Packet Power™ Power Monitoring Module

DRAFT Instructions for Use

Version 0.3

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⚠ Indicates a POTENTIAL HAZARD. Consult documentation carefully.

⚠ CAUTION

- ❑ Read all instructions carefully prior to installation.
- ❑ The Power Monitoring Module should only be connected to the type of power source indicated on the label.
- ❑ Adhere to voltage and amperage guidelines and utilize a proper branch circuit protector.
- ❑ No field-serviceable parts. Do not attempt to disassemble the product as potentially severe electrical shock may result. Installation and maintenance must be performed by qualified personnel.
- ❑ Follow basic safety precautions to reduce the risk of electrical shock and damage to equipment.
- ❑ Store in a clean, dry location. Clean with a dry cloth.
- ❑ Intended for indoor use only, do not install in a wet location.
- ❑ Adhere to all local electrical codes and guidelines.
- ❑ Failure to use the product in the specified manner may lead to injury or death and damage to equipment.

Regulatory Information [*this will need to be updated following certification]*

This product has been tested to the following requirements:

- UL / ANSI standards 61010-1,Second Edition, Dated July 12, 2004 with revisions through and including October 28, 2008
- CAN/CSA-C22.2 No. 61010-1, second edition, including Amendment 1, or a later version of the same standard incorporating the same level of testing requirements.
- Council Directive 2006/95/EC (December 12, 2006) on Low Voltage Equipment Safety; IEC 61010-1:2001 (Second Edition) and EN 61010-1:2001 (Second Edition)
- IEC 61010-2-032 (2002) 2nd Edition Handheld Electrical Test and Measure
- *[Need to verify correct EN standards to cite]* Council Directive 1999/05/EC - European Union (EU) Radio & Telecommunications Terminal Equipment Directive (R&TTE) ETSI EN 300 220-2, Issued:2006/04/01 and ETSI EN 301 489-3, Issued:2002/08/01 V1.4.1
- Council Directive 2004/108/EC (December 15, 2004) on Electromagnetic Compatibility CENELEC EN 61326-1 Issued:2006/05/01; IEC 61326-1:2005;:1997 -

Class B Device Statement:
Section 15.105(a) of the FCC Rules: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.

Section 15.19 of the FCC Rules: This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Pursuant to Part 15.21 of the FCC Rules, any changes or modifications to this product not expressly approved by Packet Power LLC might cause harmful interference and void the FCC authorization to operate this product.

Industry Canada (IC) Compliance Statement

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) This device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

Industrie Canada (IC) Déclaration de conformité

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques

Safety summary and specifications

This general safety information is to be used by both the Power Monitoring Module (PMM) operator and servicing personnel. Packet Power LLC assumes no liability for user's failure to comply with these safety guidelines. Please read this manual carefully before proceeding.

This symbol is used throughout this manual to indicate critical safety information. Failure to observe the information following this symbol may result in injury or death.

CAUTION: This PMM and the area it is installed in may contain life threatening voltages. Qualified personnel must disconnect all high voltage wiring before using or servicing the PMM.

- ⚠ PMM should only be connected to the type of power source indicated on the label.
- ⚠ Do not overload the PMM as this can result in a risk of fire or electrical shock.
- PMM should be deployed in conjunction with proper branch circuit protectors.
- The current transformer(s) used with the PMM must be appropriate to the amperage of the circuit(s) on which they will be used.
- Only current transformers approved by Packet Power should be connected to the PMM. Using unapproved current transformers could result in inaccurate readings and damage to the PMM device.
- Adhere to all local electrical codes and guidelines.
- Prior to installation, check to make sure the PMM has not been damaged.
- Store in a clean, dry location.
- Use indoors only and do not install in a wet location.
- Clean with a dry cloth.
- Following installation in the final product, the connectors on the PMM must be fully enclosed and insulated from the external product enclosure in compliance with all relevant local electrical codes and regulations.
- ⚠ Failure to use the product in the specified manner may lead to injury or death and damage to equipment.

The PMM is a Class 2 electrical device and does not require a safety connection to electrical earth.

The PMM will support three-phase or single-phase power. Please refer carefully to the detailed wiring diagrams below.

Do not apply or remove the current clamps from hazardous live conductors.

Contents

Introduction

Using this Manual

This manual contains information about the Packet Power™ Power Monitoring Module ("PMM") and associated software. This manual is divided into two parts. The first part is relevant to products using the P5T3 models of the PMM. The second part is relevant to the P2T3 models of the PMM. The PMM model number and associated information is noted on the product label. Each part is divided into sections covering the installation and connection of the PMM, basic software configuration and technical specifications.

Power Monitoring Module Overview

Service types

The PMM provides single and three-phase A/C net-metering-compatible power consumption and quality monitoring. The PMM is capable of real-time monitoring of three-phase power systems in a variety of configurations. The PMM is directly connected to the monitored circuit for voltage monitoring and uses external current transformers ("C/T"s) for current monitoring.

Communication

PMM incorporates Packet Power's advanced zero-configuration wireless mesh networking technology to transmit power measurement data to remote data monitoring and analysis systems.

Enclosure

PMM is designed to fit into a variety of standard electrical enclosures. In order to provide a reliable radio connection, the PMM is equipped with an internal radio antenna fully encased within the enclosure. To allow proper radio operation, the PMM must be housed such that the top portion of the unit is not fully enclosed in a metal housing. The PMM must be housed in an enclosure that prevents access to the terminal strip and wires. The PMM is certified as a UL modular device.

Packet Power Solution Overview

The PMM communicates using Packet Power's wireless network. As soon as a PMM is installed and powered up, it automatically tries to join the wireless network. If you already have an operating Packet Power network within your facility all information from the PMM will shortly become accessible.

If you do not yet have a Packet Power network operating within your facility, a separate radio gateway device called an Ethernet Gateway is required to create the wireless network needed in order to gather information from the PMM. A software application operates in conjunction with the radio gateway device(s) to control how information is gathered and formatted for transmission over an IP network for consumption by various other applications. Please refer to the software section of the manual for additional information regarding wireless gateway and software setup.

P5T3 Models

The P5T3 provides the following enhancements over the original models:

- Capable of supporting 60 to 270 volts
- Support for 2.4GHz and 860-920MHz radio spectrum
- Local LED display
- Compatibility with a broader range of current transformers

Installation

Safety prerequisites

⚠ The PMM should be installed only by qualified technicians with a solid understanding of electrical wiring and devices. Familiarity with and understanding of all terms used in this section is assumed. The user is responsible for ensuring that all electrical connections are safely performed in accordance with all applicable codes and regulations using appropriate tools and materials. The user is responsible for ensuring that all applicable codes and regulations are satisfied.

⚠ The PMM requires that a proper, external power disconnect such as switch or circuit breaker be available upstream (on the supply side) from the unit. Power must be disconnected before the unit is installed.

⚠ The PMM is a CAT II/CAT III measurement device. When the device is powered, line voltages may be present on all device terminals, including the C/T terminals IA, IB, and IC. All wiring and C/Ts connected to the device must meet the appropriate CAT II/CAT III standards.

Please note that exact line voltages vary with regions. “120V” is used to denote voltages in the 100-120V range. “208V” and “220V” are used to denote voltages in the 200-240V range.

Choosing the PMM version and wiring configuration

Before installing the PMM please determine the type of circuit being monitored, including:

1. Circuit type (single phase vs. three phase, Wye vs. Delta)
2. Line voltages. Please be careful not to confuse intra-phase (e.g. L-L) voltage with line-neutral (e.g. L-N) voltage.
3. Line current ratings.
4. Any space considerations that may affect the choice of C/T.

Once this information is available, please refer to Table 2 below and the wiring diagrams to determine the appropriate PMM voltage version, wiring configuration and the number of current transformers required.

Table 1. PMM wiring options for all supported configurations

Wiring	Type	PMM version	PMM terminal connections (blank denotes “not connected”)							Diagram
			VA	VB	VC	N	IA	IB	IC	
L-N	1Ø	P5T3	X			N	CTX			Figure 8-4
L-L	1Ø 208V	P5T3	X			Y	CTX			Figure 12-7
L-N	3Ø Wye	P5T3	X	Y	Z	N	CTX	CTY	CTZ	Figure 8

L-L	3Ø Delta 208V	P5T3	X	Y		Z	CTX	CTY		Figure
L-L	3Ø Delta 380+V	Not supported								

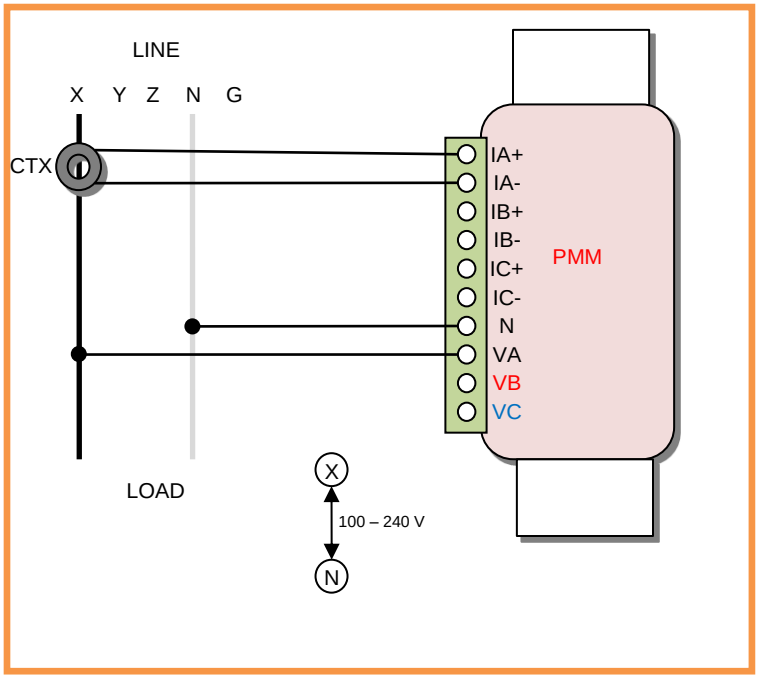


Figure 1. 1Ø L-N Wiring, L1

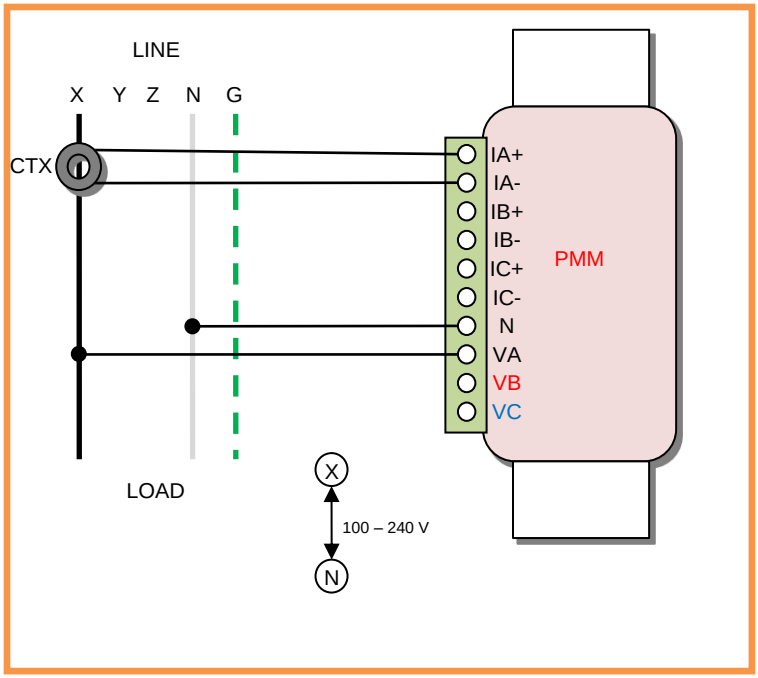


Figure 2. 1Ø L-N Wiring diagram with ground, L1

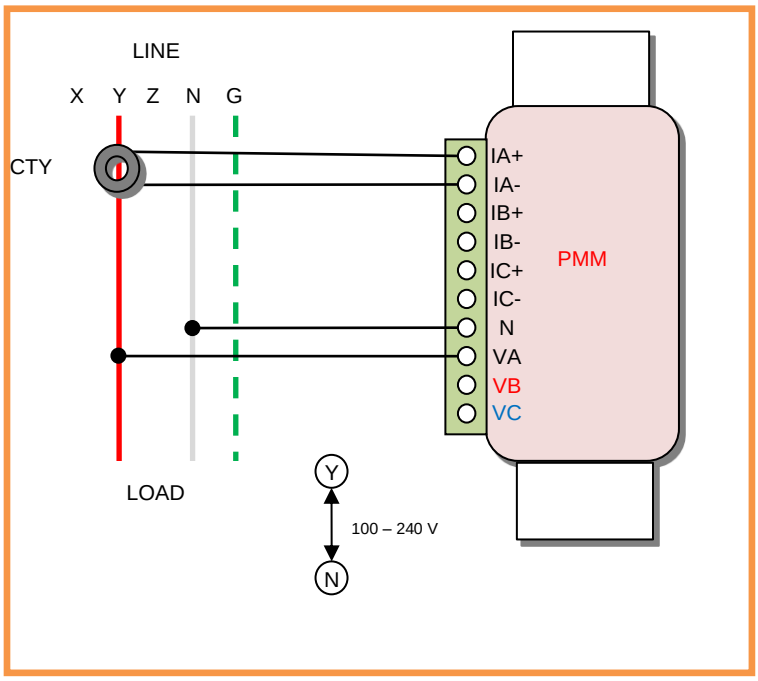


Figure 3. 1Ø L-N Wiring diagram, L2

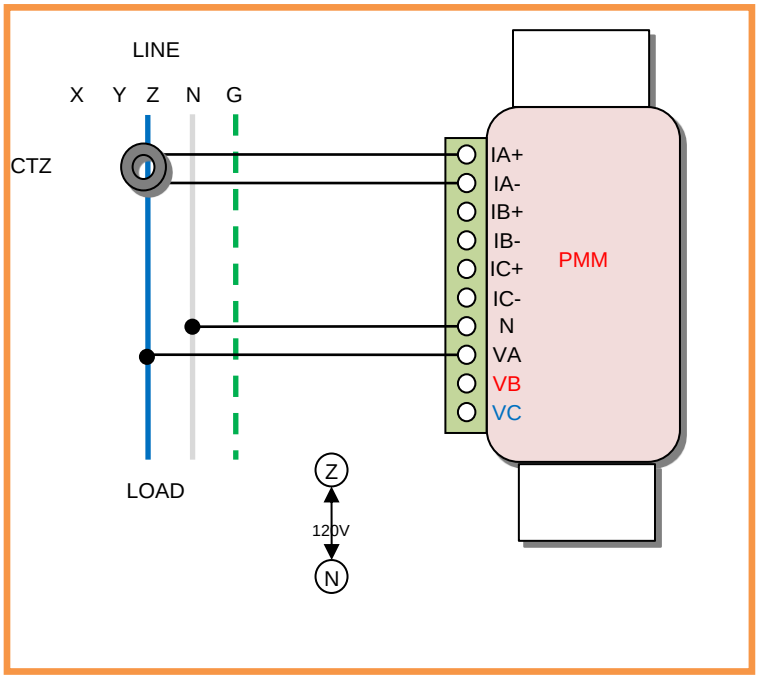


Figure 4. 1Ø L-N Wiring diagram, L3

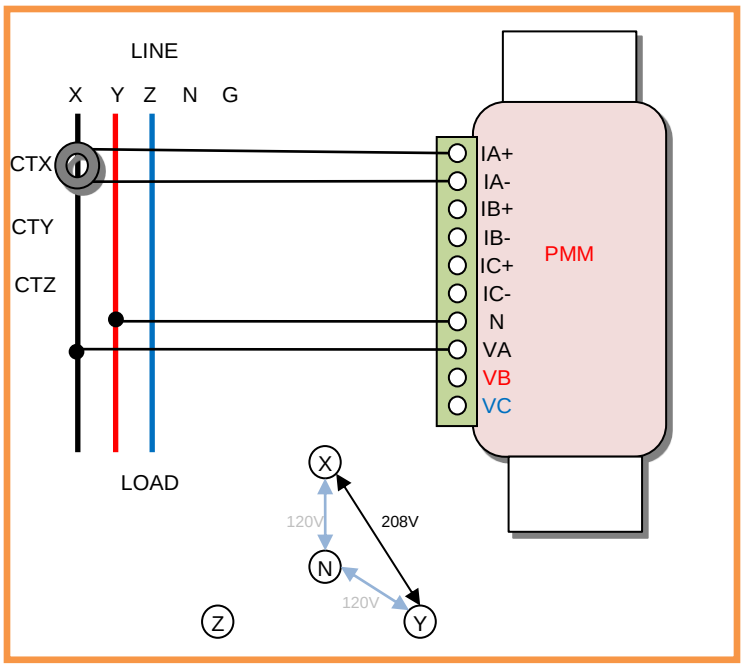


Figure 5. 1Ø 208V L-L wiring diagram, L1-L2 load

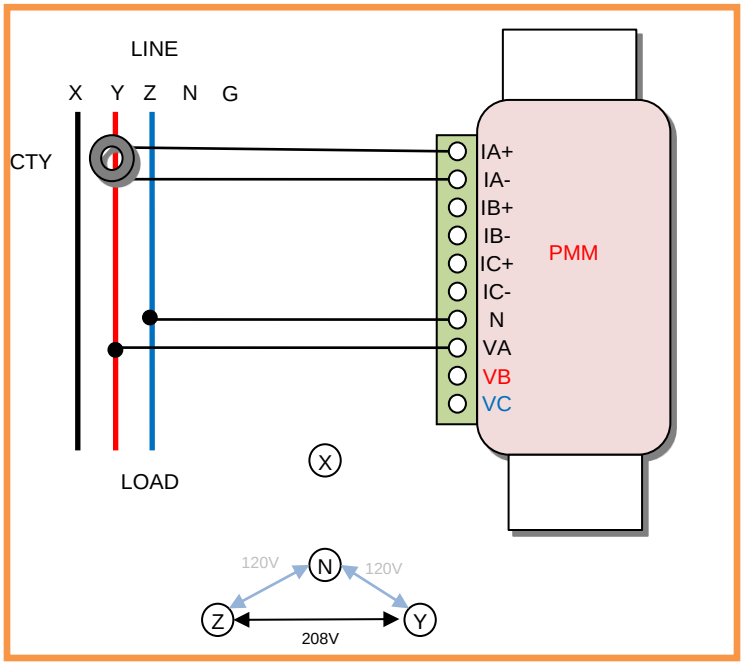


Figure 6. 1Ø 208V L-L wiring diagram, L2-L3 load

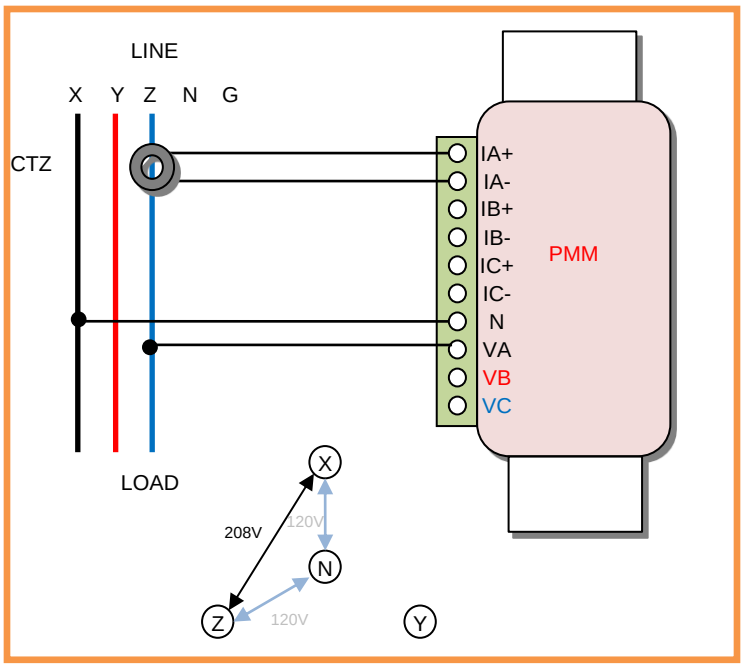


Figure 7. 1Ø 208V L-L wiring diagram, L1-L3 load

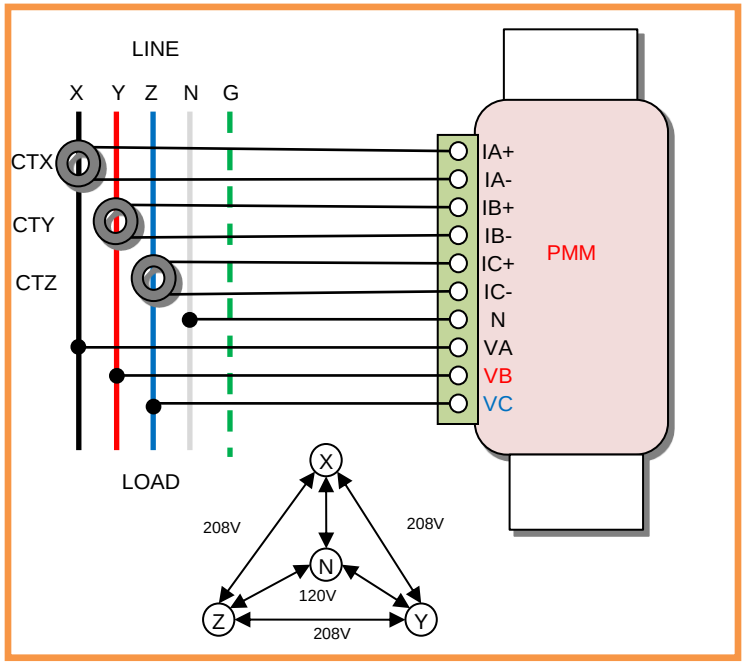


Figure 8. 3Ø Wye 120/208V L-N wiring diagram

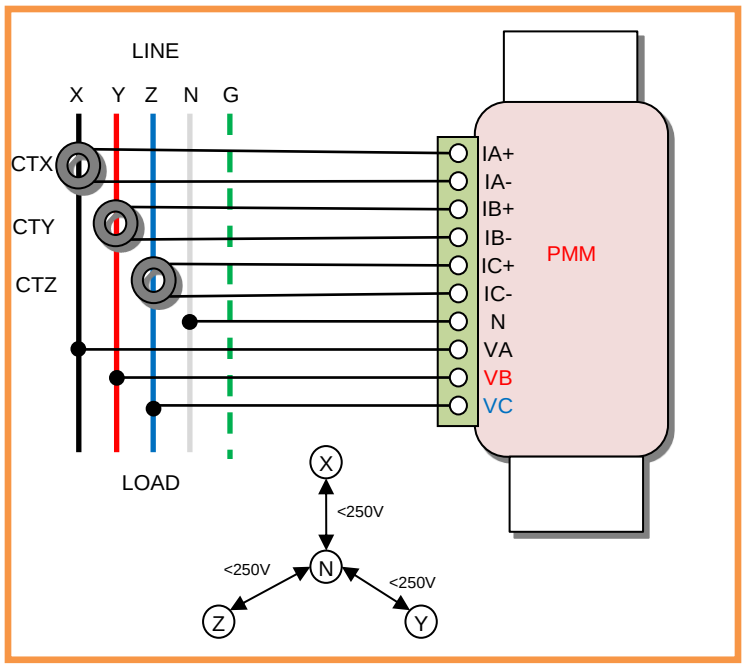


Figure 9. 3Ø Wye 240/415V L-N wiring diagram

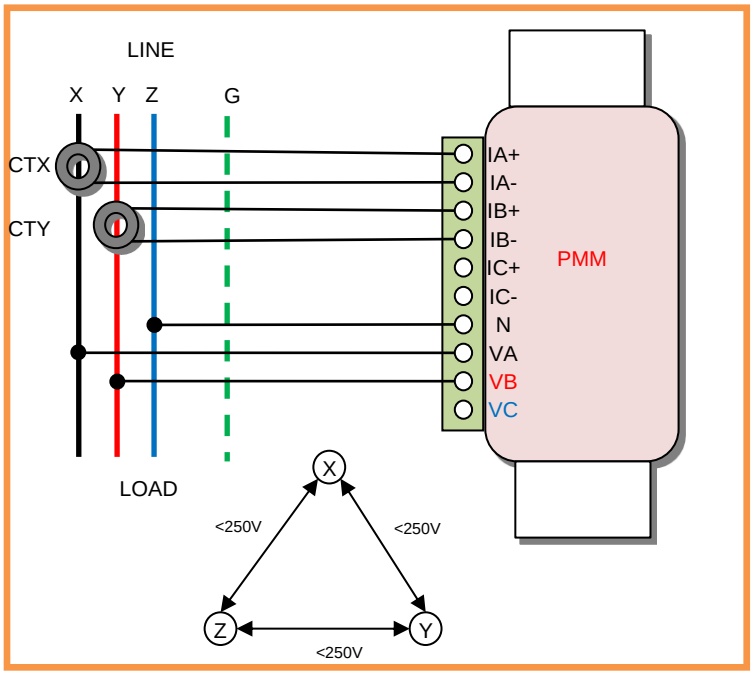


Figure 10. 3Ø Delta L-L wiring diagram

Choosing the correct current transformers

The PMM can operate with a variety of standard current transformers (C/Ts). Any current transformers used with the PMM must satisfy the following criteria:

1. The C/T must be approved by Packet Power for use with the PMM.
2. The C/T must be sized correctly for the maximum current of the circuit being measured.
3. The C/T must meet all local and national safety requirements relevant to the installation, including but not limited to maximum voltage and any other relevant mechanical requirements.
4. The output of the C/T must be compatible with the PMM. There are two versions of the P5T3 PMM, one designed to work with certain un-shunted C/Ts and one designed to work with certain shunted CTs. In order to receive accurate readings, the PMM firmware must be programmed to match the exact specifications of the C/T that is being used.
5. Each C/T input is fuse-protected with a 250mA safety fuse. Safety fuses are not field-replaceable.
6. Using the wrong C/T can result in damage to the PMM and inaccurate measurement readings. Please use only the C/T's supplied by Packet Power with your PMM.

Sample C/T's and their associated current range are shown below:

Current transformer	Max. monitored current
PacPow 35A, Geist 35A	35A
Geist 8688	72A
CR Magnetics CR 3110-3000	106A
JD-JC24-200	235A

Note that C/T's may provide less accurate readings at loads under 5-10% of their maximum rated current.

Installing the current transformer connections

Once the appropriate current transformers have been chosen they should be installed over the appropriate load-carrying lines and connected to the PMM terminals according to the configuration diagram. Please note that current transformers are polarized (i.e. the two wires are not interchangeable) – if swapped, the PMM will detect energy as flowing in the opposite direction ("running the meter backwards"). Please refer to current transformer data sheet to determine the correct connection or contact Packet Power.

> **Note:** You must ensure the current transformer(s) you have selected is approved by Packet Power and matched correctly to maximum rated load of the conductor on which it will be used. You are responsible for understanding how to correctly select and use the appropriate current transformers for the type of power you wish to monitor. Failure to correctly size and install the current transformers could result in product failure and hazardous operating conditions.

Installing the voltage circuit connections

Please connect the appropriate monitored voltage lines to the appropriate PMM terminals using 14-20AWG wire that meets all relevant safety standards.

> **Note:** You must ensure that all connections ("taps") being made to the load-carrying lines satisfy relevant safety codes and local regulations. You are responsible for understanding how to perform this connection. Failure to correctly perform this connection could result in product failure and hazardous operating conditions.

Verifying PMM connections

Before mounting the PMM please verify that:

1. You are using the correct voltage version of the PMM for your configuration.
2. All current transformers have been correctly located over the load-carrying lines (please consult C/T documentation if necessary)
3. All current transformers have been correctly and securely connected to the PMM terminals
4. All voltage connections have been correctly and securely connected to the PMM terminals.

Mounting the PMM

The PMM must be firmly secured within a housing that prevents access to any exposed connectors and ensures the connectors cannot come into contact with an electrically conductive enclosure. The design of the PMM allows for easy installation in a standard gang box with a full face plate as shown in the sequence below.

1

2

3

Note: If the current transformer(s) are located in the same enclosure as the PMM, you must ensure that any electrical code fill rate requirements are being met.

LED readings and indicator lights

The PMM has 3 large alpha-numeric LEDs that provide for local display of monitoring data and 3 small lights adjacent to the LEDs that provide operating status information.

The PMM can be configured to display all or some of the following data via the numeric LEDs. The order of display can also be customized. The data type indicator is shown followed by the corresponding value, e.g. to show a reading of 10.1 amps on channel A, the PMM displays “A1” followed by “10.1”.

- P5= XXX firmware version
- Id = ABC last 3 digits of the Packet Power node ID
- A1 / A2 / A3 = current on channel A, B or C in Amps
- U1 / U2 / U3 = voltage on channel A, B or C in Volts
- P1 / P2 / P3 = power on channel A, B or C in kilowatts
- F1 / F2 / F3 = power factor on channel A, B or C
- Fr= frequency in Hz

The 3 status lights are interpreted as follows (top, middle and bottom positions assume that the PMM is viewed such that the status lights are to the right of the large LEDs):

Top small light (green)

- 900MHz radio activity
  - off: disabled
  - solid on: active, not connected
  - slow flashing: active, connected to the mesh network
  - very rapid flashing: test/configuration mode

Middle small light (red)

- 2.4 GHz radio activity
    - off: disabled
    - solid on: active, not connected
    - slow flashing: active, connected to the mesh network
    - rapid flashing: connected in near communication mode
    - very rapid flashing: test/configuration mode

Lower small light (green)

- Power monitoring activity
    - off: power monitor disabled or not functional
    - slow flashing: active, monitoring power
    - very rapid flashing: test/configuration mode

Maintenance and Repair

Maintenance

The PMM has no user-serviceable parts and requires no maintenance. If necessary, clean the outside of the PMM using a clean, dry cloth.

Repair

The PMM contains no field-serviceable components. Failed products should be returned to Packet Power for replacement. For any service or repair information please contact Packet Power at support@packetpower.com. Please be sure to enclose the 16-character serial number.

Technical Specifications

Electrical

Service types	Supported
1Ø 100-127V	Y
1Ø 208-240V	Y
3Ø Wye 120V/208V	Y
3Ø Wye 220-240V/380-415V	Y
3Ø Wye 277V/480V	N
3Ø Delta 220V	Y
3Ø Delta 380V or above	N

Voltage inputs	
Voltage rating	60-270V
Current rating	10mA (max. current drawn, VA-N only)
Frequency range	45-65Hz
Category	CAT II/CAT III

Current inputs	K Version
Current rating	CTs producing 333mV output at full range (internally shunted). 250mA fuse protected.
Frequency range	45-65Hz
Category	CAT II/CAT III

Current inputs	R Version
Current rating	CTs producing 25mA at full range CTs (un-shunted). 250mA fuse protected.
Frequency range	45-65Hz
Category	CAT II/CAT III

Measurements	All versions
Voltage [V]	3 channels, 1%
Current [A]	3 channels, 1%
True power [W]	3 channels, net metering, 1%,
Apparent power [VAR]	3 channels, 1%
Power factor [%]	3 channels, 1%
Energy [Wh]	3 channels, total, net metering, 1%
Phase shifts [deg]	2 channels (relative A-B, A-C, 1 deg)
Frequency [Hz]	1 channel (A), 0.1%
Net metering	Yes – 3 channels + total

Mechanical

Enclosure	All versions
Enclosure material	High-impact resistant Lexan, V0 flammability rating
Weight (w/out CTs)	3.6 oz / 105 g
Dimensions (core)	2.8 in x 1.6 in x 1.4 in 71 mm x 40 mm x 36 mm
Dimensions (including mounting tabs and connectors)	4.2 in x 1.6 in x 1.8 in 106 mm x 40 mm x 45 mm

Environmental

Operating conditions	All versions
Operating temperature	-7 to +80 C (+20 to +176F)
Humidity	5% to 95% non-condensing
Max. operating altitude	2000m (6561ft)
Pollution degree	2

Communication

Information gathered by the PMM is transmitted via a Packet Power radio network. The P5T3 model may use a radio operating at 2.4GHz, a radio operating in a subset of the range between 860 and 930MHz (the exact frequencies vary with region – please contact Packet Power for details), or both depending on how the firmware in the module is configured.

The network operates in a mesh topology. Each device in the network must be within range of at least one other device in the network. The effective range of the radio in the PMM varies depending on several factors, including the environment in which the product is used. Typically, the device has an effective range of 25 to over 100 feet. The PMM will not transmit effectively if it is installed in an enclosure that blocks radio signals.

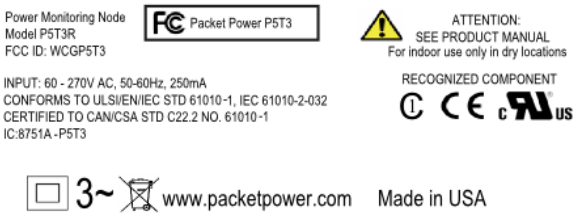
Every site where the PMM is deployed must have installed at least one compatible Packet Power Ethernet Gateway device and associated software to collect data and prepare it for transmission to approved monitoring and analysis applications.

The rate at which monitoring information is gathered from a PMM depends primarily on the ratio of the number of PMMs to the number of gateways. It can range from every few seconds to 100 seconds or more.

> **Note:** In the event of a loss of power to the PMM, energy consumption information (Wh) for all three channels and the total is retained in non-volatile memory and will be transmitted when power is restored.

Product Safety Label

The product safety label can be found on the side of the PMM.



P2T3P 125V and 250V Models

Installation

Safety prerequisites

⚠ The PMM should be installed only by qualified technicians with a solid understanding of electrical wiring and devices. Familiarity with and understanding of all terms used in this section is assumed. The user is responsible for ensuring that all electrical connections are safely performed in accordance with all applicable codes and regulations using appropriate tools and materials. The user is responsible for ensuring that all applicable codes and regulations are satisfied.

⚠ The PMM requires that a proper, external power disconnect such as switch or circuit breaker be available upstream (on the supply side) from the unit. Power must be disconnected before the unit is installed.

⚠ The PMM is a CAT II/CAT III measurement device. When the device is powered, line voltages may be present on all device terminals, including the C/T terminals IA, IB, and IC. All wiring and C/Ts connected to the device must meet the appropriate CAT II/CAT III standards.

Please note that exact line voltages vary with regions. “120V” is used to denote voltages in the 100-120V range. “208V” and “220V” are used to denote voltages in the 200-240V range.

Choosing the PMM version and wiring configuration

Before installing the PMM please determine the type of circuit being monitored, including:

5. Circuit type (single phase vs. three phase, Wye vs. Delta)
6. Line voltages. Please be careful not to confuse intra-phase (e.g. X-Y) voltage with line-neutral (e.g. X-N) voltage. Please refer to the wiring diagrams (Figure 8 through Figure) if necessary.
7. Line current ratings.
8. Any space considerations that may affect the choice of C/T.

Once this information is available, please refer to Table 2 below and the wiring diagrams to determine the appropriate PMM voltage version, wiring configuration and the number of current transformers required.

Table 2. PMM wiring options for all supported configurations

Wiring	Voltage	PMM version	PMM terminal connections (blank denotes “not connected”)							Diagram
P=pole W=wire G=ground			VA	VB	VC	N	IA	IB	IC	
2P2W	1Ø 120V	PMM 120V	X			N	CTX			Figure 8
2P3WG	1Ø 120V, X-N load	PMM 120V	X			N	CTX			Figure 8
2P3WG	1Ø 120V, Y-N load	PMM 120V	Y			N	CTY			Figure 8
2P3WG	1Ø 120V, Z-N load	PMM 120V	Z			N	CTZ			Figure 8
2P3WG	1Ø 208V, X-Y load	PMM 240V	X			Y	CTX			Figure 12
2P3WG	1Ø 208V, Y-Z load	PMM 240V	Y			Z	CTY			Figure 12
2P3WG	1Ø 208V, Z-X load	PMM 240V	Z			X	CTZ			Figure 12

3P4W	3Ø Wye 120V/208V	PMM 120V	X	Y	Z	N	CTX	CTY	CTZ	Figure
3P5WG	3Ø Wye 120V/208V	PMM 120V	X	Y	Z	N	CTX	CTY	CTZ	Figure
3P3W	3Ø Delta 208V	PMM 240V	X	Y		Z	CTX	CTY		Figure
3P4WG	3Ø Delta 208V	PMM 240V	X	Y		Z	CTX	CTY		Figure
2P2W	1Ø 220V	PMM 240V	X			N	CTX			Figure
2P2WG	1Ø 220V	PMM 240V	X			N	CTX			Figure
3P4W	3Ø Wye 220V/380V	PMM 240V	X			N	CTX			Figure
3P5WG	3Ø Wye 220V/380V	PMM 240V	X	Y	Z	N	CTX	CTY	CTZ	Figure
3P3W	3Ø Delta 380V	Not supported								
3P4WG	3Ø Delta 380V	Not supported								

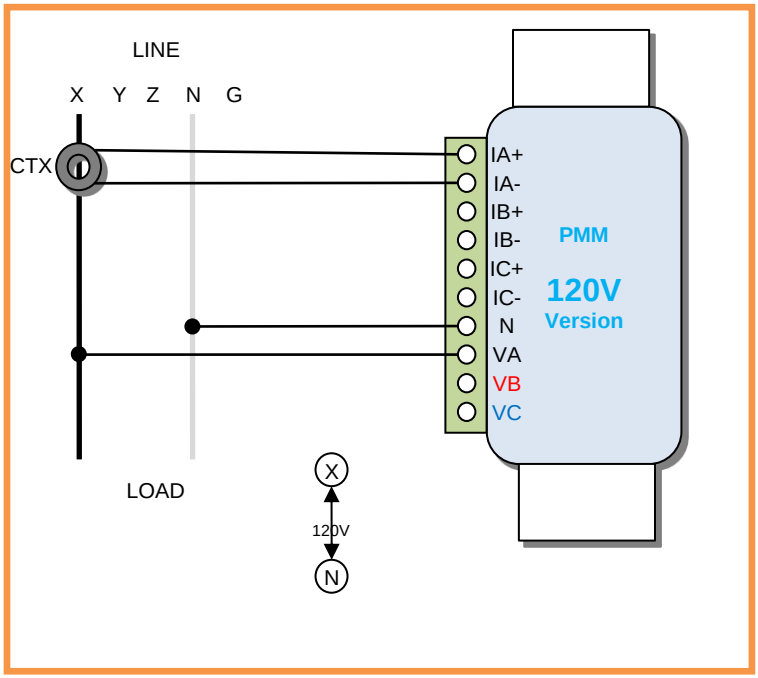


Figure 8. 1Ø 120V Wiring diagram (2P2W)

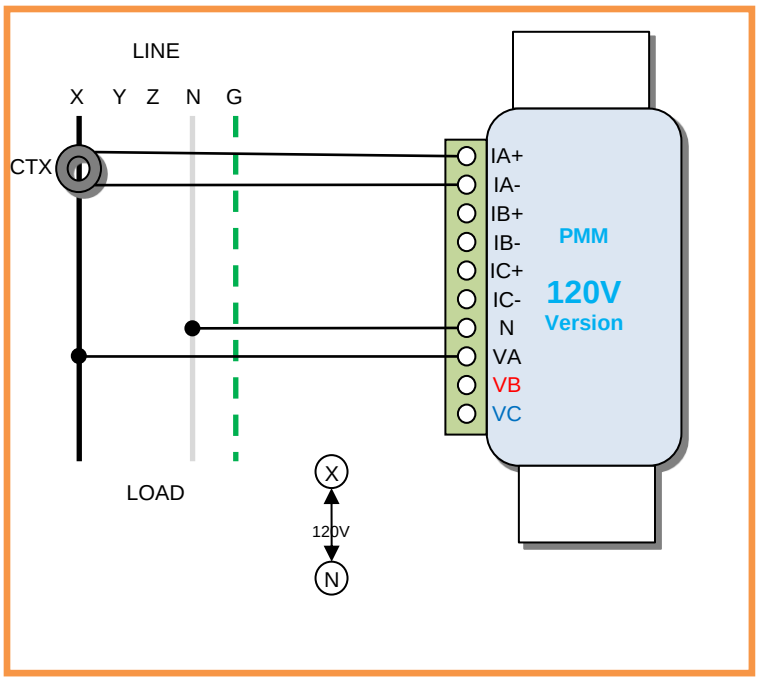


Figure 9. 1Ø 120V Wiring diagram, X-N load (2P3WG)

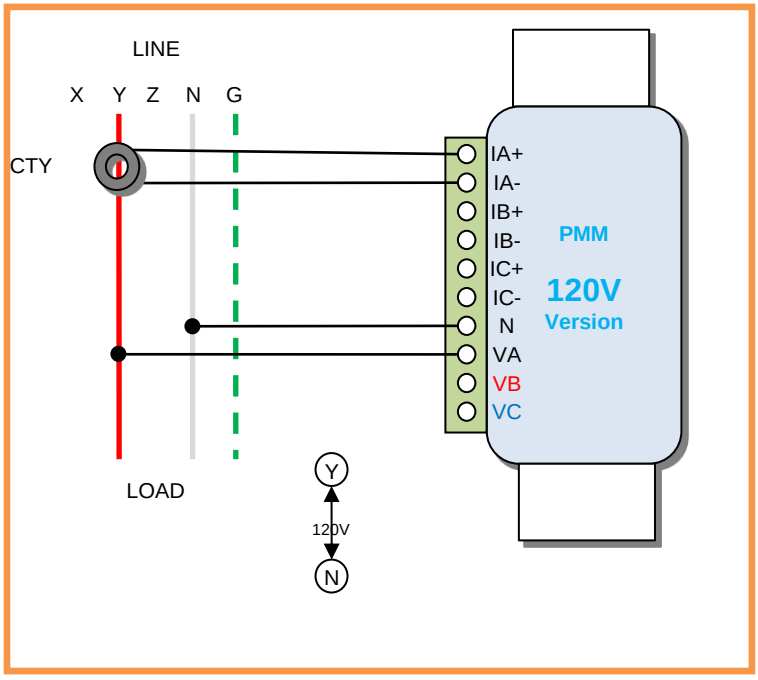


Figure 10. 1Ø 120V Wiring diagram, Y-N load (2P3WG)

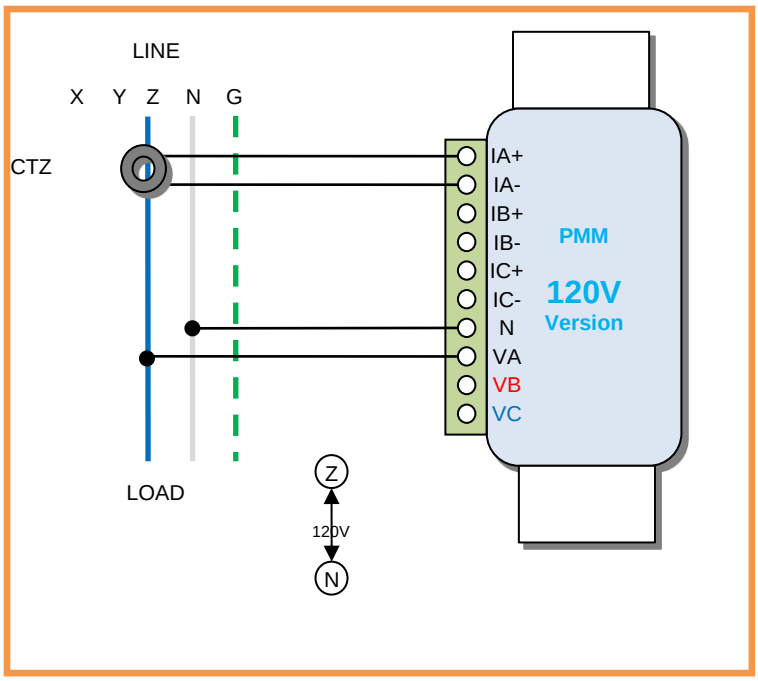


Figure 11. 1Ø 120V Wiring diagram, Z-N load (2P3WG)

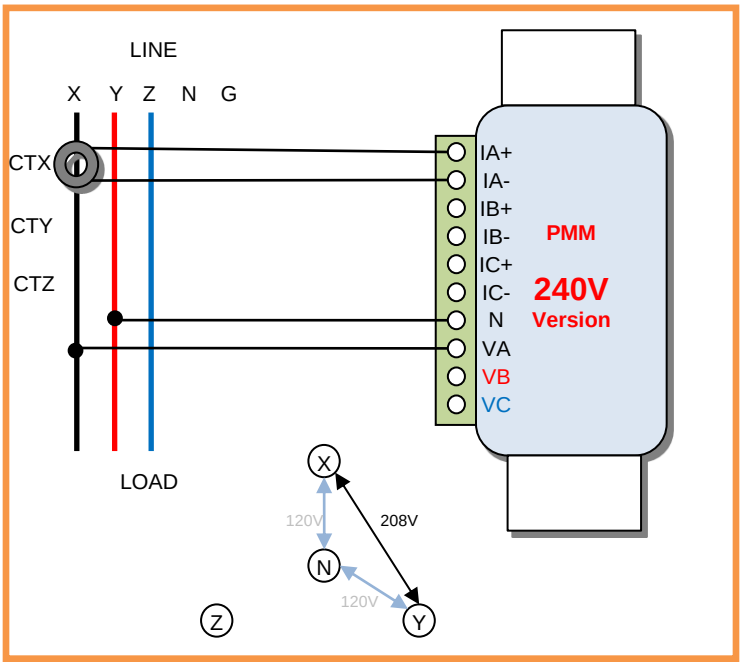


Figure 12. 1Ø 208V wiring diagram (2P3WG), X-Y load

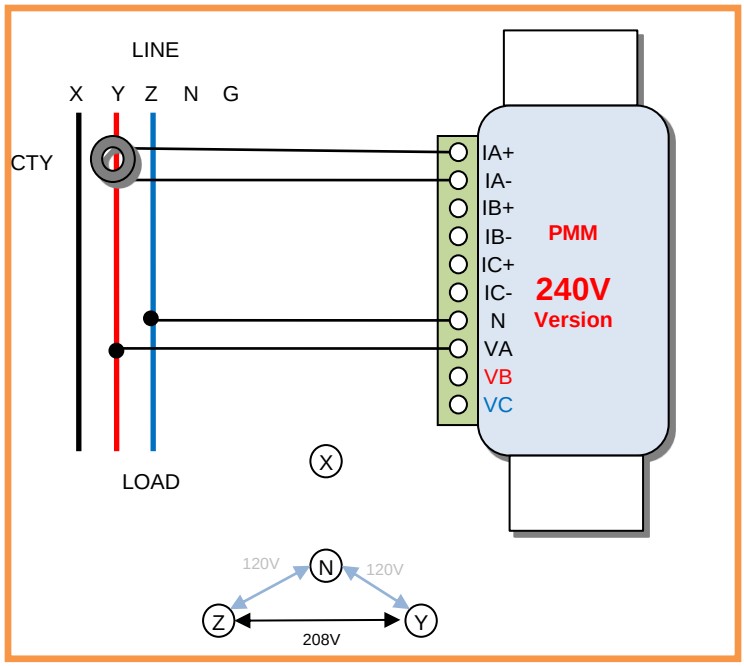


Figure 13. 1Ø 208V wiring diagram (2P3WG), Y-Z load

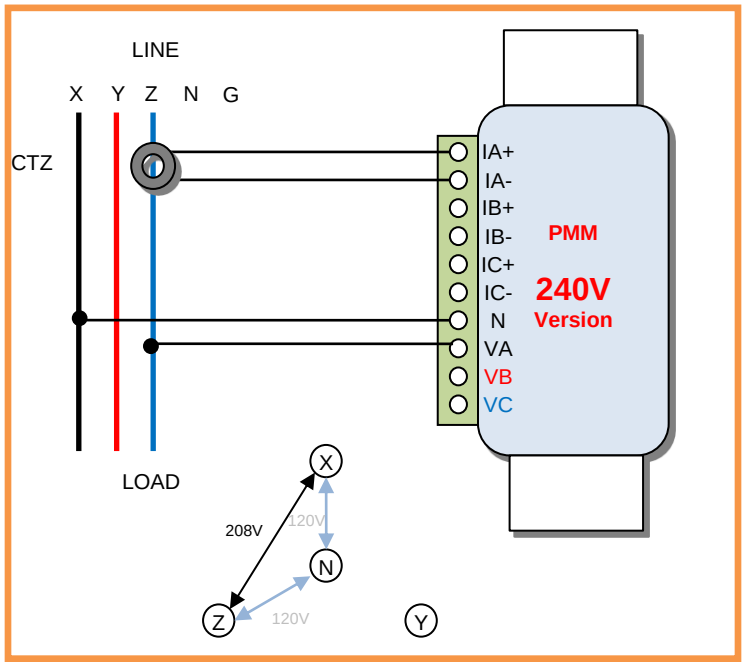


Figure 14. 1Ø 208V wiring diagram (2P3WG), Z-X load

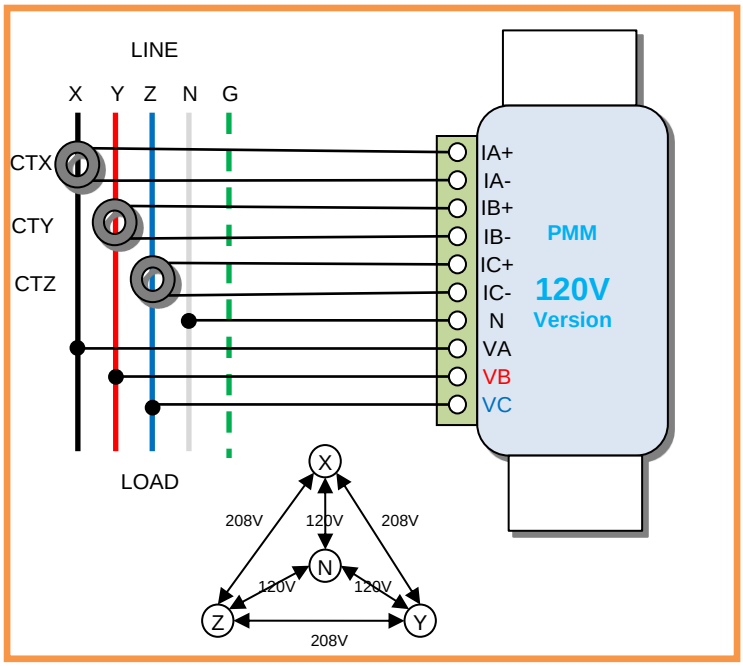


Figure 8. 3Ø Wye 120V/208V wiring diagram (3P4W, 3P5WG)

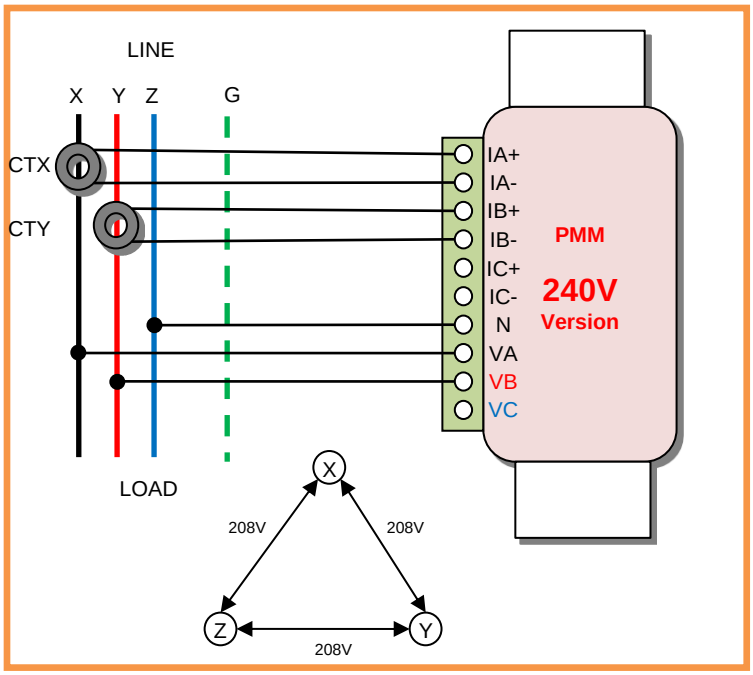


Figure 9. 3Ø Delta 208V wiring diagram (3P3W, 3P4WG)

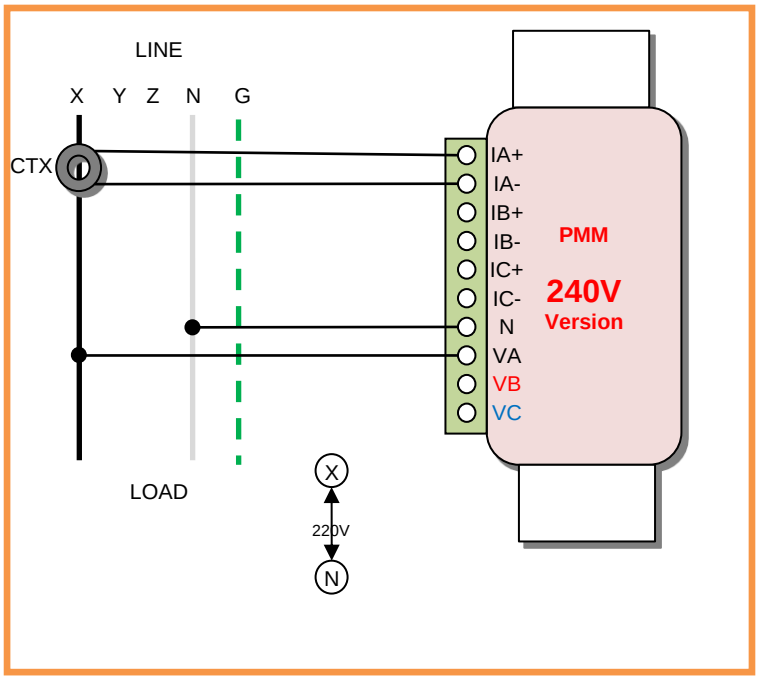


Figure 10. 1Ø 230V wiring diagram (2P2W, 2P3WG)

Note: X-N load shown. See Figures 2 & 3 for guidance on how to wire Y-N and Z-N loads.

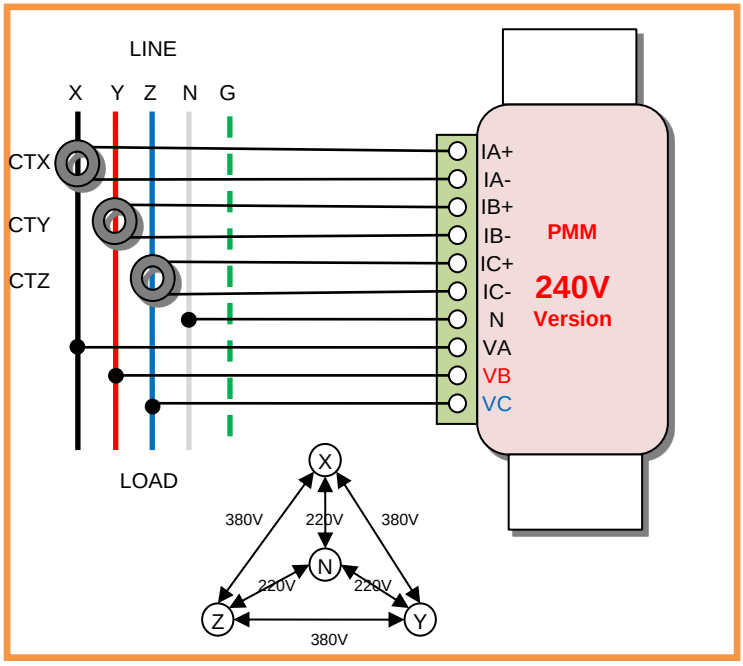


Figure 11. 3Ø Wye 220V/380V wiring diagram (3P4W, 3P5WG)

Choosing the correct current transformers

The PMM can operate with a variety of standard current transformers (C/Ts). Any current transformers used with the PMM must satisfy the following criteria:

1. The C/T must be approved by Packet Power for use with the PMM.
2. The C/T must be sized correctly for the maximum current of the circuit being measured.
3. The C/T must meet all local and national safety requirements relevant to the installation, including but not limited to maximum voltage and any other relevant mechanical requirements.
4. The output of the C/T must be compatible with the PMM. Each C/T input is fuse-protected with a 250mA safety fuse. Safety fuses are not field-replaceable.
5. In order to receive accurate readings, the PMM firmware must be programmed to match the exact specifications of the C/T that is being used.
6. Using the wrong C/T can result in damage to the PMM and inaccurate measurement readings. Please use only the C/T's supplied by Packet Power with your PMM.

Some sample C/T's and their associated current range are shown below:

Current transformer	Max. monitored current
PacPow 35A, Geist 35A	35A
Geist 8688	72A
CR Magnetics CR 3110-3000	106A
JD-JC24-200	235A

Note that C/T's may provide less accurate readings at loads under 5-10% of their maximum rated current.

Installing the current transformer connections

Once the appropriate current transformers have been chosen they should be installed over the appropriate load-carrying lines and connected to the PMM terminals according to the configuration diagram. Please note that current transformers are polarized (i.e. the two wires are not interchangeable) – if swapped, the PMM will detect energy as flowing in the opposite direction ("running the meter backwards"). Please refer to current transformer data sheet to determine the correct connection or contact Packet Power.

> **Note:** You must ensure the current transformer(s) you have selected is matched correctly to maximum rated load of the conductor on which it will be used. You are responsible for understanding how to correctly select and use the appropriate current transformers for the type of power you wish to monitor. Failure to correctly size and install the current transformers could result in product failure and hazardous operating conditions.

Installing the voltage circuit connections

Please connect the appropriate monitored voltage lines to the appropriate PMM terminals using 14-20AWG wire that meets all relevant safety standards.

> **Note:** You must ensure that all connections ("taps") being made to the load-carrying lines satisfy relevant safety codes and local regulations. You are responsible for understanding how to perform this connection. Failure to correctly perform this connection could result in product failure and hazardous operating conditions.

Verifying PMM connections

Before mounting the PMM please verify that:

5. You are using the correct voltage version of the PMM for your configuration.

6. All current transformers have been correctly located over the load-carrying lines (please consult C/T documentation if necessary)
7. All current transformers have been correctly and securely connected to the PMM terminals
8. All voltage connections have been correctly and securely connected to the PMM terminals.

Mounting the PMM

The PMM must be firmly secured within a housing that prevents access to any exposed connectors and ensures the connectors cannot come into contact with an electrically conductive enclosure. The design of the PMM allows for easy installation in a standard gang box with a full face plate as shown in the sequence below.

1

2

3 

Note: If the current transformer(s) are located in the same enclosure as the PMM, you must ensure that any electrical code fill rate requirements are being met.

Maintenance and Repair

Maintenance

The PMM has no user-serviceable parts and requires no maintenance. If necessary, clean the outside of the PMM using a clean, dry cloth.

Repair

The PMM contains no field-serviceable components in the PMM. Failed products should be returned to Packet Power for replacement. For any service or repair information please contact Packet Power at service@packetpower.com. Please be sure to enclose the 16-character serial number.

Technical Specifications

Electrical

Service types	120V Version
1Ø 120V	2P2W, 2P3WG
3Ø Wye 120V/208V	3P4W, 3P5WG

Service types	240V Version
1Ø 208V	2P3WG
1Ø 230V	2P2W, 2P2WG
3Ø Wye 230V/400V	3P4W, 3P5WG
3Ø Delta 220V	3P3W, 3P4WG

Voltage inputs	120V version
Voltage rating	100-120V
Current rating	10mA (max. current drawn, VA-N only)
Frequency range	45-65Hz
Category	CAT II/CAT III

Voltage inputs	240V version
Voltage rating	200-240V
Current rating	10mA (max. current drawn, VA-N only)
Frequency range	45-65Hz
Category	CAT II/CAT III

Current inputs	All versions
Current rating	250mA (C/T-dependent, nominal signal input: 0...25mA, 250mA fuse protected)
Frequency range	45-65Hz
Category	CAT II/CAT III

Measurements	All versions
Voltage [V]	3 channels, 1%
Current [A]	3 channels, 1%
True power [W]	3 channels, net metering, 1%,
Apparent power [VAR]	3 channels, 1%
Power factor [%]	3 channels, 1%
Energy [Wh]	3 channels, total, net metering, 1%
Phase shifts [deg]	2 channels (relative A-B, A-C, 1 deg)
Frequency [Hz]	1 channel (A), 0.1%
Net metering	Yes – 3 channels + total

Mechanical

Enclosure	All versions
Enclosure material	High-impact resistant Lexan, V0 flammability rating
Weight (w/out CTs)	3.6 oz / 105 g
Dimensions (core)	2.8 in x 1.6 in x 1.4 in 71 mm x 40 mm x 36 mm
Dimensions (including mounting tabs and connectors)	4.2 in x 1.6 in x 1.8 in 106 mm x 40 mm x 45 mm

Environmental

Operating conditions	All versions
Operating temperature	-7 to +45 C (+20 to +113F)
Humidity	5% to 95% non-condensing
Max. operating altitude	2000m (6561ft)
Pollution degree	2

Communication

Information gathered by the PMM is transmitted via a Packet Power radio network operating in a subset of the range between 860 and 930MHz (the exact frequencies vary with region – please contact Packet Power for details). The network operates in a mesh topology. Each device in the network must be within range of at least one other device in the network. The effective range of the radio in the PMM varies depending on several factors, including the environment in which the product is used. Typically, the device has an effective range of 50 to over 100 feet. The PMM will not transmit effectively if it is installed in an enclosure that blocks radio signals.

Every site where the PMM is deployed must have installed at least one compatible Packet Power Gateway device and associated software to collect data and prepare it for transmission to approved monitoring and analysis applications.

The frequency with which monitoring information is gathered from a PMM depends primarily on the ratio of the number of PMMs to the number of gateways. It can range from every few seconds to 100 seconds or more.

> **Note:** In the event of a loss of power to the PMM, energy consumption information (Wh) for all three channels and the total is retained in non-volatile memory and will be transmitted when power is restored.

Sample Label

Note the PMM is manufactured in two different models with different input power source requirements. The required type of input power is indicated on the product safety label.