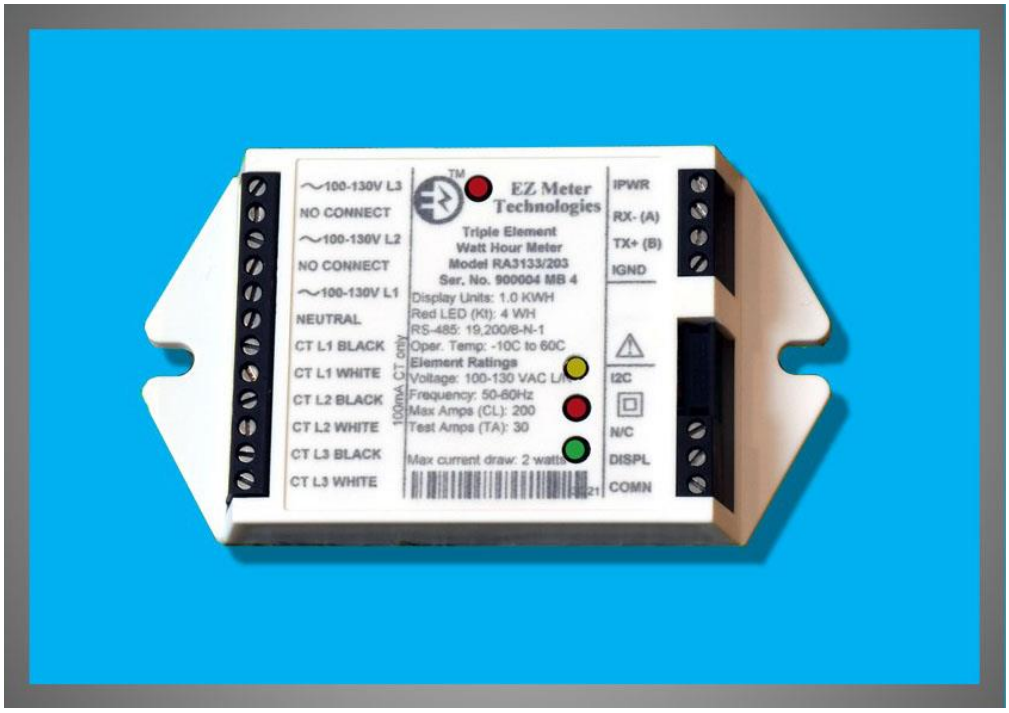
RGB, HVGP, & HVDM Watthour Meters

User Manual

Installation Manual

Product Selection Guide



CONTENTS

CAUTIONS

Serious injury can result from electric shock. Be sure to turn off the power before installing or servicing any meter.

Fire can result from loose electrical connections. Ensure that all connections are secure.

A loose or improperly connected neutral can damage equipment and cause fires. Most meters that count faster than they should are connected to a bad neutral.

Current transformers (CTs) should not be placed over conductors that are energized. Be sure that the circuit is turned off. Do not energize the circuit until the CTs are properly connected to the meter. A very serious shock hazard exists if the wires are just left loose on non-UL2808 listed CTs

These meters shall only be installed by qualified personnel. If you do not fully understand these instructions, call Customer Support at 1-805-688-9696 for clarification.

In most localities, a permit and inspection is required to install the meters. In some localities, it is illegal to use an unapproved meter for revenue billing. Check with your local Weights & Measures office or other regulatory agency.

Legends

These symbols appear on meter labels.

 Caution, risk of Danger

 Equipment protected throughout by double insulation

 Alternating Current

Abbreviations & Glossary

Common abbreviations used in this manual include:

AMR - Automatic Meter Reading System
CT - Current transformer
KWH – Kilowatt-hour
Element – Meter section that calculates Power. Meter can contain up to three Elements.

Contact Information

EZMeter Technologies
11030 Cochiti Rd SE
Albuquerque NM 87123 USA
1-805-688-9696

www.ezmeter.com
salesinfo@ezmeter.com

Note: This manual applies to meters that have a letter (A-G, or R) as the first character of the model number.

 Rev. 10/1/2021

 **WARNING**

Internal Circuit Card Components are extremely sensitive to electrostatic discharge. Prior to handling or touching internal circuitry, discharge any static buildup on your person. To discharge yourself, touch a grounded metal object such as conduit or an earth grounded metal enclosure

 **WARNING**

Use of this Meter in a manner inconsistent with this manual or not specified by the manufacturer in writing, can cause permanent damage to the unit and/or serious injury to the operator. The protection and safety features provided by this equipment may become impaired or otherwise compromised.

 **WARNING**

High Voltages are present on Main Power (voltage) Terminal Block. Risk of serious injury and/or electrical shock exists. Prior to performing any wiring operations, review all contents of the users manual and de-energize the MAINS power switch. Only qualified personnel should perform installation wiring. Installation wiring must comply with all local and national electrical codes

 **WARNING**

Hazardous voltages can exist in non-UL2808 listed CT secondary wires when the monitored circuit is energized and the wires are not connected. De-energize the monitored circuit and short the CT wires together if you must remove the meter and leave the CTs in place. The circuit may be re-energized after the CT wires have been shorted. Failure to do so may damage the CT or cause personal injury to someone.

Safety Certification

Underwriter's Laboratories (UL)

Most EZ Meters have been tested by UL to UL61010 and carry the UL Recognized Component mark for the United States (UL61010) and Canada (CAN/C22.2 No 1010.1-04). File number is E362606.

Accuracy Certification

EZ Meters are designed to meet the latest ANSI C12.20 accuracy standard for electric meters and the new ANSI SM31000 standard for submeters. Our meters are individually calibrated utilizing equipment standards that are traceable to the NIST.

In California, Maryland and Canada, meters are regulated by the government when used for revenue billing. Contact the local Weights and Measures office. Only meters that have been Type Approved by the California Division of Measurement Standards may be used for revenue billing within California (all EZ Meters exceed California's accuracy requirements, but all are not type approved).

A Note for California Users

All meters used in California for which a charge is made for power must have been inspected by a Weights & Measures inspector and placed in service by a Licensed Service Agent or a Weights & Measures official. The meter must be reinspected by Weights and Measures every ten years. It is a misdemeanor to fail to do this. See the EZ Meter.com website for more on these requirements.

Certain models of the HVGP and HVDM meters have been certified for revenue billing in California. They are the 200 amp versions of the 120 volt to neutral meters when using the Model JD6W or EZ417-1 current transformer. Approved California meters are models

A31*x*3*x*/*yzxxx*

where *x* may be any digit, *y* may be E, 0 or 3 and *z* may be 0 or 1. 0 is assumed if *x* and *y* are not present. The CTEP certificate number is 5674(b)-18.

Limited Warranty

EZ Meter Technologies warrants its products, if used in accordance with all applicable instructions, to be free from original defects in material and workmanship for a period of five years from the date of manufacture. If the product should prove defective in material or workmanship within that period, EZ Meter Technologies will repair or replace the product, in its sole discretion. Service under this Warranty can only be obtained by your delivering or shipping the product (with all shipping or delivery charges prepaid) to: EZ Meter Technologies, 11030 Cochiti Rd SE, Albuquerque NM 87123 USA. EZ Meter Technologies will pay return shipping charges. Call EZ Meter Technologies at (805) 688-9696 for a Return Material Authorization (RMA) before sending any equipment back for repair.

THIS WARRANTY DOES NOT APPLY TO NORMAL WEAR OR DAMAGE RESULTING FROM ACT OF GOD, ACCIDENT, MISUSE, ABUSE, OR NEGLECT. SELLER MAKES NO EXPRESS WARRANTIES OTHER THAN THE WARRANTY EXPRESSLY SET FORTH HEREIN, EXCEPT TO THE EXTENT PROHIBITED BY APPLICABLE LAW. ALL IMPLIED WARRANTIES INCLUDING ALL WARRANTIES OF MERCHANTABILITY OR FITNESS ARE LIMITED IN DURATION TO THE WARRANTY PERIOD SET FORTH ABOVE AND THIS WARRANTY EXPRESSLY EXCLUDES ALL INCIDENTAL AND CONSEQUENTIAL DAMAGES. (Some states do not allow limitation on how long an implied warranty lasts, and some states do not allow the exclusion or limitation of incidental or consequential damages so the above limitations or exclusions may not apply to you. This Warranty gives you specific legal rights, and you may have other rights which vary from jurisdiction to jurisdiction).

Damage from lightning strikes, power surges, and improperly connecting the meter to the power source are not covered by the warranty.

Product Overview

The newest revision to the EZ Meter line of electric submeters adds energy management to its list of capabilities. Outwardly very similar to the billing meters introduced since 1998, this third revision adds more computing power to now delivers true RMS values for volts, amps, watts, power factor and frequency while maintaining the high accuracy of energy (kWh). While the new meters, referred to as Energy Management meters, cost more than the older Billing meter designs, they can also be used for billing if desired.

** See APPENDIX F for more information on the differences between the HVGP and HVDM meters and the RGB model.

Meter Technical Specifications

Input Voltage Configuration	3-Wire (delta), 4-Wire (delta), 3-Wire Single Phase, 2-Wire Single Phase or 4-Wire (wye)
MAINS Voltage Input	Up to 480 VAC RMS Available
Input Power	2 VA maximum rating
CT Rating	Up to 3200 amps RMS AC available
Power Factor	0.5 leading or lagging
Line Frequency	50-60 Hz
Metering Accuracy	ANSI C12.20 and SM31000-2
Voltage Operating Range	+/-10% of rated load
Temperature Range	-20C to +50C
Relative Humidity Range	0-95% non-condensing
Altitude	2000 meters maximum
Voltage Overload	+25% continuously; +100% for 20 cycles
Current Sensor Overload	100% for 1 minute without damaging meter
Pollution Degree	Degree 2 in accordance with IEC 664
Overvoltage Category (120-300V)	Category III
Overvoltage Category (301-499V)	Category III
Measurement Category	Category III
Display Readout	Optional remote mechanical or LCD

*The products covered are components for Electric kWh energy usage monitoring systems that measure the consumption of electricity. These **open type** devices are components for **installing** into an **end use equipment** overall enclosure.*

CTs are available in standard (low current) output or 0.333 volt output versions

EZ Meter Current Transformers. Each meter is manufactured to work with a specific model of current transformer (CT). While a CT with the same turns ratio can be substituted for another without causing a significant error, for best accuracy, use the CT specified on the meter label. The meter has been calibrated to account for the known characteristics of the specified CT and will provide the best system performance.

Rogowski Coils: Rogowski Coils - with powered integrators - can be used with EZ Meter type RGB modules. *In order for them to be compatible, the meters must be ordered with the 0.333 volt CT inputs and the Rogowski Coils must have 333 mV integrators that are powered by an external source.* Please consult the factory if there are any questions.

The seventh character of the meter model number specifies the CT model that should be used. If there is no character in the seventh position the 4720/4 CT should be used. See the CT tables on pages 29 and 46..

Operating Instructions

After installation, the EZ Meter is simple to operate. You read the meter the same way you read the odometer in a car. The label on the front of the meter indicates the resolution of the display, either full kilowatt hours (kwh), tenths of kwh or hundredths of kwh. The label on the outside of the enclosure also states the resolution. The mechanical counters are available with all white digits -- or all white with a red right hand digit. Normally, the display reads in full kwh, except when the right hand digit is a different color. That right hand digit is reading in tenths. Look at the meter label to be sure that the display is matched to that specific unit.

To charge a tenant for the energy consumed, subtract the meter reading at the beginning of the billing cycle from the meter reading at the end of the cycle and multiply the difference by the rate per kilowatt hour.

The low power factor warning (LED "A") is only active when reverse current is detected. This means that if the CTs were installed correctly, the continuous flashing of the red LED usually indicates that the voltage and current inputs to the meter were not properly matched during installation and the meter is only recording a portion of the power being consumed. This only occurs when the power is supplied from a three phase source.

You can clean the outside of the meter enclosure with a general purpose cleanser such as 409 or Fantastic if necessary. Do not use harsh bathroom cleaners or alcohol.

If the meter appears to operate erratically, it is probably because it measures each phase separately, which may be loaded differently, and flashes the red LED when each phase accumulates 1/100 kwh (or other resolution). The resolution may be different for the red LED, the display and the isolated output. Check the meter label where the resolution of each will be noted.

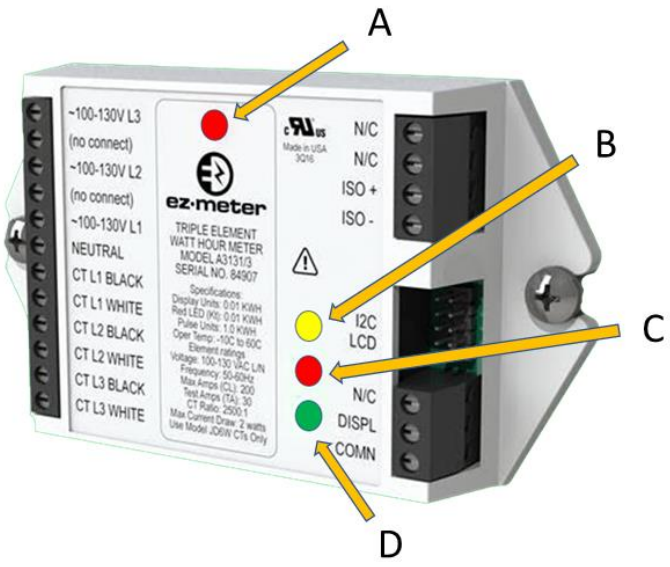
If you believe the meter is not measuring correctly, perform the test on page 25 and see the troubleshooting suggestions on page 26.

Understanding the Meter Electronics Module Label

The center section on the meter label reveals a lot of data about the meter, but some of it is in the language used by the metering standards.

Display Units - The resolution of the meter display. Either 1.0, 0.1 or 0.01 KWH. Multiply by the value shown on the display to get the total KWH the meter has recorded. Meters with 1.0 resolution have all digits the same color and the display shows KWH with no conversion needed. Meters with 0.1 resolution are usually sold with the right hand digit being a different color and is read as if there were a decimal point before the odd colored digit.

Meter LEDs:



A.) Red LED (CT/Power Factor) - The *Red LED* serves two functions. It is on when the meter is powered. However, if it is flashing about once a second, it indicates a low power factor on one or more legs.

B.) Yellow LED (Communication) - Depending on the type of meter, the *Yellow LED* will provide indication of RS485 communication.

C.) Red LED (kt) - *The Red LED* indicates load. The flash equals 0.01 kWh (10 watt-hours) for most meters.

D.) Green LED (heart beat) – *The Green LED* flashes to indicate that the meter is functioning.

Oper. Temp: - The operating temperature range applies to the electronics module only. The low temperature figure is often below the low temperature rating of the electro-mechanical display.

Voltage - The range of voltages in which the meter will operate measured between line and neutral (L/N). If there is no neutral, it is the voltage line to line (L/L). For four wire delta meters, the voltage for the high leg is shown on the left for L3.

Max Amps (CL) - The maximum load (in amps) on each leg that the meter can handle. This is also referred to as the meter class.

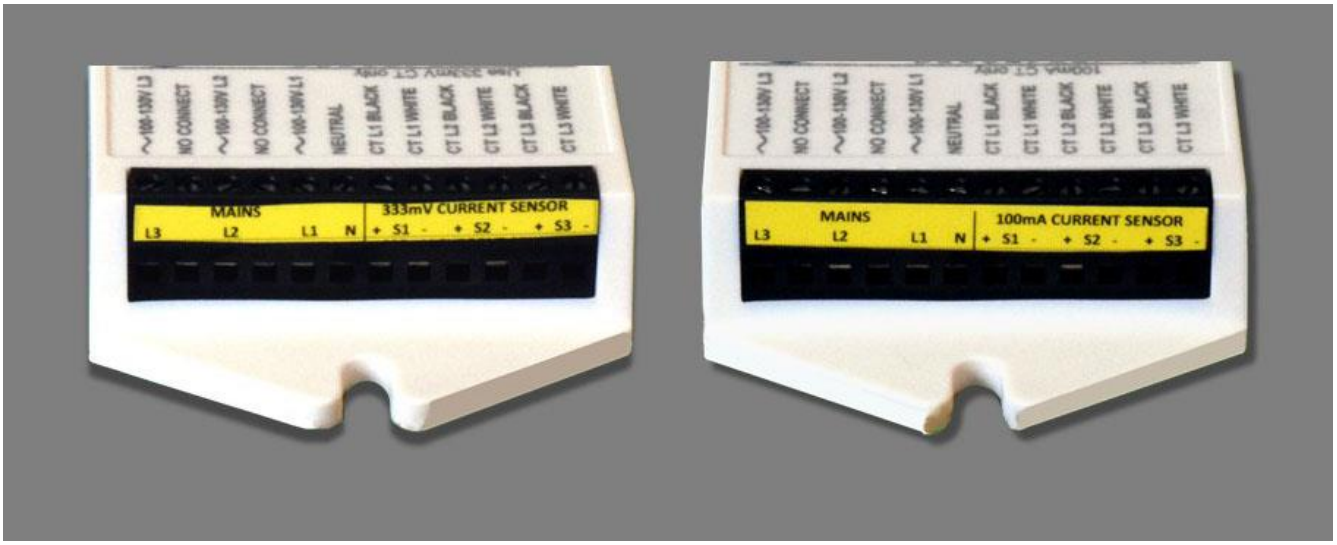
Test Amps (TA) - This is another term from the standards and is set by the manufacturer, usually at 15% of the class rating (maximum amperage).

Max current draw: All EZ Meters use 2 watts or less for operation of the meter.

CT Ratio: The turns ratio of the current transformer that is intended for use with this meter. Vertically printed next to the labeling of the CT terminals is the model number of the current transformer the meter was calibrated against. Each model of CT has a slightly different phase angle adjustment which is programmed into the meter during calibration. Using a current transformer with a different model number, but the same turns ratio may cause an error of a few tenths of one percent. Using a current transformer with a different turns ratio, or a current transformer with an internal burden resistor, will cause a significant error.

Voltage output CTs: Voltage output CTs (Current Sensors) are typically listed with a current (Amps) to voltage output. This indicates the voltage output at the CT's design Amps. As an example, a CT with a listing of 200A to 0.333 volts provides a 333mV signal to the meter when 200 amps are being monitored. This signal is proportional and reduces along with the actual load. (As a further example, at 100 Amps, the CT above (200A/0.333V) would output a proportional signal of 0.1665 volts).

Low Current output CTs: Low current output CTs -- typically 80-100 mA -- have advantages over utility type 5 amp styles. Because the output current is lower, they can be used with smaller size secondary conductors which allow them to be placed at a greater distance from the meter without loss of signal accuracy because of conductor resistance. This provides for greater flexibility in submeter installations and maintains meter accuracy.



Installation Instructions

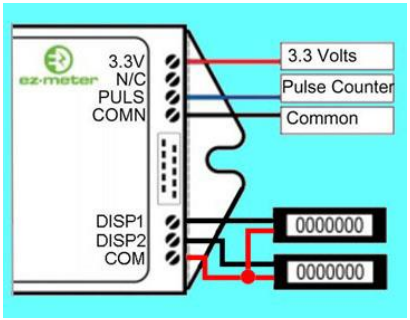
The EZ Meter consists of an electronics module, one or more current transformers (CTs), a display of one or two electro-mechanical or LCD display counters, and an enclosure that holds from one to 12 meters. If the meter will be mounted outside in direct sunlight, be sure to order a UV resistant enclosure or paint the standard enclosure. The CTs and display may be mounted in the same enclosure or mounted in a remote location. A common practice is to mount the CTs in a breaker panel and mount everything else in a separate adjacent enclosure. To ensure a safe installation, the meter requires an external switch mechanism, such as a circuit breaker, be installed on the meter's MAINS input wiring. The switch mechanism must be installed in close proximity to the meter and easily reachable for the operator. This device must also be marked as the disconnecting device for the meter. A circuit breaker rated at 15 amps or less should be installed before the meter. If a fuse is used to protect the meter, it must be a delayed-action to prevent it from opening during the meter's initial power up.

Installing the NEMA 4X Enclosure: Use the metal brackets provided to mount the enclosure in a suitable location. Drill a hole anywhere in the side or back of the enclosure for a conduit to connect to a breaker panel or disconnect box in compliance with local electrical codes**. To maintain 4X integrity, an approved conduit termination for this type of application must be utilized.** After the meter has been installed and tested, secure the cover using the screw or small padlock provided. You should also label each display counter with the unit name or number.

Installing the flush mount enclosure: This enclosure was designed to be recessed into a sheet rock wall. Cut a 6" square opening in the sheet rock adjacent to a stud. Drill a hole in the back or side of the enclosure for a conduit. Install the CTs and make the electrical connections as described below before installing the enclosure in the wall. Fillister head screws with holes are provided so that the cover may be secured with a seal if required.

A note on different meter types: All EZ Meters come with a 12 pin connector for voltage and CT inputs. There are three voltage inputs and three CT inputs (3&3) or two voltage inputs and four CT inputs (2&4). The 3&3 configuration must be used whenever a three phase wye or delta load is being measured. Either configuration can be used for measuring single phase loads, even if the load uses one or two legs of a three phase service. The 2&4 configuration is most commonly used in marinas and apartment buildings where two 3-wire 120/240V (or 120/208V) services are close enough to each other to be monitored by one meter.

Net Metering: Net meters are designed to providing kWh data on energy that is both received from and delivered to the serving Utility. This data is important when you have solar, or other forms of generating facility power, that can be delivered back to the Utility when there are tariffs that take this into account and the Utility will purchase that power from you. EZ-Meter RGB series have this capability. For further information on this, please contact EZ-Meter for details.



Installing the CTs: (See the appropriate Figures on pages 20-22). ***When installing CTs, you must turn off the power to the conductors to begin your installation.*** When installing solid-core CTs, disconnect one end of the conductor(s) that feeds the load to be measured and pass it through the center of the CT then reconnect the conductor(s) where it was attached before. Connect the two wires coming out of the CT to the appropriate terminals on the meter module. Begin connecting CTs to CT #1 and continue until all the CTs for that meter are installed. The CT should be installed with the arrow facing the direction of current flow or the label facing the source. * ***Do not re-energize the power being monitored until all CTs are connected to the meter.***

CTs Are Directional

If the meter is otherwise installed correctly, it will accurately record all the power that flows through the CTs. If you are working with three phase power, even if only one or two legs of it, you should be sure the arrows or labels are facing in the right direction (label faces the load if there is no arrow). The meter has a phase angle warning that flashes the red LED every second if power factor is below 0.7 and polarity is reversed. This will happen if the CTs are facing the proper direction, but the voltage and current sources are not properly matched. (L1 voltage and L1 CT should be on the same phase, etc).

The CT wires can be extended if needed. We have tested them at 500 feet and they can probably be extended even further. If the **total** line resistance is over one ohm, accuracy of the meter will be affected, especially at high phase angles. **NOTE: This limitation does not apply to 0.333 volt output CTs**. Be sure to install the CT wires in conduit. Connections should either be soldered or made with gel filled wire nuts. Any resistance in the connection will cause the meter to read lower than it should. The wire used should meet local codes for insulation. Any size wire from 22 AWG to 12 AWG may be used. #18 is suggested.

You can install split core CTs without disconnecting the wire Be sure to secure the two parts of the CT so it cannot come apart.

NOTE: Only qualified people are permitted to work on energized electric panels.

NOTE 2: Do not mix CTs with different turns ratios on the same meter.

WARNING

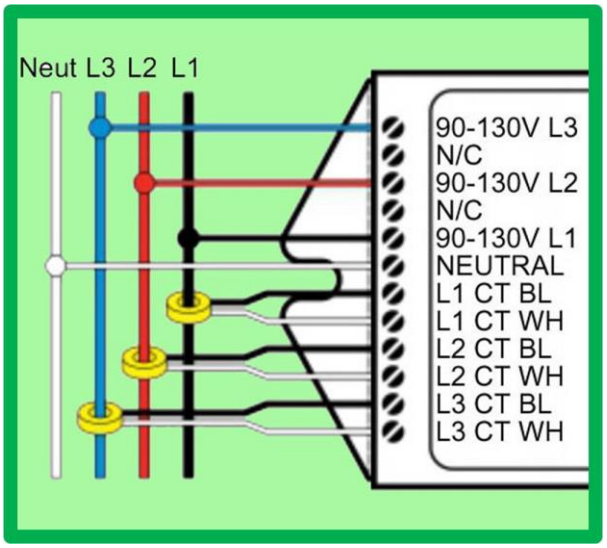
Hazardous voltages can exist in CT wires when they are not connected to a meter and current is flowing through wire passing through the CT. Wire nut the CT output wires together if you must remove the meter and leave the CTs in place. Turn of the power to the monitored conductor(s) temporarily when doing this. Failure to do so may damage the CT or injure someone.

Electrical Connections: You need to provide a voltage reference for each phase of the power you are metering plus connect the neutral to the meter as well. The voltage ranges printed on the electronics module label (before L1, etc) refer to the voltage between neutral and that terminal and indicate what meter works with what electrical system. The voltage associated with the meter name is the most commonly used voltage in the range. See the diagrams on pages 27 and 28 for specific models. For meters that do not have a Neutral reference, the voltage ranges printed on the label are line to line voltages. **NOTE: Voltage and CT terminal screw torque maximum is 3.5 in-lb.**

You can use any size wire from 16 AWG to 12 AWG. *Be sure insulation meets national and local codes for the voltage being monitored.* Each phase should be protected by a circuit breaker or fuse of 15 amps or less (see NEC for proper sizing based on conductor used). For safety, a switch or circuit breaker must be installed between the meter and the mains power source. It shall be in close proximity to the meter and within easy reach of the operator and shall be marked as the disconnecting device for the equipment. If a fuse is used, it should be a slow-blow type. Connecting the meter on the protected side of a GFCI may cause the GFCI to trip when power is applied to the meter.

IMPORTANT

You must ensure that the leg connected to the AC L1 terminal is the same leg which passes through CT L1, and the same for (AC L2 & CT L2) and (AC L3 & CT L3). This is especially important when connected to three phase power because the meter will only record a fraction of the power used on any legs that are not properly paired. After the installation is complete, turn on a 60 watt or greater load for each leg and observe the red LED. If it is flashing, you most likely did not wire the meter properly (The flashing LED indicates a power factor of 0.7 or less - optimum power factor is1.0).



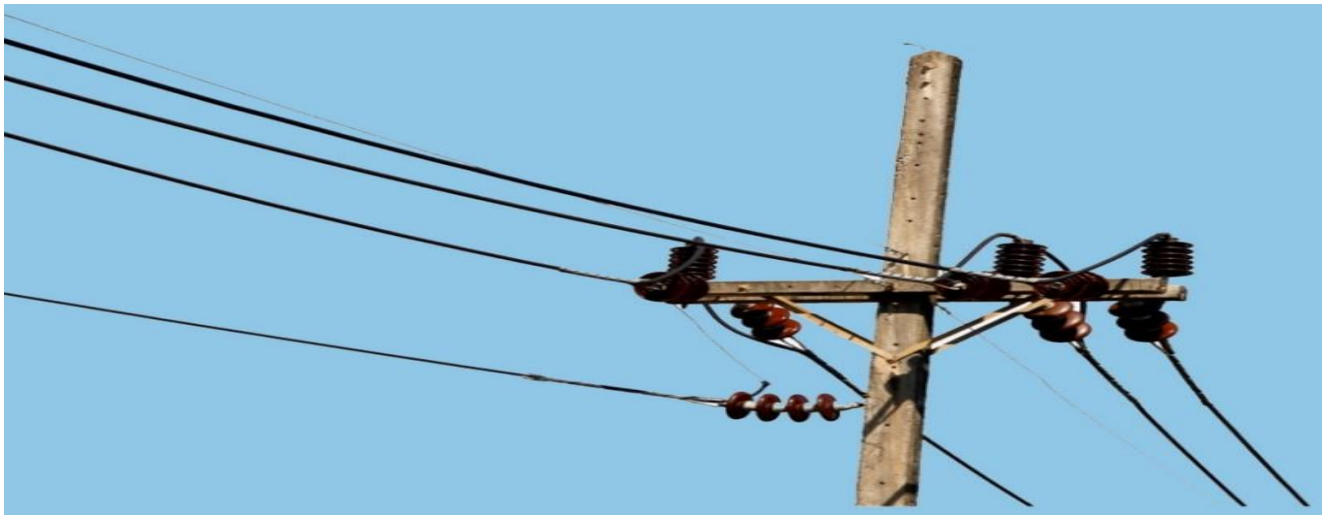
Surge Protection: Like computers, TVs and other electronic devices, EZ Meters are subject to damage from electrical surges. They are particularly likely to be affected because they are typically installed as the first piece of electronics that the surge hits when it enters the submetered electrical distribution system. You should consider a surge protection device or other sacrificial protection device.

RS-485 Connections: (See Fig. 7) The serial connections are optically isolated from the electronics of the meter and require an external power source. Any power supply capable of delivering 5-18 volts DC and 50 mA per meter will work. Connect the power supply ground to the IGND terminal and the power supply hot wire to IPWR.

For RS-485, there does not appear to be a lot of consistency in pin labeling. Some are labeled Rx+ or Rx- and Tx- or Tx+. Others are labeled A and B. We have seen four-wire RS-422/485 adapters that work when Rx+ and Rx- were connected together and others where Rx+ and B- were connected together. We have also seen adapters that work when TX+ is connected to Tx on the adapter and others where TX+ is connected to Rx on the adapter. We suggest you find the proper configuration on your workbench before installing all the meters in the field.

Connecting a meter to an RS-485 connector can be a lot of hassle. To make the process easier EZ Meter Technologies resells USB to RS-485 adapters made by FTDI Chip. These adapters have a 70 inch (1.8 m) wire bundle that can be connected directly to the meter.

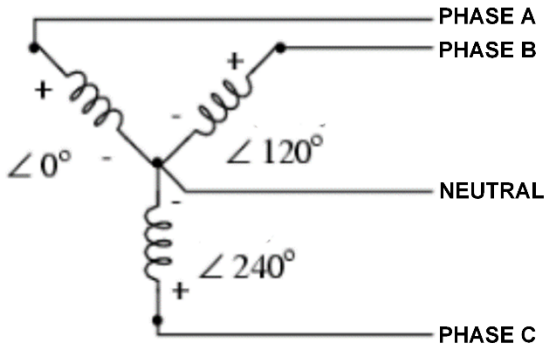
NOTE: Voltage, CT, RS-485, and display terminal screw torque maximum is 3.5 in-lb.



Electric Service Types

The drawings below show the most common electric service types provided by the Utility Companies. These drawings will help to determine the type of service that is to be monitored and assist in choosing the correct submeter for the application

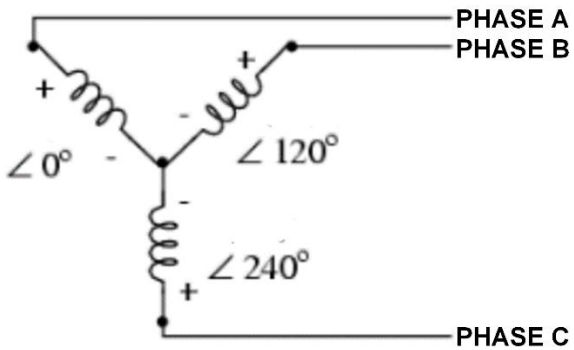
4-wire WYE



Low Voltage	High Voltage
A-B = 208V	A-B = 480V
A-C = 208V	A-C = 480V
B-C = 208V	B-C = 480V
A-N = 120V	A-N = 277V
B-N = 120V	B-N = 277V
C-N = 120V	C-N = 277V

The 4-wire WYE service is typically used in Commercial and Industrial applications for powering equipment and lighting.

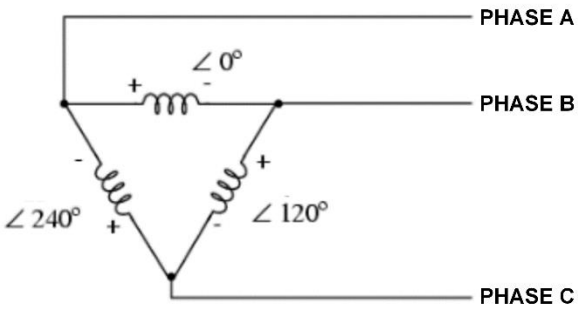
3-wire WYE



Low Voltage	High Voltage
A-B = 208V	A-B = 480V
A-C = 208V	A-C = 480V
B-C = 208V	B-C = 480V

The 3-wire WYE connection is sometimes used to power motors where a Neutral conductor is not required for operation.

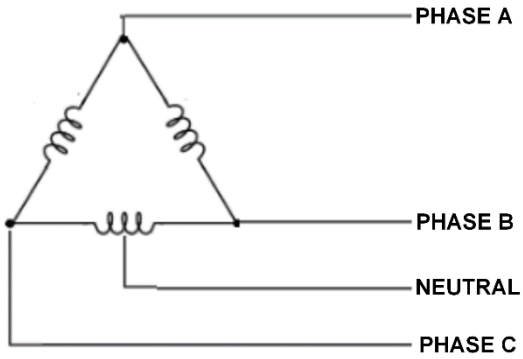
3-Wire DELTA



Low Voltage	High Voltage
A-B = 240V	A-B = 480V
A-C = 240V	A-C = 480V
B-C = 240V	B-C = 480V

The 3-wire Delta service is commonly used in facilities for supplying power to motors and any equipment that does not require a Neutral connection.

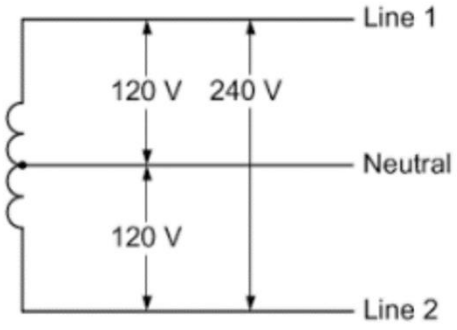
4-Wire DELTA



Phase Voltage	Phase to Neutral Voltage
A-B = 240V	A-N = 208V
A-C = 240V	B-N = 120V
B-C = 240V	C-N = 120V

The 4-wire Delta service (sometimes referred to as a "grounded center tap" or "high leg" Delta is utilized where three phase power for machinery is required and also 120 volt power for lighting and receptacle loads

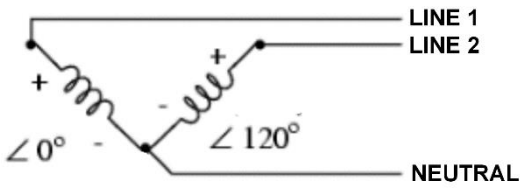
Single Phase



Line 1 to Neutral = 120V
Line 2 to Neutral = 120V
Line 1 to Line 2 = 240V

Residential service typically for single homes. Supplies power for lighting, receptacles, and appliances.

"network" Single Phase



Line 1 to Neutral = 120V
Line 2 to Neutral = 120V
Line 1 to Line 2 = 208V

Residential service using 2 phases of a 3 phase service. Typically used in apartments and condos. Power for lighting, receptacles and appliances.

Notes on Wiring Diagrams on the following pages:

The voltages shown on most of the diagrams are for the allowable voltage range for meters made for 110-120 volt electric systems found in the USA. The voltage shown is for line-to-neutral or line-to-line for meters that do not use a neutral. Meters for higher voltages are configured the same way except a higher voltage range is specified. For instance, Figure 1 specifies Voltage Type A and D meters. Type A (the second letter of the model number) is for 110-120 volt to neutral systems, Type D for 277 volt to neutral systems.

Fig. 1 shows a 4-wire WYE hookup.

Fig. 2 shows a 4-wire delta (hot leg, high leg, stinger leg). ***Be sure your L3 leg is the high voltage leg.***

Fig. 3 shows a 3-wire, single phase hookup. This meter only uses two CTs.

Fig. 4 shows a 3-wire Delta hookup. This meter only uses two CTs.
** 480 volt Delta is not currently supported*

Fig. 5 shows a 2-wire, single phase hookup of two hot legs. This meter uses two CTs.

Fig. 6 shows a 2-wire single phase hookup with Neutral.

Fig. 7 shows the typical connections needed for an RS-485 network.

Meter Wiring Diagrams

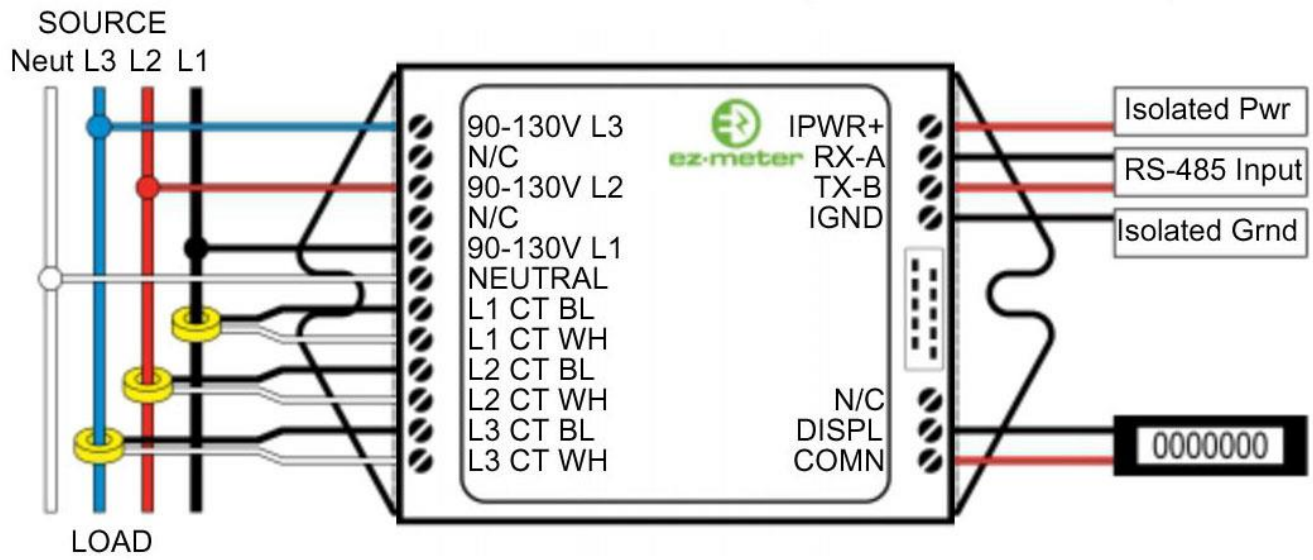


Fig 1: 4-Wire, 3-Phase, WYE Meter (Model Voltage Types A, C & D) with RS-485 installation
Note: If used in 2- or 3-Wire systems, power must be connected to L1. (Type A voltages shown)

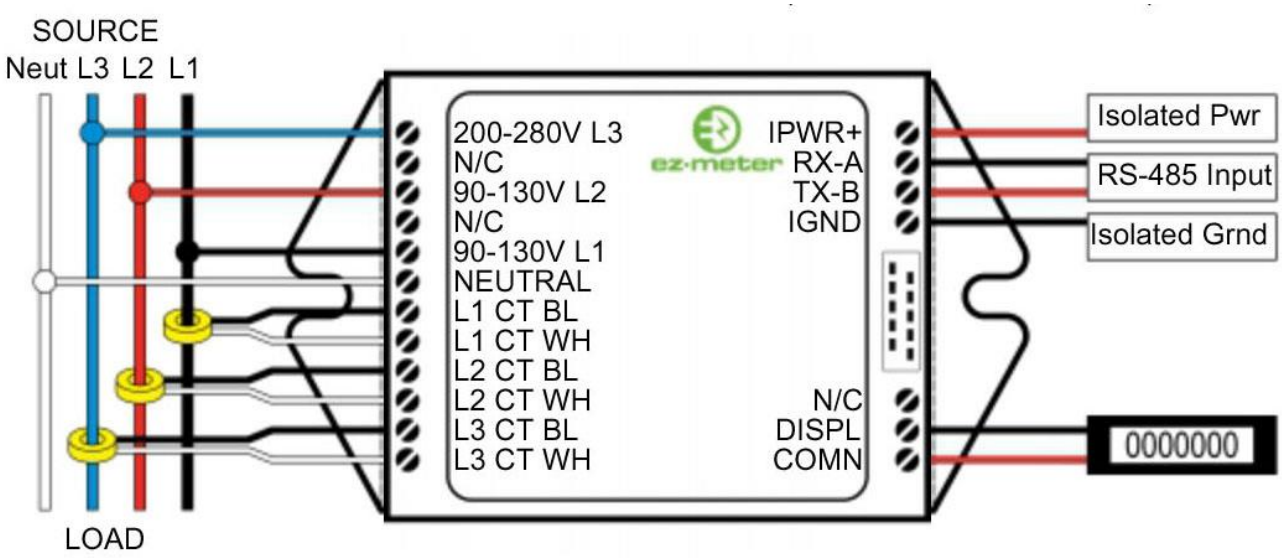


Fig 2: 4-Wire, 3-Phase, high leg Delta Meter (Voltage Type B)
Note: High leg must be connected to L3.

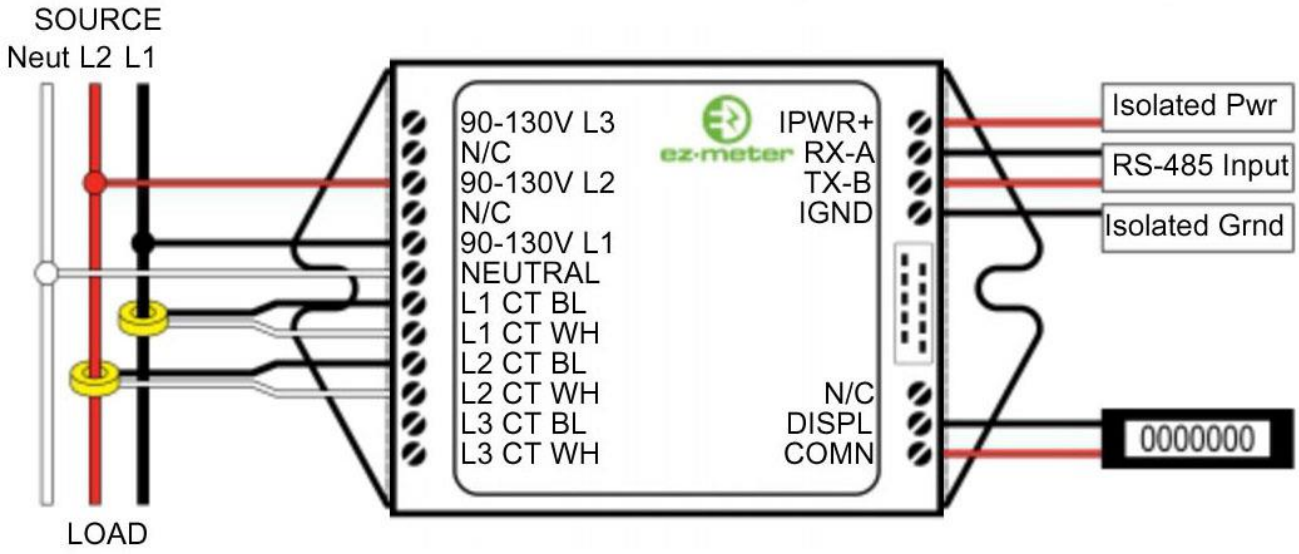


Fig 3: 3-Wire, Single Phase Meter (Voltage Types A, C, D, H)
Note: Any two legs of 3-Phase power may be used
as long as power is connected to L1 to power meter.

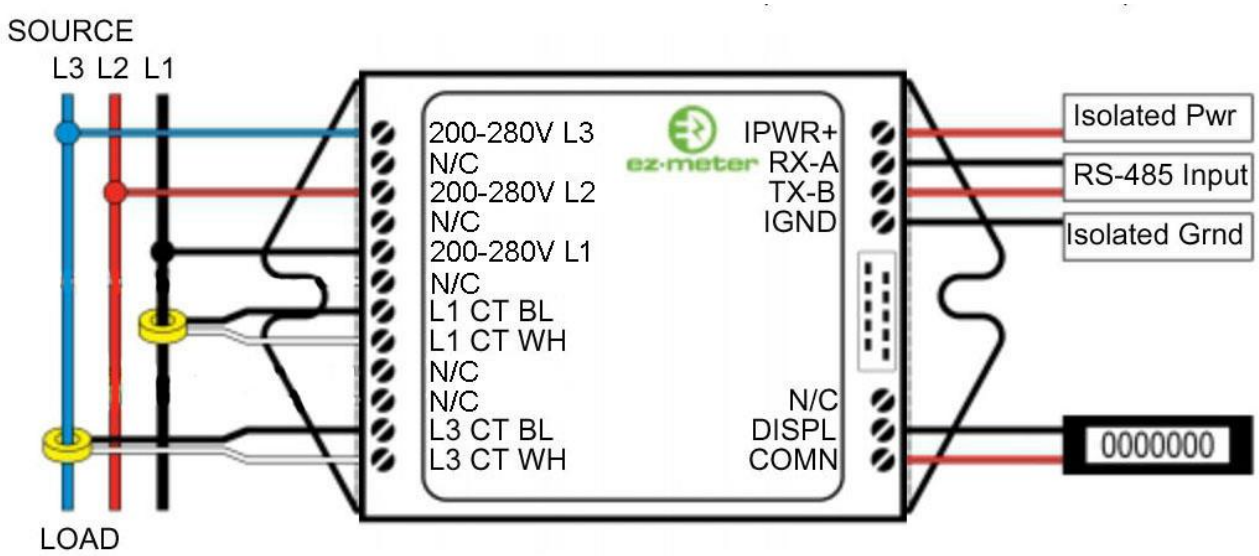


Fig 4: 3-Wire, 3-Phase Delta Meter (Voltage Type F)

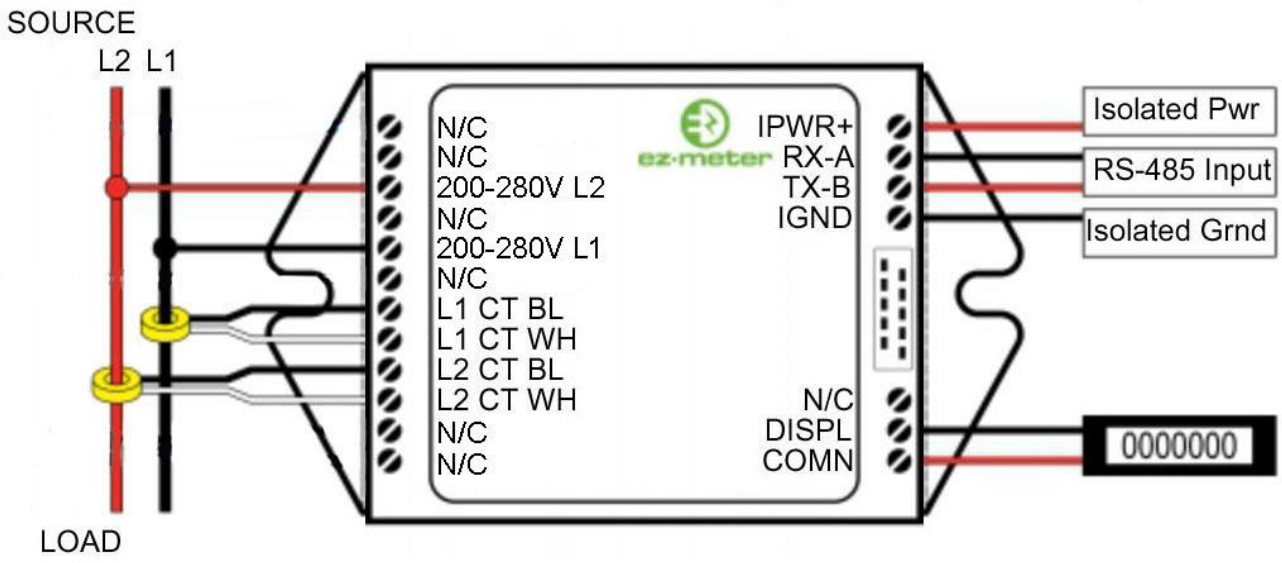


Fig 5: 2-Wire, Single Phase (Voltage Type F)

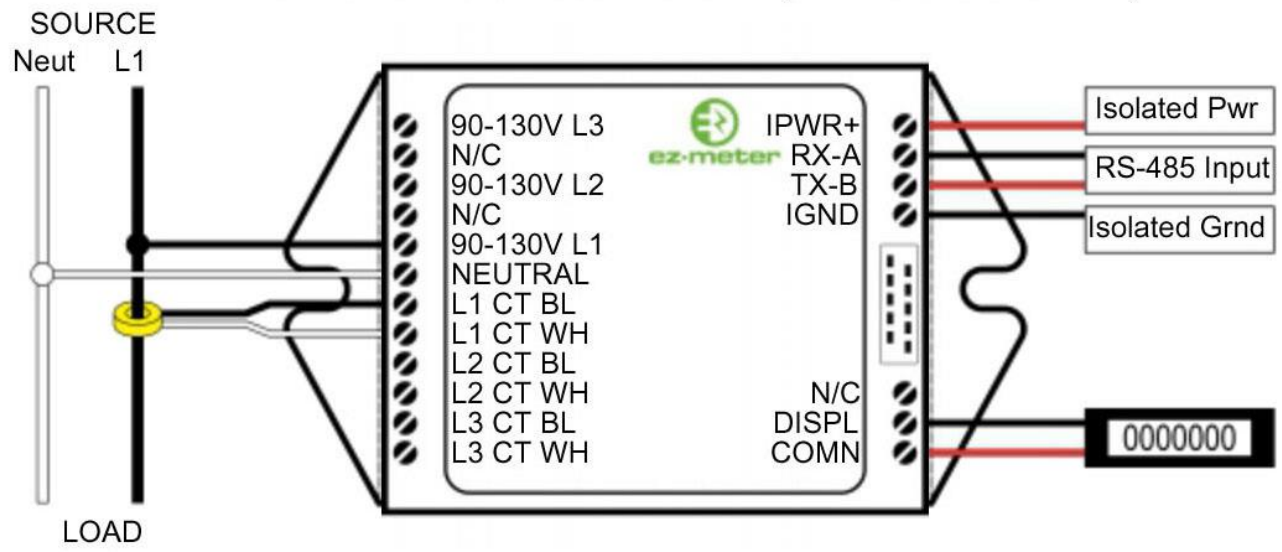


Fig 6: 2-Wire, Single Phase (Voltage Types A, D, H)

RS 485 WIRING

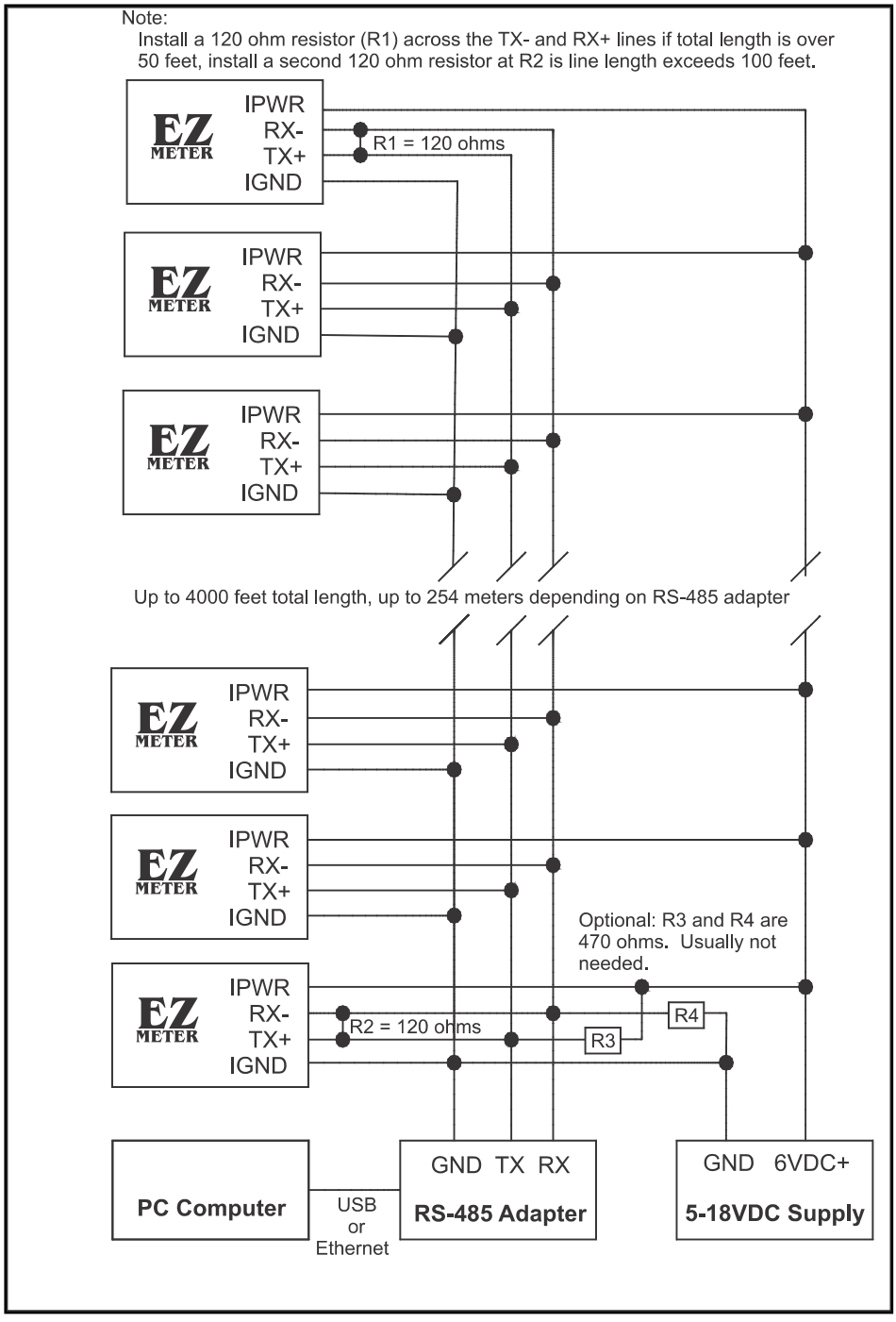


Fig. 7 RS-485 Network Layout

Testing the Installed Meter

After the meter has been installed, it is a good idea to turn power on the system and check to see that the meter was connected to the power line properly. This can be determined easily by looking at the red LED (A) in the top, center portion of the label on the electronics module. This LED should glow a bright red whenever power is on. If it is flashing continuously, about one flash per second, it is indicating a high phase angle. This could be caused by the load on the system, but frequently indicates that the voltage and current inputs are not matched properly when using three phase power. This warning requires a current flow of approximately 60 watts on each leg to be present.

If the meter is receiving power, the next step is to verify that the meter is operating properly. You will need a hair drier or other small appliance that uses approximately 1500 watts (or more) to be able to do the test in a reasonably short time. Since the meter measures each phase separately, you will need to test each phase individually.

You can get a rough idea of the accuracy of the meter with the following test procedure. The second red LED (C) will flash off and on at a rate based on the amp rating of the meter. The correct timing count cycle is from on-to-on.

Meter Amp Rating	Blink Value in watt-hours
50	**1 wh**
100	**2 wh**
200	**4 wh**
400	**8 wh**
800	**16 wh**
1600	**32 wh**
3200	**64 wh**

Without getting into phase angle, resistance and impedance measurements, the following formula will tell you how many seconds it should take to count the test load:

SECONDS = (432,000 x blink value)/VOLTS / WATTS

Where "blink value" is based on the amp rating of the meter, VOLTS is the AC voltage measured at the meter (it is important to measure this as variations up to 10% are common) and where WATTS is the wattage shown on the nameplate of the appliance providing the load.

For example, a 1500 watt heat gun on 120 volts with a 200 amp meter will use 4 wh in (432,000 x 4) / 120 / 1500 or 9.6 seconds. [1,728,000 / 120 / 1500] = 9.6 sec. If you don't get this exact value, it does not mean the meter is defective. Many name plates are only approximate. The label on the EZ Meter itself states power consumption of 2 watts, but that only happens when the serial port is read or the mechanical counter advances. Another factor that influences the accuracy of this test is the power factor of the electricity being measured. If a big power factor exists, the test may take several more seconds than what is calculated, perhaps half again as much.

To check a 120 volt service, turn on your heater and begin timing when the red LED flashes the first time. The red LED (C) should flash again about 9.6 seconds later (or whatever time you figured using the formula above for the load you are testing with).

If you have several meters but don't have a voltage meter, you can test several meters and if they all use the same number of seconds, you can assume the meters are working okay even if the time observed is different than the calculated time. This test will also correct for variation in the actual number of watts used by the appliance versus the number shown on the name plate.

Trouble Shooting

Try the following steps if the meter does not work. A simple AC voltmeter will help.

No Red LED (A)

Be sure that line and neutral wires are connected properly and that power is turned on. Check this with your voltmeter by measuring the voltage between the Neutral and L1 terminals. The voltage should fall in the range specified for the meter. If it does not, you have not connected it properly, the power is not turned on, or you have the wrong meter for your electrical system. Check the voltage between the neutral (usually white wire) and ground. This voltage should be close to zero.

No Green LED (D)

The green LED flashes to show that the meter electronics are functioning (heartbeat). If it is not flashing, verify that the meter has power. Verify if Red LED (A) is on

Second Red LED (C) flashes but Counter does not change

The meter is correctly detecting the usage of power but the mechanical (or LCD) counter is not moving. Be sure the counter is connected properly with one wire going to COMN and one wire going to DISPL When the ~~green~~ LED flashes, the mechanical (or LCD) counter should advance

If the counter is properly connected and does not advance when it should, replace the counter.

No Yellow LED (B)

The yellow LED only flashes during RS 485 communication. This is normally off except during the time the meter is being addressed by a Building Automation System or other device.

The calculated timing number is wrong when doing the accuracy check.

Be sure all the terminals are wired correctly and screwed down tightly.

Be sure the hair dryer or other electrical load is plugged into the proper circuit and that it is the only thing drawing current through the meter. *Be sure the wire to the hair dryer only passes through the current transformer one time and that the neutral wire does not pass through it.*

Q: *I have several meters and one appears to be reading lower than the others.*
A: If you think one of the meters is reading low, swap the meter with one that appears to be reading right and see if the condition remains the same. If there is no change, the meter is working properly. Check to see if it is wired incorrectly – it also may be that the actual load is lower than expected

Communication problems

See the RS485 Troubleshooting Ap Note on page 33.

Still doesn't work

Check at www.EZ Meter.com for more trouble shooting suggestions or call Customer Support at 1-805-688-9696 between 9:00AM and 5:00PM Mountain Time, Monday through Friday. Each meter is covered by a five year limited warranty (see page 4). There is a charge for meters that are returned for repair that are not defective.

APPENDIX – A -- HVGP and HVDM meter ordering information

Voltage. Each EZ Meter must be ordered to match the electric system where it will be installed. The first character of the model number determines the voltage range the meter can handle.

Note: Each meter model is capable of handling a range of voltages. Select the meter with the voltage range that includes the voltage you want to measure.

A. 100-130 volts to neutral, 200-260 volts line to line, **single output**:
Single element: 100-130 volts to neutral, single phase.
Two element: 100-130 volts to neutral, 200-260 volts line to line, single phase, or two phases of a three phase system.
Three element: 100-130 volts to neutral, four wire, three phase wye.

A. 100-130 volts to neutral, 200-260 volts line to line, **dual output**:
Two element: Two 100-130 volts to neutral, single phase services or
One bidirectional 100-130 volts to neutral, 200-260 volts line to line, single phase or two phases of a three phase system.
Three element: One 100-130 volts to neutral, single phase plus one 100-130 volts to neutral, 200-260 volts line to line, single phase or two phase of three phase system, or one bidirectional 100-130 volts to neutral, four wire, three phase wye.
Four Element: Two 100-130 volts to neutral, 200-260 volts line to line, single phase or two phases of three phase system.

B. Three element only: 100-130 volts to neutral on two legs, 200-260 volts to neutral on the third leg, 200-260 volts line to line, four wire, three phase delta. Can also be used in place of an A single output meter with a slight loss of accuracy at the low end on L3.

C. 200-260 volts to neutral, 400-500 volts line to line
Single element: 200-260 volts line to neutral, single phase
Two element: 200-260 volts to neutral, 400-500 volts line to line, or two phases of three phase.
Three element: 200-260 volts to neutral, 400-500 volts line to line, three phase wye

D. 240-300 volts to neutral, 430-500 volts line to line
Single element: 240-300 volts line to neutral, single phase
Two element: 240-300 volts to neutral, 430-500 volts line to line, or two phases of three phase.
Three element: 240-300 volts to neutral, 430-500 volts line to line, three phase wye

E. Three element only: 240-300 volts to neutral on two legs, 430-500 volts to neutral on the third leg, 430-500 volts line to line, four wire, three phase delta.

F. Dual Element only: 200-260 volts line to line, three wire, three phase delta

G. Dual Element only: 440-500 volts line to line, three wire, three phase delta

Maximum Current and Current Transformers. Each EZ Meter is calibrated to work with a specific model current transformer (CT) at any current up to the maximum rating for the meter. Solid core CTs require that the power be turned off and the wire carrying the load to be measured must be disconnected, run through the CT, and reconnected. Split core CTs come apart and can be installed without disconnecting the wires.

Solid core CTs are available for current ranges up to100, 150, 200, 250 or 400 amps. Split core CT ranges up to 60, 200, 400, 800, 1200 or1600 amps.

CTs can be installed in parallel. If want to measure several circuits in a breaker panel and the circuits are on the same leg, but opposite sides of the breaker panel, you can use two CTs, one on each side, so you don't have to rewire the panel.

The wires on CTs can be extended a reasonable distance as long as the wire resistance does not exceed one ohm.

Display and Resolution. Each EZ Meter can be equipped with either an LCD display or an electro-mechanical counter that displays accumulated kilowatt hours. Some considerations:

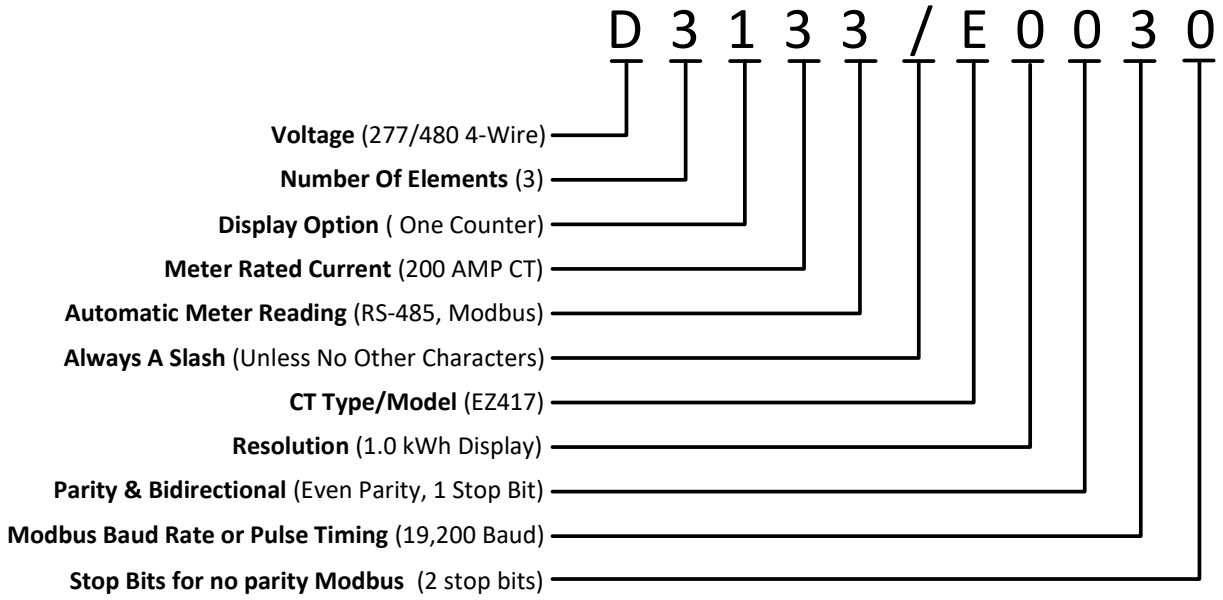
An electro-mechanical counter costs less than an LCD display, but there are a few trade-offs. The standard counter is rated to work down to 10°C (14°F) and is not suitable for outdoor use in cold climates. An extended temperature range counter rated down to -30° (-22°F) is available at added cost. If the temperature drops below the counter's operating range, the counts will be lost forever unless you are using an automatic meter reading system. If you have a dual output meter, the LCD display will actually cost less than two counters. Counters are recommended when a local display is required, but the meters will be read by an AMR system. They are also recommended for locations in bright sunlight where an LCD display is difficult to read.

LCD displays have several advantages. Single output meters display accumulated kwh on the top line of the display while the bottom line cycles through volts, watts, amps, and power factor. The dual output meters display accumulated kwh for the second channel on the bottom line. If mounted in a location where the display stops working because of low temperature, the display will return to normal operation with no loss of kwh when it warms up.

Counters for meters with 0.1 kwh resolution have a red number on the right side to indicate tenths of kwh. The other numbers are all white. Counters for meters with 1.0 kwh or 0.01 kwh resolution have all numbers the same color. The LCD displays have a resolution of 0.01 kwh.

Enclosures. A variety of enclosures that hold different numbers of meters are available. Most are NEMA4X rated plastic enclosures with the meters mounted on a plastic panel inside. Use of plastic enclosures allows AMR radios to be mounted inside. Interior rated enclosures have a clear cover while exterior rated ones have a solid cover. The LCD displays are available only on the solid door version.

Model Numbers. Each digit in a model number specifies a different feature or option. Use the table below to to determine the options in the electronics module of your meter.



First Character - Voltage (see detailed description on page 6)

A = 100-130 volts to neutral, 200-260 line to line
B = 100-130 volts to neutral on two legs, 200-260 volts line to neutral on third leg, 200-260 volts line to line, four wire, three phase delta
C = 200-260 volts to neutral, 400-500 volts line to line
D = 240-300 volts to neutral, 430-500 volts line to line
E = 240-300 volts to neutral on two legs, 400-500 volts to neutral on the third leg, 400-500 volts line to line, four wire, three phase delta.
F = Dual Element only: 200-260 volts line to line, three wire, three phase delta
G = Dual Element only: 430-500 volts line to line, three wire, three phase delta

Second Character - Number of elements supported

1 = One element
2 = Two element
3 = Three element
4 = Four element (dual two element meter)

Third Character - Display option

0 = No counter driver (AMR only)
1 = One counter (standard meter)
2 = Two counters (dual 2-in-1 meter)
3 = 2 line LCD display (standard meter)
4 = 2 line LCD display (dual 2-in-1 meter)

Fourth Character - Maximum rated current (Meter Class)

0 = 60 amps
1 = 100 amps
2 = 150 amps
3 = 200 amps
4 = 250 amps
5 = 400 amps
6 = 800 amps
7 = 1200 amps
8 = 1600 amps
9 = 2000 amps

Fifth Character - Automatic Meter Reading (AMR)

0 = No AMR or AMR through I2C port
1 = Isolated pulse output
2 = RS-485 EZ Plus protocol
3 = RS-485 Modbus protocol
4 = RS-232 EZ Plus protocol
5 = RS-232 Modbus protocol
6 = TinyMesh radio
7 = Next Century radio power/pulse interface

Valid meter model numbers contain at least five characters. The model number may contain up to five additional characters. If none of the additional characters are present, the "0" value is implied.

Sixth Character - Always a slash / unless there are no additional characters.

Seventh Character - The CT Model.

Additional CT models may be added at any time. Presently the models are:

0 = 4720/4 - 400:1, 250 max amps, solid core, 1" ID (discontinued)
1 = JC16F - 400:1, 100 max amps, split core, 0.6" ID
2 = S0140 - 3000:1, 1600 max amps, split core, 1.25" ID (discontinued)
3 = JD6W - 2500:1, 400 max amps, solid core, 0.7" ID
4 = S0160 - 3300:1, 1600 max amps, split core, 2.0" ID
5 = KFC-203-FD - 2000:1, 400 max amps, split core, 1.2" ID
6 = JC36S3 - 3000:1, 800 max amps, split core, 1.4" ID (special order)
7 = WC3-200 - 400:1, 400 max amps, split core, .94" x .75" inside
8 = WC4-800 - 800:1, 800 max amps, split core, 1.7" x 1.3" inside (special order)
9 = WC5-1600 - 1600:1, 1600 max amps. Split core, 3.5" x 2.0" inside (special order)
A = XH-BCT-1000 - 1000:1, 250 max amps, solid core, 1.0" ID (special order)
B = XH-SCT-T24/200 - 2500:1, 260 max amps, split core, 0.93" x 0.99" inside
C = WC6-2000 - 2000:1, 2000 max amps, split core, 8.4" x 4.7" inside
D = JD6WS - 417:1, 250 max amps, solid core, 0.7" ID
E = EZ417 - 417:1, 250 max amps, solid core, 0.85" ID
F = XH-SCT-24, 417:1, 200 max amps, split core, .9" x 1.0" inside

Eighth Character – Resolution

0 = Display: 1.0 kwh
Isolated: 1.0 kwh
1 = Display: 0.1 kwh
Isolated: 0.1 kwh
2 = Display: 0.01 kwh
Isolated: 0.01 kwh
3 = Display: 0.01 kwh
Isolated: 1.0 kwh

Ninth Character - Parity and Bidirectional

0 = Even parity, 1 stop bit, standard meter
1 = Even parity, 1 stop bit, bidirectional meter
2 = No parity, 2 stop bits, standard meter
3 = No parity, 2 stop bits, bidirectional meter
4 = Odd parity, 1 stop bit, standard meter
5 = Odd parity, 1 stop bit, bidirectional meter
6 = No parity, 1 stop bit, standard meter
7 = No parity, 1 stop bit, bidirectional meter

Tenth Character - Baud Rate (Modbus Configuration) or Isolated Pulse Timing.

For Serial Port meters (modbus configuration, EZPlus where noted)

0 = 9600 Baud (little endian, unsigned integers and EZPlus)
1 = 19,200 Baud (little endian, unsigned integers and EZPlus)
2 = 9600 Baud (little endian, signed integers)
3 = 19,200 Baud (little endian, signed integers)
4 = 9600 Baud (big endian, unsigned integers)
5 = 19,200 Baud (big endian, unsigned integer)s
6 = 9600 Baud (big endian, signed integers)
7 = 19,200 Baud (big endian, signed integers)
8 = 4800 Baud (EZPlus only)
9 = 1200 Baud (EZPlus only)

For Isolated Pulse Meters

0 = 50 ms pulse, 150 ms recovery
A-Y = Pulse length is position of letter in alphabet times 129 ms, recovery time is 129 ms longer than pulse length
Z = Custom pulse length

Eleventh Character - Stop Bits for no parity Modbus (legacy)

0 = 2 stop bits
1 = 1 stop bit

Part Number Suffixes for Ordering. The part numbers above are printed on the meter cases and enclosures. For ordering and invoicing, a part number suffix consisting of a hyphen (-) and two digits may be appended to the part number. The first digit is the number of CTs that go with the meter. The second digit represents the type of mechanical counter that goes with the meter. The codes are

5 = Counter for 0.1 kwh resolution, one red wheel, standard temperature range (4921/1)
6 = Counter for 1.0 or 0.01 kwh resolution, all white wheels, standard temperature (4921/0)
7 = Only one type 5 counter for dual meter with 4 CTs.
8 = Only one type 6 counter for dual meter with 4 CTs
9 = LCD Counter and ribbon cable

In addition, California approved meters require special marking on the current transformers. Append a letter "C" to the model number to be sure your meter will pass the state testing procedure.

APPENDIX – B -- HVGP and HVDM meter wiring information

Notes on Wiring Diagrams on following pages:

The voltages shown on most of the diagrams are for the allowable voltage range for meters made for 110-120 volt electric systems found in the USA. The voltage shown is for line-to-neutral or line-to-line for meters that do not use a neutral. Meters for higher voltages are configured the same way except a higher voltage range is specified. For instance, Figure 1 specifies Type A, C and D meters. Type A (the first letter of the model number) is for 110-120 volt to neutral systems, Type C for 220 or 240 volt systems and Type D for 277 volt systems.

Fig. 1 shows a 4 wire 3 Phase Wye meter (Types A, C & D) with RS-485 installation diagram.

Fig. 2 shows a 4 wire delta (hot leg, high leg, stinger leg). Be sure your L3 leg is the high voltage leg.

Fig 3 and Fig 6 show the same meter as in Fig 1, but with only two or one CTs connected. Be sure you have power on L1 or the meter won't work.

Fig 4 shows a 3 wire, 3 phase delta system. This meter only uses two CTs.

Fig 5 shows the same meter as in Fig 4, but with only 1 CT connected.

Fig 7 shows how to connect to the isolated pulse outputs. If you have a single output meter, ISO2 will be labeled ISO+ and ISO1 will be N/C (No Connect).

Fig 8 shows the special purpose dual two element meter with isolated pulse outputs. The RS232/RS485 versions connect as shown in Fig 1.

Fig 9 shows a three element, bidirectional meter. The power that flows in one direction is displayed on one counter and power that flows in the opposite direction is displayed on the other counter. This is the only installation where the direction of the CTs makes a difference.

Fig 10 shows the typical connections needed for an RS-485 network.

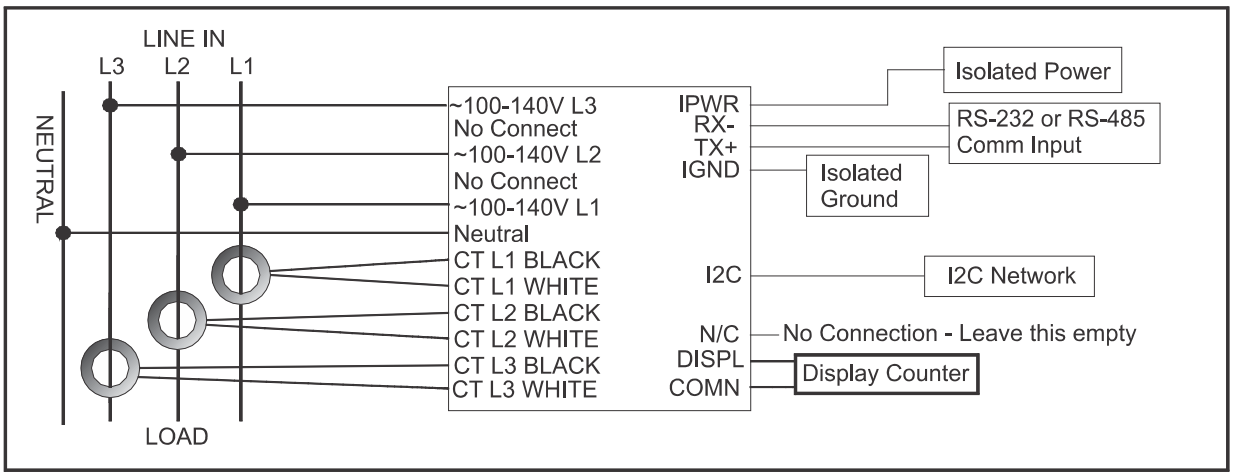


Fig 1. 4-wire, 3 Phase Wye Meter (Types A, C & D) with RS-232 or RS-485 Installation Diagram
Note: If used in 2- or 3-wire systems, power must be connected to L1. (Type A voltages shown)

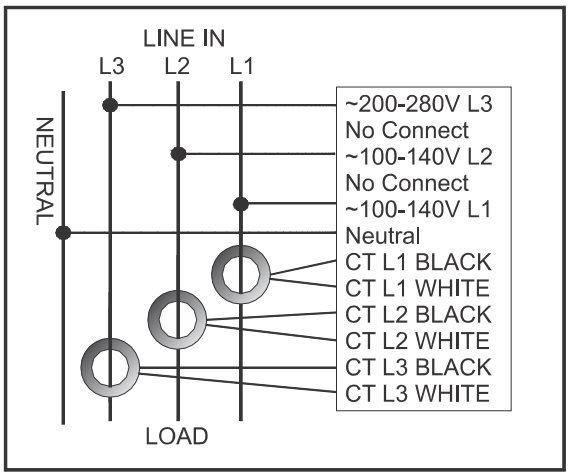


Fig 2. 4-wire, 3 Phase Delta Meter (Types B & E)
Note: High (stinger) leg must be connected to L3.

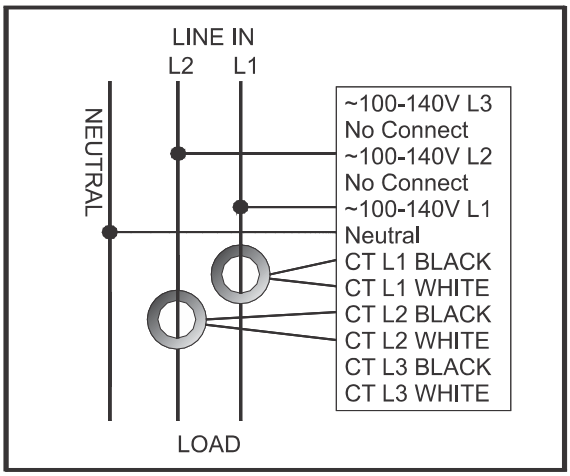


Fig 3. 3-Wire Single Phase Meter (Types A - E)
Note: Any one or two legs of 3Φ power may be used as longas power is connected to L1 to power meter.

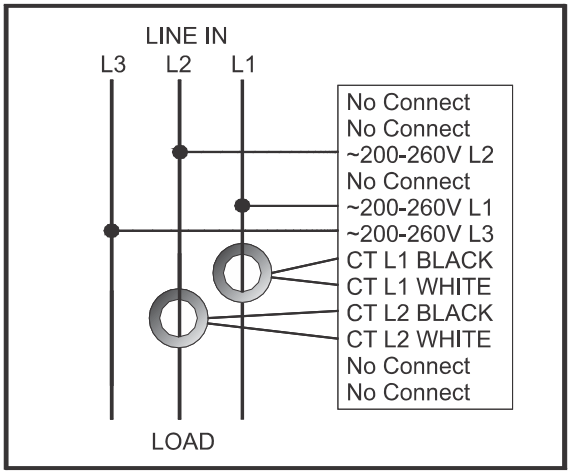


Fig 4. 3 Wire, 3 Phase Delta Meter (Types F & G)
Type E meter with Phantom Neutral suggested for 480V

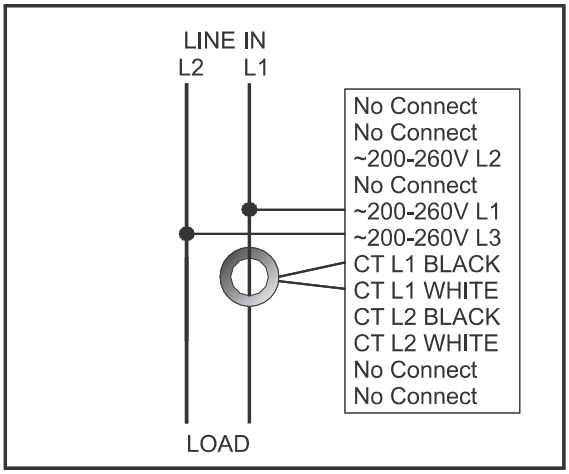


Fig 5. 2 Wire, Single Phase (Types F & G)

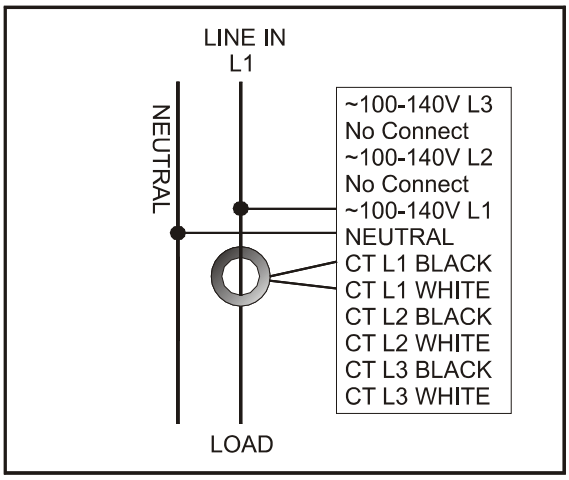


Figure 6. 2 Wire, Single Phase (Types A - E)

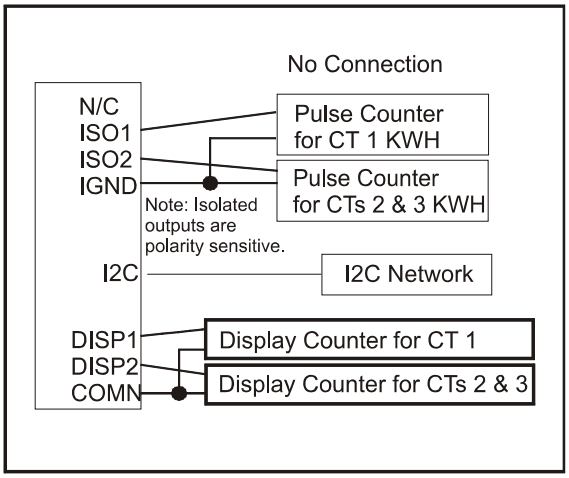


Fig 7. Display and Isolated Output configuration for dual output meters

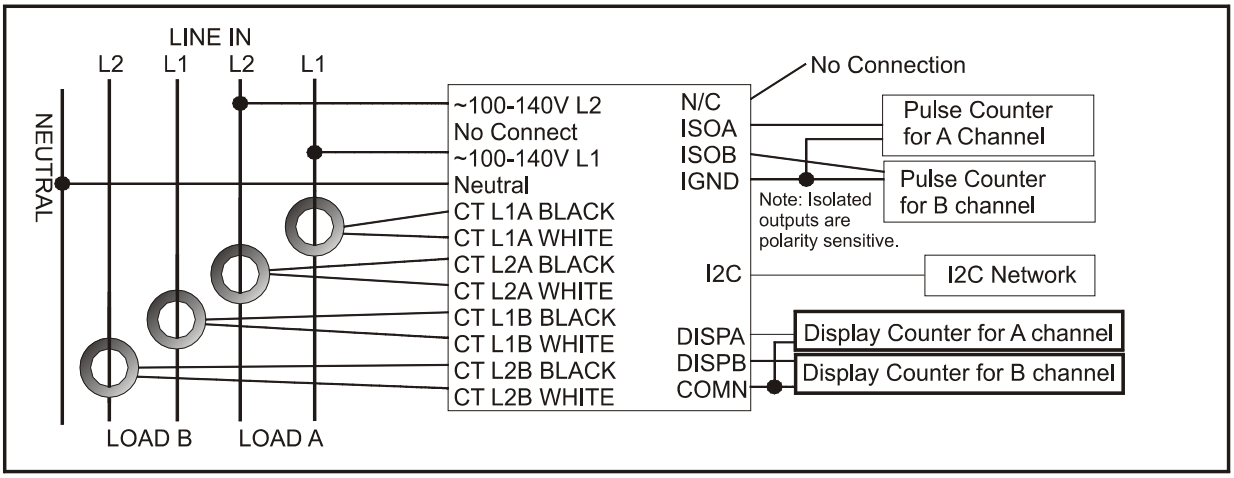


Fig 8. Dual 3-Wire, Dual Element, Single Phase Meter (Type A4)

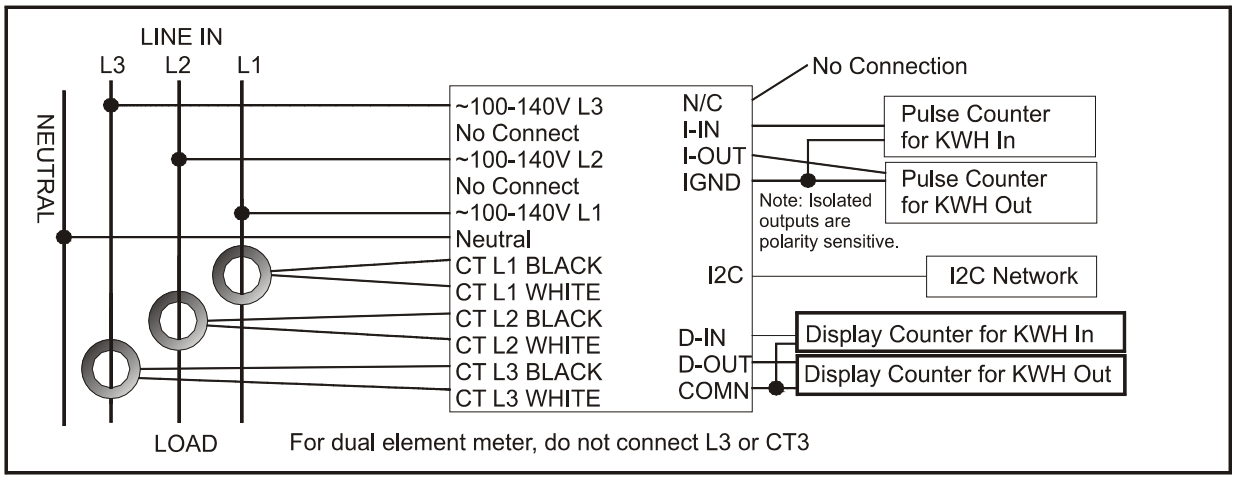


Fig 9. Bidirectional 2 or 3 Element Meter

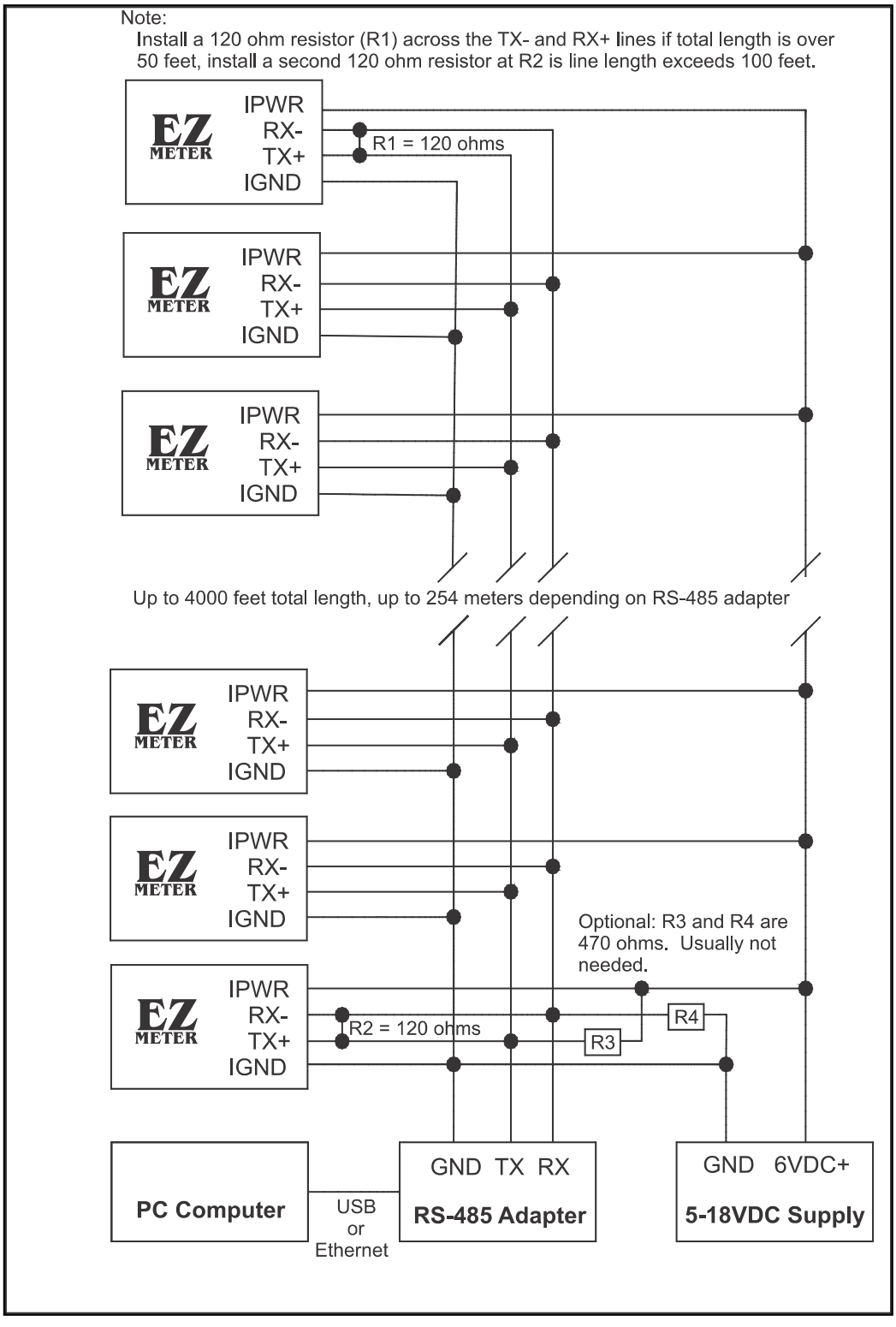


Fig. 10 RS485 wiring

APPENDIX – C -- HVGP and HVDM meter Testing the Installation

Testing the Installed Meter

After the meter has been installed, it is a good idea to turn power on the system and check to see that the meter was connected to the power line properly. This can be determined easily by looking at the red LED in the top, center portion of the label on the electronics module. This LED should glow a bright red whenever power is on. If it is flashing continuously, about one flash per second, it is indicating a high phase angle. This could be caused by the load on the system, but frequently indicates that the voltage and current inputs are not matched properly when using three phase power. This warning requires a current flow of >60 watts on each leg.

If the meter is receiving power, the next step is to verify that the meter is operating properly. You will need a hair drier or other small appliance that uses approximately 1500 watts or more to be able to do the test in a reasonably short time. Since the meter measures each phase separately, you will need to test each phase individually.

You can get a rough idea of the accuracy of the meter with the following test. If you have a high voltage or high current meter, the red LED may flash at 0.5 kwh or 0.1 kwh instead of 0.01 kwh. Check the meter label. You will have to adjust the times for other resolutions.

Without getting into phase angle, resistance and impedance measurements, the following formula will tell you how many seconds it should take to count 0.01 kwh:
SECONDS=4,320,000/VOLTS / WATTS

where VOLTS is the AC voltage measured at the meter (it is important to measure this as variations up to 10% are common) and where WATTS is the wattage shown on the nameplate of the appliance providing the load.

For example, a 1500 watt heat gun on 120 volts will use 0.01 kwh in 4,320,000 / 120 / 1500 or 24 seconds. If you don't get this exact value, it does not mean the meter is defective. Many name plates are only approximate. The label on the EZ Meter itself states power consumption of 2 watts, but that only happens when the serial port is read or the mechanical counter advances. Another factor that influences the accuracy of this test is the power factor of the electricity being measured. If a big power factor exists, the test may take several more seconds than what is calculated,

To check a 120 volt service, turn on your heater and begin timing when the red LED flashes the first time. The red LED should flash again about 24 seconds later (or whatever time you figured using the formula above for the load you are testing with).

If you have several meters but don't have a voltage meter, you can test several meters and if they all use the same number of seconds, you can assume the meters are working okay even if the time observed is different than the calculated time. This test will also correct for variation in the actual number of watts used by the appliance versus the number shown on the name plate.

APPENDIX – D -- HVGP and HVDM Trouble Shooting

Trouble Shooting

Try the following steps if the meter does not work. A simple AC voltmeter will make trouble shooting much easier.

No Red LED

Be sure that line and neutral wires are connected properly and that power is turned on. Check this with your voltmeter by measuring the voltage between the Neutral and L1 terminals. The voltage should fall in the range specified for the meter. If it does not, you have not connected it properly, the power is not turned on, or you have the wrong meter for your electrical system. Check the voltage between the neutral (usually white wire) and ground. This voltage should be close to zero.

No Green LED

The green LEDs are normally off. They flash briefly when the mechanical counter advances..

Green LED flashes but Counter does not change

The meter is correctly detecting the usage of power but the mechanical counter is not moving. Be sure the counter is connected properly with one wire going to COMN and one wire going to DISPL When the green LED flashes, the mechanical counter should advance. With 2-in1 meters, when the top green LED flashes, the counter connected to DISP1 should advance indicating current measured with the transformer connected to the CT #1 terminals. When the bottom green LED flashes, the counter connected to DISP2 should advance.

If the counter is properly connected and does not advance when it should, replace the counter with a different one.

Green LED Flashes too often

The most common cause of inaccurate meters is a poor neutral connection, either at the meter, at the panel, or where it connects to ground. Check your neutral. If a CT wire is shorted to neutral or ground, it will also cause a very high reading.

The time is wrong when doing the accuracy check.

Be sure all the terminals are wired correctly and screwed down tightly.

Be sure the hair dryer or other electrical load is plugged into the proper circuit and that it is the only thing drawing current through the meter.

Be sure the wire to the hair dryer only passes through the current transformer one time and that the neutral wire does not pass through it.

I have several meters and one appears to be reading lower than the others.

If you think one of the meters is reading low, swap the meter with one that appears to be reading right.

Communication problems

See the RS485 Troubleshooting Ap Note on page 33.

Still doesn't work

Check at www.EZ Meter.com for more trouble shooting suggestions or call Customer Support at 1-805-688-9696 between 9:00AM and 5:00PM Pacific Time, Monday through Friday. Each meter is covered by a five year limited warranty (see page 4). There is a charge for meters that are returned for repair that are not defective.

APPENDIX - E -- Connecting FTDI Chip Model USB-RS485-WE-1800-BT

Instructions for connecting FTDI Chip Model USB-RS485-WE-1800-BT

Connect the orange and brown wires to the A (RX-) terminal, the yellow and green wires to the B (TX+) terminal, the black wire to the IGND terminal and the red wire to IPWR (Be sure to check that there is at least 4.8 VDC between IGND and IPWR if there are multiple meters installed). The brown and green wires install a 120 ohm termination resistor. For the RS-232 model, the orange and yellow wires are reversed. If a separate DC power supply is required, connect it to the IGND and IPWR terminals. Instructions and drivers for Windows, Linux and OS-X are at www.ftdichip.com.

The meters should be connected in daisy chain fashion (the wire should loop from one meter to the next) with a twisted pair of wires. CAT5 or CAT6 stranded cable is suggested, and telephone wire will work fine as long as the pairs are twisted.

It is important that twisted pairs be used for connecting the meter. That means use one twisted pair for both A and B. If you want redundancy, use two twisted pairs in parallel. Do not twist the solid and striped wires of one pair together for A and another pair for B. That defeats the purpose of using twisted pairs and will most likely not work unless you have a very short wire run to the meters.

If you have at least a two pair cable, you can run the power from the DC power supply on one of the pairs. Depending on the length of the cable and the impedance of the RS-485 adapter a 120 ohm resistor may need to be installed across the A and B pins on the last meter in the daisy chain. These resistors are built into the FTDI USB to RS-485 and Grid Connect NET485 adapters. Install a 120 ohm resistor on the first meter in the daisy chain. Some systems may require two 470 ohm resistors, one between +5 VDC and the B (TX+) terminals and the other between Ground and the A (RX-) terminals. See Fig. 10. All the resistors can be connected directly to the meter terminals. Experiment with different resistor combinations until communication is established. See the RS-485 troubleshooting section for more information.

Maxim Integrated Devices, manufacturer of the RS-485 drivers used in the meters, has a very helpful document titled *Guidelines for Proper Wiring of an RS-485 (TIA/EIA-485-A) Network* at http://www.maximintegrated.com/an763.

Be sure to write down the serial number and Modbus address of each meter and its location. The EZ Power Suite requires a unique serial number for every meter location.

Application Notes at the end of this document deal with troubleshooting an RS-485 installation, connecting Digi radios and the NET485 ethernet to RS-485 module.

I2C Port Connection: Contact the factory for details on using non-isolated pulses available on this connector.

APPENDIX - F -- HVGP, HVDM, and RGB meter purposes/differences

Differences Between Meter Modules

	HVGP	HVDM	RGB	---
Purpose	Billing	Billing	Billing & Energy Mgmt.	
Services Monitored	One	Two	One	
Single phase Only	No	Yes	No	
120V Only	No	Yes	No	
Amperage options	60, 100, 150, 200, 250, 400, 800, 1200, 1600, 2000 amps		100, 200, 400, 800, 1600, 3200 amps	
kWh Accuracy	> 99%			
Volts, Amps etc	Averaged over 64 cycles		True RMS	
Display output pulse	12V pulse		12V pulse, optional isolated dry contact pulse	
Top red LED	Flashes every 10 Wh, Phase alarm		Phase alarm	
Yellow LED	RS-485 Signal Received			
Lower red LED	Not applicable		Flashes every 10 wh	
Green LED	Flashes when counter advances		Heartbeat. Flashes every second	
CT Types	No burden resistor		333 mV, 100 mA, no burdern res.	
Baud rates	1200, 4800, 9600, 19200		9600, 19200, 38400, 57600, 115200	
Big Endian only	No		Yes	
Signed Integers Only	No		Yes	

APPENDIX - G -- RGB Meter ordering information

Billing or Energy Management?

The original EZ Meters lacked the processing power to provide true RMS values for volts, amps, power factor, etc. The latest product revision corrects that problem with meter designed for energy management. The letter R before the rest of the model number designates an energy management focused meter. The new meter also handles higher amperages, standard 333mV and 100mA current transformers and Rogowski coils."

AUTOMATIC METER READING (AMR). EZ Meters are available with one of three Automatic Meter Reading (AMR) capabilities: None, Pulse, or ModBus.

NONE: Installations without AMR require someone to visit each meter periodically and manually record the reading from the display.

PULSE: A Pulse meter generates an isolated pulse, usually every kwh, which is detected by some type of data logger or pulse counting radio. EZ Meters are compatible with most types of pulse counting systems; including Next Century, Oscar, Inovonics and Hexagram. These systems are usually installed at the site and connected to a billing service via telephone modem or the internet. The pulse is generated by an optocoupler and mimics a dry-contact closure, except that it is polarity sensitive. Standard pulse duration is 50 milliseconds. Other pulse lengths are available. Contact the factory.

RS-485: is a communication protocol used commonly in building and industrial control systems. Up to 256 devices can be on one network, even more if repeaters or radio links are used. RS-485 is the most commonly used serial interface for meter reading. USB to RS-485 adapters are available at low cost from a number of vendors. TCP/IP to RS-485 adapters are also available allowing a network of power meters to be connected to the internet. Another option for extending an RS-485 network is to use two radios, something frequently done to avoid trenching between two buildings. More powerful radios have a range up to seven miles

The modular design of EZ Meter communications allows other modules to be developed and implemented fairly inexpensively. Contact the factory for RF module availability.

MODBUS: Modbus is an open protocol and the de facto standard for building and industrial automation. The register map is available on page 39. Several third-party software vendors offer software already configured to the EZ Meter register map. RGB/BAS meters are supplied with big endian only; HVGP and HVDM meters can also have little endian and either signed or unsigned integers.

Bi-directional Meters. All one, two and three element meters are available as bi-directional meters that measure the energy flow in each direction. These meters are most often used in conjunction with solar, wind or other alternative energy systems connected to the grid.

VOLTAGE: Each EZ Meter must be ordered to match the electric system where it will be installed. The first character of the model number determines the voltage range the meter can handle.

Note: Each meter model is capable of handling a range of voltages. Select the meter with the voltage range that includes the voltage you want to measure.

A. 100-130 volts to neutral, 200-260 volts line to line:
Single element: 100-130 volts to neutral, single phase.
Two element: 100-130 volts to neutral, 200-260 volts line to line, single phase or two phases of three phase system.
Three element: 100-130 volts to neutral, four wire, three phase wye.

B. Three element only: 100-130 volts to neutral on two legs, 200-260 volts to neutral on the third leg, 200-260 volts line to line, four wire, three phase delta. Can also be used in place of an A single output meter with a slight loss of accuracy at the low end on L3.

C. 200-260 volts to neutral, 400-500 volts line to line.
Single Element: 200-260 volts line to neutral, single phase.
Two element: 200-260 volts to neutral, 400-500 volts line to line, or two phases of three phase.
Three element: 200-260 volts to neutral, 400-500 volts line to line, three phase wye.

D. 220-300 volts to neutral, 430-500 volts line to line
Single element: 220-300 volts line to neutral, single phase
Two element: 220-300 volts to neutral, 430-500 volts line to line, or two phases of three phase.
Three element: 220-300 volts to neutral, 430-500 volts line to line, three phase wye

E. Three element only: 240-300 volts to neutral on two legs, 430-500 volts to neutral on third leg, 430-500 volts line to line, 4 wire, three phase delta.
This meter does not meet UL spacing requirements and is not a UL recognized component.

F. Two Element only: 200-260 volts line to line, three wire, three phase delta

G. 440-500 volts line to line:
Single element: single phase
Two element: three phase delta
This meter does not meet UL spacing requirements and is not a UL recognized component,

H. Two Element only: 100-130 volts to neutral, 200-260 volts line to line, single phase.

Maximum Current and Current Transformers. Each EZ Meter is calibrated to work with a specific model current transformer (CT) at any current up to the maximum rating for the meter. CT installation requires the conductor(s) to be de-energized before installation. Solid core CTs require the conductors to be disconnected for installation – then reconnected. Split core CTs can be installed without disconnecting the conductor(s).

Solid core CTs are available for current ranges up to 100, 200, or 400 amps. Split core CT ranges up to 100, 200, 400, 800, 1600 or 3200 amps.

CTs can be installed in parallel. If want to measure several circuits in a breaker panel and the circuits are on the same leg, but opposite sides of the breaker panel, you can use two CTs, one on each side, so you don't have to rewire the panel.

The wires from the CTs can be extended, if required, as long as the total wire resistance does not exceed one ohm. Contact the factory for further advice when using voltage output type CTs.

Display and Resolution. Each EZ Meter can be equipped with either an LCD display or an electro-mechanical counter that displays accumulated kilowatt hours.

An electro-mechanical counter (the standard counter) is rated to work down to 10^{o} C (14^{o} F) and is not suitable for outdoor use in cold climates. An extended temperature range counter rated down to -30^{o} (-22^{o} F) is available at added cost. *If the temperature drops below the counter's operating range, the counter's display will not be accurate.* Electro-mechanical counters, however, are recommended for locations in bright sunlight where an LCD display might be difficult to read.

If an LCD display is mounted in a location where it stops working because of low temperature, the display will return to normal operation with no loss of kwh data when it warms up.

Mechanical counters for meters with 0.1 kwh resolution have a red number on the right side to indicate tenths of kwh. The other numbers are all white. Counters for meters with 1.0 kwh or 0.01 kwh resolution have all numbers the same color. The LCD displays have a resolution of 0.01 kwh.

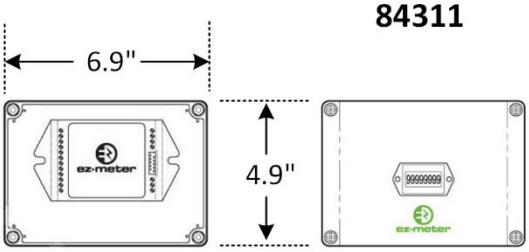
Enclosures. A variety of enclosures that hold different numbers of meters are available. Most are NEMA4X rated non-metallic enclosures with the meters mounted on a panel inside. The use of non-metallic enclosures allows AMR radios to be mounted inside. Interior rated enclosures have a clear cover while exterior rated ones have a solid cover. The LCD displays are available only on the solid door version.

The following page provides the enclosure dimensions and configurations available based on the number of meters desired to be used.

ez·meter

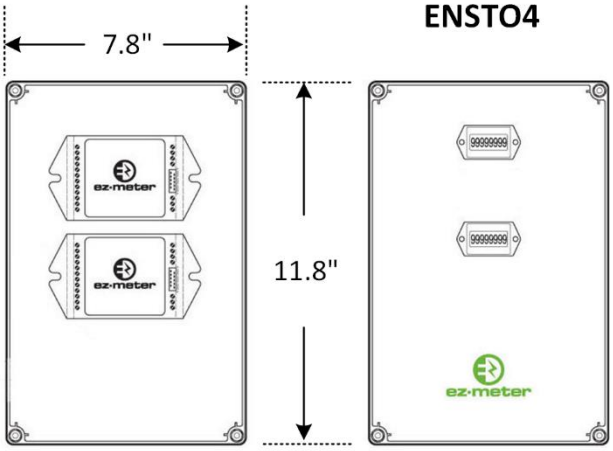
METER PANEL CONFIGURATIONS

84311



D= 2.9"

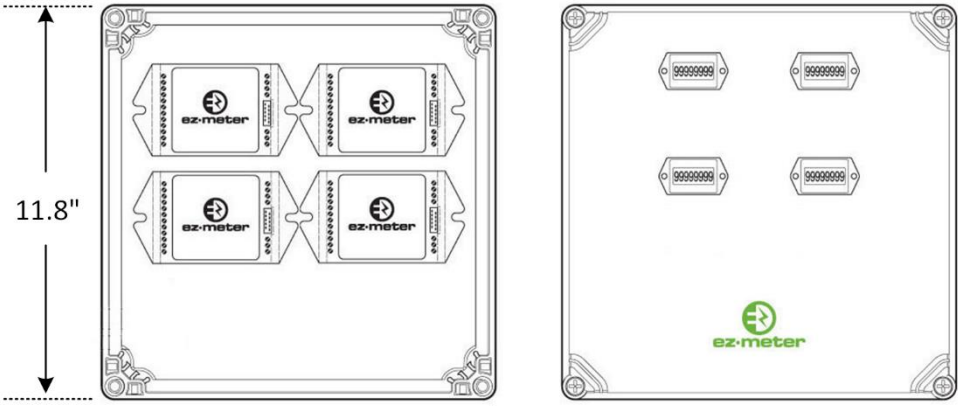
ENSTO4



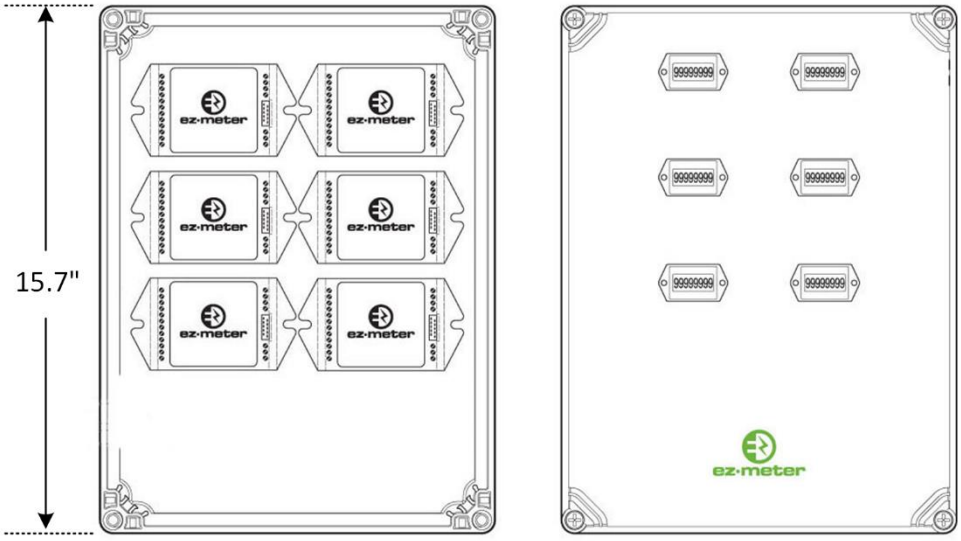
D= 5.2"

D= 5.2"

ENSTO8



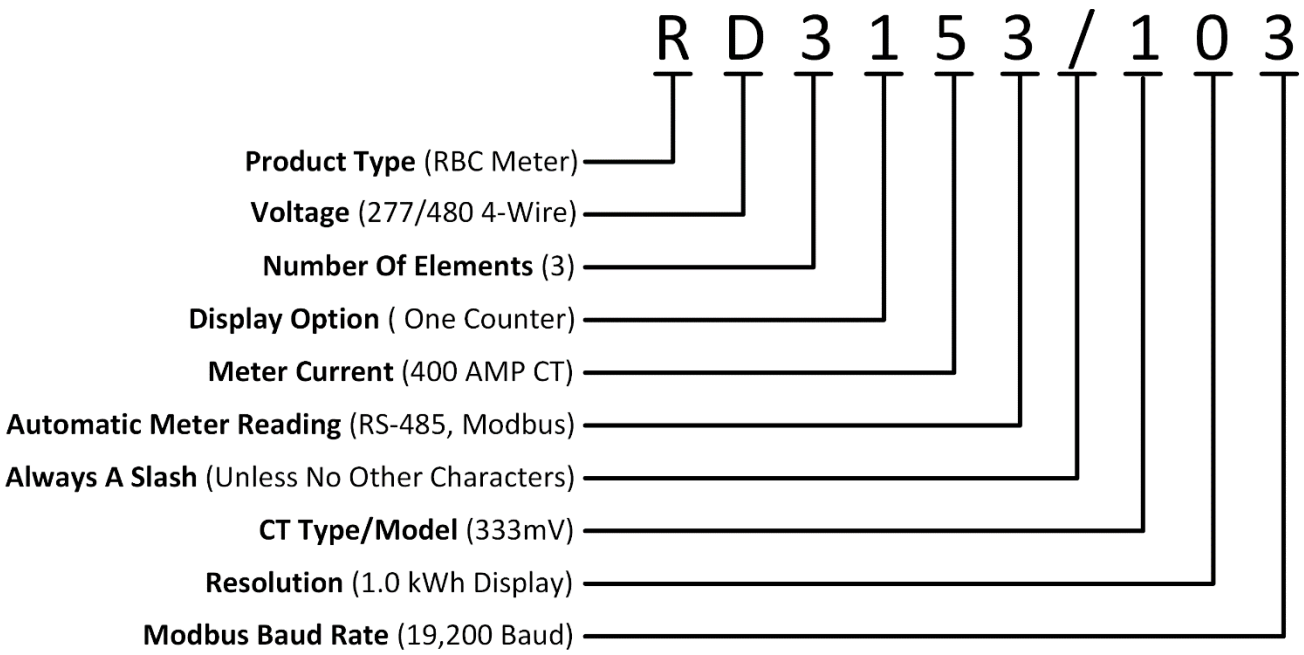
ENSTO12



D= 5.2"

Model Numbers

Each digit in a model number specifies a different feature or option. Use the table below to determine the options in the electronics module of your meter.



First Character - Product type
R = **R**evenue **G**rade **B**illing metering (RGB)

Second Character - Voltage (see detailed description on page 42)
A = 120/208: Three phase, 4 wire (wye) [default]
B = 120/240: Three phase, 4 wire (delta, high leg on L3, three-element only)
D = 277/480: Three phase, 4 wire (wye)
F = 208: Three phase, 3 wire (delta, no neutral, two-element only)
H = 120/240: Split phase, 3 wire (line 1 to line 2, 180°, neutral, two-element)

Third Character - Number of elements supported
1 = One element
2 = Two element
3 = Three element [default]

Fourth Character - Display option
0 = No counter driver (AMR only)
1 = One counter (kWh Delivered, standard meter) [default]
2 = Two counters (kWh Delivered and kWh Received)

Fifth Character - Maximum rated current (Meter Class)
1 = 100 amps
2 = n/a
3 = 200 amps [default]
4 = n/a
5 = 400 amps
6 = 800 amps
7 = n/a
8 = 1600 amp
9 = 3200 amp

Sixth Character - Automatic Meter Reading (AMR)
1 = Isolated pulse output (ISO1=delivered and ISO2=received) [default]
3 = RS-485, Modbus RTU protocol [default, secondary]
6 = Tiny Mesh RF
7 = Special meter to power NextCentury radios – Non-isolated pulse available if GND is tied to COMN.

Valid meter model numbers contain at least five characters. The model number may contain up to five additional characters. If none of the additional characters are present, the “0" value is implied.

Seventh Character - Always a slash / unless there are no additional characters.

Eighth Character - The CT Type/Model
0 = n/a
1 = 333mV
2 = 100mA
3 = n/a
4 = SO160 = (3300:1), split cores for 800A, 1200A*, and 1600A
5 = KCT-203-FD (2000:1), split cores for 400A
E = 417:1, solid core for 200A, 0.6" ID (burden resistors on PCB) [default]
F = T24/200-417 (417:1), split cores for 200A

Ninth Character - Resolution
0 = Display: 1.0 kWh [default]
Isolated: 1.0 kWh
1 = Display: 0.1 kWh
Isolated: 0.1 kWh
2 = Display: 0.01 kWh (available for 200A or less only)
Isolated: 0.01 kWh
50 mSec pulse and 150 mSec recovery

Tenth Character - Baud Rate (Modbus Configuration)
2 = 9600 Baud
3 = 19,200 Baud
4 = 38,400 Baud
5 = 57,600 Baud
6 = 115,200 Baud

Part Number Suffixes for Ordering. The part numbers above are printed on the meter cases and enclosures. For ordering and invoicing, a part number suffix consisting of a hyphen (-) and two digits may be appended to the part number. The first digit is the number of CTs that go with the meter. The second digit represents the type of mechanical counter that goes with the meter. The codes are

5 = Counter for 0.1 kwh resolution, one red wheel, standard temperature range (4921/1)
6 = Counter for 1.0 or 0.01 kwh resolution, all white wheels, standard temperature (4921/0)
9 = LCD Counter and ribbon cable

In addition, California approved meters require special marking on the current transformers. Append a letter "C" to the model number to be sure your meter will pass the state testing procedure.

EZMeter Technologies
11030 Cochiti Rd SE
Albuquerque NM 87123 USA
1-805-688-9696

www.ezmeter.com
salesinfo@ezmeter.com