

E-Mon D-Mon[®] Installation Manual

Class 5000 Advanced KWh/Demand Meter



Dear Valued Customer,

We are pleased that you chose to buy one of our products, and want you to be just as pleased with owning it. Before installing your new E-Mon product, please read the information on the following pages carefully.

We believe that you will find the E-Mon D-Mon meters easy to install and to use for monitoring and evaluating your electrical usage.

To be sure that you are 100% satisfied with your products, we provide toll-free technical and sales support Monday through Friday, 8:00 am to 7:30 pm, EST: (800) 334-3666. You may also reach us via email at info@emon.com.

If you have questions, we can handle them quickly and effectively with a telephone call. Please let us try to help you BEFORE you remove your meter. And to help us help you, we ask that you have all relevant information on hand when you call (model or part numbers, nature of difficulty, etc.)

Be sure to forward this manual to the owner after installation is complete, so that they may use it as a reference guide when reading the E-Mon D-Mon meter.

Thank you.

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1.0 Pre-Installation Information

The E-Mon D-Mon® Class 5000 Meter is a 3-element meter with communications. The device is used to monitor electric power usage of individual loads after the utility meter and store kW and kVAR data for automatic meter reading. **Installation must only be performed by qualified personnel and in accordance with these instructions and all applicable local and national electrical codes.** E-Mon or its representatives assume no responsibility for damages or injury resulting from the improper installation of this meter.

Units designated by with the “R” suffix on the model number have an extended environmental operating range and are enclosed in a NEMA 4X housing to accommodate outdoor environments. *Units with the “G” prefix are supplied in a green enclosure and display additional environmental data (cost per kWh/kW and CO² emissions in lbs.)*

VERIFY the input voltage rating and configuration on the unit panel label to ensure it is suitable for the intended electrical service. Meters labeled for 115/208 volt service **MUST NOT** be installed on service feeds of 277/480 volt and vice versa.

VERIFY the E-Mon D-Mon Class 5000 Meter current sensors are sized suitably for the load to be monitored. Compare the color of the arrows on the current sensors to the chart below to confirm the correct current sensor is being used.

| SENSOR ARROW COLOR CODE | | SENSOR RATING |
|----------------------------|----|------------------|
| Brown | -- | 100 Amp |
| Red | -- | 200 Amp |
| Yellow | -- | 400 Amp |
| Black | -- | 800 Amp |
| Blue | -- | 1600 Amp |
| White/Black | -- | 3200 Amp |

CAUTION: 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.

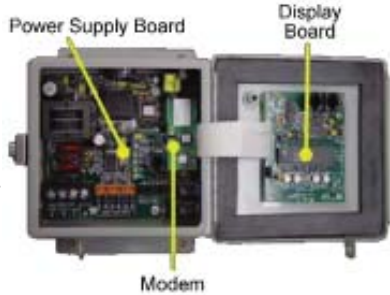
WARNING: Use of this instrument, E-Mon D-Mon Class 5000 Meter, in a manner inconsistent with this manual or not specified by the manufacturer in writing, can cause permanent damage to the unit and / or serious injury to the operator. The protection and safety features provided by this equipment may become impaired or otherwise compromised.

NOTE: If any troubles arise during the installation or functional verification operations, do not immediately remove unit. Before removing the unit, contact E-Mon’s Technical Support Department at 1-800-334-3666 (PA) or 1- 800-810-3666 (CA). E-Mon’s technical department will assist you in detailed troubleshooting of the E-Mon D-Mon Class 5000 Meter installation and assist you in getting the unit operating correctly.

Internal Electronic Assemblies

The unit is comprised of three major subassembly boards, Main Power Board, optional Modem Board and Display Board. All three circuit cards are mounted inside either a NEMA 12 or NEMA 4X enclosure.

NOTE: Units supplied in a NEMA 12 metal enclosure are suitable for indoor applications only. Units supplied in a NEMA 4X fiberglass enclosure are suitable for either indoor or outdoor applications, within the defined specifications. Refer to Section 2.0 for a definition of suitable environmental conditions for indoor and outdoor units.



Main Power Board

Connections to this board include the MAINS Input Voltage, Current Sensors, and external pulse input.

The MAINS input terminals are covered with a protective clear shield for safety purposes. The current sensor assemblies interface to either TB2, TB3 and TB4.

Each header connector input corresponds to an input voltage phase therefore care must be exercised to ensure each current sensor is connected to the correct input header.



MAINS Input Terminals

TB2, TB3 & TB4 Sensor Interfaces

Display Board

The Display Board interconnects to the Main Power Board via a flex ribbon cable and the board mounts on the inside of the housing door. The only required connection is for RS485 communications. When operated as a stand-alone unit using the modem for communications, the RS485 connections are not required. The Display Board LCD readout indicates the cumulative kWh value as well as errors associated with the E-Mon D-Mon® Class 5000 Meter, such as low battery conditions, or sensor error conditions.

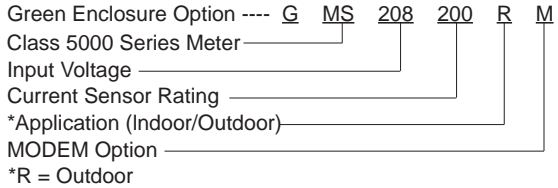
Optional Modem Board

The modem module is mounted to the main power supply board via four stand-offs. At the bottom of the modem module is an RJ11 (4 Wire) connector used to interface cable to a phone line. The modem is configured to operate at 9600 Baud, no parity, 8 Data Bits, and 1 Stop Bit.

2.0 Meter Technical Specifications

Ordering Information: Define input voltage, Current Sensor Rating, Application, and communication option if any.

Example:



| | |
|---|--|
| Input Voltage Configuration: | 3-Wire (Delta) or 4-Wire (Wye) |
| Mains Voltage Input: | Up to 480 VAC RMS Available |
| Input Power: | 6VA Maximum Rating |
| Current Sensor Rating: | Up to 3200 Amp RMS AC Available |
| Power Factor: | .5 leading or lagging |
| Line Frequency: | 50 - 60 Hz. |
| Metering Accuracy: | Certified to ANSI C12.16 (+/-1% from 1% to 100% of rated load) |
| Voltage Operating Range: | +/-10% of rated load |
| Temperature Range (Class 5000): | -20 degrees C to +50 degrees C |
| Temperature Range (Class 5000R): | -20 degrees C to +70 degrees C |
| 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 |
| Installation (Overvoltage) Category: | Category III |
| Measurement Category: | Category III |
| Outdoor Housing Rating: | NEMA 4X |
| Indoor Housing Rating: | NEMA 12 |

2.0 Meter Technical Specifications (Continued)

| | | | |
|-------------------------|-----------------|------------------------------------|--|
| Display Readout: | KWh Accumulated | | |
| Standard Ranges: | | | |
| (4 Wire Wye) | 115/208 VAC: | 100, 200, 400, 800, 1600, 3200 Amp | |
| (4 Wire Wye) | 277/480 VAC: | 100, 200, 400, 800, 1600, 3200 Amp | |
| (3 Wire Delta) | 220/240 VAC: | 100, 200, 400, 800, 1600, 3200 Amp | |
| (3 Wire Delta) | 480 VAC: | 100, 200, 400, 800, 1600, 3200 Amp | |

Modem Interface:

| | |
|-----------------------------|--|
| Cable: | UL Listed/Rated Telephone Cord, 4 Conductor, 300 VAC, stranded conductors, 26 AWG. |
| Cable Connector: | RJ11 IDC Termination |
| Ckt Input Isolation: | 2120 VDC, UL File #150299, Std. 60950 |
| Baud Rate: | 9600 |

RS485 Serial Communication Interface:

| | |
|------------------------------|---|
| Cable Specifications: | UL Listed/Rated Telephone Cord, 4 Conductor, 300VAC, stranded conductors, 22-26AWG. |
| Input/Output Voltage: | Ground Isolated +/-5.4 VDC |
| Cable Connector: | RJ45 male IDC or Screw Terminal Termination |
| Ckt Input Isolation: | 5.3KVAC |
| Max Cable Distance: | 4000 Feet |
| Max Network Nodes: | Maximum cabling nodes 52 including master node |
| Baud Rate: | 9600 |

Recommended In-Line Fuse:

| | |
|----------------------|--|
| Manufacturer: | Littelfuse |
| Mfg Part No.: | KLDR.100 |
| Rating: | 100mA, Time Delay. 600VAC Cartridge Fuse |

Battery Cell:

| | |
|--------------------------|--|
| Description: | Non-Rechargeable Cell used for memory retention. |
| Manufacturer: | Eagle-picher |
| Mfg Part No.: | LTC-3PN |
| Working Voltage: | 3.5Vdc |
| Current Capacity: | 350mAHr |
| Electrolyte: | Lithium Thionyl Nitrate |

3.0 Safety Label Definitions and Information

The E-Mon D-Mon® Class 5000 Meter may contain one or more of the following labels. Operator(s) should familiarize themselves with the meaning of each label to minimize risk.



The presence of this label is a cautionary indicator identifying a danger risk. The manual should be consulted prior to proceeding.



The presence of this label indicates an electrical shock hazard exists in the location or area where the label is placed. Prior to proceeding, the MAINS power must be disconnected and the manual consulted for safety information prior to proceeding.

4.0 Precautionary / Safety Information



Caution: Internal Circuit Card Components are extremely sensitive to electrostatic discharge. Be careful not to touch internal circuitry prior to discharging any static buildup on your person. To discharge yourself, touch a grounded metal object such as conduit or an earth grounded metal enclosure.



Warning: High Voltages present on Main Power Terminal Block, TB1. 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: Failure to ground the enclosure creates a possible shock hazard. Do not operate the E-Mon D-Mon® Class 5000 Meter without a protective earth wire attached securely to the PE terminal screw. After installing Protective Earth wiring, secure the screw tightly (10 N-m Torque).



Warning: NEVER open front panel of unit while unit has MAINS power applied. Failure to comply can increase the risk of serious injury and for electrical shock.

5.0 Meter Installation

5.1 Mounting the E-Mon D-Mon® Class 5000 Meter

STEP 1: Using appropriate sized mounting hardware, fasten the E-Mon D-Mon Class 5000 Meter enclosure to the selected mounting surface. The four housing mounting holes are centered 6.75" H x 4" W. The mounting hole spacing is identical for either the NEMA 4X or NEMA 12 enclosures.

NOTE: Only the NEMA 4X enclosed unit is suitable for outdoor environmental conditions. Units housed in NEMA 12 enclosed units must only be installed in indoor environments where it will not be affected by elements.

5.2 Main Power Board Connections

STEP 1 : Installing a temporary ground for ESD protection with all circuits de-energized, connect a temporary Protective Earth Ground connection for ESD protection. **Prior to performing any unit wiring, be sure to discharge any static on your person.**

STEP 2: Installing the E-Mon D-Mon Class 5000 Meter Protective Earth Ground
Connect an Earth ground wire to the E-Mon D-Mon Class 5000 Meter Protective Earth Ground Terminal screw located on the bottom right side of the Main Power Board. After installing the Protective Earth Ground Wire, securely fasten the Protective Earth Ground screw.

WARNING: Failure to attach the Protective Earth Ground wire securely to the enclosure creates a potential shock hazard. Do not operate the meter without a Protective Earth Ground connection securely installed.

STEP 3: Wire Entry

Two openings exist on the standard enclosure; one for 1/2" conduit and one for 3/4" conduit. The 3/4" conduit opening located on the bottom edge of the housing is used to bring in MAINS Power and Current Sensor Wiring. The 1/2" conduit opening located on the top edge of the housing is used to interface the Modem Telephone Line, Low Voltage Signals and RS485 communications wiring to the unit. Route the appropriate cabling to and through the respective enclosure opening. Outdoor applications require the use of the NEMA 4X enclosure. NEMA 4X enclosures have one opening on the bottom of the enclosure for a 3/4" conduit. The conduit and fittings interfacing tile enclosure entrances must be UL listed, properly sized to the enclosure port diameter, and rated for outdoor use. The interfacing fitting must use a gasketed seal ring to interface between the conduit fitting and the enclosure entry point. After installing the conduit fitting and conduit, verify the conduit fittings are aligned properly to their respective enclosure entrance ports and tightened securely to prevent moisture entry. VERIFY each conduit slip nut is securely tightened to its respective conduit fitting.

STEP 3 : Wire Entry (Continued)

Indoor application units are installed in the metallic NEMA 12 enclosures. The same principles outlined for the outdoor meter installation as defined in the aforementioned paragraph carry over and apply to indoor installations with one exception. This one exception is the conduit and fittings used for indoor installations do not require an outdoor materials rating.

STEP 4: Unit MAINS Wiring

Remove the clear shield located over terminal block TB1 on the Main Power Board. This shield can be removed by pressing in on each locking tab located at the top of each standoff. While pressing the tabs inward, lift the shield from the standoffs. Wire each connection to Terminal Block TB1 with stranded wire 14-12 AWG, rated at 600VAC.

Strip back all wire insulation to expose between 1/4" and 3/8" of the copper conductors. Gently twist each wires conductors to prevent fraying. Insert the conductors into their respective terminal block position and tighten down the terminal block screw to securely fasten the conductor. Terminal Block TB1 is clearly labeled PHASE A, PHASE B, PHASE C, and NEUTRAL.

Connect the NEUTRAL wire to the appropriate terminal block position.

NOTE: *For delta MAINS input wiring, DO NOT connect the NEUTRAL Wire. Remove the terminal block screw for this position.*

Connect the three AC mains power wires (Phase A, Phase B, and Phase C) to their respective positions as labeled on terminal block TB1. After all conductors are connected to their respective terminal block positions and tightened down, verify each terminal block screw is securely fastened by gently tugging on each conductor. Verify no conductor wires are frayed or shorting to adjacent terminal block positions.

STEP 5 : External Switch Mechanism / In-Line Fuse Installation

To ensure a safe installation, the E-Mon D-Mon® Class 5000 Meter requires an external switch mechanism, such as a circuit breaker, be installed to the E-Mon D-Mon Class 5000 Meter MAINS input wiring. The switch mechanism must be installed in close proximity to the E-Mon D-Mon® Class 5000 Meter and easily reachable for the operator.

This device must also be marked as the disconnecting device for the E-Mon D-Mon Class 5000 Meter.

5.0 Meter Installation (Continued)

Install 1/10 Amp Slow Activation inline fuses with the suitable voltage rating for each conductor phase at the MAINS Input to the meter. The fuses must be labeled to indicate voltage and current rating as well as element characteristics. The fuse element must be slow activating type.

STEP 6: Once the MAINS wiring is complete, close the enclosure front panel and secure the panel to the enclosure using the locking mechanism. Activate the external circuit breaker or equivalent switch to apply AC MAINS power to the unit.

The E-Mon D-Mon® Class 5000 Meter display should turn on and indicate total kWh accumulation reading.

NOTE: The unit display, clock, schedule, and other critical configuration parameters will be reset once the unit is completely wired and ready for commissioning. Resetting and configuring these parameters must be done through a host computer, locally or remotely, via an RS485 or Modem link.

STEP 7 : Using an AC Voltmeter, verify the input voltage readings are within the limits specified below.

NOTE: For 3 Wire systems, the voltages are measured Phase to Phase. On 4 wire systems the voltages are measured Phase to Neutral.

| Meter Input Voltage / Configuration | Normal Voltage | Limits (+/-10%) |
|--|-----------------------|------------------------|
| 120/208V, 3Ø, 4 Wire | 120 VAC | 108 to 132 VAC |
| 277/480V, 3Ø, 4 Wire | 277 VAC | 249 to 305 VAC |
| 240V, 3Ø, 3 Wire | 240 VAC | 216 to 264 VAC |
| 480V, 3Ø, 3 Wire | 480 VAC | 432 to 528 VAC |

STEP 8 : Remove power from the unit by de-energizing the external switch.

5.0 Meter Installation (Continued)

5.3 Current Sensor Installation and Wiring

Once the AC voltages have been confirmed to be within acceptable limits, you are ready to install the current sensors. The Main Power Board contains three header connectors located at the bottom center of the board, TB2, TB3, and TB4.

TB2: Phase A Current Sensor Input

TB3: Phase B Current Sensor Input

TB4: Phase C Current Sensor Input

The E-Mon D-Mon® Class 5000 Meter will be used with two basic types of Current Sensors:

1. Split-core Current Sensor: This sensor opens so that it can be attached around the circuit conductor being monitored without interrupting power. *Unless otherwise specified all E-Mon D-Mon Class 5000 Meter units are supplied with this sensor type.*

2. Solid-core Current Sensor: This sensor does not open and requires the monitored conductor be removed from the circuit to install the current sensor. *This type is only supplied when specified at time of order.*

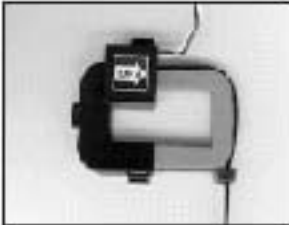
NOTE:

The unit serial label specifies if the unit is setup for split core or solid core current sensors.

Both current sensor types output a 0-2 VAC signal proportional to the current being measured.

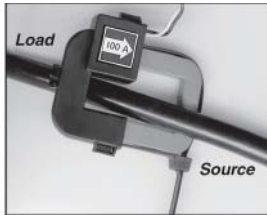
Installing the Split Core Current Sensor Assembly

STEP 1 : Each phase being monitored will require one two-piece current sensor assembly. Therefore, a three-phase meter will require three (3) assemblies. Open the two-piece current sensor assembly by releasing the nylon clamp using a flat head screwdriver.



5.0 Meter Installation (Continued)

STEP 2 : Reassemble the current sensor assembly around the conductor(s) to be monitored. Ensure the current sensor halves marked “Load” are both facing the load side of the conductor. The colored arrow will be on the source side of the conductor being monitored and **MUST** be pointed in a clockwise direction around the conductor being monitored. Tighten the nylon clamp to complete the assembly.



IMPORTANT: When looking from the source side of the conductor(s) being monitored, you should see the arrow on the current sensor assembly. The arrow should be pointing in a clockwise direction around the conductor(s) being monitored. If the arrow is not positioned on the source side, inaccurate readings will result.

Current Sensor Wiring

Once all the current sensors are installed onto their appropriate phase conductors, you can begin terminating the current sensors onto the E-Mon D-Mon® Class 5000 Meter Main Board.

The current sensor leads can be extended up to 500 feet for remote monitoring applications. *To extend the length of the wires, use #22 AWG twisted pair wire with a black and white conductor, rated for 600VAC.*

The Current Sensor connection points are located on the bottom center of the Main Power Board. Three removable plugs exist, one for each Current Sensor Phase Input. The Header portions of the connectors are labeled TB2, TB3, and TB4. Silkscreen located in front of each connector instructs you which terminal of the plug is for the white conductor and which terminal is wired to the black conductor. Once each current sensor is wired to its respective plug, insert each plug into the appropriate header.

5.0 Meter Installation (Continued)

5.4 MAINS Line Voltage and Current Sensor Wiring Diagrams

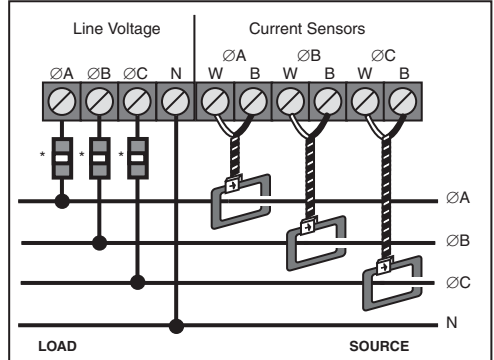
3-Phase, 4-Wire Installation Diagram

Line Voltage Connections: # 14-22 AWG

Sensor Connections: B = Black Lead
W = White Lead

* 1/10 A, 600 VAC inline fuse per conductor.
Littlefuse part number KLDR .100.

** Neutral not used in delta system.
Remove neutral terminal block screw for
Delta systems.



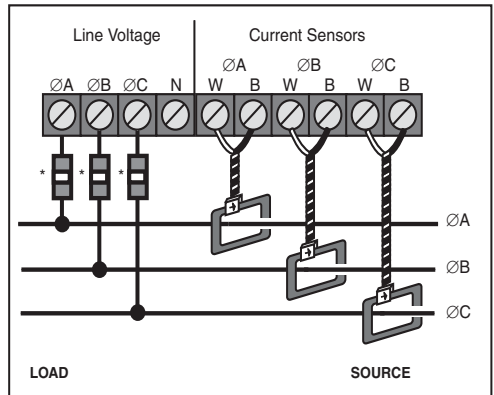
3-Phase, 3-Wire Installation Diagram

Line Voltage Connections: # 14-22 AWG

Sensor Connections: B = Black Lead
W = White Lead

* 1/10 A, 600 VAC inline fuse per conductor.
Littlefuse part number KLDR .100.

** Neutral not used in delta system.
Remove neutral terminal block screw for
Delta Systems.



5.0 Meter Installation (Continued)

5.5 Line Voltage / Current Sensor Diagnostics

The three-phase AC MAINS voltage wiring and the current connected in the proper phase sequence. If there is a phase sequence error, the Display LCD will display a message “Check Sensor” in the upper right hand corner. Additionally, LED D5 labeled “MTR” will flash at a rate of twice per second in the event of a phase error or missing phase voltage(s).

Verify the AC MAINS voltage wires are all connected to the correct positions on Terminal Block TB1. Inspect the MAINS input wiring to verify each conductor is terminated at the correct terminal block position. Using an AC voltmeter, measure the AC voltage for each Phase to Neutral terminal and to the frame ground point.



Load each current sensor by running at least 1% of the full scale rated current through the conductor being monitored by each phase. (e.g. 2 amp load required on 200 amp rated sensors for each phase to perform sensor diagnostic procedures.)

- Verify the current sensor white and black conductors are installed in the correct header positions.
- Verify the current sensors are installed in the correct direction on the conductor being monitored.
- Verify the current sensors plugs are terminated in the correct header on the Main Power board.

If the error messages still haven't been cleared, measure the AC voltage output across the plug terminals of each current sensor, individually. Set the AC voltmeter to the 20 Volt scale. If a reading of zero volts is indicated on the voltmeter, check for an open circuit. An open could exist at the plug terminals or at a splicing junction. Also verify that the core halves are assembled tightly.

If the error is still appearing, contact E-Mon Technical Support at 800-334-3666 for further assistance.

Final Main Power Board Checks

Once the phase error has been corrected, the Display LCD “Check Sensor” error should extinguish and the Main Power Board LED D5 should flash at a rate of once per second. Also verify LED D4, labeled “CPU” is flashing at a rate of once per second and synchronously with LED D5.

5.6 RS-485 Wiring

The E-Mon D-Mon® Class 5000 Meter contains an RS-485 serial communications port allowing it to communicate with a computer. The units can be Daisy Chained together over distances of up to 4000 feet. Using an RS232/485 Key, up to 52 unit nodes, including one master node, can be networked together. Communications wiring should enter / exit the E-Mon D-Mon Class 5000 Meter enclosure through the 1/2" hole located on the upper (top) surface of the enclosure using 4 conductor UL approved telephone cord terminated with an RJ-11 male connector. *A 3-screw terminal block is also available for the RS-485 wiring -- as an optional method.*
Modbus RTU meters are designed for RS-485 communication.

NOTE: The E-Mon D-Mon Class 5000 Meter will not function as a Master in a Master-slave configuration. An E-Mon D-Mon IDR or E-Mon D-Mon Class 3000 unit must serve the role of Master in this configuration.

CAUTION: Be sure you do not confuse the modem telephone jack(s) with the RS-485 jacks. Reversing the wiring can cause permanent unit damage to either communication port.

There are two methods for connecting E-Mon D-Mon Class 5000's together.

Method 1: Daisy Chain with modular jacks

- 1: Each Display Board has two RJ-11 jacks available to facilitate RS-485 Daisy Chain connections. Using RJ-11 four conductor cable, wire each cable end pin to pin. Interconnect all units together with the RJ-11 cabling.
- 2: After Daisy Chaining the units is complete, you need to decide what device will be used to communicate with this network of E-Mon D-Mon® Class 5000's.
 - a. Option 1: Internal Modem - installing a master unit such as E-Mon D-Mon Class 3000 or E-Mon D-Mon IDR within the Daisy Chain of E-Mon D-Mon Class 5000 units. The selected units' internal modem will then communicate with the other meters in the Daisy Chain via the RS-485 network. Connect a phone line to one of the two telephone jacks inside the E-Mon D-Mon Class 3000 / E-Mon D-Mon IDR to the telephone line to complete the installation.
 - b. Option 2: Local computer - If adding the E-Mon D-Mon Class 3000 or E-Mon D-Mon IDR is not an option, a locally residing computer can communicate with the RS-485 network. The computer must be connected to the RS232/485 Key. The RS232/485 Key is then connected to one of the Daisy Chained E-Mon D-Mon Class 5000 units' available RS-485 jacks using RJ-11 cabling.

Method 1: Daisy Chain with Wire Terminal

- 1: Connect the “HI” terminal (Display PCB J3 Pin 1) of each E-Mon D-Mon® Class 5000 unit together so that all unit HI terminals are linked. (HI to HI to HI, etc.)
- 2: Connect the “LO” terminal (Display PCB J3 Pin 2) of each E-Mon D-Mon Class 5000 unit together so that all unit LO terminals are linked. (LO to LO to LO, etc.)
- 3: Connect the “GND” terminal (Display PCB J3 Pin 3) of each E-Mon D-Mon Class 5000 unit together so that all unit GND terminals are linked. (GND to GND to GND, etc.)
- 4: After completing the wiring of connector J3 for all units, you need to decide what device will be used to communicate with this network of E-Mon D-Mon Class 5000's.
 - a. Option 1: Internal Modem - installing a master unit such as E-Mon D-Mon Class 3000 or E-Mon D-Mon IDR within the Daisy Chain of E-Mon D-Mon Class 5000 units. The selected units internal modem will then communicate with the other meters in the Daisy Chain via the RS-485 network. Connect a phone line to one of the two telephone jacks inside the E-Mon D-Mon Class 3000 / E-Mon D-Mon IDR to the telephone line to complete the installation. Modem option not available with Modbus communication option.
 - b. Option 2: Local computer - If adding the E-Mon D-Mon Class 3000 or E-Mon D-Mon IDR is not an option, a locally residing computer can communicate with the RS-485 network. The computer must be connected to the RS232/485 Key. The RS232/485 Key is then connected to one of the Daisy Chained E-Mon D-Mon Class 5000 units' available RS-485 jacks using RJ-11 cabling.

5.7 Optional Modem Wiring

For E-Mon D-Mon Class 5000 units installed with the optional modem, the only communications interface required is a telephone line for interfacing to the Modem module. Connect one end of the phone line cable plug into the RJ-11 jack located on the Modem interface card and the other end to a functional telephone outlet. Modem option not available with Modbus communication option.

NOTE: If the unit is sharing a phone line with a DSL device, a DSL filter must be installed between the phone line and phone jack to ensure reliable call out operations.

6.0 Monitoring Multiple Loads with one E-Mon D-Mon® Class 5000

The E-Mon D-Mon Class 5000 meter provides extreme flexibility by allowing additional sets of current sensors to be used in parallel so multiple load locations can be monitored by one E-Mon D-Mon Class 5000. This feature allows a totalized display readout of two or more load circuits.

You may use parallel sensors to monitor specific breakers from one panel, specific breakers from more than one panel, two or more complete panels, etc.

When paralleling current sensors, the following rules must be followed for accurate readings:

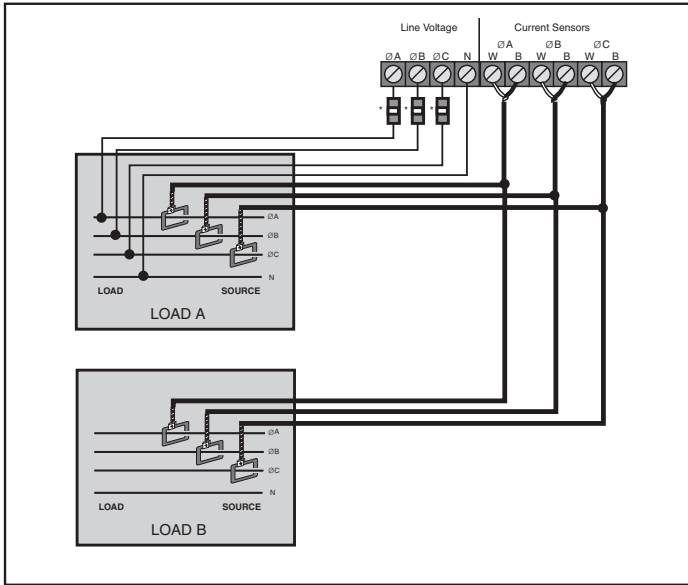
RULE 1: Current sensors must be installed in complete sets of three, with a maximum of three sensors installed in parallel per phase.

RULE 2: All sensors used in parallel must be of the same amperage rating (i.e. 100 Amp, 200 Amp, etc.). The rating is determined by the current rating (amperage) of the E-Mon D-Mon Class 5000. For example, a 200 Amp E-Mon D-Mon Class 5000 must use extra sets of 200 Amp current sensors.

RULE 3: All locations being monitored must have the same power source. A 480 Volt E-Mon D-Mon Class 5000 for example, cannot monitor a 208V load circuit nor can a E-Mon D-Mon Class 5000 monitor two 480 or 208 Volt loads if they are from different originating power sources or from different transformers.

RULE 4: The display readings must be multiplied by the number of sets of current sensors installed. E.g. E-Mon D-Mon Class 5000 reading of 5 KWH with 2 sets of currents sensors $5 \times 2 = 10$ KWH (actual usage).

NOTE: One set of current sensors equates to three sensors, one per phase. The multiplier only applies when extra sets of current sensors are installed on one E-Mon D-Mon Class 5000. Therefore, if you are using only one set of three current sensors, the multiplier is not required.



7.0 Configuring the E-Mon D-Mon® Class 5000 Using E-Mon Energy™ Software

E-Mon Energy is a product of E-Mon, LLC. This software operates on a computer running Windows 2000, XP or Vista and is used to interface to many E-Mon products including the E-Mon D-Mon Class 5000.

Reference the E-Mon Energy software for specific instructions to perform the following operations:

- Peak Demand Reset
- Modem Initialization
- Setting or changing the Remote Dial Out Number
- Downloading Profile Data
- Unit Initialization
- Setting / Changing Unit ID, Group and Location information
- Configuring Unit Call-In schedule
- Resetting Meter Display

8.0 Preventative / Scheduled Maintenance

The unit is shipped in a calibrated and full functionally tested condition. Since the unit is factory calibrated using proprietary firmware algorithms, no internal unit adjustments are necessary.

This unit contains no internal adjustments.

Therefore no preventative or scheduled maintenance is required.

No cleaning or decontamination procedures are required for this instrument.

9.0 Lithium Battery Replacement Instructions

The E-Mon D-Mon® Class 5000 has a Lithium Battery Cell, which is used to retain the contents of SRAM and the RTC during power outages. The battery has a life expectancy greater than 8 years.

Battery Specifications: 25 Degree Celsius

| | |
|------------------------------|--------------------------|
| Nominal Working Voltage: | 3.5VDC Output |
| Nominal Current Capacity: | 350 mAHr |
| Cell Chemical: | Lithium-Thionyl Chloride |
| Operating Temperature Range: | -40 to +95 Celsius |
| Manufacturer: | Eagle-Picher |
| Manufacturers Part Number: | LTC-3PN |

WARNING: Only replace battery with exact manufacturer and manufacturer part number specified above.



The Battery Cell is mounted in a socket on the upper right side of the Main Power Board. Should the battery drop below 2.4 VDC in capacity, the display will illuminate a Battery symbol on the left margin indicating a low battery condition. Additionally, the internal unit firmware will set a flag indicating the low battery condition. When the unit data is next downloaded, the monitoring facility will be alerted of the low battery condition and schedule a service call.

Use the following procedure to replace the Lithium Battery Cell.

CAUTION: The battery is not completely discharged, therefore **DO NOT** short the terminals on the battery with any conductive material.

CAUTION: Internal Circuit Card Components are extremely sensitive to Electrostatic Discharge. Be careful not to touch internal circuitry prior to discharging any static buildup on your person. To discharge yourself, touch a grounded metal object such as conduit or a metal enclosure exterior.

9.0 Lithium Battery Replacement Instructions (Continued)

Step 1 : Disconnect power from the E-Mon D-Mon® Class 5000 at the unit external circuit breaker.

Step 2 : Remove the battery from its socket and place on a non-conductive surface.

Step 3: Install new battery into the PCB Battery socket

NOTE: The Main Power Board Battery socket is keyed to prevent user from inserting the new battery in the wrong polarity. No damage to unit or battery will occur if battery is inadvertently installed in wrong direction.

Step 4: Visually inspect new battery to verify that all leads are fully inserted into their respective socket positions.

Step 5: Dispose of the used battery in accordance with the manufacturers' (Eagle Picher) instructions.

10.0 Frequently Asked Questions

- Q** **When providing line voltage to the E-Mon D-Mon® Class 5000 Meter, can I tap off of the same breaker I am monitoring?**
A Yes, the voltage can be pulled from the same breaker being monitored.
- Q** **Can the E-Mon D-Mon Class 5000 Meter line voltage wires be run in the same conduit as the sensor leads?**
A Yes, there will be no effect on the E-Mon D-Mon Class 5000 Meter if the sensor leads and line voltage wires are run in the same conduit.
- Q** **How do I find the cost for kWh and kW to bill my tenants?**
A Your local utility bill should list the cost per kWh and kW. If not, simply call your utility and ask them to provide you with the cost per kWh and kW.
- Q** **What size wire do I use for the line voltage leads?**
A These wires are normally sized at #14 AWG, but be sure to confirm this requirement with your local and national electrical codes requirements.
- Q** **What size wire should I use to extend the current sensor leads?**
A These wires are normally #14 AWG, twisted pair arrangement. Consult your local electrical code for proper sizing requirements.
- Q** **The load I need to monitor has parallel feeds. How do I install the current sensors for this application?**
A There are two ways you can monitor parallel feeds. One method is to clamp the sensors around all feed wires for each phase. The second way to monitor parallel feeds is to clamp the sensor around one of the feed wires for each phase. When you read the E-Mon D-Mon Class 5000, the final reading must be multiplied by the number of feed wires for each phase.
- Q** **I have two subpanels I would like to monitor with one E-Mon D-Mon Class 5000 Meter. These subpanels are fed by different transformers in the building. Can I parallel sensors and monitor both panels with one E-Mon D-Mon Class 5000 Meter?**
A No. These panels cannot be monitored by one E-Mon D-Mon Class 5000 because they are different power sources. When you parallel current sensors, all loads being monitored must be from the same voltage source.
- Q** **I have 5 breakers in one subpanel I would like to monitor with one E-Mon D-Mon Green Class Meter. Can this be done without having to parallel current sensors?**
A Yes. Simply run all the breaker wires through one set of current sensors. Make sure all A Phase circuits are run through the A Phase sensor, and the same for B & C phases. The E-Mon D-Mon Class 5000 should be sized by the highest amount of current being monitored by one sensor.
- Q** **I've gone through the troubleshooting guides and I still can't get my E-Mon D-Mon Class 5000 Meter to work. What should I do?**
A Before removing the unit, contact E-Mon's Technical Department at 1-800-334-3666 (PA) or 1- 800-810-3666 (CA). E-Mon's technical department will assist you in detailed troubleshooting of the E-Mon D-Mon Class 5000 Meter installation and assist you in getting the unit running without having to remove and return the unit.

11.0 External Contact Input

Description

In addition to the two channels of interval data (kW and kWh) that are being recorded by the E-Mon D-Mon® Class 5000, a third channel is available to be used for capturing pulses from an external device. This device can be another electric meter, a water meter, a gas meter, or any unit with an output pulse. The output pulse of the device must be in the form of a dry contact - either physical or electronic.

Count speeds of up to 10 Hz (600 ppm) are accepted by the E-Mon D-Mon® Class 5000, and 36 days of fifteen (15) minute interval data can be stored before requiring a download by E-Mon Energy™ software. The interval data is only available through the E-Mon Energy software.

Wiring

The external pulse is wired into the E-Mon D-Mon® Class 5000 through the TB6 terminal, marked “KYZ INPUT”. This consists of a removable plug and header assembly similar to the current sensor inputs.

The external device can be mounted up to 100 feet away from the E-Mon D-Mon® Class 5000, and wire sizes from 24 to 16 gauge (AWG) can be used for the connection. **If the external device utilizes a polarity dependent solid-state contact, the plus (+) from the contact must terminate on the left hand pin of the header on the meter - the pin above the “K” portion of the KYZ label.**



12.0 Modbus Option Wiring

The E-Mon D-Mon® Class 5000 meter equipped with the Modbus option communicates with building automation equipment (conductor) RS-485 network using Modbus RTU protocol. The meters are networked in a Daisy-Chain configuration (Section 5.7) with BELDEN 1120A cable or equivalent. The cable rating of 600V allows the RS-485 network to be connected to 480-volt meters. Up to 52 meters can be installed on a network string. The maximum combined length of all Daisy-Chained cables must not exceed 4000 feet. The meter-to-network connection is through the screw terminal which is located on the CPU board, on the door of the meter. Figure 5.10.1 shows the terminal location and correct wiring method for Modbus communication.



Wiring Details

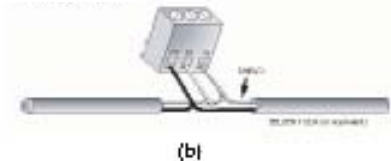


Figure 5.10.1 (a) Terminal location and (b) wiring method

The meter is shipped with a Modbus ID number of 01. This must be changed if the network has more than one meter installed. **The change must be done before the meter is introduced into the network.** The meter can be numbered from 1 to 247. There can be no duplicate numbers on a network, so caution must be taken when assigning a meter ID number prior to its installation on the RS-485 network.

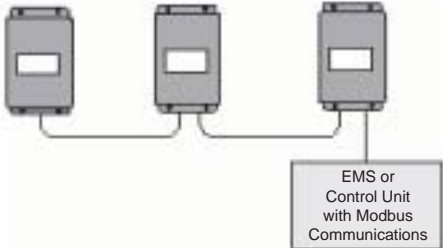


Figure 5.10.2 Modbus Installation overview

12.0 Modbus Point Map

Modbus data points available from the E-Mon D-Mon® Class 5000 meter. Listed under Class 5000.

| Modbus Point Map | | 1.03 | | 12/23/03 | | | | | | | |
|------------------|-------|------|---|----------|-------|-----|-----|--|-------------|---------|--|
| ITEM | PM-I | W | PM-F | UOM | CALC. | MEM | OP | DESCRIPTION | CL 3000 | CL 5000 | |
| 1 | 40001 | 2 | 41001 | kWh | T-del | NV | R/W | Energy delivered | Y | Y | |
| 2 | 40003 | 2 | 41003 | kWh | T-rec | NV | R/W | Energy received | Y | Y | |
| 3 | 40005 | 2 | 41005 | kVARh | T-del | NV | R/W | Reactive energy delivered | Y | Y | |
| 4 | 40007 | 2 | 41007 | kVARh | T-rec | NV | R/W | Reactive energy received | Y | Y | |
| 5 | | | 41009 | kW | T | | R | Real power | Y | Y | |
| 6 | | | 41011 | kVAR | T | | R | Reactive power | Y | Y | |
| 7 | | | 41013 | kVA | T | | R | Apparent power | Y | Y | |
| 8 | | | 41015 | % | T | | R | Power factor | Y | Y | |
| 9 | | | 41017 | Amps | T | | R | Current total | Y | Y | |
| 10 | | | 41019 | Amps | A | | R | Current average | Y | Y | |
| 11 | | | 41021 | Volts-N | A | | R | Voltage line-neutral | Y | Y | |
| 12 | | | 41023 | Volts-L | A | | R | Voltage line-line | Y | Y | |
| 13 | | | 41025 | Hz | A | | R | Frequency | Y | Y | |
| 14 | | | 41027 | Degree | A | | R | Phase angle | Y | Y | |
| 15 | | | 41029 | kW | ØA | | R | Real power, phase A | Y | Y | |
| 16 | | | 41031 | kW | ØB | | R | Real power, phase B | Y | Y | |
| 17 | | | 41033 | kW | ØC | | R | Real power, phase C | Y | Y | |
| 18 | | | 41035 | kVAR | ØA | | R | Reactive power, phase A | Y | Y | |
| 19 | | | 41037 | kVAR | ØB | | R | Reactive power, phase B | Y | Y | |
| 20 | | | 41039 | kVAR | ØC | | R | Reactive power, phase C | Y | Y | |
| 21 | | | 41041 | kVA | ØA | | R | Apparent power, phase A | Y | Y | |
| 22 | | | 41043 | kVA | ØB | | R | Apparent power, phase B | Y | Y | |
| 23 | | | 41045 | kVA | ØC | | R | Apparent power, phase C | Y | Y | |
| 24 | | | 41047 | % PF | ØA | | R | Power factor, phase A | Y | Y | |
| 25 | | | 41049 | % PF | ØB | | R | Power factor, phase B | Y | Y | |
| 26 | | | 41051 | % PF | ØC | | R | Power factor, phase C | Y | Y | |
| 27 | | | 41053 | Amps | ØA | | R | Current, phase A | Y | Y | |
| 28 | | | 41055 | Amps | ØB | | R | Current, phase B | Y | Y | |
| 29 | | | 41057 | Amps | ØC | | R | Current, phase C | Y | Y | |
| 30 | | | 41059 | Volts-N | ØA | | R | Voltage, line to neutral, phase A-N | Y | Y | |
| 31 | | | 41061 | Volts-N | ØB | | R | Voltage, line to neutral, phase B-N | Y | Y | |
| 32 | | | 41063 | Volts-N | ØC | | R | Voltage, line to neutral, phase C-N | Y | Y | |
| 33 | | | 41065 | Volts-L | ØA | | R | Voltage, line to line, phase A-B | Y | Y | |
| 34 | | | 41067 | Volts-L | ØB | | R | Voltage, line to line, phase B-C | Y | Y | |
| 35 | | | 41069 | Volts-L | ØC | | R | Voltage, line to line, phase C-A | Y | Y | |
| 36 | | | 41071 | Degree | ØA | | R | Phase angle, phase A | Y | Y | |
| 37 | | | 41073 | Degree | ØB | | R | Phase angle, phase B | Y | Y | |
| 38 | | | 41075 | Degree | ØC | | R | Phase angle, phase C | Y | Y | |
| ITEM | PM-I | W | DATA (SAMPLE) | | | | | | DESCRIPTION | | |
| | 46001 | 8 | 504D 324B 0102 1016 0300 454D 4F4E 2020 | | | | | Firmware version: PM 5K, Ver. Ver date/time, EMON | | R | |
| | 46009 | 8 | 456E 6572 6779 204D 6574 6572 0000 0000 | | | | | Device description: Emon Dmon Energy Meter | | R | |
| | 46017 | 8 | 1356 4503 0613 0300 0000 0000 0000 0000 | | | | | Initialize device with date/time | | W | |
| | 46025 | 8 | 1356 4503 0613 0300 0000 0000 0000 0000 | | | | | RTC date/time, will accept broadcast command | | R/W | |
| | 46033 | 8 | 1356 4503 0527 0300 0000 0000 0000 0000 | | | | | CPU date/time (7 bytes, rest is reserved for other future formats) | | R/W | |
| | 46041 | 8 | 0001 0001 0000 0000 0000 0311 0020 1100 | | | | | Group, location, Device ID number | | R/W | |
| | 46049 | 8 | 0041 0000 0000 0000 0000 0311 0020 1100 | | | | | Dev. ID, Hookup, Serial numbers... | | R/W | |
| | 46057 | 8 | 0592 0007 0000 0000 0000 0000 0000 0000 | | | | | Recorder info.: idr, dem, int., dem. win., dem. syn., timezone, DST... | | R/W | |
| | 46065 | 8 | 0101 0001 0D03 3531 1000 0320 0000 0000 | | | | | Meter info.: SN1&2, pulse rate, Volt/Amp/CTS, PF/mult1&2, CT, PT | | R/W | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | 46513 | 8 | 0000 0101 0000 0000 0000 0100 0000 0000 | | | | | Flags L1 | | | |
| | 46521 | 8 | 0000 0000 0000 0000 0000 0000 0613 0316 | | | | | Flags L2 | | | |
| | 46529 | 8 | 0000 0000 0000 0000 0000 0000 0000 0000 | | | | | Flags L3 | | | |
| | 46537 | 8 | 0000 0000 0000 0000 0000 0000 0000 0000 | | | | | Flags L4 | | | |

Note: To change device ID, set single point at 46049 with data set to new device ID (e.g., 1 to 247).
 To set date/time, set multiple points at 46025 for 4 points with data set to HHMM SSSD MMDD YYYY (DW=day of week).
 To clear single meter kWh/kW, set single point at 41001 with data set to 0000 (similarly for 41003, 41005, 41007).
 To clear multiple meter readings, set multiple point at 41001 for 8 points with data set to 0000's.
 Note: Jumper J5 & J6 must be closed in order for kWh del/rec and kVARh del/rec to be cleared.

13.0 Meter Limited Warranty

Subject to the exclusions listed below, E-Mon will either repair or replace (at its option) any product that it manufactures and which contains a defect in material or workmanship.

The following exclusions apply:

1. This Limited Warranty is only effective for a period of (18) eighteen months following the date of manufacture when installed in accordance with manufacturer's instructions by qualified personnel.
2. E-Mon must be notified of the defect within ninety (90) days after the defect becomes apparent or known.
3. Buyer's remedies shall be limited to repair or replacement of the product or component which failed to conform to E-mon's express warranty set forth above.
4. Buyer shall be responsible for all freight costs and shall bear all risk of loss or damage to returned goods while in transit.
5. This Limited Warranty does not cover installation, removal, reinstallation, or labor costs, and excludes normal wear and tear. Buyer shall provide labor for the removal of the defective component or item and installation of its replacement at no charge to E-Mon.
6. This Limited Warranty does not cover any product if: (i) a product is altered or modified from its original manufactured condition, (ii) any repairs, alterations or other work has been performed by Buyer or others on such item, other than work performed with E-Mon's authorization and according to its approved procedures; (iii) the alleged defect is a result of abuse, misuse, improper maintenance, improper installation, accident or the negligence of any party; (iv) damaged as a result of events beyond E-Mon's control or other force majeure events or (v) used in conjunction with equipment, components, accessories, parts or materials not supplied or approved by E-Mon.
7. This Limited Warranty is limited to the obligation to repair or replace the manufactured product. This is the sole and exclusive remedy for any breach of warranty. IN NO EVENT SHALL E-MON BE LIABLE FOR ANY INDIRECT, INCIDENTAL, SPECIAL, CONSEQUENTIAL OR PUNITIVE DAMAGES (INCLUDING ANY DAMAGE FOR LOST PROFITS) ARISING OUT OF OR IN CONNECTION WITH THE FURNISHING OF PRODUCTS, PARTS OR SERVICES, OR THE PERFORMANCE, USE OF, OR INABILITY TO USE ANY PRODUCTS, PARTS OR SERVICES, SALE OF OR OTHERWISE, WHETHER BASED IN CONTRACT, WARRANTY, TORT, INCLUDING WITHOUT LIMITATION, NEGLIGENCE, OR ANY OTHER LEGAL OR EQUITABLE THEORY.
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