EZ METER

Watthour Meters

Product Selection Guide

User Manual

Installation Manual

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

Interim Draft Manual

Notice Regarding Safety

This document is a draft prepared for submittal of the products to CSA for certification testing. It states that most of the products are CSA certified. At the time this document was written, none of the products mentioned inside have been tested by CSA and none of the products carry a CSA mark.

Updates

Check the www.ezmeter.com website for updates to this manual. Installation diagrams are expected to be added soon.

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 wires with current flowing through them without connecting them to the meter or twisting the two wires coming from the CTs together. A very serious shock hazard exists if the wires are just left loose.

These meters should only be installed by experienced electricians. If you do not fully understand these instructions, call the factory at 800-824-9696 for clarification.

In most localities, a permit and inspection is required to install the meters.

Legends

These symbols appear on meter labels.

1 Caution, risk of Danger

G Equipment protected throughout by double insulation

H Alternating Current

Abbreviations & Glossary

Common abbreviations used in this manual include:

AMR - Automatic Meter Reading System
CT - Current transformer
KWH - Kilowatthour
Element - An input for measuring power, usually a current transformer (CT)

Rev. 3/24/10

Contents

Safety Certification

Most EZMeters (except 480 volt three wire delta models) come in a CSA International certified package that includes the electronics module, counter, current transformers and enclosure. The enclosure may hold from one to 24 meters. This mark is the legal equivalent of a UL Listing mark and is valid in the United States and Canada. CSA International is a Nationally Recognized Testing Laboratory (NRTL); check the OSHA website for more information about NRTLs. The applicable standards are UL 61010-1, CA/CSA-C22.2 No. 61010-1 and ISA-82.02.01 (IEC 61010-1 MOD). The certification is for pollution degree 2 and installation category II.

The electronics modules also carry a CSA mark that may be relied on by OEMs incorporating the meter module in their own CSA certified or UL listed product.

Notice

This is a draft document prepared for CSA International evaluation. No product has been tested by CSA or any other Nationally Recognized Testing Laboratory.

Accuracy Certification

All EZ Meters are guaranteed to meet the ANSI C12.1 standard for electric meters. This standard allows an error of up to 1% when new and 2% when field tested.

In California, Maryland and Canada, meters are regulated by the government when used for revenue billing. Contact the local Weights and Measures office. Special meters are available for California that meet the state's security requirements (all EZ Meters exceed California's accuracy requirements).

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 ezmeter.com website for more on these requirements.

Limited Warranty

Davidge Controls 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, Davidge Controls 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: Davidge Controls, 583 Refugio Road, Santa Ynez, CA 93460. Davidge Controls will pay return shipping charges. Call Davidge Controls 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 Selection Guide

This chapter provides information to help you choose the best meter for your requirements.

Automatic Meter Reading (AMR). Every EZMeter is available with one of four Automatic Meter Reading (AMR) capabilities: None, Pulse, EZ Plus, or ModBus.

No AMR requires someone to visit each meter periodically and manually write down the reading from the display.

A Pulse meter generates a pulse, usually every kwh, which is detected by some type of data logger or pulse counting radio. EZ Meters are compatible with most type of pulse counting systems including Inovonics, Hexagram and Radio Path. 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.

EZ Plus and Modbus are two separate software protocols used for addressing meters using a serial interface. Either one is available with an RS-232 or RS-485 interface.

RS-232 is a very common interface that is intended for a single device within about 30 feet. Because of the addressing scheme used in the EZ Plus and Modbus protocols, multiple meters can be addressed, but no tests have been conducted to see how many will work.

RS-485 is a protocol used commonly in building and industrial control systems. Up to 256 devices can be on one network, even more if repeaters 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. Most telephone modems have an RS-232 port which requires an RS-232 to RS-485 adapter to connect the meter network to a phone line. 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 EZMeter communications allows other modules to be developed and implemented fairly inexpensively. Expect a meter with a built-in radio shortly.

EZ Plus is a relatively easy to implement protocol that will provide all the information available by Modbus. Most of the software provided by the manufacturer uses the EZ Plus protocol. Since it is a binary protocol, there is a chance it could conflict with an ASCII protocol if sharing the same network. The network must be 12, 4800, 9600 or 19,200 baud, 8 data bits, 1 stop bit, no parity. The baud rate is hard coded in the meter and cannot be changed.

Modbus is an old protocol and the de facto standard for building and industrial

automation. One downside is that you have to write your own software to talk to it. That includes assigning a Modbus address to each meter by serial number and having fewer available addresses. Unless your programmer is an old hand at Modbus, the EZPlus protocol is probably easier to implement. Modbus is more flexible for working with other equipment on the same network. The meters can be purchased preconfigured or configured in the field with an optional dongle that plugs into the I2C port and sets Modbus address, baud rate, stop bits and parity.

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

Voltage. Each EZMeter 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.

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
Three element: 230-260 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 EZMeter 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 to 50, 100, 150, 200, 250 or 400 amps. Split core CT ranges up to 200, 400, 800, 1200, 1600, or 2000 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 EZMeter can be equipped with either an LCD display or an electro-mechanical counter that displays accumulated kilowatt hours. Some considerations:

An electro-mechanical counters 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 are 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 stopps 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.

Available versions are:

6" x 6" x 4" enclosure holds one or two meters and displays.

12" x 7" x 5" enclosure holds up to four meters and displays

13" x 13" x 6" enclosure holds up to eight meters and displays

19" x 15" x 7" enclosure holds up to twelve meters on one panel and up to 24 meters with two panels

A vacuum formed plastic enclosure that flush mounts in a sheetrock wall holds one meter with space for an AMR radio. A counter mounts in the exposed cover.

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 - Voltage (see detailed description on page XX)

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, 00-260 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, 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

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 = 50 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

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

1 = 4735/1 - 3000:1

2 = 4735/2 - 3000:1

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 - Special Options

0 = Standard meter
1 = Bidirectional meter
2 = Ground Fault meter

Tenth Character - Baud Rate or Isolated Pulse Timing.

For Serial Port meters

0 = 9600 Baud
1 = 19,200 Baud
2 = 4800 Baud
3 = 1200 Baud

For Isolated Pulse Meters

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

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. If the meter has an electro-mechanical counter display, 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 states the resolution. The label on the meter electronics module also states the resolution.

If the meter has an LCD display, kwh is displayed with the digits to the right of the decimal point indicating hundredths of kwh. Single output meters, except meters without a neutral, also scrolls through volts, amps, watts and phase angle for each of the active phases.

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

Whenever power is applied to the L1 terminal, the red LED on the electronics module should light. The light will flash off then back on every time one of the legs measures 1/100 of a kwh (or whatever quantity is indicated by the Kh value on the meter label (see below). If the red LED flashes on and off continuously, the meter is detecting a high phase angle on one or more of the legs. This could indicate a piece of equipment is not operating properly or it could mean that the CTs and voltage references were not paired properly when using three phase power. See the installation instructions for curing this condition.

To disable the high phase angle alarm (if you want to test the accuracy of the meter at a high phase angle), install a jumper between the two pins on the I2C connector nearest the display connector.

Meters with electro-mechanical displays have a green LED that will flash briefly every time the display counter advances.

Meters with an RS-232 or RS-485 interface have a yellow LED that flashes briefly every time the meter responds to a request over the serial port.

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 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 18 and see the troubleshooting suggestions on page 19.

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.

Rr- The Register Constant is the number of flashes of the red LED for one indication of the display counter. The label also displays the resolution of the display in KWH.

Kh - This is the abbreviation for the Meter Constant, the number of watthours recorded in one indication of the meter. On EZ Meters, the indication is a flash of the red LED. For clarity, the label also indicated the value of one flash in kilowatt hours (KWH).

Depending on the type of meter, the next line will provide the isolated output resolution or the type of serial communication and the default baud rate.

Oper. Temp: - The operating temperature range applies to the electronics module only. The low temperature is usually lower than the low temperature for the display.

Voltage - The range of voltages in which the meter will operate measured between line and neutral. If there is no neutral, it is the voltage line to line. 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.

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 a factor used in 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.

Installation Instructions

These instructions are for meters whose model number begins with a number, not a letter.

The EZ Meter consists of an electronics module, one or more current transformers (CTs), a display consisting of an LCD module or one or two electro-mechanical display counters, and an enclosure that holds from one to 24 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. A circuit breaker rated at 200 amps or less should be installed before the meter. Be sure no one will be able to turn off the breaker and defeat the meter.

Installing the NEMA4X 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. 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 plastic enclosure: This enclosure was designed to be recessed into a sheetrock wall. Cut a 6" square opening in the sheetrock 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.

Installing the CTs: (See the appropriate Figure on pages 16 and 17.) If you are using solid core CTs, you must turn off the power to begin your installation. Disconnect one end of the wire (or wires) with the load to be measured and pass it through the center of the CT and reconnect the wire(s) where it was attached before. Connect the two wires coming out of the CT to the appropriate terminals on the electronics module. Begin connecting CTs to CT #1 and continue until all the CTs for that meter are installed. The direction of the current flow is not important unless you are installing multiple CTs on one leg or you are installing a bidirectional meter.

You can install more than one CT on each leg if you need to. You might need to if you were measuring several circuits in one breaker panel and the wires were not long enough for all to go through one CT or if you wanted to measure power being used in two separate breaker panels. Just be sure all the wires on each leg go through CTs that are connected to the same terminal on the meter and that the direction marks on the CTs are aligned the same. Multiple CTs should be connected in parallel.

If you run more than one wire through a CT, be sure that the current flow is the same direction for all wires and that all the wires are the same leg (phase). That means there

should be no voltage variation between the wires (if you touched them together, they would not spark). Failure to do so will cause the power flowing in one wire to be subtracted from the power flowing in the other wire instead of being added to it.

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 line resistance is much over one ohm, accuracy of the meter will be affected, especially at high phase angles. 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. If you have to install them without turning off power, connect the wires to the meter before securing the two parts of the CT over the wire carrying the load. Be sure to secure the two parts of the CT so it cannot come apart.

Do not mix spilt core and solid core CTs on the same meter.

WARNING

Hazardous voltages exist in CT wires when they are not connected to meter and current is flowing through wire passing through the CT. Wire nut the CT wires together if you must remove the meter and leave the CTs in place.

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 16 and 17 for specific models.

You can use any size wire from 28 AWG to 12 AWG. Be sure insulation meets local codes. Each phase should be protected by a circuit breaker or fuse of 200 amps or less. 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.

IMPORTANT

You must insure that the leg connected to the L1 terminal is the same leg which passes through CT #1, and the same for (L2 & CT #2) and (L3 & CT #3). This is especially important when connected to three phase power because the meter will only record 50% of the power used on 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 0.6 or less - optimum power factor is1.0).

Display Connections: (See Fig 1 and Fig 7)

The electro-mechanical counter comes already connected to the meter. If you purchased an OEM version of the product, connect as shown in the diagram below. If you have a three element, dual output meter, DISP1 is matched with CT #1 and VAC #1 while DISP2 is matched to the remaining CT(s). If you have a four element, dual output meter, the power flowing through CT

Isolated Outputs: (See Fig. 7) If you have a pulse output meter, connect the two wires from the pulse counting equipment to ISO- and ISO+ respecting polarities. The grounded terminal of the pulse counting device needs to be connected to the ISO- terminal on the meter. If you have a three element, dual output meter, connect one set to ISO- and ISO1 and the other set to ISO- and ISO2. They correspond with DISP1 and DISP2. On four element, dual meters, the terminals are labeled ISOA, DISPA, and ISOB and DISPB.

RS-232 and RS-485 Connections: (See Fig. 1 and Fig. 10) The serial connections are optically isolated from the electronics of the meter and require an external power source. Any power supply capable of delivering 7-18 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-232, connect the TX+ terminal to your pin 3 of your RS-232 connector and connect RX- to pin 5.

For RS-485, there does not appear to be a lot of consistency in pin labeling. We have seen four-wire RS-422/485 adapters that work when Rx+ and Rx- were connected together and others where Rx+ and Tx+ 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-232 or RS-485 connector can be a lot of hassle. To make the process easier Davidge Controls resells USB to RS-232 and USB to RS-485 adapters made by FTDI Chip. These adapters have a 1.8 meter wire bundle that can be connected directly to the meter.

Instructions for connecting FTDI Chip
Model USB-RS485-WE-1800-BT
Model USB-RS232-WE-1800-BT

For the RS-485 model, connect the orange wire to the RX- terminal, the yellow wire to the TX+ terminal and the black wire to the IGND terminal. For the RS-232 model, the orange and yellow wires are reversed. Also connect your DC power supply 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 (wire loops from one meter to the next) with a twisted pair of wires. Telephone wire will work fine as long as the pairs are twisted. If you have at least a two pair cable, you can run the power from the DC power supply on one of the pairs. If the total wire length is greater than 50 feet, a 120 ohm resistor should be installed across the RX- and TX+ pins on the last meter in the daisy chain. If the total wire length will

be greater than 100, 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 TX+ terminal and the other between Ground and the RX- terminal. See Fig. 10. All the resistors can be connected directly to the meter terminals.

Be sure to write down the serial number of each meter and its location. The serial number is used as the meter address when the software is configured to read the meters.

I2C Port Connection: The I2C port (pronounced Eye Squared See) is used to connect an LCD display to the meter. The meter should be powered down before connecting the display. The display will not function until the meter has been powered up again after the display has been installed. An exception to this applies to Modbus versions of the meter that have previously been connected to an LCD display. The display can be disconnected while the meter is running, then the optional configuration dongle can be connected, then the display can be reconnected.

Notes on Wiring Diagrams on following pages:

The voltages shown on all 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. 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 only works if you have a balanced load. If in doubt about a balanced load, run a neutral and use a Type A meter. 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.

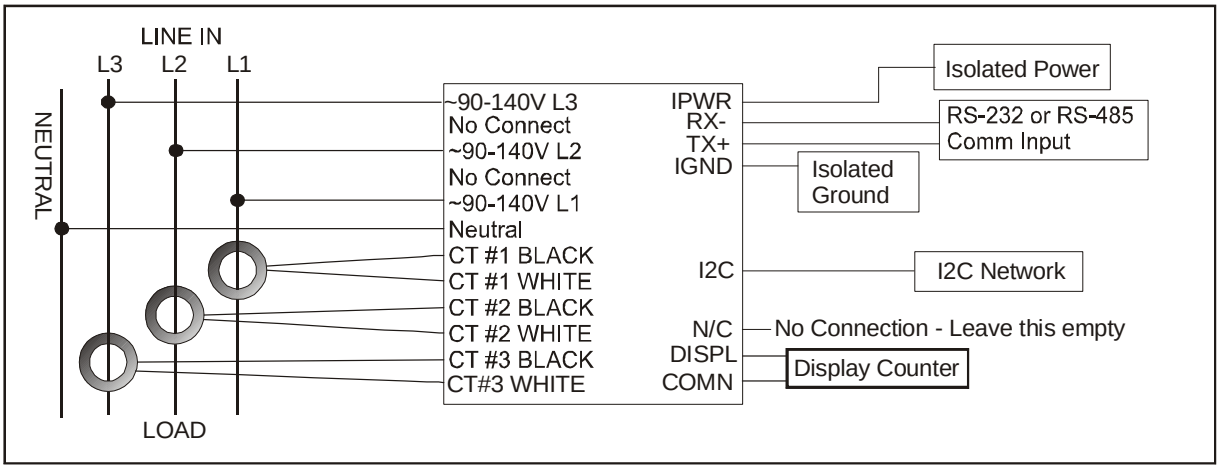

Fig 1. 4-wire, 3 Phase Wye Meter (Types A, C & D) with RS-232 or RS-485 Installation Diagram

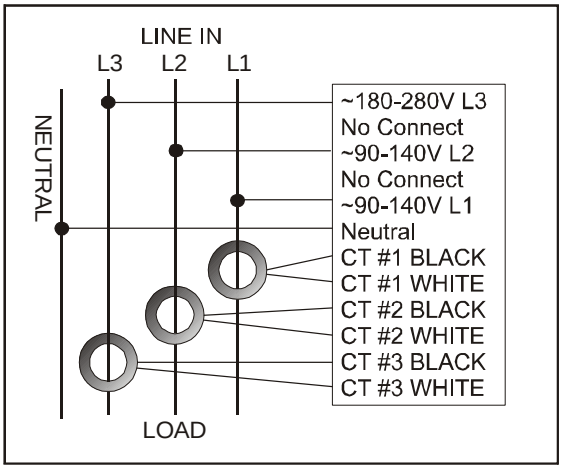

Fig 2. 4-wire, 3 Phase Delta Meter (Types B & E)

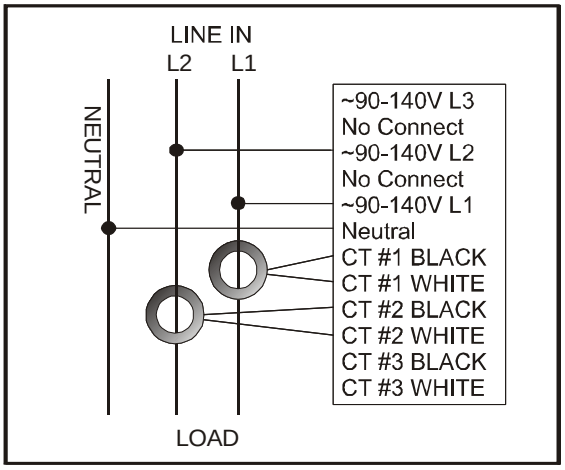

Fig 3. 3-Wire Single Phase Meter (Types A - E)

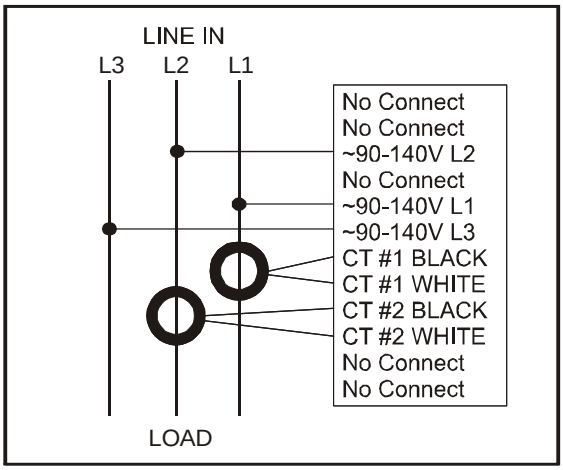

Fig 4. 3 Wire, 3 Phase Delta Meter (Types F & G)

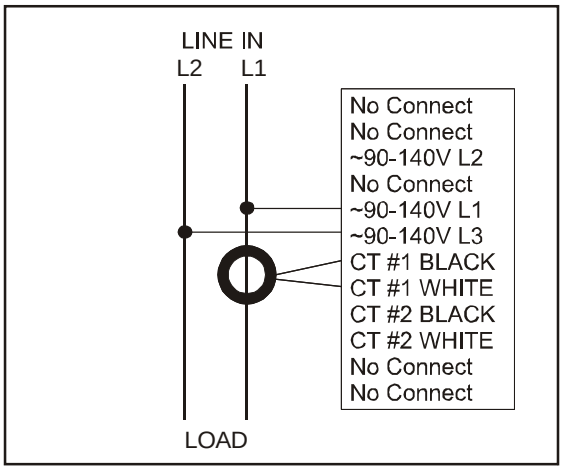

Fig 5. 2 Wire, Single Phase (Types F & G)

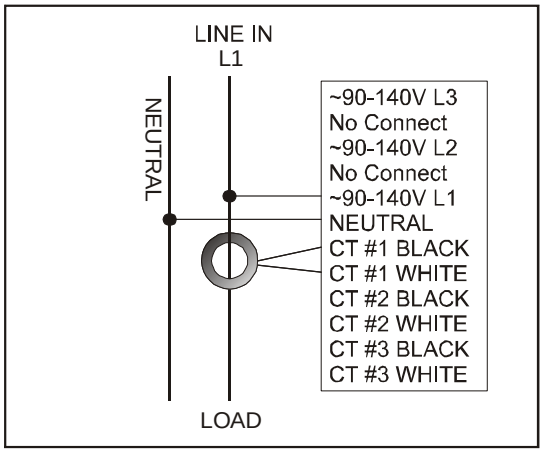

Figure 6. 2 Wire, Single Phase (Types A - E)

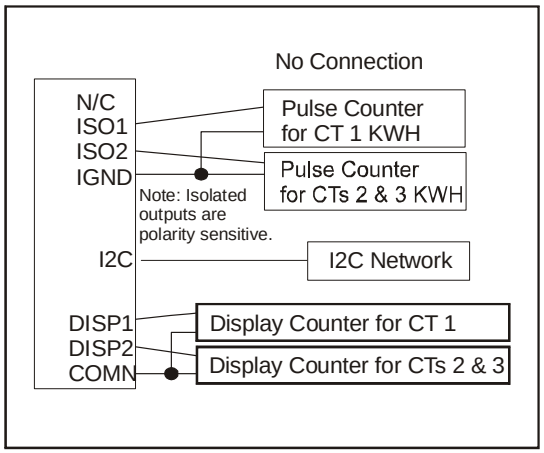

Fig 7. Display and Isolated Output configuration for dual output meters

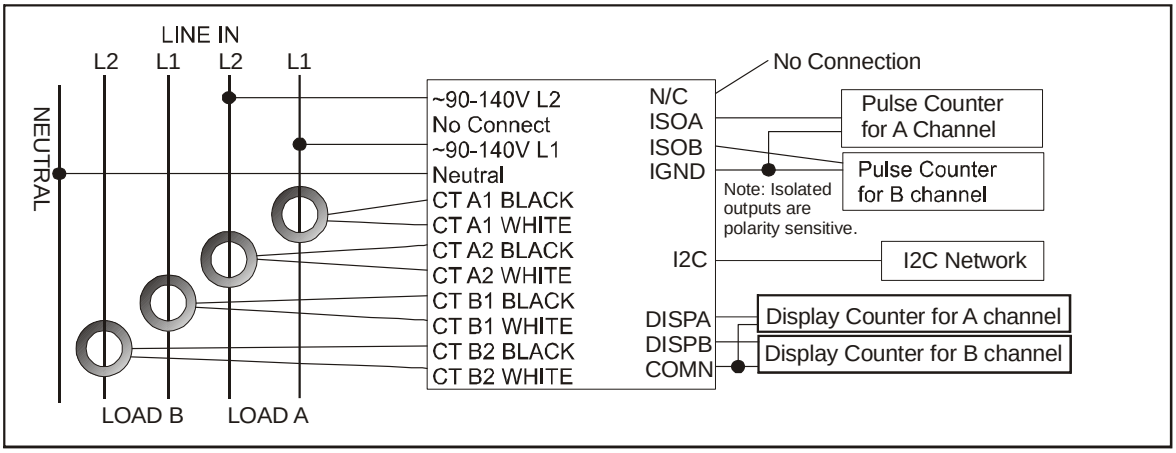

Fig 8. Dual 3-Wire, Dual Element, Single Phase Meter (Type A4)

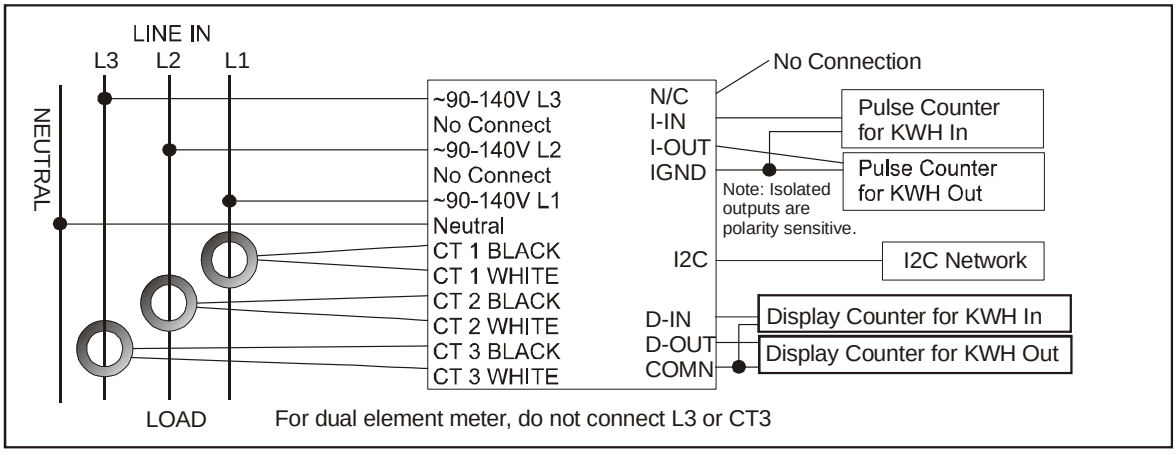

Fig 9. Bidirectional 2 or 3 Element Meter

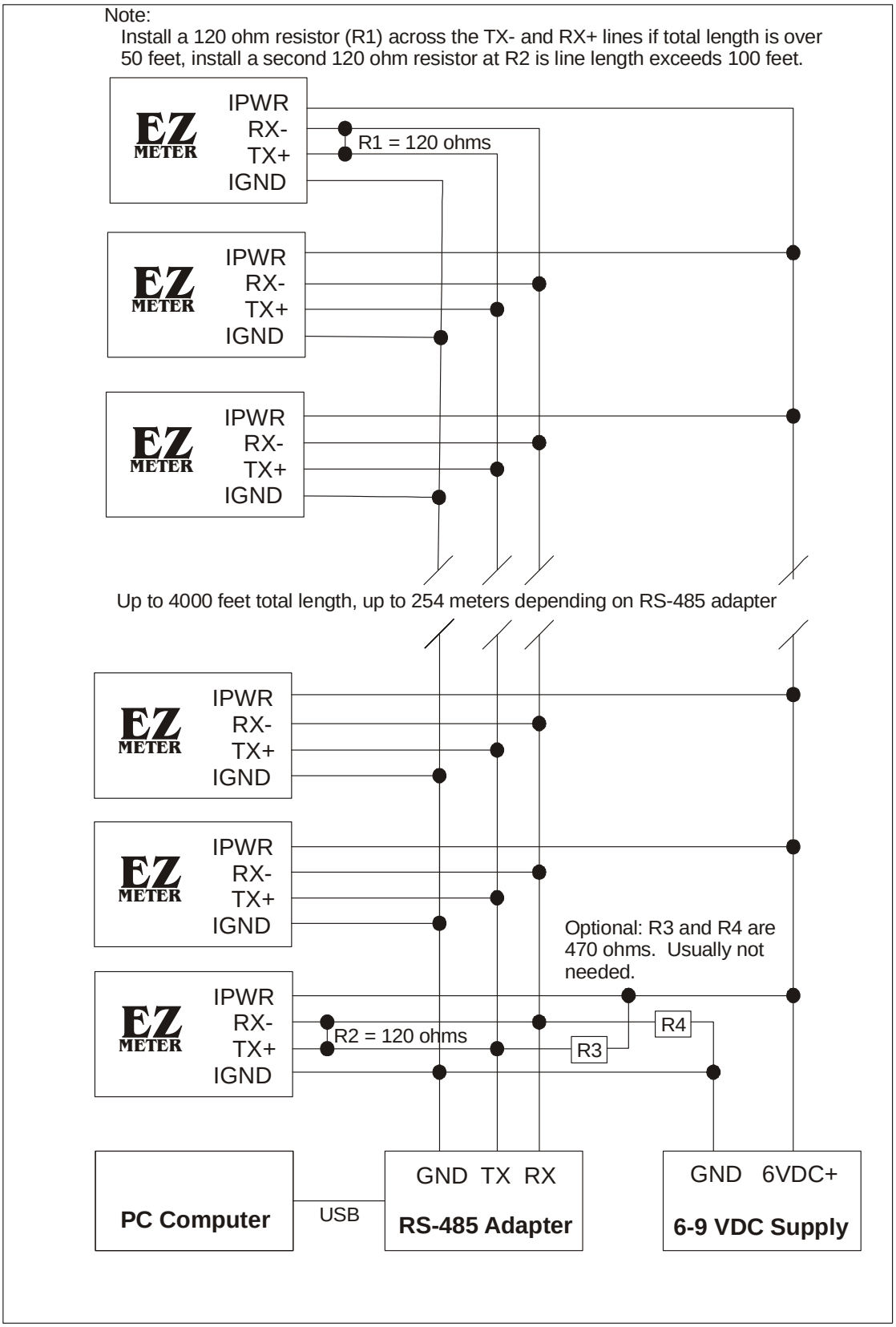

Fig. 10. RS-485 Network Layout

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 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 100 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 1.0 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 EZMeter 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 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.

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 VAC #1 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 this 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.

Still doesn't work

Check at http://www.ezmeter.com for more trouble shooting suggestions or call Tech Support at (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 2). There is a charge for meters that are returned for repair that are not defective.