 A continuous 50 A for 10 seconds per hour 120 A for 1 second per hour
	Impedance		< 0.12 Ω
	Load		< 0.15 VA
Control Power	AC		100 to 415 ±10% V AC, 5 VA; 50 to 60 Hz
	DC		125 to 250 ±20% V DC, 3W
	Ride-through time		100 ms at 120 V AC
Mechanical Characteristics			
Weight			0.37 kg
IP degree of protection (IEC 60529)			Designed to IP52 front display, IP30 meter body
Dimensions			96 x 96 x 69 mm (meter with display) 96 x 96 x 50 mm (behind mounting surface)
Environmental Characteristics			
Operating temperature	Meter		-5 °C to +60 °C
	Display		-10 °C to +55 °C
Storage temperature	Meter + display		-40 °C to +85 °C
Humidity rating			5 to 95% RH at 50 °C (non-condensing)
Pollution degree			2
Metering category (voltage inputs and control power)			CAT III, for distribution systems up to 277 V L-N / 480 V AC L-L
Dielectric withstand			As per IEC61010, UL508 Double insulated front panel display
Altitude			3000 m

Table A– 1: PM210 Specifications *(continued)*

Electromagnetic Compatibility	
Electrostatic discharge	Level III (IEC 61000-4-2)
Immunity to radiated fields	Level III (IEC 61000-4-3)
Immunity to fast transients	Level III (IEC 61000-4-4)
Immunity to impulse waves	Level III (IEC 61000-4-5)
Conducted immunity	Level III (IEC 61000-4-6)
Immunity to magnetic fields	Level III (IEC 61000-4-8)
Immunity to voltage dips	Level III (IEC 61000-4-11)
Conducted and radiated emissions	CE commercial environment/FCC part 15 class B EN55011
Harmonics	IEC 61000-3-2
Flicker emissions	IEC 61000-3-3
Safety	
Europe	CE, as per IEC 61010-1
U.S. and Canada	UL508
Communications	
RS485 port	2-wire, 2400, 4800, 9600, or 19200 baud; Parity—Even, Odd, None; 1 stop bit; Modbus RTU
Display Characteristics	
Dimensions 73 x 69 mm	Back-lit green LCD (6 lines total, 4 concurrent values)

APPENDIX B—INSTRUMENT TRANSFORMER WIRING: TROUBLESHOOTING GUIDE

Abnormal readings in an installed meter can sometimes signify improper wiring. This appendix is provided as an aid in troubleshooting potential wiring problems.

The information in this appendix is intended to be general in nature and covers a variety of metering devices.

*NOTE: The PM210 does not display **signed** readings for Power, Energy, or Power Factor. Throughout this appendix, when values are stated in terms of positive, negative, or lagging, for the PM210, those readings are absolute.*

SECTION I: USING THIS GUIDE

The following sections contain “Case” tables showing a variety of symptoms and probable causes. The symptoms listed are “ideal,” and some judgment should be exercised when troubleshooting. For example, if the kW reading is 25, but you know that it should be about 300 kW, go to a table where “kW = 0” is listed as one of the symptoms.

“Section II: Common Problems for 3-Wire and 4-Wire Systems ” addresses symptoms and possible causes that occur regardless of system type. Check this section first. If the symptoms are more complicated, proceed to “Section III: 3-Wire System Troubleshooting” or “Section IV: 4-Wire System Troubleshooting” as is appropriate.

Because it is nearly impossible to address all combinations of multiple wiring mistakes or other problems that can occur (e.g., blown PT fuses, missing PT neutral ground connection, etc.), this guide generally addresses only one wiring problem at a time.

Before trying to troubleshoot wiring problems, it is imperative that all instantaneous readings be available for reference. Specifically those readings should include the following:

- line-to-line voltages
- line-to-neutral voltages
- phase currents
- power factor
- kW
- kVAR
- kVA

What is Normal?

Most power systems have a lagging (inductive) power factor. The only time a leading power factor is expected is if power factor correction capacitors are switched in or over-excited synchronous motors with enough capacitive kVARS on-line to overcorrect the power factor to leading. Some uninterruptable power supplies (UPS) also produce a leading power factor.

"Normal" lagging power system readings are as follows:

- kW = $\sqrt{3} \times V_{AB} \times I_{3\Phi Avg} \times PF_{3\Phi Avg}) / 1000$
- kVAR = $(\sqrt{(kVA)^2 - (kW)^2})$
- kVA = $\sqrt{3} \times V_{AB} \times I_{3\Phi Avg}) / 1000$

- $PF_{3\Phi Avg}$ = lagging in the range 0.70 to 1.00 (for 4-wire systems, all phase PFs are about the same)
- Phase currents approximately equal
- Phase voltages approximately equal

A quick check for proper readings consists of kW comparisons (calculated using the equation above and compared to the meter reading) and a reasonable lagging 3-phase average power factor reading. If these checks are okay, there is little reason to continue to check for wiring problems.

SECTION II: COMMON PROBLEMS FOR 3-WIRE AND 4-WIRE SYSTEMS

Table C– 1: Section II—Case A

Symptoms: 3-Wire and 4-Wire	Possible Causes
• Zero amps • Zero kW, kVAR, kVA	• CT secondaries shorted • Less than 2% load on power meter based on CT ratio Example: with 100/5 CT's, at least 2A must flow through CT window for power meter to “wake up”

Table C– 2: Section II—Case B

Symptoms: 3-Wire and 4-Wire	Possible Causes
• Negative kW of expected magnitude • Positive kVAR • Normal lagging power factor (See NOTE: on page 27.)	• All three CT polarities backwards; could be CTs are physically mounted with primary polarity mark toward the load instead of toward source or secondary leads swapped • All three PT polarities backwards; again, could be on primary or secondary *NOTE: Experience shows CTs are usually the problem.*

Table C– 3: Section II—Case C

Symptoms: 3-Wire and 4-Wire	Possible Causes
• Frequency is an abnormal value; may or may not be a multiple of 50/60 Hz.	• PTs primary and/or secondary neutral common not grounded (values as high as 275 Hz and as low as 10 Hz have been seen) • System grounding problem at the power distribution transformer (such as utility transformer), though this is not likely

SECTION III: 3-WIRE SYSTEM TROUBLESHOOTING

Table C– 4: Section III—Case A

Symptoms: 3-Wire	Possible Causes
• Currents and voltages approximately balanced • kW = near 0 • kVAR = near 0 • PF can be any value, probably fluctuating	• CT secondary leads are swapped (A-phase lead on C-phase terminal and vice versa) • PT secondary leads are swapped (A-phase lead on C-phase terminal and vice versa)

Table C– 5: Section III—Case B

Symptoms: 3-Wire	Possible Causes
• Phase B current is $\sqrt{3}$ higher than A and C (except in System Type 31) • kVA = about half of the expected magnitude • kW and kVAR can be positive or negative, less than about half of the expected magnitude • PF can be any value, probably a low leading value	• One CT polarity is backwards

Table C– 6: Section III—Case C

Symptoms: 3-Wire	Possible Causes
• V_{CA} is $\sqrt{3}$ higher than V_{AB} and V_{BC} • kVA = about half of the expected magnitude • kW and kVAR can be positive or negative, less than about half of the expected magnitude • PF can be any value, probably a low leading value	• One PT polarity is backwards

Table C– 7: Section III—Case D

Symptoms: 3-Wire	Possible Causes
• kW = 0 or low, with magnitude less than kVAR • kVAR = positive or negative with magnitude of close to what is expected for kW • kVA = expected magnitude • PF = near 0 up to about 0.7 lead (See NOTE: on page 27.)	• Either the two voltage leads are swapped OR the two current leads are swapped AND one instrument transformer has backwards polarity (look for $V_{CA} = \sqrt{3}$ high or phase B current = $\sqrt{3}$ high) • The power meter is metering a purely capacitive load (this is unusual); in this case kW and kVAR will be positive and PF will be near 0 lead

Table C– 8: Section III—Case E

Symptoms: 3-Wire	Possible Causes
• One phase current reads 0 • kVA = about 1/2 of the expected value • kW, kVAR, and power factor can be positive or negative of any value (See NOTE: on page 27.)	• The CT on the phase that reads 0 is short-circuited • Less than 2% current (based on CT ratio) flowing through the CT on the phase that reads 0

SECTION IV: 4-WIRE SYSTEM TROUBLESHOOTING

Table C– 9: Section IV—Case A

Symptoms: 4-Wire	Possible Causes
• kW = 1/3 of the expected value • kVAR = 1/3 of the expected value • power factor = 1/3 of the expected value • All else is normal	• One CT polarity is backwards *NOTE: The only way this problem will usually be detected is by the Quick Check procedure. It is very important to always calculate kW. In this case, it is the only symptom and will go unnoticed unless the calculation is done or someone notices backwards CT on a waveform capture.*

Table C– 10: Section IV—Case B

Symptoms: 4-Wire	Possible Causes
• kW = 1/3 of the expected value • kVAR = 1/3 of the expected value • 2 of the 3 line-to-line voltages are $\sqrt{3}$ low • power factor = 1/3 of the expected value • All else is normal	• One PT polarity is backwards *NOTE: The line-to-line voltage reading that does not reference the PT with backwards polarity will be the only correct reading.* Example: $V_{AB} = 277$, $V_{BC} = 480$, $V_{CA} = 277$ In this case, the A-phase PT polarity is backwards. V_{BC} is correct because it does not reference V_A.

Table C– 11: Section IV—Case C

Symptoms: 4-Wire	Possible Causes
• One line-to-neutral voltage is zero • 2 of the 3 line-to-line voltages are $\sqrt{3}$ low • kW = 2/3 of the expected value • kVAR = 2/3 of the expected value • kVA = 2/3 of the expected value • Power factor may look abnormal	• PT metering input missing (blown fuse, open phase disconnect, etc.) on the phase that reads zero. *NOTE: The line-to-line voltage reading that does not reference the missing PT input will be the only correct reading.* Example: $V_{AB} = 277$, $V_{BC} = 277$, $V_{CA} = 480$ In this case, the B-phase PT input is missing. V_{CA} is correct because it does not reference V_B.

Table C– 12: Section IV—Case D

Symptoms: 4-Wire	Possible Causes
• 3-phase kW = 2/3 of the expected value • 3-phase kVAR = 2/3 of the expected value • 3-phase kVA = 2/3 of the expected value • One phase current reads 0 • All else is normal	• The CT on the phase that reads 0 is short-circuited • Less than 2% current (based on CT ratio) flowing through the CT on the phase that reads 0

Table C– 13: Section IV—Case E

Symptoms: 4-Wire	Possible Causes
• kW = near 0 • kVA = near 0 • 3-phase average power factor flip-flopping lead and lag • Voltages, currents, and kVA are normal	• Two CT secondary leads are swapped (A-phase on B-phase terminal, for example) • Two PT secondary leads are swapped (A-phase on B-phase terminal, for example) *NOTE: In either case, the phase input that is **not** swapped will read normal lagging power factor.*

Table C– 14: Section IV—Case F

Symptoms: 4-Wire	Possible Causes
• kW = negative and less than kVAR • KVAR = negative and close to value expected for kW • kVA = expected value • Power factor low and leading • Voltages and currents are normal	• All three PT lead connections “rotated” counterclockwise: A-phase wire on C-phase terminal, B-phase wire on A-phase terminal, C-phase wire on B-phase terminal. • All three CT lead connections “rotated” clockwise: A-phase wire on B-phase terminal, B-phase wire on C-phase terminal, C-phase wire on A-phase terminal.

Table C– 15: Section IV—Case G

Symptoms: 4-Wire	Possible Causes
• kW = negative and less than kVAR • kVAR = positive and close to the value for kW *NOTE: looks like kW and kVAR swapped places* • kVA = expected value • Power factor low and lagging • Voltages and currents are normal	• All three PT lead connections “rotated” clockwise: A-phase wire on B-phase terminal, B-phase wire on C-phase terminal, C-phase wire on A-phase terminal. • All three CT lead connections “rotated” counterclockwise: A-phase wire on C-phase terminal, B-phase wire on A-phase terminal, C-phase wire on B-phase terminal.

FIELD EXAMPLE

Readings from a 4-wire system

- $kW = 25$
- $kVAR = -15$ *
- $kVA = 27$
- $I_A = 904A$
- $I_B = 910A$
- $I_C = 931A$
- $I_{3\Phi Avg} = 908A$
- $V_{AB} = 495V$
- $V_{BC} = 491V$
- $V_{CA} = 491V$
- $V_{AN} = 287V$
- $V_{BN} = 287V$
- $V_{CN} = 284V$
- $PF_{3\Phi Avg} = 0.75$ lag to 0.22 lead fluctuating*

Troubleshooting Diagnosis

- Power factors cannot be correct
- None of the “Section II” symptoms exist, so proceed to the 4-wire troubleshooting (“Section IV”)
- Cannot calculate kW because 3-phase power factor cannot be right, so calculate kVA instead
- Calculated kVA $= (\sqrt{3} \times V_{ab} \times I_{3\Phi Avg}) / 1000$
  $= (1.732 \times 495 \times 908) / 1000$
  $= 778 \text{ kVA}$
- Power meter reading is essentially zero compared to this value
- 4-wire Case E looks similar
- Since the PTs were connected to other power meters which were reading correctly, suspect two CT leads swapped
- Since A-phase power factor is the only one that has a normal looking lagging value, suspect B and C-phase CT leads may be swapped*
- After swapping B and C-phase CT leads, all readings went to the expected values; problem solved

*See NOTE: on page 27.

GLOSSARY

TERMS

absolute energy—both energy in and out of the load are treated as additive.

absolute power—both power in and out of the load are treated as additive.

accumulated energy—energy can accumulates in either signed or unsigned (absolute) mode. In signed mode, the direction of power flow is considered and the accumulated energy magnitude may increase and decrease. In absolute mode, energy accumulates as a positive regardless of the power flow direction.

baud rate—specifies how fast data is transmitted across a network port.

block interval demand—power demand calculation method for a block of time and includes three ways to apply calculating to that block of time using the sliding block, fixed block, or rolling block method.

communications link—a chain of devices connected by a communications cable to a communications port.

current transformer (CT)—current transformer for current inputs.

demand—average value of a quantity, such as power, over a specified interval of time.

device address—defines where the power meter resides in the power monitoring system.

event—the occurrence of an alarm condition, such as *Undervoltage Phase A*, configured in the power meter.

firmware—operating system within the power meter

fixed block—an interval selected from 1 to 60 minutes (in 1-minute increments). The power meter calculates and updates the demand at the end of each interval.

float—a 32-bit floating point value returned by a register. The upper 16-bits are in the lowest-numbered register pair. For example, in the register 4010/11, 4010 contains the upper 16-bits while 4011 contains the lower 16-bits.

frequency—number of cycles in one second.

line-to-line voltages—measurement of the rms line-to-line voltages of the circuit.

line-to-neutral voltages—measurement of the rms line-to-neutral voltages of the circuit.

maximum demand current—highest demand current measured in amperes since the last reset of demand.

maximum demand real power—highest demand real power measured since the last reset of demand.

maximum demand voltage—highest demand voltage measured since the last reset of demand.

maximum demand—highest demand measured since the last reset of demand.

maximum value—highest value recorded of the instantaneous quantity such as Phase A Current, Phase A Voltage, etc., since the last reset of the minimums and maximums.

minimum value—lowest value recorded of the instantaneous quantity such as Phase A Current, Phase A Voltage, etc., since the last reset of the minimums and maximums.

nominal—typical or average.

parity—refers to binary numbers sent over the communications link. An extra bit is added so that the number of ones in the binary number is either even or odd, depending on your configuration). Used to detect errors in the transmission of data.

phase currents (rms)—measurement in amperes of the rms current for each of the three phases of the circuit. See also *maximum value*.

phase rotation—refers to the order in which the instantaneous values of the voltages or currents of the system reach their maximum positive values. Two phase rotations are possible: A-B-C or A-C-B.

potential transformer (PT)—also known as a voltage transformer.

power factor (PF)—true power factor is the ratio of real power to apparent power using the complete harmonic content of real and apparent power. Calculated by dividing watts by volt amperes. Power factor is the difference between the total power your utility delivers and the portion of total power that does useful work. Power factor is the degree to which voltage and current to a load are out of phase.

real power—calculation of the real power (3-phase total and per-phase real power calculated) to obtain kilowatts.

rms—root mean square. Power meters are true rms sensing devices.

rolling block—a selected interval and subinterval that the power meter uses for demand calculation. The subinterval must divide evenly into the interval to the second. Demand is updated at each subinterval, and the power meter displays the demand value for the last completed interval.

scale factor—multipliers that the power meter uses to make values fit into the register where information is stored.

safety extra low voltage (SELV) circuit—a SELV circuit is expected to always be below a hazardous voltage level.

short integer—a signed 16-bit integer.

sliding block—an interval selected 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 power meter displays the demand value for the last completed interval.

system type—a unique code assigned to each type of system wiring configuration of the power meter.

thermal demand—demand calculation based on thermal response.

total power factor—*see power factor*.

true power factor—see *power factor*.

ABBREVIATIONS

A—Ampere

ADDR—Power meter address

AMPS—Amperes

BARGR—Bargraph

COMMS—Communications

CPT—Control Power Transformer

CT—see *current transformer on* page 33

DMD—Demand

DOM—Date of Manufacturing

F—Frequency

HZ—Hertz

I—Current

IMAX—Current maximum demand

kVA—Kilovolt-Ampere

kVAD—Kilovolt-Ampere demand

kVAR—Kilovolt-Ampere reactive

kVARD—Kilovolt-Ampere reactive demand

kVARH—Kilovolt-Ampere reactive hour

kW—Kilowatt

kWD—Kilowatt demand

kWH—Kilowatthours

kWH/P—Kilowatthours per pulse

kWMAX—Kilowatt maximum demand

MAINT—Maintenance screen

MBUS—MODBUS

MIN—Minimum

MINMX—Minimum and maximum values

MSEC—Milliseconds

MVAh—Megavolt ampere hour

MVARh—Megavolt ampere reactive hour

MWh—Megawatt hour

O.S.—Operating System (firmware version)

P—Real power

PAR—Parity

PASSW—Password

Pd—Real power demand

PF—Power factor

Ph—Real energy

PM—Power meter

PQS—Real, reactive, apparent power

PQSd—Real, reactive, apparent power demand

PRIM—Primary

PT—Number of voltage connections (see *potential transformer on* page 34)

PWR—Power

Q—Reactive power

Qd—Reactive power demand

Qh—Reactive energy

R.S.—Firmware reset system version

S—Apparent power

S.N.—Power meter serial number

SCALE—see *scale factor* on page 34

Sd—Apparent power demand

SECON—Secondary

SEC—Secondary

Sh—Apparent Energy

SUB-I—Subinterval

U—Voltage line to line

V—Voltage

VAR—volt ampere reactive.

VMAX—Maximum voltage

VMIN—Minimum voltage

INDEX

For further assistance please contact us at:

Schneider Electric

Power Monitoring and Control

295 Tech Park Drive, Suite 100

Lavergne, TN 37086 USA

Tel: 1-615-287-3400

2195 Keating Cross Road

Saanichton, BC

Canada V8M 2A5

Tel: 1-250-652-7100

Electropole (38 EQI)

31, rue Pierre Mendès France

F - 38050 Grenoble Cédex 9

Tel : + 33 (0) 4 76 57 60 60

Getting technical support:

Contact your local Schneider Electric sales representative for assistance or go to the www.powerlogic.com website.

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.

63230-510-205A1 12/2008