

The Meter Reader

EM-2500

Owner Manual



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1.0 Introduction, (How it works):

The EM-2500 Meter Reader is a two channel Energy Monitor. It tracks and records the True Power consumer by an electrical load.

The term “load” represents an appliance, a machine, a lighting circuit or any electrical device which consumes electrical power.

In order to derive true power the Energy Monitor requires “Real Time” access of two parameters:

1. The voltage (volts) supplied to the load.
2. The current (amperes) flowing through the load.

In order to access these parameters from a powered load, the EM-2500 uses the most non-intrusive and safe method of doing this:

1. The EM-2500 reads the line voltage (120V household voltage) via the supplied AC wall transformer (usually termed AC adaptor). The low voltage secondary AC signal from a wall transformer is proportional to the line voltage. With this technique, there is no need to connect to dangerous voltage levels. When the transformer is used in this way, it is termed potential transformer.

2. In order to access the load's current without splicing into a current carrying conductor, the EM-2500 uses a current transformer (CT). The CT simply clamps around one conductor supplying the load. (The CT cannot be clamped around a power extension cord to the load since the two current carrying conductors inside the cable are opposite polarities and the magnetic fields cancel out.)

The technique described above not only makes the EM-2500 safer to install, but also provides versatility in the types of loads which can be monitored and its applications.

Since the monitor obtains the required parameters indirectly, it is important for the EM-2500 to know the value of the wall transformer's (PT's) ratio of primary to secondary voltage. The EM-2500 also requires the CT's ratio for an accurate representation of the current. These values are labeled on the PT and CT.

Note: The PT & CT value for the EM-2500 are pre-set and need not be changed unless instructed other wise.

Once this is done, the EM-2500 will always remember these values until they are manually altered. In other words, this only needs to be setup once, unless the CT is substituted with another type for higher current applications.

Once the EM-2500 is setup and monitoring a load, the energy consumption may be monitored and recorded in several ways:

1. The non-volatile incrementing counter which displays the kWh value, much like a residential power meter. This counter keeps incrementing (with power usage) until the user decides to reset it.
2. The EM-2500 also display's other values shown in Diagram II. One very usefull is the "Projected cost (\$)" for 30 days" which is similar to a projection of your monthly electric bill.

2.0 Before you start:

1. Read all safety precautions relating to the type of monitoring installation used.
2. Verify the PT setting of the monitor matches that of the supplied "Wall Transformer". Preset at Factory.
3. Verify the Ct setting with that of the CT you will be using. A separate setting is required for each channel based on the CT type being used. Preset at Factory

WARNING!!!!!!

THE EM-2500 HAS BEEN DESIGNED TO BE A SAFE INSTRUMENT. OPERATION OF THE EM-2500 DOES NOT REQUIRE ANY DISCONNECTION OR SPLICING OF LIVE WIRES, ONLY UNPLUGGING AND PLUGGING INTO STANDARD WALL OUTLETS OR CLIPPING OF CURRENT CLIP AROUND INSULATED CONDUCTORS. HOWEVER, IN CORRECT USE OR POOR SAFETY PRACTICES CAN RESULT IN INJURY OR FATALITY

The following safely practices and inspections should always be performed:

- Never connect the provided current clip to a bare or un-insulated conductor.

- When used in service panels, make sure that the insulation of the provided current clip cable is in good condition and possesses no cuts or damage that may allow the cable conductor to short or arc to any panel conductors.

- Do not perform any CT connection to service panels unless you know and understand the required safety practices required for such a task. If in doubt, have it installed by a professional.

- Do not connect the current clip to any panels possessing voltages higher than 240V.

- When using the WPA-3 adaptor, always check the condition of the wire loop insulation before branching into an electrical outlet. Check for cuts or damages to the insulation that would cause the center conductor to be exposed....never pull on the loop to unplug the adaptor!

- This unit should not be near water; for example, near a swimming pool, bathtub, laundry tub, etc.

- The EM-2500 should only be operated with the supplied adaptors and current clips.

3.0 Verifying / Modifying User Settings:

The functions of the EM-2500 keys are described below, along with a flowchart showing the various EM-2500 settings and the key sequence required.

Press "ESC" key twice to reach Main Menu:

> Display	Reset
Setup	Flash

Press DOWN to Setup:

Display	Reset
> Setup	Flash

Press SEL and Setup Options will appear. There a 6 options:

- 1.Modify Cost of Electricity ?
- 2.Modify Projection Period ?
- 3.Modify Logger Storage Interval ?
- 4.Reserved
- 5.Select "CT" Type ?
- 6.Select "PT" Type ?

Press UP to start at Option 1, "Modify Cost of Electricity ?"

Then continue to the rest .

NOTE: Only option 1 & 2 above should be used for Normal operation. Do not change PT or CT Type unless other wise instructed.

1. Modify Cost of Electricity:

This parameter allows you to set the cost of electricity to that charged by your Utility Company. This cost is generally in cents-per kilowatt/hour (kWh) To change this value:

- Press “SEL” while on this menu
- Use the UP or Down key to modify this value.
- Press “SEL” again to select the new value.
- “ESC” will take you back to the previous screen

2. Modify Projection Period:

This value is the number of days your projection is based on. For example, setting this to 30 day will allow your monitor to project your monthly energy consumption in kilowatt-hours (kWh) or dollars & cents.

- Press “SEL” while on this menu
- Use the UP or Down key to modify this value
- Press “SEL” again to select the new value
- “ESC” will take you back to the previous screen.

3. Modify Storage Interval (Data Logger Model):

The UP or DOWN key will allow you to modify how often (in minutes) the monitor will record data for download. This value pertains to the “data logger” section of the monitor only. This value has no effect unless you are planning on downloading data with the optional software. The stores data is an average of thousands of sample taken during that period. A short storage interval will yield a more accurate load profile, however, it will reduce the length of

monitoring time since the available memory will fill at a faster rate.

- Press “SEL” while on this menu.
- Use the UP or DOWN key to modify this value.
- Press “SEL” again to select the new value.
- “ESC” will take you back to the previous screen.

4. Reserved:

This setting has been reserved for future options. The flash programmable feature of your monitor will allow you to download updates (as they become available), and re-program your monitor with new options and features.

5. Select CT Type **(DO NOT CHANGE):**

The “CT Type” needs to be set each channel. The first page of this option allows you to select which channel CT value to modify. Use the UP key to select CH1 and the DOWN key for CH2 then press SEL to move to the channel’s parameter display. **This setting has two variables: “CT Type” and “CT Range”.** For each setting, the corresponding value may only be incremented and NOT decremented. A lower desired value will be obtained by incrementing the value until the display scrolls around. Once set to the desired value, press SEL twice. ESC (twice) will bring you back to the main page.

6. Select PT Type: (PT stands for potential Transformer) **(DO NOT CHANGE):**

This value has to do with the wall transformer value. This value is common to both channels. You will find the required value on the sticker located on the plug side of the wall transformer. **This setting has two variables: "PT Type" and "PT Range"**. For each setting, the corresponding value may only be incremented. A lower desired value will be obtained by incrementing the value until the display scrolls around. Once set to the desired value, press SEL twice. ESC (twice) will bring you back to the main page.

7. Changing EM-2500 for 120/208 Volts operation:

The **EM-2500** can be used to measure 120/208 Volts panels and circuits.

- 1) Press ESC twice.
- 2) Go to >Flash & press "SEL". The unit will display Firmware V
2.110 CH 2 = Phase A
- 3) Press the up arrow to display: CH 2 = Phase B
- 4) Press "SEL" and the unit will be set for 120/208 Volts. to measure 2 phases of a 3 Phase system.
- 5) Verify readings to make sure they make sense. If not, then repeat same process and Press the up arrow to display:
CH 2 = Phase C.

CAUTION:

This is normally found in buildings where 2 phases of 120/208 volts 3 phases service are used to provide power to apartments.

4.0 Displaying Consumption Information:

The first option on the “Main Menu” is “Display”. Once installed and setup, your monitor will be in this mode for viewing the desired values.

After selecting the “Display” screen, you need to select which channel you would like to view. The “Total” option displays the sum of channel one and two. This option is handy when monitoring a 240V load using two CTs. The “Total” will be the sum of the power from each leg. Use the UP or DOWN key to select the desired channel, then SEL.

Note: Verify that “Total” is set so that all power from both CT’s is measured

The “Display” screen shows various parameters. The top line of the LCD display is independent of the bottom line. This provides the user with a multitude of display options. To change the top line, use the UP key. The DOWN key will change the bottom LDC display line.

In the display mode, “SEL” has effect on only one parameter, “PEAK”. The “Peak” display is used to record the highest Watt value monitored. To reset (erase) this value, press the SEL button for approximately 6 seconds, while on the “Peak” display.

4.1 Reset:

From the main menu option three is used to reset all accumulative values to zero. This option has two prompt pages, to help prevent accidental erasure of data.

Diagram I

Set-Up Flowchart

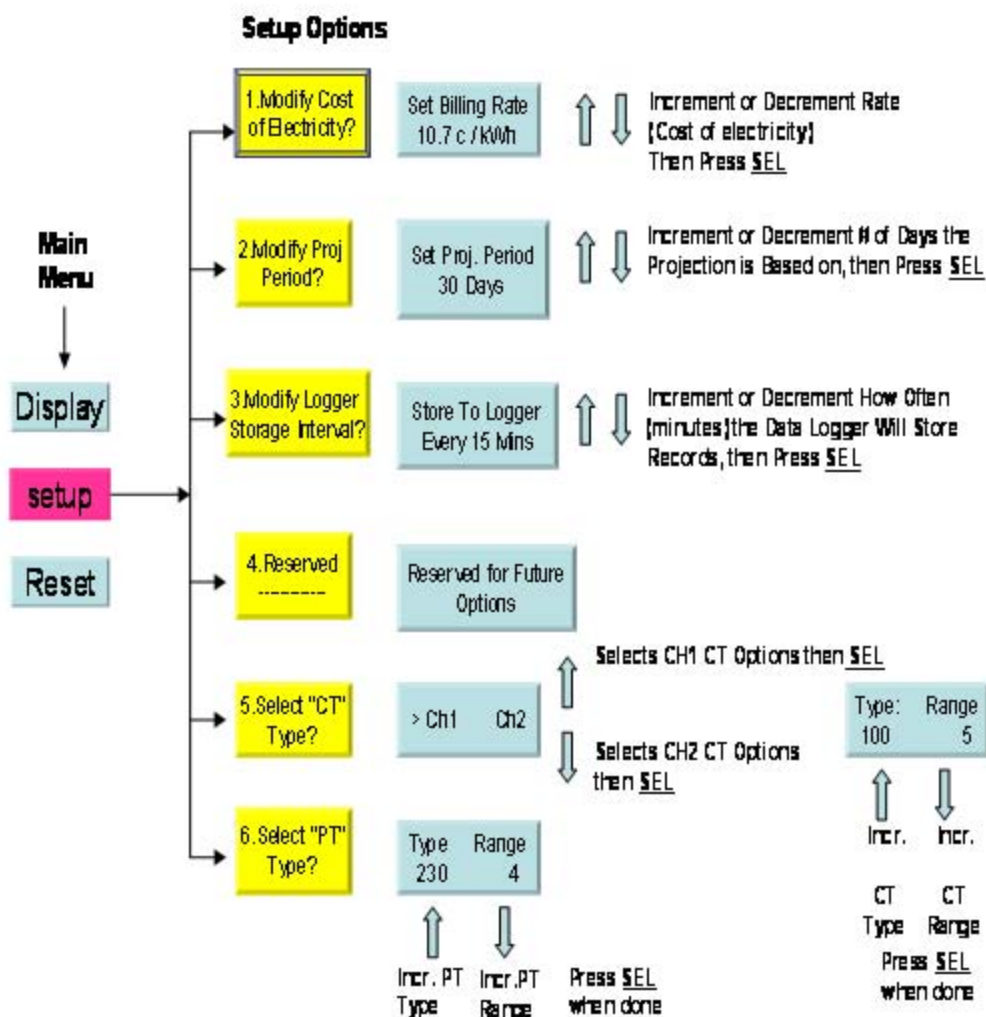


Diagram II

EM-2500 Function Keys

The Meter Reader Display Information :



Top line displays any of the following:

1. Days, hours & minutes since last reset
2. Line voltage (Volts)
3. Total Energy used in (KWH.)
4. Dollars / Hours (\$/H)
5. Rate in cents per KWH (c/KWH)
6. Projection (Days)

↑ For scrolling top line.

Bottom line display any of the following:

1. Instant Power in KW, (KW)
2. Max peak Demand (KW)
3. Total Line current, (Amps)
4. Electric Bill Estimate (Proj.\$)
5. Estimate of KWH to be used in current month (Proj. KWH)
6. Cost of total KWH used to date (Cost. \$)
7. Energy used in kW to date since last reset (KWH)

↓ For scrolling bottom line.

"SEL" the "SELECT" key behaves similarly to the ENTER key on a computer.

↓ The "DOWN" arrow is mostly used for scrolling down.

↑ The "UP" arrow is mostly used for scrolling up

"ESC" The "Escape" key causes the current display to go back to the previous screen.

5.0 Model EM - 2500 Rear connection

1) Remove cover from electrical panel and locate main feed wires.

WARNING!! The Electrical Panel has Lethal Voltages. These connections should be performed by a Licensed Electrician or other qualified person!!

2) Magnelab Opening Style Current Transformers:
(NOTE: These CT's have one side that is removable. Pull apart to remove this side. Insert in same manner as removed.)

Open and place one current transformer (CT) around each main feed wires, see Diagram VI above. The side that reads "This side towards source" should face the direction that power comes from, in other words towards the utility meter.

2a) Round Current Transformers: (NOTE: These CT's are round and main wires must be inserted thru CT.)

Disconnect main feed wires and place wires thru center hole of Current Transformers. Arrow indicates the direction of current flow, i.e., point arrow towards load (appliances). Then re-connect feed wires.(See Diagram IV)

3a) To Measure Appliances: Install current transformer (CT) around wires for circuit or appliance to be measured. Use 1 CT for 120 V circuit & 2 CT's for 240 V circuits.

Connections at Rear of EM-2500:

4) Connect the *black & white wires* from the back of the EM-2500, each to one of the black wires from the = \12 Volt Power Adaptor.

- 5) Connect the White wire from one Current Transformer to the **green wire** from the back of the EM-2500. Then connect the Black wire from the same Current Transformer to the **yellow wire** from the back of the EM-2500.
- 6) Connect the White wire from other Current Transformer to the **blue wire** from the back of the EM-2500. Then connect the Black wire from the same Current Transformer to the **red wire** from the back of the EM-2500.
- 7) Plug -in the AC adaptor into a 120 Volt outlet.

6.0 Mounting of EM-2500

Your electrician will determine the best method of installing The Meter Reader for your specific configuration. Or as an alternative, below you will find some suggested installation configurations.:

Flush Mounted Panel: Open one knock-out in panel and install 2" x 4" junction box in drywall. Make connections inside junction box. EM-2500 has 2 holes that line up with those of a 2" x 4" junction box. (Diagram IV)

Surface Mounted Panel: Open one knock-out in side of panel and install shallow 2" x 4" junction box on drywall, using an off-set nipple. Make connections inside junction box. EM-2500 has 2 holes that line up with those of a 2" x 4" junction box.

Connection of wall mounted AC adaptor.

The wall mounted AC adaptor plugs into a standard 120 Volt outlet. If you do not have a 120 Volt outlet nearby, then one may need to be installed or an extension cord may be added to plug in the EM-2500.(Diagram VI)

**The EM-2500 INSTALLATION IS NOW COMPLETE!
YOU ARE NOW READY TO OPERATE THE EM-2500.**

Model EM - 2500 Plug-In Connectors 120 / 240 Volt - Electric Panel Installation

1) Remove cover from electrical panel and locate main feed wires.
WARNING!! The Electrical Panel has Lethal Voltages.
These connections should be performed by a Licensed Electrician or other qualified person!!

Opening Style Current Transformers: (NOTE: These CT's have one side that is removable. Pull apart to remove this side. Insert in same manner as removed.)

Open and place one current transformer (CT) around each main feed wires, see Diagram VI above. The side that reads "This side towards source" should face the direction that power comes from, in other words towards the utility meter.

To Measure Appliances: Install current transformer (CT) around wires for circuit or appliance to be measured. Use 1 CT for 120 V circuit & 2 CT's for 240 V circuits.

Connections Using Plug-In Connectors on Top of EM-2500:

- 4) Connect the plug from the 12 Volt Power Adaptor to the Top of the EM-2500.
- 5) Connect the plug from one Current Transformer to the top of the EM-2500.
- 6) Connect the plug from one Current Transformer to the top of the EM-2500.
- 7) Plug -in the AC adaptor into a 120 Volt outlet.

Extending The EM-2500 at a distance from panel or sub-panel

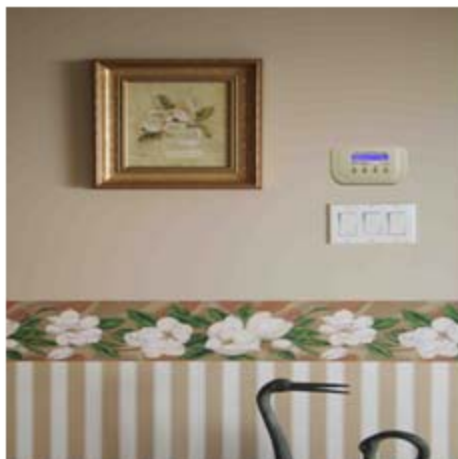
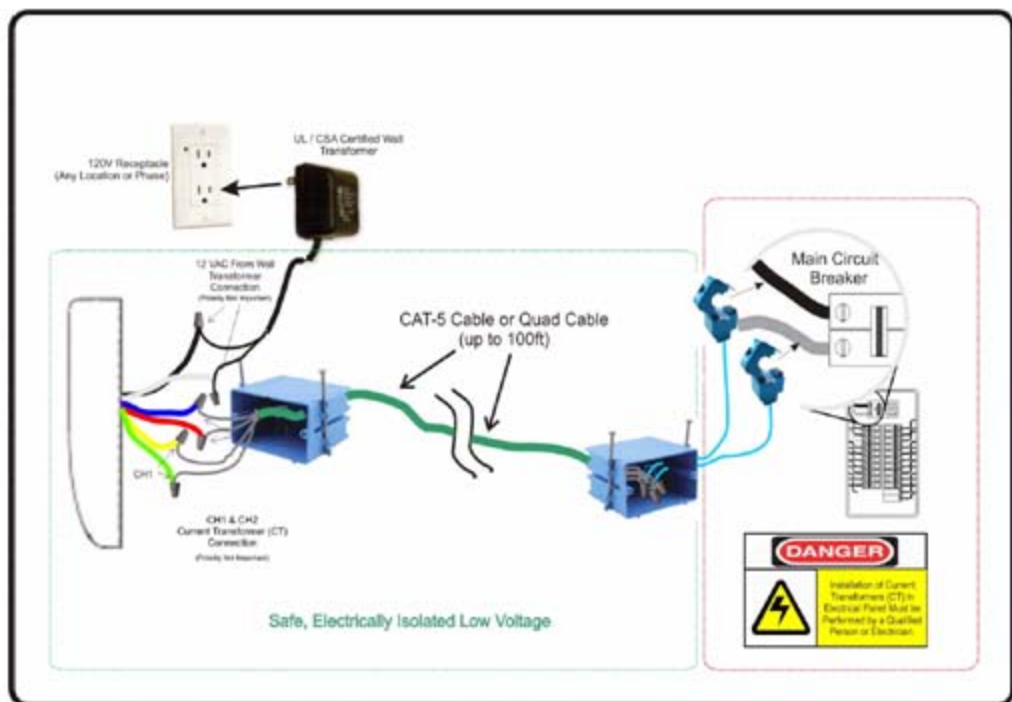
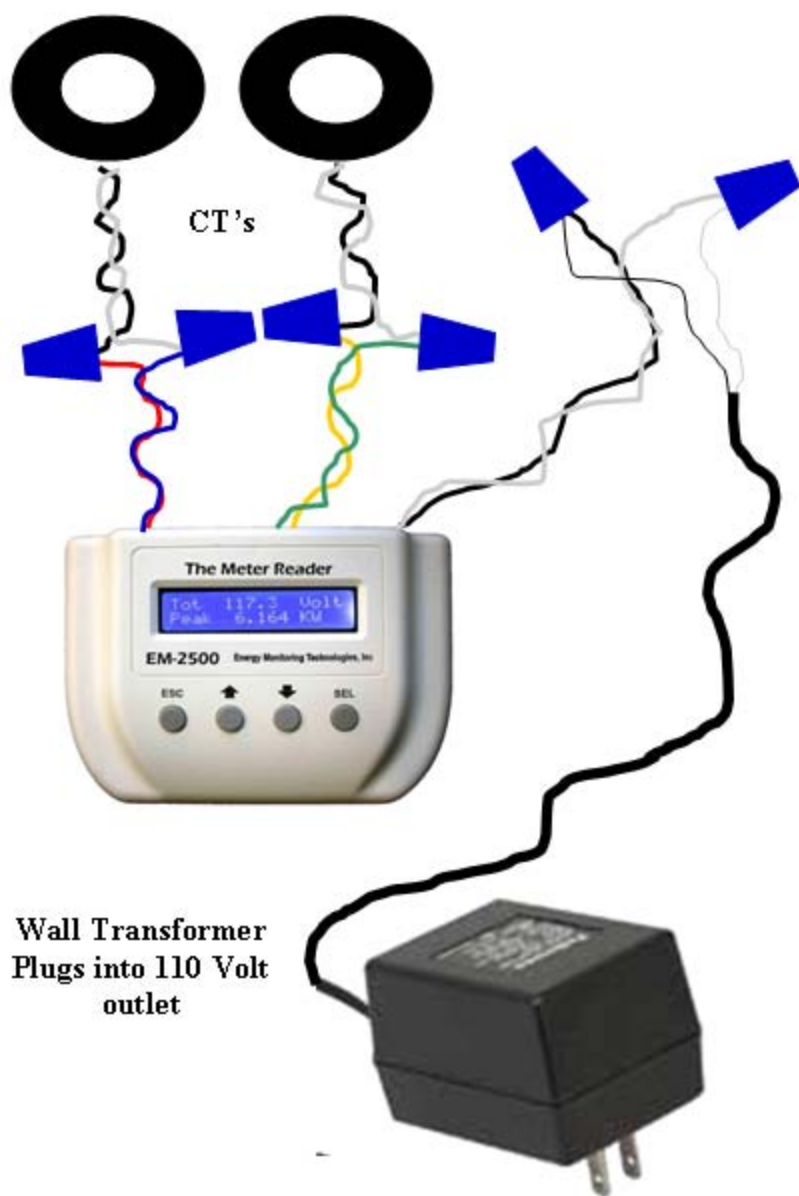


Diagram III



Wall Transformer
Plugs into 110 Volt
outlet

Note: Wiring connections above are same for American round CT's & MagneLab split core CT's.

Diagram IV

Installation of round or split core CT's for EM-2500

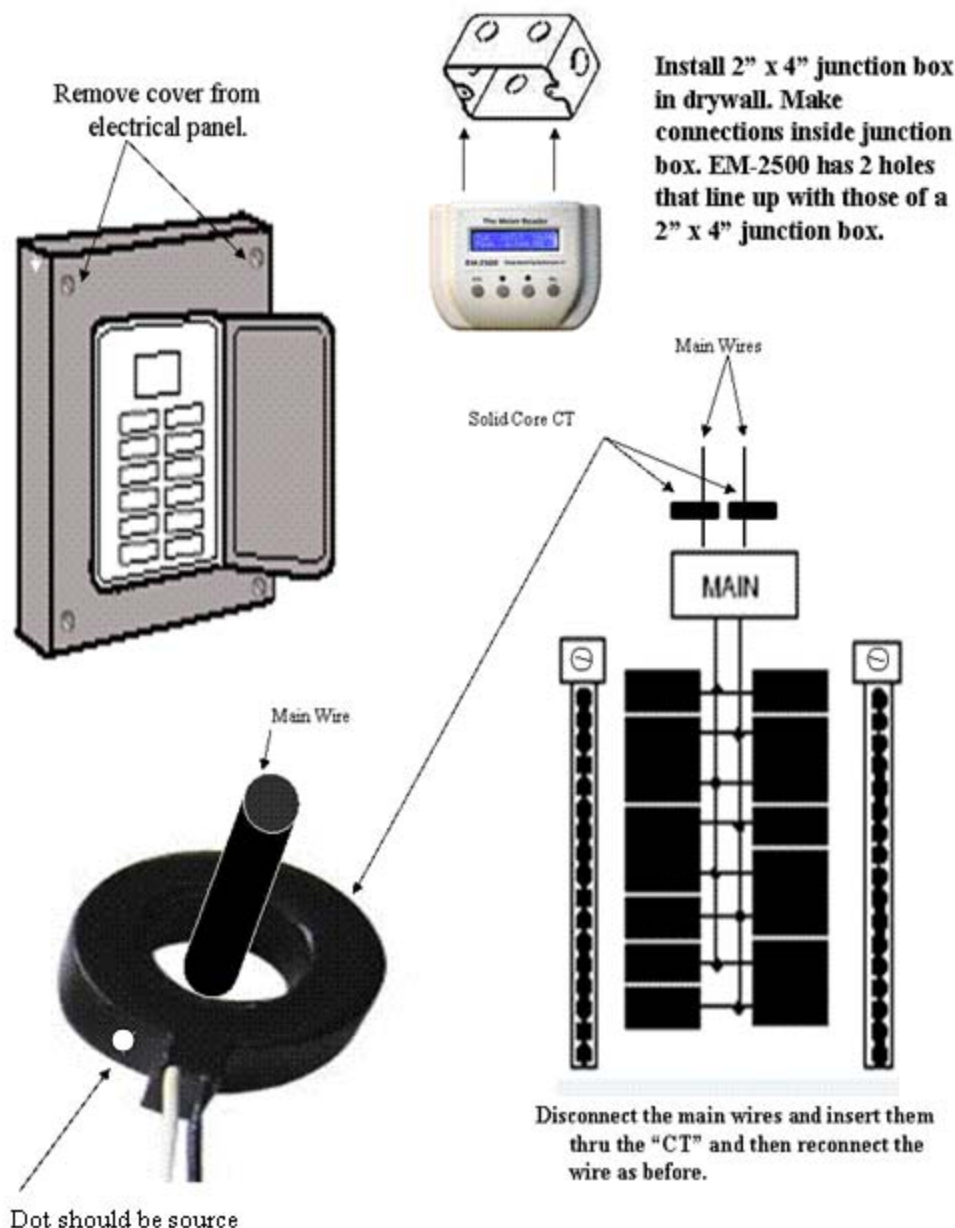


Diagram V

IMPORTANT!

DO NOT CHANGE!

CT Setting: Type: 175 Range: 4



Amecon Round CT's

Magnelab Split Core CT's

NOTE: Pull apart this side , is removable



IMPORTANT!

DO NOT CHANGE!

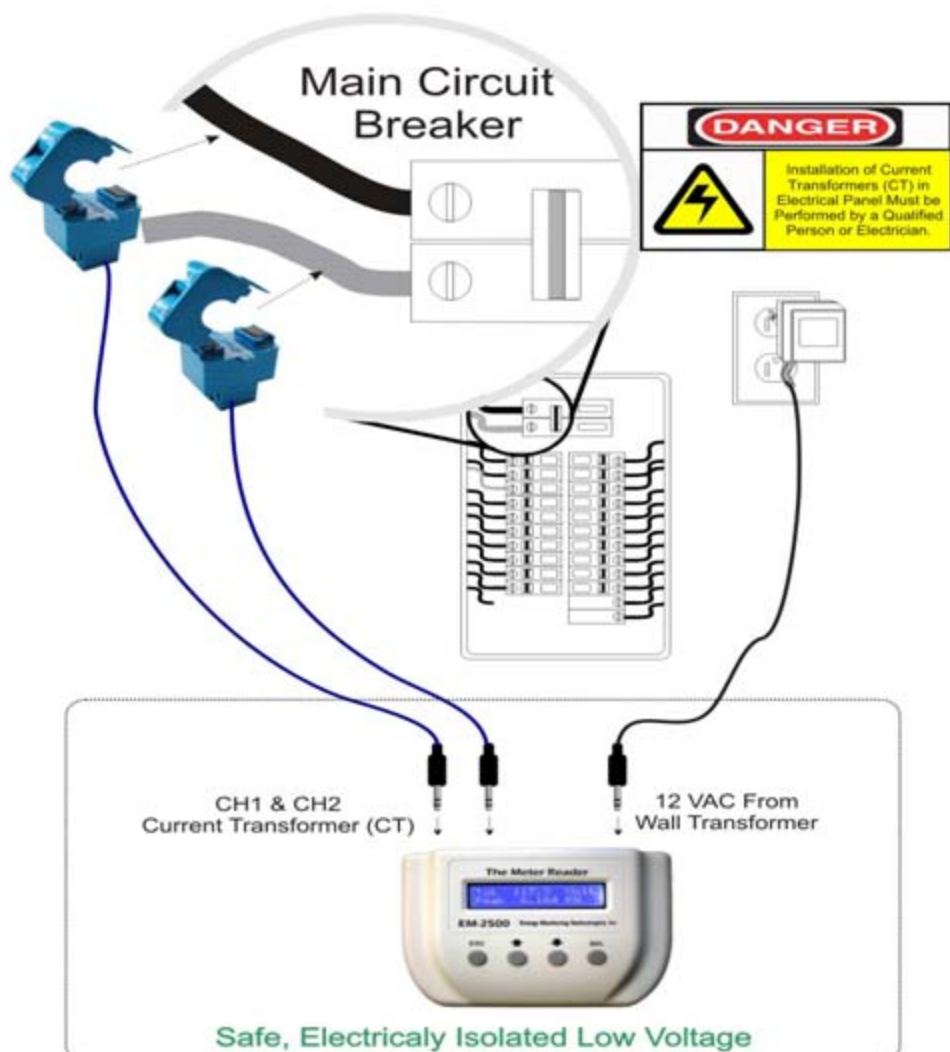
CT Setting: Type: 167 Range: 4

LEM Split Core CT's



Diagram VI

Installation of EM-2500 Plug-in



8.0 Warranty:

Energy Monitoring Technologies, Inc. Warrants **(EMT)** “**The Meter Reader**” **EM-2500** to be free from defects in materials and workmanship under normal use and service for a period of one year from the date of purchase .

The company’s obligations under this warranty shall be limited to repair or replacement of any part of the monitor which is found to be defective in materials and workmanship under normal use and service during the one year period commencing with the date of purchase.

The company shall not be obligated to repair or replace units which are found to be in need of repair or replace units which are found to be in need of repair because of accidental damage, misuse or modifications.

Opening the EM-2500 enclosure breaks the factory seal which indicates access to the printed circuit board area and automatically voids the warranty.

In no case shall the company be liable for any consequential or incidental damage for breach of this or any other warranty, expressed or implied whatsoever, even if the loss or damage is caused by the company’s negligence or fault. Some provinces and states do not allow the exclusion of limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

Units in need of repair are to be shipped PREPAID to:

**Services Department
Energy Monitoring Technologies, Inc.
7516 NW 55 Street
Miami, Florida 33166**

9.0 Trouble Shooting

<u>CONDITION</u>	<u>PROBABLE CAUSE</u>
Display and LED blank	<ul style="list-style-type: none"> ~ 12V AC adaptor not plugged in properly or plugged into dead or defective outlet ~ defective 12V AC adaptor, plug or cable. ~ EM-2500 defective.
Display on but "rST" stays on	<ul style="list-style-type: none"> ~ improper DC adaptor being used instead of AC adaptor. ~ glitch in CPU initialization..... unplug AC adaptor then re-plug.
Will not display a KW reading	<ul style="list-style-type: none"> ~ current transformer (CT or SCT) not plugged into unit (KW LED on) ~ cap of current transformer (CT or SCT) not properly closed. ~ monitored load not consuming any power ~ defective CT or SCT current transformer or EM-2500
Displays all segments	<ul style="list-style-type: none"> ~ glitch in CPU unplug then re-plug the 12V AC adaptor. ~ defective EM-2500
Displays a lower KW reading when connected to a load with a known power rating.	<ul style="list-style-type: none"> ~ cap of current transformer (CT or SCT) not properly closed. ~ dirt between the matting surfaces of the current transformer.

10.0 Specifications

Display: 2 Lines x 16 Characters Alpha Numeric Blue background with white backlight

Size: 5 ½" x 4" x 1 ½"

Weight: **Less Than 1 pound.**

Power: Digitally sampled true power.
1 Watt to 65,000 Watt (1 Watt resolution)

Accuracy: ± 1% plus CT accuracy

Energy: Typically ±2% with most current sensors
.001 kWh to 16,777.216 kWh (.0001 kWh resolution)

Voltage: 85V to 480V depending on the Potential Transformer used.
Standard Package Comes With PT:
Line Voltage: 85V to 130V
Secondary: 12VAC 300 mA 3.5mm mono phone plug
Use ONLY supplied "Wall Transformer"

CT Inputs (balanced):
333mV RMS Full Scale, 353mV RMS Max
Input Impedance: 20Kohm
Stereo 3.5mm Plug: Ring(-V), Tip (+V)
Sleeve (N.C.)

CT Inputs (unbalanced):
3.0 V RMS Max
Input Impedance: 107 Ohm
Mono 3.5mm Plug: Tip(+) Sleeve(-)

Input Current: Up to 200 Amps with solid or Split Core CT's

The Meter Reader



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