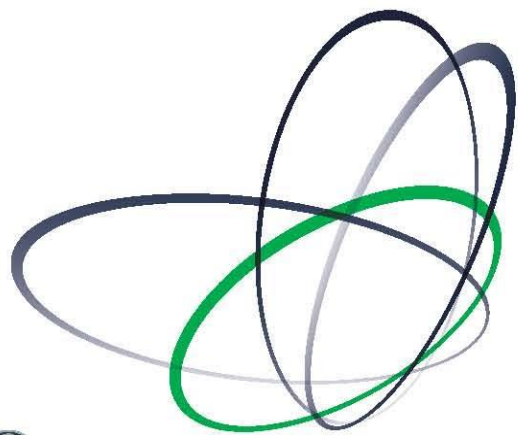


I-METER[®] MF SERIES INSTALLATION AND USER MANUAL



 **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 Current Transformer (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 must 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 (One-3 ϕ meter, with optional neutral current measurement)
- i-meter®MF6 (Two- 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 Multiple Customer Metering System 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 Meter 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_n)	10 Wh per pulse
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 6 (Plus 1 Neutral current input)
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
Operating Temperature	-10°C to +53°C
Pulse Output	Wh / VAh
Communications	ModBus RTU 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)
Patent	U.S. Patent No. 8,049,487
Regulatory Compliance / Approvals	Measurement Canada, cCSA _{us} CTEP (CA)

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

1.3 CT Specifications:

		ICI30CT108-B	ICI30CT21	ICI30CT208
Max current	Primary (A)	100	200	200
	Secondary (A)	0.08	0.1	0.08
Accuracy Class		0.3	0.3	0.3
Standard Burden		B0.005	B0.005	B0.005
Frequency		50/60Hz	50/60Hz	50/60Hz
Voltage Class (VAC)		600	600	600
Overvoltage		CAT IV	CAT IV	CAT IV
Insulation Type		Double	Double	Double
Ambient Rating		18 to 28°C	18 to 28°C	18 to 28°C
Indoor or Outdoor		Indoor	Indoor	Indoor
Altitude		<5000m	<5000m	<5000m
Operating temperature		-40 to +60°C	-40 to +60°C	-40 to +60°C
Humidity tolerance		0-95%	0-95%	0-95%
Pollution Degree		PD 3	PD 3	PD 3

		ICI30CT41	ICI30CT61
Max current	Primary (A)	400	600
	Secondary (A)	0.1	0.1
Accuracy Class		0.3	0.3
Standard Burden		B0.005	B0.005
Frequency		50/60Hz	50/60Hz
Voltage Class (VAC)		600	600
Overvoltage		CAT IV	CAT IV
Insulation Type		Double	Double
Ambient Rating		18 to 28°C	18 to 28°C
Indoor or Outdoor		Indoor	Indoor
Altitude		<5000m	<5000m
Operating temperature		-40 to +60°C	-40 to +60°C
Humidity tolerance		0-95%	0-95%
Pollution Degree		PD 3	PD 3

CTs are Measurement Canada approved and UL listed.

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, Current Transformers 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 meter 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 wiring 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 to protect them from damage during feeder and branch circuit installation. MF series can be provided with a pulse output cable upon request.
- The 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. Install the CTs polarity correctly according to the wiring diagram.
- Carefully read all the WARNING signs and notes. If the equipment is used in a manner not specified by INTELLIMETER, the protection provided by the equipment may be impaired.
- Before installation or removal of the CTs: To reduce the risk of electric shock, always open or disconnect the circuit from the power-distribution system (or service) of the building before installing of servicing current transformers.
- Always use a property-rated, voltage sensing device to confirm that all power is off. Do not exceed the device's rating for maximum limits.
- The current transformers/rails may not be installed in equipment where they exceed 75 percent of the wiring space of any cross-sectional area within the equipment.
- The current transformers/rails shall not be installed in an area where it would block ventilation openings.
- The current transformers/rails shall not be installed in the area of the breaker's arc venting.
- Intellimeter current transformers/rails wiring are not suitable for Class 2 wiring methods nor installed for the communication or signal wiring.
- The current transformers/rails shall be secured and the leads routed so that they do not directly contact live terminals or bus.

- Check the 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.
- ICI milliamp CTs are self-protected but if instrument CTs are used, please do not leave the secondary terminals of the CT open when current is flowing through the primary circuit.
- 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.

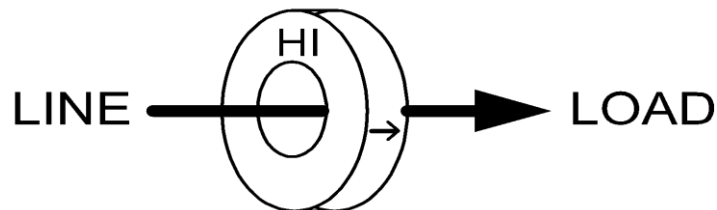
3. OPERATION AND TROUBLE SHOOTING

3.1 Metering Rules

1. Current Transformers (CTs) are directional therefore must be installed in the correct orientation and in the right polarity.
2. Voltage references must be in phase with the load current being metered and must be fed 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 milliamp 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 meter voltage 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.

Intellimeter current transformers are open-type accessory current transformers intended for installation within distribution and control equipment such as panel boards, switchboards, industrial control equipment, and energy monitoring/management equipment. The equipment is permanently connected (via wire leads), for installation into a suitable environmental enclosure. Electrical distributors and contractors use these for their industrial and commercial clients that require high accuracy class current transformers for their service metering.

Intellimeter mA series of Current Transformers are designed to accuracy class 0.3 Measurement Canada has approved them as Revenue Grade mA current transformers and UL listed current transformers.

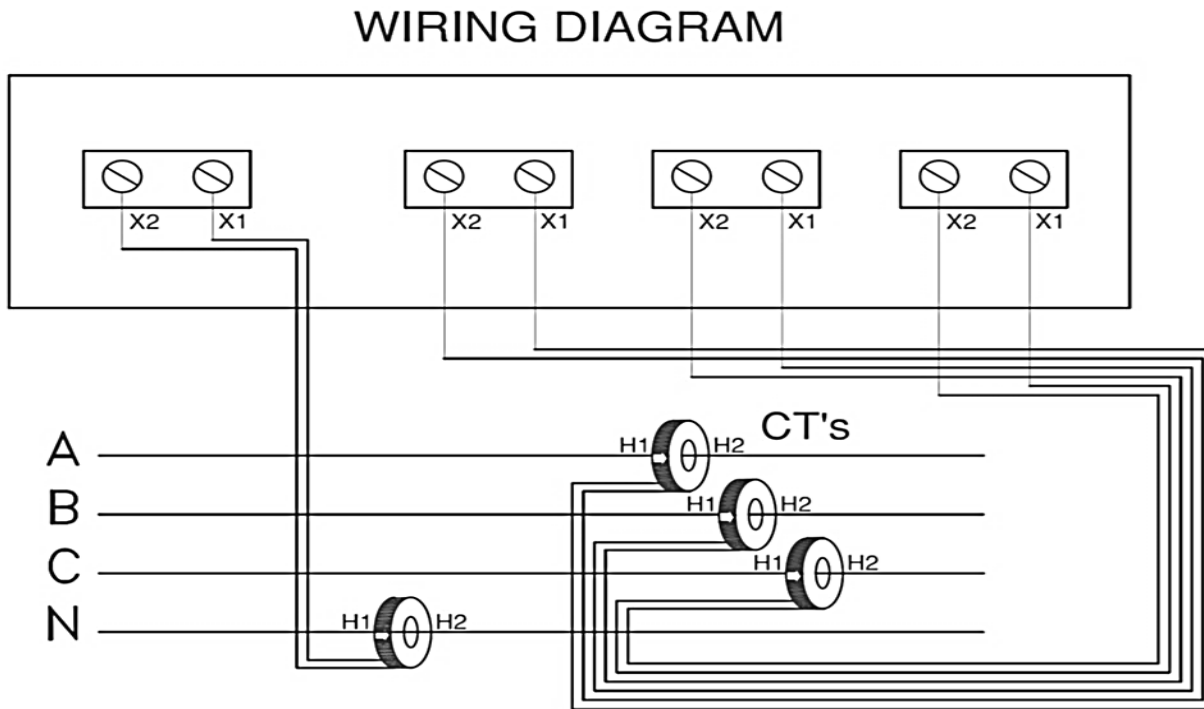
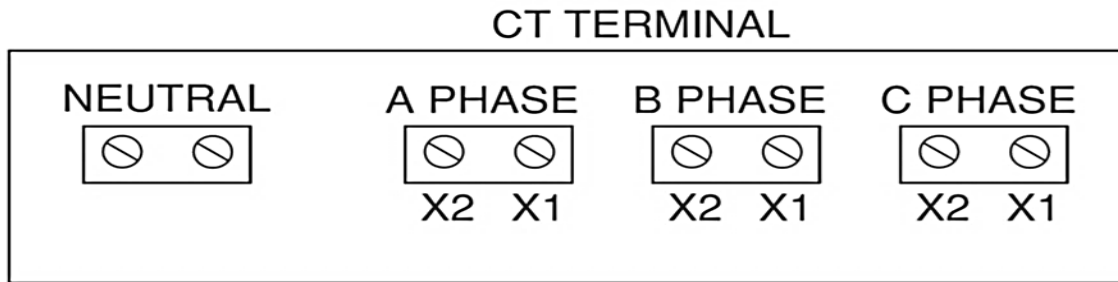
Follow the Installation Drawing! If there is a discrepancy with the drawing in comparison to your distribution panel, call us for assistance.

4. STEPS TO OPERATE THE METER

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

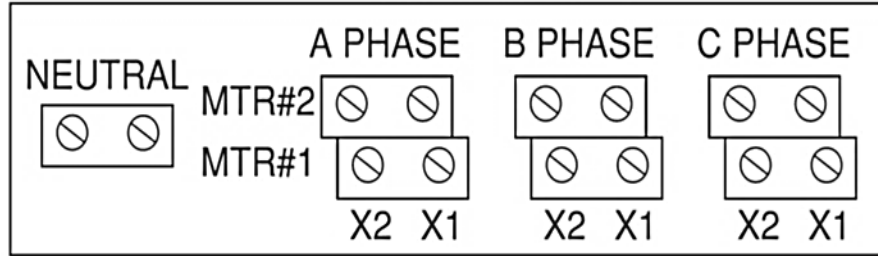
Step 2: Connect all CTs to CT Inputs according to Figures below;

Step 3: Power the meter

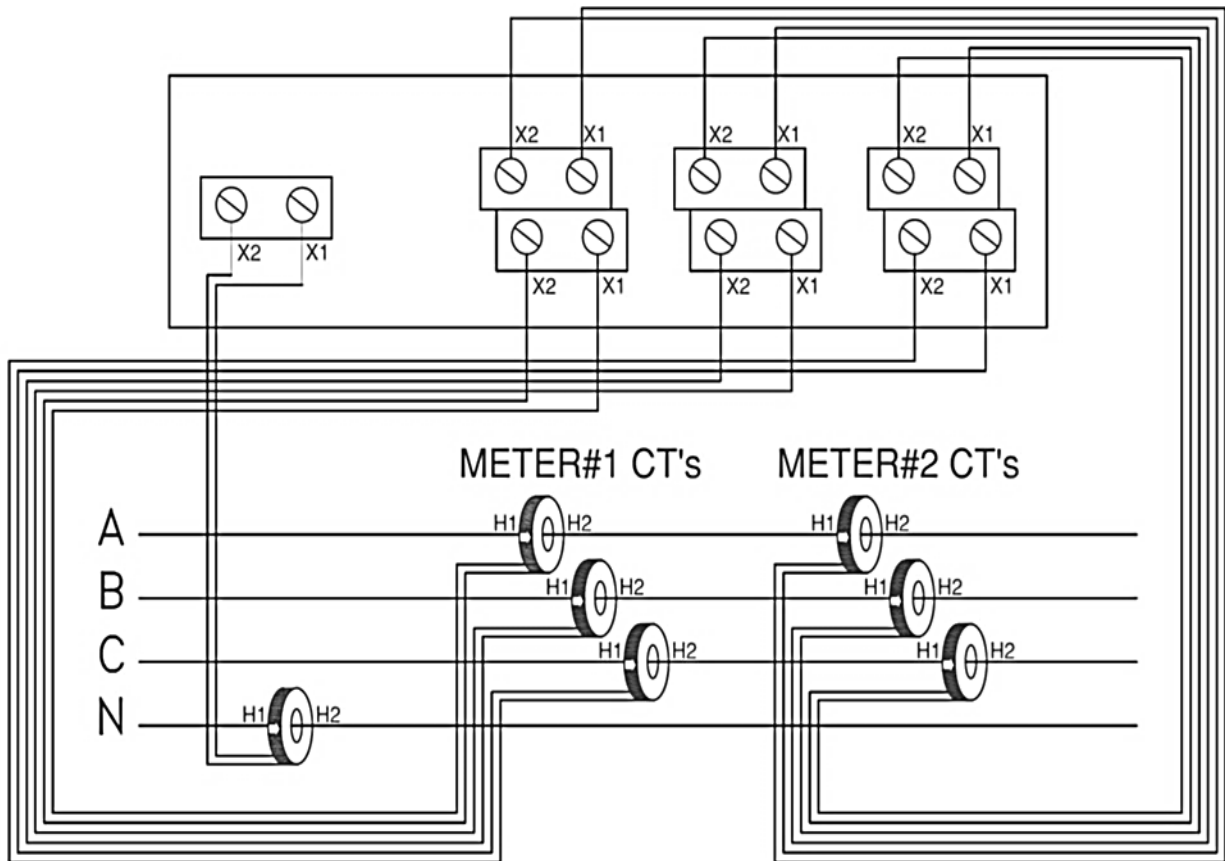


i-meter® MF3 wiring diagram

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_meter®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 h	
									L1 L2 L3	
1	2	3	4	5	6	7.	8	9	k VAh	
									L1 L2 L3	
0	0	0	5	6	7.	0	0	0	k W	
									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

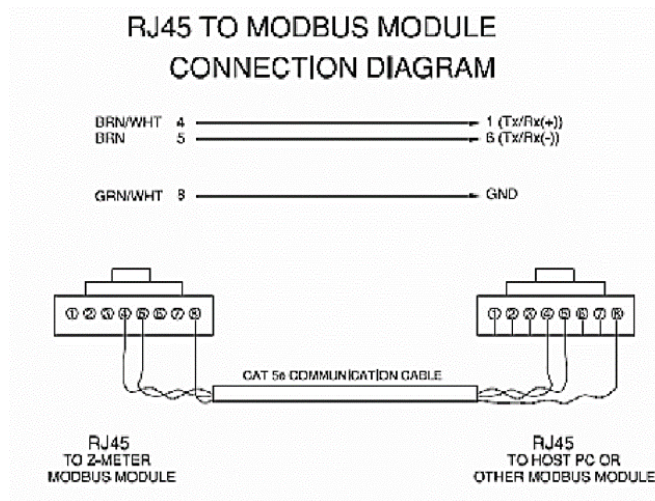
ICI	ICI	i_meter® 123456 \$\$\$						→	←	
	0	3	-	1	2	-	0	2	V	
									%	
									L1 L2 L3	
	0	8	-	1	2	-	0	2	A	
									%	
									L1 L2 L3	
n	E	U	L	-	1	0	6.	8	A	

- 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

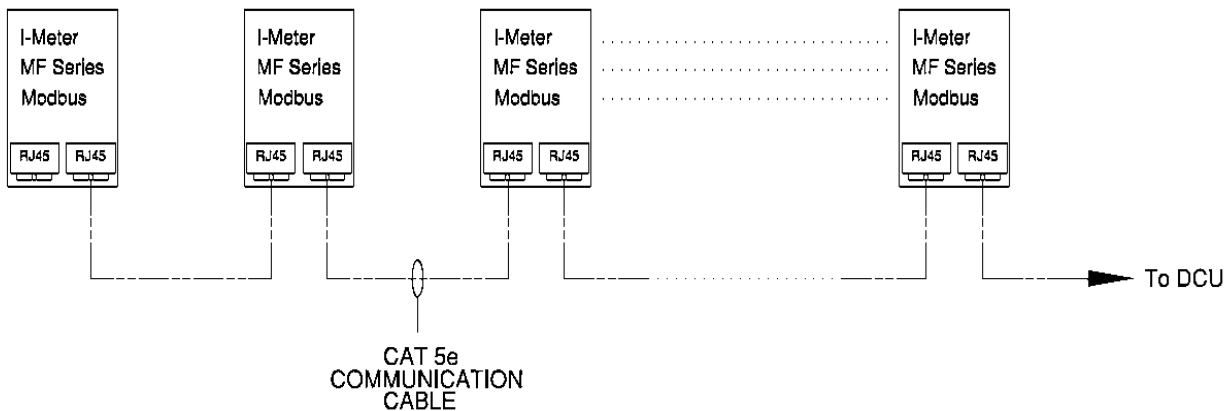
The i-meter®MF series ModBus module enables the meter to communicate on a ModBus system. It presents real time measurements, such as voltage, current, THD etc. The module supports ModBus RTU communication over an RS-485 network. By default, the module communicates at 9600 bps, 8 data bits, no parity 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	<ol style="list-style-type: none"> Address - 41002: Changes to the ModBus address takes effect immediately. The next command must use the changed address, otherwise the module will not respond. 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. Firmware Version: V4.64 (the same firmware as the i-45) 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.com>
or call us @ 905-839-9199 if you need any further assistance.