

Integrated Metering Systems, Inc.

Models beginning with MS120F and MD240F

Mini Meter in Flush Mount Enclosure

Product Description

Technical Specifications

Installation Instructions



PN: 114-0003

Revision 3.1



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1. Product Description

1.1 General Description

The IMS Mini Meter is a self-powered, current transformer (CT) rated electronic kilowatthour (kWh) meter designed for permanent connection to an electrical service. Mini Meters come in single element (2-wire) and dual element (3-wire) configurations. This guide is for use with the Mini Meter in a flush mount enclosure.

1.2 Meter Features

- Revenue-grade accuracy with solid-core or easy to install split core CTs
- Built in LCD
- Multiple load monitoring with a single meter
- AMR compatible isolated pulse outputs
- Reverse-phase LED indicator
- 10-year warranty

1.3 Meter Certifications

- UL Listed (100A & 200A models only) for use in the US or Canada
- Conforms to accuracy requirements set forth in ANSI C12.1 and C12.16
- Certified to California Division of Measurement Standards
- Approved by the California Energy Commission for use in the California Solar Initiative's Performance Based Incentive Program
- Approved by State of Maryland Public Service Commission in accordance with applicable ANSI C12.1 requirements

1.4 Physical Description

1.4.1 Single Meter

Figure 1 on the following page shows the dimensions of a single Mini Meter case and cover.

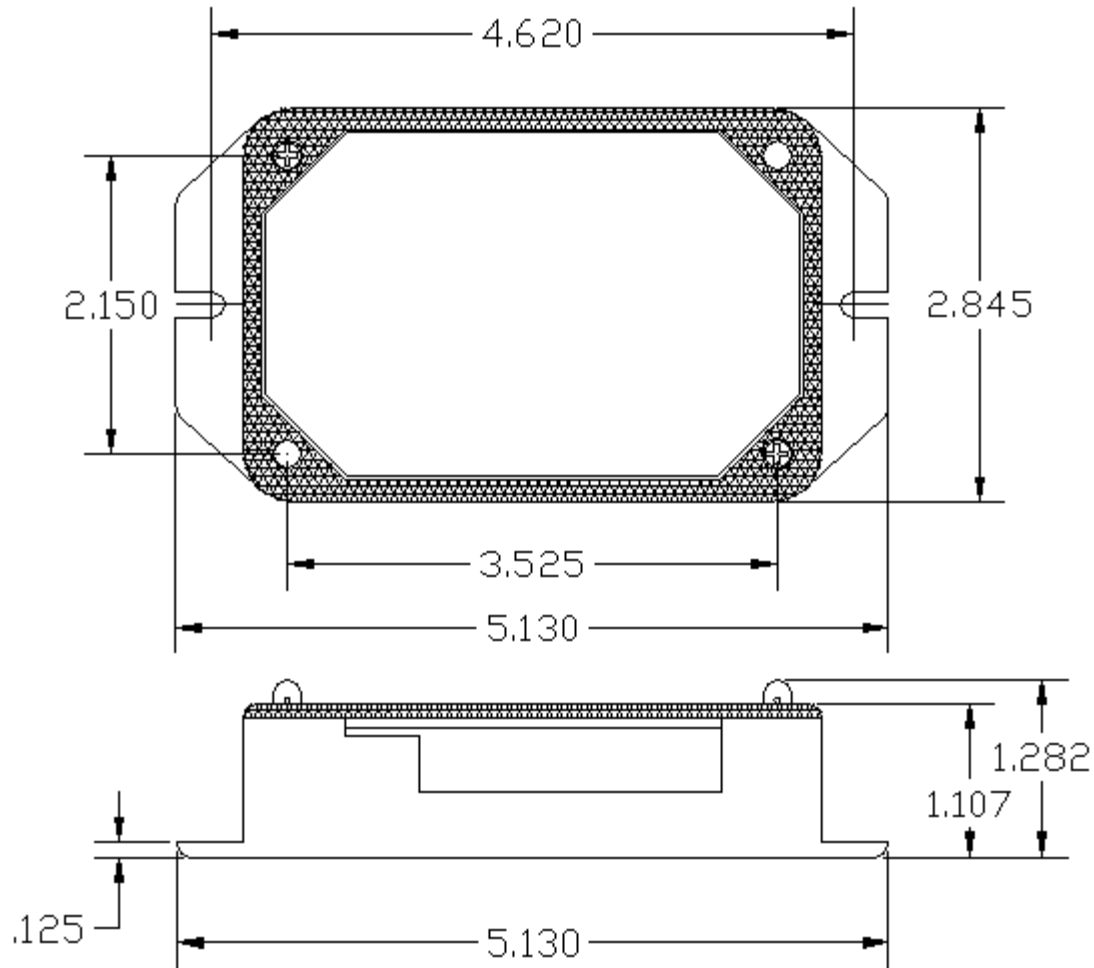


Figure 1: Single Mini Meter case dimensions

1.4.2 Flush Mount Enclosure

The dimensions of the Mini Meter flush mount enclosure are shown in Figure 2 on the following page.

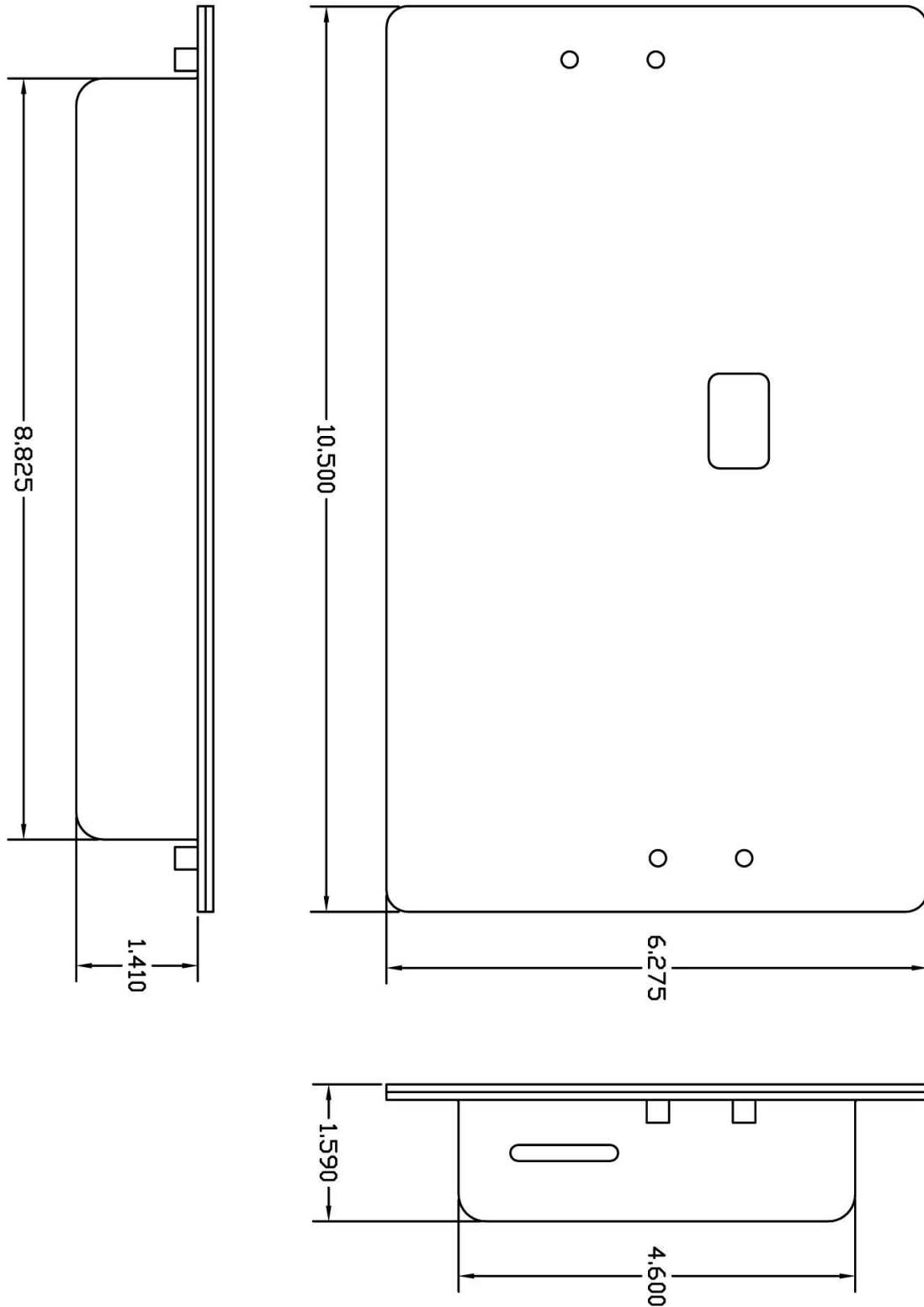


Figure 2: Mini Meter flush mount enclosure dimensions

2. Technical Specifications

2.1 Model Number Description

2.1.1 Individual Meter Model Numbers

The Mini Meter model number format is shown below and in Figure 3. The breakdown of the model number is as follows:

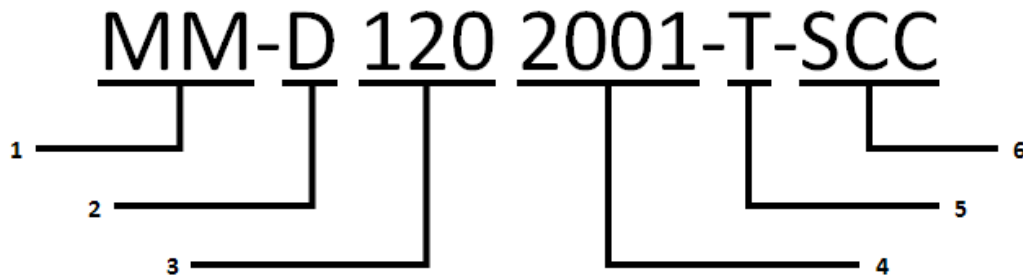


Figure 3: Mini Meter model number format

1. MM indicates a Mini Meter Product
2. Meter configuration
 - S – Single Element Meter
 - D – Dual Element Meter
3. Rated Voltage (L1 or L2 to Neutral)
4. CT Ratio
 - 1001 – 100:0.1
 - 2001 – 200:0.1
 - 2002 – 200:0.2
 - 4001 – 400:0.1
5. Outputs
 - T – Provided with 0.1 kWh and 0.01 kWh isolated outputs and 0.1 kWh counter output
 - Blank – Provided with 1.0 kWh, 0.1 kWh, and 0.01 kWh isolated outputs and 1.0 kWh counter output
6. Counter
 - SCC – Self Contained Counter (built-in LCD)
 - Blank – Not provided

2.1.2 Meter in Enclosure Model Numbers

Flush mount enclosure model numbers were recently changed to supply more precise information. The old model numbers (MMX – PKG – IF) has been replaced with the format shown in Figure 4.

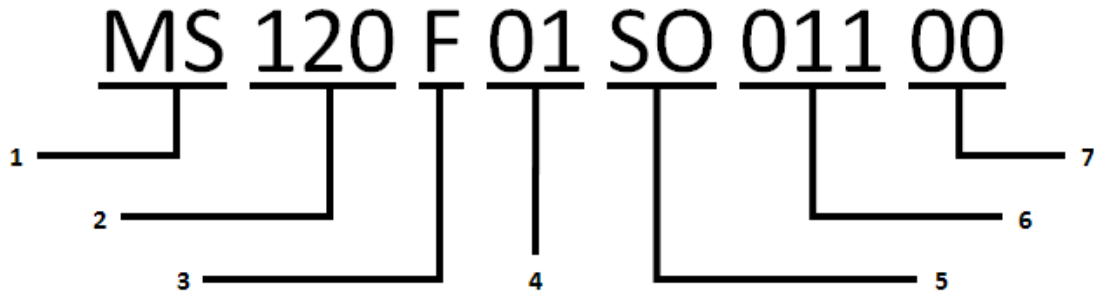


Figure 4: New flush mount model number format

1. Meter Type
 - MS – Single Element Mini Meter (1-phase, 2-wire)
 - MD – Dual Element Mini Meter (1 or 2-phase, 3-wire)
2. Voltage
 - 120 – 120V (1-phase, 2-wire) (Single Element only)
 - 240 – 240V (1 or 2-phase, 3-wire) (Works with 208V applications as well)
 - For Single Element Models, 1PH 2W: Voltage rating is Phase-to-Neutral
 - For Dual Element Models, 1PH or 2PH, 3W: Voltage rating is Phase-to-Phase
3. Enclosure Type
 - F – Indoor flush mount enclosure
4. Number of Meters Enclosed
5. Counter Type
 - SO – Self-contained LCD
 - XO – No Counter
6. CT Ratio
 - 011 – 100:0.1
 - 021 – 200:0.1
 - 022 – 200:0.2
 - 041 – 400:0.1
7. Additional Options
 - 00 – No Options

2.2 Electrical Specifications

Mini Meters fall under UL Circuit Category III: a device for measurements performed in the building installation. The electrical specifications for Mini Meters are given in the table below.

Input Configurations	1 Phase, 2 wire 1 or 2 Phase, 3 wire
Supply Voltage Range (L1 or L2 to Neutral)	Min. 102 VAC Max. 138 VAC
Maximum Input Power, L1 and L2	8 VA
Maximum Rated Current ¹	440 A primary for 400 A models 220 A primary for 200 A models 110 A primary for 100 A models 0.11 A secondary for 0.1 A secondary models 0.22 A secondary for 0.2 A secondary models
Line Frequency	50-60 Hz
Power Factor Range	0.5 to 1.0, leading or lagging
Accuracy	+/- 0.5% of registration @ 1.0pf, 2 to 200 A +/- 0.75% of registration @ 0.5pf, 2 to 200 A
Operating Temperature Range	-30 to +60 degrees C
Rated Pollution Degree ²	2
Rated Relative Humidity	80%
Terminal Blocks: Dinkle/International Connector EK508-11P or equiv.	4.4 in-lb of torque maximum

Table 1: Electrical and environmental specifications

¹Product approved for use with included IMS Current Transformers, as follows:

400A: Part number CT400148SO or CT400148SO-1.5 or CT400148SP-142

200A: Part number CT200124XX or CT200148XX or CT200148XXSO-0.72 or CT200148SP-095

100A: Part number CT100124XX or CT100148XX or CT100148XXSO-0.72 or CT100148SP-095

²Pollution Degree 2: Normally only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation must be expected.

2.3 Input/Output Connections and User Display

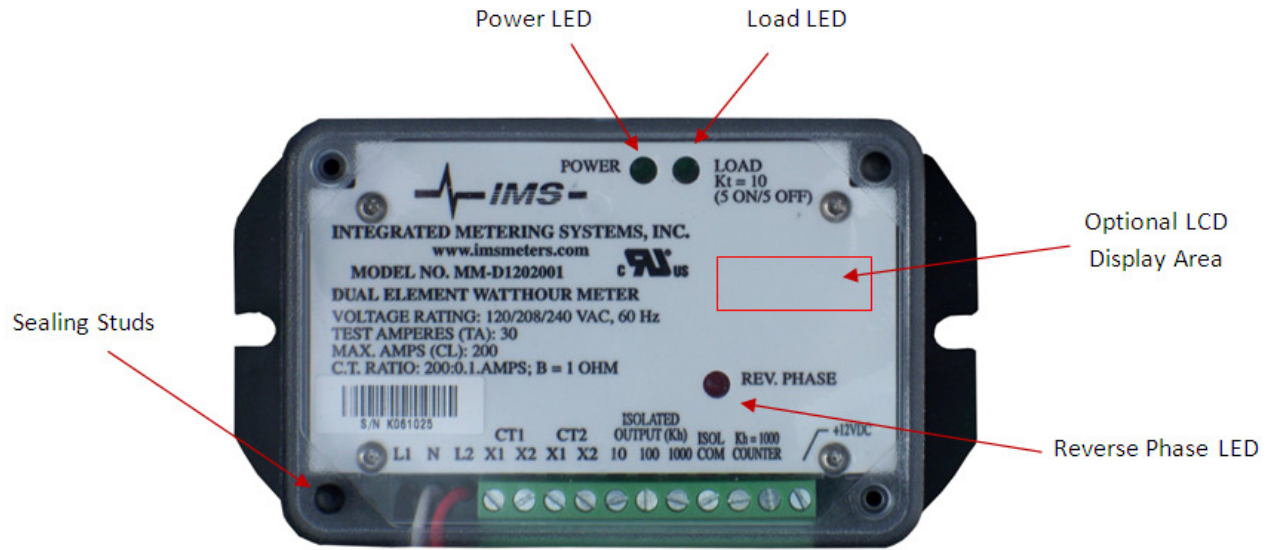


Figure 5: Mini Meter connections and display

Voltage Inputs (wire connections)

	<u>Description</u>
L1	Black wire, voltage input, Line 1, 120V with respect to neutral
N	White wire, Neutral input
L2	Red wire, voltage input, Line 2, 120V with respect to neutral (MMD models only)

CT Inputs

CT1 : X1	Current Transformer input, CT1. Colored wire of CT1
CT1 : X2	Current Transformer input, CT1. White wire of CT1
CT2 : X1	Current Transformer input, CT2. Colored wire of CT2 (MMD and EED models only)
CT2 : X2	Current Transformer input, CT2. White wire of CT2 (MMD models only)

Outputs

10, Isolated Output (10 Wh/P, Kh = 10)	Isolated pulse output: 5 watthours on, 5 watthours off, referenced to ISOL COM <u>NOT TO BE USED FOR FIELD WIRING</u>
100, Isolated Output (100 Wh/P, Kh=100)	Isolated pulse output: 50 watthours on, 50 watthours off, referenced to ISOL COM
1000, Isolated Output (1 kWh/P, Kh=1000)	Isolated pulse output: 500 watthours on, 500 watthours off, referenced to ISOL COM (not available on models with T suffix)
ISOL COM	Isolated common for 10/100/1000 isolated outputs
Counter (kh = 100 or kh = 1000)*	For 12 VDC electro-mechanical counter
Counter (kh = 100 or kh = 1000)*	For 12 VDC electro-mechanical counter
+12 VDC (MMS and MMD models only)	12 V DC output; current rating is 3 mA max.

Table 2: I/O connections

*Recommend IMS counter #521-001 (1 kWh models), #512-002 (0.1 kWh models), or equivalent

<u>LED Indicators</u>	<u>Description</u>
Power LED (green)	Illuminates when the meter is supplied with proper voltage
Load LED (green)	50% duty cycle (at constant load) LED to verify proper meter function when connected to a load. At 200 watts, LED will illuminate for 1.5 minutes, then turn off for 1.5 minutes; with no load, LED will remain on or off
Reverse Phase LED (red)	Illuminates when a problem with meter phasing exists. With no load, LED may be on or off. See section 3.7 for CT installation instructions
LCD Display	LCD display that shows total kWh

Table 3: Display indicators

3. Installation Instructions

The following section contains installation and wiring instructions for the IMS Mini Meter in indoor flush mount enclosure. If technical assistance is required at any point during the installation, contact information can be found at the end of this manual. IMS is not responsible for damage to the meter caused by incorrect wiring.

3.1. Explanation of Warning Symbols



Indicates the need to consult the operation manual due to the presence of a potential risk.



Indicates the presence of electric shock hazards. Prior to proceeding, de-energize the circuit and consult the operation manual.



Indicates that the equipment is protected throughout by double insulation.

3.2 Safety Precautions

WARNING

- **Installation of electric meters requires working with possibly hazardous voltages. These instructions are meant to be a supplement to aid trained, qualified professionals.**
- **Turn off all power supplying the equipment before performing any wiring operations. Use a properly rated voltage sensing device to confirm power is off.**
- **Bonding is not automatic for metal conduit connections; separate bonding is to be provided.**
- **Installations should be done in accordance with local codes and current National Electric Code requirements.**
- **Equipment used in a manner not specified by this document impairs the protection provided by the equipment.**

Failure to follow these warnings could result in serious injury or death.

3.3 Preparation

1. Verify the model number and electrical specifications of the device being installed to confirm they are appropriate for the intended electrical service (see Section 2).
2. Consult local codes for any possible permits or inspections required before beginning electrical work.
3. Make sure all tools to be used during installation have proper insulation ratings.
4. Check the Mini Meter and electrical panel for possible exposed wire, broken wire, damaged components or loose connections.

3.4 List of Materials

- Mini Meter, flush mount enclosure and associated mounting materials, two #6 x 1 $\frac{5}{8}$ drywall screws.
- Additional wiring for CT or voltage leads extension if needed. Wires must be 18 AWG or thicker and insulated for 300 VAC min.
- Current Transformers (CTs): This product is designed for use with IMS CTs; see Section 2.2 for details.
- Conduit and fittings.

3.5 Setting up the Enclosure

3.5.1 Selecting a Mounting Location

- Mini Meter flush mount enclosures require a switch or circuit breaker as part of the building installation.
- The switch or circuit breaker must be marked as the disconnecting device for the Mini Meter.
- It is recommended that the enclosure be mounted near the disconnecting device.
- Ensure that the CT and voltage lead lengths (and conduit lengths) are capable of reaching the enclosure from the load center.
- If a suitable mounting location near the load center cannot be found, additional in line fuses or circuit breaker may be required in accordance with NEC regulations.

3.5.2 Making Conduit Openings

The flush mount enclosure has many possible locations for conduit openings. The bottom, side, and back panels all work well as conduit opening locations.

Looking at Figure 6, conduit holes should be placed in a location away from the

meter. If the unit came with a pre-installed AMR transmitter, make certain that conduit holes will not interfere with the transmitter location. Exercise caution if drilling near internal components is required. Conduit hole sizes must be appropriate to fittings, and large enough to fit all voltage and CT wiring (4-7 18 AWG min. wires insulated for 300 V min.). Figure 6 shows an example of conduit hole positioning for an enclosure without a transmitter.

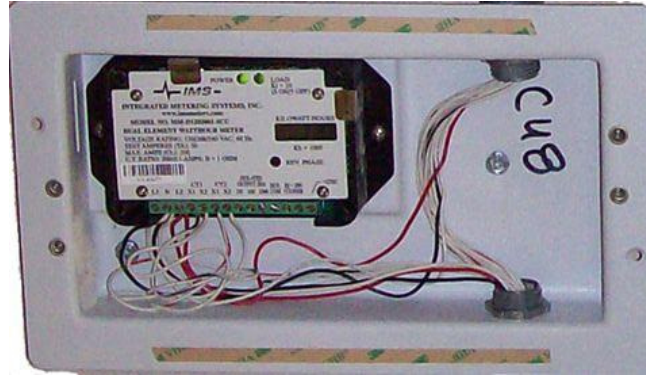


Figure 6: Example conduit location openings

3.6 Installation of Voltage Lines



Check to make sure service is disconnected before any connections are made.

1. Based on desired mounting location, check if additional in-line fuses are required to meet local electric codes. (See section 3.8 for mounting location requirements and recommendations).
2. Mini Meters come standard with voltage wires pre-connected to the metering board.
3. Route wires through conduit to the breaker panel.
4. Trim wires to the appropriate length to avoid coils of excess wiring and strip to approximately 0.300 inches.
5. Following all national and local electric codes, connect wires to appropriate locations in the load center. Wires should be tightened so that they are held snugly in place, but do not to over-tighten, as this may compress and weaken the conductor. See Figure 11 for Mini Meter wiring diagram.

3.7 Variations and Installation of Current Transformers



To reduce risk of electric shock, always open or disconnect the circuit from the power distribution system of a building before installing or servicing current transformers.



In accordance with NEC, CTs may not be installed in any panel board where they exceed 75% of the wiring space of any cross-sectional area.

General Requirements:

- Field wired CT connections are made to the Mini Meter terminal block. The rated torque for these terminal blocks is 4.4 in-lb, and can be used with solid and stranded copper wires, at 12-18 AWG.
- Splices on the CT leads must be within the meter enclosure, not inside the conduit. IMS-provided CT leads are 24 inches minimum. Wire insulation should be stripped so that the bare conductor length that connects to the meter terminal block does not exceed 0.300 inches.
- CTs should be securely fastened such that they will not slide down to live terminals.
- Wires should be tightened so that they are held snugly in place, but do not to over-tighten, as this may compress and weaken the conductor.
- Current and voltage inputs must be installed 'in phase' for accurate readings (e.g. CT1 on Line 1, CT2 on Line 2); see Figure 11.

CT Variations

- IMS solid core CTs (Figure 7): In accordance with CT label, the LINE side of CT must face incoming Line. White lead connects to X2 of CT connection (CT1:X2 or CT2:X2). Colored lead connects to X1 of the corresponding CT connection (CT1:X1 or CT2:X1).



Figure 7: IMS solid core CTs

Installing solid core CTs

1. Route CT wires through the conduit if not already done.
 2. Trim the wire to the appropriate length to avoid coils of excess wiring.
 3. Strip wiring to approximately .300 inches and connect to the appropriate terminals as described above.
 4. With power turned off, disconnect each monitored conductor and slide on a CT, ensuring the CT is correctly oriented as noted above.
 5. Reconnect the conductors.
- IMS split core CTs (Figure 8): The side with the white dot, H1, must face the incoming LINE. White wire connects to X2 terminal, black wire connects to X1 terminal.



Figure 8: IMS split core CTs

Installing split core CTs

1. Route CT wires through the conduit if not already done.
2. Trim the wire to the appropriate length to avoid coils of excess wiring.
3. Strip wiring to approximately .300 inches and connect to the appropriate terminals as described above.
4. With power to the conductors turned off, place one CT around each conductor, ensuring that the white dot is facing the line side.

Failure to install CTs in the correct orientation and on the correct phase will lead to inaccurate meter readings. The Mini Meter wiring diagram is shown in Figure 11.

3.8 Flush Mount Enclosure Installation

Flush mount enclosures come in two mounting formats. One uses L-shaped brackets to secure the enclosure (Figure X) and the other uses preinstalled clamps (Figure X). After performing steps 1 and 2, follow the instructions for the appropriate enclosure.

1. Select a desired installation location following the guidelines of 3.5.1.

2. Make a 4.5" x 8.75" hole in the mounting surface for the enclosure to be situated. See Figure 2 for enclosure dimensions.

Bracket Enclosure

3. Place the meter into the hole from step 2. Slide the mounting brackets into the slits on the side of the enclosure (see Figure 9).
4. Secure the brackets using the #6 x 1 $\frac{5}{8}$ drywall screws.

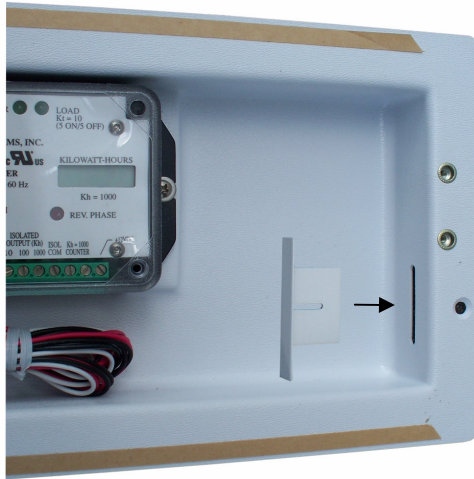


Figure 9: Bracket enclosure installation

Clamp Enclosure

3. Unscrew the clamps to their maximum distance and orient them parallel with the enclosure as show in Figure 10.1.
4. Slide the meter into the wall opening and tighten the screws for the clamps as in Figure 10.2 and Figure 10.3.
5. After running the tests in Section 3.9, place the cover on the meter and attach with the provided screws.

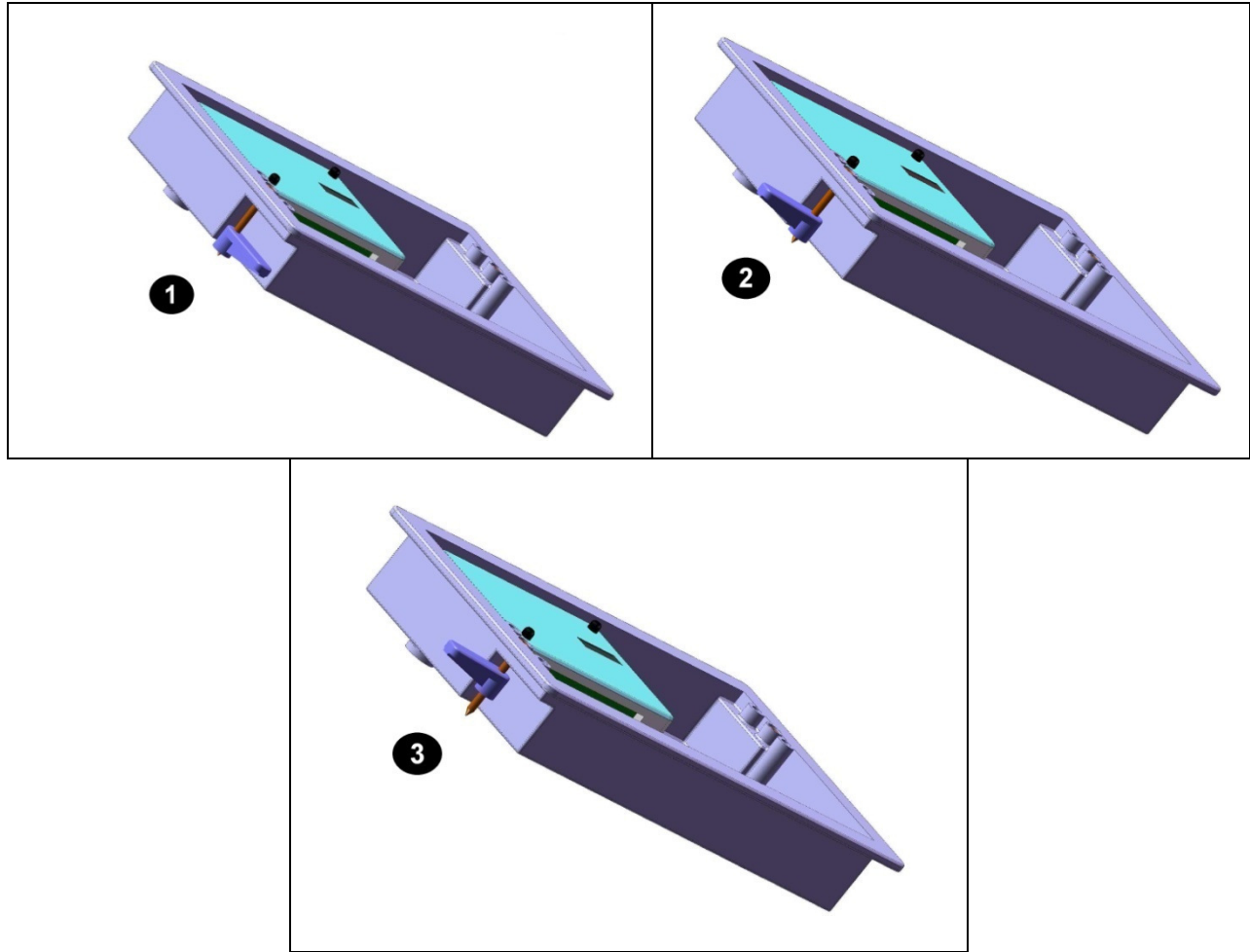
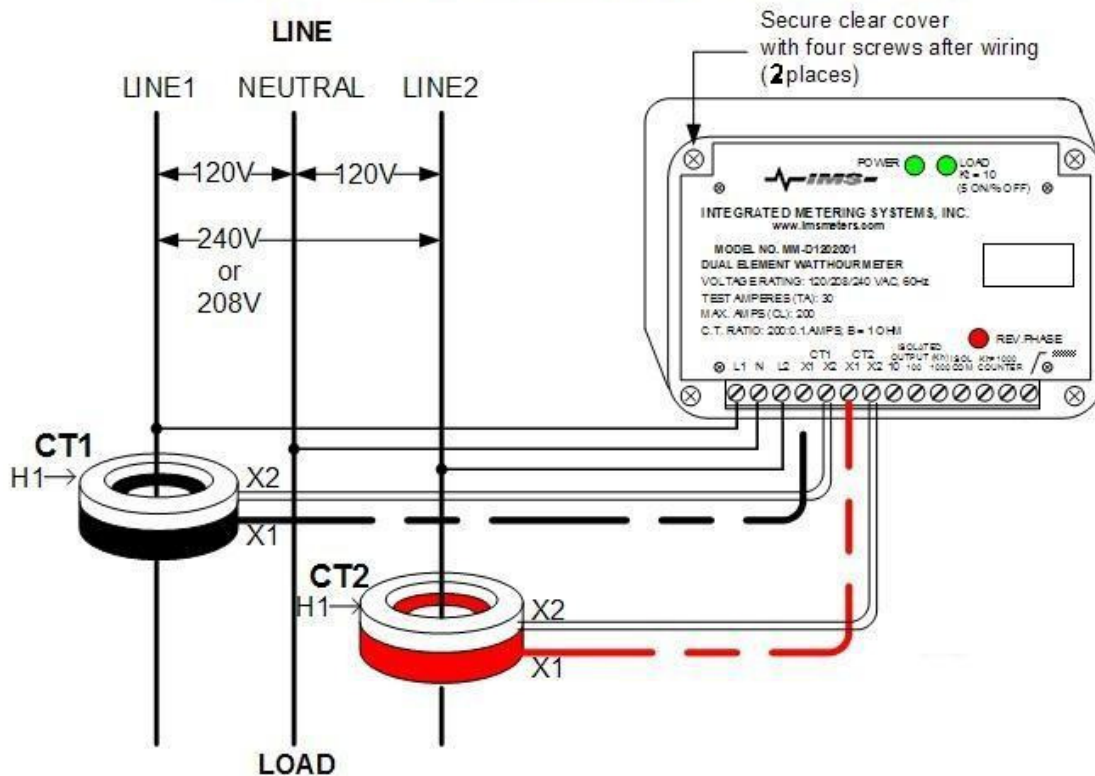
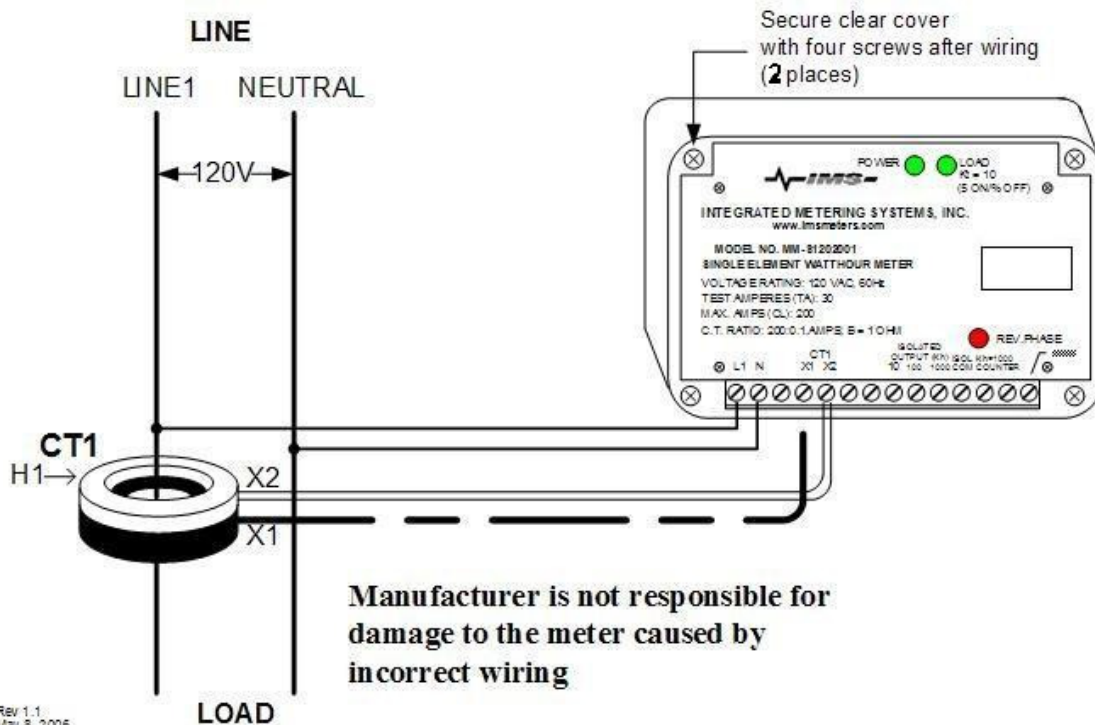


Figure 10: Clamp enclosure installation

DUAL ELEMENT MINI METER HOOKUP DIAGRAM**SINGLE ELEMENT MINI METER HOOKUP DIAGRAM**

Rev 1.1
May 8, 2006

Figure 11: Mini Meter hookup diagram

3.9 Testing the Installation

Testing Voltage

The power LED illuminates when the Mini Meter has a proper power supply. Voltage should also be tested using an AC Voltmeter to verify that the voltage across voltage line terminals (L1 to Neutral and L2 to Neutral) is not in excess of the maximum rated voltage in section 2.2.

CT Reverse Phase Indicator

Mini Meters have a red reverse phase indicator LED as described in section 2.3. **There must be a load drawing more than 1 Amp connected to the meter in order for the reverse phase LED to function correctly.** If a proper load is connected, and the LED is illuminated, power down the voltage supply and verify that CTs are installed correctly.

Load LED

The load LED is described in section 2.3. This LED should be cycling at 50% duty cycle when the meter is connected properly and a constant load is applied.

4. Maintenance

Properly installed meters with sound connections and secure conduit fittings should not require user maintenance. If the meter is functioning abnormally, consult the FAQ/Troubleshooting guide. If the answer cannot be found there, contact IMS technical support (see Section 6).

5. Troubleshooting/FAQ

Problem

Solution

- | | |
|------------------------------|--|
| 1. Power LED not illuminated | <ul style="list-style-type: none">• Check to make sure all connections are wired according to section 3.6• Test the voltage being supplied to the meter using an AC voltmeter• With power off, remove any additional line fuses and test with ohmmeter |
| 2. Load LED not flashing | <ul style="list-style-type: none">• Verify CT connections and orientations (see Section 3.7)• Make sure there is sufficient load to draw a significant current |

3. Registered consumption low

- Test the voltage being supplied to the meter using an AC voltmeter
- Check to make sure the reverse phase LED is not on
- Even if the reverse phase light is off, double-check CT orientations. One CT installed in the incorrect direction doesn't always illuminate the reverse phase LED
- Make sure that current and voltage connections are in phase (see Sections 3.6 and 3.7)
- Check power connections and fuses

4. Reverse phase LED illuminated

- Verify orientation and connection of CT wires (see Section 3.7)
- Ensure that phasing is correct (CT1 on Line 1, CT2 on Line 2)
- Verify that a load drawing more than 1 Amp is connected to the meter

FAQ

Q: Can you use additional sets of current transformers (CT's) with a submeter to accommodate more circuits?

A: Yes, you can use up to three sets of CT's in parallel per meter. Just make sure you do not exceed the current rating per phase. Consult IMS technical support for more information (see Section 6).

Q: What is AMR equipment?

A: AMR is Automatic Meter Reading equipment. This typically consists of radio transmitters, repeaters and a collector that monitors, records, and is capable of transmitting data to a third party billing service (RBC).

Q: Why do I need a third party billing service (RBC)?

A: RBC's are typically used with larger, multi-tenant facilities that want to generate tenant bills. These companies will install, initialize, maintain, and monitor the meters not only for electrical usage but for trouble signals as well.

Q: Why are the current transformers color coded (Black & white, red & white, and blue & white)?

A: CT1 needs to monitor the same phase used to power the meter on line 1, CT2 needs to monitor the same phase used to power line 2. Color coding helps the installer maintain correct phasing.

Q: Can the meters be tampered with after installation?

A: The flush mount enclosures provide two drilled fillister head screws through which wire seals can be installed. Also, tamper-evident labels can be affixed to the cover after installation.

Q: Can voltage input wires and current transformer secondary leads be routed through the same conduit?

A: Yes, provided you are using IMS supplied CTs. Alternate CTs must have a 0.1 A max secondary rating and 18 AWG min. wires with at least 300 VAC insulation rating.

Q: I accidentally installed my CTs backwards; can I switch the X1 and X2 terminal connections instead of flipping the CT?

A: Meters are tested and approved for accuracy with CTs installed in the correct orientation. Installing CTs backwards and inverting the terminal connections has a slight affect on meter accuracy.

Q: Can digital output wires be routed through the same conduit as voltage input and current sensing wires?

A: No. In accordance with NEC and UL requirements, Class 2 wiring (digital outputs) must be separated from Class 1 wiring.

Q: I still can't get my meter to work, what now?

A: Contact technical support via phone or on our website given in the following section.

6. Contact Information

Integrated Metering Systems, Inc.
11701 S. Belcher Rd., Suite 123
Largo, FL 33773
Phone: 727-539-1813
Toll Free: 800-488-3594
On the web: <http://www.imsmeters.com/>

7. Returned Material Policy

After acceptance, all sales of meters are final. IMS, in its sole discretion, authorizes product returns in appropriate circumstances, subject to such conditions as IMS may specify. Any such return is subject to the express prior authorization and approval of IMS. Buyer must notify IMS at 800-488-3594 (telephone) or 727-539-1984 (fax) and request a Returned Material Authorization Number (RMA Number) and state the specific reason for return. Unauthorized returns will not be accepted.

When requesting an RMA Number please supply the following information:

1. Distributors name and address
2. Model number of meter
3. Original purchase order number
4. Reason for return

All paperwork and boxes must be marked with an RMA number issued by IMS. All authorized returned materials must be shipped freight prepaid to IMS to the address specified below. IMS is not responsible for uninsured packages or packages lost by your carrier.

Integrated Metering Systems (IMS)
11701 S Belcher Rd., Suite 123
Largo, FL 33773

All returns are subject to a handling/restocking charge, except for product shipped in error or products under warranty. All charges (modification, repair, restock etc) related to returned products will be determined by IMS upon evaluation. All shipping costs are the responsibility of the buyer.

METERS RETURNED FOR CREDIT*

Replacement meter ordered	0% Restock Charge
<i>* RMA Number requested by stocking distributor for credit must be accompanied by a purchase order for material of equal or greater value.</i>	
NO replacement meter ordered	25% Restock Charge

METERS RETURNED FOR REPAIR (STILL UNDER WARRANTY)*

No defects found	\$75.00 evaluation charge
Defects not covered under warranty	Charges upon evaluation
Defects found covered under warranty	No Charge

METERS RETURNED FOR EVALUATION (NO LONGER UNDER WARRANTY)*

Evaluation charge of \$75.00 applies
Other charges will apply depending on evaluation by IMS

*Prices are as of May 01, 2009 and subject to change

8. Revision History

<u>Revision</u>	<u>Date</u>	<u>Changes</u>
2.0	19 Feb 2009	Initial Release
2.1	19 Mar 2009	Updated changes from UL review
2.2-2.3	6 May 2009	Formatting Updated
		Changed voltage line installation to reflect pre-connected wires
2.4	22 May 2009	Changes from engineering review
		Added mounting instructions for current enclosure
		Updated Figures 2, 4, and 5
		Added RMA Policy
3.0	25 May 2009	Initial Release
3.1	3 Feb 2010	Revised model numbers on cover page