PowerLogic™ PM1000 Series Power Meters
User manual

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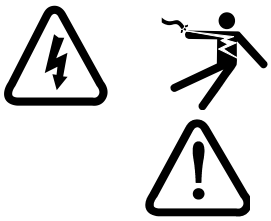
Schneider Electric

Hazard Categories and Special Symbols

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

SAFETY SYMBOLS



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.

SAFETY MESSAGES

⚠ 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.

OTHER SYMBOLS

This symbol indicates direct and alternating currents

This is double insulation symbol which indicates that, the user accessible area is protected throughout by double insulation or reinforced insulation.

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.

REACH Compliance

Complies with Regulation (EC) n° 1907/2006 of Dec 18 2006 named REACH (related to the Registration, Evaluation, Authorization and restrictions applicable to Chemical substances)

CHAPTER 1 – PM1000 SERIES POWER METERS PRODUCT DESCRIPTION

The PM1000 series power meters are digital power meters that offer comprehensive three-phase electrical instrumentation and load management facilities in a compact and rugged package.

This chapter contains the main operating instructions. The remaining chapters explain the installation & setup steps before the meter is ready for use and maintenance & troubleshooting procedures for power meter after installation.

The PM1000 series power meters are universal power meters. Before use, please program the SYS (measurement system configuration), PT (VT) and CT ratios through the front panel keys. Otherwise, it will read your system incorrectly. Other settings such as communication parameters must also be programmed as needed.

Schneider Electric stands behind your PM1000 power meters with complete User Support and Service.

Intended use: PM1000 series power meters are designed for use in industrial and commercial installations by trained and qualified professionals, not for domestic use.

Physical Description

FRONT: The front panel has 3 rows of 4 digits / characters each, with auto scaling kilo (K), Mega (M) and minus (-) indications. The **kilo** and **Mega** indications lit together show Giga readings. The Load bar graph to the right of the display gives the indication of consumption in terms of the % Amperes Load with respect to the FS (Full scale) selected. Five smart-keys make navigating the parameters very quick and intuitive for viewing data and configuring (Setup) of the power meters.

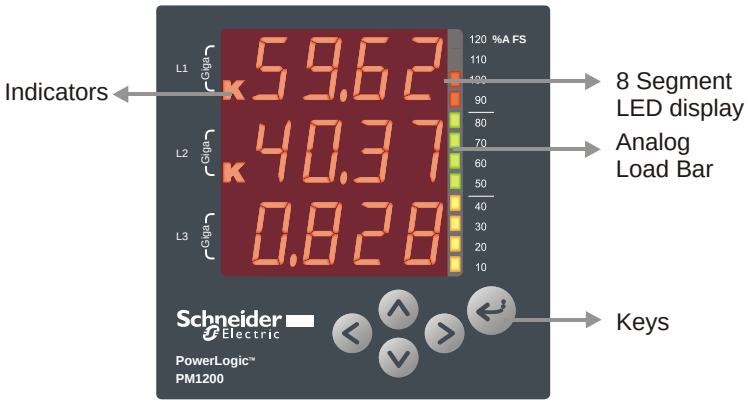
REAR: The voltage and current terminals and the communication port are located on the back of the power meter.
These contain hazardous voltages during operation and must be operated by qualified and authorized technicians. Refer “Rear Panel” in page 13 for more information.

Front Panel

The front panel contains the following indicators and controls:

- Three rows of alphanumeric displays, 4 digits each, display three RMS parameters simultaneously or one energy parameter. The displayed readings update every second.
- For each row: Kilo, Mega (Kilo + Mega = Giga) indicator and a Negative (-) indicator.
- Load bar, which gives a unique analog indication of % loading (% FS CT Pri).
- Five keys to scroll through the display page.

Figure 1-1: Parts of PM1000 Series front panel



8 Segment LED display

The power meters solve the problem of tiny cluttered indicators by prominently displaying the parameter name right on the large, alphanumeric readouts.

For the first time in a panel meter, the parameter name is as clearly readable as the value.

In order to know which parameter value is currently displayed, the power meters display parameter name for 2 seconds, as well as each time you press a key, and then the value for 8 seconds.

This method also allows programmable phase soft-Labels in the power meters. You can choose from 123 (Factory setting), ABC, RYB, PQR or RST.

Analog load bar

- Unique indication of total load % with respect to the full scale through the 12 LEDs at the right side of the display.
- This is bar graph where Each LED indicates 10% of load
- To find the total load count (of glowing LEDs): Multiply the number of glowing LED's by 10.

Table 1-1: Load percentage and Bar graph indication

Load Percentage	Bar Graph Display
Less than 10%	No LED's will glow
Between 10 to 40 %	Amber LED's will glow to indicate that the load is safe
Between 50 to 80%	Green LED's will glow to indicate that the load is acceptable and should not exceed further.
Above 80%	Red LED's will glow to indicate that the load has exceeded the sanctioned limit and is dangerous.

The Indicators – Kilo, Mega and Negative

Table 1-2 Indicators

K	**Kilo:** When lit, indicates that the reading is in Kilo (10^3). 10,000 is displayed as 10.00 K and 1.0 K as 1000.
M	**Mega:** When lit, indicates that the reading is in Mega, (10^6). 10,000 K is shown as 10.00 M. and 1.0 M as 1000 K.
M K	**Giga:** When **Kilo** and **Mega** are both glowing, the reading is in Giga (10^9). 10,000 M is shown as 10.00 G and 1.0 G as 1000 M.
-	**Negative:** When lit, indicates that the reading is **negative** as Per IEEE 100 and industry standard practice by meter-men: When PF (Power factor) is lead (Capacitive load): Both PF and VAR (reactive power) sign will be negative. When current is reversed: W (active power) is negative.

Table 1-3: Giga, Mega (M), Kilo (K) and Decimal Point Scaling

RMS Reading	Indicator
Less than 0.001	K, M OFF, displays **0.000**
Less than 9999	K, M OFF
Above 9999	K ON, M OFF
Above 9999 k	M ON, K OFF
Above 9999 M	Giga (k + M indicators ON)
Up to 9999 G	Giga
Above 9999 G	Display shows **Hi** for positive numbers, **Lo** for negative numbers

RMS readings are four digits. Energy readings have eight digits, including four additional fractional digits. The maximum number the power meter handles is 9,999 G for RMS and energy values.
This means that the energy readings of the power meter will overflow at 3 values of Wh (active energy) or VAh (Apparent energy) (selectable through PROG menu - Setup) depending upon the PT (VT) and CT ratios programmed.

The Keys

Operating the power meter is easy, using the five smart keys to navigate through the Keypad Operations Table. The display pages **expand** as you go right, much like the directory or explorer **tree** displayed on any computer. The display shows where you're headed.

Table 1-4: The Keys description

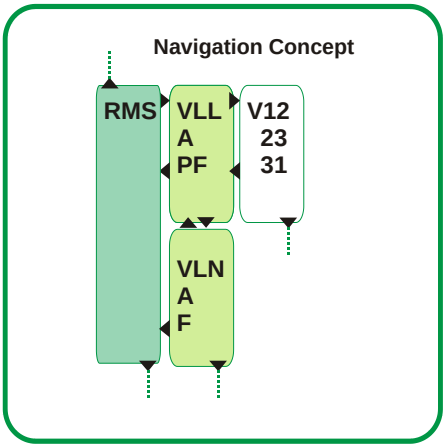
	**Right Key** • Go **forward** into sub-parameter pages. • Going right past **EDIT** in **SET** and **CLR** requires code entry to enter PROG menu (Setup and Clear) • During Edit Setup values, select **next** (right side) digit.
	**Left Key:** • The Opposite of the right key. • Go **back** towards to the main parameter pages. • During Edit Setup, selects **previous** (left side) digit • Exits from Edit mode, back to the PROG menu – Setup. • The meter will enter the SIM (simulation) mode when left key is pressed continuously while powering up the power meter. See "SIM (Simulation) mode" in page 69 for more information.
	**Up Key:** • Scroll **up** through display pages at the same level, **within the same function.** • Continuous pressing for 3 seconds initiates **limited auto-scroll (within the same function).** See "Auto scroll" in page 12 for more information. • **While editing, increases** the value of the blinking digit during edit. Typically while changing the power meter setup settings.
	**Down Key:** • The opposite of the up key. • Scroll **down** through other display pages at the same level, through **all functions**. • Continuous pressing for 3 seconds initiates **the full auto-scroll mode,** through all functions. See "Auto scroll" in page 12 for more information. • **While editing, decreases** the value of the blinking digit.
	**TURBO Key:** TURBO key is the simple one touch access to the most commonly used parameters pages (Factory set). The TURBO pages for PM1000 series are given below. **RMS (home page),** VLL, A, PF VLN, A, F VA, W, PF VA, W,VAR W, VAR, PF PF1, PF2, PF3, V% 1 2 3, A % 1 2 3, VAd RD TR, MD HR, VAh, Wh, RVAh, RWh, tVAh, tWh**.** This gives simple one-touch access to the most commonly used parameters, even for unskilled operators. **If you're lost, the TURBO key is a quick way to get back to the RMS home page.** Continuous pressing for 3 seconds initiates auto-scrolling through the above TURBO pages. See "Auto scroll" in page 12 for more information. **During the power up, if the TURBO key is pressed, power meter will go in to PROG menu - Setup. This is the simplest way to enter in to the setup.** **See "Quick setup – While powering on" in page 17 for more information.**

Keypad operation

Navigating with the power meters is very easy and intuitive. Press the key in the direction you want to go. **Display shows where you're headed.** Press the key that takes you in the desired direction.

Follow these simple steps:

- First take a quick look at what the Keys do.



Let us take an example to understand the actions of the front panel keys in the RMS menu. This example will explain how you can navigate from the **RMS** page to the **VLN A F** page, back to **RMS** in the power meter.

1. From the RMS page use the Right key. The display shows **VLL**
   A
   PF

   The right key can be used to go forward into sub-parameter pages.
2. Now press the down key.
   You can scroll down through other pages at the same level using the down key. The display shows **VLN**
   A
   F

   Congratulations you have successfully navigated from **RMS** to **VLN A F**.
3. To return to **RMS** press the left key .The display shows **RMS**.

Using the left key you can go back towards to the main parameter pages from the sub parameter pages.

- Now, try getting around to other parameters, by moving up, down, right and left. The readings are organized as display pages to the right of **RMS** and **INTG**.
- The **Kilo**, **Mega** and **Negative** Indicators are automatic. **Kilo** and **Mega** light up together to show **Giga**. See "The indicators" in page 9 for more information.
- You cannot go right into CLR, to clear INTG and MD values unless you enter a code.
- Going right through **SET**, you can go down to **VIEW** or **EDIT**. Going right through **EDIT** requires code entry to program these power meter settings. When done:
- Go Left all the way back to **SET**
- Go down to **CLR**
- Go Right into RMS to view the display pages again

Auto scroll

Auto-Scroll allows you to monitor a group of Display Pages sequentially, every 5 seconds, without constant key pressing. This is convenient for viewing from a distance. Since the power meter display the Parameter Name (1 second) followed by the Value (4 seconds) on the same large displays, both are equally readable from a distance. No more squinting at a clutter of parameter indicators.

- **To auto scroll within a page group (e.g. Within RMS group)**

  Go to a particular page in the desired page group. Then press up key continuously for 3 seconds and then release. The display will flash **AUTO** and start auto scroll within the page group.

- **To auto scroll down the entire column of pages**

  Go to the desired page. Then press down key continuously for 3 seconds and then release. The display will flash **AUTO** and start auto scroll down the entire column of pages.

- **To auto scroll through TURBO pages**

  Press of TURBO key continuously for 3 seconds and then release. The display will flash **AUTO** and start auto scroll through the TURBO pages.
  Press any key to revert to Manual Scrolling.

NOTE: Auto scrolling is not possible among the setup parameters.

Default display (View) page

You can select any page as **User-Set** default display page. You can scroll to other display pages. The **User-Set** page is displayed 2 minutes after manual scrolling was stopped by the user.
How to lock?

- Go to the page you want to set as default page.
- Press and keys together to lock the page, the power meter displays **LOCK**.

How to unlock?

- Once Default Display Page is active, press and simultaneously to unlock the Key page. The power meter displays **ULOC**.

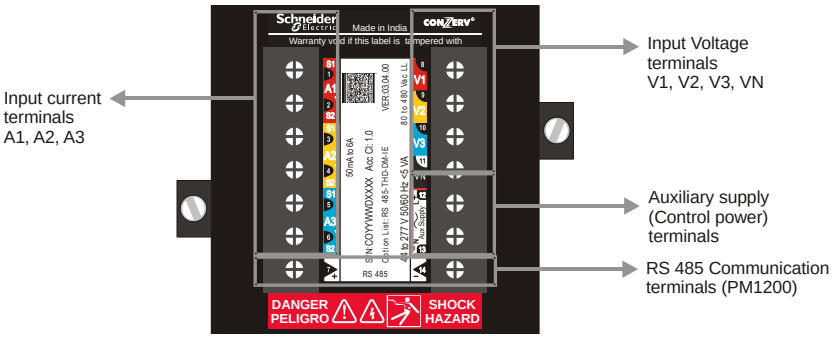
*NOTE: Entry into set up (PROG) is allowed when the **Display Page** is unlocked.*

Rear Panel

The power meter terminals are located on the rear panel. 14 terminals are provided, 7 terminals on each side:

- Six terminals for current, one **in** and one **out** per phase
- Four terminals for voltage, for three phases and neutral
- Two terminals for auxiliary power supply (Control power) and
- Two terminals for the RS 485 communications port (PM1200).

Figure 1-2: Rear Panel



Parameters with PM1000 series power meters

The power meters can measure, locally display and remotely transfer over MODBUS RTU (PM1200), the following parameters.

Table 1-5: Models and Parameters with PM1000 series

Parameter		PM1000	PM1200
RMS	VLL V12, V23, V31 VLN V1, V2, V3	■	■
	A A1 A2 A3	■	■
	An - Neutral current	■	■
	F	■	■
	%L – Amps	■	■
	% V Unbal, % A Unbal	■	■
	PF PF1 PF2 PF3	■	■
	%A FS Analog color coded load bar	■	■
	RPM	■	■
	A° Phase Angle A°1 A°2 A°3	■	■
	W W1 W2 W3	■	■
	VA VA1 VA2 VA3	■	■
	VAR VAR1 VAR2 VAR3	■	■
THD	V%1 V%2 V%3	■	■
	A%1 A%2 A%3	■	■
DM	Demand VA/ W/ A	■	■
	Rising demand	■	■
	Time remaining	■	■
	MD Maximum demand	■	■
	Hr MD occurred	■	■
INTG FWD	Wh	■	■
	VAh	■	■
	VARh	■	■
	-VARh	■	■
	Run hours	■	■
	ON hours	■	■
	INTR	■	■
I**NTG REV**	R.Wh	■	■
	R.VAh	■	■
	R.VARh	■	■
	-R.VARh	■	■
	Run hours	■	■
	ON hours	■	■
INTG TOT	t.Wh	■	■
	t.VAh	■	■
	t.VAR	■	■
	-t.VAR	■	■
	t.Run	■	■
	On.h	■	■
	INTR	■	■
OLD FWD	Wh	■	■
	VAh	■	■
	VARh	■	■
	-VARh	■	■
	Run hours	■	■

Parameter		PM1000	PM1200
OLD REV	R.Wh	■	■
	R.VAh	■	■
	R.VARh	■	■
	-R.VARh	■	■
	Run hours	■	■
OLD TOT	t.Wh	■	■
	t.VAh	■	■
	t.VAR	■	■
	-t.VAR	■	■
	t.Run	■	■
	RS 485	-	■

NOTE:
FWD: Forward indicating the import of power into the plant/grid
REV: Reverse indicating the export of power from the plant/grid

The PM1000 series displays:

- **Voltage:** Three voltage measurements line-to-line: 1-2, 2-3, 3-1 and average, Three voltage measurements line- to-neutral: 1-4, 2-4, 3-4 and average.
- **Current:** Three current measurements phase-wise (1, 2, 3), average current of all three phases, neutral current and three current phase angles ($A^{\circ}1$, $A^{\circ}2$, $A^{\circ}3$) w.r.t. the corresponding voltage line-neutral vector.
- **Phase wise load in %:** Three currents in % of the FS (%A FS).
- **Unbalanced load in % -** Current and Voltage unbalance.
- **Frequency:** Measured from whichever phase is active.
- **RPM:** Measures the speed of the generator.
- **Power:** VA, W, VAR, per phase and total. PF per phase and average. Per-Phase W readings provide a quick CT Polarity Check. A negated W phase reading indicates CT reversal.
- **Energy:** VAh, Wh, +VARh (Ind), -VARh (Cap), Run hours, On Hrs, Supply interruptions (outage).
- **Energy (OLD):** VAh, Wh, +VARh (Ind), -VARh (Cap), Run hours.
- **% Amperes Load Bar graph:** Load bar graph indicates consumption in terms of %Amperes total. Now you can quickly estimate the load by viewing the display without operating any keys. The bar graph consists of 12 segments. Each segment indicates a Current load of 10% of CT primary.
- **Kilo, Mega, Giga** indication for the above parameters. See “The indicators” in page 9 for more information.

PM1000 Series Power Meters Technical Specification

The PM1000 Series is a high-accuracy, low cost, ultra-compact, power and energy meter series. It offers ISO 9001 quality, accuracy and functional flexibility. Selective models of this series have MODBUS RTU communications capability. The standard unit flush-mounts in a DIN 96 cutout and conforms to UL safety requirements.

The power meters are designed for retrofit application such as replacement of analog meters and used as standalone meter in Electrical control panels, power distribution unit (PDU), switch boards, Uninterrupted power supply (UPS), generator sets and Motor control center (MCC) systems. It also provides easy communication to Program logic control (PLC), Distributed control system (DCS), Building management system (BMS) and other systems.

The following table gives the briefed technical specs of the power meters. Refer “Technical data” in page 67 for more information.

Table 1-6: Technical Specifications

Description	Specification
Sensing/Measurement	True RMS, 1 Second update time, 4 Quadrant power and energy
Accuracy	1.0% of reading*
Auxiliary supply (Control power)	44 to 277 VAC/DC
Burden	Voltage and Current input < 0.2 VA per phase Auxiliary supply (Control power) < 3 VA at 240 V
Display	Alphanumeric bright LED
Resolution	RMS 4 digit, INTG 8 digit
Input voltage	4 Voltage inputs (V1, V2, V3, VN) 110 or 415 VACLL nominal (Range 80 to 480 VAC LL)
Input current (Energy measurement)	Current inputs (A1, A2, A3) Class 1.0: 50 mA to 6 A* (5 mA is the starting)
Frequency	45 to 65 Hz
Overload	10 A max continuous
Environmental	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 5% to 95% non condensing
Safety	CAT III - Measurement category III, Pollution Degree 2, ⧈ - Double insulation at user accessible area
Weight	400 gms approx, Unpacked 500 gms approx, Shipping
Communication (PM1200)	RS 485 serial channel connection Industry standard Modbus RTU protocol
PM1000 Series conforms to	Emission : CISPR11 Class A; Fast Transient: 4kV IEC 61000-4-4; Surge withstand: IEC 61000-4-5; Damped Oscillatory: IEC 61000-4-12; ESD: IEC 61000-4- 2; Impulse voltage: 6 kV, IEC 60060, 1.2/50 µs
Protection against dust and Water	Front – IP 51; Back – IP 40

*NOTE: * Additional error of 0.05% of full scale, for power meter input current below 100 mA*

CHAPTER 2: QUICK START GUIDE

PROG menu - Setup

The power meter must be set (programmed/configured) to match the application settings, before use. Otherwise, the readings will be wrong. All the Setup values can be re-programmed at any time, upon entering **SET** However, the settings: SYS (WYE (Star)/Delta/1-Phase / 2-Phase), Vpri, Vsec, Apri, Asec critically determine the scaling of measured readings. While the scaling may be used to tune out Instrument Transformer errors, wrong settings will upset the readings of running systems.

⚠ CAUTION

HAZARD OF UNINTENDED OPERATION

Only qualified personnel are authorized to setup the power meter.

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

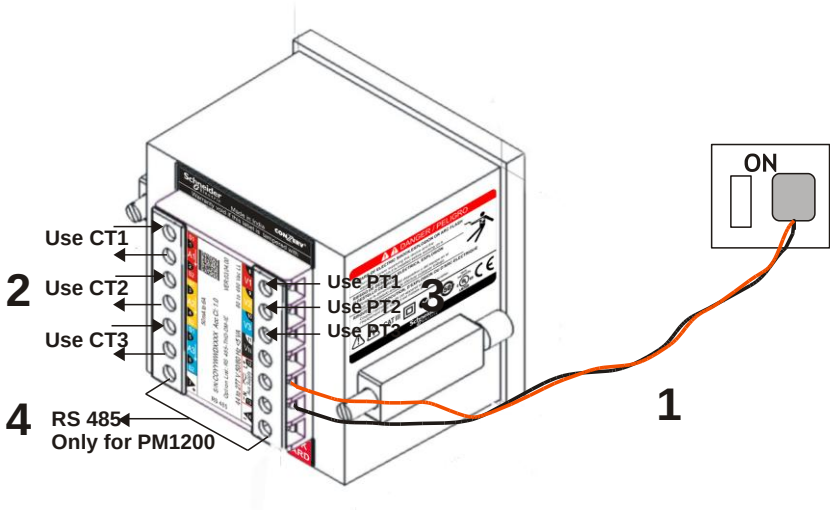
You can enter the PROG menu - setup in

- **View only mode** - to view the set parameters.
- **Edit mode** – to view or edit set parameters.

Quick setup – While powering ON

- Easiest and simplest way to enter the PROG menu setup.
- To make connections, see “Connection diagrams” in page 39. Here are few tips.

Figure 2-1: Quick Setup - Connections



1. Connect Aux supply (Control Power) 44 – 277 VAC/DC to Terminals 12 and 13 in order to power ON the power meter.

Quick Set up when input voltage < 480 VAC LL

- Keep the TURBO key pressed for 2 seconds, while powering up of the power meter. The power meter will directly enter PROG menu setup and display **EDIT A.PRI 100.0**.

Program the following in your power meter for accurate readings.

- A.pri, A.sec values match your CT Primary and Secondary values respectively. E.g: If your CT Ratio is 200:5, the Apri = 200.0 and Asec = 5.000

Use potential Transformer (PT/VT) if input voltage > 480 VAC LL.

- Program the V.Pri and V.Sec to primary and secondary of the PT(VT) respectively. E.g: if your PT (VT) ratio is 11 kV:110 V, V.Pri=11.00 k and V.Sec=110.0.
- If input voltage< 480 VAC LL, program the V.Pri and V.Sec values in the PROG Menu to input voltage VLL of the circuit. E.g: if input voltage = 300 VAC LL, V.Pri=300.0 and V.Sec=300.0.

Program the following in your system setup as per your wiring configuration

- SYS – DLTA for 3-Phase 3-Wire system
- SYS – WYE/Star for 3-Phase 4-Wire system
- SYS – 2 Phase for 2-Phase 3-Wire system
- SYS – 1 Phase for 1-Phase 2-Wire system.

2. Use CT1 CT2 CT3

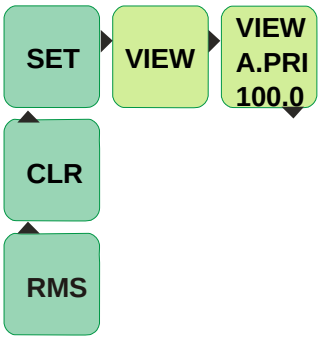
Terminals 1,2 3,4 5,6

3. Use PT1(VT1) PT2(VT2) PT3(VT3) if voltage exceeds 480 VAC LL

Terminals 8 9 10 (11 for Neutral)

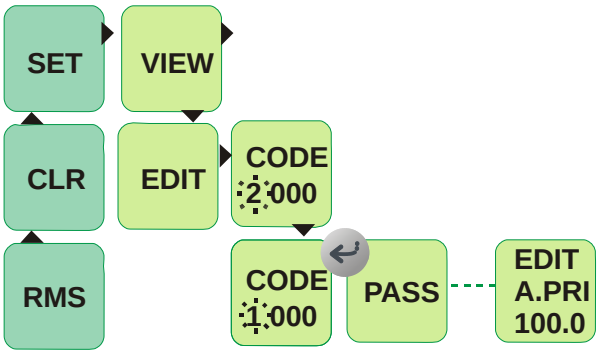
4. RS 485 Terminals 7 ($^{+}$ve), 14 ($^{-}$ ve) (PM1200)

Enter setup menu in View (read – only) mode



1. From RMS, press key. The display shows **CLR**
2. Press . The display shows **SET**
3. Press . The display shows **VIEW**
4. Press , you can view the setup parameters.

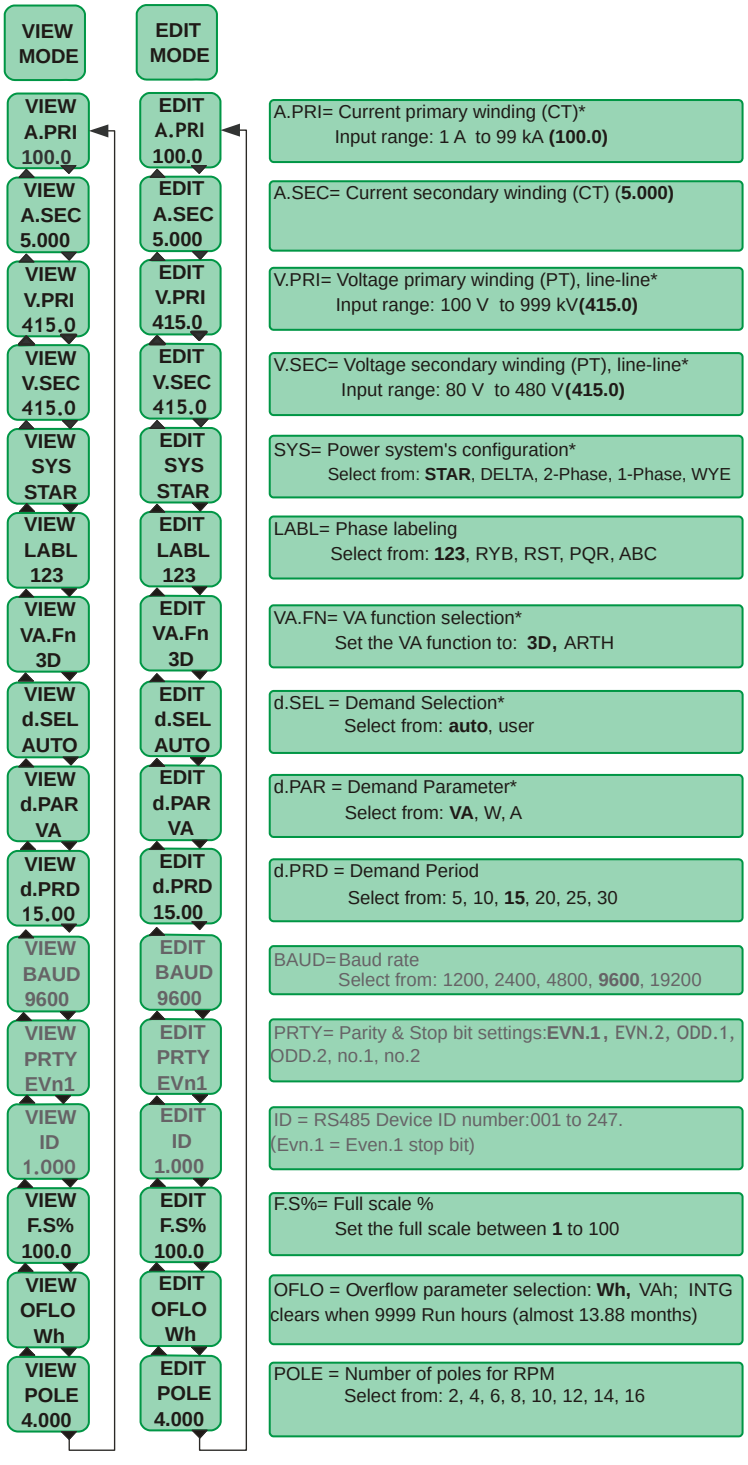
Enter setup menu in edit mode



NOTE: 1 means blinking
2 Means blinking 2

1. From RMS, press . The display shows **CLR**
2. Press . The display shows **SET**.
3. Press . The display shows **VIEW**.
4. Press . The display shows **EDIT**.
5. CODE entry is required to enter into setup menu in edit mode. Press right key for 2 seconds.
   The display will show **CODE 2000** with **2** blinking
6. The factory set code is 1000.
7. Press . The display will show **CODE 1000** with **1** blinking.
8. Now press once or four times to accept the new CODE value.
9. The display shows **PASS** and then **EDIT APRI 100.0** indicating the successful entry to the setup menu in Edit mode.
   Else if the display shows **FAIL,** you have not successfully entered Setup Menu, don't despair. Try again from step 1.

Setup parameters in View and Edit modes



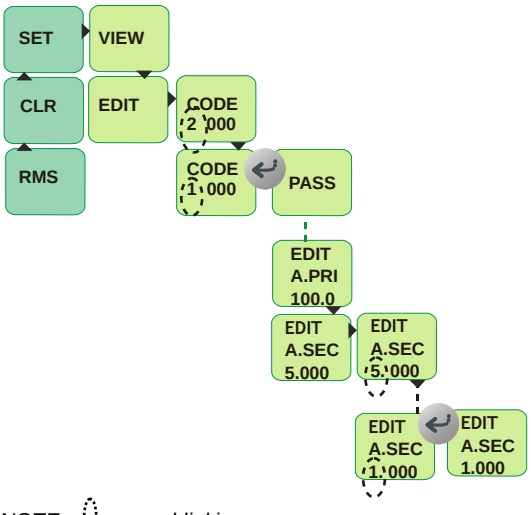
NOTE: Default setup values are given in BOLD
** Changing these values while device is in use is not recommended.*
BAUD, PRTY & ID are applicable only for PM1200

Edit Set Parameters in PROG Menu

This example explains how to edit the value of A.SEC from **5.000** to **1.000** in the Edit PROG menu – Setup of the power meters.
For easy understanding setup parameter editing is explained two parts.

NOTE: Once access to setup is gained and if there is no key press for duration > 2 min, then the power meter will exit from the setup automatically.

Edit and accept Setup

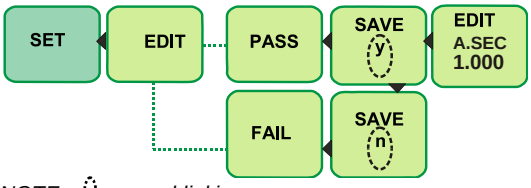


NOTE: *means blinking*
2 Means blinking 2

1. After the successful entry to setup menu in edit mode (Refer “Enter setup menu in Edit mode” in page 19 for more information), press . The display shows **EDIT A.SEC 5.000**.
2. Press key. The display shows **EDIT A.SEC 5.000** with blinking **5** i.e, the value can be edited.
3. Press key four times. The display shows **EDIT A.SEC 1.000** with blinking **1**.
4. Press . The new value will be accepted.

If you want to edit next parameter, press and repeat the above steps

To save the new value to Setup



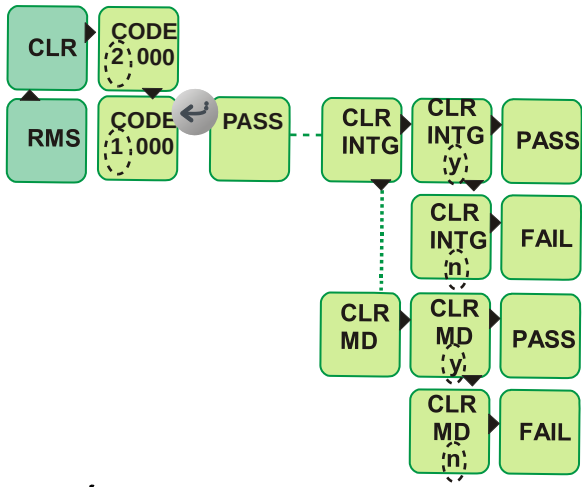
NOTE: *means blinking*
y means blinking y

1. After completing the parameter editing as above. Press . The display shows **SAVE y** with blinking **y**
2. To save the edited settings, press or key. Else go to step 4.
3. The display flashes **PASS** and then shows **EDIT**. Go to step 6.
4. Press . The display will show **SAVE n** with blinking**.**
5. Press or key. The display flashes **PASS** and then shows **EDIT**.
6. Press key to return to set.

Clear INTG and MD

The power meters are equipped with Energy Integrator INTG, where the energy parameters are accumulated

- INTG CLR – Clear both INTG and MD values
- INTG MD – Clear only MD values
  Where MD is maximum demand.



NOTE: *means blinking*
y means blinking y

INTG Clear

1. From **RMS**, press . The display will show **CLR**
2. CODE entry is required to clear the **INTG** values.
3. Press for 2 Seconds. The display will show **CODE 2000** with blinking **2.**
4. The factory set **CODE** is **1000**. Press . The display will show **CODE 1000** with blinking **1**.
5. Press key once or key four times to accept the new value.
6. After the successful **CODE** entry, the display shows **CLR INTG**.
7. In order to clear **INTG** press key. The display shows **CLR INTG y** with blinking **y**. Go to step 9 to not clear the **INTG.**
8. Press key to clear **INTG**. The display flashes **PASS** and then **CLR INTG**. Go to step 11.
9. Press key. The display will show **CLR INTG n** with blinking **n.**
10. Press key. The display flashes **FAIL** and then **CLR INTG**.
11. Press key. The display shows **CLR** means exit.
12. Press key to return to **RMS** page.

MD Clear

1. From **RMS**, press . The display will show **CLR**
2. CODE entry is required to clear the **MD** values.
3. Press for 2 Seconds. The display will show **CODE 2000** with blinking **2.**
4. The factory set **CODE** is **1000**. Press . The display will show **CODE 1000** with blinking **1**.
5. Press key once or key four times to accept the new value.
6. After the successful **CODE** entry, the display shows **CLR INTG**.
7. Press key. The display will show **CLR MD**.
8. In order to clear **MD** press key. The display shows **CLR MD y** with blinking **y**. Go to step 10 to not clear the **MD.**
9. Press key to clear **MD**. The display flashes **PASS** and then **CLR MD**. Go to step 11.
10. Press key. The display will show **CLR MD n** with blinking **n.**
11. Press key. The display flashes **FAIL** and then **CLR INTG**.
12. Press key. The display shows **CLR** means exit.
13. Press key to return to **RMS** page.

Energy Integrator

The PM1000 series power meters are equipped with an Energy Integrator function which provides several parameters for Energy Management: VAh, Wh, VARh (Ind), -VARh (Cap), run.h (run hours), on.h (on hours), INTR (Interruptions / outages).
A few of these need explanation:
RUN.h: Indicates the period the Load is ON and has run. This counter accumulates as long as the load is ON.
On.h: The period for which the power meter (supply) is ON.
INTR: Number of Supply Outages, means the number of Auxiliary Supply interruptions. If the power meter Auxiliary Supply is from a UPS then the INTR (number of interruptions) will be zero (as long as the UPS stays ON), even if the Voltage Signals did die out from time to time.

Integrator Overflow

The PM1000 series power meters contain a comprehensive **Integrator** to support Energy Management. It accumulates several parameters over time, as explained above. All values are Direct Reading and have a high resolution. This is necessary for accurate energy analysis over short intervals of time. It also means that the readings max out and reset sooner or later as given below. Since the Integrator contains counters for several parameters (VAh, Wh, VARh, -VARh, Run Hours, On Hours, Interruptions), they all reset together whenever any one of them overflows (usually Wh – but can be changed to VAh via the OF Setup). This makes energy management calculations such as Average PF very easy.
The maximum number that the power meter handles is 9,999 Giga for RMS and Energy values. The value at which the power meter overflows is given below.
The Overflow value depends on the product of the primary voltage and current rating.

Table 2-1: Integrator Overflow table

V.PRI x A.PRI x 1.732	Max Reading (Wh/VAh)	Max time to reset the integrator in Run Hours	Max time to overflow in months at full scale
1 VA to 1000 VA	9999 k	9999	13.88
1 kVA to 1000 kVA	9999 M	9999	13.88
1 MVA to 1000 MVA	9999 G	9999	13.88
> 1000 MVA		<9999	<1 year

OLD Data register

The power meters have OLD data register, where the cleared INTG values will be stored.
The energy values in the Integrator are transferred to the OLD register when the INTG is cleared (Manually/due to overflow). Thus the OLD energy values are not lost even after the integrator is cleared and can be viewed with the OLD parameter.
The values of parameters Wh, VAh, VARh, -VARh and Run.h are stored in the OLD register when the INTG is cleared.

Demand Power Calculation Methods

Demand power is the energy accumulated during a specified period divided by the length of that period. How the power meter performs this calculation depends on the method you select. To be compatible with electric utility billing with electric utility billing practices, the power meter provides the following types of demand power calculations:

- Auto (Sliding block)
- User (Fixed block)

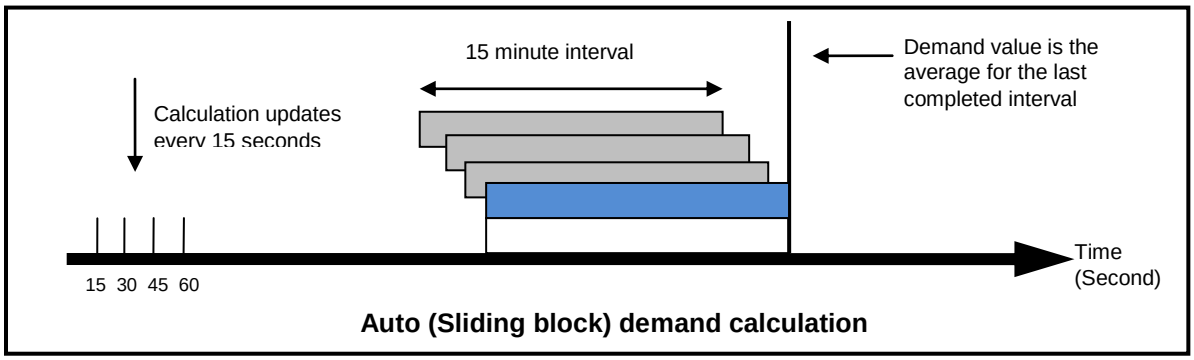
Auto (Sliding block)

In the auto demand power calculation, you select an interval between 5 to 30 minutes in steps of 5 minutes. The demand calculation updates every 15 seconds.

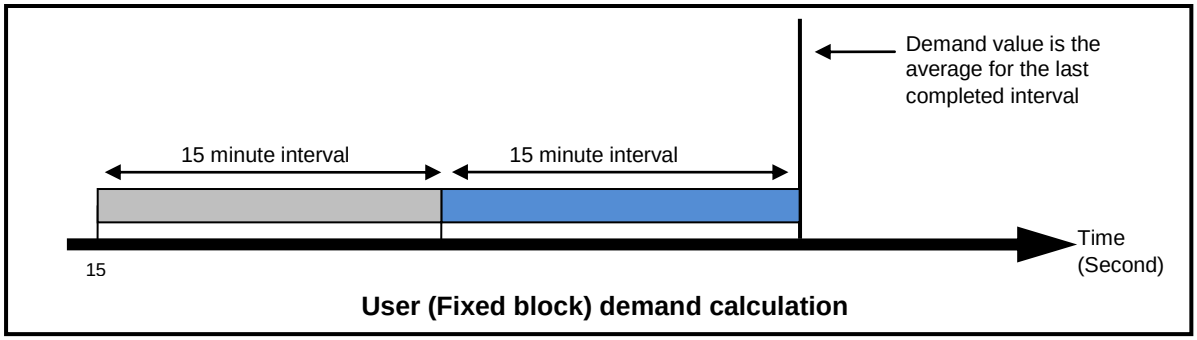
Auto demand power calculation is the default calculation for PM1000 series power meters.

User (Fixed block)

In the user demand power calculation, you select an interval between 5 to 30 minutes in steps of 5 minutes. The demand calculation updates at the end of the interval. User demand power calculation can be selected through setup. See “Setup parameters in View and Edit modes” in page 20 for more information.

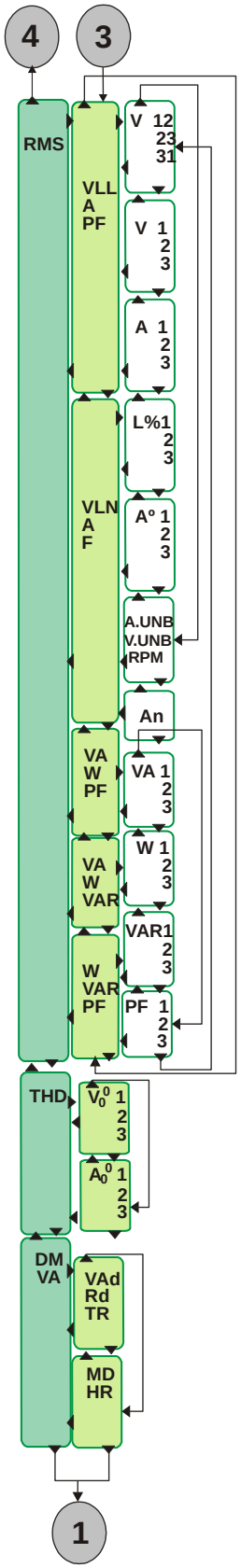


Auto (Sliding block) demand calculation



User (Fixed block) demand calculation

PM1000 Series Power Meters Menu hierarchy



RMS = RMS value display pages are in sub level

VLL = Phase-Phase voltage average
A = Current average
PF = Power Factor average

VLN = Phase-Neutral voltage average
A = Current average
F = Frequency in Hz

VA = Apparent power total
W = Active power total
PF = Power factor average

V12 = RMS voltage, phase 12
V23 = RMS voltage, phase 23
V31 = RMS voltage, phase 31

V1 = RMS voltage phase 1 to neutral
V2 = RMS voltage phase 2 to neutral
V3 = RMS voltage phase 3 to neutral

A1 = RMS current, phase 1
A2 = RMS current, phase 2
A3 = RMS current, phase 3

L1% = % of load, phase 1
L2% = % of load, phase 2
L3% = % of load, phase 3

A°1 = Current phase angle, phase 1 in degrees
A°2 = Current phase angle, phase 2 in degrees
A°3 = Current phase angle, phase 3 in degrees

A.UNB = Current unbalance
V.UNB = Voltage unbalance
RPM = RPM of the motor

An = Neutral current

VA1 = Volt-amperes, phase 1
VA2 = Volt-amperes, phase 2
VA3 = Volt-amperes, phase 3

W1 = Watts, phase 1
W2 = Watts, phase 2
W3 = Watts, phase 3

VAR1 = VAR, phase 1
VAR2 = VAR, phase 2
VAR3 = VAR, phase 3

PF1 = Power factor, phase 1
PF2 = Power factor, phase 2
PF3 = Power factor, phase 3

THD = Total Harmonic Distortion

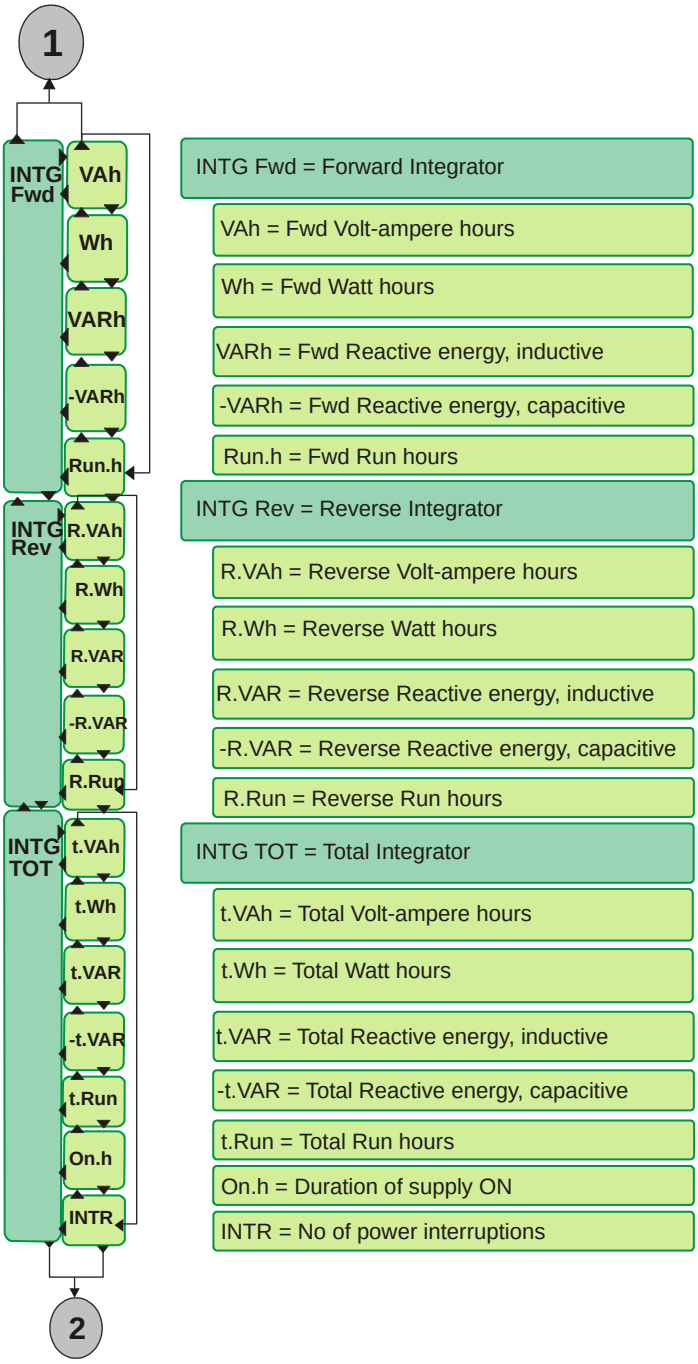
$V_0^0$1 = Voltage THD, Phase 1
$V_0^0$2 = Voltage THD, Phase 2
$V_0^0$3 = Voltage THD, Phase 3

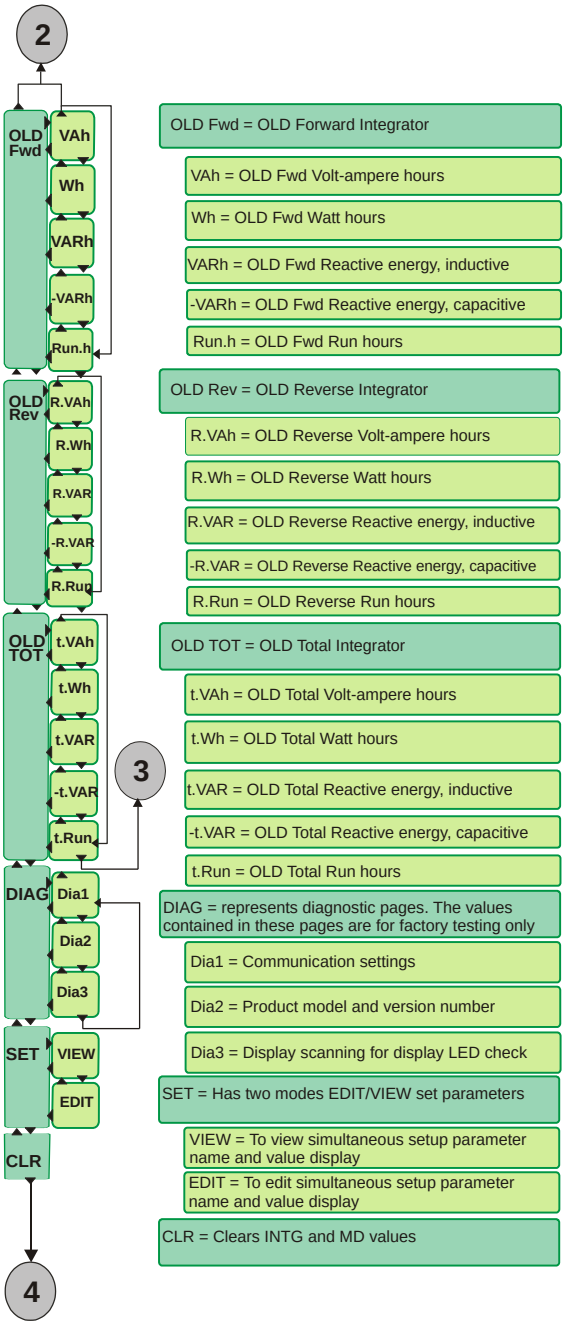
$A_0^0$1 = Current THD, Phase 1
$A_0^0$2 = Current THD, Phase 2
$A_0^0$3 = Current THD, Phase 3

DM VA = VA Demand
This can be DM A or DM W depending on the d.PAR selected in PROG menu

VAd = VA demand
Rd = Rising demand
TR = Time remaining

MD = Maximum demand
HR = On hours at which maximum demand has occured

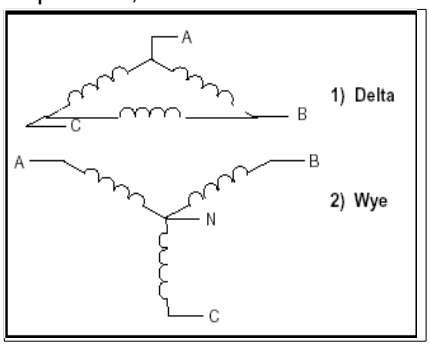




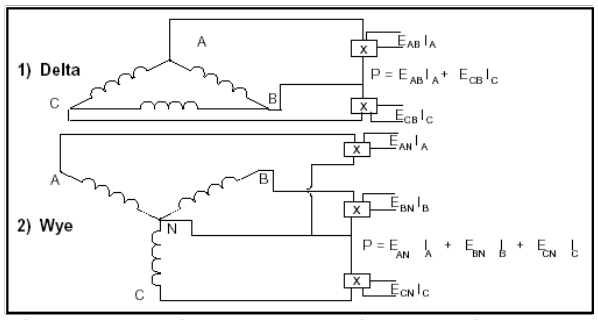
CHAPTER 3: AC POWER MEASUREMENT

Three-Phase Systems

A three-phase system delivers higher levels of power for industrial and commercial applications. The three phases correspond to three potential lines. A 120° phase shift exists between the three potential lines.
A typical configuration has either a Delta connection or a Wye (Star) connection
In a three-phase system, the voltage levels between the phases and the neutral are ideally defined by V1 = V2 = V3 = V12 / √3 = V23 / √3 = V31 / √3. In practice, there will be some unbalance (difference).



Voltages between the phases vary depending on loading factors and the quality of distribution transformers.
Power measurement in a poly phase system is governed by Blondel's Theorem. Blondel's Theorem states that in a power distribution network, which has N conductors, the number of measurement elements required to determine power is N-1. A typical configuration of poly phase system has either a Delta connection or a Wye(Star) connection (see Figure below).



Where E_{AB}= Voltage across points A and B.
E_{CB}= Voltage across points C and B.
E_{AN}= Voltage across points A and N (Neutral).
E_{BN}= Voltage across points B and N (Neutral).
E_{CN}= Voltage across points C and N (Neutral).
I_A = Current through conductor A.
I_B = Current through conductor B.
I_C = Current through conductor C.

Consumption and Poor Power Factor

CONSUMPTION: Wh = W x T, where W = instantaneous power T = time in hours

The total electric energy usage over a time period is the consumption of Wh. Typically, the unit in which consumption is specified is the kilowatt-hour (kWh): one thousand watts consumed over one hour. Utilities use the Wh equation to determine the overall consumption in a billing period.

POOR POWER FACTOR: Results in reactive power consumption. Transferring reactive power over a distribution network causes energy loss. To force consumers to correct their Power Factor, utilities monitor reactive power consumption and penalize the user for Poor Power Factor.

"3D" kVA Measurement

The power meters are equipped with 3D Measurement of kVA. This advanced method provides the most accurate and predictable measurement under unbalanced as well as distorted waveform conditions.

However, in case the power meters need to match the reading of older or simpler power meters, which use the Arithmetic kVA definition, this too is available as a Setup option.

Table 3-1: "3D" kVA Measurement

kVA Function	Formula	Other Names	Which one?
3D Factory setting	$kVA_{3D} = \sqrt{\sum W^2 + \sum VAR^2 + \sum D^2}$ Where D = Distortion Power per IEEE 100	U, Apparent, Vector kVA	Best, all around
Arth	$kVA_{Arth} = kVA_1 + kVA_2 + kVA_3$	Arithmetic, Scalar kVA	Good under Low unbalance, to match simpler meters without 3D capability

CHAPTER 4: SAFETY PRECAUTIONS

⚠ 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.
- The protection provided by the manufacturer will be impaired, if the equipment is not used in the specified manner.
- 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 back feeding.
- 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.
- Building installation shall be included with a disconnecting device like switch or circuit breaker, with clear ON/OFF markings and within close proximity to equipment and the reach of operator, to cut-off the supply mains in case of any hazardous voltages.
- 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.
- During the normal operation of this equipment, hazardous voltages might be present at the rear terminals, which can causes severe injury or death. High voltages are likely to be present even after the power meter has been switched off.
- The power meter should be installed in a suitable electrical enclosure.

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

CHAPTER 5: INSTALLATION

MECHANICAL INSTALLATION

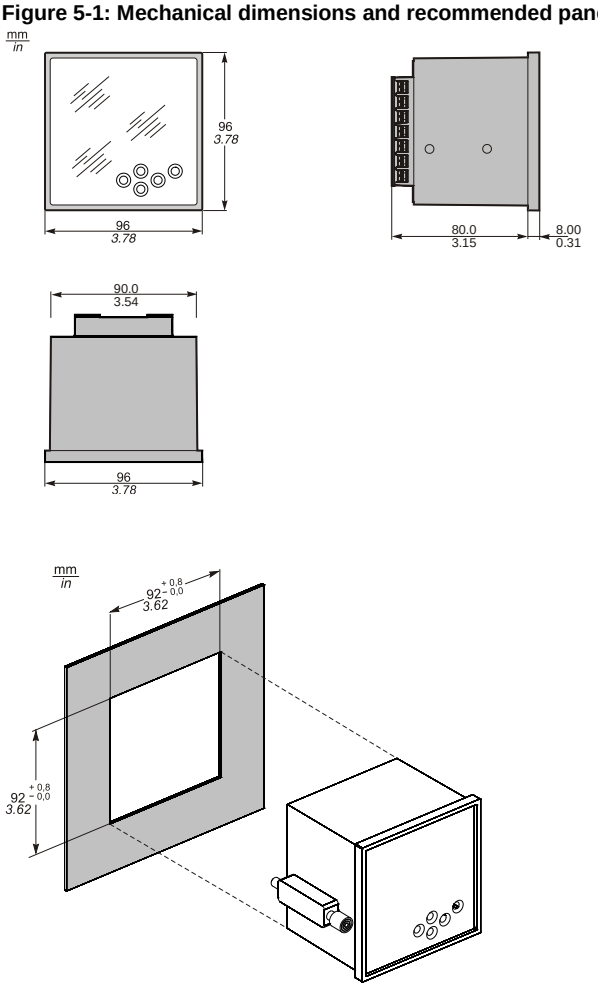
The PM1000 series power meters are panel-mounted and have reliable, rear-mounted terminal strips rated at 480 V. The 92 x 92 mm cut-out and 96 x 96 mm bezel dimensions adhere to IEC 61554 and DIN 43700.

Please read this and the following chapter completely, before proceeding

Depth required behind the Bezel is 80 mm, plus space for wiring. Two side clamps are provided for firm mounting.

Diagram below displays the various dimensions of mechanical installations.

Figure 5-1: Mechanical dimensions and recommended panel cut-out



Installation Procedure

Usage

First, decide on how the power meters are going to be used. If you do not already have an energy management program in operation, then your energy consultant should be able to help you identify which load(s) offer maximum savings potential. This will help you decide which point is to be monitored, where the readings will be viewed from, who must have access to the instrument and how often. Else decide the location of the power meter and install it. For best performance, choose a location, which provides all the required signals with minimum wiring lengths.

Panel Considerations and Environment

The power meters are high - precision measuring instruments and its operating environment is of utmost importance. For maximum performance, the instrument should be mounted in a dry, dust-free location, away from the heat sources and strong electromagnetic fields. To operate reliably, the following conditions must be met:

Table 5-1: Environmental Conditions

Description	Specification
Storage Temperature	-25 °C to 70 °C, (-13 °F to 158 °F)
Operating Temperature	-10 °C to 60 °C, (14 °F to 140 °F)
Relative Humidity	5% to 95%, non - condensing

The power meters should be separated from other equipment and sufficient space must be provided all around for cooling air to rise vertically past the instrument. The cooling air temperature must be below the specified operating temperature.

The panel or housing, in which the PM1000 power meters are mounted, should protect it from dust, moisture, oil, corrosive vapours, etc.

The panel doors must be easily opened to provide easy access to the power meters wiring for trouble-shooting. Allow clearance if the unit is going to swing out, as well as adequate slack in the wiring. Allow space for terminal blocks, CT shorting blocks, fuses, auxiliary contractors and other necessary components.

Viewing

For ease of operation, in the location should be preferably at, or slightly above, eye-level. For viewing comfort, minimize glare and reflections from strong light sources.

Mounting

The power meters are panel mountable.

Table 5-2: Mounting

Description	Specification
Panel cut-out	$92^{+0.5}_{-0}$ mm (w) x $92^{+0.5}_{-0}$ mm(h) IEC 61554 and DIN 43700
Panel Thickness	0.5 to 4.0 mm
Instrumental Bezel dimension	96 x 96 mm
Depth behind Bezel	80 mm (82 mm with terminal cover. Leave clearance for wires)
Mounting Clamps Screws	Slotted, 2 nos
Terminal Screws	Combination Phillips and Slotted head

The cutout should be punched with the proper tool and should be free from burrs. Before wiring, insert the power meter into the cutout from the front. Then, fasten the two side clamps from the rear. While supporting the power meter from the front, tighten both side clamp screws in a criss-cross pattern till all slack is taken up and then apply one full turn. Do not over-tighten. Over-tightening could result in breaking of the clamps.

The power meters should be separated from other equipments and sufficient space must be provided all around cooling air to rise vertically past around the power meter. Lack of sufficient air for cooling may result in over heating of the power meters.

NOTE: Setup procedure is much easier, before mounting the power meter on the panel, see "Quick setup" in page 17 for more information.

ELECTRICAL INSTALLATION

This section describes the following:

- The Need and selection of potential transformers (PTs) and current transformers (CTs).
- Aux supply (Control Power), PT (VT) and CT Connections.

For best wiring results with the terminals, please ensure the following specs:

- Power driver preferred, hand screwdriver OK.
- TIP: Phillips preferred, DO NOT USE POZIDRIV TIPS. Flat OK.

Screw Head Diameter = 3.5 mm, TIP Shaft Diameter < 5 mm.
IMPORTANT - Driver Shafts inserted angularly or of diameter = 5 mm or more WILL GET STUCK in the Safety Cover
Tightening Torque: 2.5 to 6 N.m
Loosening Torque: 5.5 to 6 N.m
Screw Travel: 6 mm less wire thickness
Torque greater than 6 N.m may strip the screw or break the safety cover.
Worn-out bits and insufficient hold-down pressure while tightening will cause the bit to ride on the screw head thus stripping and damaging it.

Connecting cable

Table 5-3: Connecting cable

	Insulation Rating	Current Rating
Voltage Circuit	> 600 VAC	> 0.1 A
Current Circuit	> 600 VAC	> 7.5 A Or 2.5 mm^2 minimum

Schneider Electric recommends the use of Insulated sleeved U lugs (2.5 mm^2) for wiring terminals. Don't use pin lugs which may reduce the safety isolation.

Auxiliary supply (Control Power)

The PM1000 power meters require a single-phase AC/DC Auxiliary (control) power supply to power up its internal electronic circuitry. External surge suppressors are necessary in the auxiliary supply circuit for proper operation during extreme surge conditions, where the voltage surges exceed the auxiliary supply limits (E.g. Rural areas and outlying areas prone to lightning strikes).

Range:

- 44 to 277 VAC/DC.
- Burden (load) < 3 VA at 240 V.

- The control power may be derived from the voltage signals.
- If you have a 440 V three-wire delta system and a reliable neutral is not available, a 440 V: 240 V Supply transformer should be used to provide the standard 240 V auxiliary supply.

NOTE: Setup procedure is much easier, before mounting the power meter on the panel, see "Quick setup" in page 17 for more information.

PTs (VTs) and CTs

Large electrical installations have high voltages and currents, which may exceed the direct connection rating of the power meter. In this case, Potential Transformers (PTs) and Current Transformers (CTs) are used to precisely **step down** or reduce the voltage and current level to suit the power meter rating. Potential Transformers usually have a full-scale output of 110 VAC RMS line-line and Current Transformers, a full-scale output of 5 A or sometimes 1 A.

The PTs (VTs) and CTs must be planned, installed and tested by a qualified electrical contractor before wiring the power meter. The accuracy of the measurement also depends on the accuracy and phase – angle error of the PTs (VTs) and CTs. Instrument Class 1 or better PTs and CTs are recommended. Do not use protection class (10P10, etc.) CTs to feed the power meters; they have poor accuracy and phase characteristics.

Ensure that the CT primary rating has been selected so that your normal load variation lies between 40% and 80% of its full scale. If your CT is over-rated, say if the load is always less than 10% of the CT primary rating, accuracy suffers. On the other hand, if the CT is under-rated, then you may exceed its full-scale and burn out both the CT and the power meter.

PT (VT), CT Wiring

The PTs (VTs) and CTs must have adequate VA rating to support the burden (loading) on the secondaries. You may want to support the auxiliary supply burden from one of the PTs (VTs). CT wiring can impose additional burden (loading) on the CT. For example, if the CT has a 5 A secondary and the wire resistance is 1.0 Ω, then the CT has to support an additional burden of 5 VA. If the wiring distance from the CT secondary is greater than stated in Table 5-4, then the CT could get over-burdened and give large errors. Choosing a 1 A CT secondary can reduce this error. The CT Secondary value must be user programmed into the power meter.

The power meters should be conveniently located for easy connections of voltage (PT) and Current (CT) signals, the auxiliary (control) supply.

NOTE: The power meters user programmable PT and CT Primary or secondary Settings, may be utilized to Calibrate out the PT and CT amplitude error, for improved accuracy.

Voltage Signal Connections

For proper power meter operation, the voltage connection must be maintained. The voltage must correspond to the correct terminal. The cable required to terminate the voltage sense circuit should have an insulation rating greater than 480 VAC and a current rating greater than 0.1 A.

There are 4 input voltage terminals marked V1, V2, V3 and Vn. See the connection diagrams that follow, for details. For Delta connection, the Vn terminal should be left un-connected.

PT Connections

The power meters directly accept LV voltage inputs of up to 480 VAC RMS Line to Line (277 VLN). Voltages greater than this, typically HV systems, must be connected through Potential Transformers (PTs). The power meters allow user programming of both PT Primary and Secondary voltages.

- User programmable PT Primary range - 0.1 to 999 kVAC RMS LL.
- User programmable PT Secondary range - 80 to 481 VAC RMS LL.
- Power meter Voltage Input burden - 0.2 VA per input.

IMPORTANT: The PT primary and secondary values must be user programmed before using the power meter. Otherwise, the readings will be wrong.

Selecting the Voltage Fuses

We strongly recommend using fuses on each of the sense voltages (Except for neutral) and the control / auxiliary power, although connection diagrams often do not show them.

Table 5-4: Fuse recommendation

Power Source	Source voltage	Fuse (A)
Line voltage	80 to 600 VLL	0.25
Auxiliary supply (Control power)		0.25

Current Signal Connections

The power meter accepts up to 6 A AC RMS per channel directly. Above that, a Current Transformer must be interposed to scale down the current. There are three pairs of current input terminals marked A1, A2 and A3. Each pair of input terminal is labeled as (S1, S2) and has an arrow indicating the direction of current flow. For proper measurements, the phase identification as well as the polarity of the current signals must be correct. The forward flow (import by consumer) current direction must be into the S1 terminal and the exit from the S2 terminal. Please maintain the correct sequence and polarity to avoid wrong readings.

Any unused current input terminals (e.g. A2 (S1, S2) for Delta) must be shorted together. The shorted terminals do not need to be grounded.

Install the wiring for the current circuit at 480 VAC insulation as a minimum. The cable connection should be rated for 7.5 A or greater and have a cross-sectional area of 2.5 mm^2 minimum.

CT Connections

Mount the current transformers (CTs) as close as possible to the power meter for best accuracy. The following table illustrates the maximum recommended distances for various CT sizes, assuming the connection is via 2.5 mm^2 cable.

Table: 5-5: CT Size and Maximum Distance

5 A CT size	Maximum Distance in meters (in feet) (CT to PM1000 Power Meter)
2.5 VA	3.05 metres (10 feet)
5.0 VA	4.6 metres (15 feet)
7.5 VA	9.15 metres (30 feet)
10.0 VA	12.2 metres (40 feet)
15.0 VA	18.3 metres (80 feet)
30.0 VA	36.6 metres (120 feet)

- User programmable CT Primary range - (1 A to 99 kA) AC.
- CT Secondary - (1 A or 5 A) AC (programmable)
  Other values are also programmable to compensate CT errors if desired.
- Power meters CT burden - 0.2 VA maximum per input.
  See the Setup (User programming) section for programming details.

IMPORTANT: The CT Primary and Secondary values must be User Programmed before using the Power meter. Otherwise, the readings will be wrong.

NOTE: With dual - range CTs; select the best range for programming the PM1000. Do not change the range thereafter without re-programming the PM1000; the PM1000 will read erroneous values.

CT Polarity

When the power meter is connected using the CTs, you must maintain the correct CT polarities. CT polarities are dependent upon correct connections of CT leads, and upon the direction the CTs are facing when clamped around conductors. The dot on the CT must face the line side; the corresponding secondary connection must connect to the appropriate input on the power meter.

Failure to connect CTs properly results in inaccurate power readings. If your power meter is not reading power properly, it is more than likely that the CT is incorrectly wired. If one or two CTs are reversed, then energy parameters accumulate only one phase value. If two or all the phases of the CT are reversed, energy will not accumulate. (Energy import will not be measured).

CT Connection Reversal

To check the polarity of the CT after the power meter has been installed, simply look at the phase-wise W (Watt) readings to see that each of the readings are positive (assuming you are consuming power). If one of the W readings is negative, that particular phase CT is reversed and must be corrected. On the other hand if you are exporting power, all three phase-wise W readings must be negative.

Setup – System Type

The power meters need to know what type of system it is connected to. This is programmed in the Setup procedure, before using the power meter. The power meter does allow you to change this setting while it is running; however, this capability is meant for correcting a gross error, or for training or educational purposes, not to be changed regularly. The options are:

- **Wye/Star:** For 3-Phase 4-Wire, **Three Watt-meter** or **Three Element** circuits. Here, all three voltage Phase signals, the Neutral voltage connection and all three current input signals need to be wired in, means all the 4 voltage terminals and 6 current terminals described in the following section, need to be wired. For Wye/Star wiring configuration, see “3-Phase 4-Wire WYE connection with 3 CTs and 3 PTs” in page 39 for more information.
- **Delta:** For 3-Phase 3-Wire, **Two Watt-meter** or **Two Element** circuits. For delta and open delta wiring configuration, see “3-Phase 3-Wire Delta connection with 2 CTs and 3 PTs and 3 Phase 3 Wire Open Delta connection with 2 CTs and 2 PTs” in page 40 for more information.
- **2-Phase:** For 2-Phase 3-Wire, **Two Watt-meter** or **Two Element** circuits. Here, all two voltage Phase signals, the Neutral voltage connection and all two current input signals need to be wired in, means all the 3 voltage terminals and 4 current terminals described in the following section, need to be wired. For two phase wiring configuration, see “2-Phase 3-wire connection with 2 CTs” in page 41 for more information.
- **1-Phase:** For 1-Phase 2-Wire, **One Watt-meter** or **One Element** circuits. Here a single voltage Phase signal, the Neutral voltage connection and a single current input signal need to be wired in, means the 2 voltage terminals and 1 current terminal described in the following section need to be wired. For Single phase wiring configuration, see “Single phase connection with 1 CT” in page 41 for more information.

Phase Labels

The phase labels shown on the display are programmable via the power meters front panel PROG menu. You can setup the meter to display phase labels convenient to your practice. The choices available are: 123 (factory set), RYB, RST, PQR, ABC

Connection Diagrams

Choose the diagram below that best describes your application. You must ensure that the CT phase and corresponding PT phase are identical and that the CT polarity is correct as explained in **CT Polarity** above. Follow the outlined procedure to verify correct connection.

Connection diagram symbols

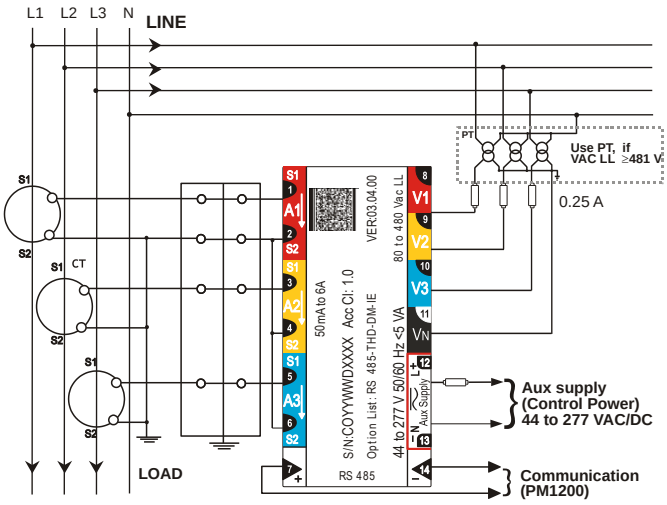
Table 5-6: Connection diagrams symbols

Symbol	Description
	Fuse
	Current transformer
	Shorting block
	Potential transformer

3-Phase 4-Wire WYE Connection with 3 CTs and 3 PTs

3 CTs. Direct Voltage Connections if the input voltage L-L is less than 481 VAC. Otherwise 3 PTs.

Figure 5-2: 3-Phase 4-Wire WYE connection



NOTE 1: Remember to make sure WYE/Star is programmed in the power meter PROG menu-Setup.

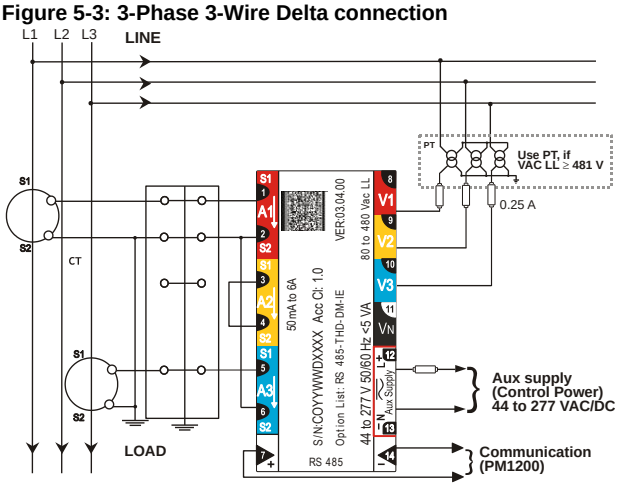
NOTE 2: For High – leg (US connection)

L1 – N = 120 V
L2 – N = 208 V
L3 – N = 120 V

3-Phase 3-Wire Delta connection with 2 CTs and 3 PTs

With 2 CTs. Direct voltage connections if the input voltage L-L is less than 481 VAC. Otherwise, 3 PTs for Closed Delta or 2 PTs for Open Delta.

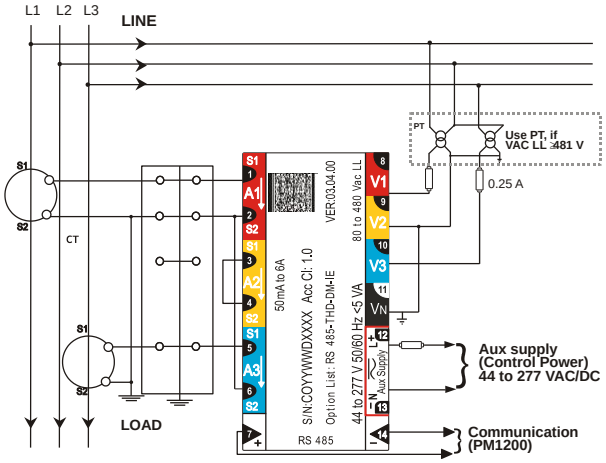
Figure 5-3: 3-Phase 3-Wire Delta connection



NOTE : Remember to make sure Delta is programmed in the power meter PROG menu- Setup. Leave the Vn terminal un-connected.

3-Phase 3-Wire Open Delta connection with 2 CTs and 2 PTs

Figure 5-4: 3-Phase 3-Wire Open Delta Connection

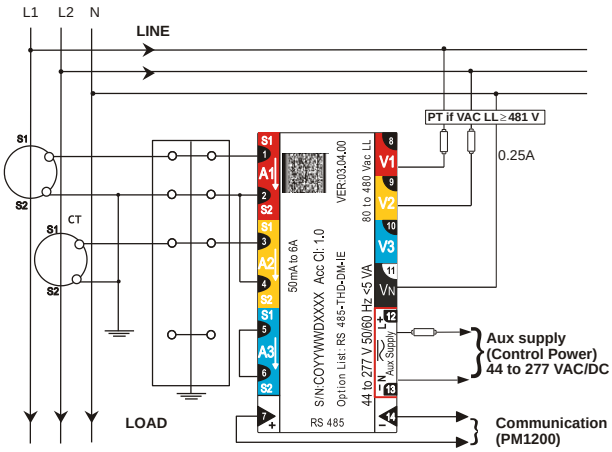


NOTE: Remember to make sure Delta is programmed in the power meter PROG menu-Setup.

2-Phase 3-wire connection with 2 CTs

2 CTs. Direct Voltage Connections if the input voltage L-L is less than 481 VAC. Otherwise 2 PTs.

Figure 5-5: 2 Phase 3 wire connection



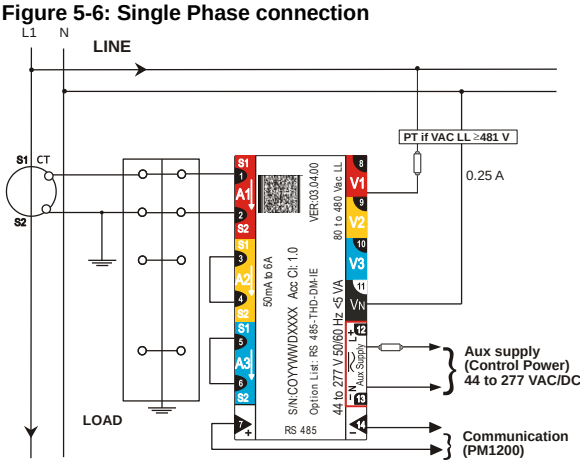
NOTE: Remember to make sure 2-Phase is programmed in the power meter PROG menu-Setup.

Single Phase connection with 1 CT

Direct Voltage Connections if Voltages are less than 481 VAC LL. Otherwise use one PT.

1. Program the power meter in single phase (1 Phase) mode. However Voltage primary and secondary needs to be programmed as Line to Line.
2. Connect the voltage and current inputs only to the V1 and A1 voltage and current terminals of the power meter.
3. The unused current terminals (A2 and A3) must be shorted together to reduce noise picked up in the power meter.
4. However, the energy parameter readings will be accurate.

Figure 5-6: Single Phase connection



CHAPTER 6: DATA COMMUNICATION

This section is applicable only for PM1200 power meter.

RS 485 Data Port

Data Port advantages:

- Rapid, on-line, real time readings into
- Your own SCADA software or PLC.
- Schneider Electric Energy Management software products such as IONE, Vijeo Citect, PowerLogic SCADA for pinpointing energy usage and wastage.
- Schneider Electric ConPAD – meter programming and basic data reading utility.
- Data Port has built-in impedance matched design for low reflectance on long data cables at high Baud rates. Eliminates need for complicated impedance matching resistors at the ends of long data cables.
- Fast 16 ms power meter response, average timing to read 10 parameters is of 90 to 100 ms (9600 Baud, Even parity, One stop bit).
- Direct reading, pre-scaled Float readings. Accurate, full precision Low and High readings. No need for additional scaling factors or decimal adjustment.
- Fast, easy to use grouping of parameters tuned for field requirements.
- TURBO area for single point polling (upto 50 per query)
- Block area for even faster access to pre-configured data blocks

Installation

Figure 6-1: 2 Wire Half Duplex Communication Connection

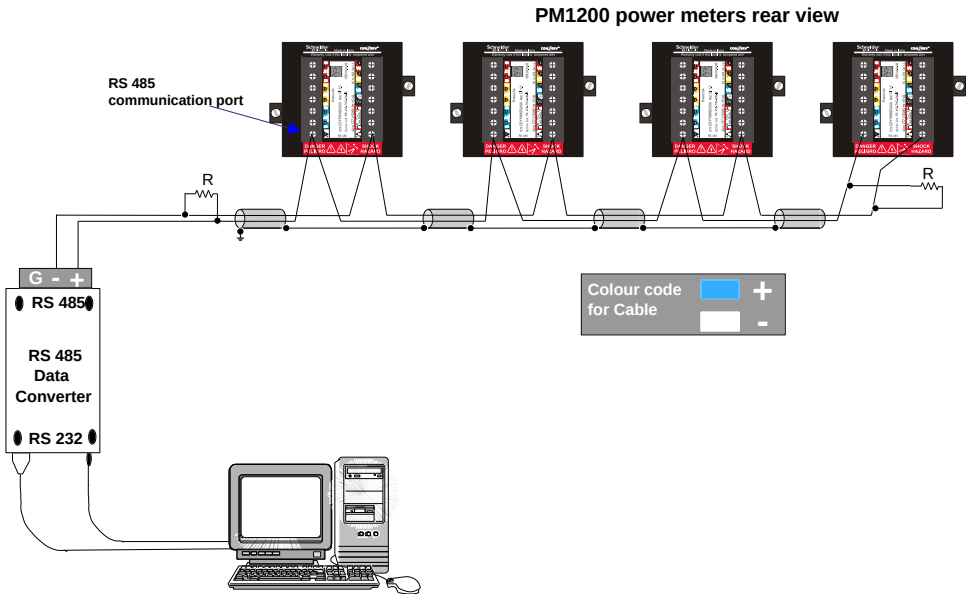
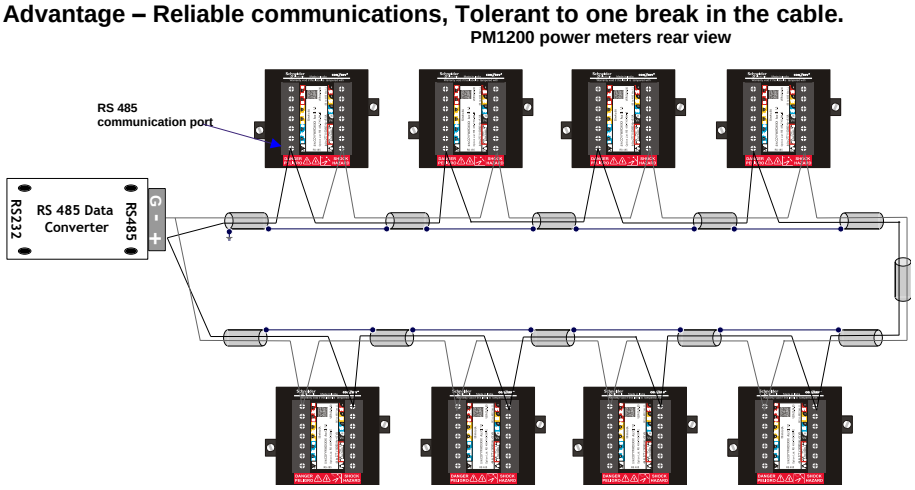


Figure 6-2: Closed Loop, 2 Wire Half Duplex.
Advantage – Reliable communications, Tolerant to one break in the cable.



Communication Capabilities

Table 6-1: RS 485 Communication Distances

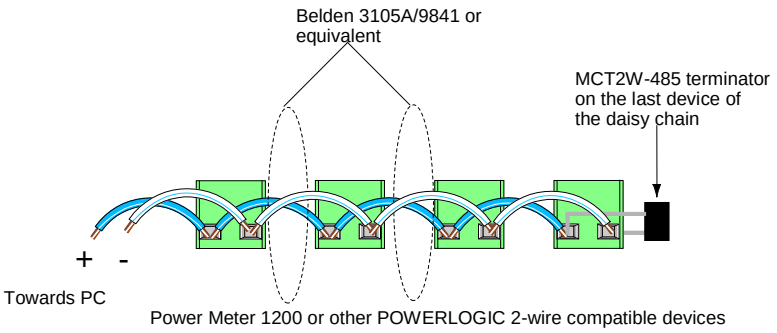
Baud Rate	Maximum Communication Distances 1 to 32 Devices	
	Feet	Meters
9600	8000	**1200**
19200	6000	**900**

NOTE: Distances listed should be used as guide only and cannot be guaranteed for non-POWERLOGIC devices.

Daisy-chaining Devices to the Power Meter

RS 485 slave port allows the power meter to be connected in a daisy chain with up to 31, 2-Wire devices. In this bulletin, communications link refers to a chain of devices that are connected by a communications cable. See Figure 6-3.

Figure 6-3: Daisy-chaining 2-Wire devices



NOTE: Belden 3105A/9841 colors: Blue (+), White (-)

- If the power meter is the first device on the daisy chain, connect it to the host device using a RS 232 to RS 422/RS 485 converter or RS 485 to Ethernet converter.

- If the power meter is the last device on the daisy chain, terminate it with the terminator provided.
- See Table 6-1 for the maximum daisy-chain communications distances for 2-Wire devices.
- The terminal's voltage and current ratings are compliant with the requirements of the EIA RS 485 communications standard.

Data Formats and Settings

Your SCADA software must be configured for Modbus RTU communication, before integrating the Schneider Electric PM1200 power meter.
The mode of transmission is defined in the following which is compatible with Modbus RTU Mode:

Table 6-2: Power meter communication and Protocol settings

Power meter Communication Settings	
Protocol	Modbus RTU
Data bits	8
Baud rate	9600 Baud, User set 1200 to 19200 Range:1200, 2400, 4800, 9600, 19200 Normally use: 9600 Baud Noisy, EMI, RFI, long data cable: 4800/2400 Baud Short cable (<300 meters or 975 feet): 19200 Baud
Parity	Even
Device Address	1
Stop bit	1
Modbus Protocol	
Device Address	1 to 247 Upto 247 meters per COM Port with Repeaters
Function Code	03 (Read)
Data Address	Refer Section Data address
Data type	32-bit float (real) : • All parameters. • Direct reading, Little Endian Float, no scaling required 32-bit unsigned integer : • INTR (number of interruptions (Outages) - RMS Blocks) • RunSec (Run seconds – Integ Block)
No of Registers	2 to 50 (optional) per PM1200 data block of 10 x 32 bit values must be configured to suit the power meter

NOTE: The polling interval to poll the data from PM1200 will depend on baud rate. We recommend polling interval of 1 sec at 9600 baud rate.

Parameter Settings for different SCADA software

The following table explains how to read the parameter VA (Refer “Individual parameter address” in page 49 for more information) in different MODBUS Master Software/PLC’s.

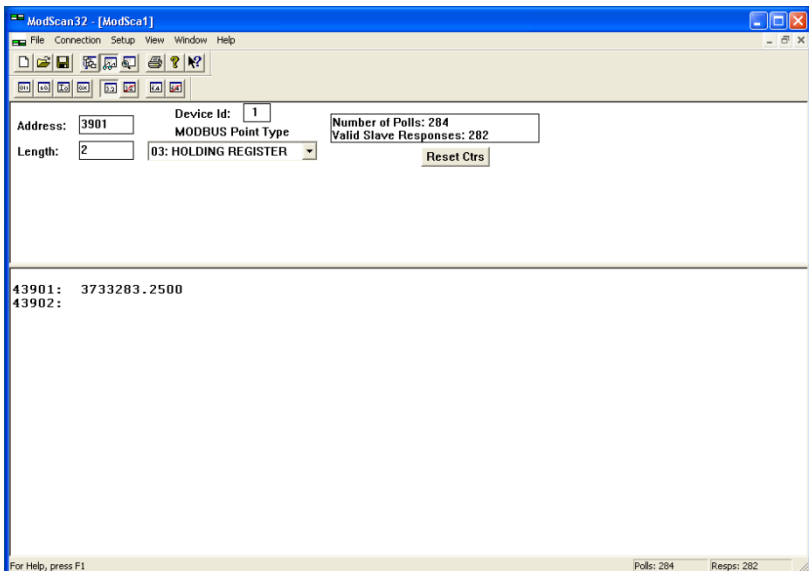
Table 6-3: Parameter settings

SL. No	SCADA software	Start Address	Function Code	No. of Register	Data Type	Remarks
1	IONE	43901	Internally configured	2	Swapped Float	Direct conversion
2	PowerLogic SCADA	43901	Internally configured	2	Real	Direct conversion
3	Vijeo Citect	43901	Internally configured	2	Real	Direct conversion
4	Intouch	43901 F	Nil	2	Float	Direct conversion
5	MODSCAN (Master)	3901	03 – Holding Registers	2	Floating point	Unswapped FP mode
6	MODTEST	43901	03 – Rosemount	Points -1	Float-Rosemount	
7	CIMPLICITY	43901	Nil	100	Real	Direct conversion. The array concept can be used here to poll all the data in single scan
8	Allenbradly – Micrologix PLC (Slave/Master)	43901	03-Holding Registers	2	Floating point	Direct
9	GE Fanuc PLC	43901	03-Holding Registers	2	Real	Direct
10	ABB RTU 560 (Mater)	Index-3900	03- Read Holding Registers	Query Range - 2	MFI – Analog measured Floating value	Under Sub parameters “Sign and Exponent in First Register” should be disabled (Unchecked)
11	SEIMENS PLC (Master)	3900	03-Holding Registers	2	Real	Direct
12	MOVICON	43901	Nil	2	Real	Direct
13	RSVIEW	43901	03-Holding Registers	2	Real	Direct
14	ABB Microscada	3900	Format – 9	Interval – 2	Real	Direct

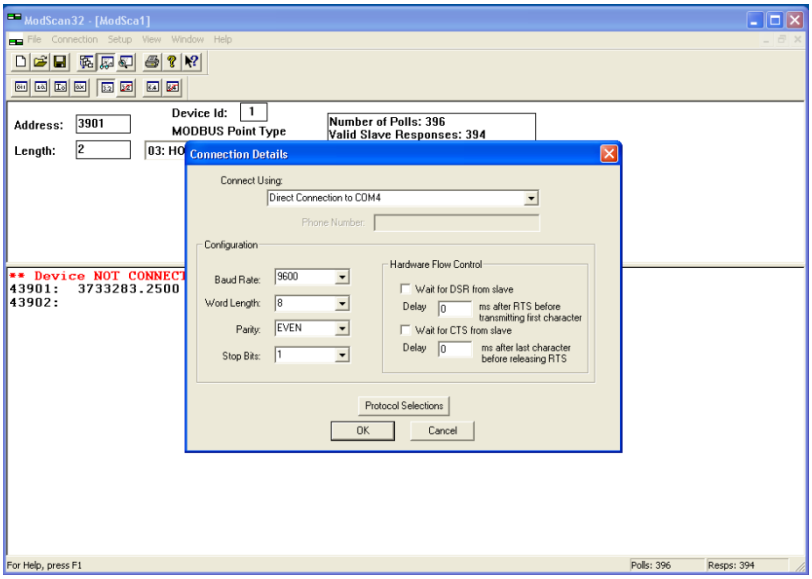
Communication Test

Communication test: PM1200 power meter can be successfully used for communication using MODSCAN Software as Modbus master in PC. Details of the settings in MODSCAN are given below.

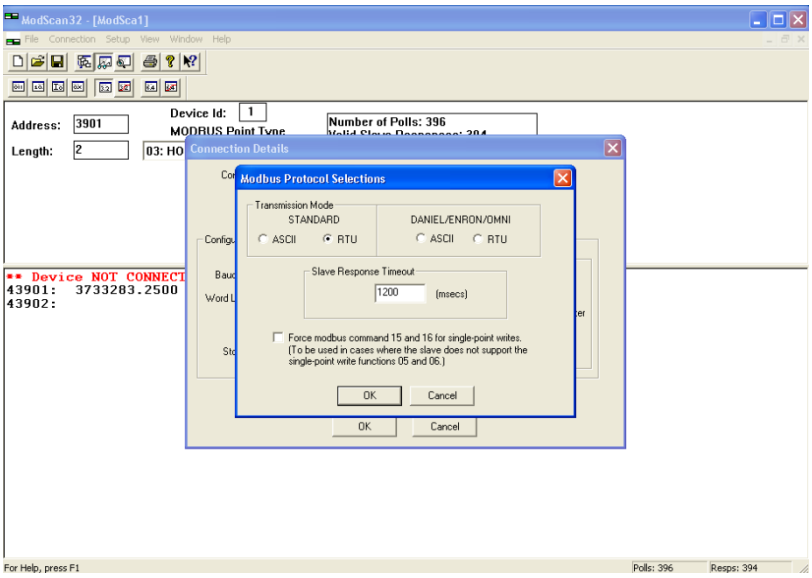
Settings in MODSCAN v3.D05-00 Software to establish communication with PM1200 power meters: Free download Demo MODSCAN Software from http://www.win-tech.com. E.g. To read the voltage V1 from 0131H Register, follow the instructions-



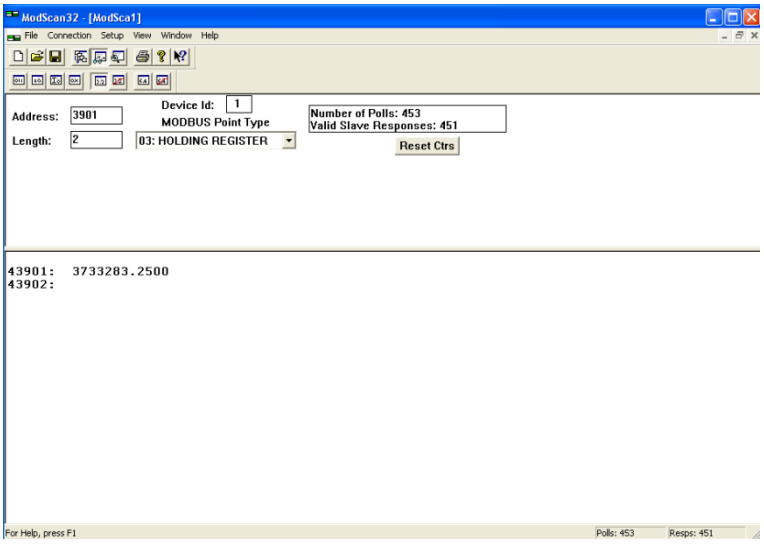
1. After starting the Modscan, to read Apparent power total (VA total), enter Address as 3901 (decimal) Length as 2; Device ID as 1; Modbus Point type as 03: HOLDING REGISTER as shown below.
2. **Modify the connection details:** Click on the connection->Connect, you will see the Connection Detail Window. Change all the settings to match with the below shown screen which are default settings of PM1200 meter.



3. Set the Modbus protocol selections: **On "Connection details"** window (shown in previous step), click on **"Protocol Selections**". Set the settings of the protocol as shown below and click 'OK' in all the windows.



4. Click 'OK', the MODSCAN Software starts polling the configured COM port for the Device ID 1.
   Modscan Demo software will stop polling after 3.5 minutes on successful communication.



This shows that the power meter is communicating with the MODBUS MODSCAN Master Software successfully on the PC. The power meter is MODBUS RTU compliant.

Data Address

The PM1200 power meters support the transfer of whole block and also of individual Data values (2 registers are used for storing single data value)

- In transfer of individual data values, it basically treats 2 registers as an object with the starting address (e.g. 3900) considered as the object name. This enables to transfer required data values for energy management.
- In transfer of whole block, it basically treats each block as an object with the starting address (e.g.3000) considered as the object name. This enables fast block-transfers, since energy management usually requires a block of related readings as of the same point of time. This method also eliminates time-skew within readings of that block.
- The Device Address, Block Start Address, number of registers, must be configured to suit the power meter. Additionally, related SCADA settings for polling priority, logging and viewing the data must also be made. Refer your SCADA software instructions on how to do this.

Individual Parameter Address

- Function Code: 03 Read
- No scaling required
- Read as block or individual parameters

Table 6-4: Individual parameter address

Parameter	Description	Address	Type	PM1200
Metering				
Metering - Current				
A	Current Average	3913	Float	●
A1	Current, Phase 1	3929	Float	●
A2	Current, Phase 2	3943	Float	●
A3	Current, Phase 3	3957	Float	●
Metering – Voltage				
VLL	Line to Line Average Voltage	3909	Float	●
VLN	Line to neutral voltage	3911	Float	●
V12	Voltage phase1 to phase2	3925	Float	●
V23	Voltage phase2 to phase3	3939	Float	●
V31	Voltage phase3 to phase1	3953	Float	●
V1	Voltage phase1 to neutral	3927	Float	●
V2	Voltage phase2 to neutral	3941	Float	●
V3	Voltage phase3 to neutral	3955	Float	●
Metering - Power				
W	Active Power, Total	3903	Float	●
W1	Active Power, phase1	3919	Float	●
W2	Active Power, phase2	3933	Float	●
W3	Active Power, phase3	3947	Float	●
VAR	Reactive Power, Total	3905	Float	●
VAR1	Reactive Power, phase1	3921	Float	●
VAR2	Reactive Power, phase2	3935	Float	●
VAR3	Reactive Power, phase3	3949	Float	●
VA	Apparent Power, Total	3901	Float	●
VA1	Apparent Power, phase1	3917	Float	●
VA2	Apparent Power, phase2	3931	Float	●
VA3	Apparent Power, phase3	3945	Float	●
Metering – Power Factor				
PF	Power factor average	3907	Float	●
PF1	Power factor, phase1	3923	Float	●
PF2	Power factor, phase2	3937	Float	●
PF3	Power factor, phase3	3951	Float	●
Metering - Frequency				
F	Frequency, Hz	3915	Float	●

Parameter	Description	Address	Type	PM1200
Power Quality				
THD				
%V1	Voltage THD, phase 1	3861	Float	•
%V2	Voltage THD, phase 2	3863	Float	•
%V3	Voltage THD, phase 3	3865	Float	•
%A1	Current THD, phase 1	3867	Float	•
%A2	Current THD, phase 2	3869	Float	•
%A3	Current THD, phase 3	3871	Float	•
NOTE: The meter will return -999.0 for invalid number/range.				
Energy				
FwdVAh	Forward Apparent Energy	3959	Float	•
FwdWh	Forward Active Energy	3961	Float	•
FwdVARh	Forward Reactive Inductive Energy	3963	Float	•
FwdVARh	Forward Reactive Capacitive Energy	3965	Float	•
RevVAh	Reverse Apparent Energy	3967	Float	•
RevWh	Reverse Active Energy	3969	Float	•
RevVARh	Reverse Reactive Inductive Energy	3971	Float	•
RevVARh	Reverse Reactive Capacitive Energy	3973	Float	•
On hrs	On hours	3993	Long	•
FwdRun secs	Forward Run seconds	3995	Long	•
RevRun secs	Reverse Run seconds	3997	Long	
Intr	Number of power interruption	3999	Long	•
Demand				
Present Demand	Present Demand	3975	Float	•
Rising Demand	Rising Demand	3977	Float	•
Max MD	Maximum demand	3979	Float	•
Max DM Occurrence Time	Maximum demand occurrence time	3981	Long	•
Percentage of Load parameters				
% Avg Load	Average Load percentage	3881	Float	•
%L1	Percentage of phase1 load	3883	Float	•
%L2	Percentage of phase2 load	3885	Float	•
%L3	Percentage of phase3 load	3887	Float	•
Unbalanced %Load	Unbalanced %Load	3889	Float	•
Unbalanced % Voltage	Unbalanced % Voltage	3891	Float	•

Block Parameter Address

Total RMS Block

- Function Code: 03H Read
- No of Registers: 20
- No Scaling Required
- Read as Block only

Table 6-5: Total RMS block

Parameter	Description	Address	Type	PM1200
VA	Apparent Power, Total	3001	Float	●
W	Active Power, Total	3003	Float	●
VAR	Reactive Power, Total	3005	Float	●
PF	Avg PF	3007	Float	●
VLL	Average Line to Line voltage	3009	Float	●
VLN	Average Line to neutral voltage	3011	Float	●
A	Average Current	3013	Float	●
F	Frequency, Hz	3015	Float	●
Reserved	Reserved	3017	Long	
Intr	Number of interruption	3019	Long	●

R phase RMS Block:

- Function Code: 03H Read
- No of Registers: 20
- No Scaling Required
- Read as Block only

Table 6-6: R phase RMS block

Parameter	Description	Address	Type	PM1200
VA1	Apparent power, phase1	3031	Float	●
W1	Active power, phase1	3033	Float	●
VAR1	Reactive power, phase1	3035	Float	●
PF1	Power factor, phase1	3037	Float	●
V12	Voltage phase1 to phase2	3039	Float	●
V1	Voltage phase1 to neutral	3041	Float	●
A1	Current, phase1	3043	Float	●
F1	Frequency, Hz	3045	Float	●
Reserved	Reserved	3047	Long	
Intr1	Number of interruption	3049	Long	●

Y phase RMS Block:

- Function Code: 03H Read
- No of Registers: 20
- No Scaling Required
- Read as Block only

Table 6-7: Y phase RMS block

Parameter	Description	Address	Type	PM1200
VA2	Apparent power, phase2	3061	Float	●
W2	Active power, phase2	3063	Float	●
VAR2	Reactive power, phase2	3065	Float	●
PF2	Power factor, phase2	3067	Float	●
V23	Voltage phase2 to phase3	3069	Float	●
V2	Voltage phase2 to neutral	3071	Float	●
A2	Current, phase2	3073	Float	●
F2	Frequency, Hz	3075	Float	●
Reserved	Reserved	3077	Long	
Intr2	Number of interruption	3079	Long	●

B phase RMS Block:

- Function Code: 03H Read
- No of Registers: 20
- No Scaling Required
- Read as Block only

Table 6-8: B phase RMS block

Parameter	Description	Address	Type	PM1200
VA3	Apparent power, phase3	3091	Float	●
W3	Active power, phase3	3093	Float	●
VAR3	Reactive power, phase3	3095	Float	●
PF3	Power factor, phase3	3097	Float	●
V31	Voltage phase3 to phase1	3099	Float	●
V3	Voltage phase3 to neutral	3101	Float	●
A3	Current, phase3	3103	Float	●
F3	Frequency, Hz	3105	Float	●
Reserved	Reserved	3107	Long	
Intr3	Number of interruption	3109	Long	●

Forward Integrated Block

- Function Code: 03H Read
- No of Registers: 20
- No Scaling Required
- Read as Block only

Table 6-9: Forward Integrated block

Parameter	Description	Address	Type	PM1200
FwdVAh	Forward Apparent Energy	3121	Float	●
FwdWh	Forward Active Energy	3123	Float	●
FwdVARh	Forward Reactive Inductive Energy	3125	Float	●
Reserved	Reserved	3127	Float	
Reserved	Reserved	3129	Float	
FwdVARh	Forward Reactive Capacitive Energy	3131	Float	●
Reserved	Reserved	3133	Float	
Reserved	Reserved	3135	Float	
Reserved	Reserved	3137	Long	
FwdRunsecs	Forward Run Seconds	3139	Long	●

Reverse Integrated Block:

- Function Code: 03H Read
- No of Registers: 20
- No Scaling Required
- Read as Block only

Table 6-10: Reverse Integrated block

Parameter	Description	Address	Type	PM1200
RevVAh	Reverse Apparent Energy	3151	Float	●
RevWh	Reverse Active Energy	3153	Float	●
RevVARh	Reverse Reactive Inductive Energy	3155	Float	●
Reserved	Reserved	3157	Float	
Reserved	Reserved	3159	Float	
RevVARh	Reverse Reactive Capacitive Energy	3161	Float	●
Reserved	Reserved	3163	Float	
Reserved	Reserved	3165	Float	
Reserved	Reserved	3167	Long	
RevRunsecs	Reverse Run Seconds	3169	Long	●

Total Integrated Block:

- Function Code: 03H Read
- No of Registers: 20
- No Scaling Required
- Read as Block only

Table 6-11: Total Integrated block

Parameter	Description	Address	Type	PM1200
TotVAh	Total Apparent Energy	3181	Float	●
TotWh	Total Active Energy	3183	Float	●
TotVARh	Total Reactive Inductive Energy	3185	Float	●
Reserved	Reserved	3187	Float	
Reserved	Reserved	3189	Float	
TotVARh	Total Reactive Capacitive Energy	3191	Float	●
Reserved	Reserved	3193	Float	
Reserved	Reserved	3195	Float	
Reserved	Reserved	3197	Long	
TotRunsecs	Total Run Seconds	3199	Long	●

Demand Block:

- Function Code: 03H Read
- No of Registers: 22
- No Scaling Required
- Read as Block only

Table 6-12: Demand block

Parameter	Description	Address	Type	PM1200
Reserved	Reserved	3721	Long	
Reserved	Reserved	3723	Float	
Reserved	Reserved	3725	Float	
Reserved	Reserved	3727	Float	
Reserved	Reserved	3729	Float	
Reserved	Reserved	3731	Float	
Reserved	Reserved	3733	Float	
Present demand	Present demand	3735	Float	●
Rising demand	Rising demand	3737	Float	●
Time remaining	Time remaining	3739	Long	●
Reserved	Reserved	3741	Float	

Note: The address 3741 is overlapped between the Demand and Max Demand blocks

Max Demand Block:

- Function Code: 03H Read
- No of Registers: 36
- No Scaling Required
- Read as Block only

Table 6-13: Max Demand Block

Parameter	Description	Address	Type	PM1200
MaxDM	Maximum demand	3741	Float	●
MaxDMTime	Maximum demand occurrence time	3743	Long	●
Reserved	Reserved	3745	Float	
Reserved	Reserved	3747	Long	
Reserved	Reserved	3749	Float	
Reserved	Reserved	3751	Long	
Reserved	Reserved	3753	Float	
Reserved	Reserved	3755	Long	
Reserved	Reserved	3757	Float	
Reserved	Reserved	3759	Long	
Reserved	Reserved	3761	Float	
Reserved	Reserved	3763	Long	
Reserved	Reserved	3765	Float	
Reserved	Reserved	3767	Long	
Reserved	Reserved	3769	Float	
Reserved	Reserved	3771	Long	
Reserved	Reserved	3773	Float	
Reserved	Reserved	3775	Long	

Note: The address 3741 is overlapped between the Demand and Max Demand blocks

Old Forward Integrated Block

- Function Code: 03H Read
- No of Registers: 20
- No Scaling Required
- Read as Block only

Table 6-14: Old Forward Integrated Block

Parameter	Description	Address	Type	PM1200
OldFwdVAh	Old forward Apparent Energy	3122	Float	●
OldFwdWh	Old Forward Active Energy	3124	Float	●
OldFwdVARh	Old Forward Reactive Inductive Energy	3126	Float	●
Reserved	Reserved	3128	Float	
Reserved	Reserved	3130	Float	
OldFwdVARh	Old Forward Reactive Capacitive Energy	3132	Float	●
Reserved	Reserved	3134	Float	
Reserved	Reserved	3136	Float	
Reserved	Reserved	3138	Long	
OldFwdRunsecs	Old Forward Run Seconds	3140	Long	●

Old Reverse Integrated Block:

- Function Code: 03H Read
- No of Registers: 20
- No Scaling Required
- Read as Block only

Table 6-15: Old Reverse Integrated Block

Parameter	Description	Address	Type	PM1200
OldRevVAh	Old Reverse Apparent Energy	3152	Float	●
OldRevWh	Old Reverse Active Energy	3154	Float	●
OldRevVARh	Old Reverse Reactive Inductive Energy	3156	Float	●
Reserved	Reserved	3158	Float	
Reserved	Reserved	3160	Float	
OldRevVARh	Old Reverse Reactive Capacitive Energy	3162	Float	●
Reserved	Reserved	3164	Float	
Reserved	Reserved	3166	Float	
Reserved	Reserved	3168	Long	
OldRevRunsecs	Old Reverse Run Seconds	3170	Long	●

Old Total Integrated Block:

- Function Code: 03H Read
- No of Registers: 20
- No Scaling Required
- Read as Block only

Table 6-16: Old Total Integrated block

Parameter	Description	Address	Type	PM1200
OldTotVAh	Old Total Apparent Energy	3182	Float	●
OldTotWh	Old Total Active Energy	3184	Float	●
OldTotVARh	Old Total Reactive Inductive Energy	3186	Float	●
Reserved	Reserved	3188	Float	
Reserved	Reserved	3190	Float	
OldTotVARh	Old Total Reactive Capacitive Energy	3192	Float	●
Reserved	Reserved	3194	Float	
Reserved	Reserved	3196	Float	
Reserved	Reserved	3198	Long	
OldTotRunsecs	Old Total Run Seconds	3200	Long	●

Phase Angle Block:

- Function Code: 03H Read
- No of Registers: 18
- No Scaling Required
- Read as Block only

Table 6-17: Phase Angle block

Parameter	Description	Address	Type	PM1200
Neutral voltage	Neutral voltage	3701	Float	●
An	Neutral current	3703	Float	●
V1	Voltage Phase Angle, phase1	3705	Float	●
V2	Voltage Phase Angle, phase2	3707	Float	●
V3	Voltage Phase Angle, phase2	3709	Float	●
A1	Current Phase Angle, phase1	3711	Float	●
A2	Current Phase Angle, phase2	3713	Float	●
A3	Current Phase Angle, phase3	3715	Float	●
RPM	Rotations per minute	3717	Float	●

Note: The parameters V1, V2, V3 (Voltage phase angles) and neutral voltage are available only through communication.

SETUP Block:

- Function Code: 03H Read, 10H Write
- No of Registers: 40
- No Scaling Required
- Read and write as block only

Table 6-18: SETUP block

Parameter	Description	Address	Type	Range	Default value	PM1200
A.Pri	Current Primary	0101	Float	1.0 to 99 k	100.0	●
A.Sec	Current Secondary	0103	Float	1.0 to 6.5	5.000	●
V.Pri	Voltage Primary	0105	Float	100.0 to 999 k	415.0	●
V.Sec	Voltage Secondary	0107	Float	50.00 to 601.0	415.0	●
SYS	System Configuration	0109	Float	2.0 to 6.0 2.0 – Delta 3.0 – Star 4.0 – Wye 5.0 – 2 Ph 6.0 – 1 Ph	3.000	●
LABL	Phase Labeling	0111	Float	0.0 to 4.0 0.0 – 123 1.0 – ABC 2.0 – RST 3.0 – PQR 4.0 – RYB	0.000	●
VA Fn	VA Function selection	0113	Float	0.0 to 1.0 0.0 – 3D 1.0 – Arth	0.000	●
D sel	Demand Selection	0115	Float	0.0 to 1.0 0.0 – Auto 1.0 – User	0.000	●
D Par	Demand parameter	0117	Float	0.0 to 2.0 0.0 – VA 1.0 – W 2.0 A	0.000	●

Parameter	Description	Address	Type	Range	Default value	PM1200
D Prd	Demand Period	0119	Float	1.0 to 6.0 1.0 – 5 Min 2.0 – 10 Min 3.0 – 15 Min 4.0 – 20 Min 5.0 – 25 Min 6.0 – 30 Min	3.000	●
BAUD	Baud rate	0121	Float	1.0 to 5.0 1.0 – 1200 2.0 – 2400 3.0 – 4800 4.0 – 9600 5.0 – 19200	4.000	●
PRTY	Parity & Stop bit	0123	Float	0.0 to 5.0 0.0 – Even 1 1.0 – Even 2 2.0 – Odd 1 3.0 – Odd 2 4.0 – No 1 5.0 – No 2	0.000	●
ID	Unit ID	0125	Float	1.0 to 255.0	1.000	●
F.S%	% Full scale	0127	Float	1 to 100	100.0	●
OFLo	Overflow parameter selection	0129	Float	0.0 to 1.0 0.0 – Wh 1.0 – VAh	0.000	●
POLE	Number of poles for RPM	0131	Float	1.0 to 8.0 1.0 – 2 2.0 – 4 3.0 – 6 4.0 – 8 5.0 – 10 6.0 – 12 7.0 – 14 8.0 – 16	2.000	●
PWD	Password	0133	Float	1000	1000	●
Reserved	Reserved	0135	Float	-	2.0	●
Reserved	Reserved	0137	Float	-	4126	●
Reserved	Reserved	0139	Float	-	0.0	●

NOTE: For efficient setup, Read the setup parameters first and then edit the required setup parameter value.

CLEAR Block

- Function Code: 10H Write
- No of Registers: 2
- No Scaling Required
- Write as block only

Table 6-19: CLEAR block

Parameter	Description	Address	Type	Range	PM1200
CLR_INTG_DMD _SETDEFAULT	INTG and demand clearing and setting up the setup default	0311	Long	1 - INTG and MD Clear 2 - MD Clear 256 - Setup default	•

NOTE: For setup default, meter will send an exception for values other than 256.

Model Info Block:

- Function Code: 03H Read
- No of Registers: 14
- No Scaling Required
- Read as block only

Table 6-20: Model Info Block

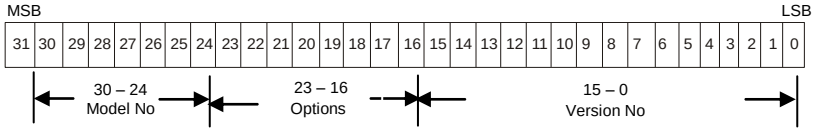
Parameter	Description	Address	Type	Range	PM1200
Reserved	Reserved	0081	Long		
Reserved	Reserved	0083	Long		
Model Version	Model, Options and version numbers	0085	Long	Bits 30 to 24 – Model No Bits 23 to 16 - Options Bits 15 to 0 – Version number E.g. PM1200 model no is 22	•
Reserved	Reserved	0087	Long		
Reserved	Reserved	0089	Long		
Reserved	Reserved	0091	Long		
Reserved	Reserved	0093	Long		

Model register details

This section explains about the model register and helps you to understand the model number, version number and options (Mentioned in table 6-20: Model Info Block).

The following figure explains how the bits are organized in the model register.

Figure 6-4: Bits in Model register



Meter Model and number: The following table bitwise explanation for Meter model and number.

Table 6-21: Meter Model and number

Meter model	Model no (5A)	Model Options
PM1200	**22 (0x16)**	**IE** **DM** **THD**

Model options description: The following table gives the model options bitwise description.

Table 6-22: Model options description

Bit23	Bit22	Bit21	Bit20	Bit19	Bit18	Bit17	Bit16	Remarks
0	0	0	0	0	0	0	0	No options available
0	0	0	0	0	0	0	1	Imp/Exp option available
0	0	0	0	0	0	1	0	DM option available
0	0	0	0	0	0	1	1	Imp/Exp and DM option available
0	0	0	0	0	1	0	0	THD option available
0	0	0	0	0	1	0	1	Imp/Exp and THD available
0	0	0	0	0	1	1	0	DM and THD available
0	0	0	0	0	1	1	1	Imp/exp, DM and THD available

Interpretation of firmware version number: The following steps clearly explain how to interpretate the FW version number.

1. Convert the hexadecimal value both MSB & LSB into decimal value.
2. Apply the formula ((MSB*256)+LSB)
3. The resultant value will be 30400 for the hexadecimal value 0x76 0xC0.
4. Insert a **0** before the result and parse it from right with 2 digits each.
5. The result will be the FW version = 03.04.00

Table 6-23: Firmware version interpretation

	MSB	LSB
Hexadecimal	0x76	0xC0
Decimal	118	192
VALUE=((MSB*256)+LSB)	30400	
FW Version	03.04.00	

NOTE:

- *● = Available*
- *Most of the reserved and unavailable parameters return zero value.*
- *The SCADA software must support Register Blocks consisting of different Data Types (Integers and Floats) to transfer of Whole Block.*
- *Each Modbus register size is 16-bits. All PM1200 readings are 32 bits. Therefore, each PM1200 reading occupies TWO consecutive Modbus Registers. E.g. VA parameter absolute address is 3901. It occupies both 3901 and 3902 Modbus registers.*
- *Address configuration: All addresses are in decimal. Some SCADA software supports MODBUS Register address instead of absolute Register address. In this case add 40000 to the above address and use it. E.g. VA parameter absolute address is 3901. Modbus address can be 43901 (40000+3901).*
- *Phase Angle Block: Voltage Phase angles (0,120,240) are hard coded (Not measured). Hence, these values are also available in communication in the absence of input signals; however, these Voltage phase angles are not available in the power meter display.*
- *TURBO, and Percentage of Load Blocks: These parameters can be read individually or as a block*
- *TURBO block: 50 parameters max*
- *Percentage of Load block: 5 parameters max*
- *All power meters address should be set between 1 and 247.*
- *All power meters should have uniform communication settings like Baud rate, parity and stop bit.*
- *Use Diagnostic mode display in the power meter to analyze the problem in communication.*
- *Error: u – Invalid unit ID*
- *A – Invalid Address*
- *c – CRC error (Cyclic Redundancy checking)*
- *t – Transmitting*
- *r – Receiving*
- *F – Invalid function code*
- *– Parity, framing or overrun error*
- *O- Buffer overflow*

CHAPTER 7: MAINTENANCE AND TROUBLESHOOTING

Introduction

This chapter describes information related to maintenance of your power meter.

The power meter 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.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Don't attempt to service the power meter. CT and PT inputs may contain hazardous currents and voltages.
- Only authorized service personnel from the manufacturer should service the power meter.

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

⚠ CAUTION

HAZARD OF EQUIPMENT DAMAGE

- Do not perform a Dielectric (Hi-Pot) or Megger test on the power meter, High voltage testing of the power meter may damage the unit.
- Before performing 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.

Failure to follow this instruction will result in injury or equipment damage.

Troubleshooting

The information in Table 7–1 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 your local 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 practices. For example, in the United States, see NFPA 70E.
- This equipment must be installed and serviced only by qualified 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 7-1: Trouble shooting

Potential Problem	Possible Cause	Possible Solution
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 and so on). See “PROG menu - Setup” in page 17 for setup instructions.
	Usage of protection Class (10P10 etc.) CTs/PTs	Use instrument Class 1 or better CTs/PTs which will have better accuracy than the protection Class CTs/PTs
	Improper wiring	Check whether all the PTs and CTs are connected properly (Proper polarity is observed) and that they are energized. Check shorting terminals. See “connection diagrams “ in page 39 for more information.
Active Power (W) reading is negative	CT may be reversed	Check and correct the CT connections.
	Power may be in export mode	1. Check the mode. If the mode is in import, s1 s2 need to be interchanged in 1 or 2 or in all the three phases. Under this condition the energy will update in INTG Rev 2. Check the mode. If it is in export, then the energy will update in INTG Rev.

Potential Problem	Possible Cause	Possible Solution
The display went blank suddenly.	Over voltage/Temperature	Interrupt the power supply or reduce the voltage or temperature within the limit.
	Fuse connection	Check whether fuse of rating 0.25 A is connected on each voltage input. If not connect the 0.25 A rated fuse to the voltage input.
The power meter stopped communication abruptly.	Communications lines are improperly connected.	Verify the power meter communications connections. See “Chapter 6 – Data communication” in page 43 for more information.
	Over voltage/Temperature	Interrupt the power supply or reduce the voltage or temperature within the limit.
Wrong Load bar indication	Incorrect F.S% selection	Select the full-scale load percentage setting as per your circuit.
The Power meter is over heated	Lack of sufficient air for cooling	Provide sufficient space all around the power meter and separate the meter from other equipment for cooling air.

APPENDIX A – TECHNICAL DATA

Accuracy

Table A-1: Accuracy

Measurement	Accuracy % of Reading
	Class 1.0
Voltage LN per phase and Avg	1.0
Voltage LL per phase and Avg	1.0
Amp per phase and Avg	1.0
Amp, phase angle per phase	2º
Frequency	0.1
Active power, (kW) per phase and total	1.0
Reactive power, (kVAR) per phase and total	2.0
Apparent power, (kVA) per phase and total	1.0
Active energy (kWh) Import/Export	1.0
Reactive energy (kVARh) (Inductive / Capacitive)	2.0
Apparent energy (kVAh)	1.0
RPM	1.0

- *NOTE 1: Additional error of 0.05 % of full scale for input current below 100 mA.*
- *NOTE 2: PF error limit is same as W error limit in %.*

Auxiliary supply (Control power)

The power meter needs a single-phase AC or DC control supply to power its internal electronics.
Range: 44 to 277 VAC/DC.
Burden (load): 0.2 VA max for each phase input voltage and current 3 VA max on Auxiliary supply.

Front Panel Display

- Brilliant 3 lines 4 digit (digit height 14.2 mm) per line, high readability alpha numeric LED display with auto scaling capability for Kilo, Mega, Giga.
- The display provides the user access to all phase voltages (phase to neutral and phase to phase), currents (per phase and average), Watts, VARs, VA, Power Factor, Frequency, kWh, kVAh and kVARh.
- The power meters display average volts, amps and frequency simultaneously.
- Load bar graph for the indication of the consumption in terms of % Amperes total.
- Set of 4 red LED's in the load bar start blinking when the load is greater than 120% indicating overload.
- Easy setup through keys located on the faceplate for common configuration parameters.
- Password protection for setup parameters.
- User selectable default display page through key pad lock.

Installation and Input Ratings

- Auto – ranging voltage inputs should allow direct connection up to 277 VLN/480VLL AC systems (no PTs (VTs) required up to 480 VLL phase to phase).
- Supports (field configurable) direct 4-Wire Wye (Star), 3-Wire Wye (Star), 3-Wire Delta configurations, two Phase three wire (2 Phase) and single phase (1 Phase).
- 3 – phase voltage and current inputs
- Volts : 46 to 277 VAC Phase–Neutral, 80 to 480 VAC Phase-Phase, Overload – Continuous 480 VLL with full accuracy, 750 VLL Max, Hz. 50 / 60
- Amps: 50 mA to 6 A, Overload: 10 A continuous, 50 A for 3 seconds
- User programmable for 5 A or 1 A secondary CTs
- Burden (Load): Less than 0.2 VA per Volt / Ampere input
- Frequency (Both input and Auxiliary): 50 / 60 Hz, 45 to 65 Hz

Environmental Conditions

- Sealed dust – proof construction. Meets IP51 for the front panel and IP40 for rear panel.
- 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: 5% to 95%, non-condensing

Safety Construction

- Self-extinguishable V0 plastic, double insulation at accessible areas.
- Pollution Degree II
- Measurements Category III

Dimensions and Shipping

- Basic unit installed depth 82 mm with the protected cover with 92x92 mm panel cutout, flush mount.
- Bezels dimension 96x96 mm. Panel Cut out 92x92 mm.
- Weight 400 gms approx Unpacked, 500 gms approx shipping. See “Mechanical Installation” in page 33 for more information.

APPENDIX B: SIM (SIMULATION) MODE

The PM1000 series power meters are provided with SIM mode for the purpose demo and exhibition display, where the user can see the functioning of the power meter without any input signals. The power meter will show a fixed Voltage, current, frequency and 0.5PF. Power and Energy parameters are calculated based on the V, A and PF displayed.

To Enter SIM mode

- Keep the Left key pressed, while powering up the power meter. The display will show **RUN**.
- Press down key. The display shows **SIM**.
- Press right key. The display sh**o**ws **RMS SIM**. You have successfully entered the SIM mode of the power meters.

To Exit from SIM mode

- Press the TURBO key continuously until you reach the RMS page.
- Press left key once. The display shows **SIM**.
- Press down key. The display shows **RUN**.
- Press right key. The display shows **RMS** indicating the exit from SIM mode

APPENDIX C: GLOSSARY

Terms

Auto – an interval selected from 5 to 30 minutes. The power meter calculates and updates the demand, every 15 seconds.

Baud rate - specifies how fast data is transmitted across a network port.

Communications link – a chain of devices connected by a communications cable to a communications port

Current Transformer (CT) – Current transformers for current inputs.

Demand - average value of a quantity, such as power, over a specified interval of time.

Firmware – Operating system within the power meter

Fixed block – See User

Float – a 32-bit floating point value returned by a register. (Refer “Data Address” in page 49 for more information)

Forward – Importing the power into the plant/grid

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.

LOCK – Default display page lock (Refer “Default display (View) page” in page 12 for more information)

Long – a 32-bit value returned by a register (Refer “Data Address” in page 49 for more information)

Maximum demand – highest average load during a specific time interval

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.

Power factor – true power factor is the ratio of real power to apparent power using the complete harmonic content of real and apparent power**Reverse –** Exporting the power from the plant/grid

RMS – Root mean square. The power meters are true RMS sensing devices

Run mode – This is the normal operating mode of the power meter, where the readings are taken.

Sliding block – See Auto

Total Harmonic Distortion (THD) – indicates the degree to which the voltage or current signal is distorted in a circuit.

ULOC – Default display page unlock (Refer “Default display (View) page” in page 12 for more information)

User – An interval selected between 5 to 30 minutes. The power meter calculates and updates the demand at the end of each interval.

Abbreviations

%A FS - % Amperes full scale
A – Amperes
Amps – Amperes
An – Neutral current
A.PRI – Current primary winding
A.SEC – Current secondary winding
Avg – Average
CLR – Clear
CT – Current transformer
DIAG, Dia - Diagnostic
FW – Firmware
FWD - Forward
Hz – Hertz
ID – Identity
INTG – Integrator
IP – Ingress protection
kVAh – Kilo volt-ampere hour
kVARh – Kilo volt-ampere reactive hour
kWh – Kilo watt hour
LABL – Phase labeling
MD – Maximum demand
Min – Minimum
ms – Milli seconds
O.F – Over flow
PF – Power factor
PT – Potential transformer
R.d – Rising demand
Rev – Reverse
RPM – Revolution per minute
SYS – System configuration
THD – Total Harmonic Distortion
ULOC - Unlock
Unb – Unbalance
V – Voltage
VA – Apparent power
VAh – Apparent energy
VAR – Reactive power
VARh – Reactive energy (Inductive)
-VARh – Reactive energy (Capacitive)
V.SEC – Voltage secondary winding
VT – Voltage transformer
V.PRI – Voltage primary winding
W – Active power
Wh – Active energy

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