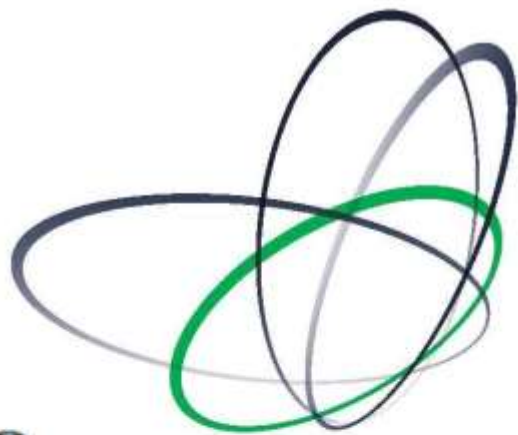


I-METER[®] MF SERIES INSTALLATION AND USER MANUAL



 **i-meter[®]**
Innovative Metering Solutions

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WARNING

Field electrical installers must follow proper safety precautions and all local electrical code requirements during electrical installation, meter wiring, and CT installation. During normal operation of this device, hazardous voltages are present which can cause severe injury or death. It is strongly recommended that only qualified, properly trained personnel should perform installation and servicing.

DISCLAIMER

The information presented in this publication has been carefully checked; however, Intellimeter Canada Inc. (ICI) assumes no responsibility for inaccuracies. The information provided in this document is subject to change without notice.

CUSTOMER SUPPORT

To report any defect, please contact ICI at 905.839.9199. Prior to returning any merchandise to ICI, a return material authorization (RMA) number should be obtained from ICI.

STATEMENT OF CALIBRATION

The accuracy and calibration of our instruments are traceable to Measurement Canada, a division of Industry Canada.

CONFIGURATION

The i-meter®MF series are only to be configured by Intellimeter Canada Inc. at ICI's Factory according to the customers provided panel schedule.

INSTALLATION CHECKLIST

Make sure you have received the right meter as per your order and packing list.

INSTALLATION DISCLAIMER

INTELLIMETER does not accept any responsibility and will not be liable for any loss or damage or expense of any kind whatsoever and howsoever caused by improper installation of its products, be it indirect, special, incidental or consequential damages (including but not limited to damages for loss of business, loss of profits, interruption or the like). Please refer to Intellimeter's Terms and Conditions of Sale available at <https://intellimeter.ca/pages/terms-of-service-privacy-statement>

ELECTRICAL CODE

Installer is responsible for ensuring that all safety and local electrical codes are followed.

1. PRODUCT DESCRIPTION

The i-meter®MF series are multifunctional meters, which read real time V, I, W, VA, pf, THD and energy consumption; meeting LEED and billing requirements. The meter is an auto ranging voltage input from 120V-347V L-N, and supports 80mA and 100mA outputs Current Transformers (CTs).

There are two models:

- i-meter®MF3 (1 3 ϕ meter, with optional neutral current measurement)
- i-meter®MF6 (2 3 ϕ meters, with optional neutral current measurement)

Measurement Canada, California (CTEP) and CSA approved.



i-meter® MF series

1.1 Applications

The i-meter®MF is designed for a wide variety of applications. In MCMS applications, property managers can use the latest data for cost allocation and demand side management.

The i-meter®MF3 is configured for 1 point of metering

The i-meter®MF6 is configured for 2 points of metering

Note: Any changes to the original configuration will need to be coordinated with Intellimeter Canada

1.2 Specifications

| | |
|--|---|
| Dimensions (Inches) | 9.8 H x 7.3 W x 3.5 D |
| Dimensions (Millimeters) | 275 H x 185 W x 89 D |
| Meter Constants (K_h) | 10 Wh |
| Measurements¹ | Total Energy: kWh is accumulated in non-volatile memory on the meter; Real Time Measurements: V (RMS) per phase, I (RMS) per phase, W per phase, VA per phase, power factor per phase, frequency |
| Number of Meters | MF3:1/ MF6:2 |
| Meter Elements (CTs) | MF3:1 to 3/ MF6 1 to 7 (1 Neutral) |
| Voltage Rating | Auto range 120 - 347VAC (L-N), -20% to +10% of rating |
| Rated VA | < 4 VA |
| Service Type | 1Ø2W, 1Ø3W, 2Ø3W, 3Ø4W wye, 3Ø3W Delta* |
| Current Transformers | 80/100 mA output, Self Shorting Protection |
| Current Range | 0.08 – 80mA, 1 – 100mA |
| Instrument Transformers Interface | Yes |
| Power Quality | Per phase V & I Total harmonic Distortion (THD), Per phase V & I individual harmonic order up to 23 rd |
| Memory | 45 days (5 min intervals) kWh |
| Pulse Output | Wh / VAh |
| Communications | ModBus RTU or TCP/IP, BACnet MSTP or TCP/IP and pulse output. |
| Frequency | 45 to 65 Hz |
| Accuracy Class | 0.5 (Meets ANSI C12.20) |
| Real Time Measurements | V, I, kW, kVA, kVar, PF, Hz, THd (V/I) |
| Operating Temperature | -10°C to +53°C |
| Regulatory Compliance / Approvals | Measurement Canada, cCSAus CTEP (CA) |
| Patent | U.S. Patent No. 8,049,487 |

¹ All instantaneous measurements and interval data must be with a wired/wireless communication module.

2. INSTALLATION

To get detailed information about the installation process, please visit:

<https://intellimeter.ca/pages/downloads#videos>: Intellimeter i-meter®MF6 Installation & Troubleshooting and/or Intellimeter i meter®MF3 Installation & Troubleshooting.

- Verify the number of breakers is the same as the number of meters assigned for that panel board. Follow the installation drawings. Group the assigned modules to the identified panel board.
- Referring to the diagram below, CTs can be embedded in the distribution panel. If the customer has supplied a special compartment for the meter with their electrical panel, Intellimeter will install the meter and have the SPE-1000 field evaluation completed. Otherwise, the meter will be installed in an external enclosure to be mounted near the electrical panel for ease of servicing.
- Install the modules into their appropriate position.
- Voltage connectors are fixed to the meter PCB. Contractor has to wire to the meter board and use the wire terminals (spade connectors) provided.
- Terminate the voltage reference chain to the designated, 15Amp breaker and ensure the proper phasing retained as per drawings.
- Install the communication connectors to the meter modules and dress the wires they are protected from damage during feeder and branch circuit installation. MF series can be provided with a pulse output cable upon request.
- Communication cable is to be terminated to a junction box outside of the panel board by the electrical contractor.
- Review general information and wiring diagram.
- Carefully read all the WARNING signs and notes.
- Check meter serial number and other information on the meter.
- All meter modules are assigned within the panel board and are identified with respect to position, or section of breakers.
- A label on the top of each unit indicates meter assignment. Follow the installation drawings that are supplied with the units.
- Do not leave the secondary CT open when current is flowing through the primary circuit. This applies to instrument CTs as ICI milliamp CTs are self-protected.
- Contact ICI if there has been a change made to the layout or if the assigned drawings do not match the actual distribution panel layout.

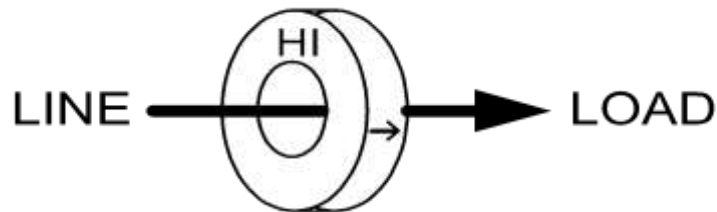
3. OPERATION AND TROUBLE SHOOTING

3.1 Metering Rules

1. Current Transformers (CTs) are directional.
2. Voltage references must be in phase with the load being metered and from the same source.

Rule #1:

- If the CTs are mounted in the opposite direction, the polarity of the CT will be opposite.
- The arrow on the CT indicates the direction from LINE to LOAD.



Similarly, the “**H1**” is on the LINE SIDE.

All Intellimeter milli-Amp current transformers 100:0.8A, 200:0.1A, 400:0.1A and 600:0.1A have self-shorting protection built into the device. They can safely be open circuited while under load.

| | External Current Transformers (CTs) | Twisted Pair #18-14 stranded colour code |
|----|---|--|
| #1 | Intellimeter CTs 100A (ICI30CT108-B) | White (+) Black (-) |
| #2 | Intellimeter CTs 200A (ICI30CT21) | White (+) Black (-) |
| #3 | Intellimeter CTs 400A (ICI30CT41) | White (+) Black (-) |
| #4 | Intellimeter CTs 600A (ICI30CT61) | White (+) Black (-) |
| #5 | Instrument CTs X000:5A + 20 Turn CTs | White (+) Black (-) |

- The maximum length the CT leads can be extended is 30metres.
- 1 twisted pair wire only for each CT.

Rule #2:

Check to verify that the voltage potential used, as a reference voltage, is the same phasing as the loads being metered. ABC is ABC not CBA. The reference voltage must come from the same source. Voltage reference from another transformer is incorrect and causes inaccurate readings.

Connect the voltage reference to the meters disconnect or terminals making sure it is the same phase sequence.

Usually:

Line 1 = Red or 'A' phase
Line 2 = Black or 'B' phase
Line 3 = Blue or 'C' phase
Neutral = White

Note: Colour sequence may vary depending on the country and region.

Rule #3:

When the metering system is tested at Intellimeter's factory, the CT's are assigned to a meter and to a specific element of that meter. The CTs are recommended to be installed and used only with the meter and element that they have been tested with.

Each CT has been identified so it can be easily installed by following the installation drawing that was designed for that particular distribution.

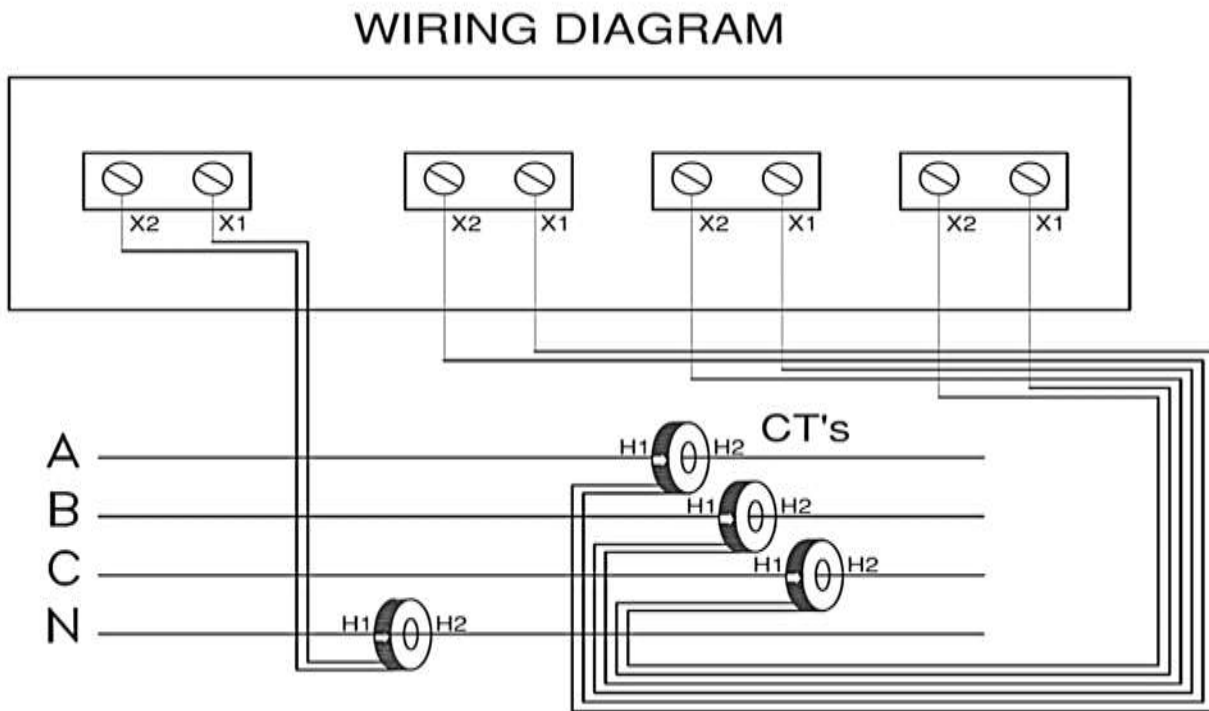
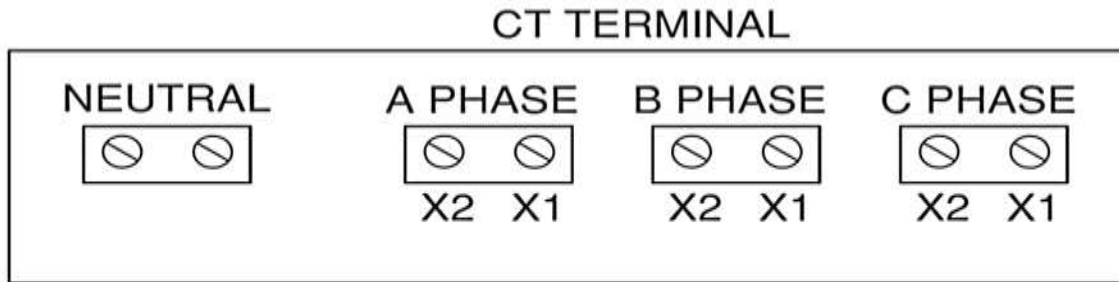
Follow the Installation Drawing! If there is a discrepancy with the drawing in comparison to your distribution panel, call us for assistance.

4. STEPS TO OPERATE THE METER

Step 1: Connect three phase voltage to Voltage Inputs terminals;

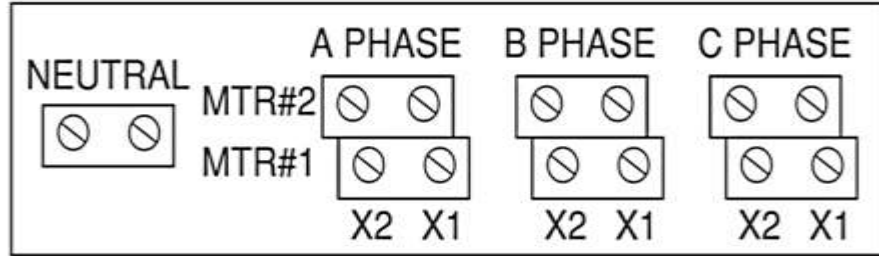
Step 2: Connect all CTs to CT Inputs according to Figures below;

Step 3: Power the meter

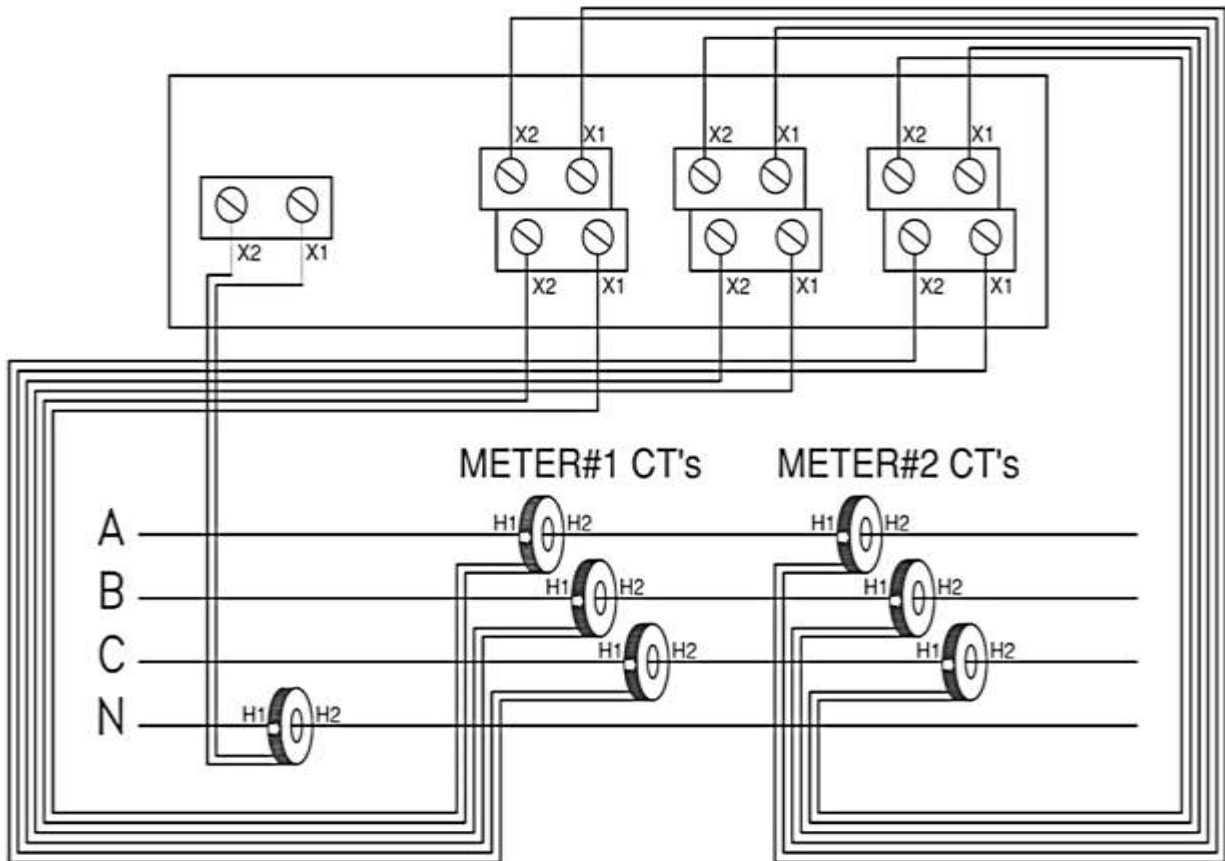


i-meter® MF3 wiring diagram

CT TERMINAL



WIRING DIAGRAM



i-meter® MF6 series wiring diagram

5. CONFIGURATION

The i-meter® MF series meter is a mA meter, which uses any Measurement Canada approved mA current transformers. In order to have the same meter constants, the i-meter® MF series meter must be configured in the factory to match with the CT supplied with the meter. If the requirement changes, the meter will need to be reconfigured at our factory.

6. i-meter® MF SERIES DISPLAY

The i-meter® MF3 and the i-meter® MF6 have a three-line LCD that shows both energy consumption and real-time measurements.



Three-line LCD (3x9 character)

i-meter® MF3 is a single three-phase meter. It displays energy consumptions and instantaneous measurements, such as voltage, current, wattage etc. It is a multifunctional meter. See all screens below.

Note: The “i_meter®1” indicates meter 1 measurements on this screen. The “i_meter45®2” indicates meter 2 measurements on this screen. See below for all display functions.

Screen #1

| ICI | | | ICI | | | i_meter® 123456 \$\$\$ | | | → | ← |
|-----|---|---|-----|---|----|------------------------|---|---|----------|-------|
| 1 | 2 | 3 | 4 | 5 | 6 | 7. | 8 | 9 | k W hL1 | L2 L3 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7. | 8 | 9 | k VAh | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7. | 8 | 9 | L1 L2 L3 | k W |
| 0 | 0 | 0 | 5 | 6 | 7. | 0 | 0 | 0 | L1 L2 L3 | |

- Line 1 – Total kWh
- Line 2 – Total kVAh
- Line 3 – Total kW (Three Phase Watts)

Screen #2

| | | | | | | | | | | |
|-----|---|-----|----------|---|--------|----|--------|---|----|---|
| ICI | | ICI | i_meter® | | 123456 | | \$\$\$ | | → | ← |
| 1 | 2 | 1. | 4 | - | - | 0. | 9 | 5 | V | |
| | | | | | | | | | Pf | |
| | | | | | | | | | L1 | |
| 1 | 2 | 3. | 6 | - | - | 0. | 9 | 2 | V | |
| | | | | | | | | | Pf | |
| | | | | | | | | | L2 | |
| 1 | 2 | 4. | 8 | - | - | 0. | 9 | 8 | V | |
| | | | | | | | | | Pf | |
| | | | | | | | | | L3 | |

- Line 1 – Phase A Voltage – Power Factor
- Line 2 – Phase B Voltage – Power Factor
- Line 3 – Phase C Voltage – Power Factor

Screen #3

| | | | | | | | | | | |
|-----|---|-----|----------|---|--------|---|--------|---|----|---|
| ICI | | ICI | i_meter® | | 123456 | | \$\$\$ | | → | ← |
| 0 | 3 | 1 | 5. | 1 | - | 6 | 0. | 5 | Hz | A |
| | | | | | | | | | L1 | |
| 0 | 2 | 9 | 5. | 7 | - | 6 | 0. | 5 | Hz | A |
| | | | | | | | | | L2 | |
| 0 | 1 | 2 | 6. | 5 | - | 6 | 0. | 5 | Hz | A |
| | | | | | | | | | L3 | |

- Line 1 – Phase A Current – System Frequency
- Line 2 – Phase B Current – System Frequency
- Line 3 – Phase C Current – System Frequency

Screen #4

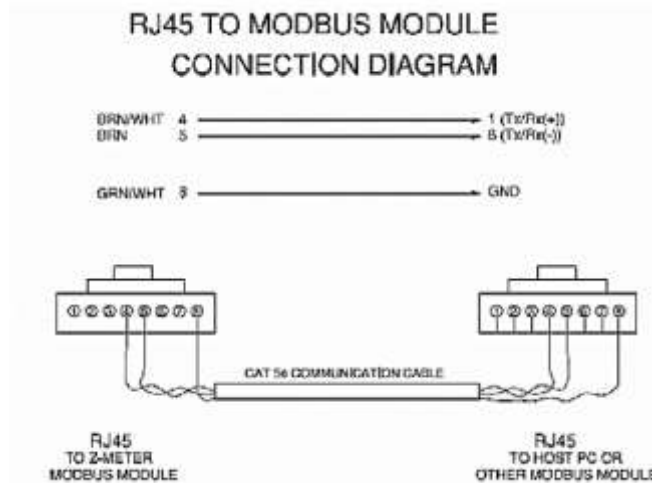
| | | | | | | | | | |
|-----|-----|------------------------|---|---|---|---|----|----------|---|
| ICI | ICI | i_meter® 123456 \$\$\$ | | | | | | → | ← |
| 0 | 3 | - | 1 | 2 | - | 0 | 2 | V | |
| | | | | | | | | % | |
| | | | | | | | | L1 L2 L3 | |
| 0 | 8 | - | 1 | 2 | - | 0 | 2 | A | |
| | | | | | | | | % | |
| | | | | | | | | L1 L2 L3 | |
| n | E | U | L | - | 1 | 0 | 6. | 8 | |
| | | | | | | | | A | |

- Line 1 – Phase A, B and C Voltage THD
- Line 2 – Phase A, B and C Current THD
- Line 3 – Neutral Current

7. i_meter® MF SERIES COMMUNICATION

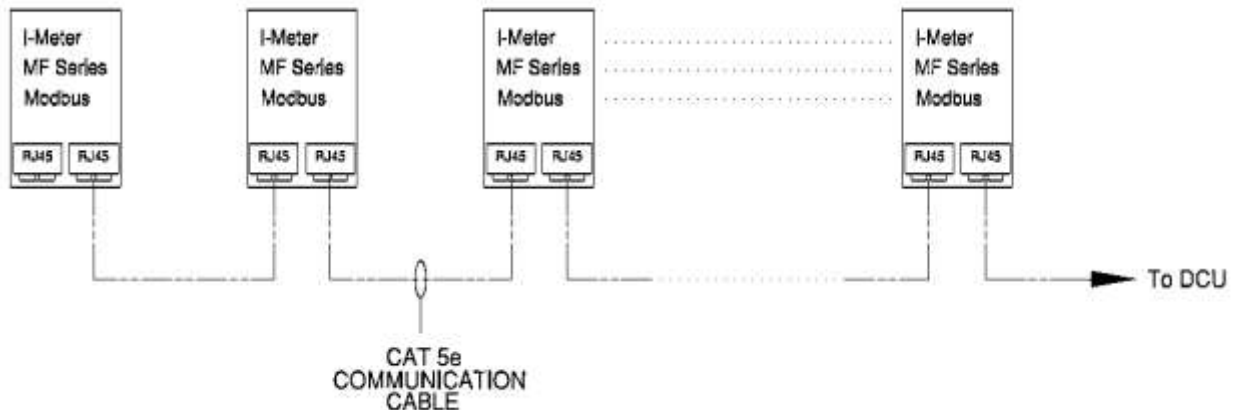
The i_meter®MF series ModBus module enables the meter to communicate on a ModBus system. It presents real time measurements, such as voltage, current, THD etc. The module supports ModBus RTU communication over an RS-485 network. By default, the module communicates at 9600 bps, 8 data bits, no parity and 1 stop bit (8N1). The communication parameters and ModBus ID may be changed through the ModBus registers.

7.1 ModBus Module Connection



RJ45 Connection

i-Meter MF Series Modbus RTU Serial communication Layout



7.2 i-meter® ModBus RTU Registers Mapping

The ModBus module has a plethora of registers that present the metering data, as well as diagnostic information for the module itself. The bulk of the registers are available using the Read Holding Register ModBus command, while the Read Input Registers provides direct read access to the non-volatile memory. The system registers provide general information about the meter and the ModBus module. This information is the identification data and it generally remains constant with the exception of the up time.

Configuration Parameters:

| Modbus Address | Name | Format | Access | Default |
|----------------|--|----------|--------|--------------|
| 40003 | Firmware Version | UINT16 | | |
| 41002 | Address | UINT16 | R/W | 1 |
| 41003 | Baud Rate | Enumated | R/W | 3 = 9600 bps |
| Note | 1. Address - 41002: Changes to the ModBus address takes effect immediately. The next command must use the changed address, otherwise the module will not respond. 2. Baud Rate - 41003: 3 = 9600 bps; 4 = 19200 bps; 5 = 38400 bps; 6 = 57600 bps; 7 = 115200 bps. The Baud Rate takes effect after power cycling. 3. Firmware Version: V4.64 (the same firmware as the i-45) 4. Hardware Version: 101-1357 REV-A | | | |

Meter 1 Information:

| Modbus Address | Name | Format | Unit | Default |
|----------------|--|---------|-------------|---------|
| 41100 | Active Phases | Bit map | x1 | |
| 41101 | Voltage A | UINT32 | x0.001V | |
| 41103 | Voltage B | UINT32 | x0.001V | |
| 41105 | Voltage C | UINT32 | x0.001V | |
| 41107 | Current A | UINT32 | x0.001A | |
| 41109 | Current B | UINT32 | x0.001A | |
| 41111 | Current C | UINT32 | x0.001A | |
| 41113 | Watts A | INT32 | W | |
| 41115 | Watts B | INT32 | W | |
| 41117 | Watts C | INT32 | W | |
| 41119 | Volt-Amp A | INT32 | VA | |
| 41121 | Volt-Amp B | INT32 | VA | |
| 41123 | Volt-Amp C | INT32 | VA | |
| 41131 | Power Factor A | INT32 | 0.001 Units | |
| 41133 | Power Factor B | INT32 | 0.001 Units | |
| 41135 | Power Factor C | INT32 | 0.001 Units | |
| 41143 | kWh | UINT32 | X0.001kWh | |
| 41145 | kVAh | UINT32 | X0.001kVAh | |
| 41149 | Frequency | UINT32 | 0.01 Hz | |
| | | | | |
| Note | <p>1. Active Phases - 41100: 0x0001 - Meter uses phase A; 0x0002 - Meter uses phase B; 0x0004 - Meter uses phase C.</p> | | | |

Meter 2 Information:

| Modbus Address | Name | Format | Unit | Default |
|----------------|---|---------|-------------|---------|
| 41200 | Active Phases | Bit map | x1 | |
| 41201 | Voltage A | UINT32 | x0.001V | |
| 41203 | Voltage B | UINT32 | x0.001V | |
| 41205 | Voltage C | UINT32 | x0.001V | |
| 41207 | Current A | UINT32 | x0.001A | |
| 41209 | Current B | UINT32 | x0.001A | |
| 41211 | Current C | UINT32 | x0.001A | |
| 41213 | Watts A | INT32 | W | |
| 41215 | Watts B | INT32 | W | |
| 41217 | Watts C | INT32 | W | |
| 41219 | Volt-Amp A | INT32 | VA | |
| 41221 | Volt-Amp B | INT32 | VA | |
| 41223 | Volt-Amp C | INT32 | VA | |
| 41231 | Power Factor A | INT32 | 0.001 Units | |
| 41233 | Power Factor B | INT32 | 0.001 Units | |
| 41235 | Power Factor C | INT32 | 0.001 Units | |
| 41243 | kWh | UINT32 | X0.001kWh | |
| 41245 | kVAh | UINT32 | X0.001kVAh | |
| 41249 | Frequency | UINT32 | 0.01 Hz | |
| | | | | |
| Note | 1. Active Phases - 41100: 0x0001 - Meter uses phase A; 0x0002 - Meter uses phase B; 0x0004 - Meter uses phase C. | | | |

Harmonic Distortion :

| Modbus Address | Name | Format | Unit | Default |
|----------------|--------------------------------|--------|-------|---------|
| 47001 | THD (I _A , Meter 1) | UINT16 | 0.01% | |
| 47021 | THD (I _B , Meter 1) | UINT16 | 0.01% | |
| 47041 | THD (I _C , Meter 1) | UINT16 | 0.01% | |
| 47061 | THD (I _A , Meter 2) | UINT16 | 0.01% | |
| 47081 | THD (I _B , Meter 2) | UINT16 | 0.01% | |
| 47101 | THD (I _C , Meter 2) | UINT16 | 0.01% | |
| 47001 | THD (V _A , Meter 1) | UINT16 | 0.01% | |
| 47001 | THD (V _B , Meter 1) | UINT16 | 0.01% | |
| 47001 | THD (V _C , Meter 1) | UINT16 | 0.01% | |
| Note | The THD is for reference only | | | |

Thank you for giving us the opportunity to serve you. We appreciate your business and the confidence you have placed in us.

Please visit us @ <https://intellimeter.ca>
or call us @ 905-839-9199 if you need any further assistance.