

ARTISAN®
TECHNOLOGY GROUP

Your **definitive** source for quality pre-owned equipment.

**Artisan Technology Group**
(217) 352-9330 | sales@artisantg.com | artisantg.com

**Full-service, independent repair center**
with experienced engineers and technicians on staff.

**We buy your excess, underutilized, and idle equipment**
along with credit for buybacks and trade-ins.

**Custom engineering**
so your equipment works exactly as you specify.

- Critical and expedited services
- In stock / Ready-to-ship
- Leasing / Rentals / Demos
- ITAR-certified secure asset solutions

**Expert team | Trust guarantee | 100% satisfaction**

All trademarks, brand names, and brands appearing herein are the property of their respective owners.

Find the *Schneider Electric / Conzerv EM6400* at our website: ***Click HERE***

# Conzerv EM6400 Series Power Meters
## User Manual

NHA12533-03
07/2015

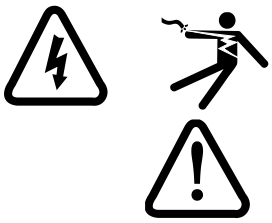



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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

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

| ⚠ CAUTION |
| --- |
| **CAUTION** indicates a potentially hazardous situation which, if not avoided, **could 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. |

| *NOTICE* |
| --- |
| **NOTICE** is used to address practices not related to physical injury. |


© Schneider Electric. All rights reserved.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

**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.

© Schneider Electric. All rights reserved.


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

**Chapter 1 – Product Description....6**
Physical Description....6
Front Panel....7
Rear Panel....12
Models and Parameters....13
Technical Specifications....15
**Chapter 2: Safety Precautions....17**
**Chapter 3: Quick Start Guide....18**
PROG Menu — Setup....18
Quick Setup – While powering ON....18
Enter Setup Menu in View (Read-Only) Mode....20
Enter Setup Menu in Edit Mode....20
Setup Parameters in View and Edit Modes....21
Setup Parameters in View and Edit Modes (continued)....22
Edit Set Parameters....23
Clear INTG and Maximum Demand (MD)....25
Energy Integrator....27
Integrator Overflow....27
Demand Power Calculation Methods....28
EM6400 Series Power Meters Menu Hierarchy....30
EM6459 Meter Menu Hierarchy....30
EM6433 Power Meter Menu Hierarchy....31
EM6436 Power Meter Menu Hierarchy....32
EM6434 Power Meter Menu Hierarchy....33
EM6400 Power Meter Menu Hierarchy....34
EM6400 Power Meter Menu Hierarchy (Continued)....35
EM6400 Power Meter Menu Hierarchy (Continued)....36
**Chapter 4: AC Power Measurement....37**
3-Phase Systems....37
Consumption and Poor Power Factor....38
“3D” kVA Measurement....38
**Chapter 5: Installation....39**
Mechanical Installation....39
Installation Procedure....40
Electrical Installation....42
Terminal connections using lugs....43
Auxiliary Supply (Control Power)....44
PTs (VTs) and CTs....44
Voltage Signal Connections....45
Current Signal Connections....45
Setup — System Type....47
Phase Labels....48
Connection Diagrams....48
**Chapter 6: Data Communication....51**
Float Byte Register....51
Health Check Register....51
Float Byte Order Detection....51
RS 485 Data Port....52


© Schneider Electric. All rights reserved.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Installation ..... 52
Communication Capabilities ..... 53
Daisy-chaining Devices to the Power Meter ..... 53
Data Formats and Settings ..... 54
Modbus Standard Device Identification ..... 54
Parameter Settings for Different SCADA Software ..... 55
Communication Test ..... 56
Data Address ..... 58
**Chapter 7: Maintenance and Troubleshooting ..... 70**
Introduction ..... 70
Troubleshooting ..... 71
Disposal and Recycle ..... 72
To Disassemble ..... 72
**Appendix A – Technical Data ..... 73**
Accuracy ..... 73
Auxiliary supply (Control Power) ..... 73
Front Display ..... 73
Installation and Input Ratings ..... 74
Environmental Conditions ..... 74
Construction ..... 74
Dimensions and Shipping ..... 74
**Appendix B: SIM (simulation) Mode ..... 75**
**Appendix C: Glossary ..... 76**
Terms ..... 76
Abbreviations ..... 78
**INDEX ..... 79**

© Schneider Electric. All rights reserved.


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

# Chapter 1 – Product Description

The EM6400 series power meters are digital power meters that offer comprehensive 3-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 and setup steps required before the power meter is ready for use, and maintenance and troubleshooting procedures for the power meter after installation.

The EM6400 series power meter is a universal power meter. Before use, please program the SYS (measurement system configuration) and the 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 EM6400 power meters with complete user support and service.

**Intended use:** The EM6400 series power meter is designed for use in industrial and commercial installations by trained and qualified professionals, not for domestic use.

## Physical Description

**FRONT:** The front panel has three rows of four digits/characters each, with auto scaling Kilo (K), Mega (M), and minus (-) indications. The **K** and **M** indicators are lit together to 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 full scale (FS) selected. Five smart keys make navigating the parameters very quick and intuitive for viewing data and configuring the power meter.

**REAR:** The voltage and current terminals and the RS 485 communication port are located on the back of the power meter. Refer to “Rear Panel” on page 13 for more information.


© Schneider Electric. All rights reserved.

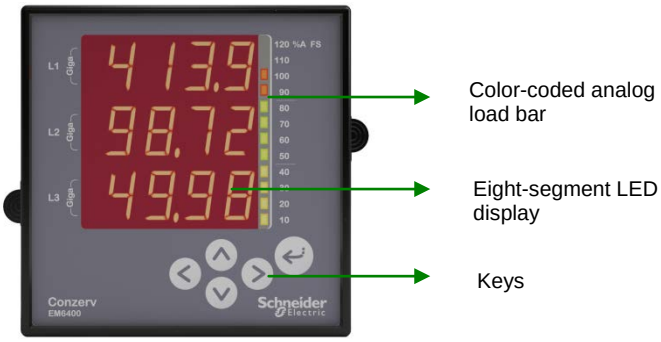
Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

# Front Panel

The front panel contains the following indicators and controls:

- **Eight-segment LED display:** Three rows of alphanumeric displays, four digits each, display three RMS parameters simultaneously or one energy parameter. The displayed readings update every second.
- **Analog load bar:** Unique indication of % load with respect to the full scale (FS).
- **Indicators:** For each row Kilo, Mega (Kilo + Mega = Giga) indicators, and a Negative (-) indicator.
- **Keys:** Five smart keys to scroll through the display pages.

**Figure 1-1: Parts of EM6400 series power meter front panel**




### Eight-segment LED display

- Four line, three digits, eight-segment LED display.
- The power meter displays the parameter name prominently right on the large, alphanumeric readouts.
- The power meter displays the parameter name for **two** seconds and then the value for **eight** seconds. The parameter name is also displayed each time when you press a key. This helps the user to know which parameter is currently displayed.
- 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 the number of illuminated LEDs, and then multiply by 10**.**

**Table 1-1: Load percentage and bar graph indication**

| Load percentage | Bar graph display |
|---|---|
| Less than 10% | No LEDs are lit. |
| Between 10 to 40 % | Amber LEDs are lit. |
| Between 50 to 80% | Green LEDs are lit to indicate that the load is acceptable and should not be increased further. |
| Above 80% | Red LEDs are lit to indicate that the load has exceeded the sanctioned limit and is dangerous. |

© Schneider Electric. All rights reserved.


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## 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 1000 as 1.0 K. |
| M | **Mega:** When lit, indicates that the reading is in Mega ($10^6$). 10,000 K is shown as 10.00 M and 1000 K as 1.0 M. |
| M K | **Giga:** When **Kilo** and **Mega** are lit together, the reading is in Giga ($10^9$). 10,000 M is shown as 10.00 G and 1000 M as 1.0 G. |
| – | **Negative:** When lit, indicates that the reading is **negative** as per IEEE 100 and industry standard practice.<br>When PF (power factor) is lead (capacitive load): Both PF and VAR (reactive power) signs 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 three values of Wh (active energy) or VAh (apparent energy) (selectable through PROG menu - setup) depending upon the PT (VT) and CT ratios programmed.


© Schneider Electric. All rights reserved.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## Smart Keys

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

### Table 1-4: Smart keys description

| | |
|---|---|
|  | **Right Key**<br>• Go **forward** into sub-parameter pages.<br>• Going right past **EDIT** in **SET** and **CLR** requires code entry to enter PROG menu (setup and clear).<br>• During setup, select **next** (right side) digit. |
|  | **Left Key:**<br>• Go **back** towards to the main parameter pages.<br>• During edit setup, select **previous** (left side) digit.<br>• Exits from Edit mode, back to the PROG menu – setup.<br>• The meter enters the SIM (simulation) mode when you press the left key continuously during the power up of the power meter. See “SIM (Simulation) mode” on page 77 for more information. |
|  | **Up Key:**<br>• Scroll **up** through display pages at the same level, **within the same function.**<br>  • Continuous pressing for three seconds initiates **limited auto-scroll (within the same function).** See “Auto-scroll” on page 12 for more information.<br>• **While editing, increases** the value of the blinking/selected digit. |
|  | **Down Key:**<br>• Scroll **down** through other display pages at the same level, through **all functions**.<br>  • Continuous pressing for three seconds initiates **the full auto-scroll mode,** through all functions. See “Auto-scroll” on page 12 for more information.<br>• **While editing, decreases** the value of the blinking/selected digit. |
|  | **TURBO Key:**<br>• TURBO key is simple one touch access to the most commonly used parameters pages (factory set). The TURBO pages for EM6400 series power meters are given below.<br>• **EM6400: 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, VAh E, Wh E, RVAh, RWh, tVAh, tWh**.**<br>• **EM6433:** RMS (home page), A, W, Wh, Wh E.<br>• **EM6459:** RMS (home page), VLL A PF, VLN A F.<br>• **EM6434:** RMS (home page), VA W PF, VA W VAR, W VAR PF PF1 PF2 PF3 VAh, VAh E, Wh, and Wh E.<br>• **EM 6436:** RMS (home page), 'VLL, A, PF' 'VLN, A, F', ‘A, W, PF’, ‘PF1, PF2, PF3’, Wh, Wh E and Run.h.<br>• If you’re lost, the TURBO key is a quick way to get back to the RMS home page.<br>• Continuous pressing for three seconds initiates auto scrolling through the above TURBO pages.  See “Auto-scroll” on page 12 for more information.<br>• During the power up, if the TURBO key is pressed, then the power meter goes directly into PROG menu – Setup. This is the easiest way to enter into the setup menu. See “Quick setup – While powering on” on page 19 for more information. |

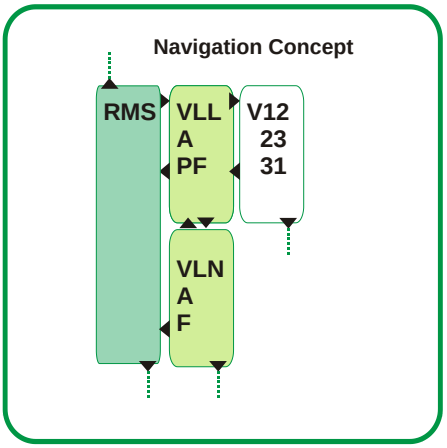
© Schneider Electric.  All rights reserved.


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

**Keypad Operation**

Press the key in the direction you want to go. The display shows where you are headed. Press the key that takes you in the desired direction.

The following example explains how to navigate from the **RMS** page to the **VLN A F** page and back to the **RMS** page in the EM6400 power meter.




1. From the **RMS** page, press . The display shows **VLL A PF**
2. Now press .The display shows **VLN A F**
3. To return to **RMS,** press .The display shows **RMS**.

Use to go forward to the sub-parameter page and use to go backward to the main parameter pages. Use and to scroll up and down through the display 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” on 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.


© Schneider Electric. All rights reserved.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

### Auto-scroll

Auto-scroll allows you to monitor a group of display pages sequentially, every five seconds, without manual key operation. This is convenient for viewing from a distance. The power meter shows the parameter name for **one second** followed by the value for **four seconds**.

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

  Go to a particular page in the desired page group. Press  continuously for three seconds and then release. The display flashes **AUTO** and starts auto-scroll within the page group.
- **To auto-scroll down the entire column of pages**

  Go to the desired page. Press  continuously for three seconds and then release. The display flashes **AUTO** and starts auto-scroll down the entire column of pages.
- **To auto-scroll through TURBO pages**

  Press  continuously for three seconds and then release. The display flashes **AUTO** and starts auto-scroll through the TURBO pages.

*Note: Press any key to revert to manual scrolling. Auto scrolling is not possible in the setup parameters.*

### Default Display (View) Page

You can select any page as a **user-set** default display page. You can scroll to other display pages. The **user-set** page is displayed two minutes after the manual scrolling is stopped by the user.

**To lock the user-set default page:**

- Go to the page you want to set as the default page.
- Press  and  simultaneously to lock the page. The power meter displays **LOCK**.

**To unlock the user-set default page:**

- Once the default display page is active, press  and  simultaneously to unlock the page. The power meter displays **ULOC**.

*Note: Entry into setup (PROG) is allowed only when the **display page** is unlocked.*

### Default Display Page through Communication

- You can lock and unlock the default display page through communication.
- If the default display page is locked by operator through communication, the default display page can be unlocked through front panel.
- If the default display page is locked by supervisor through communication, the operator cannot unlock the default display page through front panel and communication. Only supervisor can unlock through communication.

© Schneider Electric. All rights reserved.

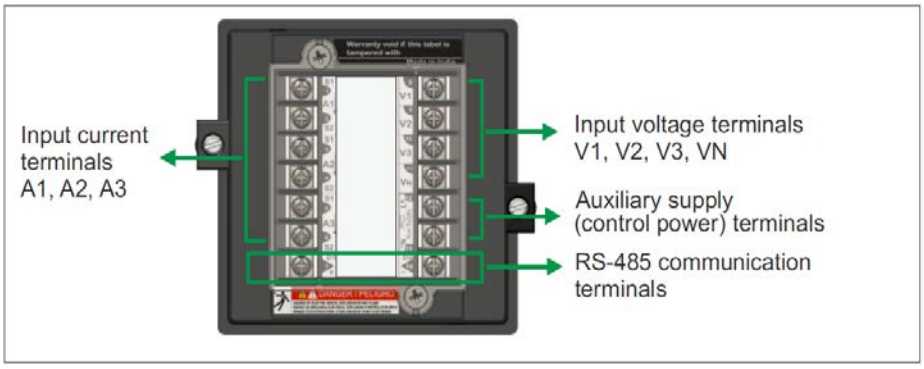

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## Rear Panel

The EM6400 series power meter terminals are located on the rear panel. 14 terminals are provided, seven 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).
- Two terminals for the RS 485 communication port.

**Figure 1-2: Rear panel**





© Schneider Electric. All rights reserved.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

# Models and Parameters

The power meter can measure, locally display, and remotely transfer over Modbus RTU protocol, the following parameters:

**Table 1-5: Models and parameters**

| Parameter | | EM 6459 | EM 6433 | EM 6434 | EM 6436 | EM 6400 |
|---|---|---|---|---|---|---|
| **RMS** | VLLV12, V23, V31<br>VLN V1, V2, V3 | ✓ | - | - | ✓ | ✓ |
| | A A1 A2 A3 | ✓ | ✓ | - | ✓ | ✓ |
| | An<br>Neutral current | C | - | - | - | C |
| | F | ✓ | - | - | ✓ | ✓ |
| | %L – Amps | ✓ | - | - | - | ✓ |
| | % V Unbal<br>% A Unbal | ✓ | - | - | - | ✓ |
| | PF PF1 PF2 PF3 | ✓ | - | ✓ | ✓ | ✓ |
| | %A FS<br>Analog color coded load bar | ✓ | ✓ | ✓ | ✓ | ✓ |
| | RPM | ✓ | - | - | - | ✓ |
| | A° Phase Angle<br>A°1 A°2 A°3 | ✓ | - | - | - | ✓ |
| | W W1 W2 W3 | - | ⊙ | ✓ | ⊙ | ✓ |
| | VA VA1 VA2 VA3 | - | ⊙ | ✓ | ⊙ | ✓ |
| | VAR VAR1 VAR2 VAR3 | - | - | ✓ | - | ✓ |
| **DM** | Demand VA/ W/ A | - | - | - | - | DM<br>☐ |
| | Rising demand | - | - | - | - | |
| | Time remaining | - | - | - | - | |
| | Maximum Demand (MD) | - | - | - | - | |
| | Hr MD occurred | - | - | - | - | |
| **INTG FWD** | Wh | - | ⊙ | ✓ | ⊙ | ✓ |
| | VAh | - | ⊙ | ✓ | ⊙ | ✓ |
| | VARh | - | - | ✓ | - | ✓ |
| | -VARh | - | - | ✓ | - | ✓ |
| | Run hours | - | ✓ | ✓ | ✓ | ✓ |
| | ON hours | ✓ | ✓ | ✓ | ✓ | ✓ |
| | INTR | ✓ | ✓ | ✓ | ✓ | ✓ |
| **INTG REV** | R.Wh | - | - | - | - | **I/E**<br>☐ |
| | R.VAh | - | - | - | - | |
| | R.VARh | - | - | - | - | |
| | -R.VARh | - | - | - | - | |
| | Run hours | - | - | - | - | |
| **OLD FWD** | Wh | - | ⊙ | ✓ | ⊙ | ✓ |
| | VAh | - | ⊙ | ✓ | ⊙ | ✓ |
| | VARh | - | - | ✓ | - | ✓ |
| | -VARh | - | - | ✓ | - | ✓ |
| | Run hours | - | ✓ | ✓ | ✓ | ✓ |
| **OLD REV** | R.Wh | - | - | - | - | **I/E**<br>☐ |
| | R.VAh | - | - | - | - | |
| | R.VARh | - | - | - | - | |
| | -R.VARh | - | - | - | - | |
| | Run hours | - | - | - | - | |
| | RS 485 | ☐ | ✓ | ✓ | ☐ | ☐ |

*Note:*
*√ – Standard; ☐ – Option specified while ordering; C – Only through communication;*
*⊙ – Selectable through setup.*

© Schneider Electric. All rights reserved.


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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

**The EM6400 series power meter 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°1, A°2, A°3) with respect to 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:** Measures 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 totawl. 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” on page 9 for more information.


© Schneider Electric. All rights reserved.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

# Technical Specifications

The EM6400 series power meters are high-accuracy, low cost, ultra-compact, power, and energy meter. 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 product standards.

The power meters are designed for retrofit applications such as replacement of analog meters. Each can be used as a standalone meter in electrical control panels, power distribution units (PDU), switch boards, uninterrupted power supplies (UPS), generator sets, and motor control center (MCC) systems. It also provides easy communication to program logic controls (PLC), distributed control systems (DCS), building management systems (BMS), and other systems.

The following table gives the technical specifications of the power meters. Refer to “Technical Data” on page 75 for more information.

**Table 1-6: Technical specifications**

| Description | Specification |
|---|---|
| Sensing/Measurement | True RMS, one second update time, four quadrant power and energy |
| Accuracy | Class 1.0 as per IEC 62052-11 and IEC 62053-21;<br>Class 0.5S (Optional) as per IEC 62052-11, 62053-22;<br>Class 0.2* (optional) ; |
| Auxiliary supply (Control power) | 44 to 300 VAC/DC CAT III<br>50/60 Hz |
| Burden | Voltage and current input < 0.2 VA per phase<br>Auxiliary supply (control power) < 3 VA at 240 V, 5 VA Max<br>< 2 W at 300 V DC |
| Display | Alphanumeric bright LED |
| Resolution | RMS four digits, INTG eight digits |
| Input voltage | Four voltage inputs (V1, V2, V3, VN)<br>IEC: 80 to 480 V-LL (50 to 277 V-LN) CAT III<br>80 to 600 V-LL (50 to 350 V-LN) CAT II<br>UL: 80 to 600 V-LL |
| Input current** (Energy measurement) | Current inputs (A1, A2, A3);<br>5 A Class 1.0/0.5S: 5 mA (starting) to 6 A<br>5 A Class 0.5S/0.2: 5 mA (starting) to 6 A<br>1 A Class 0.5S/0.2: 1 mA (starting) to 1.2 A |
| Frequency | 45 to 65 Hz |
| Overload | 5 A meter: 10 A max continuous, 50 A for 5 sec/hr, 120 A for 1 sec/hr<br>1 A meter: 2 A max continuous, 10 A for 5 sec/hr, 24 A for 1 sec/hr |
| Environmental | Operating temperature: -10 °C to 60 °C (14 °F to 140 °F)<br>Storage temperature: -25 °C to +70 °C (-13 °F to 158 °F)<br>Humidity 5% to 95% non condensing<br>Altitude ≤ 2000m |
| Standard | CAT III - Measurement category III,<br>Pollution Degree 2,<br>⧈ - Double insulation at user-accessible area |
| Weight | 400 gms approx, unpacked<br>500 gms approx, shipping |
| Communication (optional) | RS-485 serial channel connection Industry standard Modbus RTU protocol |
| EM6400 series | Emission : CISPR22 Class A; Fast Transient: 4kV IEC |

© Schneider Electric. All rights reserved.


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

| | |
|---|---|
| conforms to | 61000-4-4; Surge withstand: IEC 61000-4-5;<br>Damped Oscillatory: IEC 61000-4-12; ESD: IEC 61000-4- 2;<br>Impulse voltage: 6 kV, IEC 60060, 1.2/50 µs |
| IP degree of protection | Front display – IP 51;<br>Meter body – IP 40 Excluding terminals |

**NOTE:** Universal CT range is applicable for Class 1 & Class 0.5 meters where CT secondary of 1 A or 5 A is field-programmable.
For Class 0.5S & Class 0.2 meters, CT secondary rating (1 A or 5 A) should be specified while ordering.

** Class 0.2 is applicable when the voltage (line-neutral) is above 120 V.*
*** Additional error of 0.05% of full scale, for power meter input current below 100 mA for 5A and below 20 mA for 1A.*


© Schneider Electric. All rights reserved.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

# Chapter 2: Safety Precautions

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

## ⚠ DANGER

**HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH**

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. In the USA, see NFPA 70E.
- Only qualified electrical workers should install this equipment. Such work should be performed only after reading this entire set of instructions.
- If the equipment is not used in a manner specified by the manufacturer, the protection provided by the equipment may be impaired.
- 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, inspect the work area for tools and objects that may have been left inside the equipment.
- When removing or installing panels do not allow them to extend into the energized bus.
- The successful operation of this equipment depends upon proper handling, installation, and operation. Neglecting fundamental installation requirements may lead to personal injury as well as damage to electrical equipment or other property.
- NEVER bypass external fusing.
- NEVER short the secondary of a PT.
- NEVER open circuit a CT; use the shorting block to short circuit the leads of the CT before removing the connection from the power meter.
- Before performing Dielectric (Hi-Pot) or Megger testing on any equipment in which the power meter is installed, disconnect all input and output wires to the power meter. High voltage testing may damage electronic components contained in the power meter.
- The power meter should be installed in a suitable electrical enclosure.
- RS 485 is safe to access up to 277 L-N / 480 L-L V only. If the voltage is above 277 L-N / 480 L-L V, then switch OFF the input voltage before handling the RS 485 terminal.

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

© Schneider Electric. All rights reserved.


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

# Chapter 3: Quick Start Guide

## PROG Menu — Setup

- The power meter must be configured to match the application settings, before use. Otherwise, the readings will be incorrect.
- All the setup values can be re-programmed at any time, using **SET.** However, the settings: SYS (WYE (Star)/Delta/single-phase / 2-Phase), Vpri, Vsec, Apri, Asec critically determine the scaling of measured readings.
- The scaling may be used to reduce the errors in readings due to Instrument Transformer errors. However, incorrect settings will introduce errors in readings of other running systems.

**⚠ CAUTION**

**HAZARD OF UNINTENDED OPERATION**

Only qualified personnel are authorized to set up the power meter.

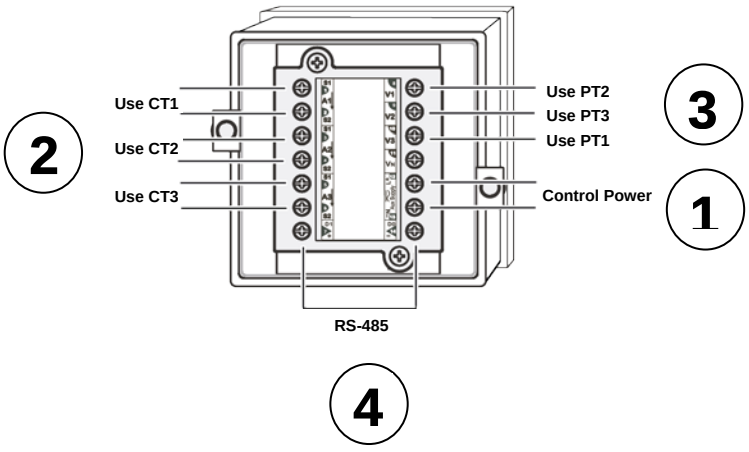
**Failure to follow this instruction can result in injury or equipment damage.**

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

- This is the easiest way to enter the PROG menu setup.
- To make connections, see “Connection Diagrams” on page 48. Here are few tips.

**Figure 3-1: Quick setup – connections**





© Schneider Electric. All rights reserved.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

1. Connect auxiliary supply (control power) 44 to 300 VAC/DC to terminals 12 and 13 in order to power ON the power meter.
   - Keep  pressed for two seconds, while powering up the power meter. The power meter enters directly into PROG menu setup and displays **EDIT A.PRI 100.0**.

   **Program the following setup parameters for accurate readings:**
   - **A.pri, A.sec:** Set these values to match your CT primary and secondary values. For example, if your CT Ratio is 200:5, set A.pri = 200.0 and A.sec = 5.000.
   - **V.pri, V.sec:**
     - Set these values to match the input voltage VLL of circuit, if the input voltage < 600 VAC LL. For example, if input voltage = 300 VAC LL, set V.pri = 300.0 and V.sec = 300.0.
     - Use potential transformer (PT/VT), if the input voltage > 600 VAC LL. Set the V.pri and V.sec values to match the primary and secondary of the PT (VT) respectively. For example, if PT(VT) ratio is 11 kV: 110, set V.pri = 11.00 k and V.sec = 110.0.

   Select one of the following systems according to 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: single-phase for single-phase 2-wire system
2. Connect the current transformers (CTs).

| CT1 | CT2 | CT3 |
|---|---|---|
| 1, 2 | 3, 4 | 5, 6 |

3. Connect the voltage inputs. Use PT (VT), if voltage exceeds 600 VAC LL.

| PT1 | PT2 | PT3 | Neutral |
|---|---|---|---|
| 8 | 9 | 10 | 11 |

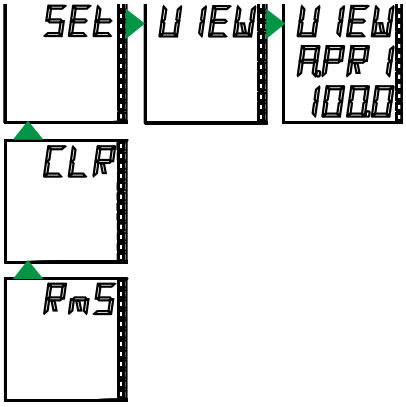
4. RS 485 terminals

| +ve | -ve |
|---|---|
| 7 | 14 |

© Schneider Electric. All rights reserved.

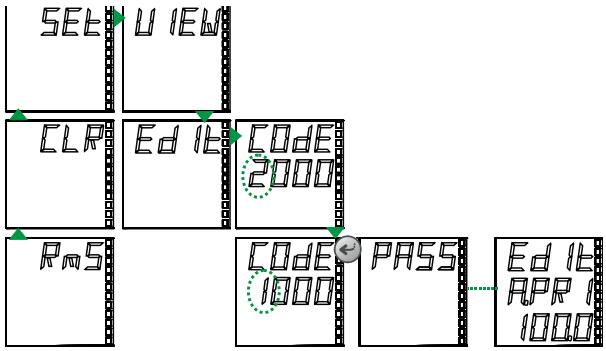

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## Enter Setup Menu in View (Read-Only) Mode




1. From **RMS**, press . The display shows **CLR.**
2. Press . The display shows **SET.**
3. Press . The display shows **VIEW.**
4. Press . Use and to scroll and view the setup parameters and their current settings.

## Enter Setup Menu in Edit Mode




*NOTE: means blinking*
*2 Means blinking 2*

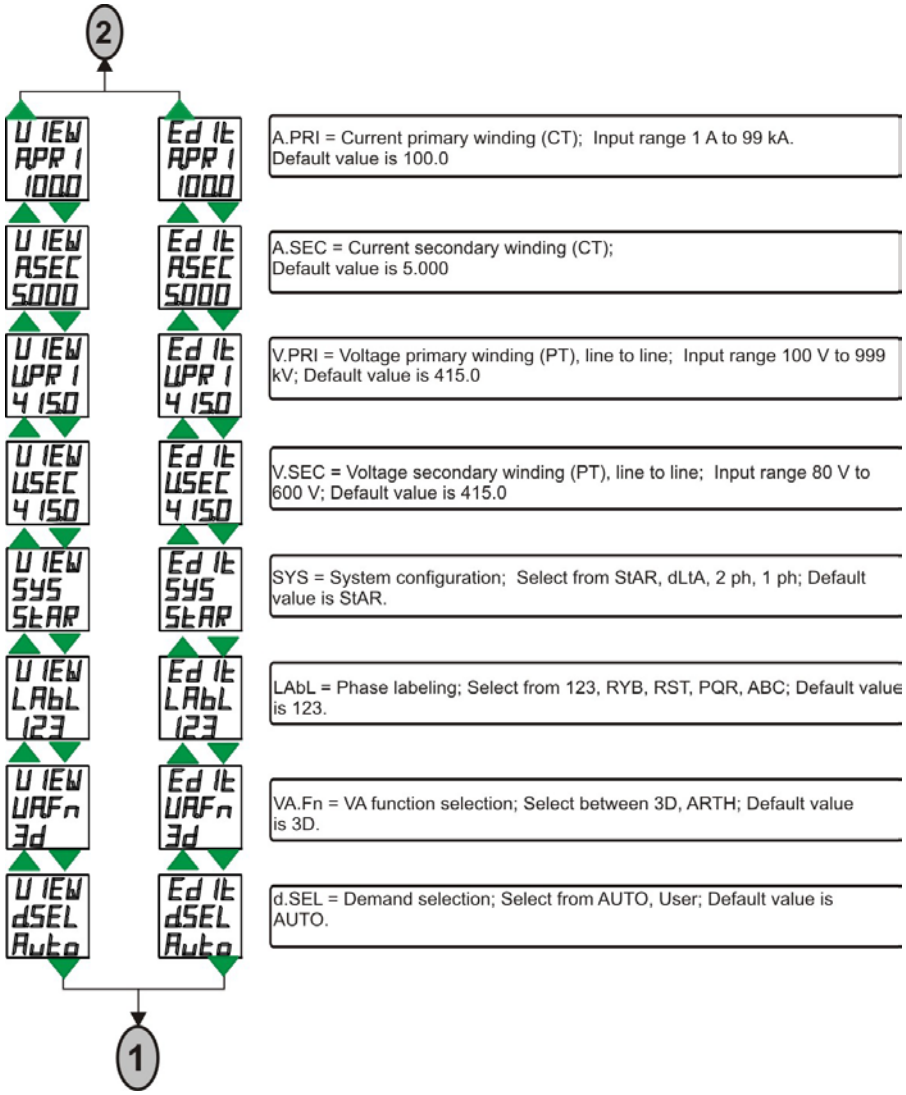
1. From RMS, press . The display shows **CLR.**
2. Press . The display shows **SET**.
3. Press . The display shows **VIEW**.
4. Press . The display shows **EDIT**. CODE entry is required to enter the setup menu in edit mode.
5. Press for two seconds. The display shows **CODE 2000** with **2** blinking The factory set code is 1000.
6. Press . The display shows **CODE 1000** with **1** blinking.
7. Press once or four times to accept the new CODE value. The display shows **PASS** and then **EDIT A.PRI 100.0** indicating the successful entry to the setup menu in edit mode.

*Note: If you enter an incorrect code, the display flashes **FAIL**, and then displays **EDIT**. Repeat the procedure and make sure that you enter the correct code.*


© Schneider Electric. All rights reserved.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

# Setup Parameters in View and Edit Modes

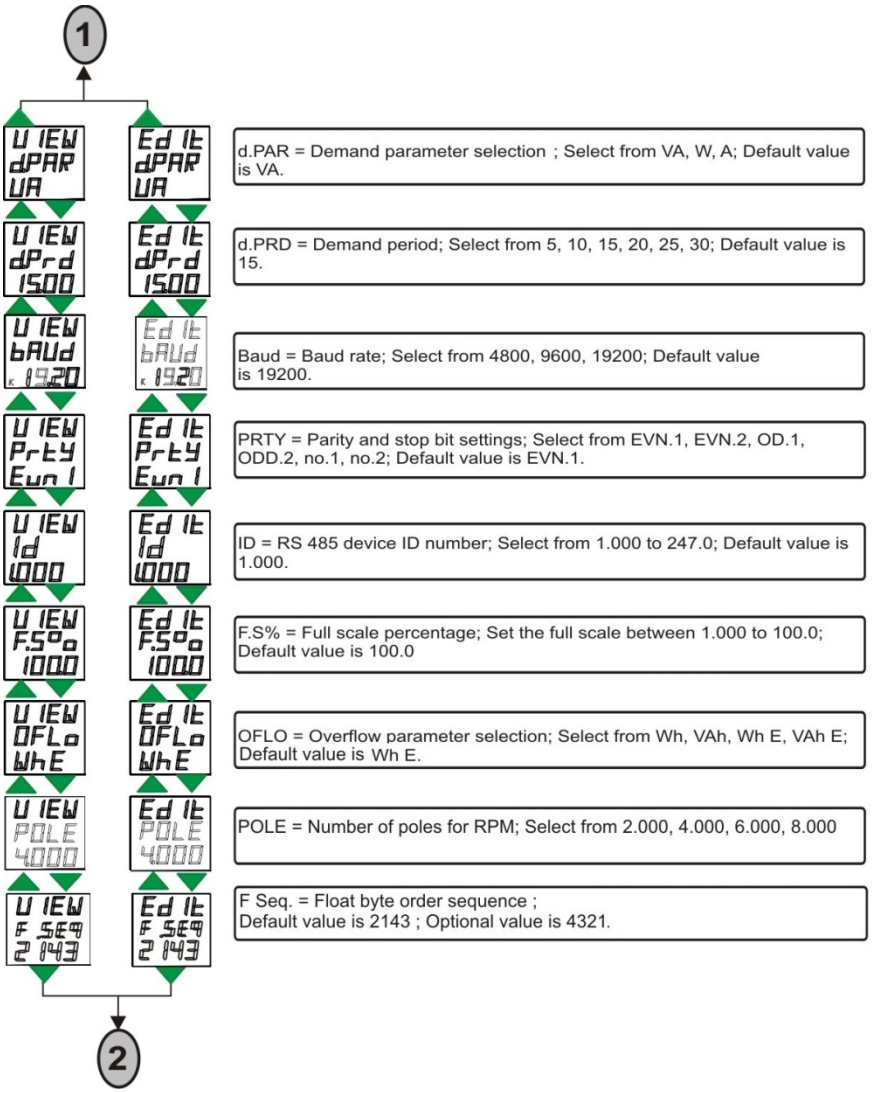



*Note:*
*BAUD, PRTY, and ID are applicable only for EM6400 series power meters with RS 485 communication option.*

© Schneider Electric. All rights reserved.


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

# Setup Parameters in View and Edit Modes (continued)




*Note:*
*BAUD, PRTY, and ID are applicable only for EM6400 series power meters with RS-485 communication option.*


© Schneider Electric. All rights reserved.

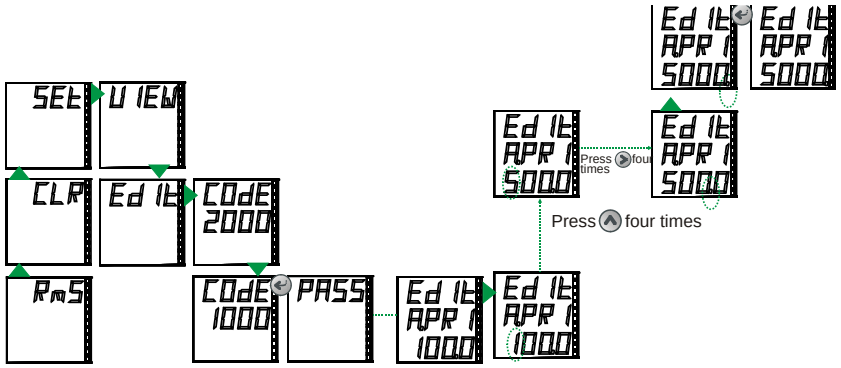
Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

# Edit Set Parameters

This example explains how to edit the value of **A.PRI** from **100.0** to **5000** in PROG menu setup of the EM6400 series power meter. Then it shows how to save the value to the setup.

*Note: After entering into setup, the power meter exits from the setup automatically, if there is no key press for > 2 min.*

### Edit and Accept Setup




*NOTE: 1 means blinking*
*2 Means blinking 2*

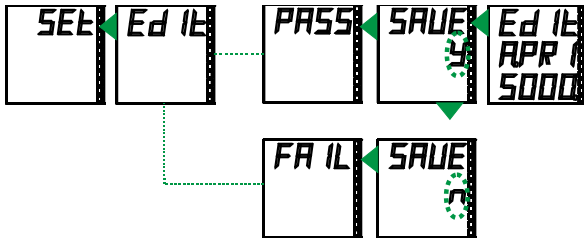
1. After you have successfully entered setup menu in edit mode, (Refer to "Enter setup menu in Edit mode" on page 21 for more information) press . The display shows **EDIT A.PRI 100.0** with blinking **1**. This indicates that the value can be edited.
2. Press for four times. The display shows **EDIT A.PRI 5.000** with blinking **5**. The value can be edited.
3. Press four times. The display shows **EDIT A.PRI 500.0** with blinking "**.**".
4. Press . The display shows **EDIT A.PRI 5000.** with blinking "**.**".
5. Press to accept the new value.

To edit the next parameter, press and repeat the above steps.

© Schneider Electric. All rights reserved.


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

### Save the New Value to Setup

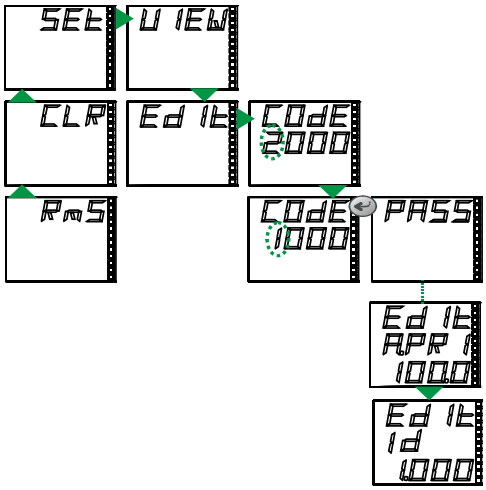



*NOTE: y means blinking*
*y means blinking y*

1. After you edit the parameter as described above, press . The display shows **SAVE y** with blinking **y.**
2. Press or to save the new value. The display flashes **PASS** and then shows **EDIT**.
3. Press to return to **SET**.

*Note: If you do not want to save the new value, press to change the value from **SAVE y** to **SAVE n** in step 1. Then press or . The display flashes **FAIL** and shows **EDIT**. Proceed to step 3.*

### Edit ID




*NOTE: y means blinking*
*y means blinking y*

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. Press for two seconds. The display shows **CODE 2000** with **2** blinking. The factory set **CODE** is **1000**.
6. Press . The display shows **CODE 1000** with **1** blinking.
7. Press once or four times to accept the new **CODE** value.


© Schneider Electric. All rights reserved.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

The display shows **PASS** and then **EDIT A.PRI 100.0** indicating the successful entry to the setup menu in edit mode.

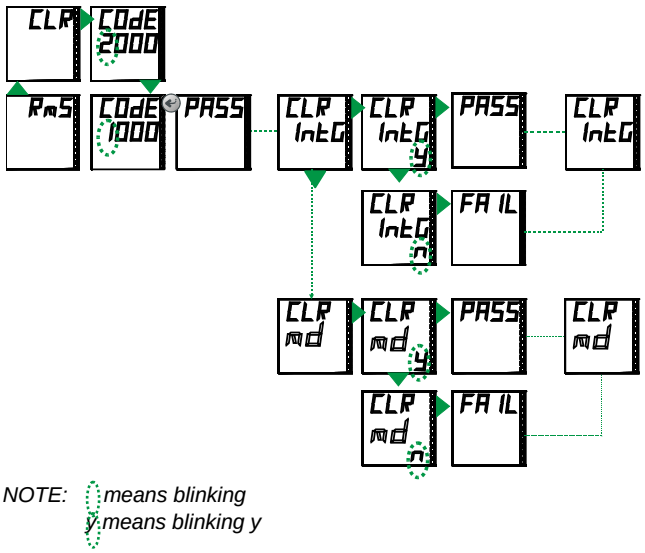
8. Press ⌄ until the display shows **EDIT ID 1.000** page.
   Press > to set the desired **EDIT ID** value. Press ↵ to view the **Edit ID** page set with the new values.

*NOTE: If you enter a wrong code, the display flashes FAIL and then displays EDIT. Repeat the procedure and make sure that you enter correct code.*

## Clear INTG and Maximum Demand (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




*NOTE: y means blinking*
*y means blinking y*

### INTG Clear

1. From **RMS**, press ^. The display shows **CLR.**
   CODE entry is required to clear the **INTG** values.
2. Press > for two seconds. The display shows **CODE 2000** with blinking **2.** The factory set CODE is 1000.
3. Press ⌄. The display shows **CODE 1000** with blinking **1**.
4. Press ↵ once or > four times to accept the new value.
   After the successful **CODE** entry, the display shows **CLR INTG**.
5. In order to clear **INTG,** press >. The display shows **CLR INTG y** with blinking **y**.
6. Press > to clear **INTG**. The display flashes **PASS** and then **CLR INTG**.
7. Press <. The display shows **CLR**.
8. Press ⌄ to return to **RMS** page.

*Note: If you do not want to clear the integrators, press ⌄ to change the value from **CLR INTG y** to **CLR INTG n** in step 5. Then press > . The display flashes **FAIL** and then show **CLR INTG**. Proceed to step 7.*

© Schneider Electric. All rights reserved.


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

### MD Clear

1. From **RMS**, press . The display shows **CLR.**
   CODE entry is required to clear the **INTG** values.
2. Press for two seconds. The display shows **CODE 2000** with blinking **2.** The factory set CODE is 1000.
3. Press . The display shows **CODE 1000** with blinking **1**.
4. Press once or four times to accept the new value.
   After the successful **CODE** entry, the display shows **CLR INTG**.
5. Press . The display shows **CLR MD**
6. Press **.** The display shows **CLR MD y** with blinking **y**.
7. Press to clear **MD**. The display flashes **PASS** and then **CLR MD**.
8. Press . The display shows **CLR**.
9. Press to return to **RMS** page.

*Note: If you do not want to clear the **MD**, press to change the value from **CLR MD y** to **CLR MD n** in step 6. Then press . The display flashes **FAIL** and then show **CLR MD**. Proceed to step 8.*


© Schneider Electric. All rights reserved.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

# Energy Integrator

The EM6400 series power meter is equipped with an energy integrator function. It provides several parameters for Energy Management: VAh, Wh, VAh E, Wh E, 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 has been ON and has run. This counter accumulates as long as the load is ON.
**On.h:** Indicates the period for which the power meter's auxiliary supply is ON, regardless of the voltage and current inputs.
**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 die out from time to time.

*Note:*
*CT Reversal: Auto-correction for energy integration in star (wye) mode. In star (wye) mode energy integration always be in forward direction irrespective of the direction of current flow or sign of the power reading per phase (not applicable IE models).*

## Integrator Overflow

The EM6400 series power meter contains a comprehensive **integrator** to support energy management. It accumulates several parameters over time, as explained above. All values are direct readings 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.

By setting the Integrator reset parameter to WhE or VAhE, the time it takes for the integrator to reset depends on the Power Ratio of the load. Below table shows the Max. Reading under different load conditions:

**Table 3-1: Integrator overflow for Wh E / VAh E**

| Power Ratio (1.732 x V.PRI x A.PRI) | Max reading (Wh E / VAh E) | Minimum time ( in months) to overflow at full scale |
|---|---|---|
| 1 VA to 1000 VA | 9999 K | 13.88 |
| 1 kVA to 1000 kVA | 9999 M | 13.88 |
| 1 MVA to 1000 MVA | 9999 G | 13.88 |
| > 1000 MVA | | <1 year |

$$\text{Approx. overflow time in years} = \left(\frac{\text{Max reading}}{\text{Power Ratio}}\right) \Big/ 24 \Big/ 30 \Big/ 12$$

**Example:** For a full scale of 200kVA constant load, the overflow duration can be calculated as follows:

$$\left(\frac{\text{Max reading}}{\text{Power Ratio}}\right) = \left(\frac{9999 \times 10^{6}}{200 \times 10^{3}}\right) = 49995$$

© Schneider Electric. All rights reserved.


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

÷ 24 = 2083.12 days
÷ 30 = 69.43 months
÷ 12 = **5.78 years**

Selecting Wh or VAh as overflow parameters under the Setup menu, normally Run Hours reaches the maximum value (9999) and all other Integrators such as Wh, VAh, VARh, -VARH, On Hours and Interruptions are reset together

**Table 3-2: Integrator overflow for Wh / VAh**

| Power Ratio (1.732 x V.PRI x A.PRI) | Max reading (Wh / VAh) | Max time to reset the integrator in Run Hours | Max time (in months) to overflow 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 an OLD data register, where the cleared INTG values are 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. Remember that the OLD values will be overwritten, when the INTG is cleared next time.
- The values of parameters Wh, Wh E, VAh, VAh E, 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 depending on the method you select. To be compatible 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 five and 30 minutes in steps of five minutes. The demand calculation updates every 15 seconds.

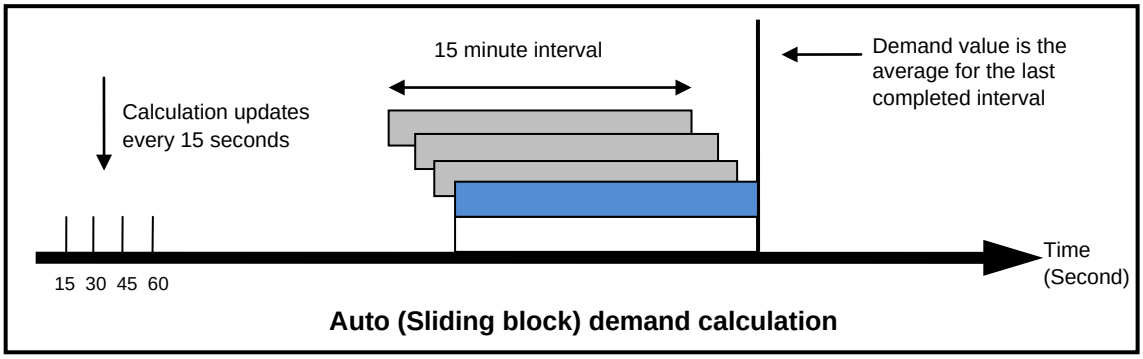
Auto demand power calculation is the default calculation for EM6400 series power meters.

**User (fixed block)**

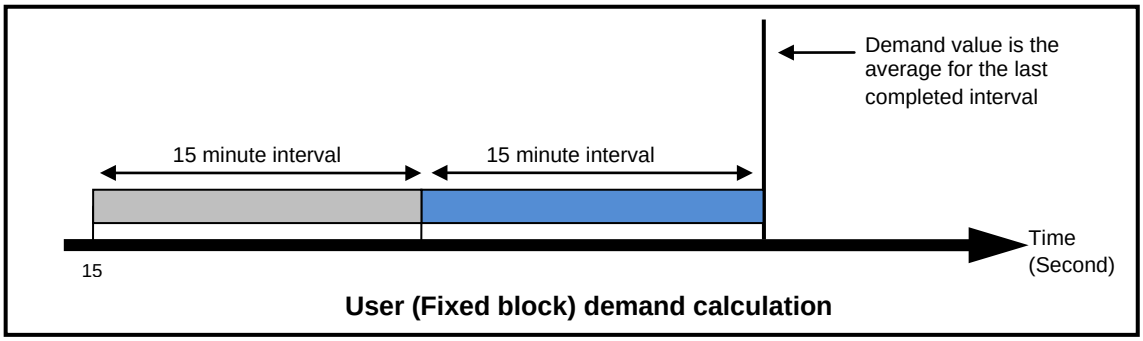
In the user demand power calculation, you select an interval between five and 30 minutes in steps of five minutes. The demand calculation updates at the end of the interval. User demand power calculation can be selected through setup. See “Setup parameters in View and Edit modes” on page 22 for more information.


© Schneider Electric. All rights reserved.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com




**Auto (Sliding block) demand calculation**



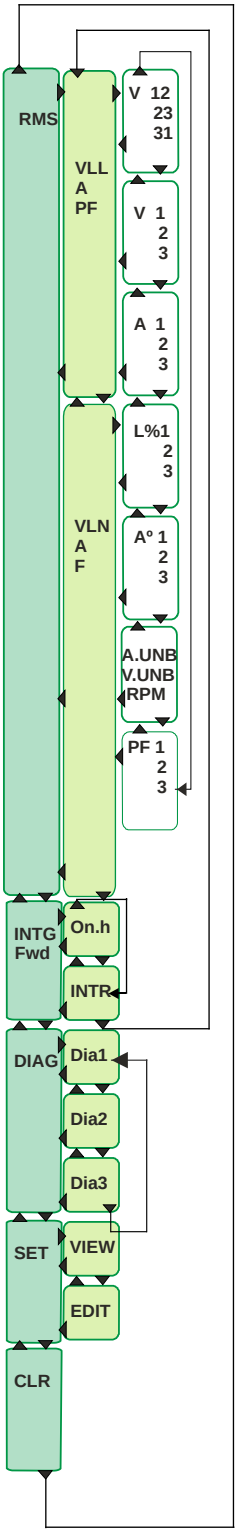

**User (Fixed block) demand calculation**

© Schneider Electric. All rights reserved.


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

# EM6400 Series Power Meters Menu Hierarchy

## EM6459 Meter 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

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

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

An = Neutral current

INTG Fwd = Forward Integrator

On.h = Duration of supply ON

INTR = No of power interruptions

DIAG = represents diagnostic pages. The values contained in these pages are for factory testing only

Dia1 = Communication settings

Dia2 = Product model and version number

Dia3 = Display scanning for display LED check

SET = Has two modes: EDIT/VIEW set parameters

VIEW = To view simultaneous setup parameter name and value display

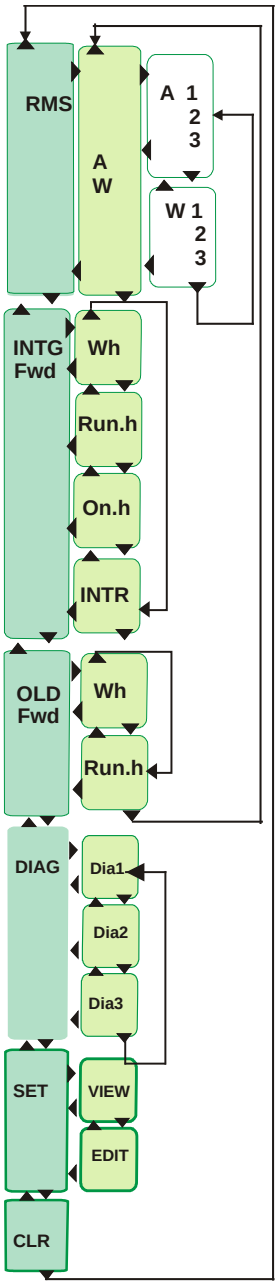
EDIT = To edit simultaneous setup parameter name and value display

CLR = Clears INTG values


© Schneider Electric. All rights reserved.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

# EM6433 Power Meter Menu Hierarchy




RMS = RMS value display pages are in sub level

A = Current average
W = Watt total

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

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

INTG Fwd = Forward Integrator

Wh = Forward Watt hours. Wh integrates always in the forward direction irrespective of the direction of flow of current for star (Wye) mode

Run.h = Forward run hours, Total hours the load was ON

On,h = Duration of supply ON

INTR = No of power interruptions

OLD Fwd = The energy values stored in the integrator will be transferred to the OLD register when the integrator is cleared (manually or due to overflow)

Wh = OLD Forward Watt hours.

Run.h = OLD Forward run hours

DIAG = Represents diagnostic pages. The values contained in these pages are for factory testing only

Dia1 = Communication settings

Dia2 = Product model and version number

Dia3 = Display scanning for display LED check

SET = Has two modes EDIT/VIEW set parameters

VIEW= To view simultaneous setup parameter name and value display

EDIT = To edit simultaneous setup parameter name and value display

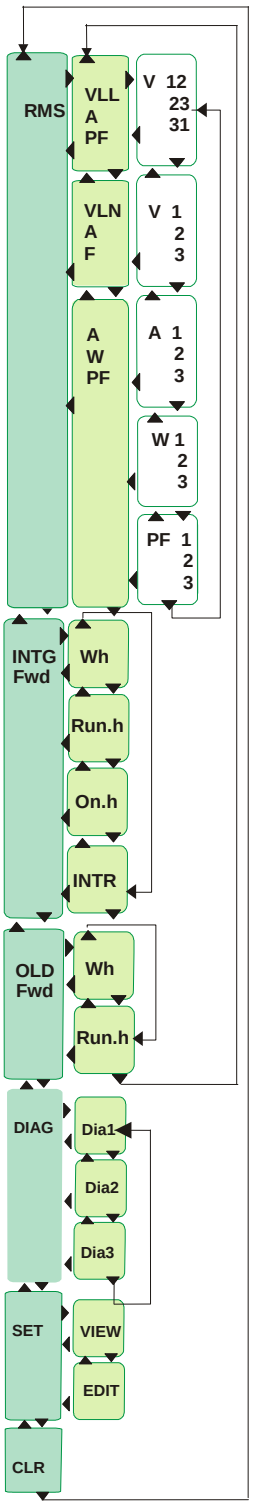
CLR = Clears INTG values

© Schneider Electric. All rights reserved.



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

# EM6436 Power Meter 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 = Apparant 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

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

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

INTG Fwd = Forward Integrator

Wh = Forward Watt hours. Wh integrates always in the forward direction irrespective of the direction of flow of current for star (Wye) mode

Run.h = Forward run hours, Total hours the load was ON

On,h = Duration of supply ON

INTR = No of power interruptions

OLD Fwd = The energy values stored in the integrator will be transferred to the OLD register when the integrator is cleared (manually or due to overflow)

Wh = OLD Forward Watt hours.

Run.h = OLD Forward run hours

DIAG = Represents diagnostic pages. The values contained in these pages are for factory testing only

Dia1 = Communication settings

Dia2 = Product model and version number

Dia3 = Display scanning for display LED check

SET = Has two modes EDIT/VIEW set parameters

VIEW= To view simultaneous setup parameter name and value display

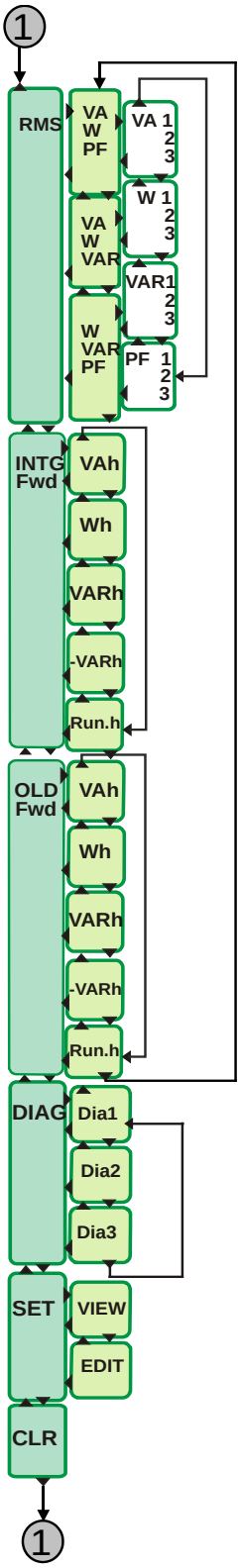
EDIT = To edit simultaneous setup parameter name and value display

CLR = Clears INTG values


© Schneider Electric. All rights reserved.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

# EM6434 Power Meter Menu Hierarchy




RMS = RMS value display pages are in sub level

- VA = Apparent power total
  W = Active power total
  PF = Power factor average
- VA = Apparent power total
  W = Active power total
  VAR = Reactive power total
- W = Active power total
  VAR = Reactive power total
  PF = Power factor average
- 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

INTG Fwd = Forward Integrator

- VAh = Fwd Volt-ampere hours
- Wh = Fwd Watt hours
- VARh = Fwd Reactive energy, inductive
- -VARh = Fwd Reactive energy, capacitive
- Run.h = Fwd Run hours

OLD Fwd = OLD Forward Integrator

- VAh = OLD Fwd Volt-ampere hours
- Wh = OLD Fwd Watt hours
- VARh = OLD Fwd Reactive energy, inductive
- -VARh = OLD Fwd Reactive energy, capacitive
- Run.h = OLD Fwd Run hours

DIAG = represents diagnostic pages. The values contained in these pages are for factory testing only

- Dia1 = Communication settings
- Dia2 = Product model and version number
- Dia3 = Display scanning for display LED check

SET = Has two modes: EDIT/VIEW set parameters

- VIEW = To view simultaneous setup parameter name and value display
- EDIT = To edit simultaneous setup parameter name and value display

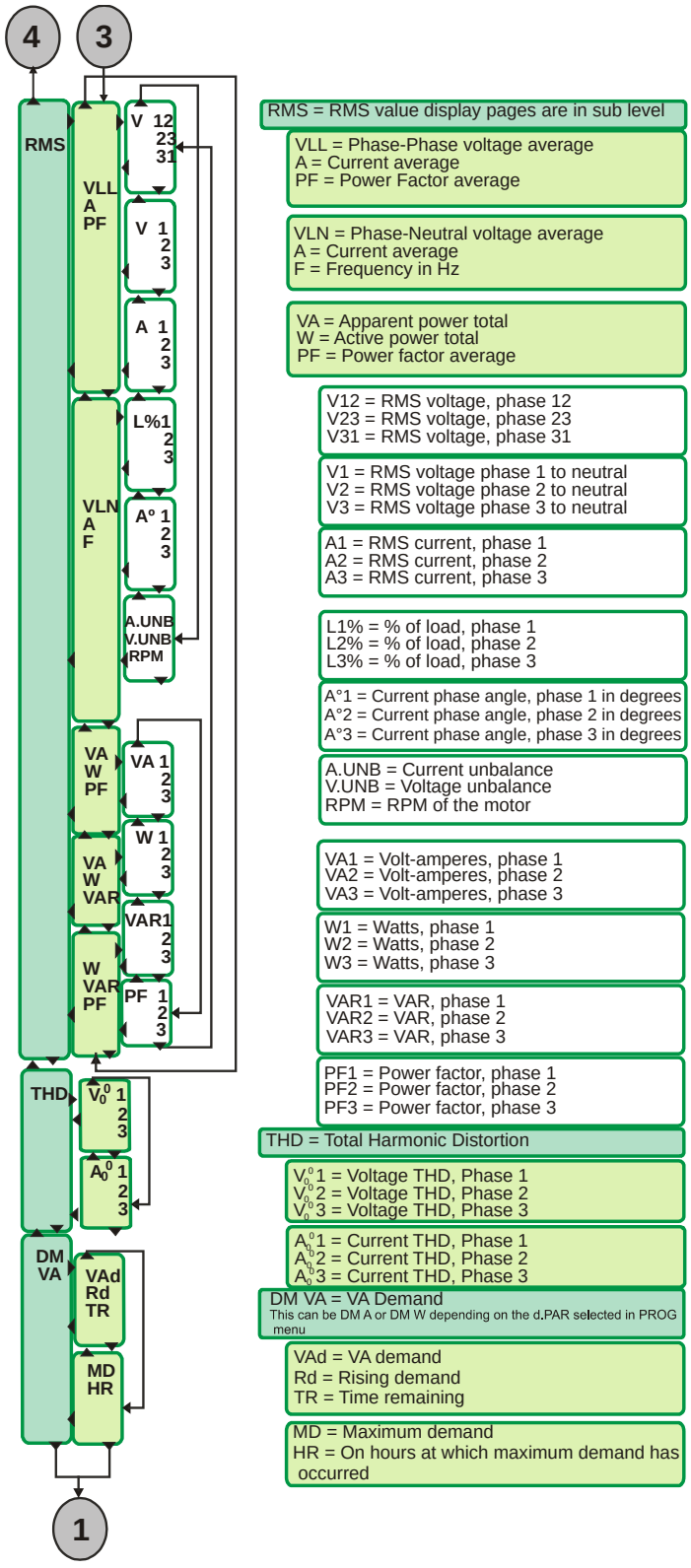
CLR = Clears INTG values

© Schneider Electric. All rights reserved.



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

# EM6400 Power Meter Menu Hierarchy

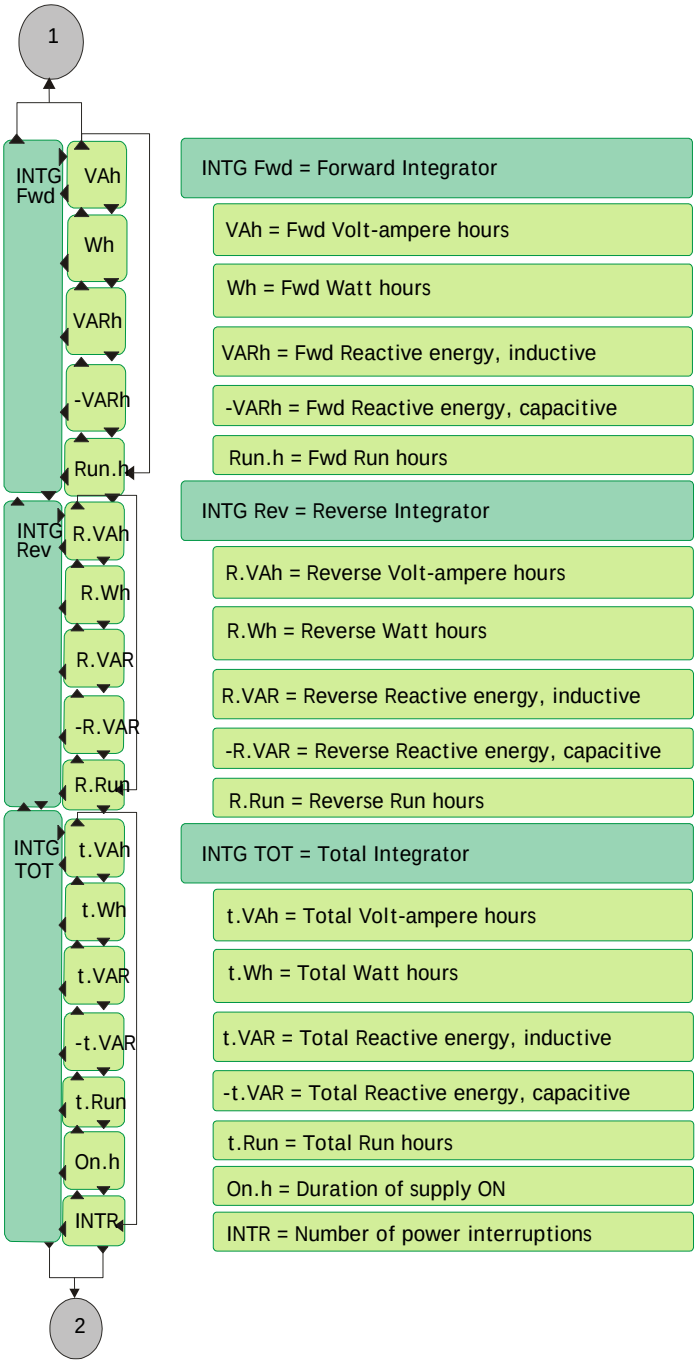



*Note: THD values are indicative only*


© Schneider Electric. All rights reserved.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

# EM6400 Power Meter Menu Hierarchy (Continued)

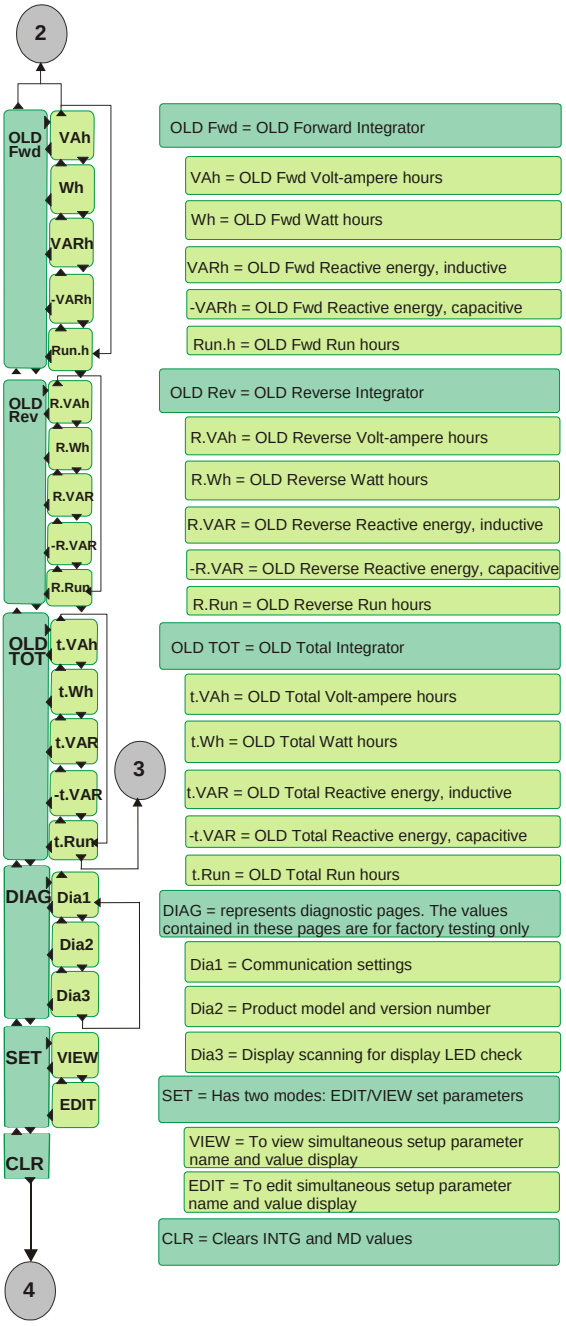



© Schneider Electric. All rights reserved.



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

# EM6400 Power Meter Menu Hierarchy (Continued)





© Schneider Electric. All rights reserved.

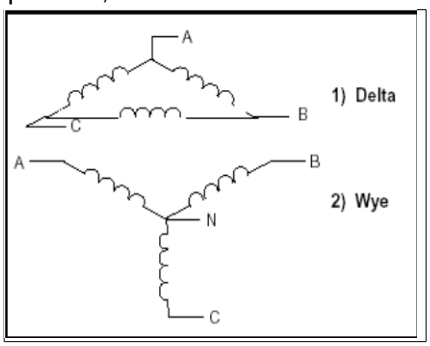
Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

# Chapter 4: AC Power Measurement

## 3-Phase Systems

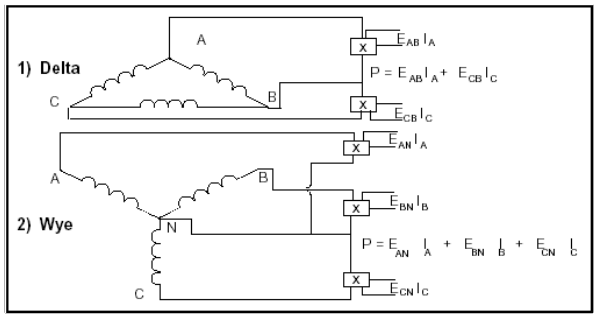
A 3-phase system delivers higher levels of power for industrial and commercial applications. The three phases correspond to three potential lines. A 120° phase shift exists between the three potential lines.
A typical configuration has either a Delta connection or a Wye (Star) connection

In a 3-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 a 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

© Schneider Electric. All rights reserved.


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

# 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 4-1: "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 |


© Schneider Electric. All rights reserved.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

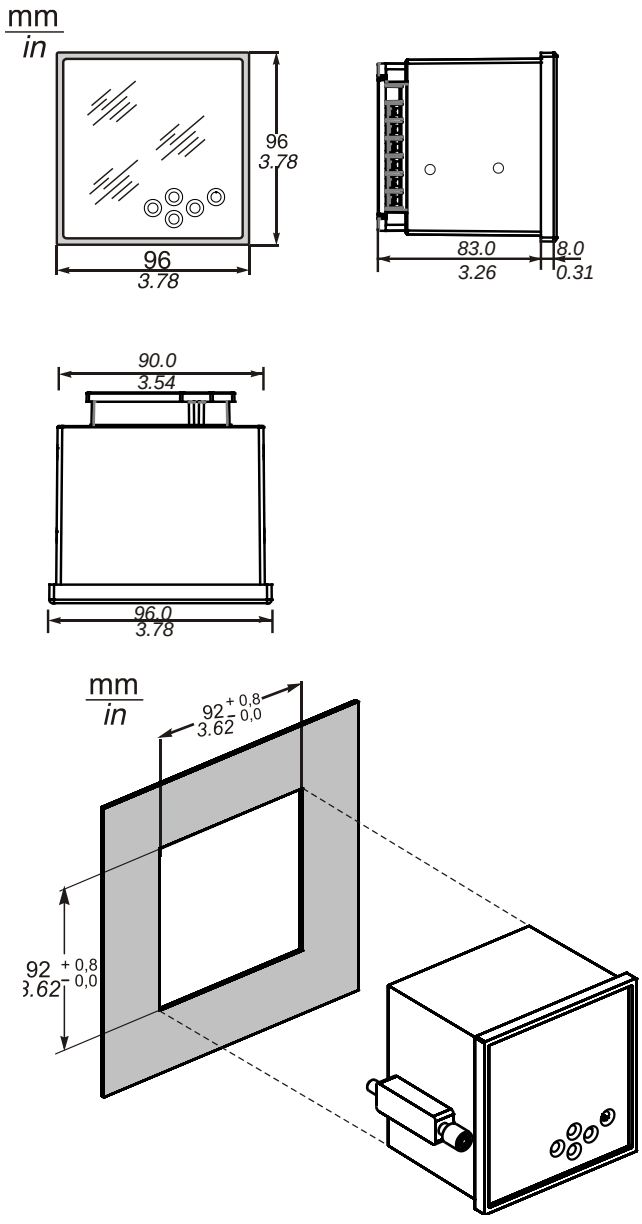
# Chapter 5: Installation

## Mechanical Installation

The EM6400 series power meters are panel-mounted and have reliable, rear-mounted terminal strips rated at 600 V.
The 92 x 92 mm (3.62 x 3.62 in.) cut-out and 96 x 96 mm (3.78 x 3.78 in.) bezel dimensions adhere to IEC 61554 and DIN 43700.

The diagram below displays the various dimensions of mechanical installations.

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




© Schneider Electric. All rights reserved.


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

# Installation Procedure

### Usage

First, decide how the power meter is 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, from where the readings will be viewed from, who must have access to the instrument and how often. Otherwise, decide the location of the power meter and install it. For best performance, choose a location that provides all the required signals with minimum wiring lengths.

### Panel Considerations and Environment

The power meter is high-precision measuring instrument, and its operating environment is of utmost importance. For maximum performance, the instrument should be mounted in a dry, dust-free location, away from 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 |
| Altitude | ≤ 2000 |

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 EM6400 power meter is mounted, should protect it from dust, moisture, oil, corrosive vapors, etc.

The panel doors must be easily opened to provide easy access to the power meter wiring for troubleshooting. 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 contactors, and other necessary components.

### Viewing

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


© Schneider Electric. All rights reserved.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## Mounting

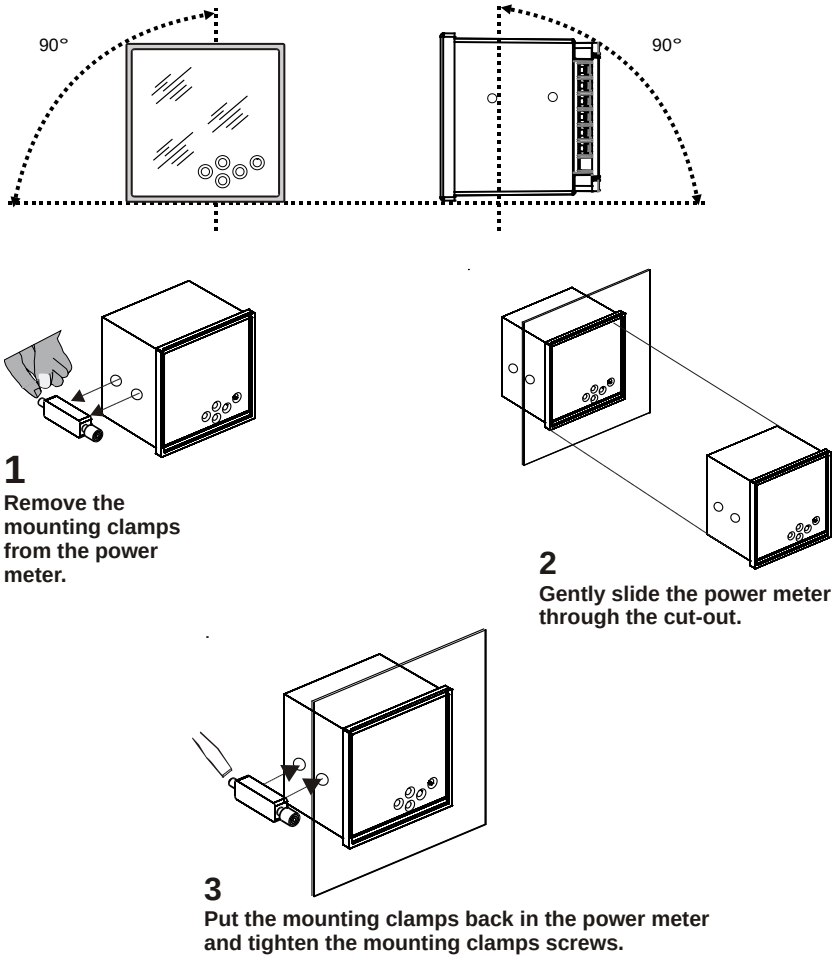
The power meters are panel mountable.

### 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 | 83 mm |
| Mounting clamps screws | Two in numbers, Slotted |
| Terminal screws | Combination Phillips and slotted head |

The cut-out should be punched with the proper tool and should be free from burrs. The following figure explains the mounting of the power meter.

### Figure 5-2: Mounting




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 meter should be separated from other equipments and sufficient space must be provided all around the power meter, to allow air to rise

© Schneider Electric. All rights reserved.


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

vertically around the power meter. Lack of sufficient air for cooling may result in over heating of the power meter.

*Note: It is much easier to set up the meter before you mount the power meter on the panel. See "Quick setup" on page 19 for more information.*

# Electrical Installation

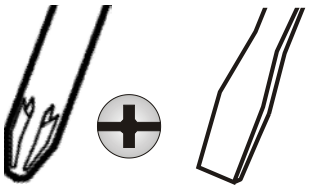
This section describes the following:

- The need for, and selection of, potential transformers (PTs) and current transformers (CTs).
- Auxiliary supply (control power), PT (VT), and CT connections.

| ***NOTICE*** |
|---|
| **DAMAGE TO THE DEVICE**<br><br>• Use only the specified tool for tightening and loosening the screw<br>• Do not over-torque the screw above the specified range<br><br>**Failure to follow these instructions can result in equipment damage.** |

For best results, ensure the following specifications:

- Torque driver preferred, hand screwdriver OK.
- TIP: Phillips head is preferred, but flat head is acceptable. Do not use Pozidriv tips.



Screw head diameter = 3.5 mm (0.14 in.), TIP shaft diameter < 5 mm (0.2 in.).

**IMPORTANT**: Screwdriver shafts inserted angularly or of diameter ≥ 5 mm (0.2 in.) will get stuck in the cover.

Tightening Torque: 0.25 to 1 N.m (2.21 to 8.85 lb-in)

*NOTE: If the torque is more than 1 N.m (8.85 lb-in), then it may damage the screw or the screw head.*

Loosening Torque: 1.2 N.m (10.62 lb-in)

### Connecting Cable Recommendations

**Table 5-3: Connecting cable**

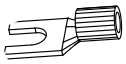
| | Current Rating | Wire size | Temperature rating | Insulation rating |
|---|---|---|---|---|
| Voltage Circuit | > 0.1 A | 1.5 - 2.5 $mm^2$ (16 - 14 AWG) | > 75 °C (167 °F) | > 600 VAC |
| Current Circuit | > 7.5 A | 1.5 - 2.5 $mm^2$ (16 - 14 AWG) | | |

*NOTE: Installations should include a disconnecting device, like a switch or circuit breaker, with clear ON/OFF markings to turn-off the auxiliary supply (control power). The disconnecting device should be placed within the reach of the equipment and the operator.*


© Schneider Electric. All rights reserved.

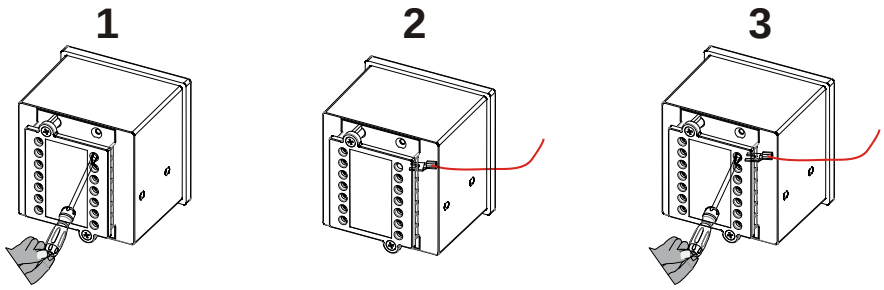
Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

# Terminal connections using lugs

**Terminal connection using U lugs** 

Lug type: Insulated sleeved U lugs
Cross-section: 1.5 - 2.5 $mm^2$ (16 - 14 AWG)

It is very simple and easy to connect the terminals using the U lugs. The following steps explain how to connect the power meter terminals using U lugs.

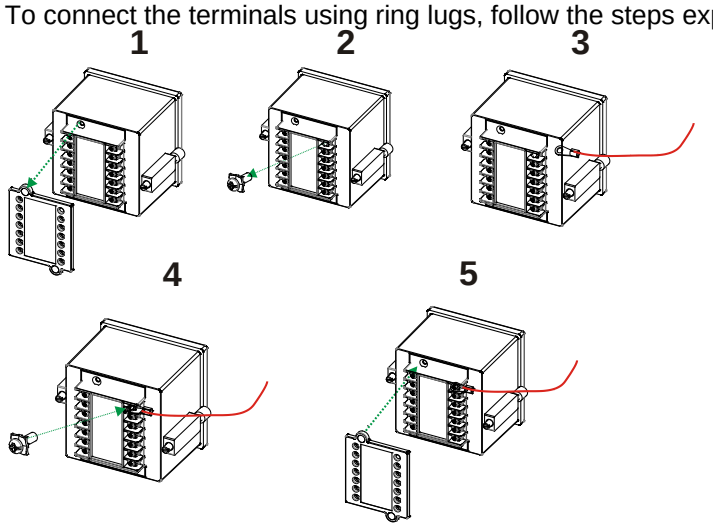



1. Loosen the terminal screw.
2. Connect the wire with the U lug to the power meter terminal.
3. Tighten the terminal screw.

**Terminal connections using ring lugs** 

Lug type: Ring lugs
Cross-section: 1.5 - 2.5 $mm^2$ (16 - 14 AWG)

To connect the terminals using ring lugs, follow the steps explained below.




1. Remove the protective cover from the power meter.
2. Remove the terminal screw from the power meter.
3. Connect the wire with the ring lug to the power meter terminal.
4. Place the terminal screw back in the terminal and tighten the terminal screw.
5. Place the protective cover back and tighten the protective cover.

*Note:*

- *The above example explains connection for only one terminal. In order to connect the other terminals, repeat the steps 2 and 3 for as many numbers of terminals. Then proceed to the remaining steps.*
- *To Disassemble the meter, refer to "To Disassemble" on page 73.*

© Schneider Electric. All rights reserved.


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## Auxiliary Supply (Control Power)

The EM6400 power meter requires 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 (for example, rural areas and outlying areas prone to lightning strikes).

**Range:**

- 44 to 300 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 3-wire delta system and a reliable neutral is not available, use a 440 V: 240 V supply transformer to provide the standard 240 V auxiliary supply.

*Note: It is much easier to set up the meter before you mount the meter on the panel. See "Quick setup" on page 19 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 levels to suit the power meter rating. Potential transformers usually have a full scale output of 110 VAC RMS line-line and current transformers usually have 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, e.g., if the load is always less than 10% of the CT primary rating, then the accuracy suffers. On the other hand, if the CT is under-rated, then you may exceed its full-scale. As a result, both the CT and the power meter will burn out.

**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 5-5 on page 41, 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), current (CT) signals, and 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.*


© Schneider Electric. All rights reserved.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

# 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 600 VAC and a current rating greater than 0.1 A.
There are four 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 unconnected.

### PT Connections

The power meters directly accept LV voltage inputs of up to 600 VAC RMS line to line (347 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 601 VAC RMS LL
- Power meter voltage Input burden: < 0.2 VA per input

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

### Selecting the voltage fuses

We strongly recommend using fuses on each of the sense voltages (except for neutral) and the control / auxiliary power.

**Table 5-4: Fuse recommendation**

| Power Source | Source voltage | Fuse |
|---|---|---|
| Line voltage | 80 to 600 VLL | 250mA, 600V AC, fast-acting type |
| Auxiliary supply (Control power) | 44 to 300 VAC/DC | 250mA, 300V AC/DC, fast-acting type |

# 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 terminals is labeled as S1, S2 and has an arrow indicating the direction of current flow. For proper measurements, the phase identification, and 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. Maintain the correct sequence and polarity to avoid incorrect readings.

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

The wiring used for the current inputs should have an insulation rating greater than 600 VAC. The cable connection should be rated for 7.5 A or greater and have a cross-sectional area of 1.5 - 2.5 $mm^2$ (16 - 14 AWG) minimum.

© Schneider Electric. All rights reserved.


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

### 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 1.5 - 2.5 $mm^2$ (16 - 14 AWG) cable.

**Table 5-5: CT size and maximum distance**

| 5 A CT size | Maximum Distance in metres (in feet/inch) (CT to EM6400 power meter) |
|---|---|
| 2.5 VA | 3.05 m (10 ft/120 in.) |
| 5.0 VA | 4.6 m (15 ft/181 in,) |
| 7.5 VA | 9.15 m (30 ft/360 in.) |
| 10.0 VA | 12.2 m (40 ft/480 in.) |
| 15.0 VA | 18.3 m (60 ft/720 in.) |
| 30.0 VA | 36.6 m (120 ft/1441 in.) |

- 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 “PROG menu — Setup” on page 19 for more information.

*Note:*
*The PT primary and secondary values must be user programmed before using the power meter. Otherwise, the readings will be incorrect.*
*With dual- range CTs; select the best range for programming the power meter. If you change the range thereafter without re-programming the power meter, the power meter will read erroneous values.*

### CT Polarity

When the power meter is connected using the CTs, you must maintain 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.


© Schneider Electric. All rights reserved.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## Setup — System Type

The power meter needs to know the type of system to which it is connected to. This information 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; it is not to be changed on regular basis. 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. This means all the four voltage terminals, and six 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” on page 48 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” on page 49 for more information.
- **2-phase:** For 2-phase 3-wire, **two Watt-meter** or **two Element** circuits. Here, the two voltage phase signals, the neutral voltage connection, and two current input signals need to be wired in. This means that the three voltage terminals and four 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” on page 50 for more information.
- **Single-phase:** For single-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. This means that two voltage terminals and one current terminal described in the following section need to be wired. For Single phase wiring configuration, see “Single phase connection with 1 CT” on page 50 for more information.

© Schneider Electric. All rights reserved.


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## Phase Labels

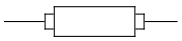
The phase labels shown on the display are programmable via the power meters front panel PROG menu. You can setup the meter to display phase labels convenient to your practice. The choices available are: 123 (factory set), RYB, RST, PQR, ABC.

## 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. Follow the outlined procedure to verify correct connection.

### Connection Diagram Symbols

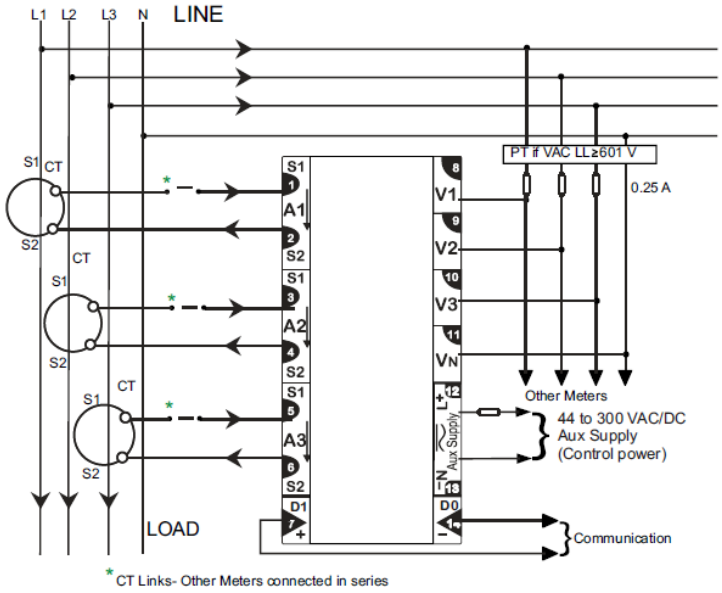
**Table 5-6: Connection diagrams symbols**

| Symbol | Description |
|---|---|
|  | Fuse |
|  | Current transformer |

### 3-phase 4-wire WYE connection

Direct voltage connection for the input voltages L-L up to 600 VAC. Otherwise use three PTs.

**Figure 5-3: 3-phase 4-wire WYE connection**




*Note:*
*Make sure WYE/Star is programmed in the power meter PROG menu- Setup.*
*For High – leg (US connection)*
*L1 – N = 120 V*
*L2 – N = 208 V*
*L3 – N = 120 V*

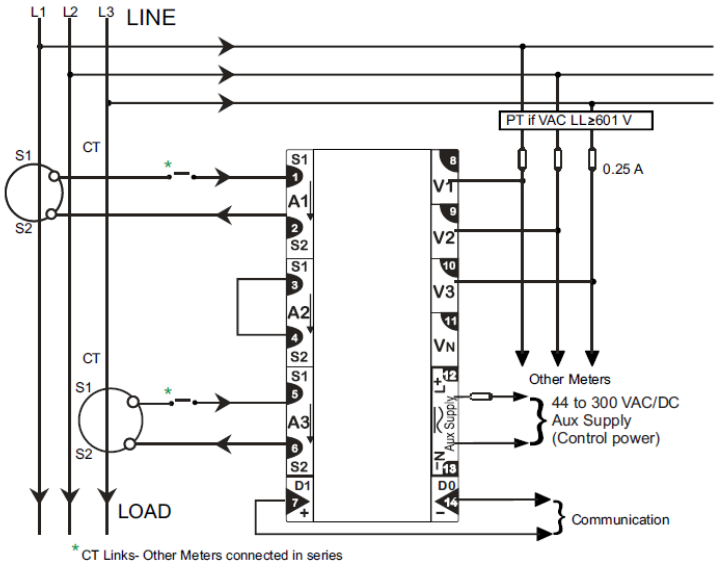

© Schneider Electric. All rights reserved.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

### 3-phase 3-wire delta connection

Direct voltage connection for the input voltages L-L up to 600 VAC. Otherwise use three PTs

**Figure 5-4: 3-phase 3-wire delta connection**

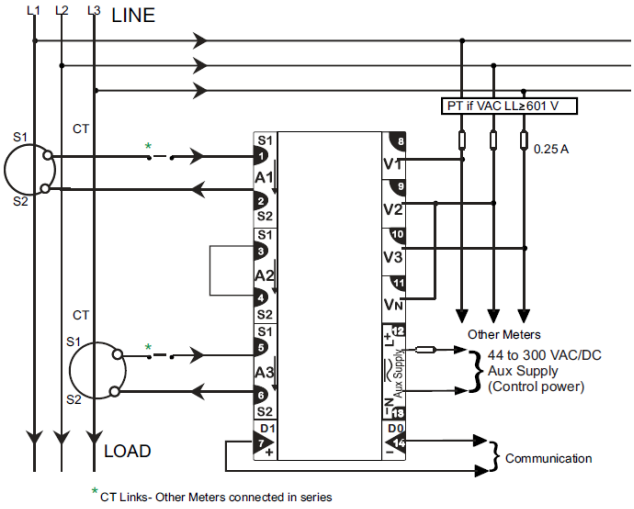



*Note: Make sure Delta is programmed in the power meter PROG menu- setup. Leave the Vn terminal disconnected.*

### 3-phase 3-wire open delta connection

Direct voltage connection for the input voltages L-L up to 600 VAC. Otherwise use two PTs.

**Figure 5-5: 3-phase 3-wire open delta connection**




*Note: Make sure Delta is programmed in the power meter PROG menu-setup.*

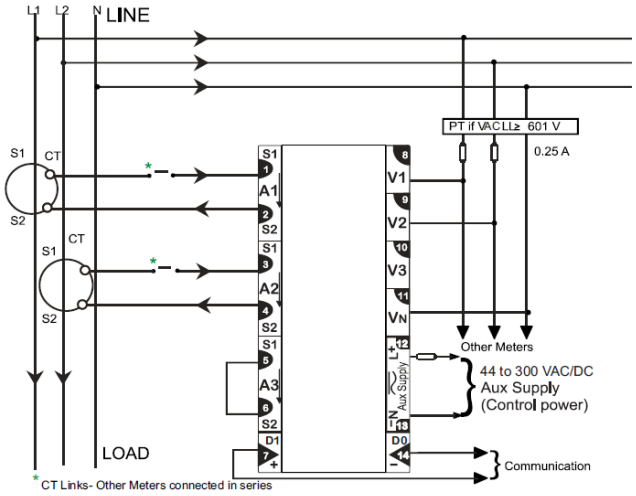
© Schneider Electric. All rights reserved.


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

### 2-phase 3-wire connection

Direct voltage connection for the input voltages L-L up to 600 VAC. Otherwise use two PTs.

**Figure 5-6: 2-phase 3-wire connection**



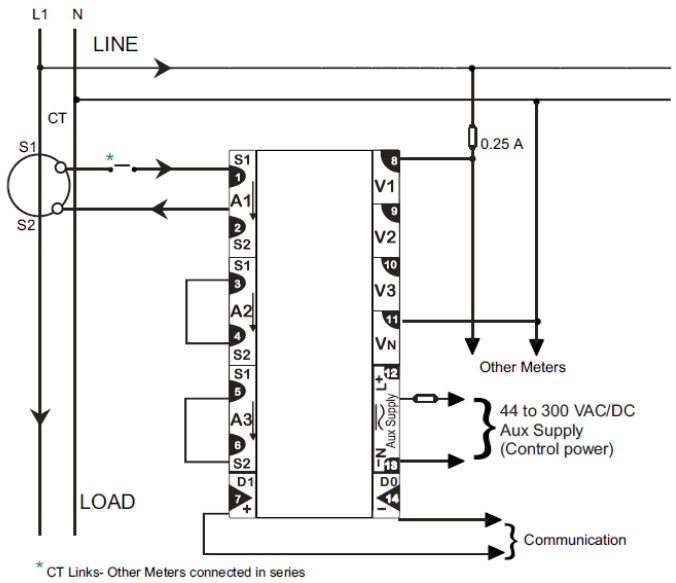

*Note: Make sure 2-phase is programmed in the power meter PROG menu- setup.*

### Single-phase connection

Direct voltage connection for the input voltages L-L up to 600 VAC. Otherwise use one PT.

1. Program the power meter in single-phase mode.
   However, voltages primary and secondary need 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 5-7: Single-phase connection**





© Schneider Electric. All rights reserved.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

# Chapter 6: Data Communication

This section is applicable only for EM6400 series power meters with RS 485 communication option.

## Float Byte Register

**Float Byte Characteristics:**

- Block wise access.
- If Read and Write values are matching, then it means the float byte sequence is in sync with the master.
- The float byte number is fixed.

**Table 6-1: Float Byte Test Sequence Register**

| Addr: 320-321 (2 registers) | Data Type | Description | Property |
|---|---|---|---|
| 4030201.0 | Float | Before starting the communication, you must write this number and read. | Normal Read and Write. |

*Note:*

- *If any other write value is given as input other than the mentioned write value in the above table, then the meter will give a data exception response.*
- *If you do not want the default value, you can always set the desired values in the Edit page.*

## Health Check Register

**Health Check Register Characteristics:**

- Normal Read Only.
- 16bit UNIT.
- Identifies the meter existence in the network.

**Table 6-2: Health Check Register**

| Addr: 0304 (1 register) | Data Type | Description | Property |
|---|---|---|---|
| Model Type | UNIT16 | To identify the meter presence in the network. | Normal Read. |

## Float Byte Order Detection

**Float Byte Order Detection Characteristics:**

- Normal Read Only.
- 16bit UNIT.
- Identifies the float byte order in the meter.

**Table 6-3: Float Byte Order Detection**

| Addr: 0306 (1 register) | Data Type | Description | Property |
|---|---|---|---|
| Model Type | UNIT16 | To identify the float byte order in the meter. | Normal Read. |

© Schneider Electric. All rights reserved.


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

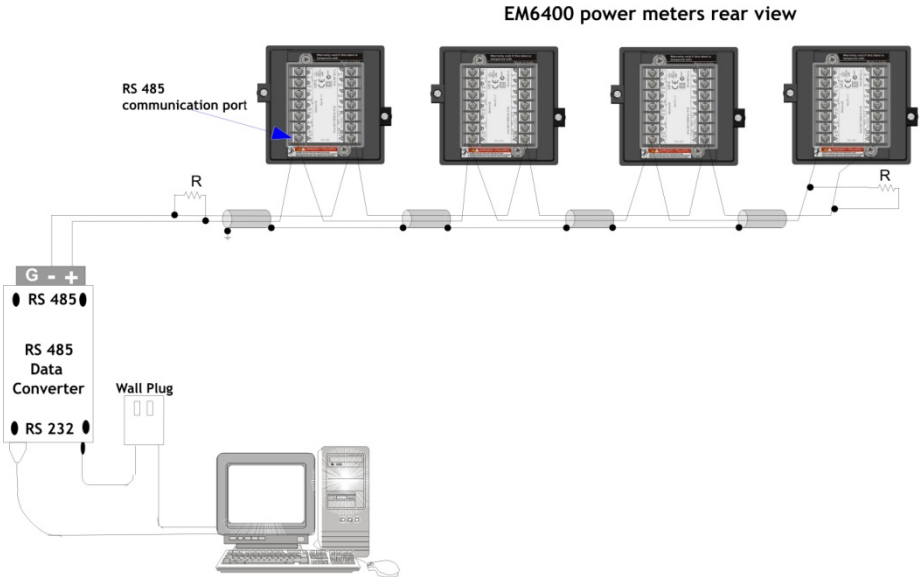
# RS 485 Data Port

**Data Port Advantages:**

- Rapid, on-line, real time readings into
- Your own SCADA software or PLC.
- Schneider Electric energy management software products such as Vijeo Citect, PowerLogic SCADA for pinpointing energy usage and waste.
- It supports ION™ enterprise.
- 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 time to read 10 parameters is 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**

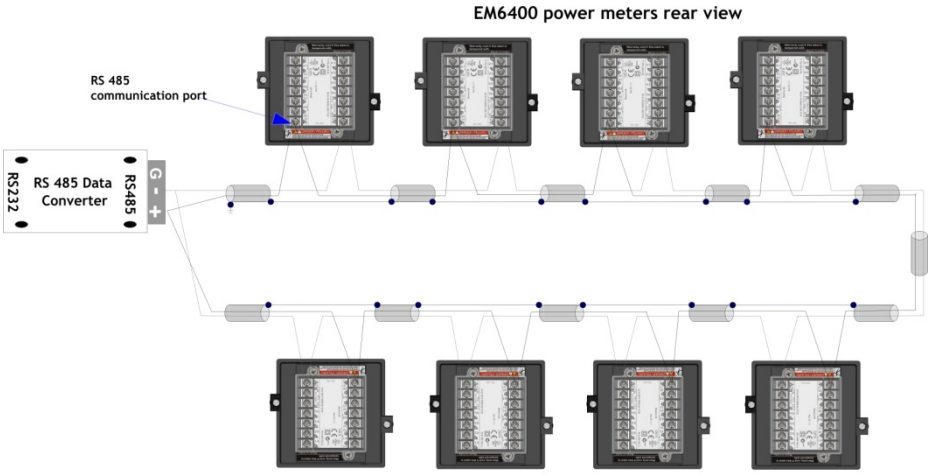




© Schneider Electric. All rights reserved.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

**Figure 6-2: Closed loop, 2-wire half duplex.**
**Advantage – Reliable communications, tolerant to one break in the cable.**




# Communication Capabilities

**Table 6-4: RS 485 communication distances**

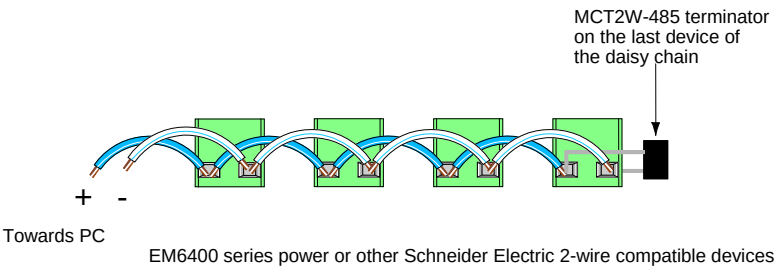
| Baud Rate | Maximum communication distances 1 to 32 devices |
|---|---|
| | Meters |
| 9600 | 1200 |
| 19200 | 900 |

*Note: Distances listed should be used as guide only and cannot be guaranteed for non-Schneider Electric devices. Above distances subject to vary based on the quality of the cable.*

# 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**




- 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.

© Schneider Electric. All rights reserved.


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

- See “Table 6-4” on page 55, 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.

*Note: For better performance, Schneider Electric recommend to use SWG 100 % shielded cable with low resistance (Belden or Lapp make).*

# Data Formats and Settings

Your SCADA software must be configured for Modbus RTU communication, before integrating the Schneider Electric EM6400 series power meter.

The mode of transmission is defined in the following which is compatible with Modbus RTU Mode:

**Table 6-5: Power meter communication and protocol settings**

| **Power meter communication settings** | |
|---|---|
| Protocol | Modbus RTU |
| Data bits | 8 |
| Baud rate | 9600 Baud, User set 4800 to 19200<br>Range: 4800, 9600, 19200<br>Normal use: 9600 Baud<br>Noisy, EMI, RFI, long data cable: 4800 Baud<br>Short cable (< 300 meters or 975 feet): 19200 Baud |
| Parity | Even |
| Device Address | 1 |
| Stop bit | 1 |
| **Modbus Protocol** | |
| Device Address | 1 to 247<br>Upto 247 meters per COM port with repeaters |
| Function Code | 03 (Read) |
| Data Address | Refer to “Data Address” on page 57 for more information |
| Data type | 32-bit float (real) :<br>• All parameters.<br>• Direct reading, little-endian float, big-endian float, no scaling required 32-bit unsigned integer<br>• INTR (number of interruptions (outages) - RMS Blocks)<br>• RunSec (Run seconds – Integ Block) |
| No of Registers | 2 to 50 (optional) per power meter 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 EM6400 power meter will depend on baud rate. We recommend polling interval of one second at 9600 Baud rate.*

# Modbus Standard Device Identification

**Addressing the Modbus standard device identification**

You can use Modbus command 0x2B/0x0E on these device identification parameters.


© Schneider Electric. All rights reserved.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

**Table 6-6: Modbus standard device identification parameters**

| Object ID | Object Name | Format | Access |
|---|---|---|---|
| 00 | Manufacturer name | String | R |
| 01 | Product code | String | R |
| 02 | FW Version | String | R |

*Note:*

- *The Read device identification can be read as stream access and as individual access.*
- *The product code is the same file name without version number.*

# Parameter Settings for Different SCADA Software

The following table explains how to read the parameter VA (See “Individual parameter address” on page 58 for more information) in different Modbus master software/PLC’s.

**Table 6-7: Parameter settings**

| SL. No | SCADA software | Start Address | Function Code | No. of Register | Data Type | Remarks |
|---|---|---|---|---|---|---|
| 1 | ION™ Enterprise | 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 | SIEMENS 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 |

© Schneider Electric. All rights reserved.



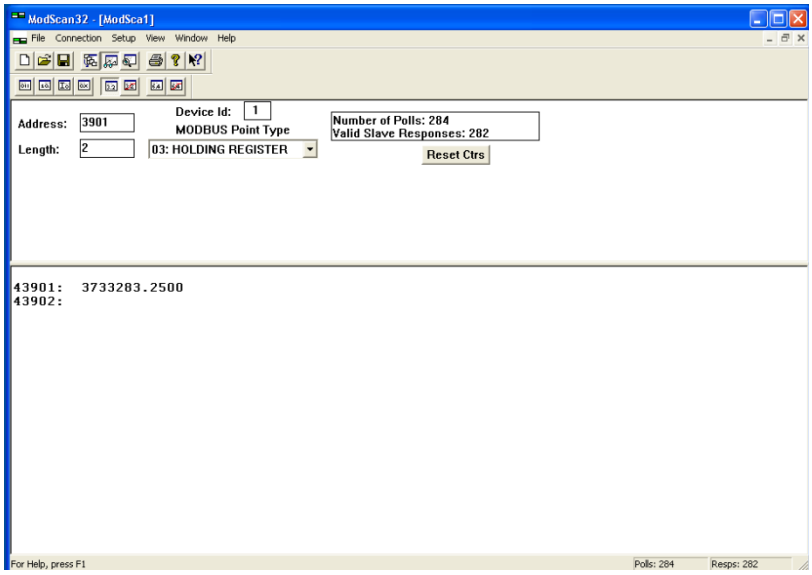
Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

# Communication Test

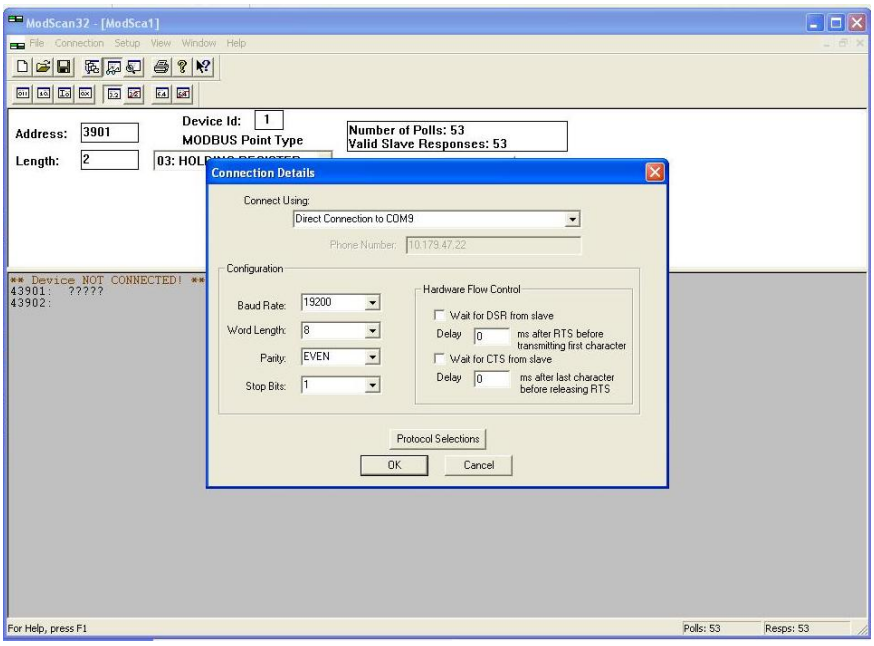
**Communication test:** EM6400 series power meter can be successfully used for communication using Modscan software as Modbus master in PC. Details of the settings in Modscan are given below.

**Settings in Modscan v3.D05-00 software to establish communication with power meters:**

- Free download demo Modscan software from http://www.win-tech.com.
- The following explains how to read apparent power total (VA total) from register 3901.




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, and HOLDING REGISTER.
2. **Modify the connection details:** Click connection > connect, to see the **connection detail window**. Change all the settings to match the following screen. These are default settings of the power meter.

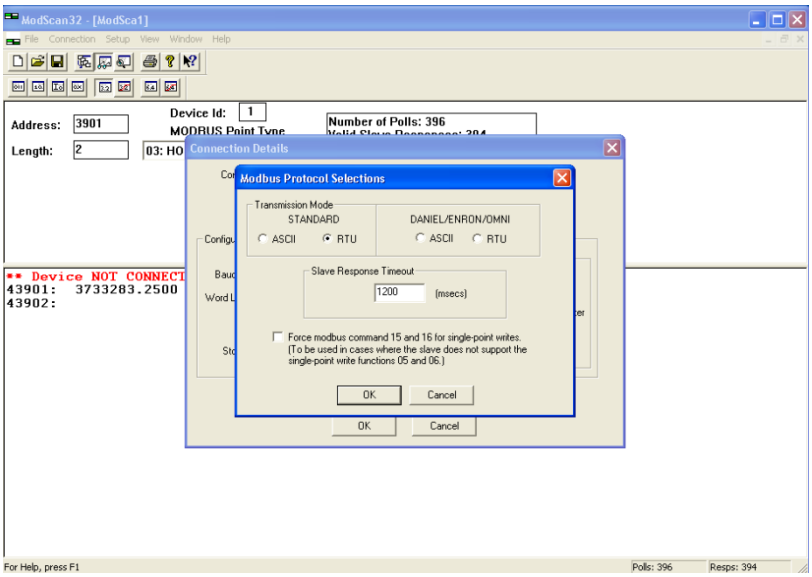




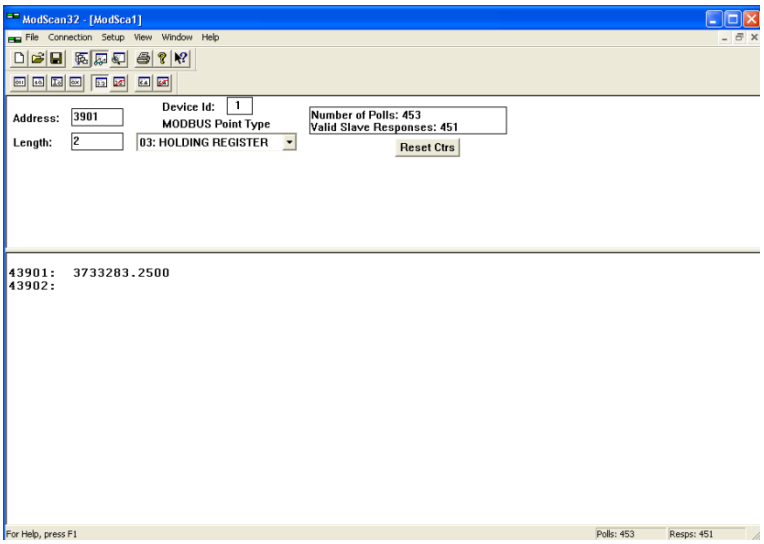
© Schneider Electric. All rights reserved.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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




4. The Modscan software starts polling the configured COM port for the Device ID 1.
   Modscan Demo software will stop polling after 3.5 minutes.




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.

© Schneider Electric. All rights reserved.



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

# Data Address

The EM6400 power meter supports the transfer of whole block and also of individual data values (two registers are used for storing single data values).

- In the transfer of individual data values, it treats two registers as an object with the starting address (e.g., 3900) considered as the object name. This enables you to transfer required data values for energy management.
- In the transfer of the 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 for 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. You must also make the related SCADA settings for polling priority, logging, and viewing the data. Refer your SCADA software instructions to learn how to do this.

**Individual Parameter Address:**

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

**Table 6-8: Individual parameter address**

| Parameter | Description | Address | Type | EM 6400 | EM 6459 | EM 6434 | EM 6436 | EM 6433 |
|---|---|---|---|---|---|---|---|---|
| **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 phase 1 to phase 2 | 3925 | Float | ✓ | ✓ | - | ✓ | - |
| V23 | Voltage phase 2 to phase 3 | 3939 | Float | ✓ | ✓ | - | ✓ | - |
| V31 | Voltage phase 3 to phase 1 | 3953 | Float | ✓ | ✓ | - | ✓ | - |
| V1 | Voltage phase 1 to neutral | 3927 | Float | ✓ | ✓ | - | ✓ | - |
| V2 | Voltage phase 2 to neutral | 3941 | Float | ✓ | ✓ | - | ✓ | - |
| V3 | Voltage phase 3 to neutral | 3955 | Float | ✓ | ✓ | - | ✓ | - |
| **Metering – Power** | | | | | | | | |
| W | Active power, total | 3903 | Float | ✓ | - | ✓ | ✓ | ✓ |
| W1 | Active power, phase 1 | 3919 | Float | ✓ | - | ✓ | ✓ | ✓ |
| W2 | Active power, phase 2 | 3933 | Float | ✓ | - | ✓ | ✓ | ✓ |
| W3 | Active power, phase 3 | 3947 | Float | ✓ | - | ✓ | ✓ | ✓ |
| VAR | Reactive power, total | 3905 | Float | ✓ | - | ✓ | - | - |
| VAR1 | Reactive power, phase 1 | 3921 | Float | ✓ | - | ✓ | - | - |
| VAR2 | Reactive power, phase 2 | 3935 | Float | ✓ | - | ✓ | - | - |
| VAR3 | Reactive power, phase3 | 3949 | Float | ✓ | - | ✓ | - | - |
| VA | Apparent power, total | 3901 | Float | ✓ | - | ✓ | ✓ | ✓ |
| VA1 | Apparent power, phase 1 | 3917 | Float | ✓ | - | ✓ | ✓ | ✓ |
| VA2 | Apparent power, phase 2 | 3931 | Float | ✓ | - | ✓ | ✓ | ✓ |
| VA3 | Apparent power, phase 3 | 3945 | Float | ✓ | - | ✓ | ✓ | ✓ |
| **Metering – Power Factor** | | | | | | | | |
| PF | Power factor average | 3907 | Float | ✓ | ✓ | ✓ | ✓ | - |
| PF1 | Power factor, phase 1 | 3923 | Float | ✓ | ✓ | ✓ | ✓ | - |
| PF2 | Power factor, phase 2 | 3937 | Float | ✓ | ✓ | ✓ | ✓ | - |
| PF3 | Power factor, phase 3 | 3951 | Float | ✓ | ✓ | ✓ | ✓ | - |
| **Metering - Frequency** | | | | | | | | |
| F | Frequency, Hz | 3915 | Float | ✓ | ✓ | - | ✓ | ✓ |


© Schneider Electric. All rights reserved.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

| Parameter | Description | Address | Type | EM 6400 | EM 6459 | EM 6434 | EM 6436 | EM 6433 |
|---|---|---|---|---|---|---|---|---|
| **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 | ✓ | - | - | - | - |
| *THD measurement range:*<br>*i. 0.5A to 6A measurement current, for 5A meter and universal 1A or 5A meter models*<br>*ii. 0.1A to 1.2A measurement current, for 1A meter models*<br>*iii. 50V to 600V line-to-line measurement voltage*<br>*iv. 45 to 65Hz measurement line frequency*<br><br>*NOTE: The EM6400 power meter may show current and voltage THD% as "----" on the meter display and "-999" through communications, under any of the following conditions:*<br>*1. When the current through the internal CT of the meter is:*<br>*i. ≤ 0.5A or ≥ 6A, for 5A meter and universal 1A or 5A meter models*<br>*ii. ≤ 0.1A or ≥ 1.2A, for 1A meter models*<br>*2. When the voltage at measurement terminals of meter is ≤ 50V or ≥ 600V*<br>*3. When the measurement line frequency is > 65 Hz* | | | | | | | | |
| **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 interruptions | 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 phase 1 load | 3883 | Float | ✓ | ✓ | - | - | - |
| %L2 | Percentage of phase 2 load | 3885 | Float | ✓ | ✓ | - | - | - |
| %L3 | Percentage of phase 3 load | 3887 | Float | ✓ | ✓ | - | | - |
| Unbalanced %Load | Unbalanced %load | 3889 | Float | ✓ | ✓ | - | - | - |
| Unbalanced % voltage | Unbalanced % voltage | 3891 | Float | ✓ | ✓ | - | - | - |

*Note: THD values are indicative only.*

## Block Parameter Address

### Total RMS Block:

- Function Code: 03H Read
- Number of registers: 20
- No scaling required

© Schneider Electric. All rights reserved.



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

- Read as block only

**Table 6-9: Total RMS block**

| Parameter | Description | Address | Type | EM 6400 | EM 6459 | EM 6434 | EM 6436 | EM 6433 |
|---|---|---|---|---|---|---|---|---|
| VA | Apparent power, total | 3001 | Float | ✓ | - | ✓ | ✓ | ✓ |
| W | Active power, total | 3003 | Float | ✓ | - | ✓ | ✓ | ✓ |
| VAR | Reactive power, total | 3005 | Float | ✓ | - | ✓ | - | - |
| PF | Average 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
- Number of registers: 20
- No scaling required
- Read as block only

**Table 6-10: R phase RMS block**

| Parameter | Description | Address | Type | EM 6400 | EM 6459 | EM 6434 | EM 6436 | EM 6433 |
|---|---|---|---|---|---|---|---|---|
| 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
- Number of registers: 20
- No scaling required
- Read as block only

**Table 6-11: Y phase RMS block**

| Parameter | Description | Address | Type | EM 6400 | EM 6459 | EM 6434 | EM 6436 | EM 6433 |
|---|---|---|---|---|---|---|---|---|
| VA2 | Apparent power, phase 2 | 3061 | Float | ✓ | - | ✓ | ✓ | ✓ |
| W2 | Active power, phase 2 | 3063 | Float | ✓ | - | ✓ | ✓ | ✓ |
| VAR2 | Reactive power, phase 2 | 3065 | Float | ✓ | - | ✓ | - | - |
| PF2 | Power factor, phase 2 | 3067 | Float | ✓ | ✓ | ✓ | ✓ | - |
| V23 | Voltage phase 2 to phase 3 | 3069 | Float | ✓ | ✓ | - | ✓ | - |


© Schneider Electric. All rights reserved.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

| Parameter | Description | Address | Type | EM 6400 | EM 6459 | EM 6434 | EM 6436 | EM 6433 |
|---|---|---|---|---|---|---|---|---|
| V2 | Voltage phase 2 to neutral | 3071 | Float | ✓ | ✓ | - | ✓ | - |
| A2 | Current, phase 2 | 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
- Number of registers: 20
- No scaling required
- Read as block only

### Table 6-12: B phase RMS block

| Parameter | Description | Address | Type | EM 6400 | EM 6459 | EM 6434 | EM 6436 | EM 6433 |
|---|---|---|---|---|---|---|---|---|
| VA3 | Apparent power, phase 3 | 3091 | Float | ✓ | - | ✓ | ✓ | ✓ |
| W3 | Active power, phase 3 | 3093 | Float | ✓ | - | ✓ | ✓ | ✓ |
| VAR3 | Reactive power, phase 3 | 3095 | Float | ✓ | - | ✓ | - | - |
| PF3 | Power factor, phase 3 | 3097 | Float | ✓ | ✓ | ✓ | ✓ | - |
| V31 | Voltage phase 3 to phase 1 | 3099 | Float | ✓ | ✓ | - | ✓ | - |
| V3 | Voltage phase 3 to neutral | 3101 | Float | ✓ | ✓ | - | ✓ | - |
| A3 | Current, phase 3 | 3103 | Float | ✓ | ✓ | - | ✓ | ✓ |
| F3 | Frequency, Hz | 3105 | Float | ✓ | ✓ | - | ✓ | - |
| Reserved | Reserved | 3107 | Long | - | - | - | - | - |
| Intr3 | Number of interruption | 3109 | Long | ✓ | ✓ | ✓ | ✓ | ✓ |

### Forward Integrated Block:

- Function Code: 03H Read
- Number of registers: 20
- No scaling required
- Read as block only

### Table 6-13: Forward integrated block

| Parameter | Description | Address | Type | EM 6400 | EM 6459 | EM 6434 | EM 6436 | EM 6433 |
|---|---|---|---|---|---|---|---|---|
| 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
- Number of registers: 20
- No scaling required
- Read as block only

© Schneider Electric. All rights reserved.


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

### Table 6-14: Reverse integrated block

| Parameter | Description | Address | Type | EM 6400 | EM 6459 | EM 6434 | EM 6436 | EM 6433 |
|---|---|---|---|---|---|---|---|---|
| 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
- Number of registers: 20
- No scaling required
- Read as block only

### Table 6-15: Total integrated block

| Parameter | Description | Address | Type | EM 6400 | EM 6459 | EM 6434 | EM 6436 | EM 6433 |
|---|---|---|---|---|---|---|---|---|
| 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
- Number of registers: 22
- No scaling required
- Read as block only

### Table 6-16: Demand block

| Parameter | Description | Address | Type | EM 6400 | EM 6459 | EM 6434 | EM 6436 | EM 6433 |
|---|---|---|---|---|---|---|---|---|
| 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 | ✓ | - | - | - | - |


© Schneider Electric. All rights reserved.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Reserved | Reserved | 3741 | Float | - | - | - | - | - |

*Note: The address 3741 is overlapped between the demand and max demand blocks.*

© Schneider Electric. All rights reserved.


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

**Max Demand Block:**

- Function Code: 03H Read
- Number of registers: 36
- No scaling required
- Read as block only

**Table 6-17: Max demand block**

| Parameter | Description | Address | Type | EM 6400 | EM 6459 | EM 6434 | EM 6436 | EM 6433 |
|---|---|---|---|---|---|---|---|---|
| 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
- Number of registers: 20
- No scaling required
- Read as block only

**Table 6-18: Old forward integrated block**

| Parameter | Description | Address | Type | EM 6400 | EM 6459 | EM 6434 | EM 6436 | EM 6433 |
|---|---|---|---|---|---|---|---|---|
| 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
- Number of registers: 20
- No scaling required
- Read as block only


© Schneider Electric. All rights reserved.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

### Table 6-19: Old reverse integrated block

| Parameter | Description | Address | Type | EM 6400 | EM 6459 | EM 6434 | EM 6436 | EM 6433 |
|---|---|---|---|---|---|---|---|---|
| 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
- Number of registers: 20
- No scaling required
- Read as block only

### Table 6-20: Old total integrated block

| Parameter | Description | Address | Type | EM 6400 | EM 6459 | EM 6434 | EM 6436 | EM 6433 |
|---|---|---|---|---|---|---|---|---|
| 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
- Number of registers: 18
- No scaling required
- Read as block only

### Table 6-21: Phase angle block

| Parameter | Description | Address | Type | EM 6400 | EM 6459 | EM 6434 | EM 6436 | EM 6433 |
|---|---|---|---|---|---|---|---|---|
| Vn | Neutral voltage | 3701 | Float | ✓ | ✓ | - | - | - |
| An | Neutral current | 3703 | Float | ✓ | ✓ | - | - | - |
| V1 | Voltage phase angle, phase 1 | 3705 | Float | ✓ | ✓ | - | - | - |
| V2 | Voltage phase angle, phase 2 | 3707 | Float | ✓ | ✓ | - | - | - |
| V3 | Voltage phase angle, phase 3 | 3709 | Float | ✓ | ✓ | - | - | - |
| A1 | Current phase angle, phase 1 | 3711 | Float | ✓ | ✓ | - | - | - |
| A2 | Current phase angle, phase 2 | 3713 | Float | ✓ | ✓ | - | - | - |
| A3 | Current phase angle, phase 3 | 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.*

© Schneider Electric. All rights reserved.


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

**Setup Block:**

- Function Code: 03H Read, 10H Write
- Number of registers: 40/42
- No scaling required
- Read and write as block only

**Table 6-22: Setup block**

| Parameter | Description | Address | Type | Range | Default value |
|---|---|---|---|---|---|
| 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<br>2.0 – Delta<br>3.0 – Star<br>4.0 – Wye<br>5.0 – 2 Ph<br>6.0 – 1 Ph | 3.000 |
| LABL | Phase Labeling | 0111 | Float | 0.0 to 4.0<br>0.0 – 123<br>1.0 – ABC<br>2.0 – RST<br>3.0 – PQR<br>4.0 – RYB | 0.000 |
| VA Fn | VA Function selection | 0113 | Float | 0.0 to1.0<br>1.0 – 3D<br>1.0 – Arth | 0.000 |
| D sel | Demand Selection | 0115 | Float | 0.0 to 1.0<br>0.0 – Auto<br>1.0 – User | 0.000 |
| D Par | Demand parameter | 0117 | Float | 0.0 to 2.0<br>0.0 – VA<br>1.0 – W<br>2.0 A | 0.000 |
| D Prd | Demand period | 0119 | Float | 1.0 to 6.0<br>1.0 – 5 Min<br>2.0 – 10 Min<br>3.0 – 15 Min<br>4.0 – 20 Min<br>5.0 – 25 Min<br>6.0 – 30 Min | 3.000 |
| BAUD | Baud rate | 0121 | Float | 3.0 to 5.0<br>3.0 – 4800<br>4.0 – 9600<br>5.0 – 19200 | 5.000 |


© Schneider Electric. All rights reserved.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

| Parameter | Description | Address | Type | Range | Default value |
|---|---|---|---|---|---|
| PRTY | Parity and stop bit | 0123 | Float | 0.0 to 5.0<br>0.0 – Even 1<br>1.0 – Even 2<br>2.0 – Odd 1<br>3.0 – Odd 2<br>4.0 – No 1<br>5.0 – No 2 | 0.000 |
| ID | Unit ID | 0125 | Float | 1.0 to 247.0 | 1.000 |
| F.S% | % Full scale | 0127 | Float | 1 to 100 | 100.0 |
| OFLo | Overflow parameter selection | 0129 | Float | 0.0 – Wh<br>1.0 – VAh<br>2.0 - Wh E<br>3.0 - VAh E | 2.0 - Wh E |
| POLE | Number of poles for RPM | 0131 | Float | 1.0 to 8.0<br>1.0 – 2<br>2.0 – 4<br>3.0 – 6<br>4.0 – 8<br>5.0 – 10<br>6.0 – 12<br>7.0 – 14<br>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 |
| F.SEQ | Float byte sequences | 0141 | Float | 1.0 to 2.0<br>1.0 – 4321<br>2.0 – 2143 | 2.0 |

*Note:*

*For efficient communication setup, read the setup parameters first and then edit the required setup parameter value.*

### Clear Block:

- Function Code: 10H Write
- Number of registers: 2
- No scaling required
- Write as block only

### Table 6-23: Clear block

| Parameter | Description | Address | Type | Range |
|---|---|---|---|---|
| CLR_INTG_DMD_SETDEFAULT | INTG and demand clearing and setting up the setup default | 0311 | Long | 1 - INTG and MD Clear<br>2 - MD Clear<br>256 - Setup default |

*Note:*

*For setup default, the power meter will send an exception for values other than 256.*

### Model Info Block:

- Function Code: 03H Read
- Number of registers: 14
- No scaling required
- Read as block only

© Schneider Electric. All rights reserved.


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

**Table 6-24: Model Info Block**

| Parameter | Description | Address | Type | Range |
|---|---|---|---|---|
| Reserved | Reserved | 0081 | Long | |
| Reserved | Reserved | 0083 | Long | |
| Model Version | Model, Options and version numbers | 0085 | Long | Bits 30 to 24 for model number;<br>Bits 23 to 16 for options<br>Bits 15 to 0 for version number<br>E.g., PM1200 model no is 22 |
| Reserved | Reserved | 0087 | Long | |
| Reserved | Reserved | 0089 | Long | |
| Reserved | Reserved | 0091 | Long | |
| Reserved | Reserved | 0093 | Long | |

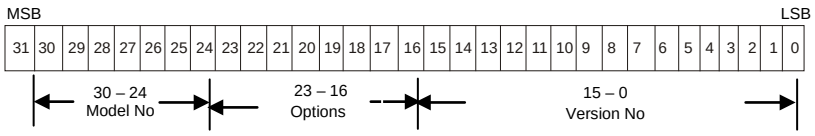
### Model

### Register Details

This section explains about the model register and helps you to understand the model number, version number, and options.

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 6-25: Meter model and number**

| Meter Model | Model Number 5A Meter | Model Number 1A Meter | Option bit wise |
|---|---|---|---|
| EM 6400 | 01 (0x01) | 129 (0x81) | Bit16– IE, Bit17– DM<br>Bit18- THD |
| EPM 2000 | 02 (0x02) | 130 (0x82) | |
| EM6434 | 03 (0x03) | 131 (0x83) | |
| EM6459 | 04 (0x04) | 132 (0x84) | |
| EM6433 | 05 (0x05) | 133 (0x85) | |
| EM6434-3 | 08 (0x08) | 136 (0x88) | |
| EM6436-3 | 09 (0x09) | 137 (0x89) | |

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

**Table 6-26: 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 |


© Schneider Electric. All rights reserved.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

| Bit23 | Bit22 | Bit21 | Bit20 | Bit19 | Bit18 | Bit17 | Bit16 | Remarks |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | 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 interpret the firmware (FW) version number.

1. Convert the hexadecimal values both MSB and LSB into decimal values.
2. Apply the formula ((MSB*256) +LSB).
3. The resulting value will be 30400 for the hexadecimal value 0x76 0xC0.
4. Insert a **0** before the result and parse it from the right with two digits each.
5. The result will be the FW version = 03.05.01.

**Table 6-27: Firmware version interpretation**

| | MSB | LSB |
|---|---|---|
| **Hexadecimal** | 0x76 | 0xC0 |
| **Decimal** | 118 | 192 |
| **VALUE=((MSB*256)+LSB)** | 30400 | |
| **FW Version** | 03.05.01 | |

***Note:*** *Firmware version representation only. To determine your power meter's present firmware version, refer the diagnostic page in the power meter. See "EM6400 series power meters menu hierarchy", on page 30 to navigate through the diagnostic page.*

*NOTE:*

- *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 the power meter readings are 32 bits. Therefore, each power meter reading occupies two consecutive Modbus registers. For example, 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. For example, 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 maximum*
- *Percentage of Load block: 5 parameters maximum*
- *All power meters addresses 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*
  *o – Parity, framing or overrun error*
  *O- Buffer overflow*

© Schneider Electric. All rights reserved.


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

# 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.

**CAUTION**

**HAZARD OF EQUIPMENT DAMAGE**

- Do not perform a Dielectric (Hi-Pot) or Megger test on the power meter, test voltages may damage the power meter.
- 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 these instructions will result in equipment damage.**


© Schneider Electric. All rights reserved.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

# Troubleshooting

The information in Table 7–1 describes potential problems and their possible causes. It also includes possible checks to perform or solutions to the problems. 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 these instructions 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” on page 19 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 “on page 48 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 one or two or in all the three phases. Under this condition, the energy will update in INTG Rev.<br>2. Check the mode. If it is in export, then the energy will update in INTG Rev. |

© Schneider Electric. All rights reserved.


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

| 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 a fuse with rating of 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” on page 51 for more information. |
| | Over voltage/temperature | Interrupt the power supply or reduce the voltage or temperature within the allowable limits. |
| Incorrect 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. Separate the power meter from other equipment for cooling air. |

# Disposal and Recycle

Dispose of or recycle the device in accordance with the applicable laws and regulations in your country.

# To Disassemble

1. Ensure to shut down the device, before you begin to disassemble the meter.
2. Disconnect all the connected terminals from the meter.
3. Loosen the mounting clamps at the back of the meter.
4. Remove the side clamps on both the sides of the meter by sliding them forward.
5. Remove the meter from the panel-cutout carefully.

*Note: For the use of proper tool, refer “Electrical Installation” on page 42 for more information*.


© Schneider Electric. All rights reserved.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

# Appendix A – Technical Data

## Accuracy

**Table A-1: Accuracy**

| Measurement | Accuracy % of Reading* | | |
|---|---|---|---|
| | Class 1.0 | Class 0.5S | Class 0.2 |
| Voltage LN per phase and average | 1.0 | 0.5 | 0.2 |
| Voltage LL per phase and average | 1.0 | 0.5 | 0.5 |
| Amp per phase and average | 1.0 | 0.5 | 0.2 |
| Amp, phase angle per phase | 2º | 1º | 1º |
| Frequency | 0.1 | 0.1 | 0.1 |
| Total Active power, (kW) | 1.0 | 0.5 | 0.2 |
| Total Reactive power, (kVAR) | 2.0 | 1.0 | 0.5 |
| Total Apparent power, (kVA) | 1.0 | 0.5 | 0.2 |
| Active energy (kWh) Import/Export | 1.0 | 0.5 | 0.2 |
| Reactive energy (kVARh) (Inductive / Capacitive) | 2.0 | 1.0 | 0.5 |
| Apparent energy ( kVAh) | 1.0 | 0.5 | 0.2 |
| RPM | 1.0 | 0.5 | 0.2 |

*NOTE:*

- *5 A meter - Additional error of 0.05 % of full scale for meter input current below 100 mA.*
- *1 A meter - Additional error of 0.05 % of full scale for meter input current below 20 mA.*
- *PF error limit is same as W error limit in %.*
- **In Delta mode configuration the accuracy will be 1.0% of reading.*

## Auxiliary supply (Control Power)

The power meter needs a single-phase AC or DC control supply to power its internal electronics.
Range: 44 to 300 VAC/DC.
Burden (load): 3 VA max on Auxiliary supply.

## Front Display

- Brilliant three lines four digits (digit height 14.2 mm/0.56 in.) 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 consumption in terms of % amperes total.
- Set of four red LED's in the load bar start blinking when the load is greater than 120%, to indicate overload.

© Schneider Electric. All rights reserved.


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

- Easy setup through keys located on the faceplate for common configuration parameters.
- Password protection for setup parameters.
- User-selectable default display page through keypad lock.

# Installation and Input Ratings

- Auto-ranging voltage inputs should allow direct connection up to 347 VLN/600VLL AC systems, no PTs (VTs) required up to 600 VLL phase to phase).
- Supports the following configurations (field configurable): Direct 4-wire Wye (Star); 3-wire Wye (Star); 3-wire Delta; 2-phase 3-wire (2-phase); and single-phase.
- 3-phase voltage, and current inputs
- Volts : 46 to 347 VAC phase-neutral, 80 to 600 VAC phase-phase, Overload: Continuous 600 VLL with full accuracy, 750 VLL Max, Hz. 50 / 60
- Amperes: 5 mA (starting )to 6 A, Overload: 10 A continuous, 50 A for three 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
- Altitude ≤ 2000m

# Construction

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

## Dimensions and Shipping

- Basic unit installed depth 83 mm with 92 x 92 mm panel cut-out, flush mount.
- Bezels dimension 96 x 96 mm. Panel Cut-out 92 x 92 mm.
- Weight 400 gms approx unpacked, 500 gms approx shipping. See “Mechanical Installation” on page 39 for more information.


© Schneider Electric.  All rights reserved.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

# Appendix B: SIM (simulation) Mode

The EM6400 series power meters are provided with SIM mode for 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  pressed, while powering up the power meter. The display shows **RUN**.
- Press . The display shows **SIM**.
- Press . The display sh**o**ws **RMS SIM**. You have successfully entered the SIM mode of the power meters.

**To Exit from SIM mode**

- Press and hold the , until you reach the RMS page.
- Press . The display shows **SIM**.
- Press . The display shows **RUN**.
- Press . The display shows **RMS** indicating the exit from SIM mode

© Schneider Electric. All rights reserved.


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

# Appendix C: Glossary

## Terms

**Auto (sliding block):** An interval selected from five to 30 minutes. The power meter calculates and updates the demand every 15 seconds.

**Baud rate**: Specifies how fast data is transmitted across a serial 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.

**Float:** A 32-bit floating point value returned by a register (See “Data Address” on page 57 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 (See “Default display (View) page” on page 12 for more information).

**Long**: A 32-bit value returned by a register (See “Data Address” on page 57 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. It is 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.

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

**ULOC:** Default display page unlock (See “Default display (View) page” on


© Schneider Electric. All rights reserved.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

page 12 for more information).

**User (fixed block)**: An interval selected between five to 30 minutes. The power meter calculates and updates the demand at the end of each interval.

© Schneider Electric. All rights reserved.


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

# Abbreviations

| | |
|---|---|
| %A FS | % Amperes full scale |
| A, Amps | Amperes |
| An | Neutral current |
| A.PRI | Current primary winding |
| A.SEC | Current secondary winding |
| Avg | Average |
| CLR | Clear |
| CT | Current transformer |
| Dia, DIAG | Diagnostic |
| ft | Feet/foot |
| F.Seq | Float byte sequence |
| FW | Firmware |
| FWD | Forward |
| Hz | Hertz |
| ID | Identity |
| in. | Inch |
| INTG | Integrator |
| IP | Ingress protection |
| kVAh | Kilo volt-ampere hour |
| kVARh | Kilo volt-ampere reactive hour |
| kWh | Kilo watt hour |
| LSB | Least significant bit |
| MD | Maximum demand |
| Min | Minimum |
| ms | Milliseconds |
| MSB | Most significant bit |
| O.F | Overflow |
| 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.PRI | Voltage primary winding |
| V.SEC | Voltage secondary winding |
| VT | Voltage transformer |
| W | Active power |
| Wh | Active energy |


© Schneider Electric. All rights reserved.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

## INDEX

AC Power Measurement
  3D kVA Measurement, 38
  Consumption and Poor PF, 38
AC Power Measurement
  Three phase systems, 37
Auto scroll
  Within page group, column of pages and TURBO pages, 12
Block parameter address
  B Phase RMS block, 60
  Clear block, 66
  Forward Integrated block, Reverse Integrated block, 61
  Max Demand block, OLD Forward Integrated block, 63
  Model Info Block, 67
  OLD Reverse Integrated block, OLD Total Integrated block, 63
  Phase Angle Block, Setup Block, 64
  Total Integrated block, Demand block, 62
  Total RMS block, R phase RMS block, 59
  Y Phase RMS block, 60
Clear
  INTG, 26
  MD, 27
Communication Test, 56
Connections
  Connection diagram symbols, 48
  Delta connection, 49
  Fuse recommendations, 45
  Open delta connection, 49
Data Address
  Block parameter address, 59
  Individual parameter address, 57
Data communication, 51
  Daisy chaining devices to the power meter, 53
Data Communication
  Data formats and settings, 54
Default display (View) page
  Display lock and unlock, 12
Demand Power Calculation Methods
  Auto - Sliding block, User - Fixed block, 29
Disassemble, 73
Disposal and Recycle, 73
Electrical Installation, 42
Energy Integrator
  Integrator overflow, OLD data register, 28
Front panel
  Kilo, Mega, Giga and negative indicators, 9
Front Panel
  LED display, Load bar, 8
INTR, 28
Keys
  Left, Right, Up, Down keys, 10
  Operation, 11
Maintenance and Troubleshooting, 71
Mechanical Installation
  Panel considerations and Environment, 40
Mechanical Installation, 39
on.h, 28
EM6400 Series Menu hierarchy, 34
EM6400 Series Power Meters Product Description, 7
PROG menu - Setup
  List of setup parameters in View & Edit modes, 22
  Quick setup - While powering on, 19
  Setup entry in View mode, 21
  Setup entry in Edit mode, 21
  Setup parameters editing, 24
Rear Panel, 13
Safety
  Precautions, 17
  Symbols, 3
Sim (Simulation) Mode, 77
Technical specifications, 16
Total RMS block, 59
TURBO Key, 10

© Schneider Electric. All rights reserved.


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

**Schneider Electric India Pvt Ltd**
44 P, Electronics City, East Phase,
Hosur Road,
Bangalore - 560 100, India

email: customercare.in@schneider-electric.com
Toll free help desk number:
1800 425 4272, 1800 103 0011
www.schneider-electric.co.in

Conzerv, PowerLogic, and ION Enterprise are either trademarks or registered trademarks of Schneider Electric.

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.

NHA12533-03 © 2015 Schneider Electric. All rights reserved. 07/2015

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

**Artisan Technology Group** is an independent supplier of quality pre-owned equipment

## Gold-standard solutions

Extend the life of your critical industrial, commercial, and military systems with our superior service and support.

## We buy equipment

Planning to upgrade your current equipment? Have surplus equipment taking up shelf space? We'll give it a new home.

## Learn more!

Visit us at **artisantg.com** for more info on price quotes, drivers, technical specifications, manuals, and documentation.

Artisan Scientific Corporation dba Artisan Technology Group is not an affiliate, representative, or authorized distributor for any manufacturer listed herein.

We're here to make your life easier. How can we help you today?

(217) 352-9330 | sales@artisantg.com | artisantg.com

ARTISAN® TECHNOLOGY GROUP