MICRO CONTROL SYSTEMS

MCS-POWERMETER

Getting Started Manual

Powermeter monitors the voltage, current, power, energy, and many other electrical parameters on single- and three-phase electrical systems.

MCS Total Solution for all your Control Needs

Revision/Disclaimer Page

Date	Author	Description of Changes
10-21/31-2016	DEW	Setup Manual
11-01-16	DEW	Adding setup with USB and RS-485
11-02/03-16	DEW	Update mapping chart from Max
11-04-16	DEW	Update mapping chart for powermeter from max
06-05-18	DEW	Update photos
04-22-19	DEW	Update Meter Setup to include RoCoil
04-24-19	DEW	Changes from John Toney
03-25-21	DEW	Change drawings and EXV driver info

The MCS Commitment is to provide practical solutions for the industries
needs and to be both a leader and partner in the effective use of microprocessor controls.

Micro Control Systems, Inc.

5580 Enterprise Parkway
Fort Myers, Florida 33905
PH:(239) 694-0089   FAX:(239) 694-0031
www.mcscontrols.com

Table of Contents

Chapter - 1.   Introduction

MCS-POWERMETER monitors the voltage, current, power, energy, and many other electrical parameters on single and three-phase electrical systems. A MCS-POWERMETER uses direct connections to each phase of the voltage, and uses current transformers to monitor each phase of the current. Information on energy use, demand, power factor, line frequency, and more are derived from the voltage and current inputs.

The communications interface to the meters is an RS-485 serial connection that uses the BACnet Master Slave Token Passing (MS/TP) protocol or Modbus protocol for sending commands and retrieving data. A separate remote terminal unit (RTU), Data Logger, or Building Management and Control System is usually connected to the MCS-POWERMETER to provide data recording and trend logging plus a human interface or display.

1.1.   MCS-POWERMETER

The MCS-POWERMETER is light-weight and compact enough to mount within an electrical panel. It is used for long-term monitoring of electrical systems.

Up to 127 MCS-POWERMETER serial meters may be connected to a single BACnet MS/TP network for monitoring and recording power usage at multiple locations within a single site. Up to 247 serial meters may be connected to a Modbus RTU network.

There is a configurable digital pulse output port on the MCS-POWERMETER that can be used to output kWh, kVARh, or kVAh pulses to external devices, or to toggle on and off to control a remote device or relay.

1.2.   Unpacking the Unit

Your MCS-POWERMETER comes with documents such as the Certificate of Calibration (COC) that has information about the meter and is valuable for tech support. Be sure to set these documents aside in a safe place when not in use.

If a Comm package was purchased as well, look for the ViewPoint software and the USB adapter. Verify that all connectors are included (CT, voltage, comm, pulse).

DO NOT EXCEED 600V. This meter is equipped to monitor loads up to 600V. Exceeding this voltage will cause damage to the meter and danger to the user. Always use a Potential Transformer (PT) for loads in excess of 600V. The MCS-POWERMETER is a 600 Volt Over Voltage Category III device.

The next few pages are for helping you get started.

For additional information on the MCS-POWERMETER, contact sales@mcscontrols.com

Communication LED

Pulse LED

PhaseChek LEDs

MCS-POWERMETER

MICRO
CONTROL
SYSTEMS

PhaseCh

COM   CT1   CT2   CT3

WARNING: Disconnect all voltages
before servicing
AVERTISSEMENT : Déconnecter
toutes les tensions avant l'entretien

N   L1   L2   L3

ADDRESS   RS-485   CT INPUTS 1 V MAX

80-346 VAC L to Neutral
80-600 VAC L to L CAT III
90 mA 50/60 Hz

Mounting Tab

CT Connections

Voltage Connection

Network Address Switches

Digital Pulse

RS-485

Standard USB (type AB) Connection

Chapter - 3.   Getting Ready

3.1.   Prepping for Field Installation

There are multiple tasks that should be completed before heading to the field, usually by your technical support personnel. These include determining how to communicate with the meter, setting address switches, installing ViewPoint, etc. Communication configuration must be set up in the ViewPoint software even if you use a separate logger to record data. The more tasks completed before installation means less time in the field.

These determinations figure into how you set up the MCS-POWERMETER for operation:

- BACnet vs. Modbus
- Set the network address switches on the meter to either BACnet or Modbus
- RS-485 Communication Protocol
- The type of connection is part of the configuration set up in the ViewPoint software
- Laptop/PC for setup verification via USB

NOTE: Installation of the ViewPoint software and a communication cable should be completed and tested with a meter prior to the field installation. A USB cable can be used when configuring the meter in this manner.

3.2.   Installing Software

The ViewPoint software is designed to let you easily configure the MCS-POWERMETER for different current transformers, check readings, and verify correct setup. The MCS-POWERMETER uses ViewPoint software to communicate with the meter. It needs to be installed on any computer talking to the MCS-POWERMETER.

ViewPoint is compatible with Windows® 7 (32 or 64 bit), Windows® 8, Windows® 10, Vista (32 or 64 bit), or XP.

3.2.1   ViewPoint Software

NOTE: ViewPoint software serves several functions, including setting up a meter, getting real-time values, and read/write registers and objects, but for the purpose of prepping for field installation only three are important to the process:

- Communications
- Meter Setup
- Comms Setup

The other functions are described later in this document.

NOTE: To download the latest MCS-POWERMETER manual and Viewpoint Software;

https://mcscontrols.com/manuals.html

https://mcscontrols.com/software.html#PCTools

3.2.2 Connecting and Communicating Via a Usb or RS-485 Adapter

A type AB USB cable may be used between a PC and a MCS-POWERMETER and is the preferred method for setting up the powermeter with Modbus protocols. The USB cable will also power the meter when connected to a PC. When using a USB cable with a PC, each USB port on the PC generates a unique comm port in the ViewPoint software, such as Com3 or Com4.

NOTE: A USB driver is installed when you install the ViewPoint software.

ViewPoint can read information through a USB and RS-485 isolated COM port. When the RS-485 connection is selected a base address is required (the base address is the rotary switch settings). Address switches are ignored by USB.

The USB connector on the MCS-POWERMETER can be used to power the unit when configuring it using ViewPoint and Modbus protocols.

If connecting with a USB cable is not practical, the use of an RS-485 to USB adapter connected to your PC may be used for communicating with your MCS-POWERMETER. First, install the driver on the computer and then complete the connection between the meter and the computer by plugging the RS-485 connector into the meter.

NOTE: If ViewPoint was installed first, it needs to be restarted following a RS-485 driver installation. If the RS-485 port does not appear in the drop-down list, the RS-485 was not installed correctly.

3.2.2.1. Communications

1. Select USB/RS-485 (MSTP) as your communication type.

2. When connecting with an RS-485, enter a base address that matches the switches on the MCS-POWERMETER. (A USB connection ignores address switches).

3. When connecting with an RS-485, select Modbus or BACnet as your communication protocol. When communicating over USB, whether the power meter is configured for Modbus or BACnet mode, the power meter will communicate over the Modbus protocol.

4. Select the PC COM Port from the drop-down list. For a USB connection, select "COMxx DENT USB" in the field, where "xx" is the port number. For an RS-485 connection using an RS-485 adapter, select COMxx RS-485 Isolated Port (COMxx) where "xx' is the COM port number.

Default settings are used for the two remaining fields: Data Bits is 8N1 and the Baud Rate is 9600.

When BACnet is selected as your protocol an additional read-only field appears displaying the BACnet Device ID.

3.2.2.2.   MCS-POWERMETER Setup

Once communications is established between the PC and the MCS-POWERMETER, you are now ready to configure the meter for the field. This is accomplished in the Meter Setup tab of ViewPoint.
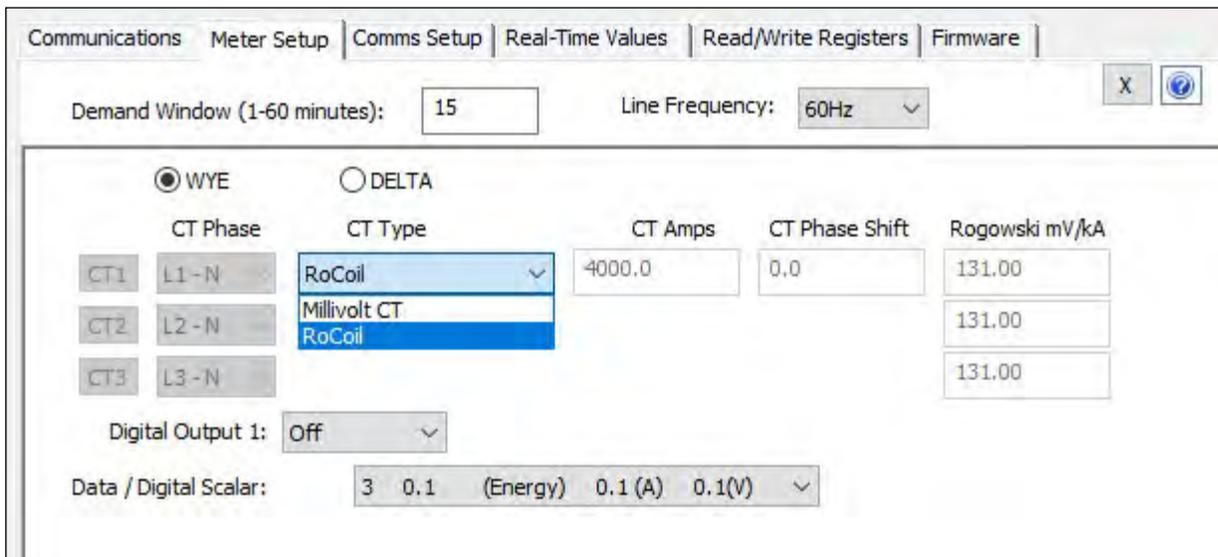
1. Select the 'Demand Window (1-60 minutes) - **example 15 minutes**
2. Select 'Line Frequency' - **example 60Hz**
3. Select 'WYE or DELTA' - **MCS recommends using 3 CTs in a WYE connection for Delta loads.**

A WYE connection automatically displays all three CTs. Any changes made to CT1 also apply to CT2 and CT3.

4. Select the CT Type - **MCS-POWERMETER ships with (3) RoCoils**
5. Select 'Data / Digital Scalar' setting -

Data Scalar	Scalar Value					
	kW/kWh Demand	kVAR/kVARh	kVA/kVAh	Power Factor	Amps	Volts
0	.00001	.00001	.00001	.01	.01	.1
1	.001	.001	.001	.01	.1	.1
2	.01	.01	.01	.01	.1	.1
3	.1	.1	.1	.01	.1	.1
4	1	1	1	.01	1	1
5	10	10	10	.01	1	1
≥6	100	100	100	.01	1	1

Table II-6: Data Scalars and Values for Registers 44001 thru 44061

The data scalar is stored in register 44602. When selecting a data scalar, the following guidelines need to be considered:

- If the data scalar selected is too low, an incorrect data result is returned from the register.
- If the data scalar selected is too high, the significant digits following the decimal point are removed.

After selecting a data scalar, the formula for calculating the actual value is:

register value X scalar value = actual value

Or, another way to state this formula is:

actual value/scalar value = register value

The following table is an example when selecting a data scalar for 3-phase loads based on the CT size or maximum current. These are the minimum recommended scalar settings.

CT Size or Max. Current	3-phase Loads	
	230 volts	460 volts
50	Scalar 1	Scalar 2
100	Scalar 2	Scalar 2
200	Scalar 2	Scalar 2
400	Scalar 2	Scalar 2
600	Scalar 2	Scalar 3
1000	Scalar 3	Scalar 3
3000	Scalar 3	Scalar 3

Table II-7: Data Scalar Selection

Examples Using a Data Scalar

The following examples use kW throughout.

For example 1, the following data is used:

Volts x amps = watts   480 volts x 100 amps = 48,000 watts

Watts x 3 = system watts   48,000 watts x 3 = 144,000 watts (144kW)

Check the register's value using the data scalar 2 value of .01:

System kW / scalar value = register value   144kW/.01 = 14,400

Since 14,400 is less than 65,535, using data scalar 2 is a good choice for this example.

For example 2, the following data is used:

480 volts x 1000 amps = 480,000 watts

480,000 watts x 3 = 1,440,000 watts (1,440kW)

Check the register's value using the data scalar 1 value of .001:

1,440kW/.001 = 1,440,000

Since 1,440,000 is greater than 65,535, using data scalar 1 returns an incorrect result. Data scalar 1 is not an appropriate choice.

Reviewing this example using the data scalar 3 value of .1 provides the following result:

1,440kW/.1 = 14,400

Since 14,400 is less than 65,535, using data scalar 3 is a good choice for this example.

Chapter - 4.   Field Installation

Once your MCS-POWERMETER is set up for the desired communication method and protocol, it's ready to install out in the field.

4.1.   Mounting a MCS-POWERMETER

> ⚠ **WARNING! Remove the meter from all sources of voltage before mounting.**

When connecting the MCS-POWERMETER to an AC load, follow these steps in sequence to prevent a shock hazard.

1. De-energize the circuit to be monitored.

2. Connect the CTs to the phases being monitored.

3. Connect the voltage leads to the different phases. Use proper safety equipment (gloves and protective clothing) as required for the voltages monitored.

MCS-POWERMETER must be installed in an approved electrical panel or enclosure using proper installation practices according to the local electrical codes.

To mount the MCS-POWERMETER, use the two tabs provided at both ends of the case.

Securely mount the MCS-POWERMETER near a dedicated circuit disconnect breaker.

- The MCS-POWERMETER can also be mounted on a 35 mm width DIN rail.
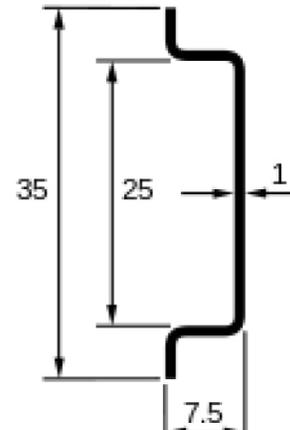
4.2.   Wiring Connections on the MCS-POWERMETER

- USB port for powering the meter and communicating during setup, a three-wire connector for the RS-485 BACnet/Modbus link.
- Digital output port - The port can be used to output kWh, kVARh, or kVAh pulses to external devices, or to toggle on and off to control a remote device or relay.
- Three CT inputs.
- Four voltage connections. - Voltage leads are customer supplied. MCS-POWERMETER are self powered from L1 and L2.

4.3. Completing the Field Installation

- Follow these steps to complete the field installation of your MCS-POWERMETER:
- Connect whatever communications cable you are using to the building network.
- Connect the CTs. See Wiring CTs. Make sure you connect CT1 to CT1 on the MCS-POWERMETER, and so forth.
- Connect the voltage and power the meter. See Connecting Voltage.

> ⚡ High voltage MAY BE PRESENT. Risk of electric shock. Life threatening voltages may be present. Qualified personnel only.
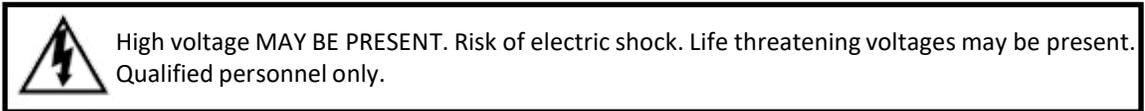
4.4. Modbus Switch Settings

Slave Devices currently pre-programed with current Firmware (new firmware will support 99 different slave devices).

(Firmware version 2.02I or better)

The MCS-MODBUS switch is set to the MCS-POWERMETER, setting #7 in this example.

Setting on the Modbus board,

PROGRAM SELECT CHART

PROGRAM SELECT	CONFIGURATION NAME
0	YASKAWA VFD A1000-HARDWIRED / MODBUS
1	TURBOCOR CMP
2	Reserved for future
3	DANFOSS VLT DRIVE
4	BITZER Compressor
5	DANFOSS CDS 303 DRIVE
6	EMERSON_CSD-100
7	MCS-POWERMETER 3037
8	RUKING_VFD
9	USER
10	ABB AC880
11	EMERSON EVC-1150B
12	SKF/MBC
13	KEB VFD
14	SKF/MBC - TANDEM
15	KEB VFD - TANDEM
16-99	Reserved for future

10's switch each number moves 10

1's switch each number moves 1

Program Type Switch 9 is reserved for 'USER' setup

MODBUS   10's   =   '0'

MODBUS   1's   =   '7'

5.1.   Wiring MCS-ROCOIL-CT's

1. Attach the CTs onto the MCS-POWERMETER connections labeled CT 1, CT 2 and CT 3.

2. Place the CTs on the phase wires of the load to be monitored and corresponding to the phase of the voltage leads. The CT labeled CT 1 must be placed on L1 phase voltage wire, CT 2 must be on the L2 voltage and CT 3 on the L3 voltage. Refer to PhaseChek™ in MCS-POWERMETER manual for information about the CT LEDs and verifying the CT installation.
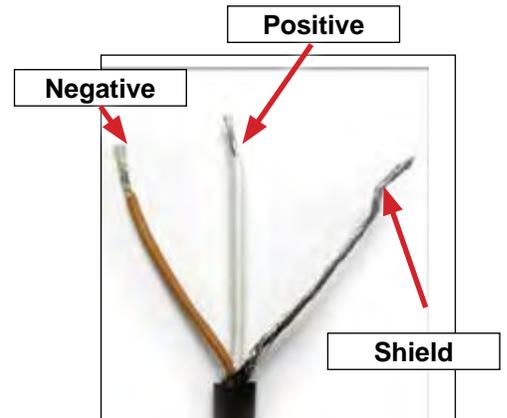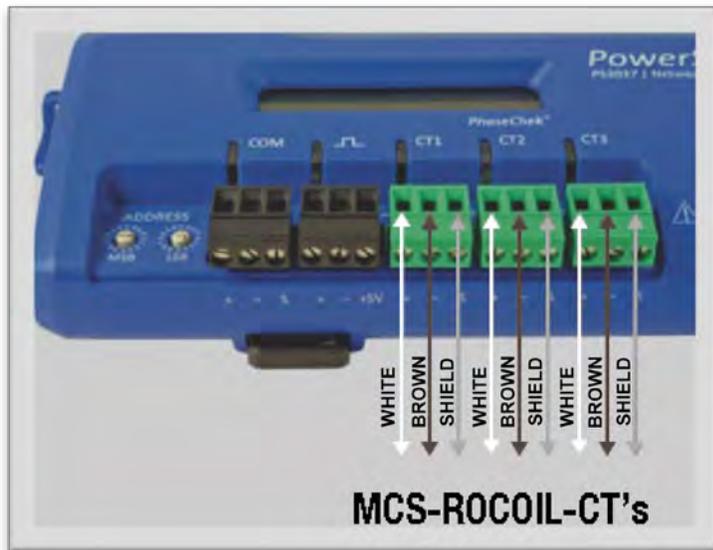
5.1.1   Connect the MCS-ROCOIL-CT's wires

1. Connect the CTs brown wire to the negative terminal on the connector. See photo next page.

2. Connect the CTs white wire to the positive terminal on the connector.

3. Connect the bare shield wire from the MCS-ROCOIL-CT's to the "S" shield terminal that is part of the connector. This reduces interference and improves accuracy of the CT.

5.2. Connecting MCS-ROCOIL-CT's to a Load

To install the MCS-ROCOIL-CT'S to the conductor(s)

1. Open the CT by squeezing the connector latch and pulling it apart.
2. Connect the CT around the load conductor to be measured. Orient the CT so that the arrow on the CT case points towards the load. Make sure the maximum current of the conductor does not exceed 5,000 amps.
3. Push the connector back together with the conductor within the loop of the CT.

Repeat the above three steps for additional **MCS-ROCOIL-CT-R16-A4U**.

5.3. Verifying Installation with PhaseChek

Figure 1
Diagram shows percentage error resulting from position of conductor inside coil for MCS-RoCoil CT

Figure 2
Shows 'CORRECT' POSITION for MCS-RoCoil
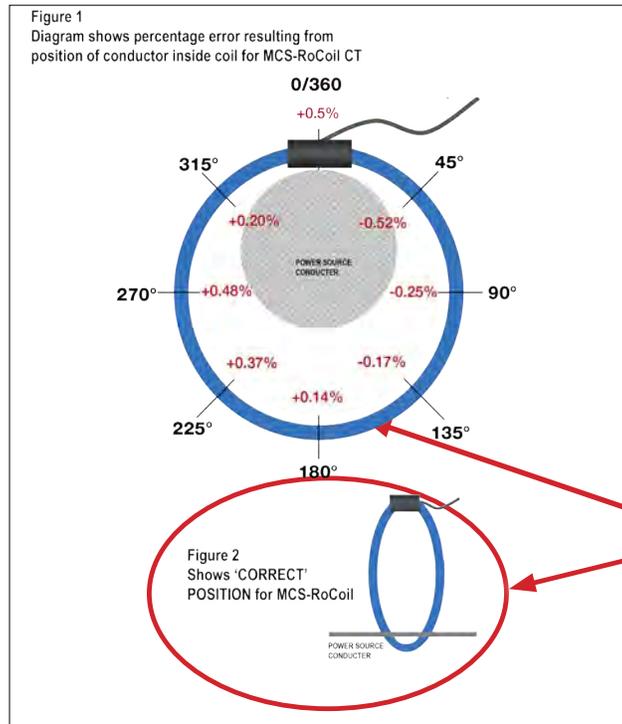
Figure 2 Shows the position for best readings from the CT's 180^0 (connector at top, Load cable wire tied at bottom of CT).

RoCoil Error and Phase Test

Position in Degrees	Output in Amps	MCS-RoCoil Error %	MCS-RoCoil Phase Error	Normalized to Center
0	985.4	-0.12%	0,26	0.51%
45	995.5	0.90%	0.28	0.51%
90	992.84	0.63%	0.27	0.24%
135	992.04	0.55%	0.25	0.16%
180	988.96	0.24%	0.25	0.15%
225	986.7	0.01%	0.26	0.38%
270	985.58	-0.10%	0.25	0.49%
315	988.35	0.18%	0.26	0.21%
CENTER	990.43	0.39%	0.25	0.00%

Table 1. Percentage error measured as function of position of conductor inside coil for 36" MCS- RoCoil CT.

Note that the conductor is at the 0/360 degree position.

PhaseChek1 is a unique feature of the MCS-POWERMETER series instruments that simplifies installation by ensuring proper CT orientation and avoiding faulty data collection.

Verifying the MCS-POWERMETER Setup Using the LEDs

The MCS-POWERMETER uses three bi-color PhaseChek LEDs. These LEDs provide the following information:

- All LEDs are green—the system power factor is greater than 0.55 and the CTs are properly placed on the corresponding voltage phases.
- Any one LED is red—there is a phasing connection error.
- Two LEDs are red and one is green—two CTs are reversed.
- All three LEDs are red—all CTs are incorrectly connected.

CT1	CT2	CT3	Error Description	Correction
● (green)	● (red)	● (red)	CT 2 and CT 3 are reversed.	Switch the position of the CTs flashing red.
● (red)	● (red)	● (green)	CT 1 and CT 2 are reversed.	Switch the position of the CTs flashing red.
● (red)	● (green)	● (green)	CT 1 is swapped with either CT 2 or CT 3.	Switch CT 1 with CT 2. -or- Switch CT 1 with CT 3.
● (green)	● (red)	● (green)	CT 2 is swapped with either CT 1 or CT 3.	Switch CT 2 with CT 1. -or- Switch CT 2 with CT 3.
● (green)	● (green)	● (red)	CT 3 is swapped with either CT 1 or CT 2.	Switch CT 3 with CT 1. -or- Switch CT 3 with CT 2.
● (red)	● (green)	● (red)	CT 1 and CT 3 are reversed.	Switch the position of the CTs flashing red.

6.1. RS-485 Communication

A two wire plus shielded cable is connected between the MCS-MODBUS and the MCS-POWERMETER.
Requires firmware 2.02I or better

Slave Devices currently pre-programed
with current Firmware

MCS-MODBUS-IO-12
To MCS-MAGNUM or MCS Expansion Board   Wiring Diagram
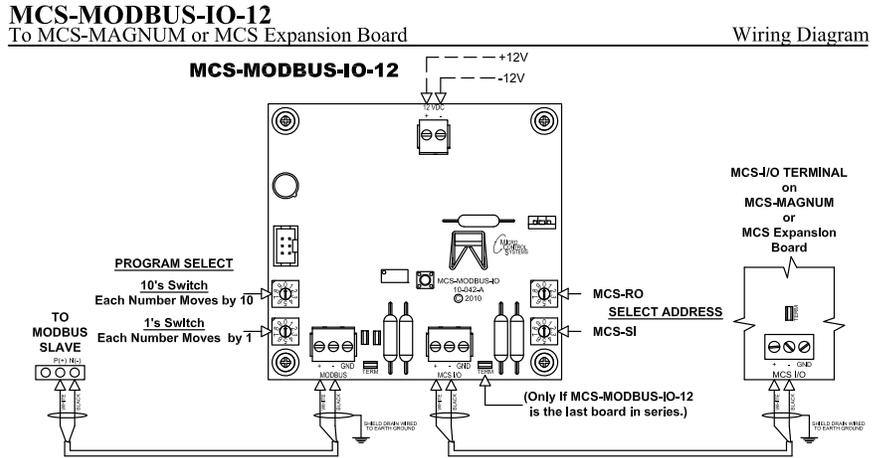
6.2. Address for MCS-POWERMETER and MCS-MODBUS

The address for I/O communication over the RS-485 protocol is set using the
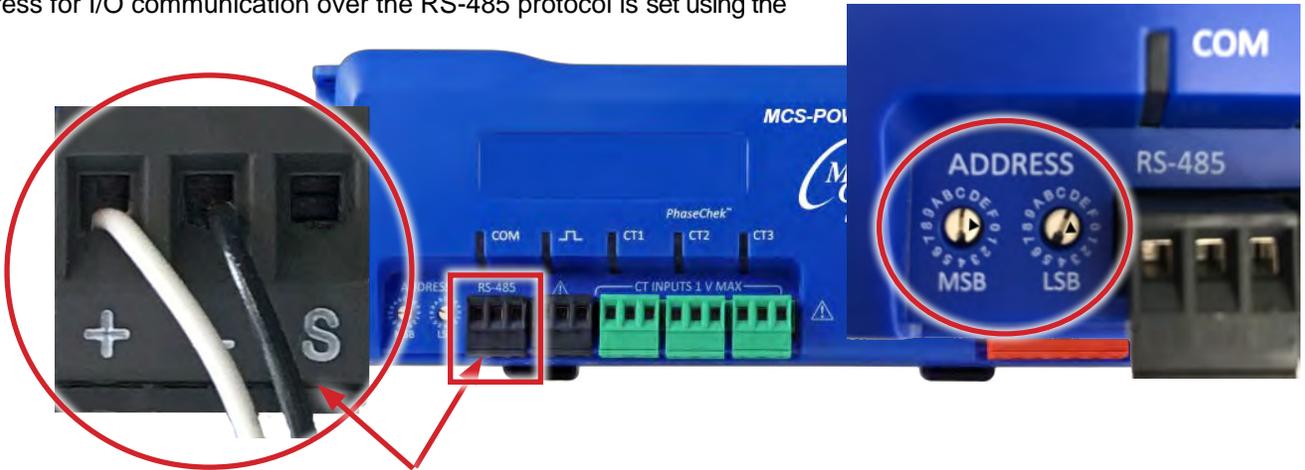
**RS-485 Connection from
MCS-MODBUS**

address switches located on the MCS-POWERMETER. The address must match that of the MCS-MODBUS that is communicating with it.

MSB SWITCH = 0

LSB SWITCH = 1

THE MCS-POWERMETER IS SHIPPED FROM MCS WITH THE <u>DEFAULT ADDRESS SETTING OF 1</u> AS SHOWN ABOVE.

THE ADDRESS YOU USE MUST MATCH THE SETTING ON THE MCS-MODBUS.

Chapter - 7.   Mounting & Power to MCS-POWERMETER

7.1.   Mounting

MCS-POWERMETER mounted on wall in Chiller room. Photo shows wiring and ground to earth ground.

1. Gray wires connect to MODBUS.

2. (3) CT's are wired to C1, C2 and C3 terminals of MCS-POWERMETER.

3. Power wires coming from Transformer (Power in from main power source)

4. White wire grounded to earth ground

7.2.   Installing MC RoCoil's in Chiller room.

NOTE: MCS-RoCoil's should be installed on in-coming power from the power source:

1. **'ARROW ON THE MCS-RoCoil's SHOULD POINT toward the Load'.**

2. SPACING BETWEEN MCS-RoCoil's SHOULD BE A MINIMUM OF ONE INCH APART.

   Photo: shows MCS-RoCoil's more than one inch apart.

The MCS-RoCoil's in the photo are wire tied to the power cable so the position of the MCS-RoCoil is at the optimal reading position for the least amount of errors.

See chart on the page 13.
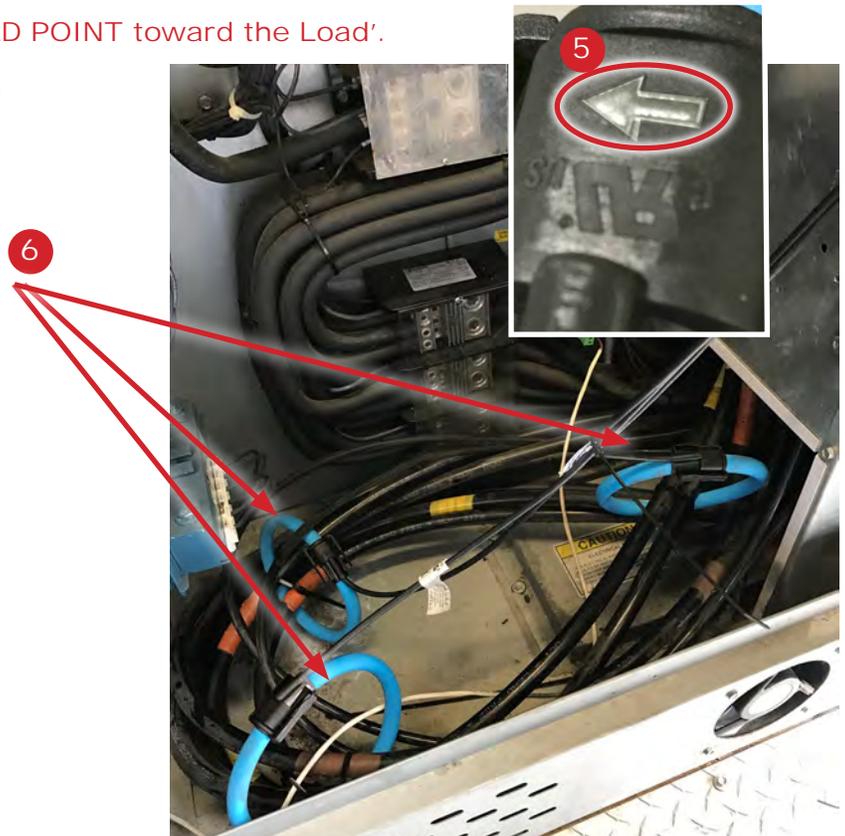
7.3. Connecting Voltage

1. Connect the voltage leads (L1, L2, L3, and N, as necessary) to the meter. A voltage lead of 14 AWG THHN Minimum 600VAC rating (or equivalent in order to maintain 600VAC safety rating of the device) is required.

2. Connect the leads to the POWER SOURCE TRANSFORMER.

   a. Refer to the wiring diagrams for wiring connection specifics. Follow local electrical codes during this installation.

   b. **IMPORTANT:** VERIFY THAT THE METHOD OF POWER DISCONNECT IS SPECIFIED AT THE MCS-POWERMETER.

   c. NOTE: Refer to the Safety Summary in the manual, for information on DC voltage connections.

7.4. Powering the Meter

Connect the MCS-POWERMETER 14 AWG THHN Minimum 600VAC rating (or equivalent in order to maintain 600VAC safety rating of the device) voltage leads as close as possible to a building installed, dedicated circuit disconnect breaker. Mark the breaker as the "disconnect" for the MCS-POWERMETER. Refer to the wiring diagrams for specifics of the wiring connections.

Follow local electrical codes during this installation. MCS-POWERMETER are self-powered from the L1 and L2 lines. When 80–600VAC or DC is placed across the L1 and L2 wires, the three phasing LEDs begin to flash in sequence.

7.4.1 MCS-POWERMETER Single-Phase Connections

The MCS-POWERMETER can be used to monitor single-phase loads. There are several guidelines to keep in mind about this type of connection:

1. The MCS-POWERMETER is powered from a potential between L1 and L2. This can be phase-to-phase (230V) or phase-to-neutral (115V).

2. With a single-phase 230V panel, the L1 and L2 voltage leads are connected between the L1 and L2 voltage sources. With a 115V circuit, the L1 voltage lead is connected to the L1 "hot lead," and the L2 voltage lead is connected to neutral.

3. Each CT must be paired with the correct voltage source. The current and voltage need to be in- phase for accurate measurements. For instance, CT 1 would monitor branch circuit supplied by voltage source L1, and so on.

4. The neutral must be connected because the MCS-POWERMETER uses line-to-neutral measurements for all calculations.

THREE-WIRE DELTA
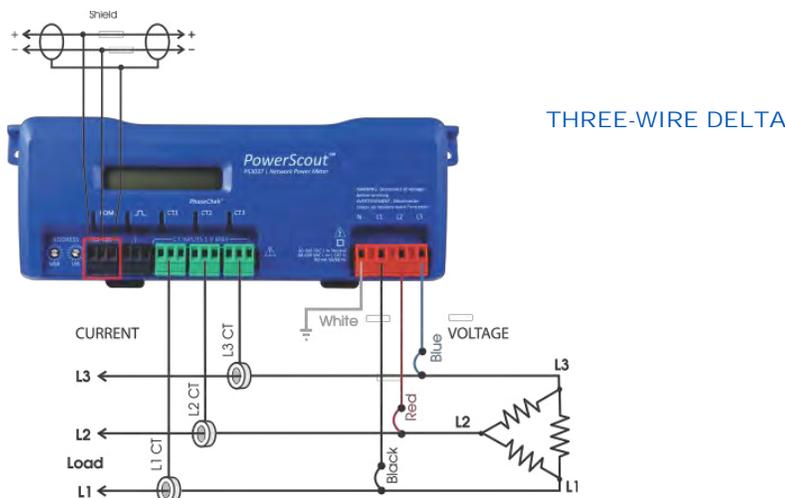
7.4.2 A Typical 230V Single-Phase Panel

Setup (US Wire Colors)

Connect the Black L1 voltage lead to Voltage L1, Red L2 voltage lead to L2 voltage, White Neutral voltage lead to neutral. CT1 would monitor L1 loads and CT2 would monitor L2 loads. Based on the above guidelines, CT3 can be used if the Blue L3 voltage lead is connected to either L1 or L2. As long as voltage lead L3 and CT3 are in-phase, the MCS-POWERMETER will provide correct kW readings. If the Blue L3 voltage lead was connected to L2 voltage source, then CT3 could monitor any L2 branch circuit. Or, if the Blue L3 voltage lead was connected to L1 voltage source, then CT3 could monitor any L1 branch circuit.

7.4.3 A Typical 115V Single-Phase Panel Setup

Connect the Black L1 voltage lead to Voltage L1 (hot), Red L2 voltage lead to Neutral, and White N voltage lead to neutral. CT1 would monitor the L1 load. CT3 can be used if the Blue L3 voltage lead is connected to L1. CT3 could then monitor any L1 branch circuit.

7.4.4 System Values

System values are the sum of L1 + L2 + L3 measurements. System values may not be meaningful since two different devices or loads can be monitored by a single MCS-POWERMETER element.

When paired with the right voltage phase, each CT provides individual kW/kWh readings for that CT channel.
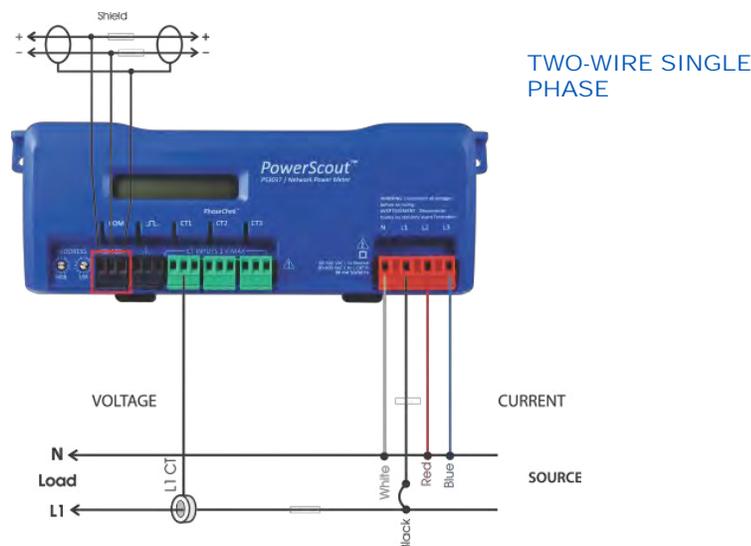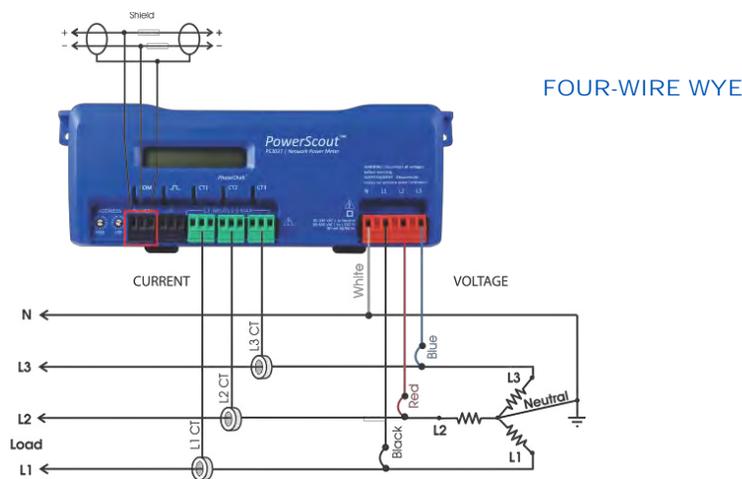
FOUR-WIRE WYE

TWO-WIRE SINGLE PHASE

Once communications is established between the PC and the MCS-POWERMETER, you are now ready to configure the meter for the field. This is accomplished in the Meter Setup tab of ViewPoint.

The Meter Setup screen allows unique changes to an element on the powermeter. Within the element, CT Phase, Type, Amps, and Phase Shift are entered, based on wiring connection, for CT1, CT2, and CT3. The type of wiring connection and the Digital Output are also entered for the element. Overall, a Demand Window of 1–60 minutes is available for the recording of values and a Line Frequency of 50 Hz or 60 Hz is selectable. Also, the Volts Multiplier field can be altered when used with a step-down transformer to allow the meter to record values as if it was connected to a higher than 600V source.

NOTE: In MCS-POWERMETER the Peak Demand is calculated using a moving window and is averaged across the selected demand window size. Each minute the total consumption is recalculated and compared to the last demand window. If the new window is larger than the last recorded value it is recorded. This value is calculated during the sampling of the waveform.

The Meter Setup screen is blank when first accessed. Click Retrieve Meter Setup to view the current status of the element. The Element Status dialog box displays while the element is read.

8.1. Entering Wiring Information for an Element

Begin setup by entering an amount of time (1-60 minutes) into the Demand Window and selecting a Line Frequency from the drop-down list.

Use the following steps within an element:

1) Select WYE as the wiring connection.

NOTE: MCS recommends using 3 CTs in a WYE connection for Delta loads.

- A WYE connection automatically displays all three CTs. Any changes made to CT1 also apply to CT2 and CT3.
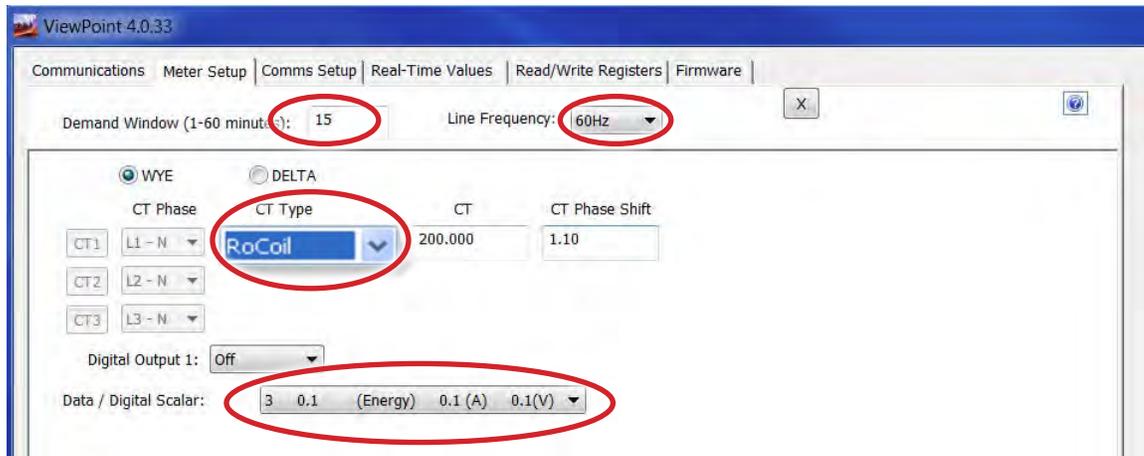
2) Depending on the wiring connection, make changes to CT1, CT2, and/or CT3.

- CT Phase—Shows the voltage of the referenced CT
- CT Type—Use the drop-down list to select the type of CT attached to the MCS-POWERMETER.
- CT Amps—Enter the amperage rating.
- CT Phase Shift—Enter in degrees the phase shift of the CT. The default is 1.1.

Current Transformers	Recommended CT Phase Shift Values
CT-R16-A4U	+0.15%

Chapter - 9.   USER - Custom Setup

9.1.   Connecting using MCS-CONNECT

The MCS-MODUBS I/O has 9 'PROGRAM SELECT SWITCHES', 14 slave devices have been pre-programmed into the firmware for common slave devices as shown in the chart below. Number 9 has been set aside for 'USERS' to setup custom configurations for slave devices that have not been pre-programmed.

PROGRAM SELECT CHART

PROGRAM SELECT	CONFIGURATION NAME
0	YASKAWA VFD A1000-HARDWIRED / MODBUS
1	TURBOCOR CMP
2	Reserved for future
3	DANFOSS VLT DRIVE
4	BITZER Compressor
5	DANFOSS CDS 303 DRIVE
6	EMERSON_CSD-100
7	MCS-POWERMETER 3037
8	RUKING_VFD
9	USER
10	ABB AC880
11	EMERSON EVC-1150B
12	SKF/MBC
13	KEB VFD
14	SKF/MBC - TANDEM
15	KEB VFD - TANDEM
16-99	Reserved for future

10's switch each number moves 10

1's switch each number moves 1

Program Type Switch 9 is reserved for 'USER' setup

Open MCS-CONNECT and enter the information from the slave devices that you will be communicating with.

The information concerning the 'Registers' that you want to read or write to comes from the manufacture of the device.

9.2.   Data Input

When MSC-Connect opens, the screen will display the service panel setup and the registers that MCS-CONNECT will read from the MCS-POWERMETER.

9.2.1   Service Panel-MCS-CONNECT

Service Panel

ModBus Connection Setup

Baud Rate	9600
Parity	No Parity
Stop Bits	1
Poll Delay (ms)	20
Poll Timeout (ms)	600

Transmit to ModBus

Send Changes
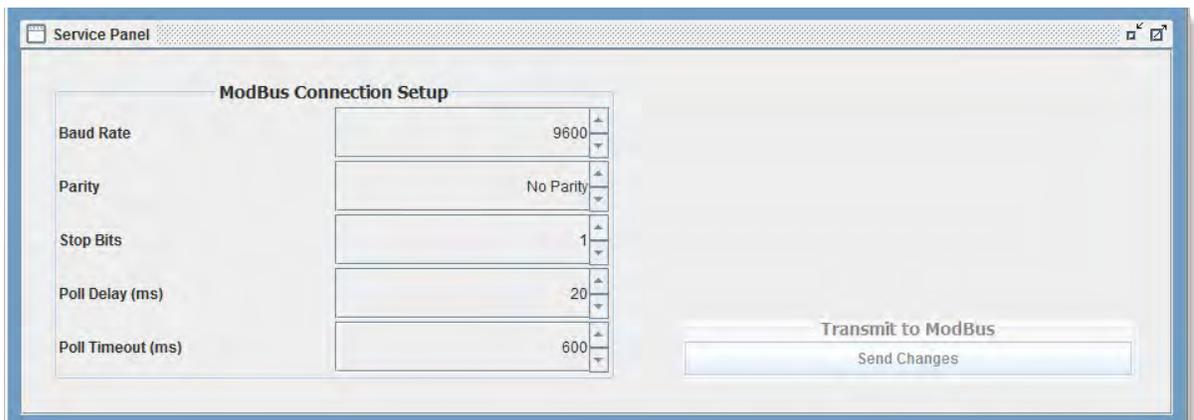
This window block is to setup the MCS-ModBus I/O communication port parameters for the slave devices.

Refer to your slave device User Manual for details about the correct values to setup the communication port.

- **Baud Rate: In this field enter the Device communication Baud Rate.**
- **Parity bit: In this field enter the Device communication Parity Bit.**
- **Stop Bit: In this field enter the Device communication Stop Bit.**
- **Poll Delay (ms): This is for future use and is not yet implemented.**
- **Poll Timeout (ms): This is for future use and is not yet implemented.**

This window block is to configure the following ModBus options:

- **Node Address** (Slave Address): In this column enter the Device slave address that identifies the specific device in the network.

- **Register Number** (Data Address): In this column enter the register address that you need to read to.

- **Function** (Function Code): in this column you will find the following options:
  - Read Single Coil: Read Discrete Output Coils.
  - Read Single Register: Read Analog Output Holding Registers.
  - Read input Register: Read Analog Output Registers.

- **Special** (Data type): In this column you will find the following options:
  - **Read Single Bit:** Use this special in combination with the Bitmask to read specific status bit.
  - **Read High:** Some manufacturer implemented Modbus in their equipment to store and transmit the higher byte first followed by the lower byte.
  - **Read Low:** Alternatively to previously mentioned other manufacturer store and transmit the lower byte first.
  - **Floating LSB** (least significant byte**)** or **Floating MSB** (most significant byte**):**
    Some devices support 32 bit floating point values that are encoded according to IEEE Standard 754. Those devices required two 16-bit addresses to hold a 32-bit float value. In this case it is also necessary to select 2 registers in the #Register column.

- **Bitmask:** The Bitmask is used to easily check the state of individual bits regardless of the other bits.

Example: Let's use the Drive Status (U1-12 Register) of the VFD YASKAWA AC Drive-A1000 HHP

In this example let say that we want to know if the Driver is running (bit 0), also we want to check for fault detection (bit 8). The bit mask in binary should look like this 10000001, this value has to be converted to hex to enter the value in the Bitmask column, so the value to be entered will be 0x81.

- **Multiplier:** This value is used to display the value with the decimal place moved to the right.
- **Divider:** This value is used to display the value with the decimal place moved to the left.
- **Math offset:** use this value if an offset is need to display the adjusted value.
- **#Register:** enter the number of consecutive registers that you want to read.

9.2.2 Read Sensor Inputs

#	Node Address	Register Number	Function	Data Type	Bitmask	Multiplier	Divider	Math Offset	#Registers
1	1	4003	(R) Hold Registers	Not Used	65535	1	1	0	1
2	1	4004	(R) Hold Registers	Not Used	65535	1	1	0	1
3	1	4005	(R) Hold Registers	Not Used	65535	1	1	0	1
4	1	4015	(R) Hold Registers	Not Used	65535	1	1	0	1
5	1	4056	(R) Hold Registers	Not Used	65535	1	1	0	1
6	1	4057	(R) Hold Registers	Not Used	65535	1	1	0	1
7	1	4058	(R) Hold Registers	Not Used	65535	1	1	0	1
8	1	4019	(R) Hold Registers	Not Used	65535	1	1	0	1
9	1	4020	(R) Hold Registers	Not Used	65535	1	1	0	1
10	1	4021	(R) Hold Registers	Not Used	65535	1	1	0	1
11	1	4001	(R) Hold Registers	Power Mtr	65535	1	1	0	1
12	1	0	(R) Not Used	Not Used	65535	1	1	0	1
13	1	0	(R) Not Used	Not Used	65535	1	1	0	1
14	1	0	(R) Not Used	Not Used	65535	1	1	0	1
15	1	0	(R) Not Used	Not Used	65535	1	1	0	1
16	1	0	(R) Not Used	Not Used	65535	1	1	0	1

This window displays the Read Sensor registers that MCS-CONNECT is receiving from the MCS-POWERMETER.

MODBUS MAPPING DETAILS
MCS-POWERMETER

VDF Parameter No.	Parameter Description	Setting Descrip.	Setting Value
	Address	1	
	Baud Rate	9600	
	Parity / Stop Bits	No Parity	
	Number of Stop Bits	1	

These Parameters need to be programmed in the **MCS-POWERMETER** before it will accept the control word from the MCS-Modbus Drive.

After these changes have been made shut the power off and wait until the display on the digital operator goes out completely.

Turn the power back on to accept the changes after the setup.

MCS-MAGNUM POINTS

AO #	RO #	SI #	SI Display Type	Modbus Display Type	SI Multiplier Setting	SI Divisor Setting	SI Offset Setting	Range	AO Control Type	Additional Info	VDF Parameter Display	Points Description	Type Read	Type Write	Modbus Register	Conversion Factor	UNITS	Data Type
												Writable Point						
												Readable Points						
		1	Modbus		1	1	0	N/A				KW SYSTEM AVERAGE			4003			Int16
		2	Modbus		1	1	0	N/A				KW PEAK			4004			Int16
		3	Modbus		1	1	0	N/A				KW DEMAND			4005			Int16
		4	Modbus		1	1	0	N/A				KW APPARENT POWER FACTOR			4015			Int16
		5	Modbus		1	1	0	N/A				AMPS L1			4056			Uint32
		6	Modbus		1	1	0	N/A				AMPS L2			4057			Uint32
		7	Modbus		1	1	0	N/A				AMPS L3			4058			Uint32
		8	Modbus		1	1	0	N/A				VOLTS L1			4019			Uint32
		9	Modbus		1	1	0	N/A				VOLTS L2			4020			Int32
		10	Modbus		1	1	0	N/A				VOLTS L3			4021			Uint16
		11																
		12																
		13																
		14																
		15																
		16																

Micro Control Systems

Providing HVAC/R Control Solutions Worldwide

5580 Enterprise Pkwy. Fort Myers, FL 33905
Office: (239) 694-0089
Fax: (239) 694-0031
www.mcscontrols.com