



## **Powermonitor 3000 Master Module**

Catalog Numbers 1404-M4, 1404-M5, 1404-M6, 1404-M8

<b>Topic</b>	<b>Page</b>
Important User Information	2
About This Publication	3
Safety Considerations	4
About Power Monitor	6
Catalog Number Explanation	10
Quick Start Guidelines	10
Install the Powermonitor 3000 Unit	12
Interpret the LED Indicators	47
Specifications	57
Additional Resources	62

## Important User Information

Solid state equipment has operational characteristics differing from those of electromechanical equipment. Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls (publication SGI-1.1 available from your local Rockwell Automation sales office or online at <http://literature.rockwellautomation.com>) describes some important differences between solid state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

No patent liability is assumed by Rockwell Automation, Inc. with respect to use of information, circuits, equipment, or software described in this manual.

Reproduction of the contents of this manual, in whole or in part, without written permission of Rockwell Automation, Inc., is prohibited.

Throughout this manual, when necessary, we use notes to make you aware of safety considerations.

<p><b>WARNING</b></p> 	<p>Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.</p>
<p><b>IMPORTANT</b></p>	<p>Identifies information that is critical for successful application and understanding of the product.</p>
<p><b>ATTENTION</b></p> 	<p>Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you to identify a hazard, avoid a hazard, and recognize the consequences.</p>
<p><b>SHOCK HAZARD</b></p> 	<p>Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.</p>
<p><b>BURN HAZARD</b></p> 	<p>Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.</p>

## About This Publication

These installation instructions do not contain the following information. Except as noted, refer to the Powermonitor 3000 Unit User Manual, publication 1404-UM001, for detailed information on the topics in this list.

- Information on metering functionality and measurements
- Use of the display module for configuration, monitoring and commands
- Discussion of communication options, functionality, configuration, and operation
- Setpoint configuration and operation
- Discrete I/O configuration and operation
- Data logging including Event Log, Trend Log, Min/Max Log, and Load Factor Log
- Advanced features including Oscillography, Harmonic Analysis, and Transient Detection
- Powermonitor 3000 data tables
- Sample ladder diagrams for communicating with the Powermonitor 3000 unit using various communication options
- Display Module Installation Instructions, publication 1404-IN005

This manual does not provide information on functionality found in the Powermonitor 3000 master module, firmware revisions 3.0 and earlier, or Ethernet series A, all firmware revisions, or Ethernet series B firmware revisions 2.0 earlier. Please refer to publications 1404-IN007D-EN-P and 1404-UM001D-EN-P, available as downloads from <http://www.rockwellautomation.com>.

## Terms and Conventions

In this manual, the following terms and conventions are used.

Abbreviation	Term
AWG	American Wire Gauge
CSA	Canadian Standards Association
CT	Current Transformer
DM	Display Module
EMI	Electromagnetic Interference
ID	Identification
IEC	International Electrotechnical Commission

Abbreviation	Term
LED	Light Emitting Diode
NEMA	National Electrical Manufacturers Association
PLC	Programmable Logic Controller
PT	Potential Transformer (Also known as VT in some countries)
RAM	Random Access Memory
RFI	Radio Frequency Interference
R I/O	Remote Input/Output
RMS	Root-mean-square
SLC	Small Logic Controller
SPDT	Single Pole Double Throw
UL	Underwriters Laboratories
VA	Volt-ampere
VAR	Volt-ampere Reactive
CIP	Control and Information Protocol
NAP	Network Access Port

## Safety Considerations

---

### ATTENTION



Only qualified personnel, following accepted safety procedures, should install, wire, and service the Powermonitor 3000 unit and its associated components. Before beginning any work, disconnect all sources of power and verify that they are de-energized and locked out. Failure to follow these instructions may result in personal injury or death, property damage, or economic loss.

---

### ATTENTION



Never open a current transformer (CT) secondary circuit with primary current applied. Wiring between the CTs and the Powermonitor 3000 unit should include a shorting terminal block in the CT secondary circuit. Shorting the secondary with primary current present allows other connections to be removed if needed. An open CT secondary with primary current applied produces a hazardous voltage, which can lead to personal injury, death, property damage, or economic loss.

---

**IMPORTANT**

The Powermonitor 3000 unit is not designed for nor intended for use as a circuit protective device. Do not use this equipment in place of a motor overload relay or circuit protective relay.

---

**IMPORTANT**

The relay output contacts and solid-state KYZ output contacts on the Powermonitor 3000 unit may be used to control other devices through setpoint control or communication. The response of these outputs to a communication failure is configurable by the user.

Refer to publication 1404-UM001 for information on configuring the outputs.

Be sure to evaluate the safety impact of the output configuration on your plant or process.

---

**ATTENTION**

Electrostatic discharge can damage integrated circuits or semiconductors. Follow these guidelines when you handle the module.

- Touch a grounded object to discharge static potential.
  - Wear an approved wrist strap-grounding device.
  - Do not open the module or attempt to service internal components.
  - Use a static safe workstation, if available.
  - Keep the module in its static shield bag when not in use.
-

## About Power Monitor

The Bulletin 1404 Powermonitor 3000 unit is uniquely designed and developed to meet the needs of both producers and users of electric power. A power monitor system consists of:

- master module that provides metering and native RS-485 communication.
- optional display module for configuration, commands, and data display.
- optional communication port to serve data to other devices using a choice of networks.
- optional external devices and applications that display and utilize data for reporting, control, and management of power and energy usage.

The Powermonitor 3000 unit is a microprocessor-based monitoring and control device ideally suited for a variety of applications including these:

- Load Profiling - Using the configurable trending utility to log power parameters such as real power, apparent power, and demand, for analysis of power usage by loads over time.
- Demand Management - Understanding when and why demand charges occur lets you make informed decisions that reduce your electrical power costs.
- Cost Allocation - Knowing your actual energy costs promotes manufacturing efficiencies.
- Distribution System Monitoring - Using power parameters to show power flow, system topology, and distribution equipment status.
- Emergency Load Shedding - Monitoring power usage to preserve system stability in the event of sudden utility outage.
- Power System Control - Managing system voltage, harmonic distortion, and power factor.

The power monitor is a sophisticated modern alternative for traditional electro-mechanical metering devices. A single power monitor can replace many individual transducers and meters. The power monitor provides you with easy to understand, accurate information in a compact economical package.

## Powermonitor 3000 Master Module

The master module contains the main microprocessor-based monitoring functions, including terminations for power system connections, status inputs, control outputs, a native RS-485 communication port, and a port for the display module.

## *Configuration*

Although the power monitor ships from the factory with default settings, you need to configure it for your particular requirements. You may configure the power monitor using the optional display module. Alternately, you may use an external device or application to write configuration, operational parameters and commands to the master module through its native or optional communication port.

Refer to the Powermonitor 3000 User Manual, publication 1404-UM001, for additional detail.

Optional external applications that you may use for power monitor configuration include RSPower, RSPowerPlus, and RSEnergyMetrix software operating on a personal computer. Contact your local Rockwell Automation sales office or distributor, or visit <http://www.software.rockwell.com/> for more information on available software packages.

## *Communication*

Every Powermonitor 3000 unit comes with a native RS-485 communication port. The native port is suitable for communicating to devices including:

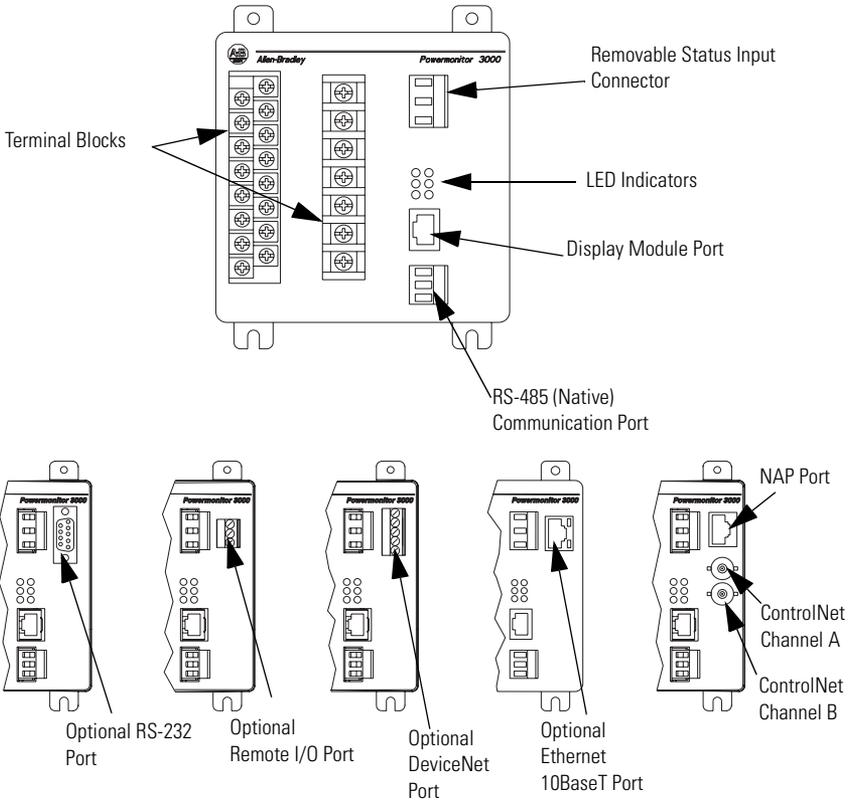
- PLC-5, SLC 500, and ControlLogix processors.
- RSLinx software with DDE/OPC server functionality.
- Modbus RTU Master devices.
- other third-party devices.
- software that you develop.

You may also specify Powermonitor 3000 units with optional communication ports including:

- serial RS-232.
- remote I/O.
- DeviceNet.
- EtherNet/IP.
- ControlNet.

A power monitor may be easily integrated into a programmable controller or computer-based control and monitoring system, using any of the communication methods listed above.

### Master Module with Communication Options



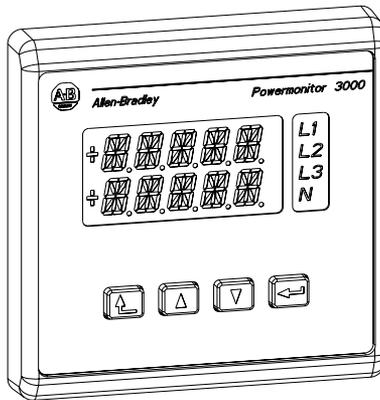
## Powermonitor 3000 Display Module

The display module is an optional user-interface device. The display module provides the most economical and simplest method for setting up and configuring the master module for operation.

The display module has a highly visible, two-line LED display and four operator buttons with tactile feedback. Use the buttons and display to navigate through a series of menus for configuration, commands and data display.

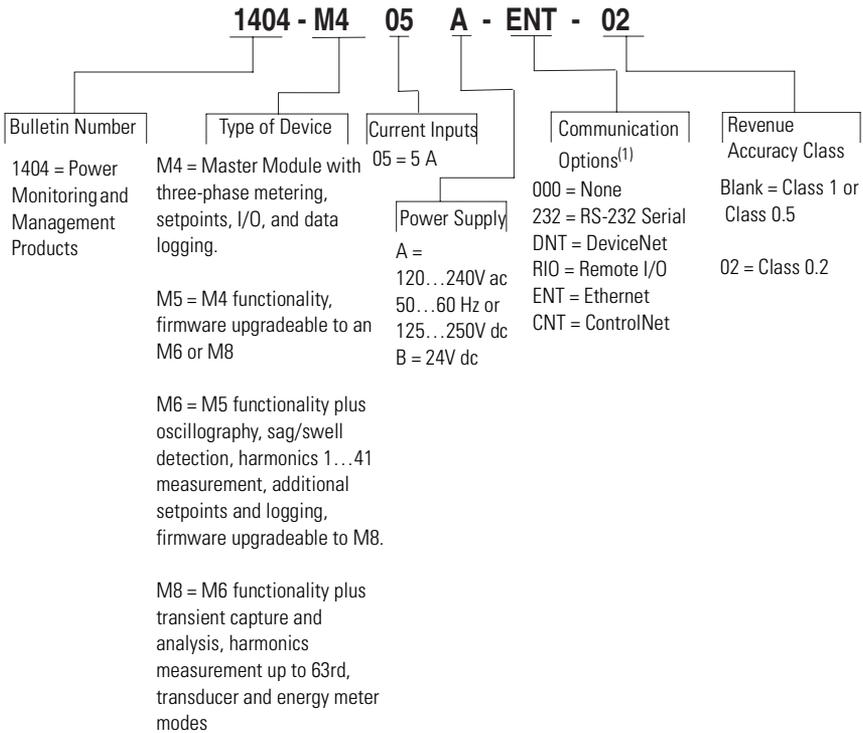
The display module is shipped with a 3 m (10 ft) long, shielded 4-pair cable that provides power and serial communication between the master module and the display module. The display module fits into a standard ANSI four inch analog meter cutout for panel mounting. Only one display module may be connected to a master module, although you may use one display module to configure and monitor any number of master modules; one at a time.

### Display Module



## Catalog Number Explanation

The Powermonitor 3000 unit has the following catalog number possibilities.



<sup>(1)</sup> In addition to Native RS-485 port.

## Quick Start Guidelines

The Powermonitor 3000 unit may be used in many electric power monitoring and control systems. Whether your power monitor is a complete power and energy monitor or a component in a plant- or enterprise-wide energy management system, there are a few basic steps to follow to make your unit operational.

1. Install your Powermonitor 3000 master module within a suitable enclosure.  
Refer to Install the Powermonitor 3000 Unit on page 12.

2. Install your optional display module.

Refer to the Bulletin 1404 Display Module Installation Instructions, publication 1404-IN005.

3. Determine your wiring mode and install wiring between the power monitor and your power system.
4. Connect control power wiring, preferably from a separate source of control power.
5. If used, connect wiring to the status inputs, Form C control relay, and KYZ solid-state outputs.  
Refer to Wiring and Connecting the Power Monitor on page 18.
6. Configure the potential transformer (PT) and current transformer (CT) ratios to match those used in your power system connections.
7. Configure the Voltage mode of the power monitor to match your power system configuration.
8. Configure power monitor communication.  
This step varies depending upon the communication option you have selected.
9. Configure the power monitor date and time.
10. Configure other optional performance features such as setpoint control and data logging.

Refer to the Powermonitor 3000 User Manual, publication 1404-UM001, for complete information on configuring and operating your power monitor.

## Install the Powermonitor 3000 Unit

Only qualified personnel should install, wire, service, and maintain this equipment. Refer to and follow the safety guidelines and pay attention to all warnings and notices in these instructions.

---

### ATTENTION



Electrostatic discharge can damage integrated circuits or semiconductors. Follow these guidelines when you handle the module.

- Touch a grounded object to discharge static potential.
  - Wear an approved wrist strap grounding device.
  - Do not open the module or attempt to service internal components.
  - Use a static safe work station, if available.
  - Keep the module in its static shield bag when not in use.
- 

See Product Dimensions on page 14 for mounting hole dimensions.

Mount the master module with four (4) No. 8-32 UNC or M4 screws with flat washers and lock washers.

## Mounting Consideration

Mount the Powermonitor 3000 master module in a suitable protective enclosure. Select an enclosure that protects the master module from atmospheric contaminants such as oil, water, moisture, dust corrosive vapors and other harmful airborne substances. The enclosure should also protect against personnel contact with energized circuits.

The ambient temperature within the enclosure must remain within the limits listed in the Specifications, page 57.

Select an enclosure that provides adequate clearance for ventilation and wiring for the power monitor and other equipment to be installed within the enclosure.

See Product Dimensions on page 14 for dimensions and spacing guidelines for the power monitor.

When installed within a substation or switchgear lineup, we recommend that the power monitor be mounted within a low-voltage cubicle, isolated from medium- and high-voltage circuits.

Mount the master module so that the metal grounding clips on the bottom of the mounting feet make direct contact with the enclosure mounting panel. If the mounting panel is painted, scrape or sand the paint down to bare metal. Use star washers to assure good long-term electrical contact with the mounting panel. Be sure that the mounting panel is properly connected to a low-impedance earth ground.

Mount the enclosure in a position that allows full access to the master module. Install the master module with the ventilation slots in the bottom and top of the unit unobstructed to assure adequate free convection cooling of its internal electronic components.

---

**IMPORTANT**

Use caution not to block the ventilation slots of the master module. All wiring and other obstructions must be a minimum of 50 mm (2.0 in.) from the top and bottom of the unit.

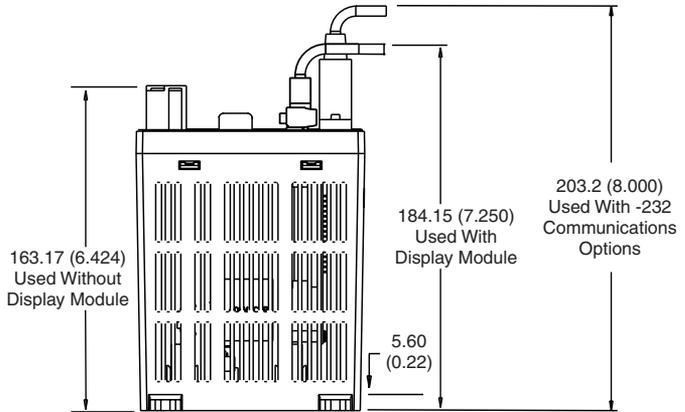
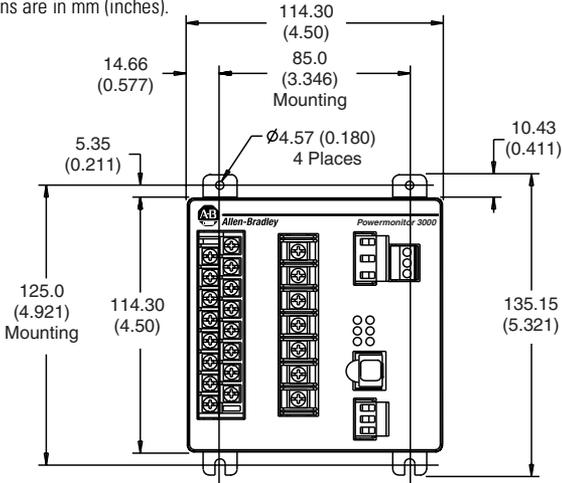
---

## Product Dimensions

Use the dimensions in these drawings when mounting the master module.

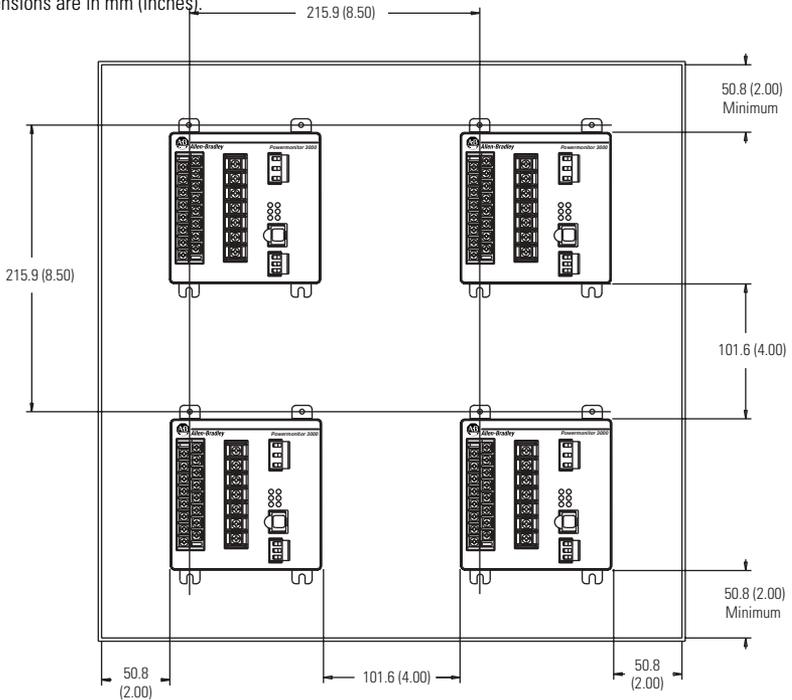
### Master Module Dimensions

All dimensions are in mm (inches).



## Master Module Spacing

All dimensions are in mm (inches).



### General Notes:

- Recommended spacing provides reasonable wiring clearance and ventilation.
- Maintain approximately 102 mm (4.00 in.) clearance between master modules and other electrical equipment.
- Do not block cooling vents. Wiring and other obstructions must be 50 mm (2.00 in.) minimum from top and bottom of unit.
- Mount with ventilation opening in top and bottom to provide optimum free convection cooling.
- Refer to Specification for ambient temperature requirements.

## System Accuracy Considerations

User-supplied potential transformers (PTs) and current transformers (CTs), as well as wiring from the CTs to the power monitor, may reduce the accuracy of your power monitor system. The quality of the power monitor's measurements can be no better than the quality of the signals presented to its input terminals. It is your responsibility to select transformers that are adequate for the desired metering accuracy.

ANSI/IEEE C57.13, Requirements for Instrument Transformers, defines three classes of transformer accuracy: class 1.2, class 0.6, and class 0.3. The application should dictate the transformer accuracy class used.

PTs and CTs may introduce errors in three areas: ratio errors, phase errors, and bandwidth errors.

### *Ratio Errors*

The voltage ratio of a PT is the number of primary turns of wire divided by the number of secondary turns. Manufacturing tolerances may cause the ratio to be slightly different than the design specifies, causing an error affecting the voltage input to the power monitor.

Likewise, the current ratio of a CT is a function of the ratio of the number of turns of wire on the primary and secondary. Some error in this ratio is quite common in commercial grade PTs and CTs.

Other errors include magnetic core losses, winding impedance, and the burden, or load, on the transformer secondary. The combination of these errors is known as Ratio Error. You may compensate for Ratio Error, if known, by adjusting the Basic Configuration entries for PT and CT primary or secondary voltages.

For a PT, the Ratio Error increases as the transformer's load current increases, so its total load impedance should be as high as possible. Conversely, a CT's Ratio Error increases as the voltage supported by the transformer secondary increases, so its total load impedance, including the impedance of the wire connecting the CTs to the metering device, should be as low as possible. This is why 4 mm<sup>2</sup> (12 AWG) or larger is usually recommended for wiring CTs with a 5 Amp secondary rating.

### *Phase Error*

Phase shift between the primary to secondary signals is another source of inaccuracy introduced by the user-supplied PTs and CTs. Phase shift is generally not of concern for simple voltage or current measurements. When these signals are combined, for instance when calculating line to line voltage or phase power, the effect of phase shift can become significant. The difference in phase error among different transformers causes measurement errors. If all the PTs and CTs introduced a 5° phase shift, there would be no error in the measured quantities. If on the other hand the PTs had a phase error of 1° and the CTs had a phase error of 6°, there would be a 5° phase error in the power calculation. This would show up as power factor and reactive power (VAR) errors. Phase errors cannot be corrected by adjusting the power monitor configuration since the errors change based on varying conditions of the power system.

A typical PT phase error varies from  $\pm 1^\circ \dots \pm 0.25^\circ$ , depending on the PT's accuracy class. Applying higher than rated voltage increases the phase error and may saturate the transformer and cause even larger errors.

The phase error in a CT increases as its current decreases, and is lowest when the current is greater than 80% of the CT rating. Because significant phase error can occur when CT current is less than 20% of rated current, CTs sized for protection do not perform well when used for metering.

The phase error of both PTs and CTs are also affected by the power factor of the load on the secondary. For best accuracy, loads should be resistive, with PT loads as high as possible and CT loads as low as possible.

### *Bandwidth Error*

For fundamental 50 or 60 Hz measurements, bandwidth error has no affect on accuracy. However, for waveforms with significant harmonic content, the PTs and CTs you supply may attenuate higher harmonics. Most instrument quality PTs have a flat frequency response out to 3 kHz, or the 50th harmonic on a 60 Hz system. Current transformers, especially older, existing units, tend to be less linear, with a flat response only out to 300 Hz, or the fifth (60 Hz) harmonic. Wide-band instrument CTs are available for improved frequency response. Bandwidth error cannot be corrected by adjusting the power monitor configuration.

In addition, operation of either the PTs or CTs at extremely low frequencies may also cause saturation and resulting magnitude and phase errors.

For more detailed information on instrument transformer accuracy and power measurement, refer to Bulletin 1403 Powermonitor II Tutorial, publication 1403-1.0.2.

## Wiring and Connecting the Power Monitor

### ATTENTION



Only qualified personnel, following accepted safety procedures, should install, wire, and service the power monitor and its associated components. Before beginning any work, disconnect all sources of power and verify that they are de-energized and locked out. Failure to follow these instructions may result in personal injury or death, property damage, or economic loss.

---

Wiring of the power monitor includes the following steps:

- Connection of voltage and current signals from PTs and CTs
- Connection of control power
- Connection of status inputs and status/control outputs
- Communication wiring

Follow these guidelines to help assure reliable, trouble-free operation of your power monitor.

- Install and connect all wiring. Use wire tags to identify connections. Bundle wiring neatly and maintain a minimum of 50 mm (2.0 in.) clearance from the master module ventilation slots to avoid a buildup of heat within the unit.
- Furnish and install properly-selected fuses for voltage signals and control power.
- Use 600 volt wiring rated at 75 °C (167 °F) or higher. We strongly recommend the use of flame-retardant wire rated VW-1 by Underwriters Laboratories.
- Use a shorting terminal block (you provide) for CT wiring, to permit servicing connected equipment, such as the Powermonitor 3000 master module, without de-energizing the power system.
- Use ring lugs or locking spade lugs for voltage and current connections to provide additional wiring security and safety.
- Pay careful attention to correct phasing and polarity for proper operation.
- Connect the master module to a low-impedance earth ground using its grounding terminal and a dedicated grounding wire at least as large as the largest current-carrying wire connected to the master module. Keep grounding wiring as short as possible. To obtain maximum EMI immunity, the master module mounting feet should make electrical contact with the mounting panel.

Refer to Mounting Consideration on page 12 for additional information.

- Connect all equipment ground terminals (master module, PT and CT secondary) to a single point, low-impedance earth ground

For information on wire sizes and types for grounding electrical equipment, refer to Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1, or the National Electric Code published by National Fire Protection Association (NFPA).

## Wiring the Master Module

Observe all wire lug sizes and screw torques for terminal blocks wire sizes and screw torques.

Refer to Specifications on page 57.

## Voltage and Current Inputs

The following sections give information on the selection of PTs and CTs.

### *Voltage Input and PT Selection*

The power monitor is designed to connect directly to a power system rated up to 600 Volts line-to-line (347 Volts line-to-neutral). Higher system voltages require the use of user-supplied PTs. Typical secondary voltage on a PT is 120V ac. Select the PT primary voltage to match the nominal voltage of your power system.

Connect short circuit protection, that you supply, between the power system and the power monitor. If PTs are used, install short circuit protection on the high-voltage side of the PTs.

### *Current Inputs and Current Transformer (CT) Selection*

The current input on the power monitor is designed for a 5 Amp nominal current signal. User-supplied CTs are required to connect your power system to the input of the power monitor. Select the CT primary current to match the nominal current of your power system.

---

**ATTENTION**

Never open a current-transformer secondary circuit with primary current applied. Wiring between the CTs and the power monitor should include a shorting terminal block in the CT secondary circuit. Shorting the secondary with primary current present allows other connections to be removed if needed. An open CT secondary with primary current applied produces a hazardous voltage, which can lead to personal injury, death, property damage, or economic loss.

---

The shorting terminal block should be located adjacent to the Powermonitor 3000 master module so that it is readily accessible should service be needed. Use 2.5 mm<sup>2</sup> (14 AWG) wire for the short run between the power monitor and the shorting terminal block. Use wiring of 4 mm<sup>2</sup> (12 AWG) or larger between the shorting terminal block and the CT so that the additional load of the wiring does not overload the CT and reduce its accuracy.

---

**IMPORTANT**

You may install either two or three CTs for any of the Delta or Open Delta wiring or voltage modes.

Refer to the wiring diagrams on pages 28, 30, and 33 for wiring of a two CT configuration.

Whether there are two or three CTs in a circuit does not affect the voltage wiring.

Refer to the Powermonitor 3000 Unit User Manual, publication 1404-UM001.

---

Do not install fuses or other overcurrent protection in the secondary circuit of a CT.

Refer to System Accuracy Considerations on page 16 for guidelines on PT and CT selection.

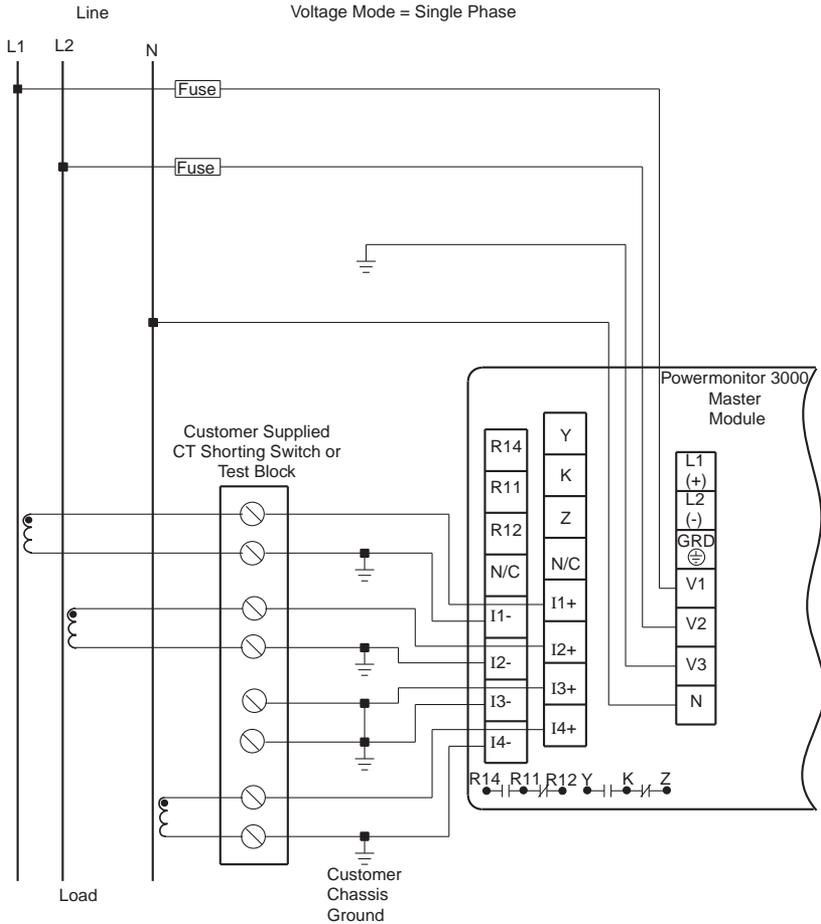
Refer to Technical Specifications on page 59 for information on voltage isolation levels and wire termination recommendations.

The wiring diagrams depict wiring methods for a variety of power system configurations. You need to configure your power monitor to match the power system configuration for correct operation.

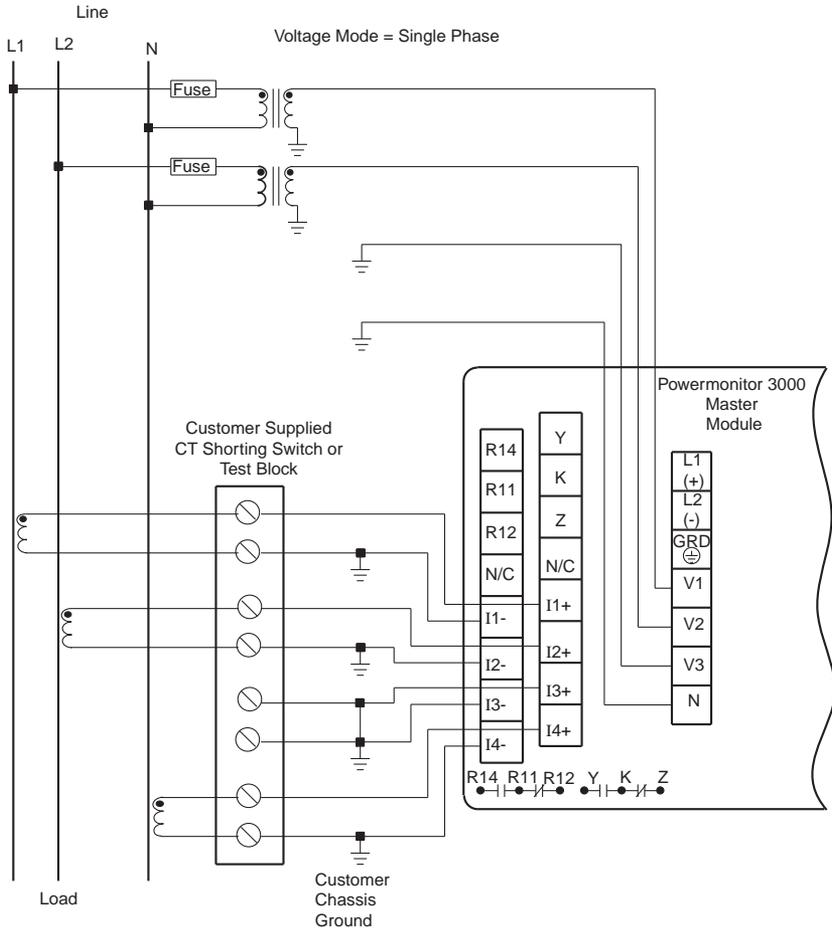
Refer to the Powermonitor 3000 Unit User Manual, publication 1404-UM001, for detailed instructions on unit configuration.

## Wiring Diagrams

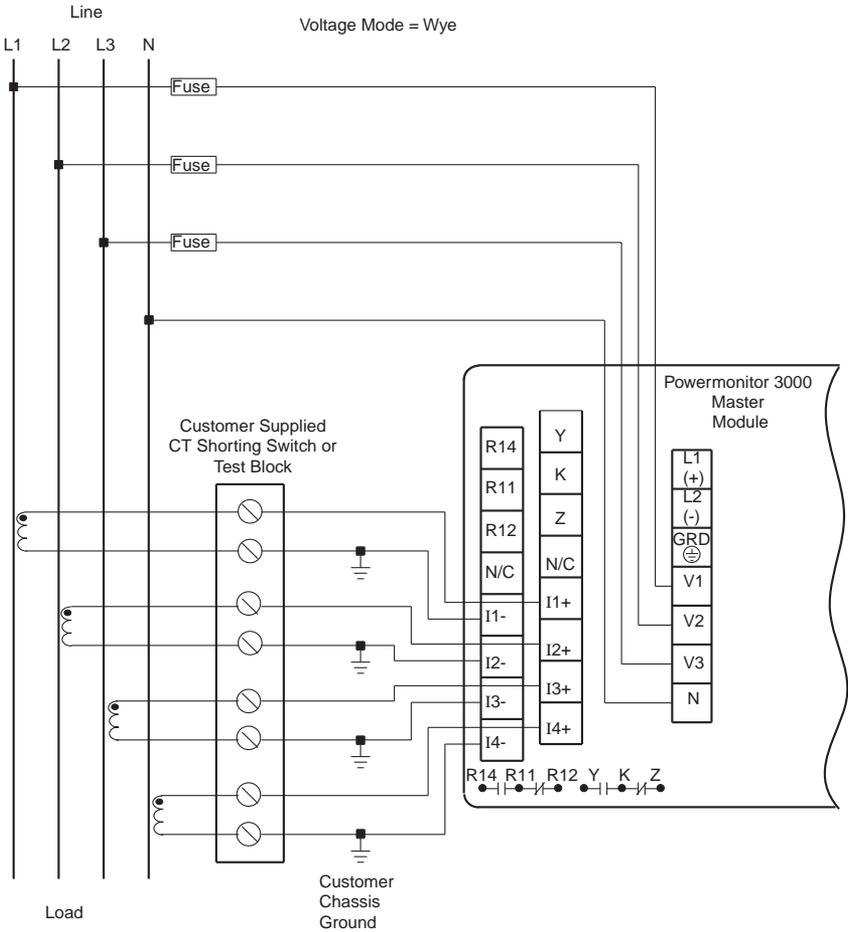
### Single-phase Direct Connection Wiring Diagram (Systems < 600 Volts Nominal L-L)



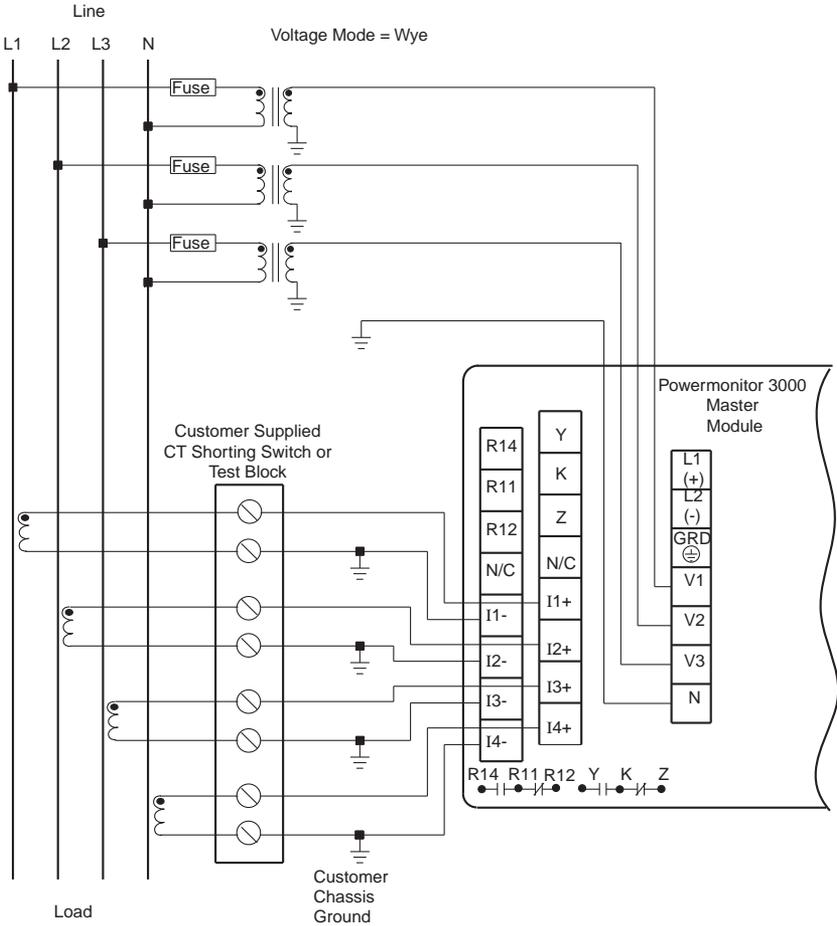
### Single-phase with PTs Wiring Diagram



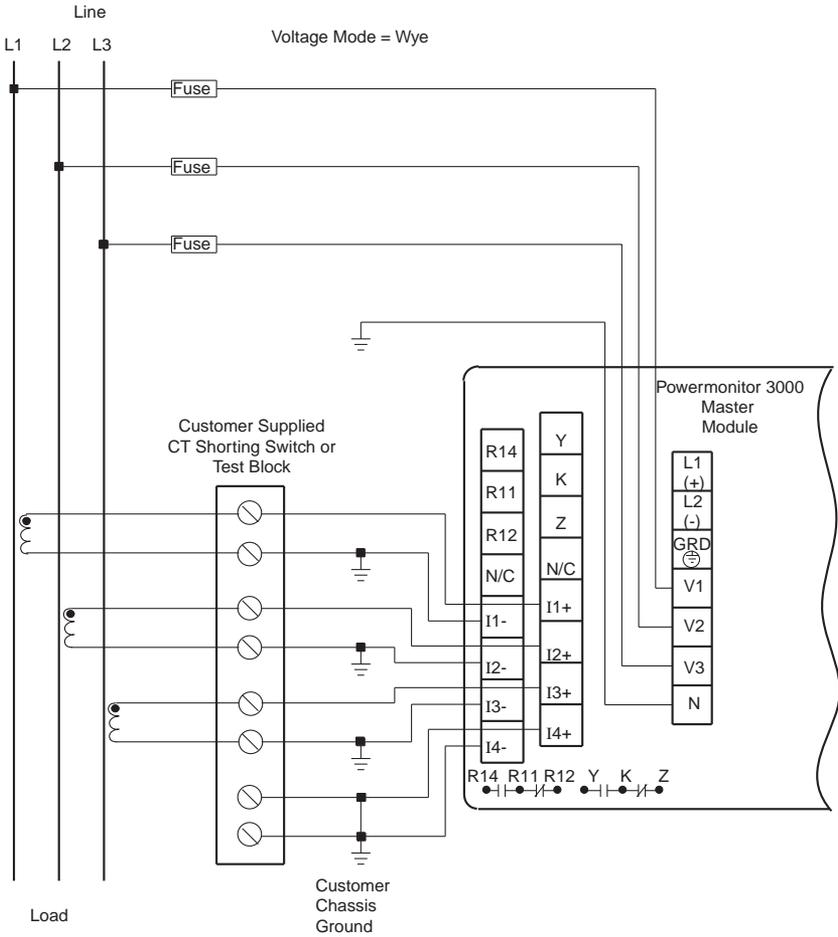
### Three-phase Four-wire Wye Direct Connect Wiring Diagram (Systems < 600 Volts Nominal L-L)



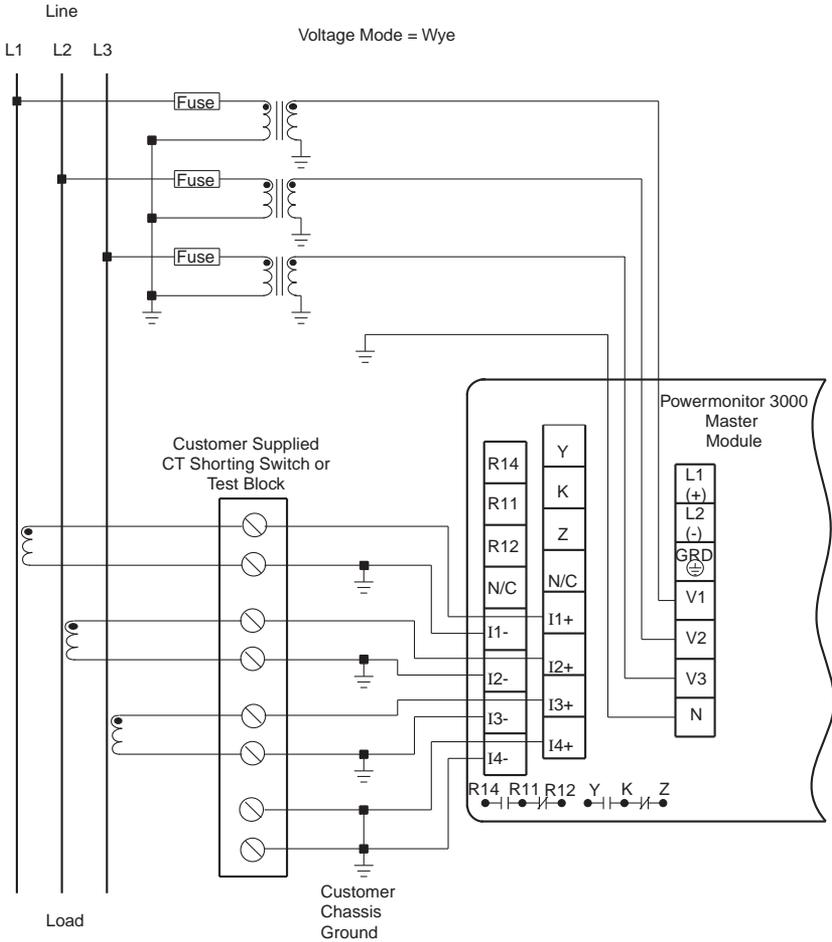
### Three-phase Four-wire with PT's Wiring Diagram



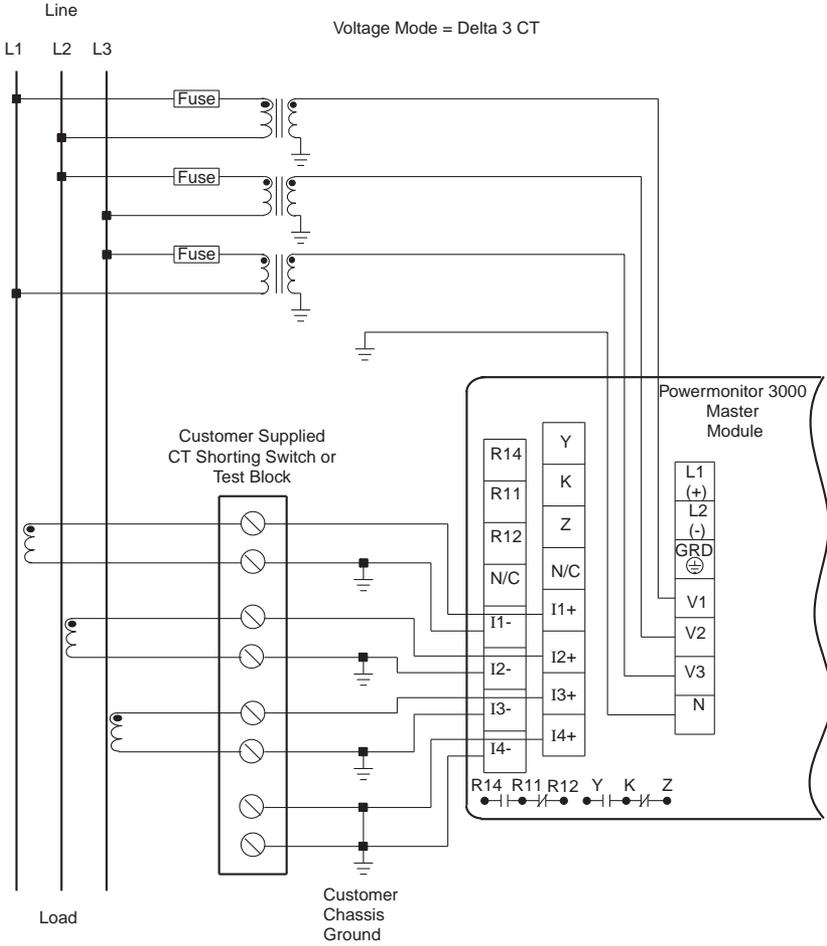
### Three-phase Three-wire Grounded Wye Direct Connection Wiring Diagram (Systems < 600 Volts Nominal L-L)



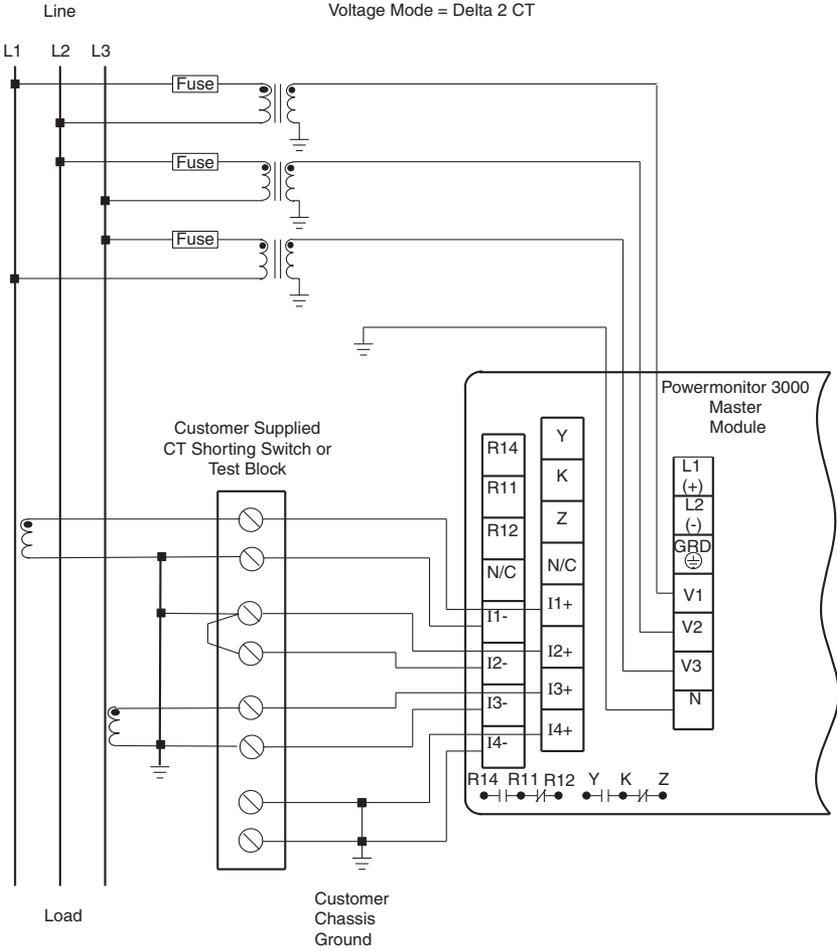
### Three-phase Three-wire Grounded Wye with PT's Wiring Diagram



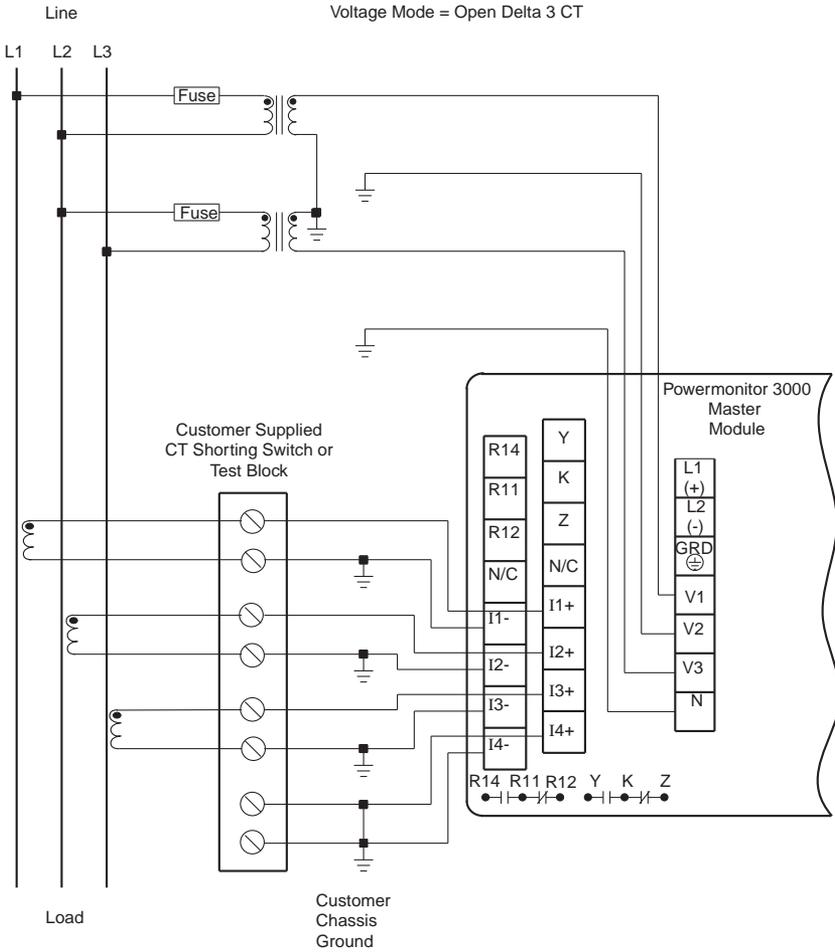
### Three-phase Three-wire Delta with Three PT's and Three CT's Wiring Diagram



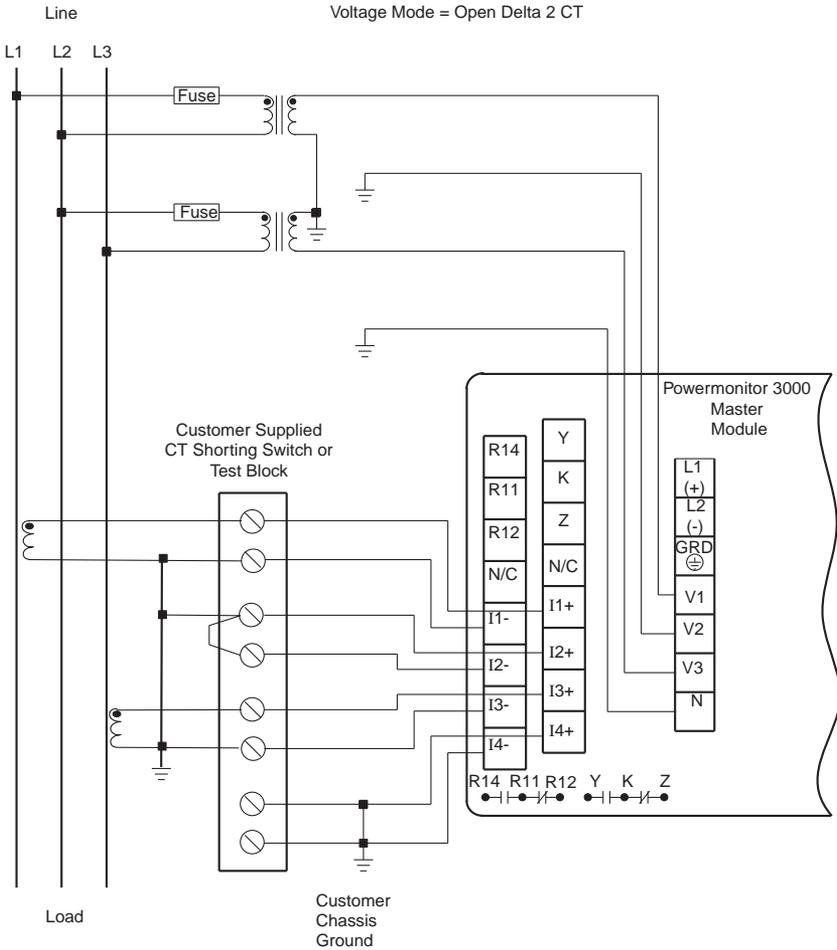
### Three-phase Three-wire Delta with Three PT's and Two CT's Wiring Diagram



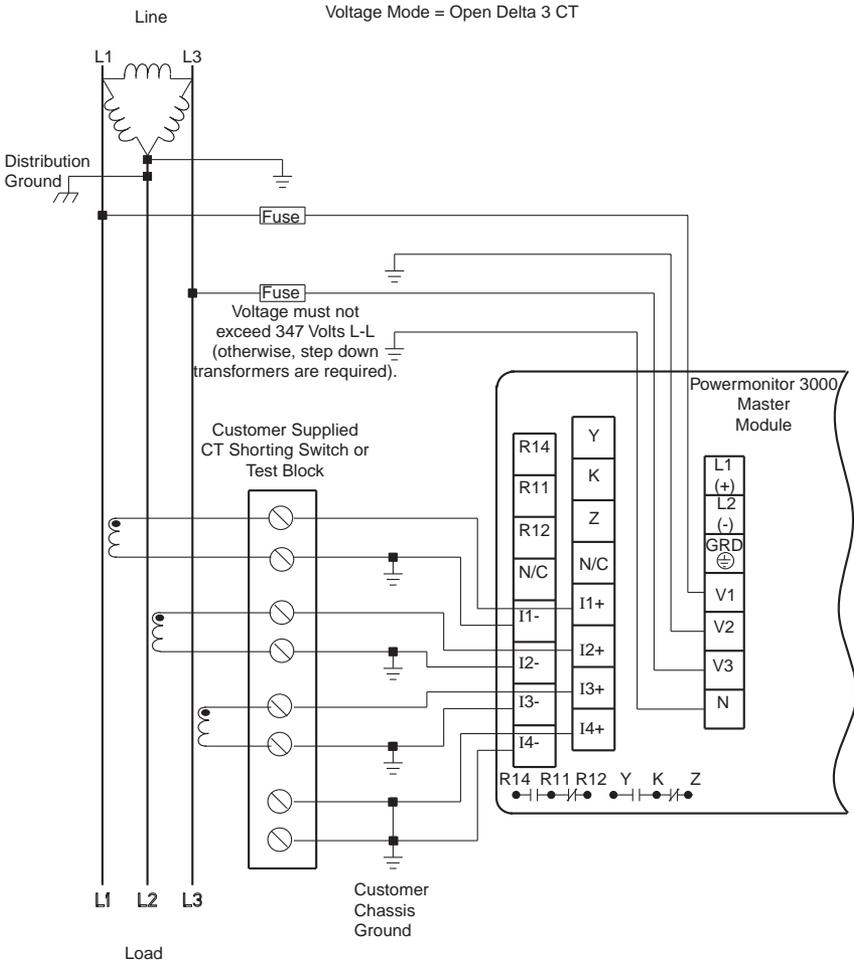
### Three-phase Three-wire Open Delta with Two PT's and Three CT's Wiring Diagram



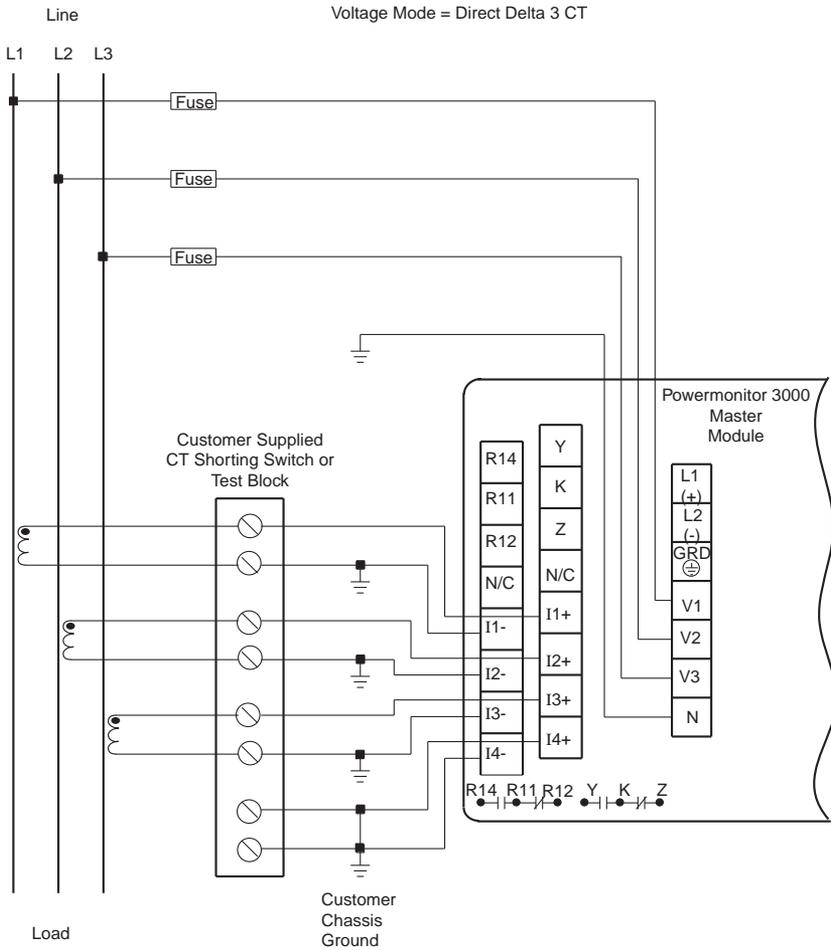
### Three-phase Three-wire Open Delta with Two PT's and Two CT's Wiring Diagram



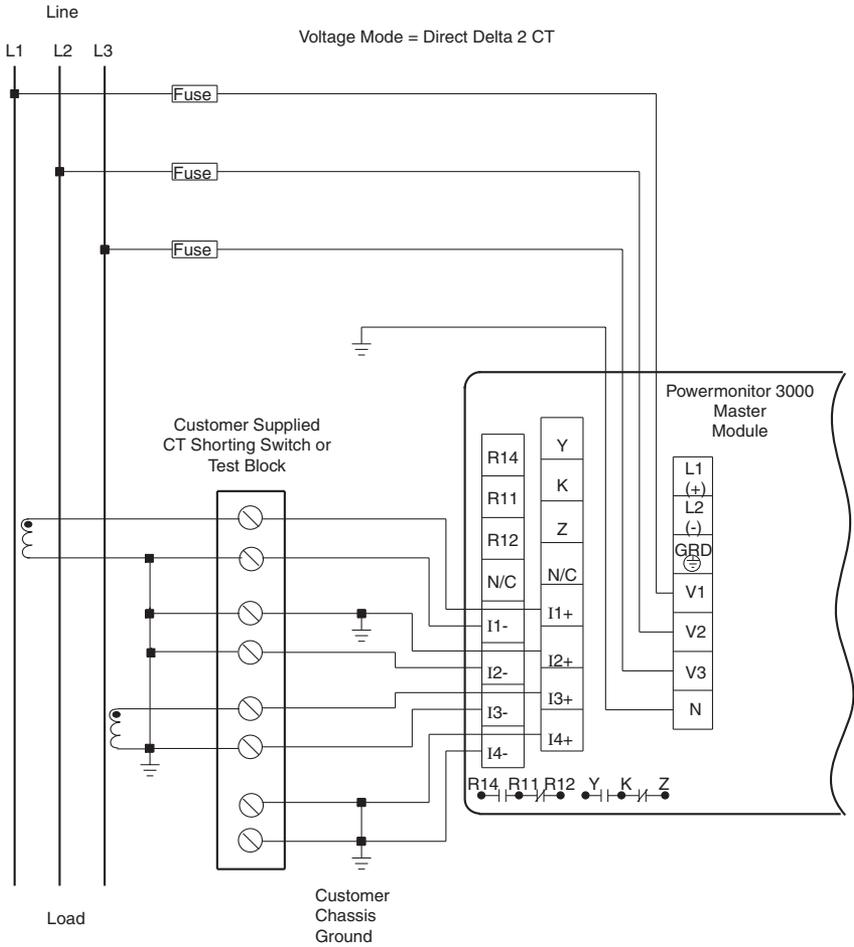
### Three-phase Three-wire Grounded L2(B) Phase Open Delta Direct Connect with Three CT's Wiring Diagram (Systems < 600 Volts Nominal L-L)



### Three-phase Three-wire Delta Direct Connect with Three CT's Wiring Diagram (Systems < 600 Volts Nominal L-L)



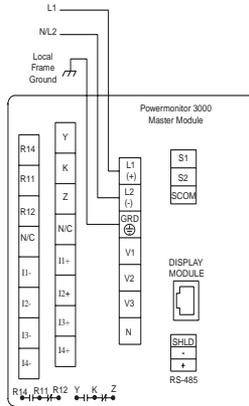
### Three-phase Three-wire Delta Direct Connect with Two CT's Wiring Diagram (Systems < 600 Volts Nominal L-L)



## Control Power

The power monitor draws a nominal 15V A control power. Catalog numbers 1404-MxxxA-xxx require nominal control power of 120...240V ac or 125...250V dc. The power supply is self-scaling. Catalog number 1404-MxxxB-xxx requires nominal control power of 24V dc.

## Control Power



Refer to Specifications on page 57 for acceptable control voltage ranges and wiring termination information.

It is strongly recommend that you use a separate source of control power from the power system being monitored. For applications where power system information is critical, consider the use of a user-supplied uninterruptible power supply so that the power monitor continues to operate during power system events such as significant sags, swells, and transient disturbances.

It is required to connect your power-monitor control power through user-supplied disconnecting means and overcurrent protection.

## Status Inputs

### ATTENTION

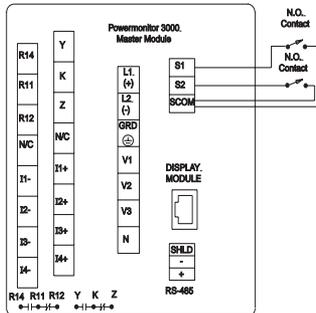


Do not apply an external voltage to a Status Input. These inputs have an internal source and are intended for dry contact input only. Applying a voltage may damage the associated input or internal power supply.

All Status Inputs are common to an internal 24V dc source on the SCOM terminal. Status input terminals S1 and S2 are positive polarity and SCOM is negative polarity.

For optimal EMC performance, we recommend wiring the status inputs using shielded cable, Belden 8771 or equivalent, with the cable shield grounded at both ends where possible.

## Status Input Connections



Parameter	Condition 1	Condition 2
Applied resistance verses status state	3.5 k $\Omega$ or less = ON	5.5 k $\Omega$ or greater = Off

Isolation Voltage 500V status input to case; 500V status input to internal digital circuitry.

### TIP

Status Input S2 can be configured for external demand pulse input. See Powermonitor 3000 User Manual, publication 1404-UM001, for more information.

## Relay and KYZ Outputs

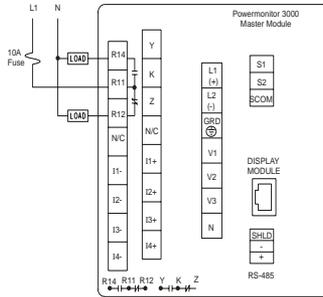
Control Relay Connections on page 36 shows the Form C relay output connections and an example of customer wiring to a supply voltage and two loads. Terminal R11 is the common connection, R14 is the normally-open connection and R12 is the normally-closed connection. You must supply the wetting voltage and overcurrent protection for the circuit connected to the relay output.

Refer to Specifications on page 57 for further information.

The KYZ output is a solid-state relay designed for low-current switching and long life. Its normal application is to provide a pulse based on energy usage (or one of five other parameters) to an external pulse accumulator. Terminal K is common, Y is normally-open, and Z is normally-closed.

Refer to Powermonitor 3000 Unit User Manual, publication 1404-UM001, for further information on the application and operation of relay and KYZ outputs.

**Control Relay Connections**



**Communication Wiring**

Methods for connecting communication wiring vary from option to option. This section provides guidelines for installing dependable communication wiring for your power monitor system.

**ATTENTION**



You must supply and install special high-level isolation when the possibility of high ground potential differences exists. This may occur when communicating with a unit connected to a power ground mat. Failure to install such isolation may lead to personal injury or death, property damage, or economic loss.

**IMPORTANT**

You need to configure communication for each communication option.

Refer to the Powermonitor 3000 Unit User Manual, publication 1404-UM001, for detailed communication configuration instructions.

### *Native RS-485 Communication Wiring*

The RS-485 communication standard supports multi-drop communication among as many as 32 stations or nodes.

The RS-485 port is also used for master module firmware upgrades in the field.

RS-485 communication wiring should be installed in a daisy-chain configuration. We recommend that you use Belden 9841 two-conductor shielded cable or equivalent. The maximum cable length is 1219 m (4000 ft). Use of a star or bridging topology is not recommended and will result in signal distortion unless impedance is matched for each spur (star topology) or network (bridge topology).

If required, install suitable terminating resistors at the ends of the daisy-chain cable. For RS-485, install a 150  $\Omega$  1/4 Watt terminating resistor (refer to the wiring diagram). Note that some RS-485 conversion devices are equipped with internal terminating resistors. Contact the manufacturer of the converter for additional information.

At one end of each cable segment, connect the cable shield to the SHLD terminal of the master module RS-485 port or the converter. The SHLD connection provides a low-impedance ground for high-frequency noise while attenuating dc or line-frequency signals.

The RS-485 port in the master module presents a standard load impedance to the RS-485 network, allowing the standard 32 nodes on a network.

Configuration options for the native RS-485 port include the protocol, device address, and the data rate. Defaults are:

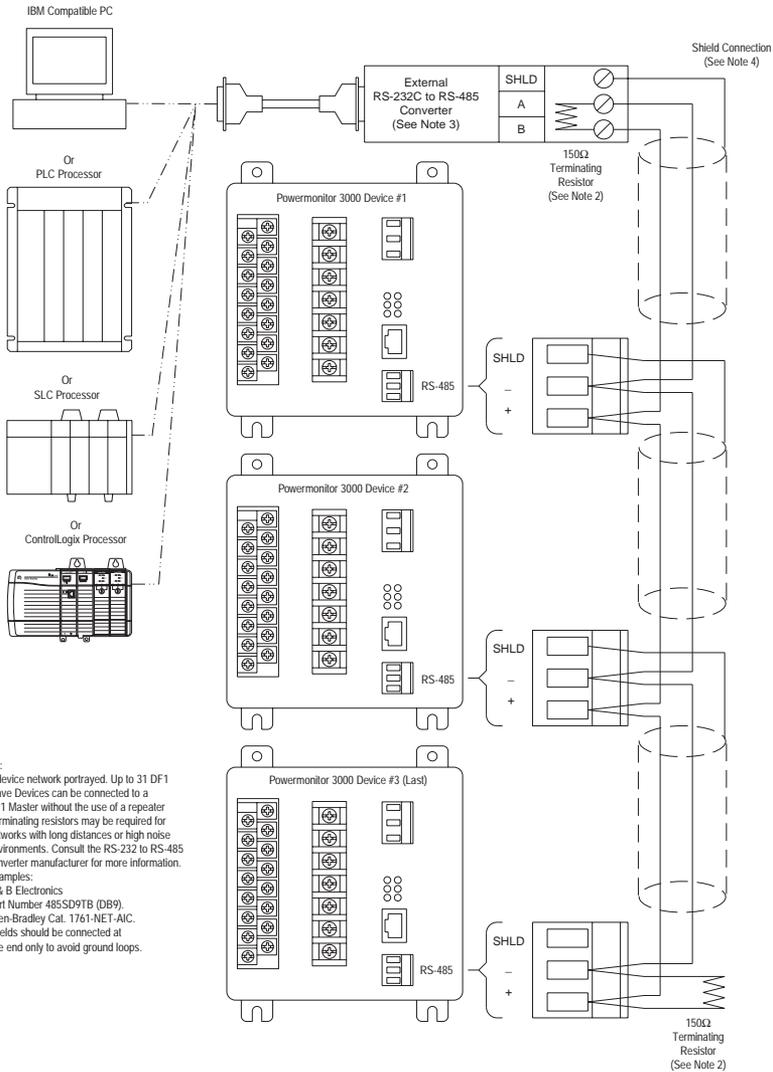
- auto-detect protocol.
- device address = the Device ID assigned at the factory in the range 1...254.
- communication rate = 9600 bps.

### *Use of RS-232 to RS-485 Converter*

You need a user-supplied RS-232 to RS-485 converter for communication between the power monitor native RS-485 port and an external device such as a computer or programmable controller RS-232 port. Examples include:

- B&B Electronics, Inc. part number 485SD9TB (DB-9 connection).
- Allen-Bradley catalog number 1761-NET-AIC.

## RS-485 Connections



**Notes:**

- 1) 3-device network portrayed. Up to 31 DF1 Slave Devices can be connected to a DF1 Master without the use of a repeater
- 2) Terminating resistors may be required for networks with long distances or high noise environments. Consult the RS-232 to RS-485 converter manufacturer for more information.
- 3) Examples:  
B & B Electronics  
Part Number 485SD9TB (DB9),  
Allen-Bradley Cat. 1761-NET-AIC.
- 4) Shields should be connected at one end only to avoid ground loops.

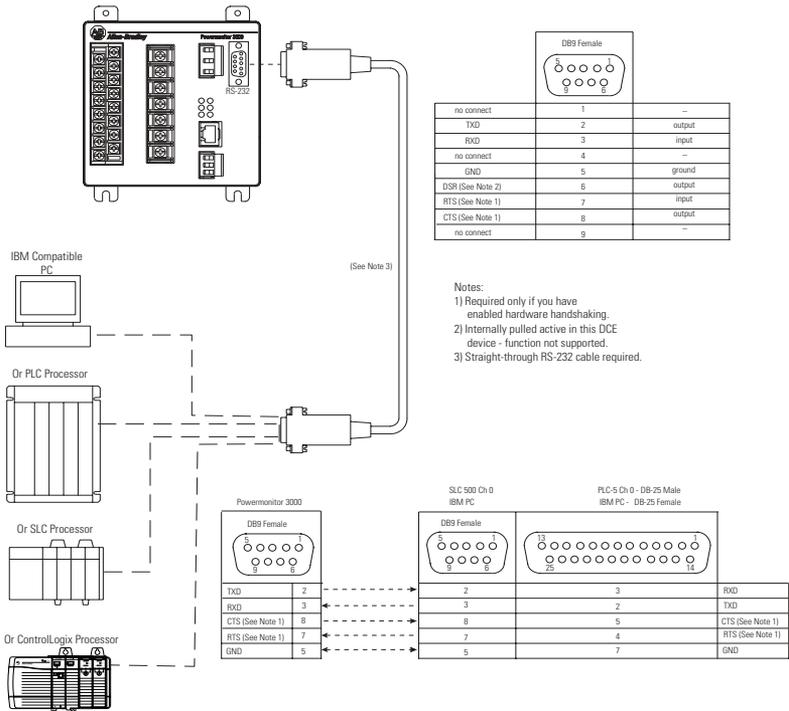
### Optional RS-232 Communication

Powermonitor 3000 units with a catalog number ending in -232 are equipped with an RS-232 serial communication port in addition to the native RS-485 port. The RS-232 communication standard supports point-to-point communication among two stations or nodes. You must select either optional RS-232 communication or native RS-485 communication. The two ports do not operate at the same time.

The optional RS-232 communication port is a data communication equipment (DCE) type device. It requires a straight-through RS-232 cable to connect with personal computers, programmable controller serial ports, and other data terminal equipment (DTE) devices. It requires a crossover cable for connection to a modem or other DCE devices. No terminating resistor is required.

The maximum cable length is 15.24 m (50.0 ft). Refer to the following wiring diagrams for cable pinout information for constructing your own cable using DB-9 and DB-25 connectors.

### Connecting Powermonitor 3000 Unit to Computer Communication Port



### *Optional Remote I/O Communication*

Powermonitor 3000 units with a catalog number ending in -RIO are equipped with a remote I/O port in addition to the native RS-485 port. Allen-Bradley remote I/O is a robust, widely used industrial data network that uses twinaxial cable as its physical media. The power monitor emulates a logical quarter rack and supports both polled I/O and block transfer communication. The remote I/O port and the native RS-485 port may be used simultaneously, although overall data throughput may be reduced.

Remote I/O communication wiring should be installed in a daisy-chain configuration. We recommend that you use Belden 9463 twinaxial cable or equivalent. The maximum cable length is shown in the Remote I/O Communication Rates table and varies with the data rate. Use of a star or bridging topology is not recommended and will result in signal distortion unless impedance is matched for each spur (star topology) or network (bridge topology).

Be sure that all devices on your remote I/O network are capable of operation at the desired communication rate. Certain legacy devices may not support a 230.4 Kbps communication rate.

### **Remote I/O Communication Rates**

<b>Communication Rate</b>	<b>Maximum Distance</b>	<b>Terminating Resistor</b>
57.6 Kbps	3048 m (10,000 ft)	150 $\Omega$ 1/4 W
115.2 Kbps	1542 m (5000 ft)	150 $\Omega$ 1/4 W
230.4 Kbps	762 m (2500 ft)	84 $\Omega$ 1/4 W

Install suitable terminating resistors at the ends of the remote I/O network.

#### **TIP**

Some remote I/O devices are equipped with internal terminating resistors.

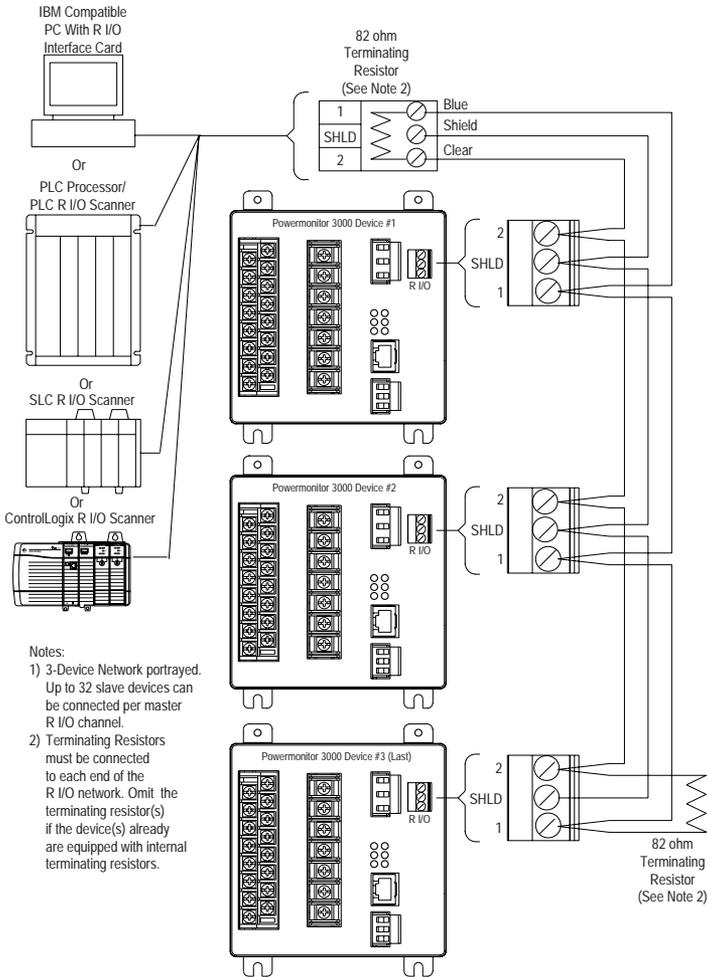
At each end of each cable segment, connect the cable shields to the SHLD terminal of the remote I/O port connector. The SHLD connection provides a low-impedance ground for high-frequency noise while attenuating dc or line-frequency signals. We recommend that you follow the standard blue/shield/clear color scheme for remote I/O to differentiate it from Data Highway Plus (clear/shield/blue) cables.

Configuration options for optional remote I/O communication include the logical rack address and module group (the power monitor is always one-quarter rack), and data rate. Defaults are rack 1, group 0, 57.6 Kbps.

Refer to the Powermonitor 3000 Unit User Manual, publication 1404-UM001.

Refer to the note at the beginning of Communication Wiring on page 38.

### Connecting Powermonitor 3000 Unit to Remote I/O Scanner



### *Optional DeviceNet Communication*

Powermonitor 3000 units with a catalog number ending in -DNT are equipped with a DeviceNet port in addition to the native RS-485 port. The DeviceNet network is an open-standard, multi-vendor, industrial device data network that uses a variety of physical media. The DeviceNet network also provides 24V dc power to devices connected to the network. The DeviceNet port and the native RS-485 port may be used simultaneously, although overall data throughput may be reduced.

For detailed DeviceNet system installation information, including cable lengths, the placement of terminating resistors, power supplies, and other media components, refer to DeviceNet Cable System Planning and Installation Manual, publication DN-6.7.2.

Refer to the note at the beginning of Communication Wiring on page 36.

Install suitable terminating resistors at the ends of the DeviceNet cable.

**TIP**

Some DeviceNet devices are equipped with internal terminating resistors.

**IMPORTANT**

You must install and wire a suitable 24V dc power supply to the V+ and V- conductors in the DeviceNet cable. The power monitor consumes less than 100 mA from the DeviceNet 24V dc supply.

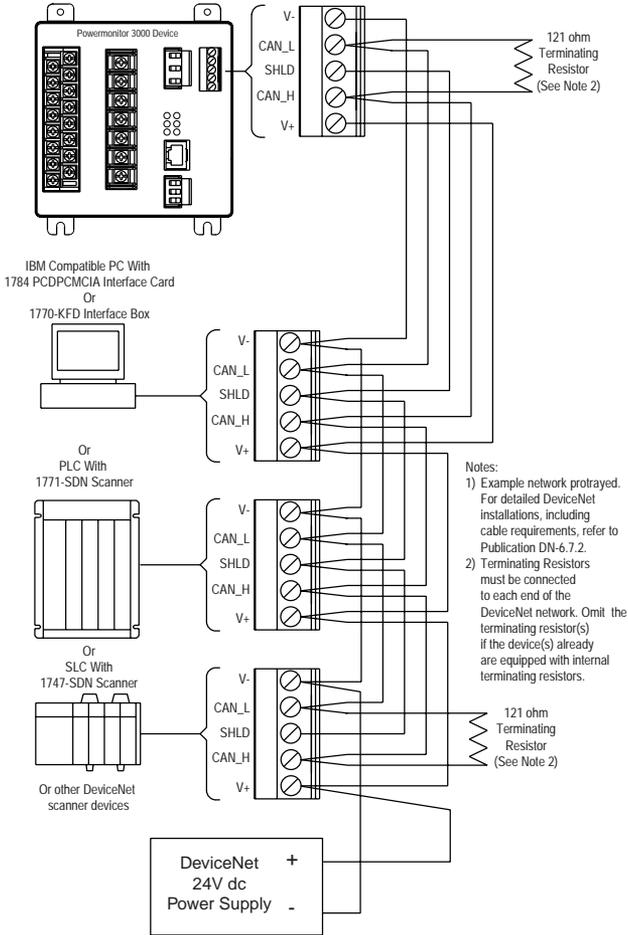
Configuration options for optional DeviceNet communication include the node address (MAC ID) and data rate. Defaults are node 63 and 125 Kbps.

Refer to the Powermonitor 3000 Unit User Manual, publication 1404-UM001.

### **DeviceNet Terminal Block Wiring Connections**

<b>Terminal</b>	<b>Signal</b>	<b>Function</b>	<b>Color</b>
1	COM (V-)	Common	Black
2	CAN_L	Signal Low	Blue
3	SHIELD	Shield	Uninsulated
4	CAN_H	Signal High	White
5	VDC+ (V+)	Power Supply	Red

## Connecting Powermonitor 3000 to other DeviceNet Devices



### Optional Ethernet Communication

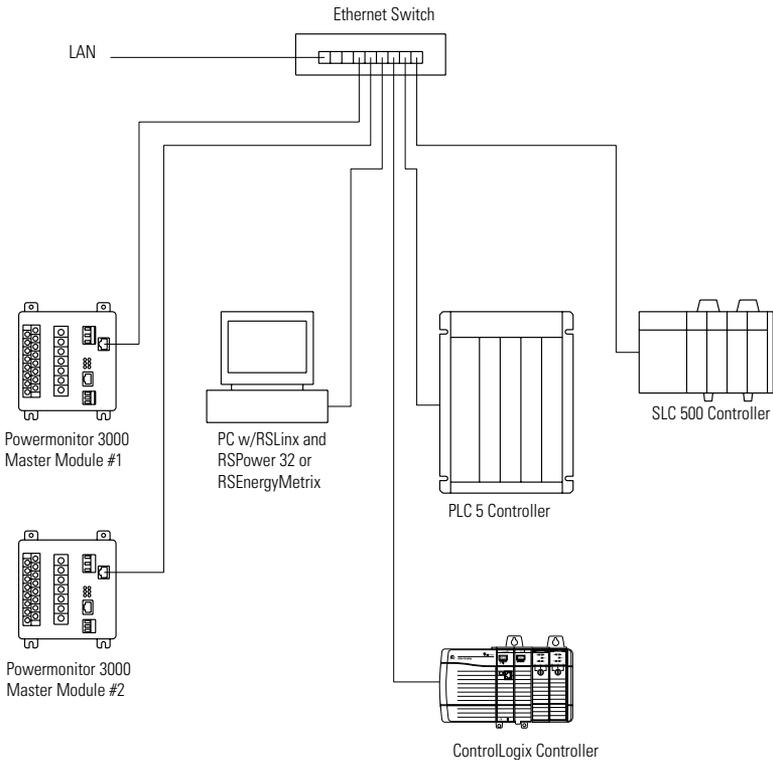
Powermonitor 3000 units with catalog numbers ending in -ENT are equipped with an industry standard Ethernet 10/100baseT port.

The power monitor is designed to connect easily to industry-standard Ethernet hubs and switches using standard UTP (unshielded twisted-pair) cables with RJ-45 connectors. The Ethernet Wiring Connections table shows the cable and connector pin assignments and Powermonitor 3000 Ethernet Network Example shows a typical star network topology.

### Ethernet Wiring Connections

Terminal	Signal	Function
1	TX+	TX+
2	TX-	TX-
3	RX+	RX+
4		
5		
6	RX-	RX-
7		
8		

### Powermonitor 3000 Ethernet Network Example



Refer to the note at the beginning of Communication Wiring on page 36.

Configuration options for optional Ethernet communication include the IP (Internet Protocol) address, subnet mask, default gateway IP address, and protocol.

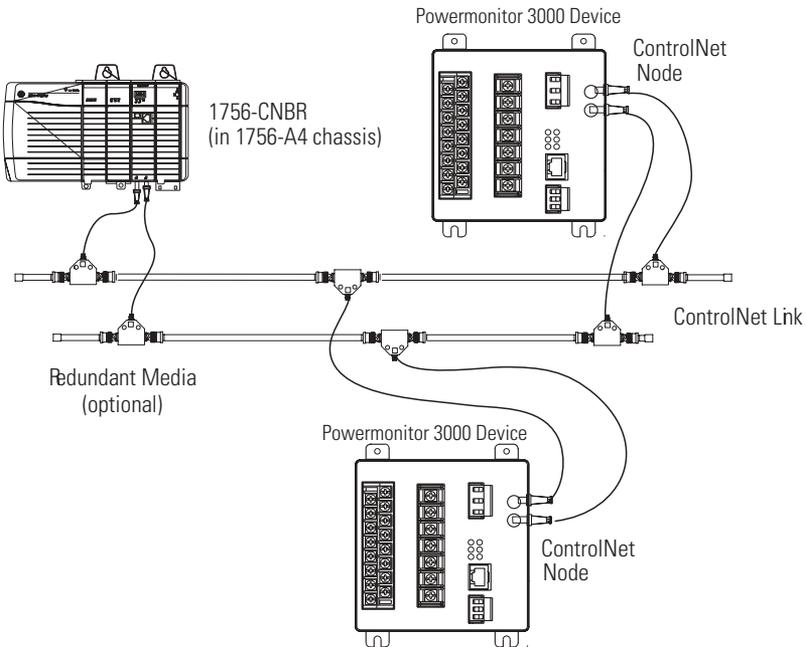
Defaults are:

- IP address: 192.168.254.xxx where xxx is the Device ID assigned at the factory in the range 1...247.
- subnet mask: 255.255.0.0.
- default gateway IP address: 128.1.1.1.
- protocol: CSP (PCCC) and CIP (EtherNet/IP).

### *Optional ControlNet Communication*

Powermonitor 3000 units with catalog numbers ending in -CNT are equipped with a ControlNet communication interface. The ControlNet power monitor can be connected in a single media or redundant media network. An example of a ControlNet network using redundant media is shown here.

### **Powermonitor 3000 Unit ControlNet Network Example**



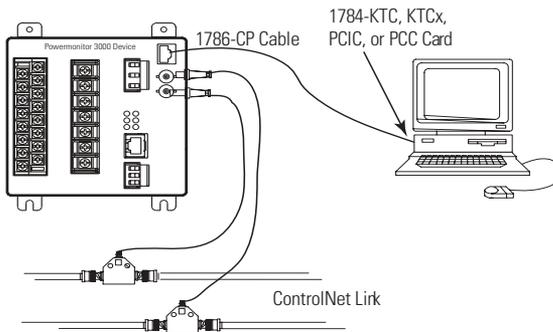
Refer to the following documentation for ControlNet network wiring requirements and general ControlNet information.

- ControlNet Cable System Planning and Installation Manual, publication 1786-6.2.1
- ControlNet Coax Tap Installation Instructions, publication 1786-IN007
- ControlNet Coax Media Planning and Installation Guide, publication CNET-IN002

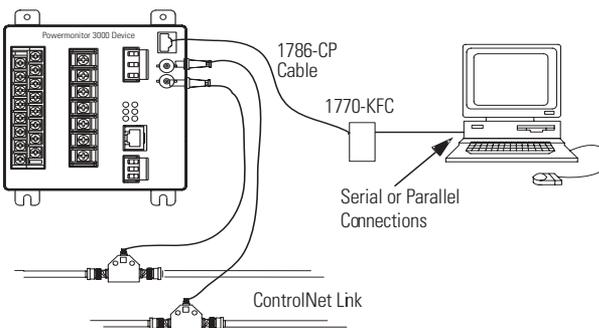
### *Connecting a Programming Terminal to the Network Using a 1786-CP Cable*

To connect a programming terminal to the network using a 1786-CP cable, you have the following options:

- Using a 1784-KTC, 1784-KTCx, or 1784-PCC communication card and a 1786-CP cable



- Using a 1770-KFC communication interface, a serial or parallel connection, and a 1786-CP cable



The 1786-CP cable can be plugged into any ControlNet product's NAP to provide programming capability on the ControlNet network. A programming terminal connected through this cable is counted as a node and must have a unique network address.

### ATTENTION



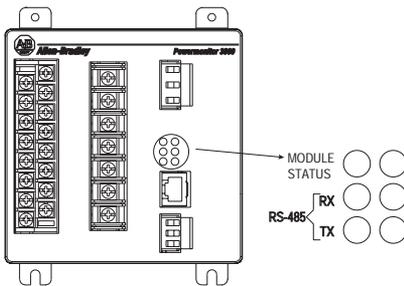
Use a 1786-CP cable when connecting a programming terminal to the network through NAPs. Using a commercially available RJ-style cable could result in network failure.

## Interpret the LED Indicators

The power monitor is equipped with six bi-color light emitting diode (LED) indicators.

The three LED indicators on the left display the same information on power monitor modules with any communication option including native RS-485 communication only. The three LED indicators on the right have different labels and different indications depending on the communication option selected, as shown in the charts below.

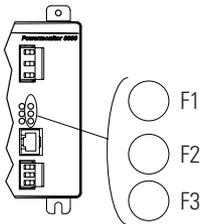
### Powermonitor 3000 LED Indicators



**All Powermonitor 3000 Models LED Indicators**

LED Indicator	LED Indicator Color	LED Indicator State and Communication Condition
Module Status	Off	Control power is off or insufficient.
	Steady Red	Major fault; internal self-test has failed. If a power cycle does not correct the problem, call customer support.
	Steady Green	Power monitor is operating normally.
RS-485 RX	Off	The RS-485 bus is idle; no active data is present.
	Flashing Green	Active data is present on the RS-485 bus.
RS-485 TX	Off	Power monitor is not transmitting data onto the RS-485 bus.
	Flashing Green	Power monitor is transmitting data onto the RS-485 bus.

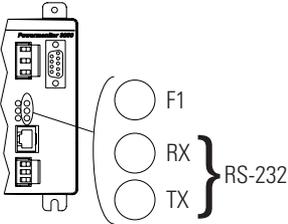
**RS-485 LED Indicators**



**Native RS-485 Communication Only (catalog numbers ending in -000)**

LED Indicator	LED Indicator Color	LED Indicator State and Communication Condition
F1	Off	Not used.
F2	Off	Not used.
F3	Off	Not used.

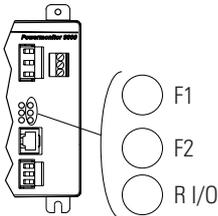
## RS-232 LED Indicators



### RS-232 Optional Communication (catalog numbers ending in -232)

LED Indicator	LED Indicator Color	LED Indicator State and Communication Condition
F1	Off	Not used.
RS-232 RX	Off	The RS-232 bus is idle; no active data is present.
	Flashing Green	Power monitor is receiving data.
RS-232 TX	Off	The power monitor is not transmitting any data onto the RS-232 bus.
	Flashing Green	The power monitor is transmitting data.

## Remote I/O LED Indicators



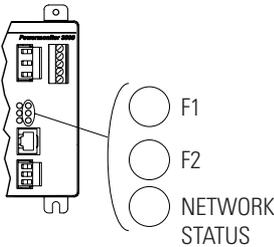
### Remote I/O Optional Communication (catalog numbers ending in -RIO)

LED Indicator	LED Indicator Color	LED Indicator State and Communication Condition
F1	Off	Not used.
F2	Off	Not used.

**Remote I/O Optional Communication (catalog numbers ending in -RIO)**

LED Indicator	LED Indicator Color	LED Indicator State and Communication Condition
R I/O	Off	Remote I/O communication has not been established.
	Flashing Green	Remote I/O communication has been established but there are errors.
	Steady Green	Remote I/O communication has been established.

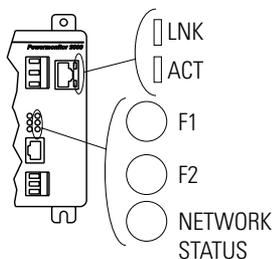
**DeviceNet LED Indicators**



**DeviceNet Optional Communication (catalog numbers ending in -DNT)**

LED Indicator	LED Indicator Color	LED Indicator State and Communication Condition
F1	Off	Not used.
F2	Off	Not used.
Network Status	Off	Power is off or the power monitor is not online.
	Flashing Green	Network status is OK, no connections established.
	Steady Green	Network status is OK, connections established.
	Flashing Red	Recoverable communication failure; port is restarting.
	Steady Red	Nonrecoverable communication error; check wiring and configuration parameters.

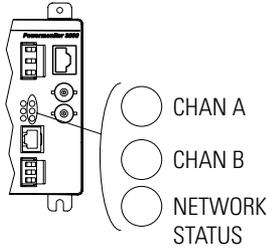
## EtherNet/IP LED Indicators



## EtherNet/IP Optional Communication (catalog numbers ending in -ENT)

LED Indicator	LED Indicator Color	LED Indicator State and Communication Condition
LNK	Off	No valid physical EtherNet connection.
	Steady Green	Valid physical EtherNet connection.
ACT	Strobing or Solid Yellow	Power monitor transmitting onto the EtherNet/IP network.
F1	Off	Not used.
F2	Off	Not used.
Network Status	Off	No power.
	Flashing Green	No established connections.
	Steady Green	Connected; has at least one established connection.
	Flashing Red	Connection timeout; one or more connections to this device has timed-out.
	Steady Red	Duplicate IP; the IP address assigned to this device is already in use.
	Flashing Green/Red	Selftest; this device is performing a power-up self-test.

**ControlNet LED Indicators**



**ControlNet Optional Communication (catalog numbers ending in -ENT)**

LED Indicator	LED Indicator Color	LED Indicator State and Communication Condition
Chan A and Chan B	Off	No power or channel disabled.
	Steady Red	Faulted unit.
	Alternating Red/Green	Self-test.
	Alternating Red/Off	Incorrect node configuration.
	Steady Green	Normal operation.
	Flashing Green/Off	Temporary errors or node is not configured to go online.
	Flashing Red/Off	Media fault or no other nodes present on network.
Status	Flashing Red/Off	Incorrect network configuration.
	Off	Normal operation.
	Flashing Green	Communication card power-up self-test.

## Access Self-test and Diagnostic Data

You can access valuable diagnostic information using the optional display module.

1. Connect the display module to the master module using the display module cable.
2. Using the four control keys, navigate through the menus to Display - Status and select using the Enter key.

The display module then displays the following data. Use the up and down arrow keys to step through the status data.

Display	Description
<i>CAT NO</i>	The unit catalog number and series revision letter.
<i>ACC CLASS</i>	Displays the revenue meter accuracy class.
<i>WIN NO</i>	The unit's unique Warranty Identification Number (needed for service and optional firmware enhancements).
<i>HW REV</i>	Displays details of the digital board, analog board, and ASIC revisions.
<i>FRN MASTER MODULE</i>	Shows the master module firmware revision.
<i>DEVICE ID</i>	Shows the units device ID number assigned at the factory. This number is also used in the default address for native RS-485, and optional RS-232 and EtherNet/IP communication.
<i>SELFTEST STATUS</i>	Displays a status code bitfield as a hex number. A non-zero value indicates a problem.
<i>CODE FLASH</i>	Indicates the health of the flash memory code area.
<i>RAM</i>	Indicates the health of the random access memory.
<i>DATA FLASH</i>	Indicates the health of the flash memory data area.
<i>NVRAM</i>	Indicates the health of the super-cap backed non volatile random access memory.
<i>D ACQ</i>	Indicates the data acquisition system health.
<i>W DOG</i>	Indicates the system watchdog timer status.
<i>CLOCK</i>	Indicates the health of the real-time clock.
<i>COMM</i>	Displays the firmware revision of the optional communication card (if applicable).
<i>COMM</i>	Displays the optional communication card type.
<i>COMM</i>	Displays the optional communication status bitfield as a hex number (0000 hex is normal for -232 and -RIO units, and 9001 hex is normal for -DNT and -ENT units).

<b>Display</b>	<b>Description</b>
<i>DMSTA</i>	Displays the display module status bitfield as a hex number. A non-zero value may indicate a problem, although a non-zero value may appear if a display module is connected to an operating master module.
<i>DMFRN</i>	Indicates the display module firmware revision.
<i>MM/DD/YYYY</i>	Displays the current date.
<i>HH/MM/SS</i>	Displays the current time.
<i>RELAY</i>	Shows the status of the Form 4C relay.
<i>KYZ</i>	Shows the status of the KYZ output.
<i>S1 STATUS</i>	Shows the status of Status Input 1.
<i>S1 COUNT</i>	Shows the accumulated value of Status Input 1 counter, since last cleared.
<i>S2 STATUS</i>	Shows the status of Status Input 2, since last cleared.
<i>S2 COUNT</i>	Shows the accumulated value of Status Input 2 counter.
<i>OUTW</i>	Displays the output word bitfield as a hex number.

Refer to the Powermonitor 3000 Unit User Manual, publication 1404-UM001, for information on using the display module.

## Calibration

To meet general operating requirements, regular recalibration is not necessary.

For special customer requirements, contact your local Rockwell Automation representative for calibration or service information.

---

## Cleaning Instructions

---

**ATTENTION**

Electrostatic discharge can damage integrated circuits or semiconductors. Follow these guidelines when you handle the module.

- Touch a grounded object to discharge static potential.
- Wear an approved wrist strap grounding device.
- Do not open the module or attempt to service internal components.
- Use a static safe work station, if available.
- Keep the module in its static shield bag when not in use.
- Disconnect and lock out all power sources and short all current transformer secondaries before servicing. Failure to comply with these precautions can lead to personal injury or death, property damage, or economic loss.

- 
1. Turn off all electrical power supplied to the master module.
  2. Clean the master module with a dry, anti-static, lint-free cloth.
    - a. Remove all dust and any obstructions from the cooling air vents on the upper, lower, and ends of the module.
    - b. Be sure that the nameplate is clean and in good condition.
  3. Clean the display module with a dry, anti-static, lint-free cloth.
    - a. Remove all dust and foreign materials from the exterior of the module.
    - b. Be sure that the graphic front panel overlay and back nameplate are clean and in good condition.

## Field Service Considerations

If the power monitor requires servicing, please contact your nearest Rockwell Automation sales office. To minimize your inconvenience, the initial installation should be performed in a manner that makes removal easy.

- A CT shorting block should be provided to allow the Powermonitor 3000 master-module current inputs to be disconnected without making the user-supplied CT's an open circuit. The shorting block should be wired to prevent any effect on the external protective relays.
- All wiring should be routed to allow easy maintenance at connections to the power monitor terminal strips and the power monitor itself.

---

### ATTENTION



Never open a current transformer (CT) secondary circuit with primary current applied. Wiring between the CTs and the power monitor should include a shorting terminal block in the CT secondary circuit. Shorting the secondary with primary current present allows other connections to be removed, if needed. An open CT secondary with primary current applied produces a hazardous voltage, which can lead to personal injury, death, property damage, or economic loss.

---

## Firmware Upgrades

Power monitor firmware upgrades are of two types. Service upgrades are those that occur from time-to-time to improve operation and resolve issues. Product upgrades are optional firmware enhancements that you may purchase to convert your M5 master module to an M6 or M8, or your M6 to an M8.

Service upgrades may be available at no charge. Contact your local Rockwell Automation representative for information or visit the Internet at <http://www.ab.com/PEMS>.

Product upgrades are available for purchase. Contact your Rockwell Automation representative for additional information.

Master module firmware upgrades (of either type) are performed using the native RS-485 communication port. Firmware upgrades may be performed without removing the power monitor from its installation. An RS-485 to RS-232 converter is required to connect between the power monitor and your personal computer communication port. Cycling power to the power monitor may be required to complete the firmware upgrade.

## Factory-installed Communication Cards

The RS-485 communication is integral to the master module and cannot be removed. Adding or changing a second communication card to a power monitor must be done at the factory and is not field upgradeable.

## Specifications

### Measurement Accuracy and Range

#### Powermonitor 3000 Master Module - 1404-M4, 1404-M5, 1404-M6, 1404-M8

Parameter	Accuracy in % of Full Scale at 25 °C (77 °F) 50/60 Hz Unity Power Facator				Nominal/Range
	1404-M4	1404-M5	1404-M6	1404-M8	
Voltage sense inputs: V1, V2, V3	±0.2%	±0.05%	±0.05%	±0.05%	347V/15...399V <sub>L-N</sub> rms 600V/26...691V <sub>L-L</sub> rms
Current sense input: I1, I2, I3, I4	±0.2%	±0.05%	±0.05%	±0.05%	5 A/50 mA...10.6 A rms
Frequency	±0.05 Hz	±0.05 Hz	±0.05 Hz	±0.05 Hz	50 or 60 Hz/40...75 Hz
Power functions: kW, kVA, kVAR Demand functions: kW, kVA Energy functions: kWH, kVAH	ANSI C12.16 and EN 61036 Class 1 Accuracy	ANSI C12.20 and EN 60687 Class 0.5 Accuracy (Class 0.2 is also available)	ANSI C12.20 and EN 60687 Class 0.5 Accuracy (Class 0.2 is also available)	ANSI C12.20 and EN 60687 Class 0.5 Accuracy (Class 0.2 is also available)	
Metering update rates	65...90 ms	55...80 ms	55...85 ms	50...100 ms	

## Input and Output Ratings

Attribute	Value
Control power 1404-xxxxA-xxx	102...264V ac 47...63 Hz or 106...275V dc (0.2 A max loading)
Control power 1404-xxxxB-xxx	18...50V dc (15V A max loading)
Voltage sense inputs: V1, V2, V3	Input impedance: 1 M $\Omega$ min, 399V ac max; V1, V2 and V3 to N.
Current sense inputs: I1, I2, I3, I4	Overload withstand: 15 A continuous, 200 A for 1 s Burden: 0.05V A Impedance: 0.002 $\Omega$ Max crest factor at 5 A is 3 Starting current: 5 mA
Status inputs	Contact closure (internal 24V dc)
Control relay KYZ output	(1) ANSI C37.90-1989 trip duty (1) Solid State KYZ - 80 mA at 240...300V dc

## Control Relay<sup>(1)</sup>

Rating	50/60 Hz AC rms	DC
Max resistive load switching	10 A at 250V (2500V A)	10 A at 30V and 0.25 A at 250V
Min load switching	10 mA at 24V	10 mA at 24V
UL 508, CSA 22.2, IEC Rating Class	B300	Q300
Max make values (inductive load)	30 A at 120V 15 A at 240V (3600V A)	0.55 A at 125V 0.27 A at 250V (69V A)
Max break values (Inductive Load)	3 A at 120V 1.5 A at 240V (360V A)	0.55 A at 125V 0.27 A at 250V (69V A)
Max motor load switching	1/3 HP at 125V 1/2 HP at 250V	

<sup>(1)</sup> Meets ANSI/IEEE C37.90-1989 standards for trip duty.

## Input and Output Ratings<sup>(1)</sup>

Attribute	Number of Operations
Mechanical	$5 \times 10^6$
Electrical	$1 \times 10^5$

<sup>(1)</sup> Meets ANSI/IEEE C37.90-1989 standards for trip duty.

## General Specifications

Attribute	Value	
Dielectric withstand	Control power	2000V
	Voltage inputs	2000V
	Current inputs	2000V
	Status inputs	500V
	Control relays	1600V
Terminal blocks	Power supply and voltage input terminals	4 mm <sup>2</sup> (12 AWG) max, 1.02 Nm (9 lb-in) torque, 75 °C (167 °F) or higher copper wire only
	Relay, KYZ outputs, Current input terminals <sup>(1)</sup>	2.5 mm <sup>2</sup> (14 AWG) max, 1.18 Nm (10.4 lb-in) torque, 75 °C (167 °F) or higher copper wire only
	Status inputs, RS485	2.5 mm <sup>2</sup> (14 AWG) max, 0.56 Nm (5 lb-in) Torque
	RIO, DNT (when present)	2.5 mm <sup>2</sup> (14 AWG) max, 0.56 Nm (5 lb-in) Torque
Temperature, operating	-20...60 °C (-40...140 °F) Cat. No. 1404-DM, 1404-Mxxx-000, 1404-Mxxx-DNT 0...55 °C (32...131 °F) 1404-Mxxx-232, -RIO, -ENT, -CNT	
Temperature, storage	-40...85 °C (-40...185 °F)	
Humidity	5...95%, noncondensing	
Vibration	10...500 Hz: 2 g operational (±0.012 in.)	
Shock	1/2 sine pulse, 11 ms duration: 30 g operational and nonoperational	

<sup>(1)</sup> Recommended Ring lug: AMP part # 320634.

## Product Approvals

Powermonitor 3000 units have the following approvals and certifications.

### *EtherNet/IP Conformance Testing*

All products equipped with an EtherNet/IP communication port bear the mark shown below. This mark indicates the power monitor has been tested at an Open Device Vendor Association (ODVA) independent test lab and has passed the EtherNet/IP conformance test. This test provides a level of assurance that the power monitor interoperates with other conformance tested EtherNet/IP devices (including devices from other vendors). Two representative devices from the Powermonitor 3000 EtherNet/IP family of devices; the 1404-M405A-ENT B and the 1404-M8805A-ENT B have been tested by ODVA using EtherNet/IP Conformance Test version A2.8. The ODVA website (<http://www.odva.org>) maintains a list of products that have passed the conformance test at one of their test labs.



### *ControlNet Conformance Testing*

All products equipped with a ControlNet communication port bear the mark shown below. This mark indicates the power monitor has been tested at a ControlNet International (CI) independent test lab and has passed the ControlNet conformance test. This test provides a level of assurance that the power monitor interoperates with other conformance tested ControlNet devices (including devices from other vendors). Two representative device from the Powermonitor 3000 ControlNet family of devices; the 1404-M405A-CNT A and the 1404-M805A-CNT A have been tested by CI using ControlNet Conformance Test version 12. The CI website (<http://www.ControlNet.org>) maintains a list of products that have passed the conformance test at one of their test labs.



### *UL/CUL*

UL 508 listed, File E96956, for Industrial Control Equipment and CUL Certified.

### *CE Certification*

If this product bears the CE marking, it is approved for installation within the European Union and EEA regions. It has been designed to meet the following directives.

### *EMC Directive*

This product is tested to meet Council Directive 89/336/EEC Electromagnetic Compatibility (EMC) and the following standards, in whole, documented in a technical construction file:

- EN 50081-2 - Generic Emission Standard, Part 2 - Industrial Environment
- EN 50082-2 - Generic Immunity Standard, Part 2 - Industrial Environment

This product is intended for use in an industrial environment.

### *Low Voltage Directive*

This product is tested to meet Council Directive 73/23/EEC Low Voltage, by applying the safety requirements of IEC 1010-1, Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use.

This equipment is classified as an open style device. Open style devices must be provided with environmental and safety protection by proper mounting in enclosures designed for specific application conditions. See NEMA Standards publication 250 and IEC publication 529, as applicable, for explanations of the degrees of protection provided by different types of enclosure.

### *International Standard IEC 529 / NEMA / UL 508 Degree of Protection*

The Powermonitor 3000 master module is rated as IP10 degree of protection per International Standard IEC 529. It is considered an open device per NEMA and UL 508.

The Powermonitor 3000 display module is rated as IP65 degree of protection per International Standard IEC 529. It is rated as Type 4 (Indoor) per NEMA and UL 508.

Follow the recommended installation guidelines to maintain these ratings.

### *ANSI/IEEE Tested*

Meets or exceeds the Surge Withstand Capability (SWC) C37.90.1 - 1989 for protective relays and relay systems on all power connection circuit terminations.

## Additional Resources

For more information on additional power quality products, refer to the following publications.

<b>For this information</b>	<b>Refer to Publication</b>
Powermonitor 3000 User Manual	1404-UM001
Powermonitor 3000 Display Module Installation Instructions	1404-IN005
Bulletin 1403 Powermonitor II Tutorial	1403-1.0.2

You can view or download publications at <http://literature.rockwellautomation.com>. To order paper copies of technical documentation, contact your local Rockwell Automation distributor or sales representative.



# Rockwell Automation Support

Rockwell Automation provides technical information on the Web to assist you in using its products. At <http://support.rockwellautomation.com>, you can find technical manuals, a knowledge base of FAQs, technical and application notes, sample code and links to software service packs, and a MySupport feature that you can customize to make the best use of these tools.

For an additional level of technical phone support for installation, configuration, and troubleshooting, we offer TechConnect Support programs. For more information, contact your local distributor or Rockwell Automation representative, or visit <http://support.rockwellautomation.com>.

## Installation Assistance

If you experience a problem with a hardware module within the first 24 hours of installation, please review the information that's contained in this manual. You can also contact a special Customer Support number for initial help in getting your module up and running.

United States	1.440.646.3223 Monday – Friday, 8am – 5pm EST
Outside United States	Please contact your local Rockwell Automation representative for any technical support issues.

## New Product Satisfaction Return

Rockwell tests all of its products to ensure that they are fully operational when shipped from the manufacturing facility. However, if your product is not functioning, it may need to be returned.

United States	Contact your distributor. You must provide a Customer Support case number (see phone number above to obtain one) to your distributor in order to complete the return process.
Outside United States	Please contact your local Rockwell Automation representative for return procedure.

Rockwell Automation, Allen-Bradley, SLC, SLC500, PLC, PLC-5, ControlLogix, Powermonitor 3000, Powermonitor II, Data Highway Plus, TechConnect, RSPower, RSPowerPlus, RSEnergyMetrix, and RSLink are trademarks of Rockwell Automation, Inc.

Trademarks not belonging to Rockwell Automation are property of their respective companies.

[www.rockwellautomation.com](http://www.rockwellautomation.com)

### Power, Control and Information Solutions Headquarters

Americas: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444  
Europe/Middle East/Africa: Rockwell Automation, Vorstlaan/Boulevard du Souverain 36, 1170 Brussels, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640  
Asia Pacific: Rockwell Automation, Level 14, Core F, Cyberport 3, 100 Cyberport Road, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

Publication 1404-IN007E-EN-P - October 2006

PN 40055-212-01(5)

Supersedes Publication 1404-IN007D-EN-P - September 2004

Copyright © 2006 Rockwell Automation, Inc. All rights reserved. Printed in the U.S.A.