# PWRM10-01
# PWRM20-01

## IoT Energy Monitoring Modules

## MA1068

## Hardware User Manual


DATAFORTH®

**PWRM10-01 & PWRM20-01 Hardware User Manual**
**MA1068 Rev. A – May 2022**

**ISO 9001:2015 Registered QMS**

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## About Dataforth Corporation

"Our passion at Dataforth Corporation is designing, manufacturing, marketing, and selling the best possible signal conditioning, data acquisition, and data communication products. Our mission is to set new standards of product quality, performance, and customer service." Dataforth Corporation, with more than thirty years of experience, is the worldwide leader in Instrument Class® Industrial Electronics – rugged, high performance signal conditioning, data acquisition, and data communication products that play a vital role in maintaining the integrity of industrial automation, data acquisition, and quality assurance systems. Our products directly connect to most industrial sensors and protect valuable measurement and control signals and equipment from the dangerous and degrading effects of noise, transient power surges, internal ground loops, and other hazards present in industrial environments.

Dataforth spans the globe with more than 50 International Distributors and US Representative Companies. Our customers benefit from a team of over 130 sales people highly trained in the application of precision products for industrial markets. In addition, we have a team of application engineers in our Tucson factory ready to solve any in-depth application questions. Upon receipt of an RFQ or order, our Customer Service Department provides fast one-day delivery information turnaround. We maintain an ample inventory that allows small quantity orders to be shipped from stock.

Dataforth operates under an ISO9001:2015 quality management system.

## Contacting Dataforth Corporation

| Contact Method | Contact Information |
|---|---|
| **E-Mail:** Technical Support | support@dataforth.com |
| **Website:** | www.dataforth.com |
| **Phone:** | +1-520-741-1404 and toll free US +1-800-444-7644 |
| **Fax:** | +1-520-741-0762 |
| **Mail:** | Dataforth Corporation<br>3331 E. Hemisphere Loop<br>Tucson, AZ 85706 USA |

# 1.0 Features

The PWRM10-01 and PWRM20-01 IoT Energy Monitoring Modules encompass more than 35 years of design excellence in the process control industry. These DIN rail mounted, industrially rugged, IoT modules provide a modern solution for a wide range of energy related applications.

**Instrument Class Performance**

- Wide Operating and Measurement Range of 85 - 265VAC for PWRM10
- Wide Operating and Measurement Range of 85 - 525VAC for PWRM20
- Connects to 3-Phase Systems, 3-Wire Wye, 4-Wire Wye, and Delta
- Connects to Single Phase Systems
- Self-Powered from any Phase – A, B, or C
- 0.1% Phase Voltage Accuracy
- 0.1% Phase Current Accuracy
- Industrial Operating Temperature Range -40°C to +85°C
- 100ppm/°C Temperature Coefficient
- CE Compliant

**Industry Leading Functionality**

- Internet of Things (IoT) Connectivity
- Simple Interface through a Web Browser, Smart Phone, or Tablet
- Data Charting
- Data Logging
- Events (Alarm) Configurable on Power Quality Parameters
- Event Trips Post Notifications
- Field Upgradeable for Improvements and Feature Addition
- Security Features
- Compact DIN Rail Housing

**Interface Options**

- Web UI Hosted on the Module
- HTTP API

## 2.0 Description and Documentation

Energy Monitoring Modules PWRM10-01 and PWRM20-01 are IoT, universal, high accuracy, compact, self-powered, electrical energy measurement devices that interface to three-phase and single-phase systems. The modules are specifically designed for heavy-duty industrial and commercial installations and retrofit applications, providing a wide range of highly accurate power and energy measurements over an operating temperature range of -40°C to +85°C.

The DIN rail mounted enclosures have pluggable terminal blocks for connecting to phase voltages and phase currents which simplifies setup and maintenance. Both modules have a small form factor which occupies less space in control cabinets than other measurement solutions. The PWRM10-01 module interfaces to phase voltages of 85 – 265VAC, 50/60Hz and is self-powered from any of the three phases. For higher voltage systems, the PWRM20-01 module interfaces to phase voltages of 85 – 525VAC, 50/60Hz and is self-powered from any of the three phases. Both modules can interface to higher phase voltages with the use of voltage transformers and scaling configured in the module. Power consumption is low and does not affect measured power and energy.

Phase current inputs have an industry standard range of 0.333VAC full scale. The modules are configurable to use an external shunt, current transformer, or Rogowski Coil to measure phase currents directly or non-contact.

The PWRM10-01 and PWRM20-01 modules measure and report a wide range of electrical energy parameters which include, but are not limited to:

- RMS Voltages and Currents
- Phase Angles
- Line Periods
- Instantaneous Total Active Power
- Instantaneous Total Apparent Power
- Fundamental Active Power
- Power Factors
- Total Active Energy
- Fundamental Active Energy
- Fundamental Reactive Energy
- Reactive Energy
- Harmonics
- Power Quality – Configurable Events Monitor and Post Notifications for:
  - Over-Voltage
  - Over-Current
  - Sag

Real-time data from the module is accessed via an Ethernet port using the HTTP API or a standard web browser on a host computer, smart phone, or tablet. Data logging is user configurable and once parameters and ranges are selected, the data is automatically downloaded and stored.

With the ease of use and many features of the PWRM10-01 and PWRM20-01 modules, measuring power quality, monitoring energy consumption, determining machine health, and other powerful data analyses become simple operations.

PWRM module literature and software is available for download from the PWRM Software & User Manual Download Center. This includes, but is not limited to:

MA1069 PWRM10-01 & PWRM20-01 Quick Start Guide
MA1068 PWRM10-01 & PWRM20-01 Hardware User Manual
MA1067 PWRM10-01 & PWRM20-01 HTTP API User Manual

## 3.0 Specifications

**SPECIFICATIONS: IoT ENERGY MEASUREMENT MODULE** Typical at Ta = +25°C, 85-265VAC, 50/60Hz

| | |
|---|---|
| **Model Number & Input Range** | |
| PWRM10-01 | 85 - 265VAC |
| **Electrical System** | |
| Three Phase | 3-Wire Wye, 4-Wire Wye, Delta |
| Single Phase | |
| Voltage Measurement | Direct connection or through Voltage Transformer |
| Current Measurement | Shunt, CT, Rogowski Coil – 0.333VAC max output |
| **Measured Parameters and Accuracy** | |
| RMS Voltage | ±0.1% of full-scale range |
| RMS Current | ±0.1% of full-scale range |
| Active Power | ±0.2% |
| Apparent Power | ±0.2% |
| Reactive Power | ±0.2% |
| Power Factor | ±0.2% |
| Active Energy | ±0.25% |
| Apparent Energy | ±0.25% |
| Fundamental Active and Reactive Energy | ±0.25% |
| Phase Angles | ±0.1% |
| Line Periods | ±0.1% |
| **Measurement Bandwidth** | |
| RMS Voltage & Current (-3dB) | 3.3kHz |
| Total Active Energy (-3dB) | 3.3kHz |
| Fundamental Reactive Energy (-3dB) | 3.3kHz |
| Harmonics (-3dB) | 3.3kHz (2.8kHz no attenuation pass band) |
| **Power Quality (Events)** | |
| Over-Voltage, Over-Current, Sag | Event Monitor & Post Notification |
| **Power Source** | 85 - 265VAC Self-Powered from Phase A, B, or C |
| **Temperature Drift** | ±100ppm/°C |
| **Protocol & Communications** | HTTP API over Ethernet TCP/IP |
| **Dimensions (h)(w)(d)** | 4.01” x 0.89” x 5.04” (102mm x 22.6mm x 128mm) |
| **Weight** | 0.3lb (0.14kg) |
| **Environmental** | |
| Operating Temperature | -40°C to +85°C |
| Storage Temperature | -40°C to +85°C |
| Relative Humidity | 0 to 95%, non-condensing |
| **Emissions, EN61000-6-4** | ISM Group 1 |
| Radiated, Conducted | Class A |
| **Immunity EN61000-6-2** | ISM Group 1 |
| RF | Performance A ±2% Span Error |
| ESD, EFT | Performance B |
| **Certifications** | Heavy Industrial CE |

| **SPECIFICATIONS: PWRM20-01 IoT ENERGY MODULE** | Typical at Ta = +25°C, 85-525VAC, 50/60Hz |
|---|---|
| **Model Number & Input Range** | |
| PWRM20-01 | 85 - 525VAC |
| **Electrical System** | |
| Three Phase | 3-Wire Wye, 4-Wire Wye, Delta |
| Single Phase | |
| Voltage Measurement | Direct connection or through Voltage Transformer |
| Current Measurement | Shunt, CT, Rogowski Coil – 0.333VAC max output |
| **Measured Parameters and Accuracy** | |
| RMS Voltage | ±0.1% of full-scale range |
| RMS Current | ±0.1% of full-scale range |
| Active Power | ±0.2% |
| Apparent Power | ±0.2% |
| Reactive Power | ±0.2% |
| Power Factor | ±0.2% |
| Active Energy | ±0.25% |
| Apparent Energy | ±0.25% |
| Fundamental Active and Reactive Energy | ±0.25% |
| Phase Angles | ±0.1% |
| Line Periods | ±0.1% |
| **Measurement Bandwidth** | |
| RMS Voltage & Current (-3dB) | 3.3kHz |
| Total Active Energy (-3dB) | 3.3kHz |
| Fundamental Reactive Energy (-3dB) | 3.3kHz |
| Harmonics (-3dB) | 3.3kHz (2.8kHz no attenuation pass band) |
| **Power Quality (Events)** | |
| Over-Voltage, Over-Current, Sag | Event Monitor & Post Notification |
| **Power Source** | 85 - 525VAC Self-Powered from Phase A, B, or C |
| **Temperature Drift** | ±100ppm/°C |
| **Protocol & Communications** | HTTP API over Ethernet TCP/IP |
| **Dimensions (h)(w)(d)** | 4.24” x 0.89” x 4.48” (107.7mm x 22.6mm x 113.7mm) |
| **Weight** | 0.4lb (0.18kg) |
| **Environmental** | |
| Operating Temperature | -40°C to +85°C |
| Storage Temperature | -40°C to +85°C |
| Relative Humidity | 0 to 95%, non-condensing |
| **Emissions, EN61000-6-4** | ISM Group 1 |
| Radiated, Conducted | Class A |
| **Immunity EN61000-6-2** | ISM Group 1 |
| RF | Performance A ±2% Span Error |
| ESD, EFT | Performance B |
| **Certifications** | Heavy Industrial CE |

## 4.0 Unpacking

Each PWRM10-01 and PWRM20-01 module is shipped in electro-static discharge (ESD) protective packaging. Use appropriate ESD protection measures while unpacking. Check visually for physical damage. If physical damage is noted, file a claim with the shipping carrier and contact the factory.

## 5.0 Module Dimensions and I/O Connections

### 5.1 PWRM10-01

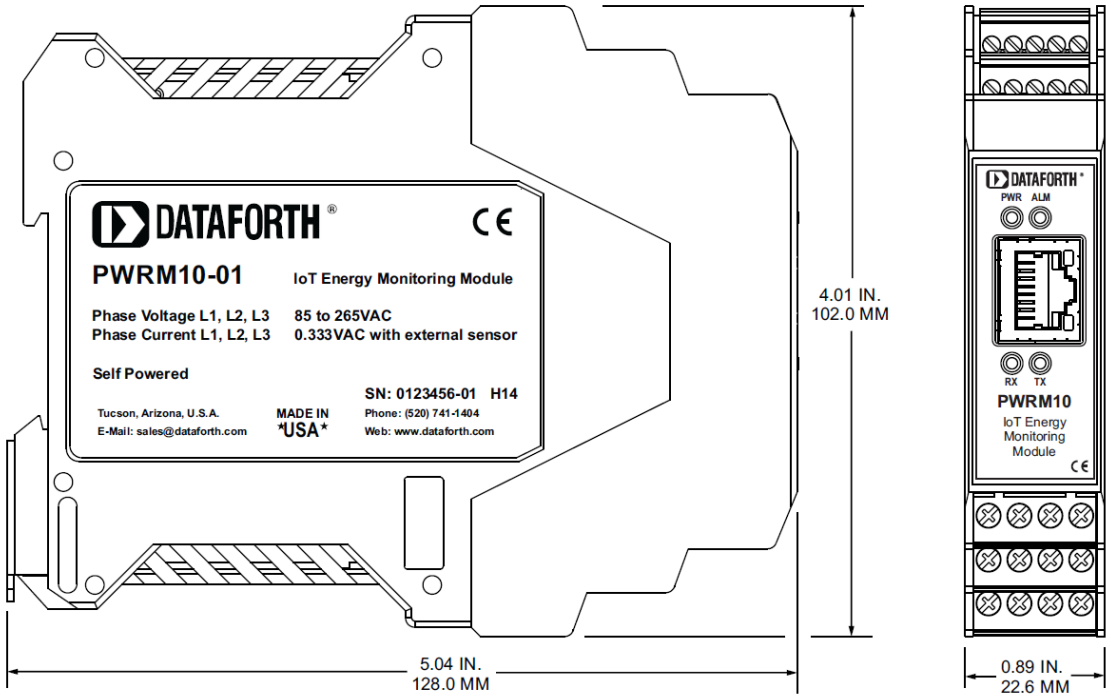


Figure 1: PWRM10-01 Module Dimensions

The PWRM10-01 modules have pluggable terminal blocks to connect to phase voltages and phase currents. This allows modules to be easily added to or removed from a system.

> **DANGER – HAZARDOUS VOLTAGES**
>
> These wiring instructions are for use by qualified personnel only.
> Only licensed electricians or qualified personnel should install and maintain the modules and wiring.
>
> REFER TO SECTION 8.0, SECTION 9.0, AND SECTION 10.0 FOR DETAILS ON WIRING TO PHASE VOLTAGES AND FOR SENSOR SELECTION AND WIRING TO PHASE CURRENTS.

PWRM10-01 modules interface to phase currents with burden resistors, current transformers, or Rogowski Coils with 0.333VAC output at rated current. This low voltage interface is on the module top terminal blocks.

PWRM10-01 modules interface to phase voltages using the bottom terminal blocks.

**⚠ WARNING!**

Mains voltages of 85VAC to 525VAC can be lethal!

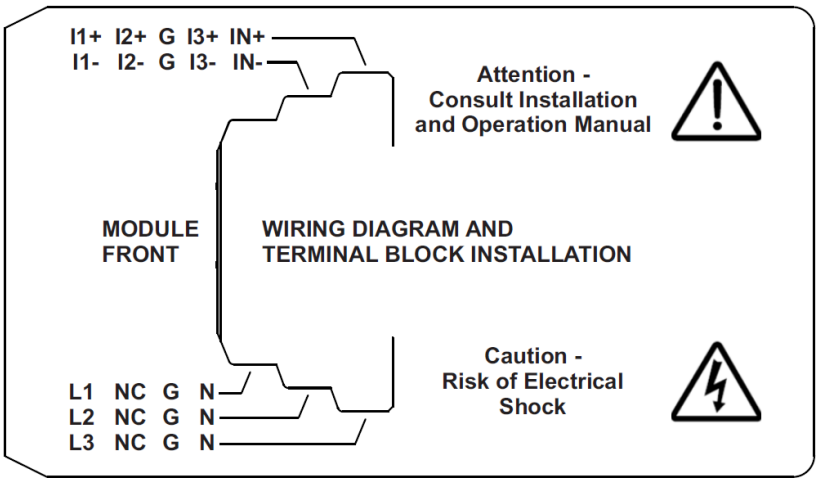


Figure 2: PWRM10-01 Wiring Diagram & Terminal Block Positions

Table 1: PWRM10-01 Phase Voltage & Phase Current Connections

| Connector | Module Top | | | | | Wire Gauge |
|---|---|---|---|---|---|---|
| Back | I1+ (Phase 1 Current +) | I2+ (Phase 2 Current +) | G (Protected Earth / Shield) | I3+ (Phase 3 Current +) | IN+ (Neutral Current +) | AWG 30-14 |
| Middle | I1- (Phase 1 Current -) | I2- (Phase 2 Current -) | G (Protected Earth / Shield) | I3- (Phase 3 Current -) | IN- (Neutral Current -) | AWG 30-14 |
| Front | | | | | | |
| | | | Ethernet RJ-45 | | | |
| Front | L1 (Phase 1 Voltage) | NC (No Connection) | G (Shield) | N (Neutral) | | AWG 30-12 |
| Middle | L2 (Phase 2 Voltage) | NC (No Connection) | G (Shield) | N (Neutral) | | AWG 30-12 |
| Back | L3 (Phase 3 Voltage) | NC (No Connection) | G (Shield) | N (Neutral) | | AWG 30-12 |
| Connector | Module Bottom | | | | | Wire Gauge |

## 5.2 PWRM20-01

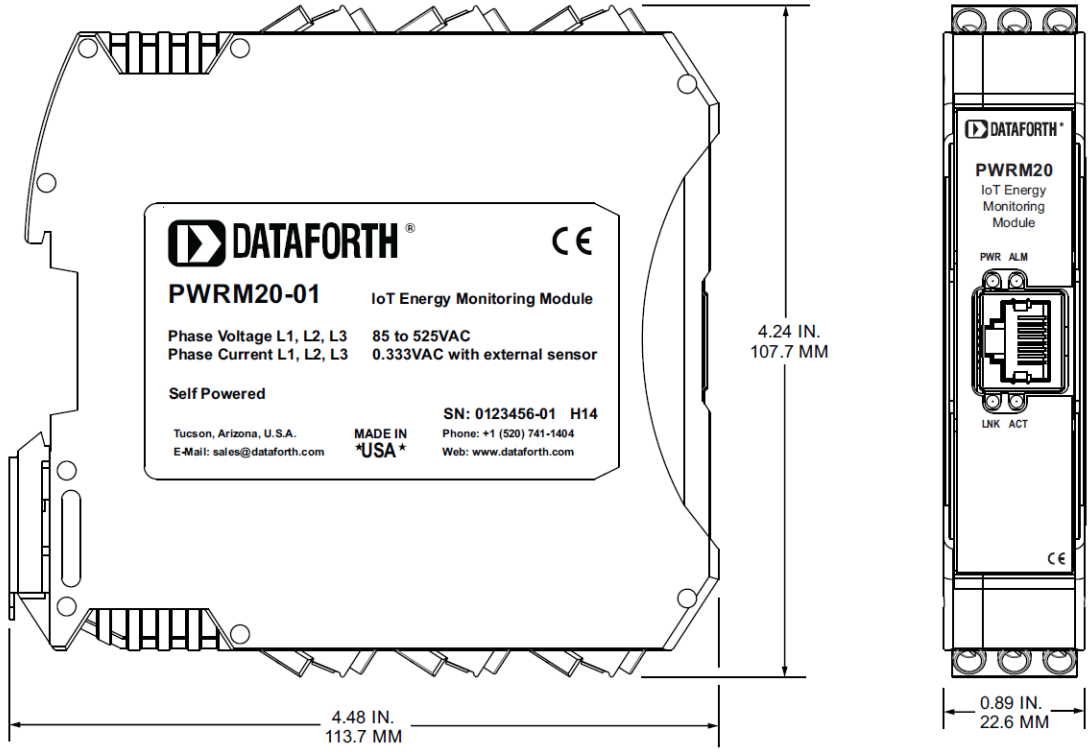


Figure 3: PWRM20-01 Module Dimensions

The PWRM20-01 modules have pluggable terminal blocks to connect to phase voltages and phase currents. This allows modules to be easily added to or removed from a system.

## DANGER – HAZARDOUS VOLTAGES

These wiring instructions are for use by qualified personnel only.
Only licensed electricians or qualified personnel should install and maintain the modules and wiring.

REFER TO SECTION 8.0, SECTION 9.0, AND SECTION 10.0 FOR DETAILS ON WIRING TO PHASE VOLTAGES AND FOR SENSOR SELECTION AND WIRING TO PHASE CURRENTS.

PWRM20-01 modules interface to phase currents with burden resistors, current transformers, or Rogowski Coils with 0.333VAC output at rated current. This low voltage interface is on the module top terminal blocks.

PWRM20-01 modules interface to phase voltages using the bottom terminal blocks.

## WARNING!

Mains voltages of 85VAC to 525VAC can be lethal!

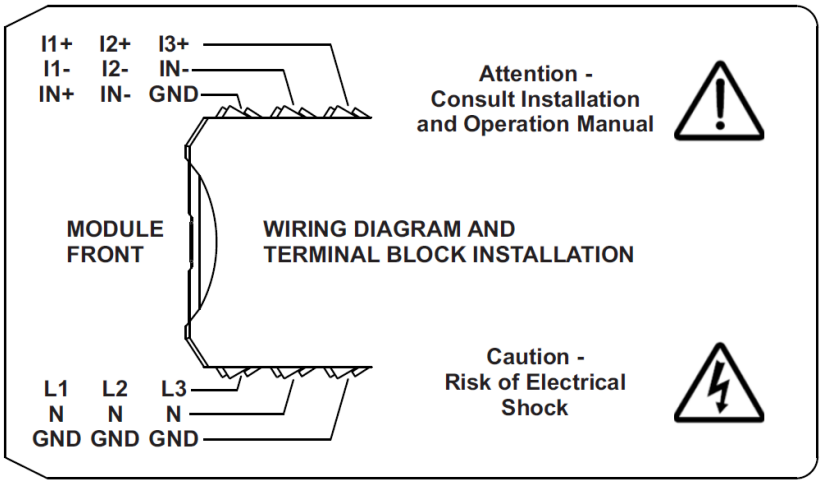


Figure 4: PWRM20-01 Wiring Diagram & Terminal Block Positions

Table 2: PWRM20-01 Phase Voltage & Phase Current Connections

| Connector | Module Top | | | Wire Gauge |
|---|---|---|---|---|
| Back | I1+<br>(Phase 1 Current +) | I2+<br>(Phase 2 Current +) | I3+<br>(Phase 3 Current +) | AWG<br>24-14 |
| Middle | I1-<br>(Phase 1 Current -) | I2-<br>(Phase 2 Current -) | I3-<br>(Phase 3 Current -) | AWG<br>24-14 |
| Front | IN+<br>(Neutral Current +) | IN-<br>(Neutral Current -) | GND<br>(Protected Earth / Shield) | AWG<br>24-14 |
| | | Ethernet<br>RJ-45 | | |
| Front | L1<br>(Phase 1 Voltage) | L2<br>(Phase 2 Voltage) | L3<br>(Phase 3 Voltage) | AWG<br>24-12 |
| Middle | N<br>(Neutral) | N<br>(Neutral) | N<br>(Neutral) | AWG<br>24-12 |
| Back | GND<br>(Protected Earth / Shield) | GND<br>(Protected Earth / Shield) | GND<br>(Protected Earth / Shield) | AWG<br>24-12 |
| Connector | Module Bottom | | | Wire Gauge |

# 6.0 Module Installation and Removal

## 6.1 PWRM10-01

> **ATTENTION**
>
> Read, understand, and follow all instructions in this manual and MA1068 PWRM10 & PWRM20-01 Hardware User Manual including all warnings, cautions, and precautions before installing and using the product.

> **CAUTION – RISK OF ELECTRICAL SHOCK**
>
> When installing and operating the PWRM10-01 module, there is a potential shock hazard from dangerous high voltage. Ensure systems are de-energized before installing the product or removing the terminal blocks.

The PWRM10-01 module mounts on 35mm DIN rails that are elevated or flush on panels. They require no tools or hardware for insertion into a system and only a simple flat blade screwdriver for removal.

To install a module:

1. Orient the module with the metal latch down and the Ethernet jack away from the DIN rail
2. Align the module DIN rail capture with the top edge of the rail
3. Slide the module down until the module engages the rail
4. Rotate the module and snap in place

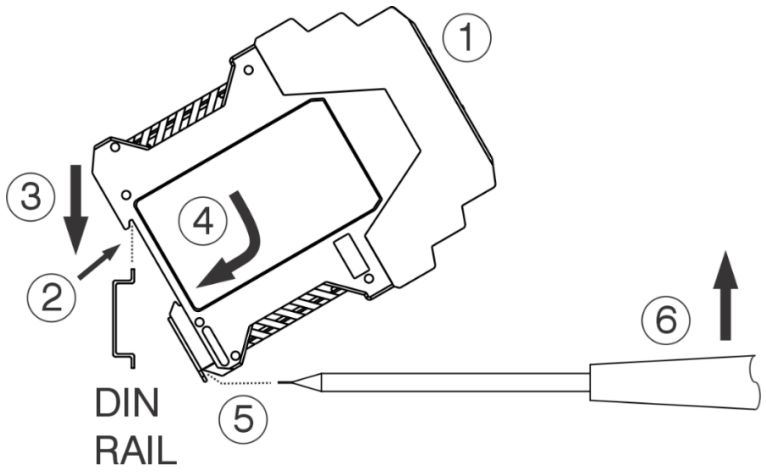


Figure 5: PWRM10-01 Installation and Removal from a DIN Rail

To remove a module:

5. Insert a flat blade screwdriver into the slot in the metal clip
6. Lift the screwdriver to pull back the clip and release the module from the rail

### 6.2 PWRM20-01

## ATTENTION

Read, understand, and follow all instructions in this manual and MA1068 PWRM10 & PWRM20-01 Hardware User Manual including all warnings, cautions, and precautions before installing and using the product.

## CAUTION – RISK OF ELECTRICAL SHOCK

When installing and operating the PWRM20-01 module, there is a potential shock hazard from dangerous high voltage. Ensure systems are de-energized before installing the product or removing the terminal blocks.

The PWRM20-01 module mounts on 35mm DIN rails that are elevated or flush on panels. They require no tools or hardware for insertion into a system and only a simple flat blade screwdriver for removal from a system.

To install a module:

1. Orient the module with the metal latch down and the Ethernet jack away from the DIN rail
2. Align the module DIN rail capture with the top edge of the rail
3. Slide the module down until the module engages the rail
4. Rotate the module and snap in place

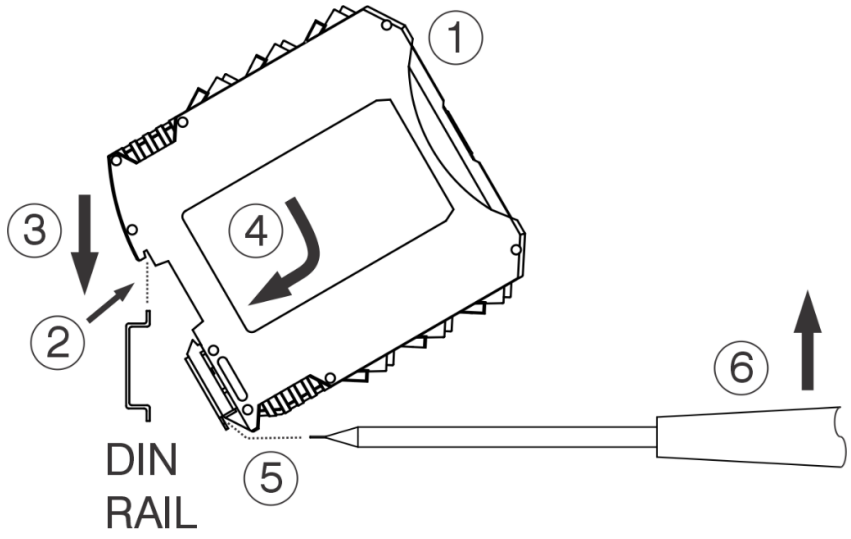


Figure 6: PWRM20-01 Installation and Removal from a DIN Rail

To remove a module:

5. Insert a flat blade screwdriver into the slot in the metal clip
6. Lift the screwdriver to pull back the clip and release the module from the rail

# 7.0 LED Indicators

## 7.1 PWRM10-01

Six LEDs on the PWRM10-01 front panel indicate power, operation, communication, and alarm status.

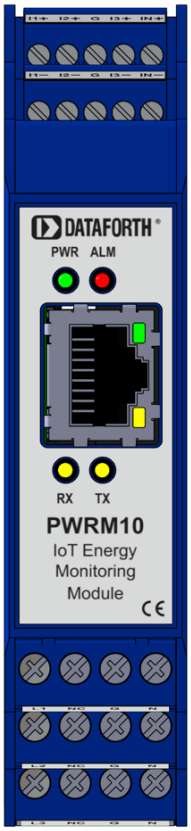


Figure 7: PWRM10-01 LEDs

| **PWR (Power)** | **GREEN LED** |
|---|---|
| Normal Operation: | LED blinking at 1 second interval<br>The module has power, and the internal processor is operating |
| Fault: | LED off |
| Troubleshooting: | Check connections to the phase voltages |
| Alternate Function: | Use the Web Interface Tool or the HTTP API to send the *Locate* command to the module. This blinks the PWR LED at a rate of 10Hz for 10 seconds. When a system is comprised of multiple modules, this feature is useful to identify which module the host computer is communicating with.<br>See MA1067_PWRM10-01 & PWRM20-01 HTTP API User Manual **Tools \| Controls** page for details. |

**ALM (Alarm)** **RED LED**

Normal Operation: LED off

Alarm Condition 1: LED blinking twice at a 2Hz rate
A user defined Event has occurred – a parameter has exceeded a set limit

Alarm Condition 2: LED On
Module Self-Test has failed. This test is performed at module power-on, or when a *SystemRestart* command has been issued using the Web Interface Tool or the HTTP API.
See MA1067 PWRM10-01 & PWRM20-01 HTTP API User Manual
**Tools | Diagnostics** page for details.

Clearing: To clear an Alarm Condition – Use the Web Interface Tool or the HTTP API.
See MA1067 PWRM10-01 & PWRM20-01 HTTP API User Manual
**Data | Events** page for details.

**ACT (Activity)** **GREEN LED, Integrated in the RJ-45 Ethernet Connector**

Normal Operation: Blinking
Ethernet activity including communications with the PWRM10-01 and background activity on the network

Fault: Off
No activity on the connected network
Invalid network connection

Troubleshooting: Check network connection
Check cable integrity

**LNK (Link)** **YELLOW LED, Integrated in the RJ-45 Ethernet Connector**

Normal Operation: LED on
The PWRM10-01 is connected to a network

Fault: LED off
Invalid network connection

Troubleshooting: Check network connection
Check cable integrity

**RX (Receive)** **YELLOW LED**

Normal Operation: LED blinking
A Discovery Protocol command or HTTP API request has been directed at the module

LED off
No active communication with the module

Fault: LED off when commands are sent to the module
Invalid network connection
Incorrect IP address

| | |
|---|---|
| Troubleshooting: | Check network connection<br>Verify network configuration settings using the Web Interface Tool or the HTTP API. See MA1067 PWRM10-01 & PWRM20-01 HTTP API User Manual **Configuration \| Network** page for details. |

**TX (Transmit) YELLOW LED**

| | |
|---|---|
| Normal Operation: | LED blinking<br>A Discovery Protocol command or HTTP API response has been sent from the module<br><br>LED off<br>No active communication with the module |
| Fault: | LED off when commands are sent to the module<br>Invalid network connection<br>Incorrect IP address |
| Troubleshooting: | Check network connection<br>Verify network configuration settings using the Web Interface Tool or the HTTP API. See MA1067 PWRM10-01 & PWRM20-01 HTTP API User Manual **Configuration \| Network** page for details. |

## 7.2 PWRM20-01

Four LEDs on the PWRM20-01 front panel indicate power, operation, communication, and alarm status.

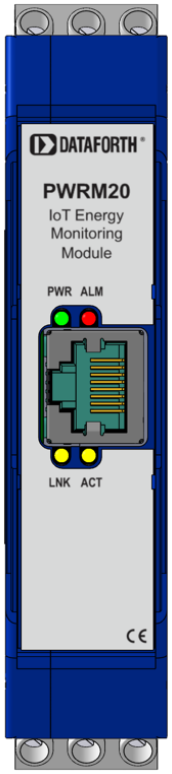


Figure 8: PWRM20-01 LEDs

**PWR (Power)** **GREEN LED**

Normal Operation: LED blinking at 1 second interval
The module has power, and the internal processor is operating

Fault: LED off

Troubleshooting: Check connections to the phase voltages

Alternate Function: Use the Web Interface Tool or the HTTP API to send the *Locate* command to the module. This blinks the PWR LED at a rate of 10Hz for 10 seconds. When a system is comprised of multiple modules, this feature is useful to identify which module the host computer is communicating with.
See MA1067 PWRM10-01 & PWRM20-01 HTTP API User Manual and the **Tools | Controls** page for details.

**ALM (Alarm)** **RED LED**

Normal Operation: LED off

Alarm Condition 1: LED blinking twice at a 2Hz rate
A user defined Event has occurred – a parameter has exceeded a set limit

Alarm Condition 2: LED On
Module Self-Test has failed. This test is performed at module power-on, or when a *SystemRestart* command has been issued using the Web Interface Tool or the HTTP API.
See MA1067 PWRM10-01 & PWRM20-01 HTTP API User Manual **Tools | Diagnostics** page for details.

Clearing: To clear an Alarm Condition – Use the Web Interface Tool or the HTTP API.
See MA1067 PWRM10-01 & PWRM20-01 HTTP API User Manual **Data | Events** page for details.

**ACT (Activity)** **YELLOW LED**

Normal Operation: LED blinking
Ethernet activity including communications with the PWRM20-01 and background activity on the network

Fault: LED off
No activity on the connected network
Invalid network connection

Troubleshooting: Check network connection
Check cable integrity
Verify network configuration settings using the Web Interface Tool or the HTTP API. See MA1067 PWRM10-01 & PWRM20-01 HTTP API User Manual **Configuration | Network** page for details.

| LNK (Link) | YELLOW LED |
|---|---|
| Normal Operation: | LED on<br>The PWRM20-01 is connected to a network |
| Fault: | LED off<br>Invalid network connection |
| Troubleshooting: | Check network connection<br>Check cable integrity |

## 8.0 Phase Voltage and Phase Current Sensors

Several common technologies can be used to interface phase voltages and phase currents to the PWRM10-01 and PWRM20-01 modules.

### 8.1 Voltage Transformers

The PWRM10-01 module interfaces to phase voltages of 85 – 265VAC, 50/60Hz and is self-powered from any of the three phases. For higher voltage systems, the PWRM20-01 module interfaces to phase voltages of 85 – 525VAC, 50/60Hz and is self-powered from any of the three phases. Both modules can interface to higher phase voltages with the use of Voltage Transformers (VT) and scaling configured in the module.

Voltage Transformers are also referred to as Potential Transformers (PT). These can be connected to phase voltages to step down the voltages to levels compliant with the input ratings of the PWRM10-01 or PWRM20-01 module. The high input impedance and low power consumption of the PWRM modules, along with the characteristics of a VT, result in a negligible load to the phase voltage being measured. The primary to secondary voltage ratio and phase relationship of the VT produce an accurate secondary signal that can be used for monitoring.

**ATTENTION**

Read, understand, and follow all instructions in this manual including all warnings, cautions, and precautions before installing and using the product.

**CAUTION – RISK OF ELECTRICAL SHOCK**

When installing and operating the PWRM10-01 and PWRM20-01 modules, there is a potential shock hazard from dangerous high voltage. Ensure systems are de-energized before installing the product or removing the terminal blocks.

In the following example, a PT with secondary Line-to-Neutral voltage of 120VAC and a step-down ratio of 4800:120 = 40 is used to connect the PWRM10-01 or PWRM20-01 to a utility voltage of 4800VAC. 120VAC is compatible with both modules.

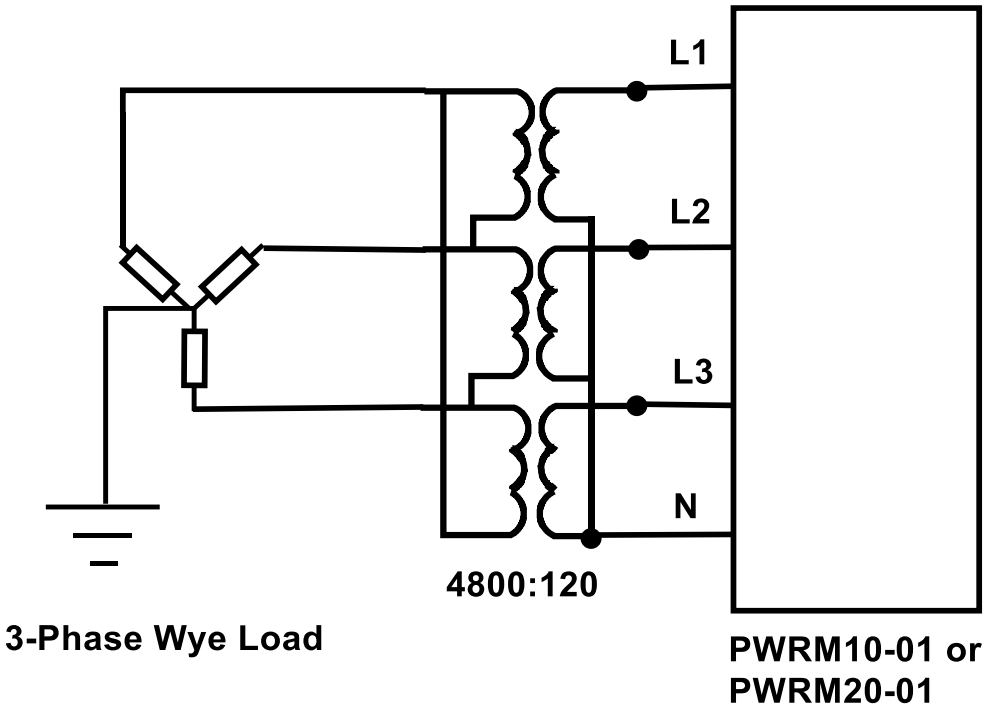


Figure 9: Connection of PWRM Modules to High Voltage Utility Service using a Voltage Transformer

Use the Web Interface Tool **Configuration | Sensor** page or the HTTP API to enable voltage transformer interface to a polyphase system and to specify the step-down ratio.

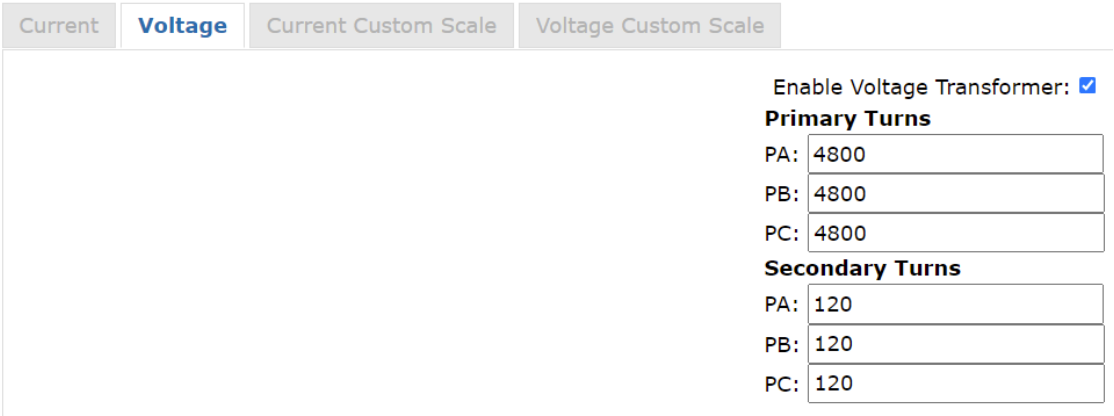


Figure 10: Voltage Transformer Sensor Configuration

## 8.2 Current Sensors

PWRM10-01 and PWRM20-01 modules can be configured to use one of three types of AC sensors commonly used to measure phase currents directly or indirectly. The choice of which sensor to use is based on application requirements.

### 8.2.1 Shunts

Advantages

- Low cost
- Linear

Disadvantages

- Must be installed in-line with phase wiring
- Non-isolated
- Inductive
- Limited ability to measure high currents

**ATTENTION**

Read, understand, and follow all instructions in this manual including all warnings, cautions, and precautions before installing and using the product.

**CAUTION – RISK OF ELECTRICAL SHOCK**

When installing and operating the PWRM10-01 and PWRM20-01 modules, there is a potential shock hazard from dangerous high voltage. Ensure systems are de-energized before installing the product or removing the terminal blocks.

The PWRM10-01 and PWRM20-01 modules have a full-scale input range of 0.333VAC for measuring phase currents. When selecting a shunt, the resistance must be chosen such that maximum phase current does not exceed this value.

In the following example, in-line shunts are used to measure phase currents. The load draws a nominal current of 20A. A shunt with 10milli-ohm resistance was selected to produce a nominal signal of 20A * 0.01Ohms = 0.200A. This is within the module 0.333VAC limit and leaves margin for higher current demands. Similar connections and sensor selection are used if Neutral current is to be measured.

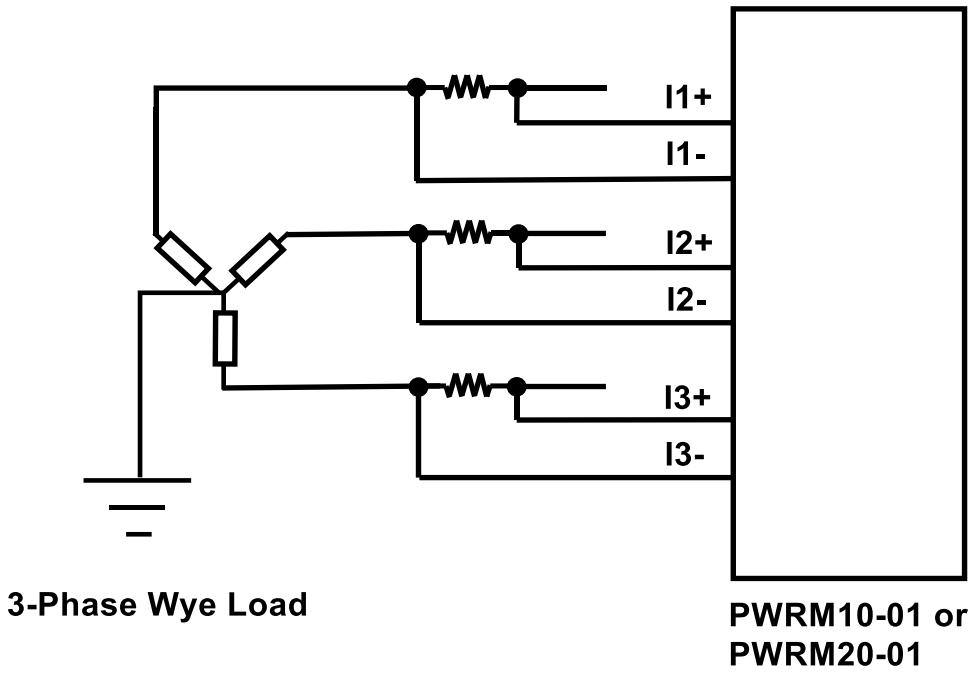


Figure 11: Measuring Phase Currents with Shunts

Use the Web Interface Tool **Configuration | Sensor** page or the HTTP API to specify that shunts are used to measure phase currents and to enter the shunt resistance value from the manufacturer datasheet.

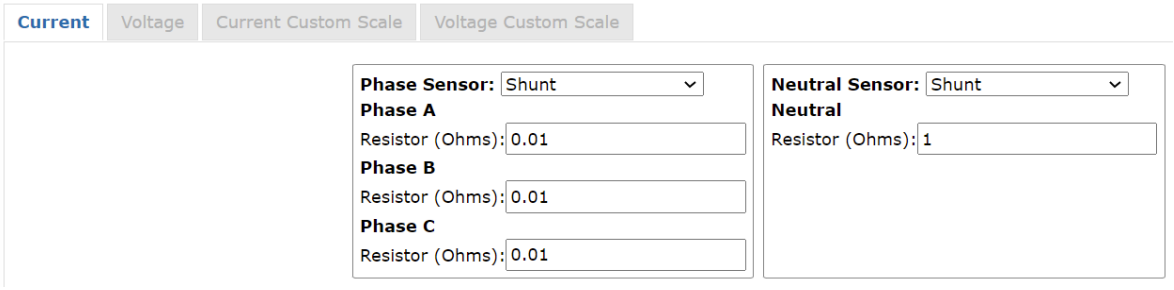


Figure 12: Shunt Sensor Configuration for Phase Current Measurement

Different sensor types can be used to measure phase currents and neutral current, but the same sensor type must be used on all 3 phases.

### 8.2.2 Current Transformers

Advantages

- Isolated, non-contact measurement – route phase wiring through solid core devices
- Isolated, non-contact measurement – clamp split-core devices onto phase wiring
- Accurate measurement at high current

Disadvantages

- DC signal component can saturate the core and cause hysteresis effects
- Can introduce phase shift which requires compensation
- Susceptible to environmental magnetic fields

## ATTENTION

Read, understand, and follow all instructions in this manual including all warnings, cautions, and precautions before installing and using the product.

## CAUTION – RISK OF ELECTRICAL SHOCK

When installing and operating the PWRM10-01 and PWRM20-01 modules, there is a potential shock hazard from dangerous high voltage. Ensure systems are de-energized before installing the product or removing the terminal blocks.

When using current transformers, polarity is important during the installation. Observe markings for Source Face or current direction and consult the sensor manufacturer datasheet.

In the following example, current transformers are used to measure phase currents. The load draws a nominal current of 50A so a device was selected with an internal burden resistor and a characteristic of 0.333VAC output for 100A input. Lines run through the sensors once. Multiple loops can be made through the CTs to increase measurement sensitivity. Similar connections, sensor choice, and scaling are used if Neutral current is to be measured.

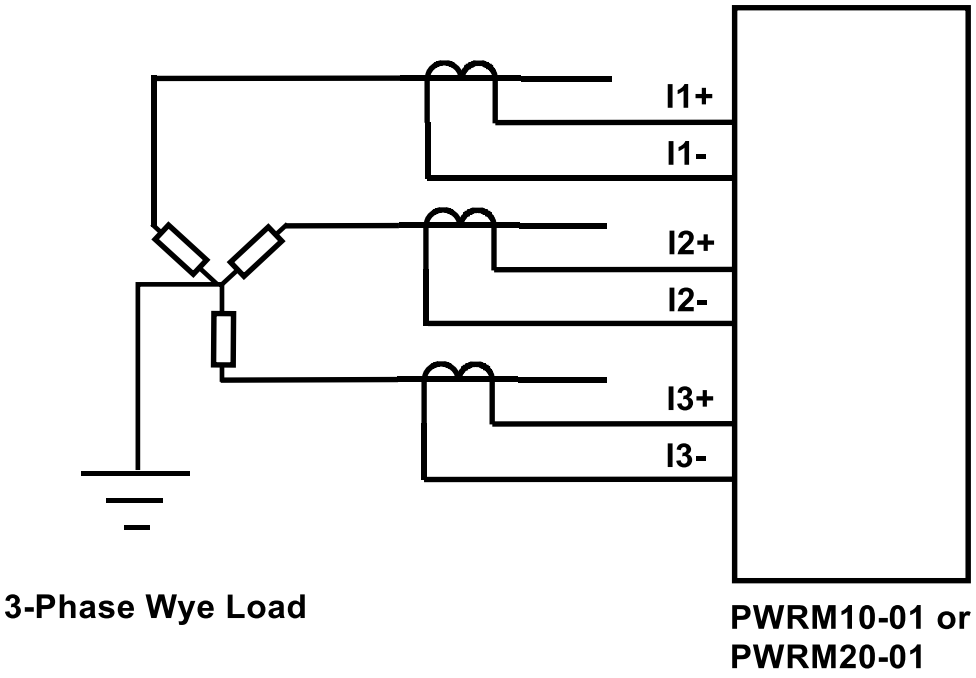


Figure 13: Measuring Phase Currents with Current Transformers

Use the Web Interface Tool **Configuration | Sensor** page or the HTTP API to specify that current transformers are used to measure phase currents and to enter the sensor parameters from the manufacturer datasheet as well as the application wiring.

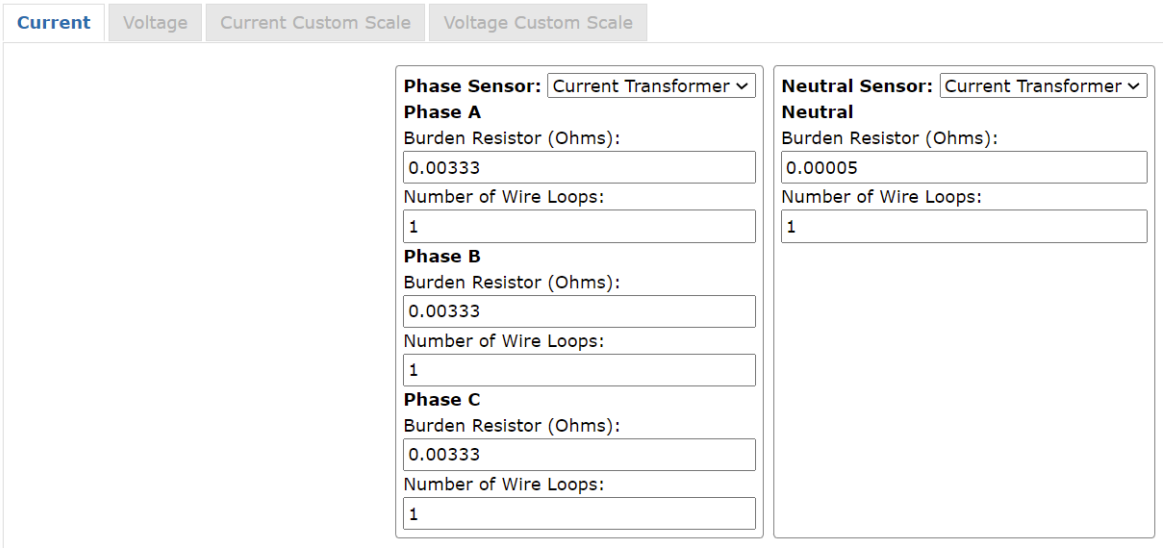


Figure14: Shunt Sensor Configuration for Phase Current Measurement

Different sensor types can be used to measure phase currents and neutral current, but the same sensor type must be used on all 3 phases.

### 8.2.3 Rogowski Coils

Advantages

- Non-contact measurement – clamp devices onto phase wiring
- Wide measurement range from milliamps to kiloamps
- Does not saturate
- Immune to DC effects

Disadvantages

- Output requires an integrator*
- Accuracy is dependent on the positioning of the sensor on phase wiring
- Susceptible to environmental magnetic fields

*PWRM10-01 and PWRM20-01 modules have an internal integrator which is automatically enabled when a Rogowski Coil is selected as the sensor used to measure phase current.

## ATTENTION

Read, understand, and follow all instructions in this manual including all warnings, cautions, and precautions before installing and using the product.

## CAUTION – RISK OF ELECTRICAL SHOCK

When installing and operating the PWRM10-01 and PWRM20-01 modules, there is a potential shock hazard from dangerous high voltage. Ensure systems are de-energized before installing the product or removing the terminal blocks.

When using Rogowski coils, placement of the wire within the coil affects measurement accuracy. Consult the sensor Manufacturer's datasheet.

The output of a Rogowski coil must be measured with an integrator to obtain correct measurements. The PWRM10-01 and PWRM20-01 modules have an integrator in the signal path which is automatically enabled when a Rogowski coil is chosen as the phase current sensor.

In the following example, Rogowski coils are used to measure phase currents. The load draws a nominal current of 50A and the device selected has a characteristic of 600mV output for 1000A input at 60Hz. Similar connections, sensor choice, and scaling are used if Neutral current is to be measured.

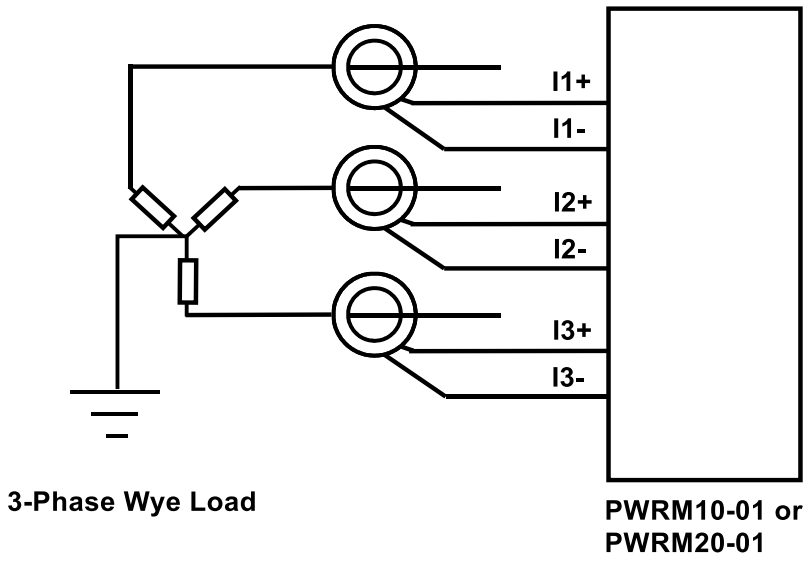


Figure 15: Measuring Phase Currents with Rogowski Coils

Use the Web Interface Tool **Configuration | Sensor** page or the HTTP API to specify that Rogowski coils are used to measure phase currents and to enter the sensor parameters from the manufacturer datasheet.

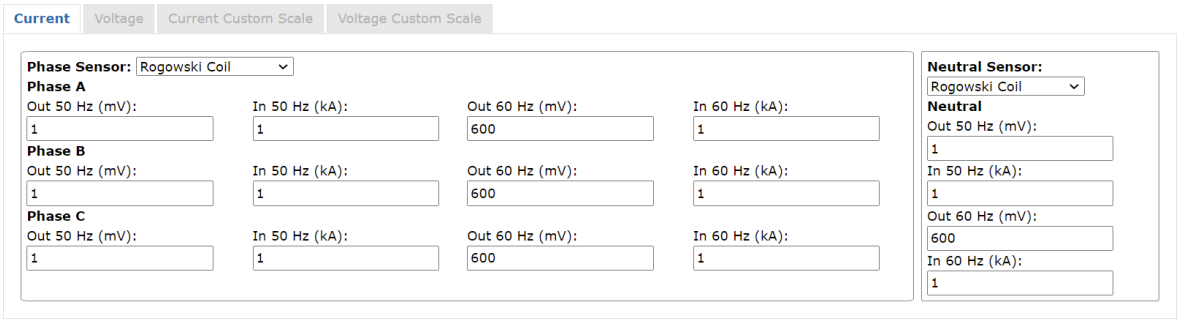


Figure15: Rogowski Coil Sensor Configuration for Phase Current Measurement

Coils may be specified for 50Hz or 60Hz line frequencies. Enter the values appropriate for the application. Use the Web Interface Tool **Configuration | Data** page or the HTTP API to select the line frequency of the polyphase system.

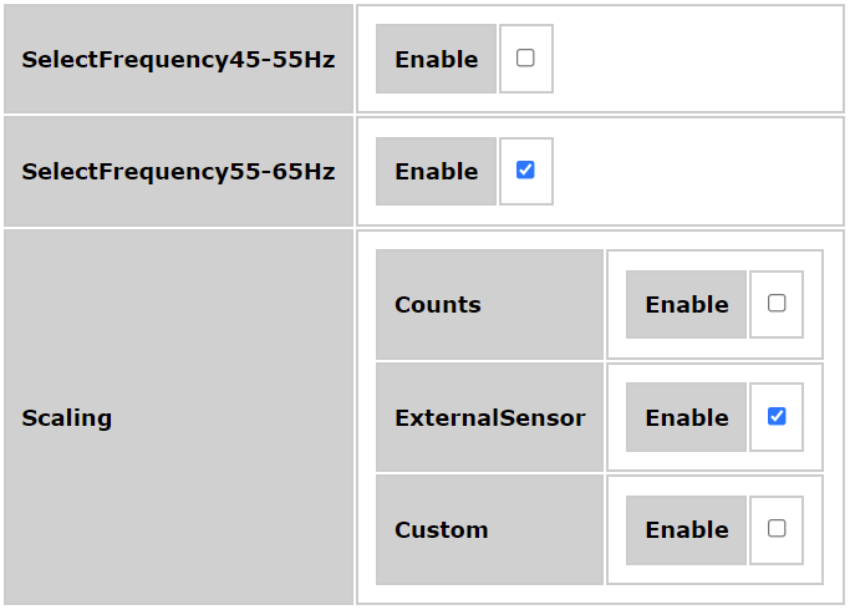


Figure16: System Line Frequency Configuration

Different sensor types can be used to measure phase currents and neutral current, but the same sensor type must be used on all 3 phases.

## 9.0 Wiring Connections for a 3-Phase 4-Wire Wye System

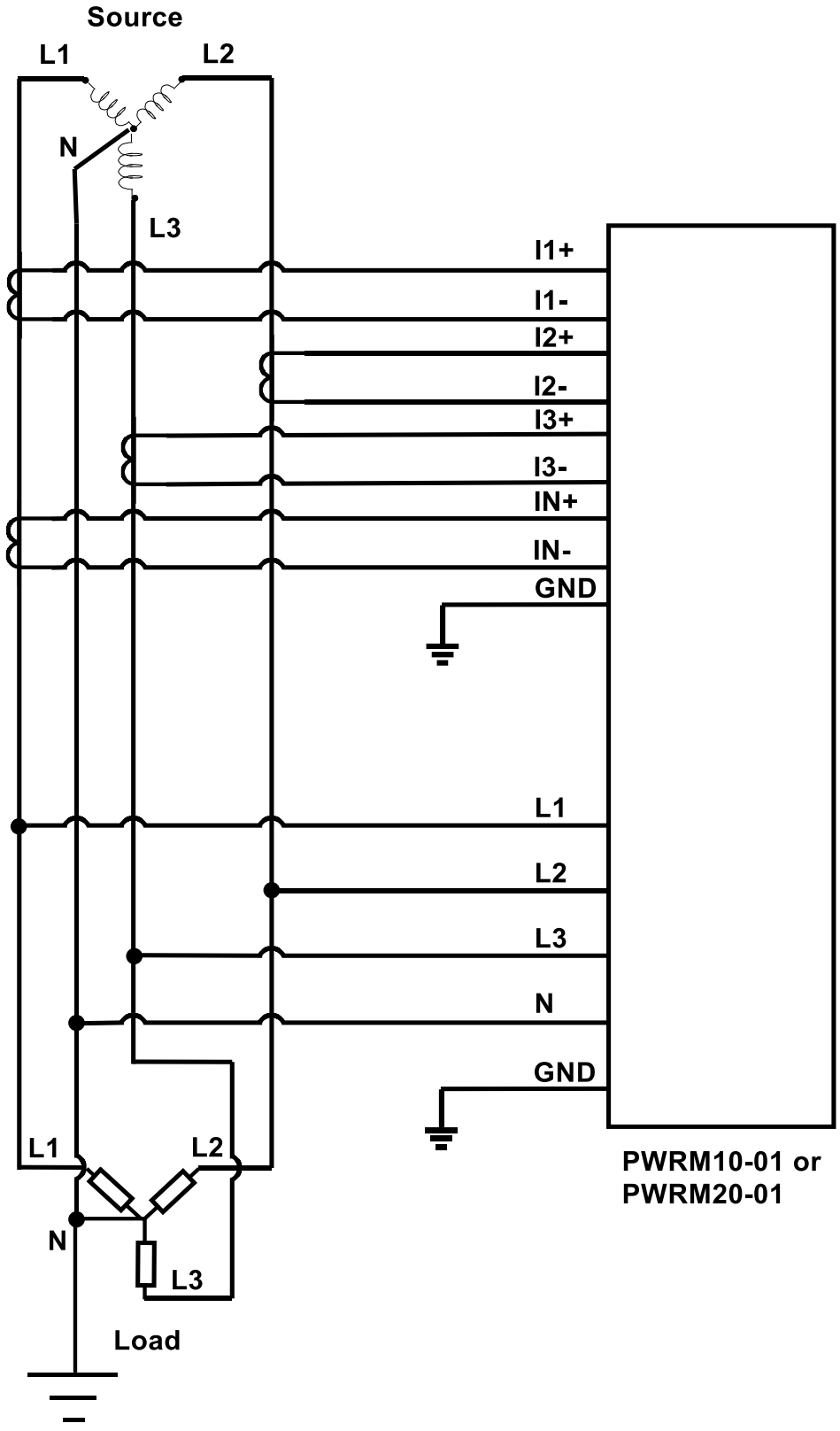


Figure17: 3-Phase 4-Wire Wye Connection

## 10.0 Wiring Connections for a 3-Phase 3-Wire Delta System

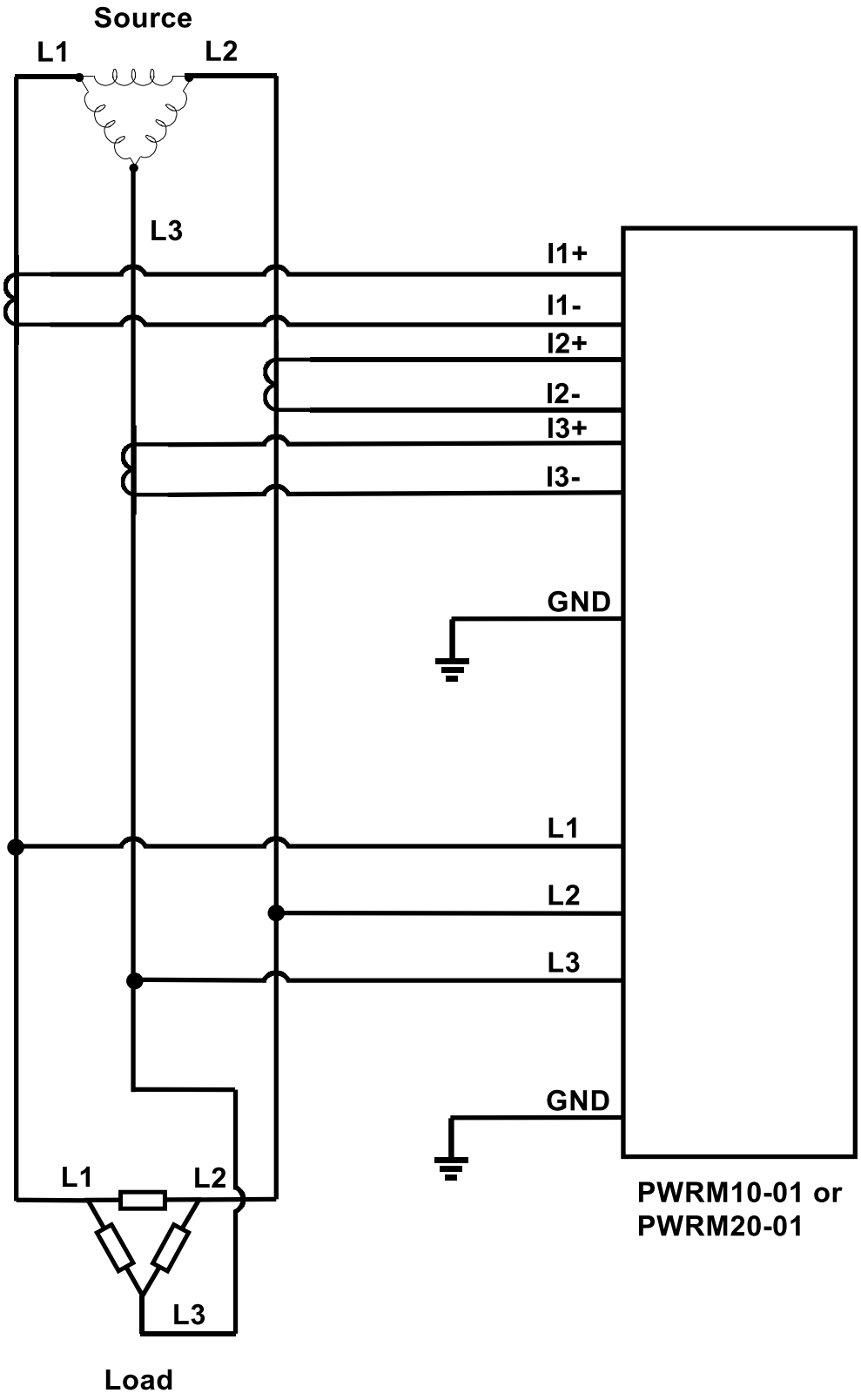


Figure18: 3-Phase 3-Wire Delta Connection

## Standard Terms and Conditions of Sale Applying to Products Sold by Dataforth Corporation

Full details on Terms and Conditions of Sale, including Warranty, are found on the Dataforth website at Dataforth Terms and Conditions of Sale

## Application Support

Dataforth provides timely, high-quality product support.

| Contact Method | Contact Information |
|---|---|
| **E-Mail:** Technical Support | support@dataforth.com |
| **Website:** | www.dataforth.com |
| **Phone:** | +1-520-741-1404 and toll free US +1-800-444-7644 |
| **Fax:** | +1-520-741-0762 |
| **Mail:** | Dataforth Corporation<br>3331 E. Hemisphere Loop<br>Tucson, AZ 85706 USA |

## Returns/Repair Policy

All warranty and repair requests should be directed to the Dataforth Customer Service Department.

Return Material Authorization instructions and form are found on the Dataforth website at RMA Instructions and Form.



**PWRM10 & PWRM20 Hardware User Manual**
**MA1068 Rev. A – May 2022**

**ISO 9001:2015 Registered QMS**