MicroMG/Micro100 GAS OPERATORS MANUAL

Flow Computer
Gas Version

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Date: 9/28/2022

WARRANTY

Dynamic Flow Computers warrants to the owner of the Smart Flow Computer that the product delivered will be free from defects in material and workmanship for one (1) year following the date of purchase.
This warranty does not cover the product if it is damaged in the process of being installed or damaged by abuse, accident, misuse, neglect, alteration, repair, disaster, or improper testing.
If the product is found otherwise defective, Dynamic Flow Computers will replace or repair the product at no charge, provided that you deliver the product along with a return material authorization (RMA) number from Dynamic Flow Computers.
Dynamic Flow Computers will not assume any shipping charge or be responsible for product damage due to improper shipping.

THE ABOVE WARRANTY IS IN LIEU OF ANY OTHER WARRANTY EXPRESS IMPLIED OR STATUTORY. BUT NOT LIMITED TO ANY WARRANTY OF MERCHANTABILITY, FITNESS FOR PARTICULAR PURPOSE, OR ANY WARRANTY ARISING OUT OF ANY PROPOSAL, SPECIFICATION, OR SAMPLE.
LIMITATION OF LIABILITY:
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Date: 9/28/2022

CHAPTER 1: QUICK START

Introduction:

The MicroMG Gas Flow Computer was designed after careful listening to our customers in all sectors of the oil and gas industry. It was built to address the different needs for refineries, chemical plants, gas processing plants, offshore platforms, pipeline and transmission, remote gas wells, and storage caverns. The focus has been to bring the different needs and requirements of these specialized industries into one hardware platform and therefore reducing the spare parts requirements, the training process, calibration, and overall cost of ownership. We believe the MicroMG Gas Flow Computer has delivered and met the design intentions.

The MicroMG Flow Computer combines the following features:

- One Minute Integral Multiplier Period as per API chapter 21.1
- User Friendly
- Flexible
- Easy to understand and configure
- Rugged
- Economical to install and maintain
- Accurate

We hope that your experience with the MicroMG Flow Computer will be a simple pleasant experience, not intimidating in any way.

The MicroMG Flow computer handles up to two meter runs. It includes the following mass flow equations: New API14.3, Venturi, Annubar, turbine (AGA7), and V cone meter. Additionally, it can perform density calculations per these standard procedures: AGA8, NX19 for gas, NBS1048 for hydrogen and oxygen, NBS for steam, NBS1045 for ethylene, saturated and superheated steam tables, and other tables are added constantly, call our main office for current equations

One multi-variable digital transducers can be connected to each MicroMG flow computer for temperature, pressure (up to 3626 PSIG), and DP (up to 830 inches H_2O). Other multivariable transmitters can be connected to the MicroMG Flow Computer via RS485 serial interface. Up to four meter runs can be stored and calculated in a single MicroMG flow computer. The 2nd RS485 is used as a slave or a master Modbus port for data acquisition and other serial functions.

The MicroMG flow Computer has a host of inputs and outputs beyond the built in Multi Variable transmitter.

Three turbine inputs (Sine or Square wave), 70 mV peak to peak or sine wave 6 volts, or lighter on square wave

Four additional analog inputs, or two analog inputs and one three wire RTD inputs

One analog output expandable to four

One RS232 and two RS485 with Modbus protocol, and one additional serial printer output

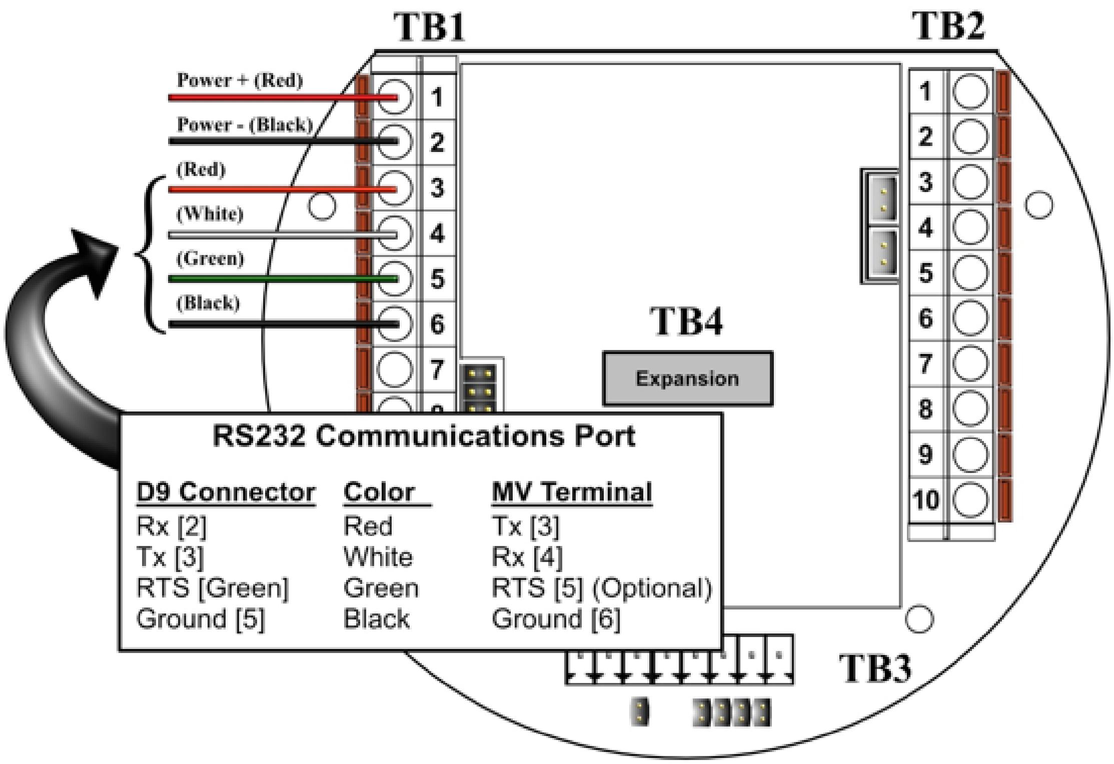
4 status inputs or digital outputs (user configurable).

Additionally, each MicroMG Flow Computer can store up to 50 days daily and 40 days hourly data.

Quick Start Up -

Version 2 - MicroMV Main/Memory Boards (Micro2009 and Later Model)

Main Board

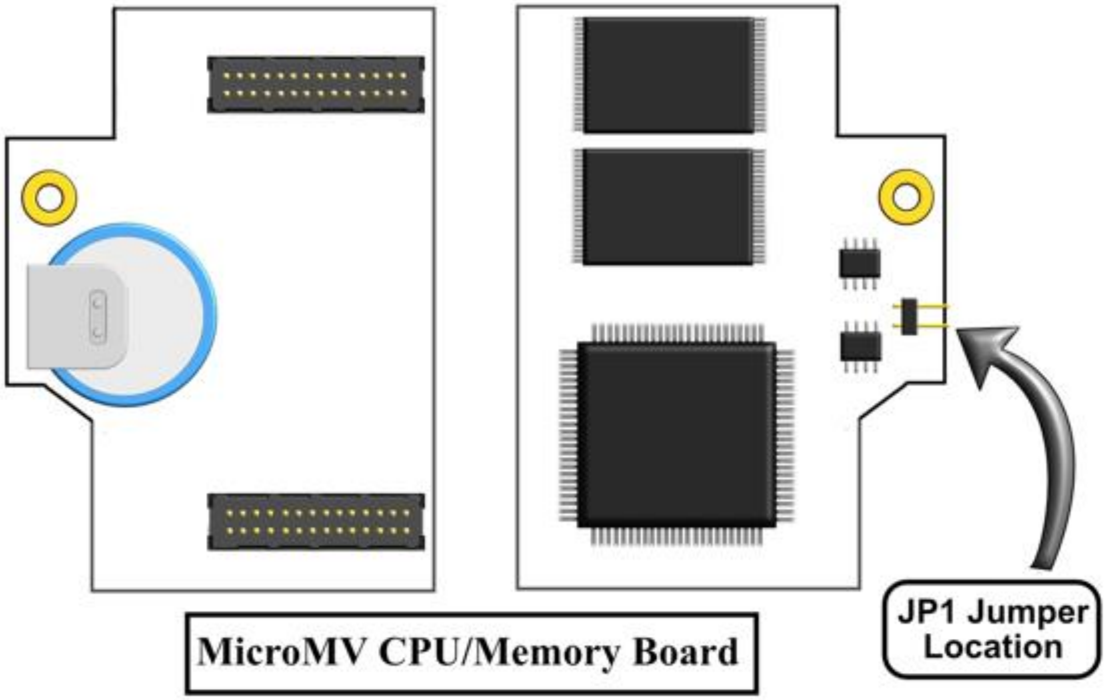


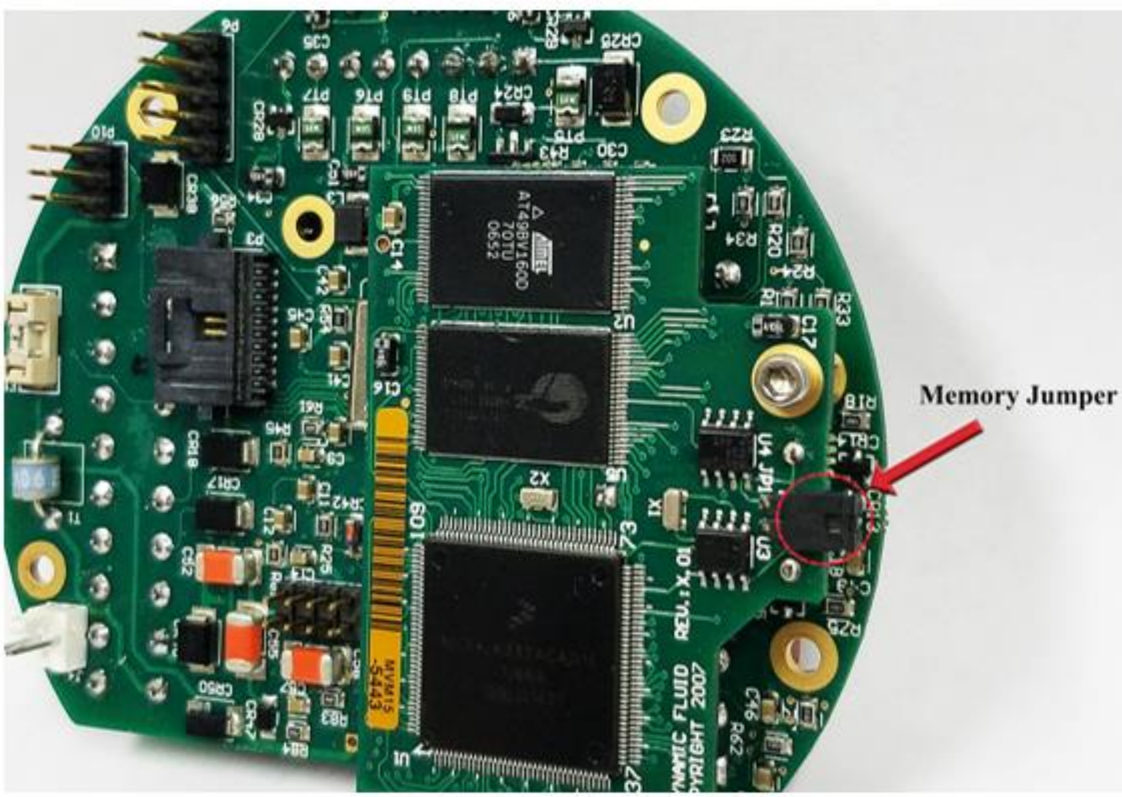
MV Step by Step Startup:

1. Connect power supply cable
2. Connect RS-232 Communications
3. Ensure jumper JP1 is installed on memory board
4. Energize power supply (24 Volts Recommended)
5. Verify display comes on
6. Run DFC Software
7. Configure the Micro MV device

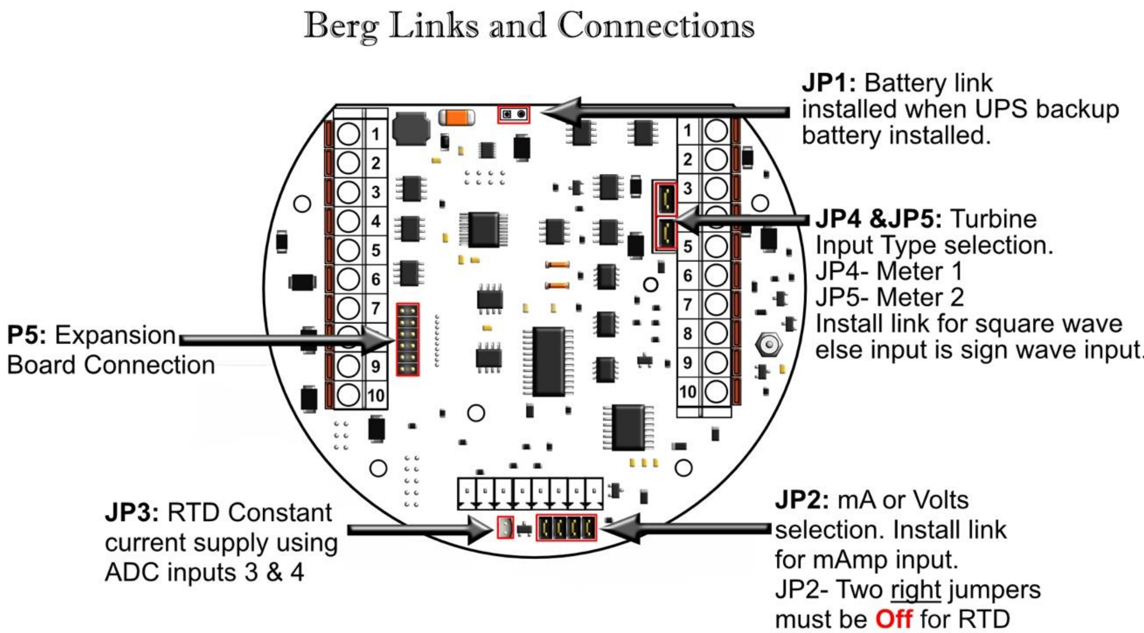
Version 2 - MicroMV Main/Memory Boards (Micro2009 and Later Model)

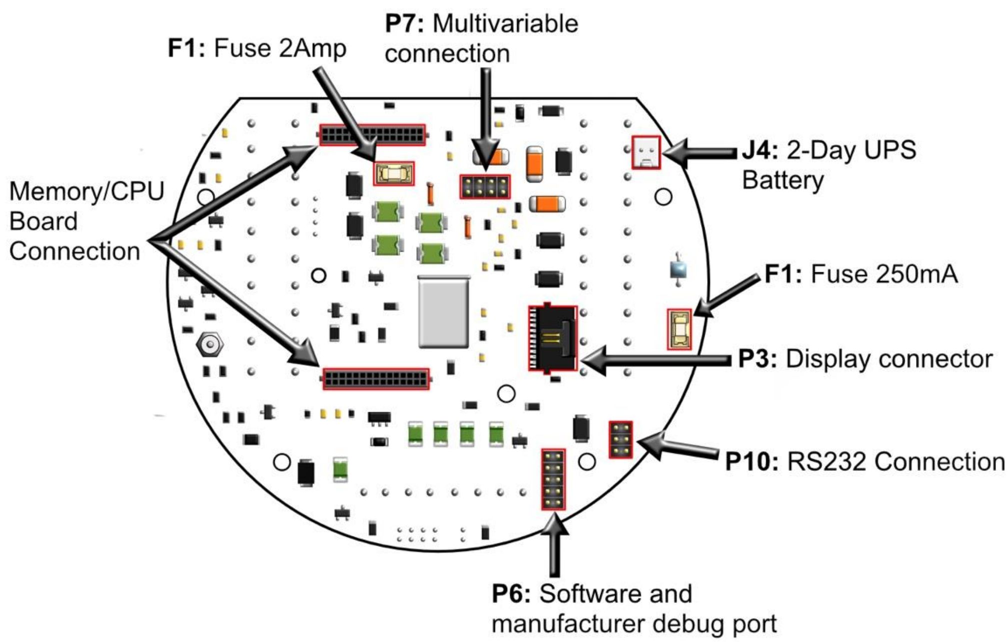
Memory/CPU Board



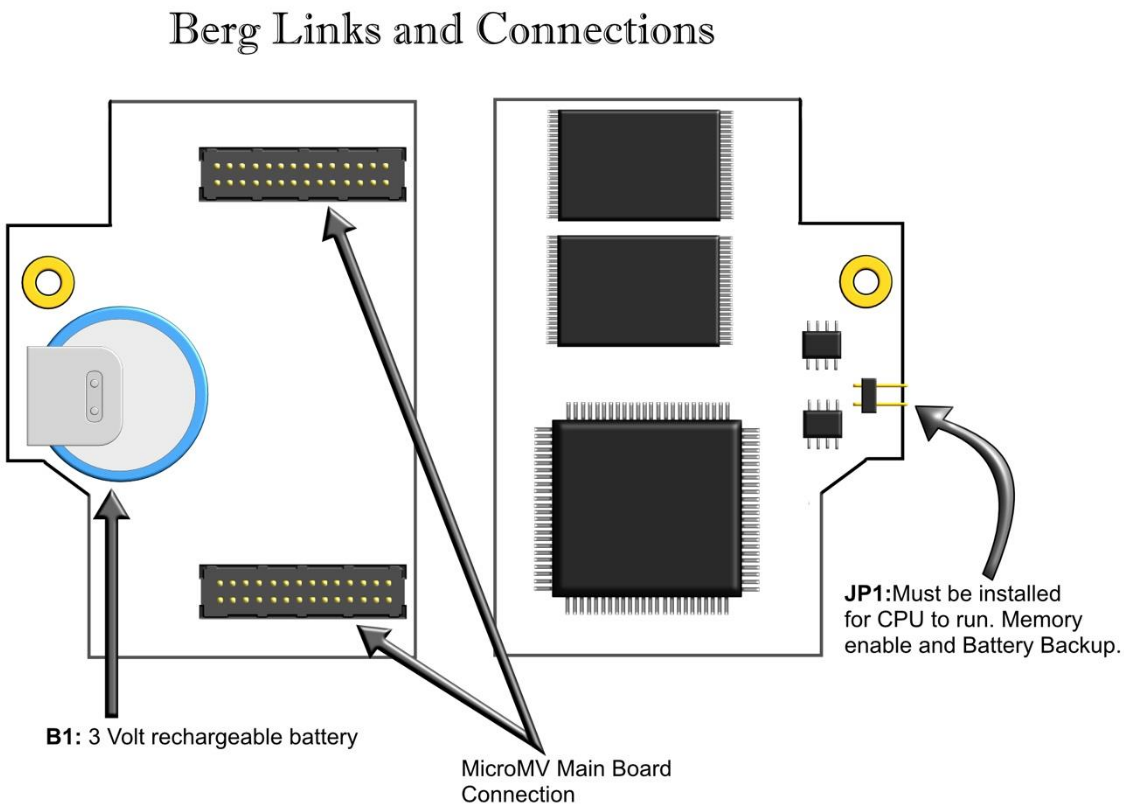


Version 2 - MicroMV Main Board (Micro2009 and Later Model)





Version 2 - MicroMV Memory/CPU Board



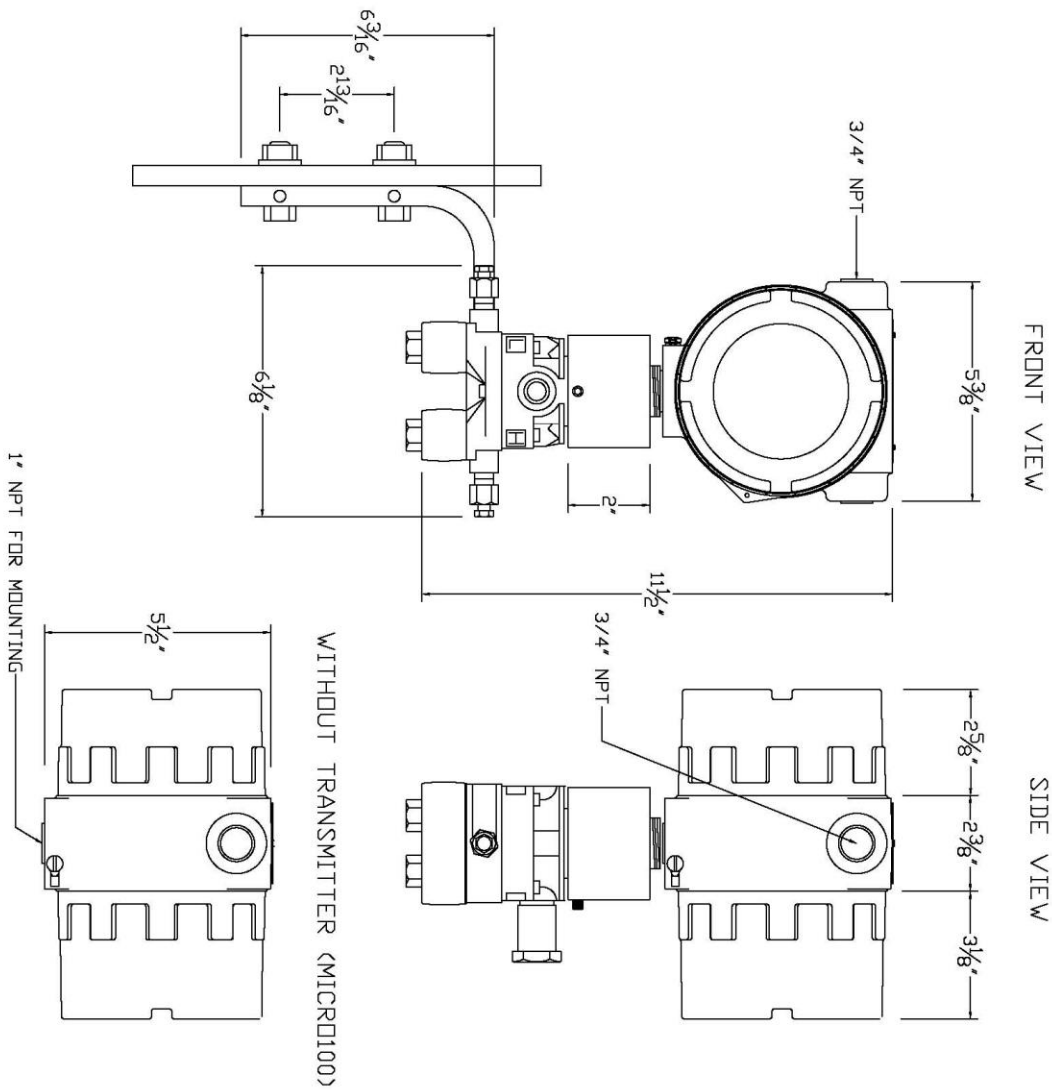
Technical Data

POWER	
VOLTAGE RANGE	7-28 VDC
POWER CONSUMPTION	0.5 WATT
OPERATING CONDITIONS	
TEMPERATURE	- 40 TO 185 °F
HUMIDITY	100%
HOUSING	NEMA 4X CLASS 1 DIV. 1
FEATURES	
DISPLAY	PLASMA 4 LINES 20 CHARACTERS BACKLIT DISPLAY WITH 4 INFRARED REFLECTIVE SENSORS
PROCESSOR	32-BIT MOTOROLA 68332 @ 16.7 MHZ
FLASH ROM	4 MBITS @ 70 NANO SECONDS
RAM	2 MBITS
FREQUENCY INPUT	3 CHANNELS CHANNELS 1 & 2 ARE SINE/SQUARE WAVE CAPABLE CHANNEL 3 IS SQUARE WAVE ONLY SQUARE WAVE RANGE 0 - 6000 HZ SINE WAVE RANGE 0 – 1200 HZ SIGNAL > 40 mV FOR SINE WAVE SIGNAL > 3 VOLTS FOR SQUARE WAVE
ANALOG INPUT	4 INPUTS STANDARD EXPANDABLE UP TO 9 ANALOG INPUTS OR 7 WITH ADDITIONAL 3 WIRE RTD.
MULTIVARIABLE	BUILT-IN MULTIVARIABLE TRANSMITTER WITH DIRECT SPI DIGITAL CONNECTION. MAXIMUM UPDATE SPEED ONCE EVERY 109 MILLISECONDS.
ANALOG OUTPUT	ONE (1) OPTICALLY ISOLATED 16 BITS EXPANDABLE TO FOUR (4)
DIGITAL I/O	4 DIGITAL INPUTS OR OUTPUTS. DIGITAL OUTPUTS HAVE 0.25 AMPS RATING.
SERIAL	2 RS485 @ 9600 BAUDS VARIABLE 1 RS232 @ 9600 BAUDS VARIABLE 1 PRINTER OUTPUT
COMMUNICATION PROTOCOL	MODBUS

Parts List

Part #	Spare Parts - Micro MV Description
MVC	Micro MV CPU Main Board Only
MVM	Micro MV CPU Memory Board Only
MVD	Micro MV Display Board
MVI	Micro MV Analog In Board
MVO	Micro MV Analog Out Board
MVP	Micro MV Prover Board
MVR	Micro MV Rosemount Board
S6920	Explosion Proof Housing Unit for Micro MV Flow Computer
Adapter A	Adapter for 0205 Rosemount Transmitter (Accommodates Micro MV Flow Computer)
Bracket-MVD	Bracket for Micro MV Display
Bracket-MVC A	Bracket for Micro MV CPU (Without Analog)
Bracket-MVC B	Bracket for Micro MV CPU (With Analog)
MVD Cable	Micro MV Display Ribbon Cable
O-Ring A	O-Ring Gasket for Micro MV Housing
Fuse A	250 mA Fuse
Fuse B	500 mA Fuse
Fuse C	2 Amp Fuse
Battery A	Replacement Battery for Micro MV Flow Computer (Board Mounted)

MicroMG Flow Computer: Dimensions



Window Software Minimum Requirements:

Please make sure your computer has the minimum requirements to install Dynamic's Dynacom software.

System Minimum Requirements

In order to install this software product the following requirements must be met:

- Windows Operating System (Win98, Win98SE, win2000, WinNT, WinXP, Vista, Win7, Win8, Windows 10)
- For a Windows NT machine: Service Pack 3 or later
- For Windows NT, 2000, XP or Vista: Administrator level access to create an ODBC system DNS.
- Minimum disk space available: 16 MB.
- 1 Serial Communication Port

If your computer meets these requirements, you can run the setup file downloaded from our website

What is a configuration file?

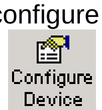
The configuration file is an archive that contains the data used by the flow computer to determine calculation settings (Pipe ID, Flow Equation, Meter ID, etc.) and input/output assignments.

Downloading a configuration file to the flow computer.

- Open the configuration file using the **Configuration File | Open…** option on the main menu or pressing the open button  in the toolbar. Once the file is open the file name will appear on the upper left corner of the window, so you can verify that the desired file was open.

- Connect to the Flow Computer either by using the **Tools | Connect to Device** option on the main menu, the 

button on the vertical toolbar, or by pressing the **[F5]** key on the keyboard. Once you are connected the application it will show an ONLINE status on the upper right corner of the main window. Failure to communicate can occur because of a communication wiring problem, wrong PC port selection, communication parameter mismatch between PC and MicroMV (Modbus type, parity, baud rate, etc.) or lack of power to the MicroMV Flow Computer. To use **"Tools | Com Settings | Auto Detect Settings"** option, the user must insure that **only one MicroMV** computer is connected to the PC. More than one MicroMV Flow Computer in the loop will cause data collisions and unintelligible responses.

- Go to the configure device option either by using the **Tools | Meter Configuration** option, the 

button on the vertical toolbar, or by pressing the **[F10]** key on the keyboard.

- Because you are connected to a device, a window will appear asking you if you want to read the configuration from the connected meter, Press **NO** since what we want is to write the PC file to the flow computer.

- A configuration window will now appear showing you the information in the configuration file, you can check these values to make sure this is the file you want to send to the flow computer. Once you have checked that the configuration is correct, press the **[Download]** button. A blue bar indicating the progress of the download will appear at the bottom of the application window, after that the information in the configuration file will be in the flow computer.

What is an Image File?

An image file is an EPROM code for a certain purpose (liquid, gas, prover, etc.) **The image file is only done when an application upgrade is needed**.

When an image file is downloaded to the flow computer, all the information in the computer is lost (configuration and historical data), so make sure to retrieve all the important information before changing the image file.

How to download an Image File

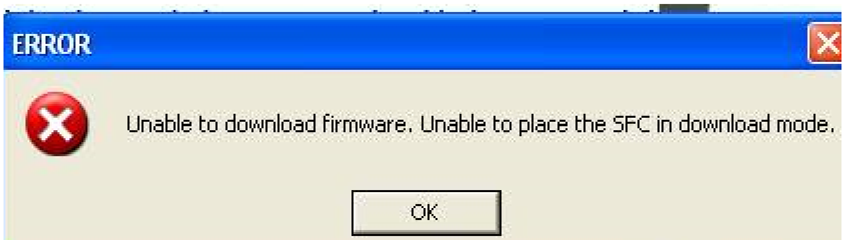
- Download an image file through **RS232 port** only.
- To Download an Image File to the Flow Computer select the **Tools | Download Program** option form the main menu or press the  button in the toolbar.
- A small dialog will appear asking for the file name of the image file (Image file have the extension .img). Type it in or use the **Browse** button to locate it.
- Once the file name is in place press **Download**.
- If a retry message of small dialog appears, try to use **"Tools | Com Settings | Auto Detect Settings"** option, the user must insure that **only one MicroMV** computer is connected to the PC. More than one MicroMV Flow Computer in the loop will cause data collisions and unintelligible responses. Failure to communicate can occur because of a communication wiring problem, wrong PC port selection, communication parameter mismatch between PC and MicroMV (Modbus type, parity, baud rate, etc.) or lack of power to the MicroMV Flow Computer. After the device is detected, then you can follow steps described above.

Warning messages will remind you that this action will erase **ALL** the information in the flow computer.

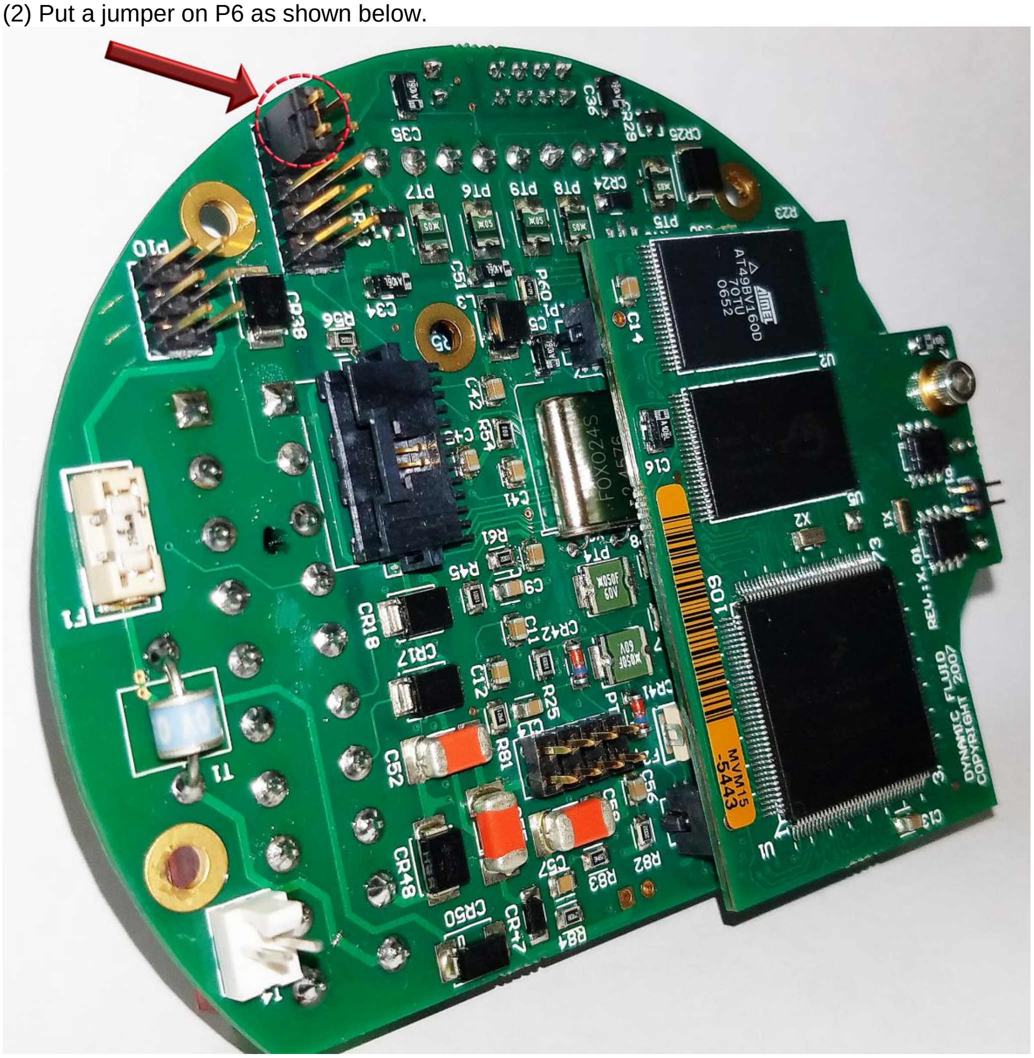
The download task will take about 7 minutes to be completed. Once the image file is in place, the flow computer is ready to be configured (enter calculation parameters and I/O assignments).

How to force a board into download mode

First, try to recycle the power and reload the image if the error message is displayed while downloading a new image file. Download an image file through **RS-232 port** only. Forcing download mode could be required if a wrong type of application image was loaded or other issues.
Call our main office for more information



Steps to force the board into download mode.
(1) Remove Power
(2) Put a jumper on P6 as shown below.



(3) Power up the board
(4) Board is in download mode
(5) Download image
(6) Remove power and jumper on P6 after a new image is loaded
(7) Board is ready.

Website - DFM Configuration Software

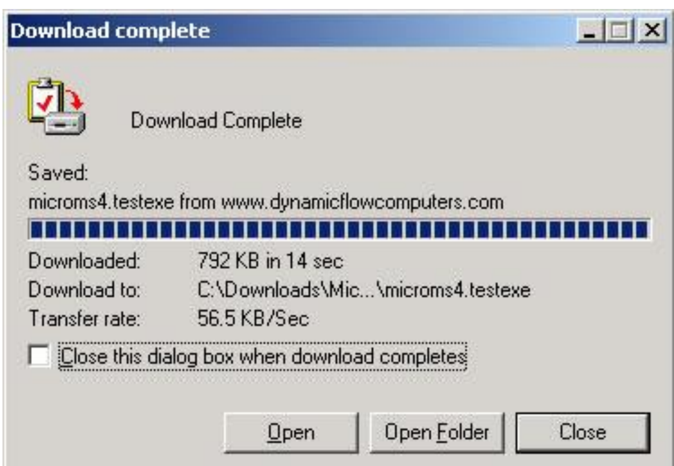
Step 1. Go to our website WWW.DYNAMICFLOWCOMPUTERS.COM

Step 2. Click on the **Software** link located on the left hand side of the web page. You will be presented with two options: **Windows®** software and **DOS** software.

First look for your application under Windows, if you don't see your application listed here it means it only has DOS software.

Step 3. Select either Windows® or DOS software based on Step 2.

Step 4. On the new screen presented to you click on the application that you are trying to download. Once you hit the link it will ask you if you want to run or save the file in your computer. Select **SAVE.** (See illustration 1)



Step 5. The file will start to transfer to your computer. The download time depends on your Internet connection speed and the type of application that being downloaded.

Step 6. When the download if finish. Press the **OPEN** button to start the setup process. (See Illustration)

Step 7. Follow the steps in the application setup.

Website – Image File (Firmware)

Check the version number of image file. **The image file is only done when an application upgrade is needed**.

Step 1. Go to our website WWW.DYNAMICFLOWCOMPUTERS.COM

Step 2. Click on the **Software** link located on the left hand side of the web page, then you select **Firmware** option. All our image files are available for download. Only EEPROM based models like the SFC will need actual EEPROMS to be shipped out to you.

Step 3. On the new screen presented to you click on the application that you are trying to download. Once you hit the link it will ask you the location and file name to be saved.

Step 4. The file will start to transfer to your computer. The download time depends on your Internet connection speed and the type of application that being downloaded.

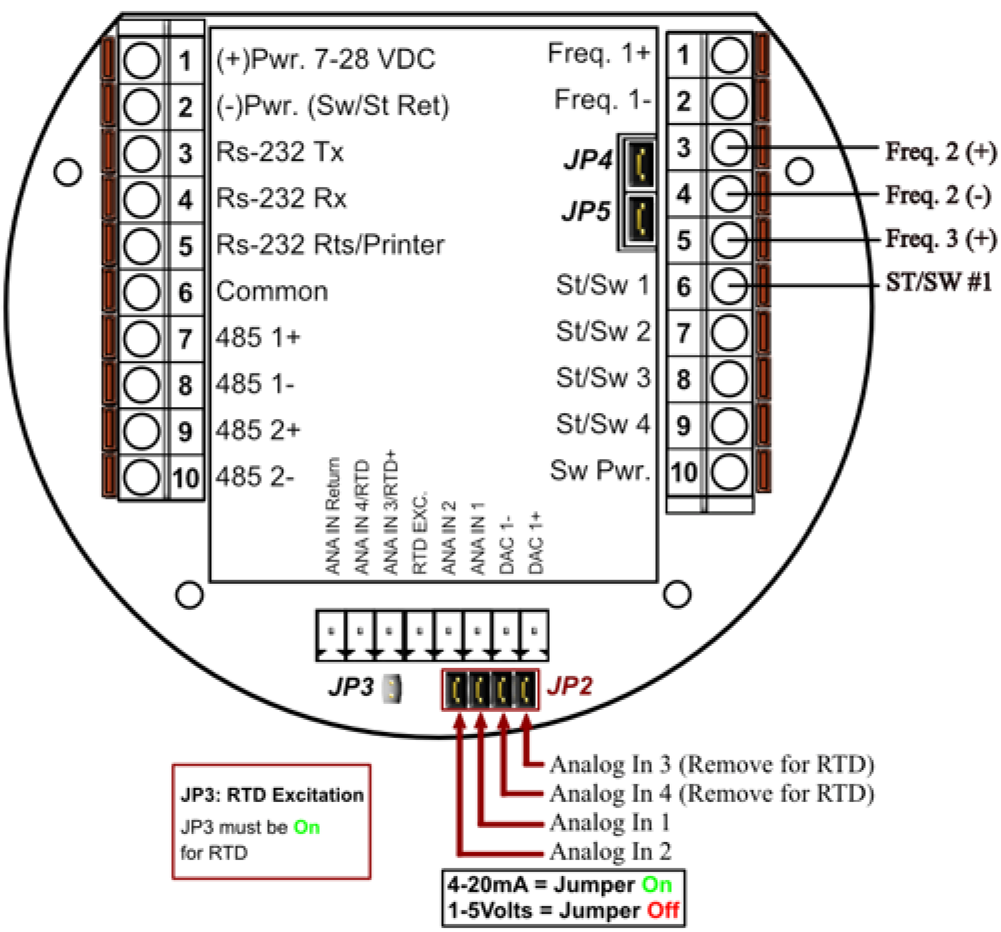
Step 5. After the download is finished, follow the steps in the image downloading setup.

Getting acquainted with the flow computer wiring:

Back Terminal Wiring

The back terminal wiring indicates the overall positions of the terminal plugs and their functions. Though the back panel's jumpers are also shown, refer to the next drawing, "Back Panel Jumpers", for information on their settings and functions.
The MicroMV receives its power via the .top two pins on Terminal P1, on the left of the board. Also on Terminal P1 from top to bottom are inputs to the four serial connections
To the right (P4), from top to bottom, are two turbine inputs, density frequency input, and switch/status inputs and output.
Terminal P3, at the lower bottom, handles analog inputs/RTD and analog output.

VERSION 2 - MICROMV MAIN/MEMORY BOARDS (MICRO2009 AND LATER MODEL)



JP4: When ON Meter 1 Uses Square Wave. When OFF Meter 1 Uses Sine Wave
JP5: When ON Meter 2 Uses Square Wave. When OFF Meter 2 Uses Sine Wave

INPUT/OUTPUT: ASSIGNING AND RANGING INPUTS

Input/Output Assignment

We will now configure your MicroMG Flow Computer's inputs and outputs. The flow computer allows the user to configure the inputs and outputs. (I.e. Analog #1 is pressure for Meter #1). The flow computer does not use unassigned inputs.

How to assign a transmitter to an I/O point:

1 Click "Configure Device", configuration menu is prompted

2 On configuration menu, click "Input Assignment"

3 Enter assignments for DP, temperature, pressure, density and spare inputs.

4 **Assignment (1-*n*)**. Assignments 1-4 are analog inputs attached to terminal of the back panel. These inputs accept 4-20mA or 1-5 volts input (version 2 board are suitable for temperature, pressure, density, or spare inputs. An assignment 5 is strictly RTD (temperature) input only for the meter, densitometer or spare. Assignment 7 indicates a density frequency input; it is assigned automatically once you choose live density frequency input in the setup menu at density type Assignment 10 (module 1) is for multi-variable module only. DP, pressure, and temperature for the meter can be assigned. When a frequency type primary element is hooked to the flow computer, the Multi Variable pressure and temperature can be used and the DP becomes a spare input that could be assigned for strainer differential.

Ranging the Transmitter Inputs:

1. **Enter the range values for analog inputs**: after assigning the analog inputs, click square box next to the assignment to scale the 4-20mA. Enter the value at **@4mA** and **@20mA**. Enter both values similar to the way the transmitter is ranged. 1-5 volts (version 2 board) are equivalent to 4-20mA. Enter the 1 Volt value at the 4mA, and 5 volt (version 2 board) value at 20mA. When the Multi Variable is used the 4-20 ma scale has no effect on anything and does not need to be configured for that input. The reason is simply that the flow computer gets the data via digital communication from the transmitter in engineering units, and therefore a scale is not needed. Normal pressure range is 0-3626, temperature –40 to 1200, DP –250 to 250, or -830 to 830 inches of water.
2. **Enter the high and low limits**: high limits and low limits are simply the alarm points in which you would like the flow computer to flag as an alarm condition. Enter these values with respect to the upper and lower range conditions. Try to avoid creating alarm log when conditions are normal. For example: If the line condition for the pressure is between 0 to 500 PSIG. Then you should program less than zero for low-pressure alarm, and 500 or more for high-pressure alarm. High limits are also used in the SCALE for the Modbus variables. The high limit is equivalent to 32767 or 4095. The low limit is not used for calculating the scale. The scale starts at zero to wherever the high limit value.
3. **Set up the fail code: `Maintenance`** and **`Failure Code`** values tell the flow computer to use a default value in the event the transmitter fails. The default value is stored in **`Maintenance`**. There are three outcomes: the transmitter value is always used, no matter what (**`Failure Code`** = 0); the **`Maintenance`** value is always used, no matter what (**`Failure Code`** = 1); and the **`Maintenance`** value is used only when the transmitter's value indicates that the transmitter has temporarily failed (**`Failure Code`** = 2).

RTD inputs will skip 4-20 mA assignment because RTD is a raw signal of 50Ω (ohms) to 156Ω. Readings beyond that range require a 4-20 mA signal to the flow computer or using the built in Multi Variable transmitter. The Multivariable has a range of –40-1200 degrees Fahrenheit.
Density coefficients for raw frequency inputs are programmed in this menu. The menu will only show parameters relevant to the live density selected (i.e., Solartron or UGC, etc.).

WIRING:

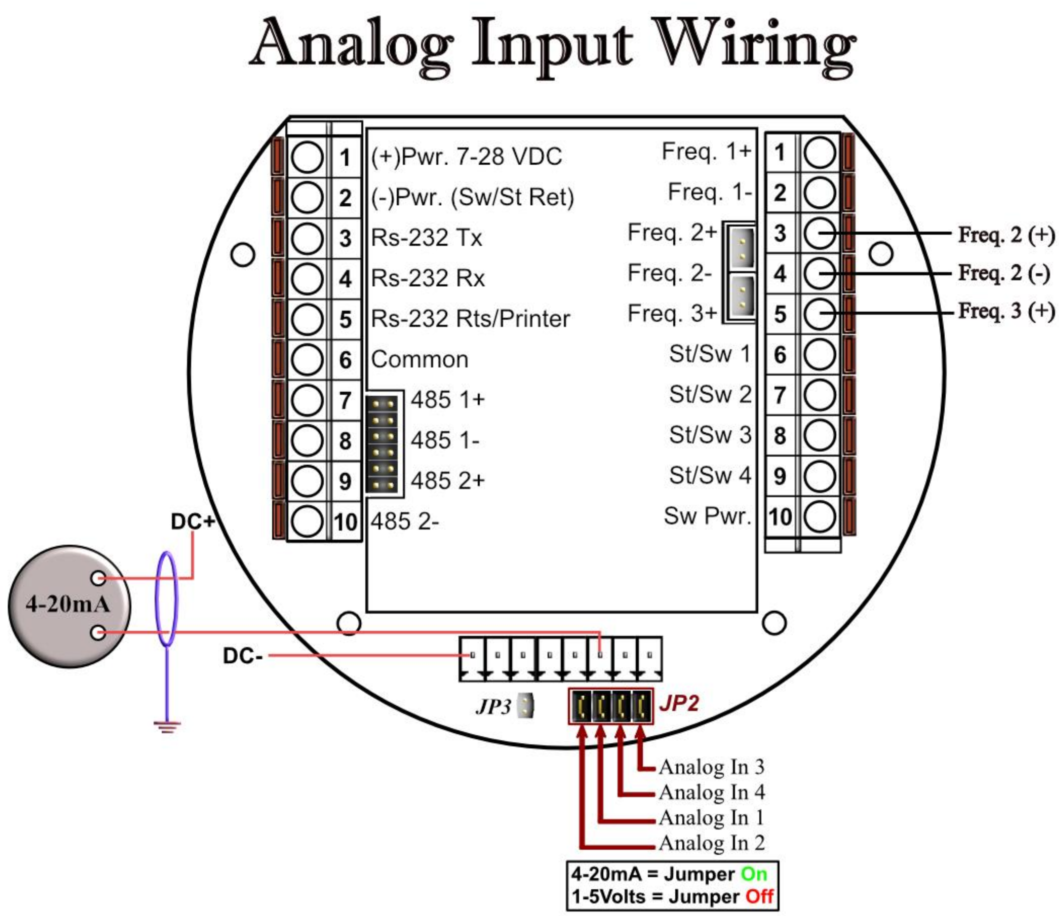
Wiring to the flow computer is very straightforward and simple. But still it is very important to get familiar with the wiring diagram.

Wiring of Analog Inputs: Version 2 Board

MicroMV Main/Memory Boards (Micro2009 and Later Model)

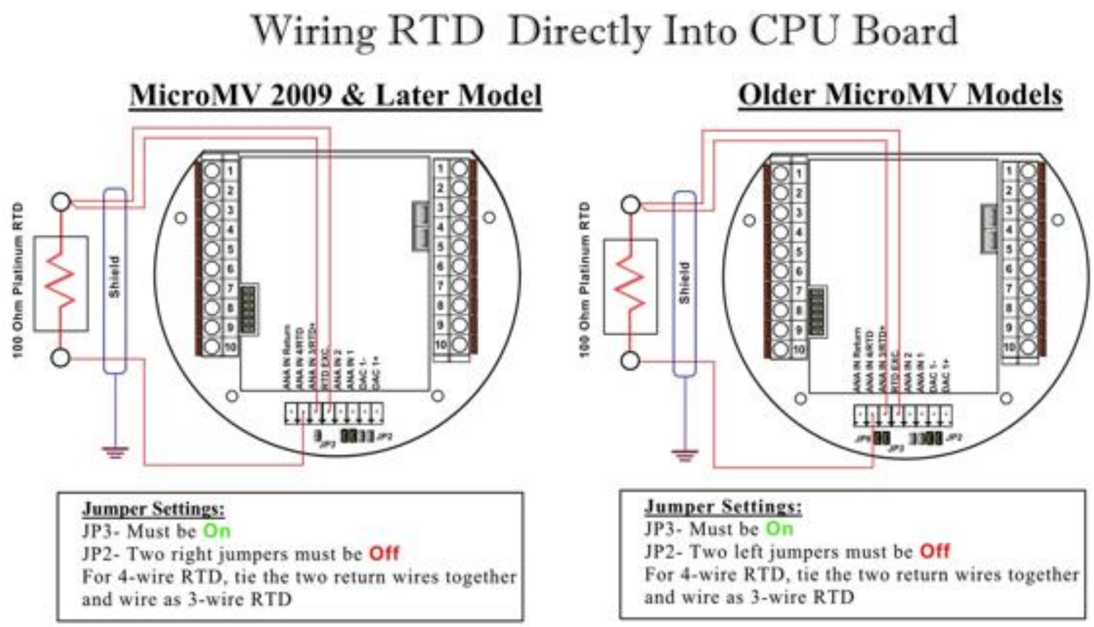
Typical wiring for analog inputs 2 and 1 are shown in the drawing. Analog inputs 4 and 3 are to the left of analog 2 and 1 separated by the RTD excitation. Note that the analog input has only one common return that is the -Ve signal of power supply powering the transmitters.

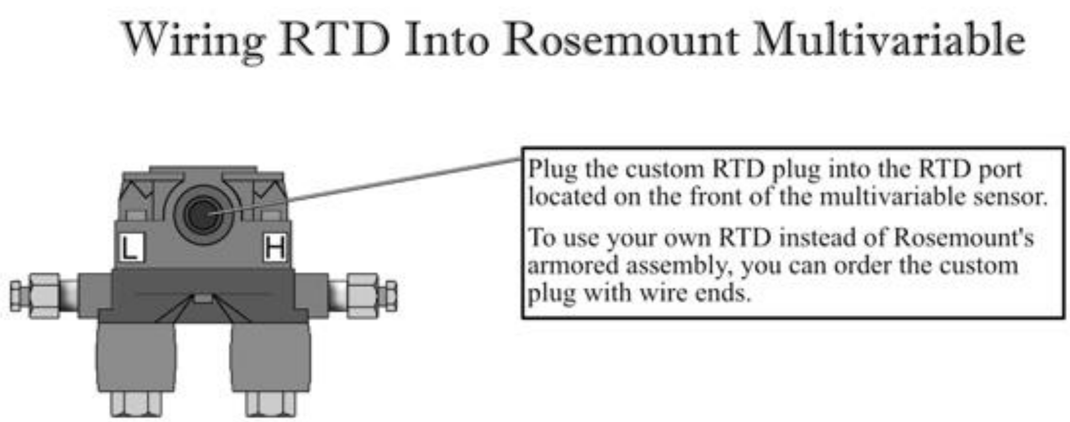
When wiring **1-5 volts**, **make sure to calibrate** the flow computer for the 1-5 volt signal because the flow computer calibration defaults for the 4-20 ma, which is different from the 1-5 volts. JP2 must be removed for 1-5 volt inputs. Signal line impedance provided by our flow computer is 250Ω.



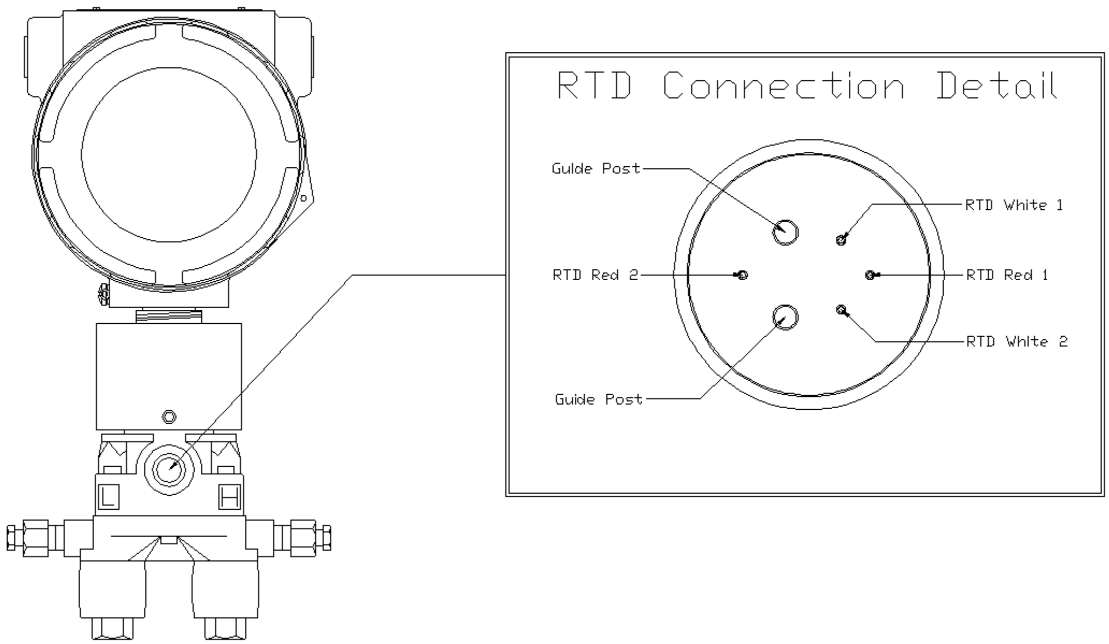
Wiring of RTD

100Ω platinum **must** be used; a temperature range of -43°F to +300°F can be measured. RTD is to the left of analog in 1&2. The RTD excitation jumper (JP3) has to be installed for the RTD to function. In the figure below, notice that the RTD requires a three wire connections. Internal excitation current source generated is in the micro AMP range.

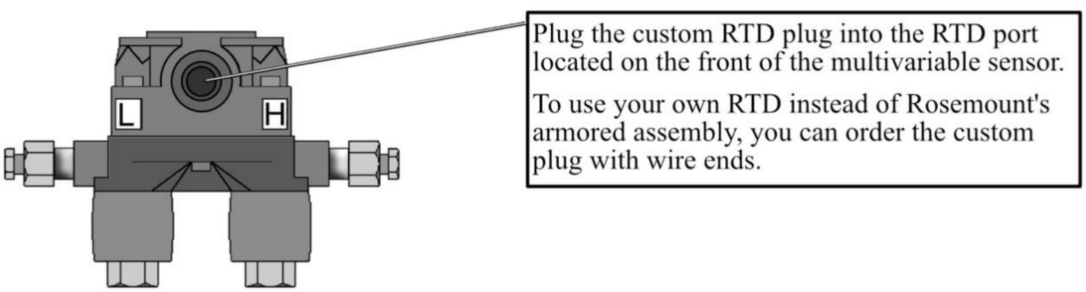




Rosemount RTD Connection

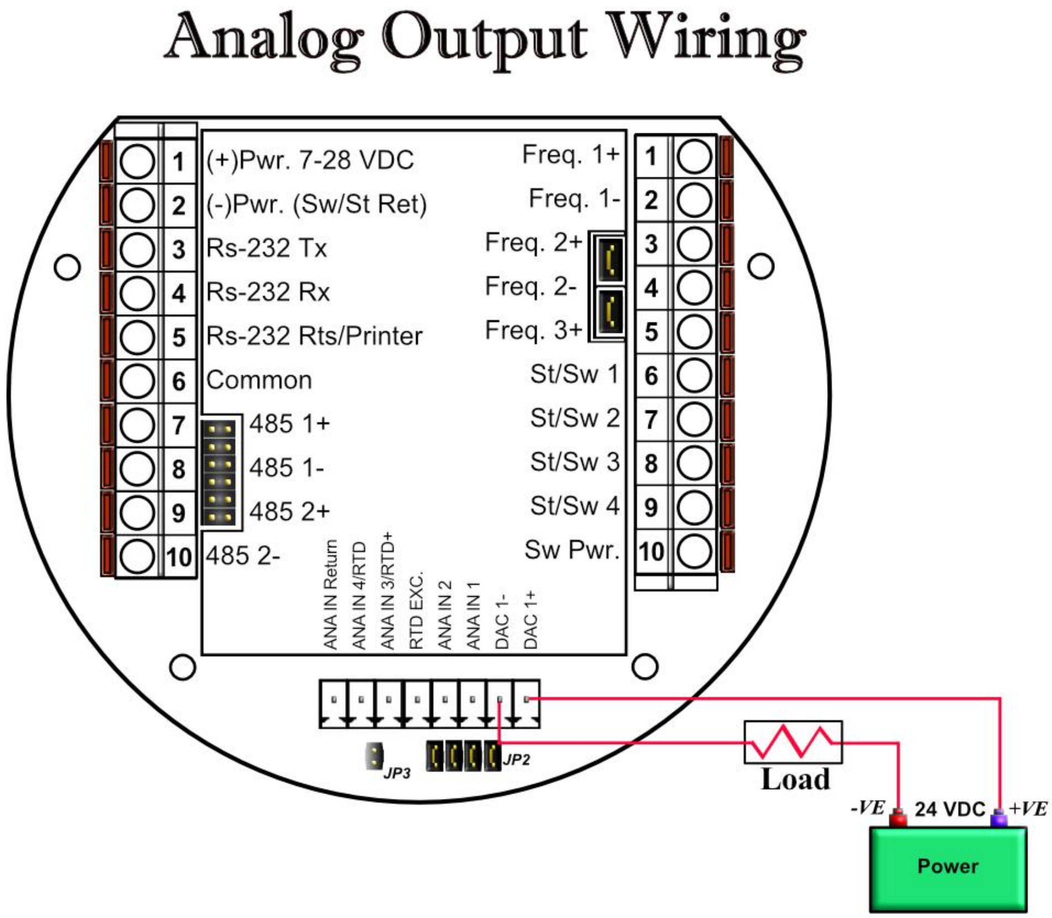


Wiring RTD Into Rosemount Multivariable



Wiring of Analog Output:

Wiring diagram shows typical Analog output wiring. Notice that analog outputs will regulate 4-20 mA current loops but DOES NOT source the power for it. External power is required.

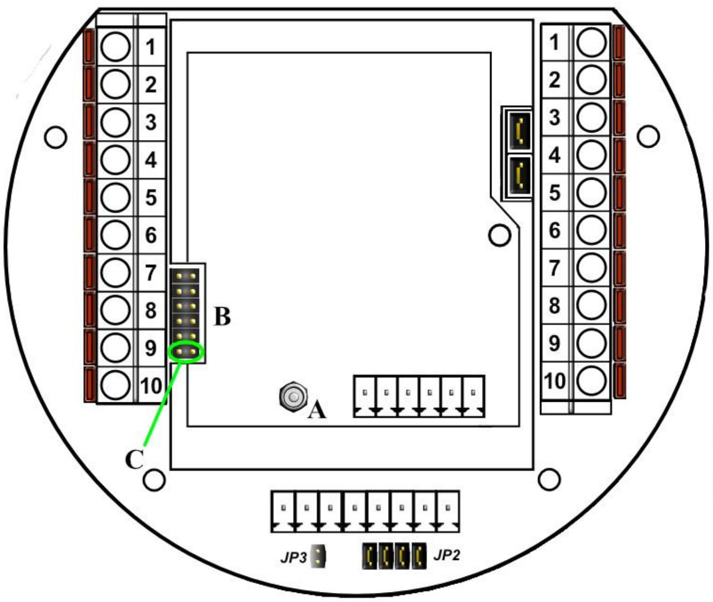


Assigning/Ranging the 4-20mA Analog Outputs:

Go to the **`I/O`** assignment main menu and click **`Analog Output Assignment`**. A selection menu is prompted. Select the analog output number, and then enter what the 4 mA output will indicate and the 20 mA. Make sure that the 20 mA assignment value exceeds the upper range limit of what you assigned the Analog output for, otherwise the analog output will not update beyond 20 mA.

Additional Analog Inputs or Analog Outputs – Board Installation

Connecting Additional Analog Board



Components Needed:
- Extra Analog Board
- 1/4" Stand-off (**Figure D**)
- 1/4 Nut Screwdriver

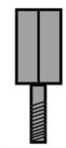
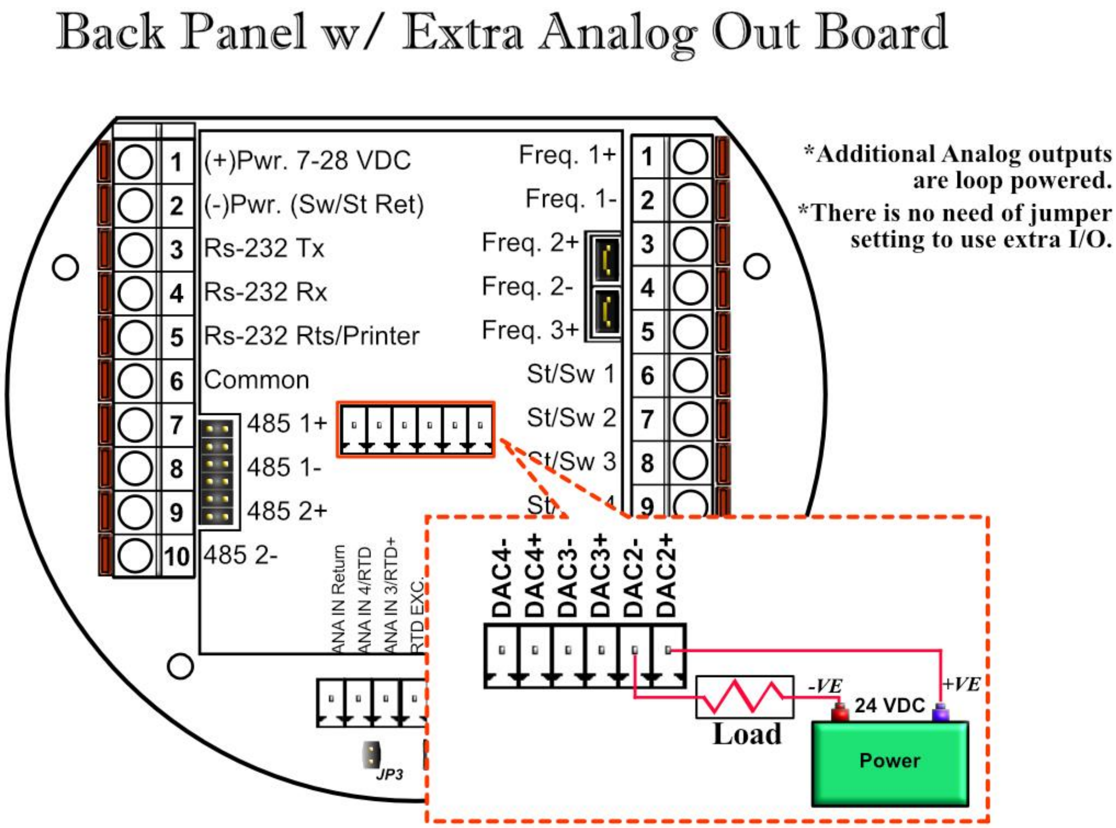


Figure D

Procedure:
1. Remove power from the Main board.
2. Remove nut from the Main Board (See **A**) and Install 1/4" Stand Off in its place.
3. Plug Analog board to the Main Board (Using Connector **B**)
4. Note that the Analog board connector has 10 pins while the Main board connector has 12 pins. The bottom two are NOT connected [See **C**].
5. Place the nut removed on step 2 on the stand-off (**A**) to secure analog board.
6. For wiring of extra Analogs, refer to specific drawing.(Analog Input/Analog Output).

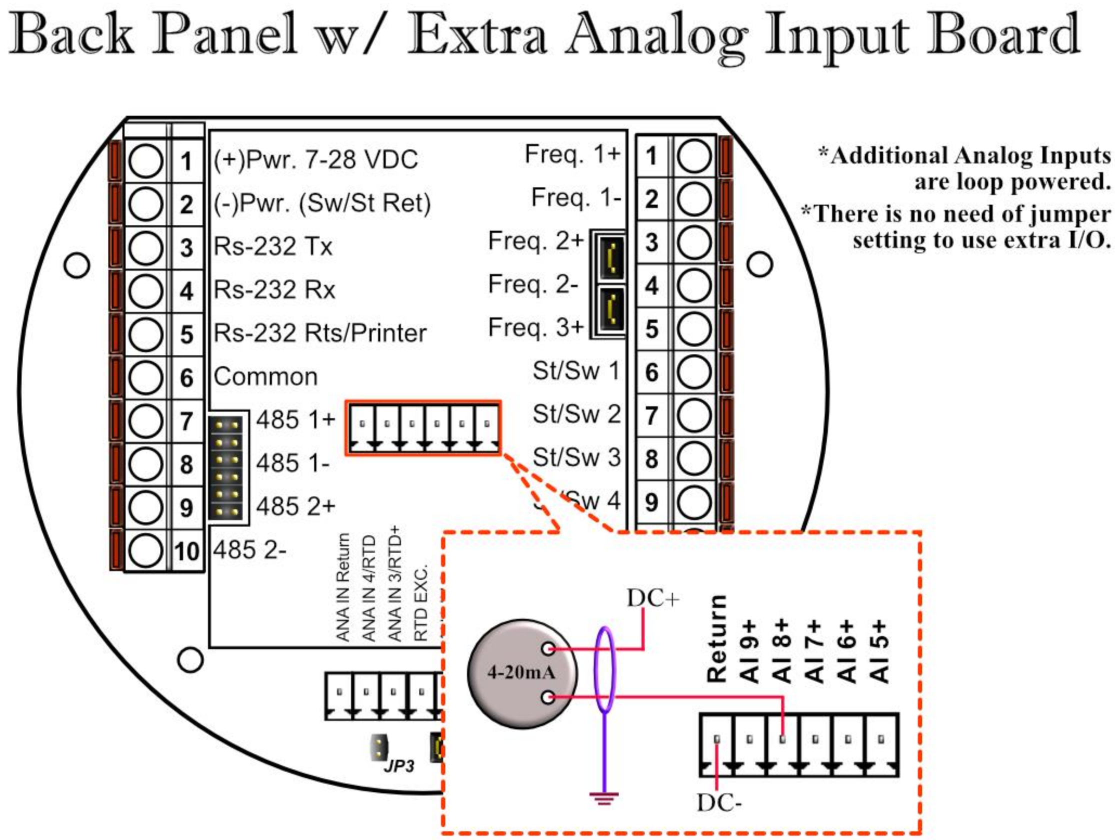
Back Panel - Additional Analog Outputs

Addition analog output board is required to have additional 3 analog outputs.



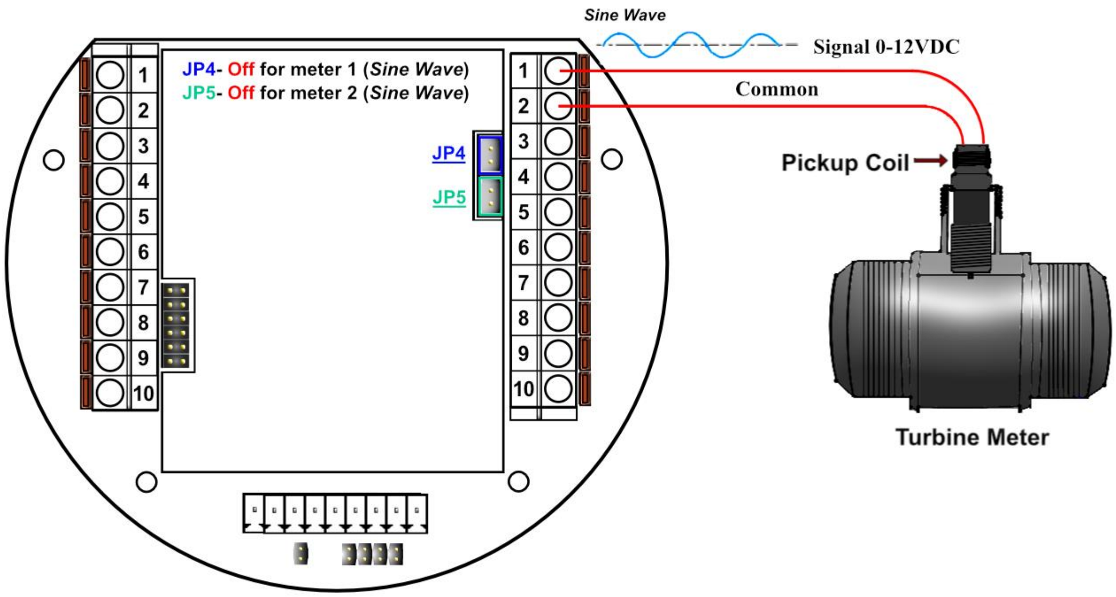
Back Panel - Additional Analog Intputs

Addition analog input board is required to have additional 5 analog inputs.



Turbine Input Wiring

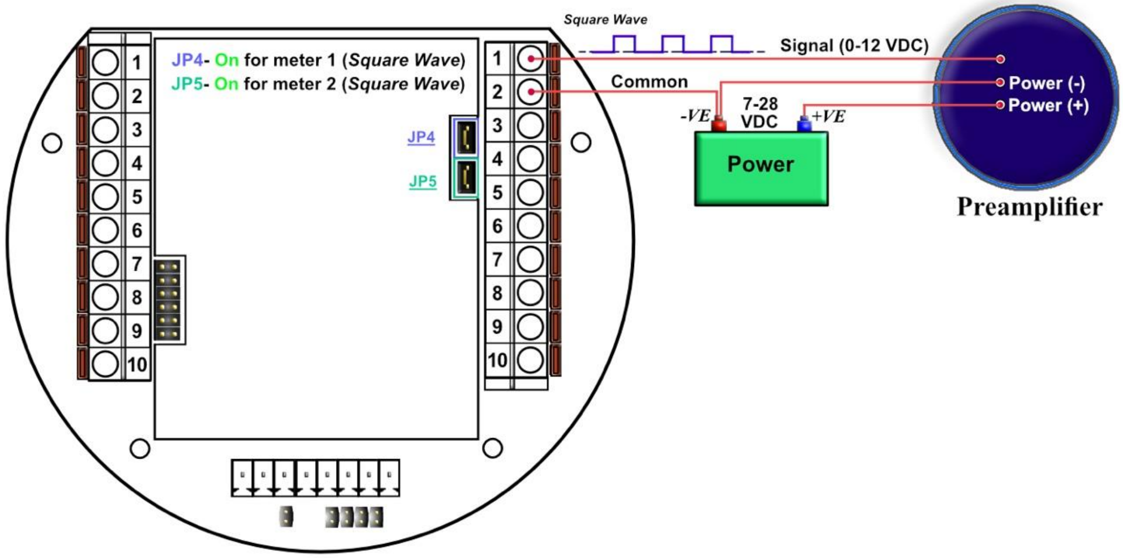
Go to view main menu, click turbine under **`Wiring Drawings`**. Two drawings above each other will show typical wiring for turbine meter 1 and turbine meter 2. When connecting sine wave directly from the pickup coil make sure the distance from the pickup coil to the flow computer is very short–less than 50 feet with shielded cable. In the event there is presence of noise, the distance must be shortened. When connecting sine wave signal, the JP4 jumper for meter 1 must not be installed and JP5 jumper for meter 2 must not be installed. (***JP4 and JP5 must be off when using sine wave***). On the other hand, when using square wave, the square wave signal can be sinusoidal but has to be above 5 volts peak to peak with less than 0.4 volts offset in order for the flow computer to read it. **The JP4 jumper for meter 1 must be installed and JP5 jumper for meter 2 must be installed when using square wave.**



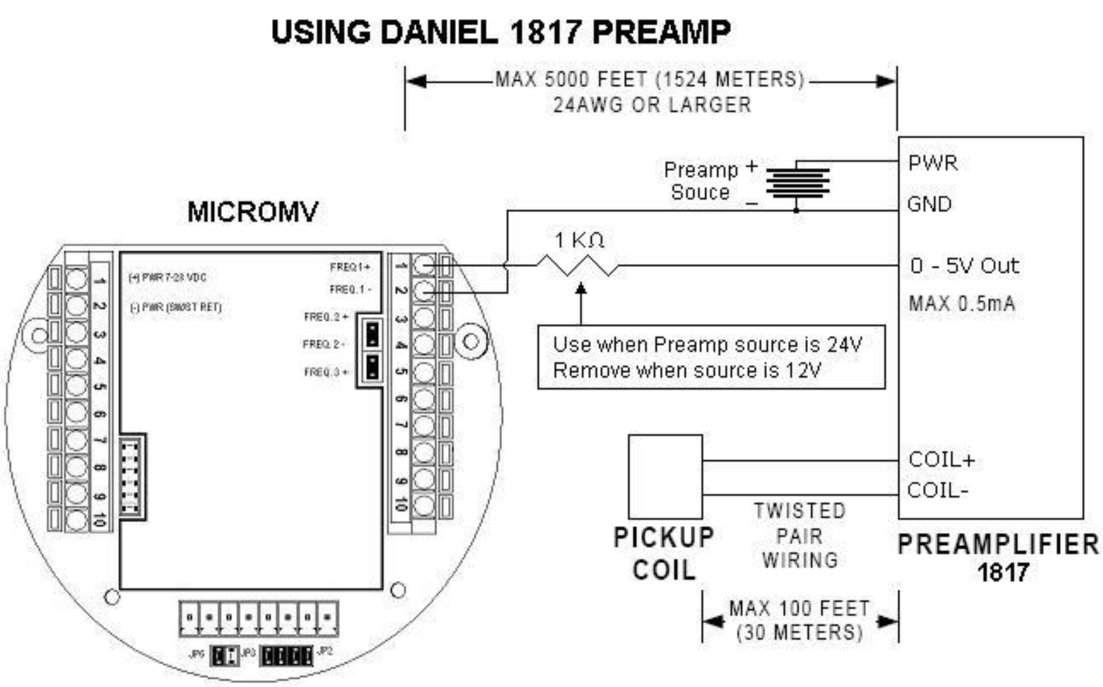
Note:	*When connecting square wave input, the JP4 and JP5 connect the turbine return to the flow computer power return. Therefore, signal polarity is very important. Reverse polarity could result in some **damage or power loss**. When sine wave is used the signal polarity is usually of no significance.*

The turbine input is on the top of terminal P3.The third pin down from the top is Turbine/PD input 2 plus and below it is Turbine 2 minus. The third frequency input (fifth pin down) has the positive input and the negative is the power input ground. If a different power supply is used to power the densitometer then the power return for that input needs to be connected to the MicroMG power ground.

Turbine Input Wiring – Using Daniel 1818 Preamp



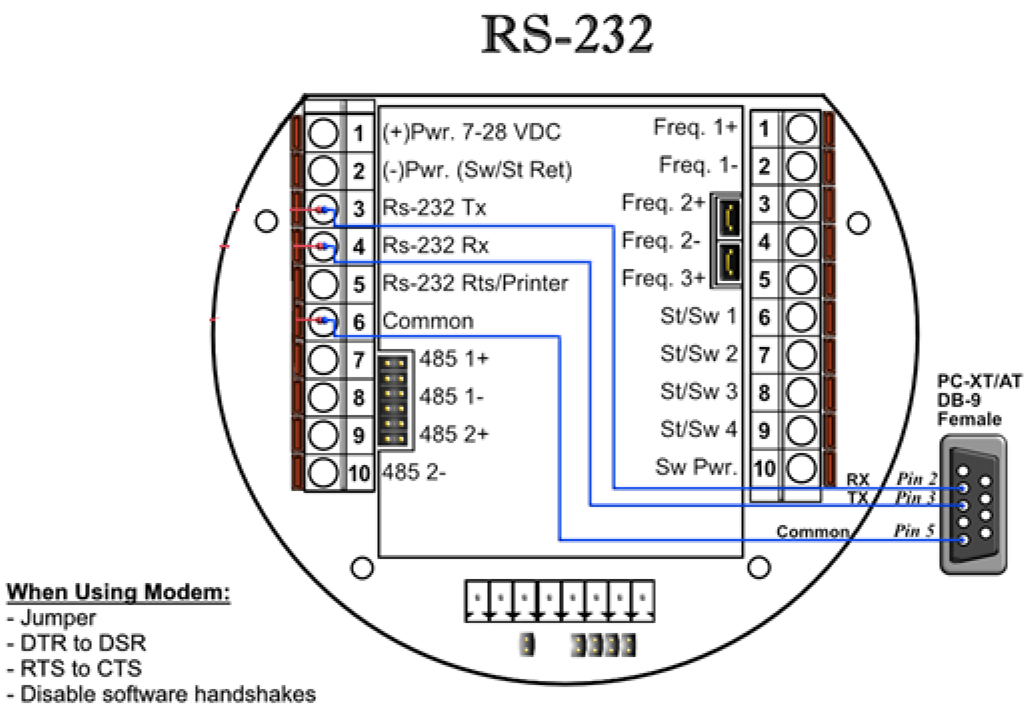
Turbine Input Wiring – Using Daniel 1817 Preamp



RS-232 Connection:

The RS-232 is located on the left terminal block. The third, fourth, fifth, and sixth pins of the RS232 below the power input.

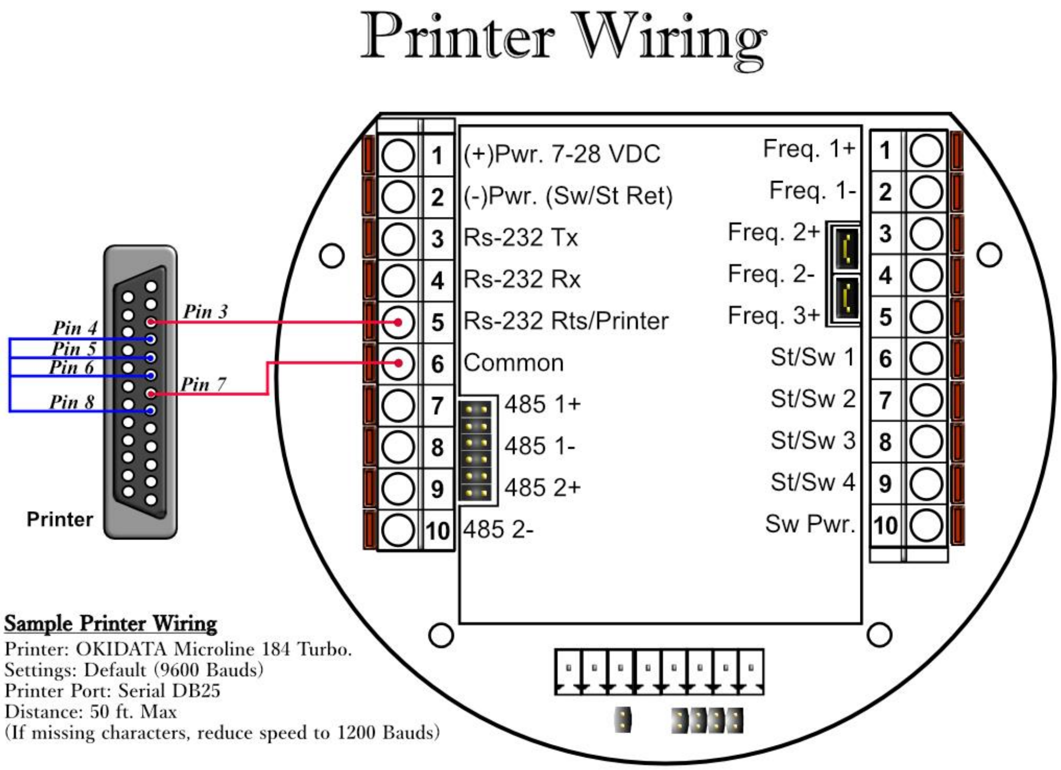
Note: Twisted shielded cable is required.



WARNING: *When the RS-232 terminal is used with a modem, external protection on the phone line is required. Jumper DTR to DSR, RTS to CTS, and disable software handshake on the modem RS232 connection*

Printer Connection:

When RS232/Printer pin configured as a printer line it is a TRANSMIT line (TX)



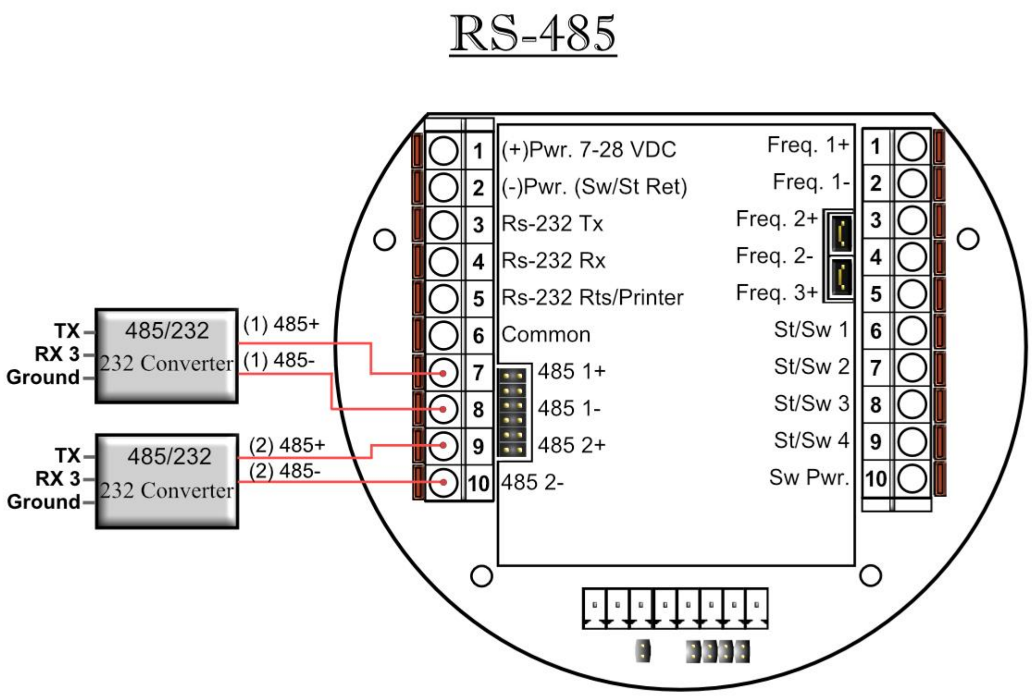
Avoid connecting pin 20 on DB25 if wanting to communicate flow computer to PC on the same port.
* Note 1: Jumper pins 1-4 only if not using the RS232 port for communication

RS-485 Connection

RS-485 wiring is shown in the wiring diagram under **RS-485**. Two Rs485 channels are available for Modbus. The maximum distance when 18-gauge wire is used is 4000 feet.

The second RS485 can be configured to be a master to other slave devices. I.e. gas G.C.,

Note: Twisted shielded cable is required.



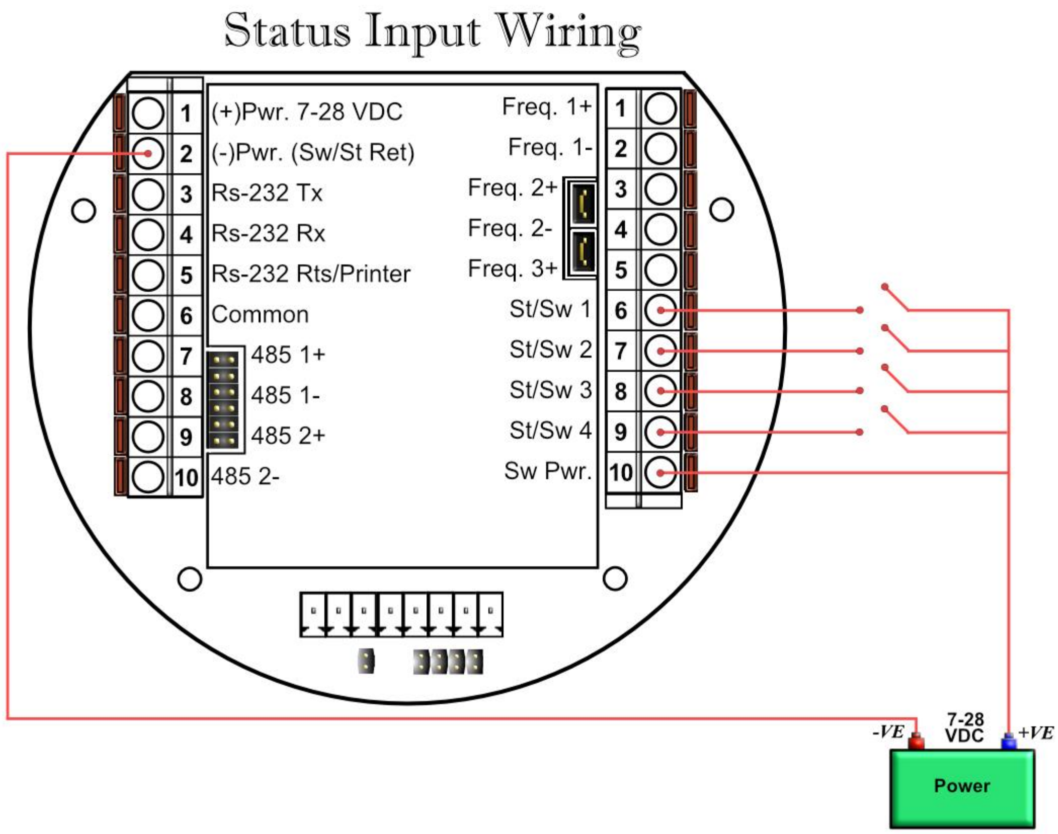
WARNING: When the RS-485 terminal is used, external transient protection and optical isolation is required, especially for long distance wiring.

RS485/232 Adapter

Dynamic recommends B&B Electronics. We generally use Model 485D9TB, which is a port power converter requiring only a 2-Wire connection. The 485D9TB has a terminal block which makes the wiring more convenient and provides the option of external 12V power for low power serial ports. Model 485SD9R can also be used, but it has a DB9 terminal which requires additional cables. With Model 485SD9R the pins that connect to the flow computer are pin 3 on the DB9 to TX on the flow computer and pin 8 on the DB9 goes to RX on the flow computer. For a USB to RS485 converter, we recommend Model USTL4 which is also port powered and supports half and full duplex networks.

Wiring of Status Inputs:

There are 4 digital inputs or outputs that are user configurable. The configuration software will configure the input to be a status input or a switch output.. The standard status input has 4 volts of noise hysteresis, with on trigger point of 5 volts and an off point of 1 Volt.

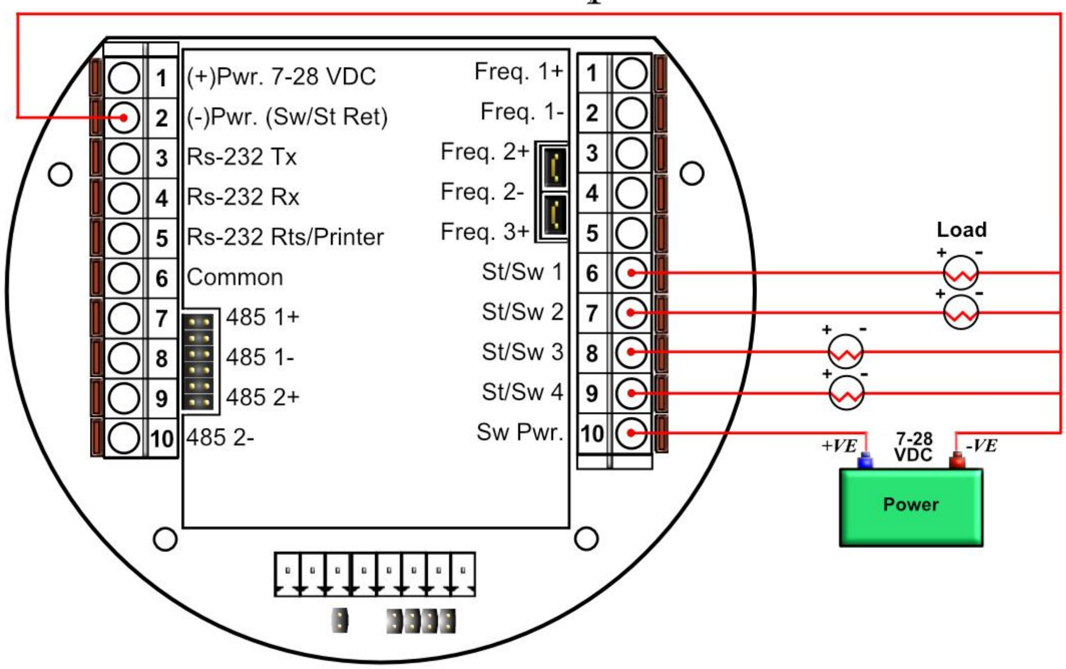


Wiring of Switch/Pulse Outputs:

Switch one and two can be on /off or pulse type output up to 125 pulse per second. Notice that the switch outputs are transistor type outputs (open collector type with maximum DC rating of 350 mA continuous at 24 VDC) connections

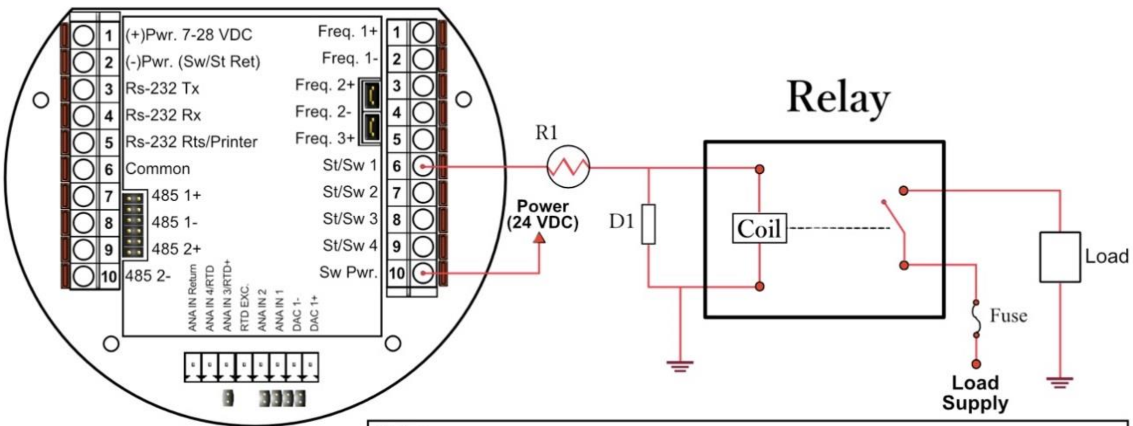
1	Status Input /switch output 1	Switch - Maximum rating: 350mA @24 volts Switch Output Range: 5-28 VDC Status Input Rating: 6-28 VDC
2	Status Input/switch output 2	
3	Status Input /switch output 3	
4	Status input/ switch output 4	

Switch Output



Switch Output to Relay Wiring Diagram

When wiring the Switch Outputs to an inductive load such as a relay, it is better to add transient protection to the flow computer's electronics due to the surge in voltage that inductive loads may create. This protection can be added as shown in the drawing below.



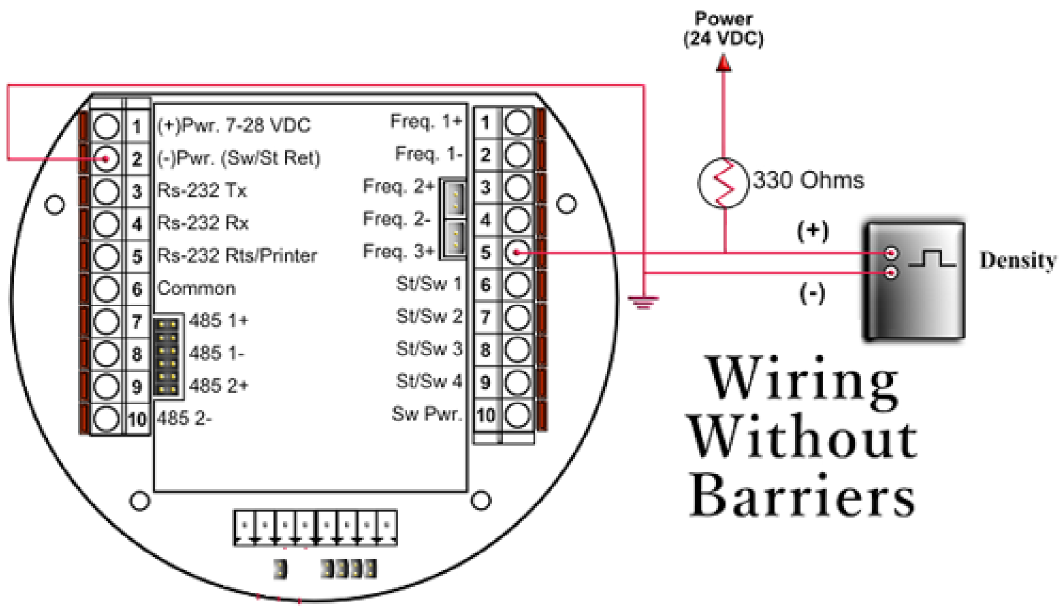
Note:

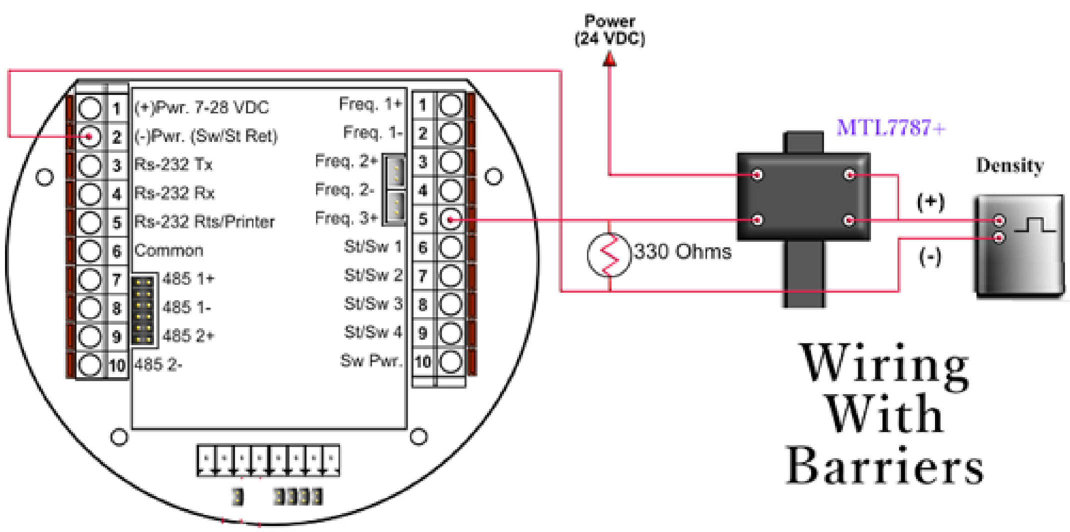
R1- Current limiting resistor. Current must not exceed 250mA.

D1- Use on relay or any inductive load
Transient voltage suppressor. Part No. 1.5KE30CA
It is a bidirectional part, so wiring polarity is indifferent.
Unidirection part No. 1.5KE30A may also be used. In such case, the stripped side is to be connected to the Switch Output side and the other side to ground.

Density Input Wiring:

When using a live densitometer input with frequency signal, the signal can be brought into the MicroMV in its raw form. The MicroMV accepts a sine wave or square with or without DC offset.





MTL7787+: Barrier for **switches** or **digital inputs**

Note:	*When wiring the density input polarity is of significance and reverse polarity could result in some damage or power loss. When Density input is 4-20mA it should be connected as a regular 4-20mA signal to the analog input and not the density frequency input.*

CALIBRATION

Calibrations are performed under **Calibration**. Select inputs to be calibrated, and then select full, single, offset calibration method.

Analog Input of 4-20mA or 1-5 volt signal

RESET CALIBRATION:

Reset calibration to use default calibration
1. Select Input
2. Select “Reset Calibration” method
3. Now verify the live reading against the flow computer reading

OFFSET CALIBRATION:

For simple offset type calibration simply induce the signal into the analog input and make sure the MicroMG is reading it. After you verify that the MicroMG recognized the analog input, enter the correct mA reading, and then click OK. The offset type calibration is mainly used when a small offset adjustment needs to be changed in the full-scale reading. The offset will apply to the zero and span. Offset is the recommended method for calibrating the temperature input.

FULL CALIBRATION METHOD:

To perform full calibration be prepared to induce zero and span type signal. Reset calibration first if any wrong doing before staring full calibration procedure.

Full Calibration – Two Points

Two reference values must be entered (generally low and high range)

1. Reset Calibration
2. Induce the low end signal i.e. 4mA in the analog input.
3. Click inputs to be calibrated under calibration menu, click full calibration, enter the first point - the analog input value i.e. 4mA, and then press Set button.
4. Now be ready to enter the full-scale value. Simply induce the analog signal, wait for the reading to stabilize, enter the second value i.e. 20mA, and then press Set button
5. *Induce live values to verify the calibration*.

Full Calibration – Three Points

Three reference values must be entered (generally low, medium, and high range)

1. Reset Calibration
2. Induce the low end signal i.e. 4mA in the analog input.
3. Click inputs to be calibrated under calibration menu, click full calibration, enter the first point - the analog input value i.e. 4mA, and then press Set button.
4. Induce the second reference value.

   Once the live reading is steady, enter the second point, and then press Set button.
5. Now be ready to enter the full-scale value. Simply induce the analog signal, wait for the reading to stabilize, enter the third value i.e. 20mA, and then press Set button
6. *Induce live values to verify the calibration*.

RTD Calibration:

RTD Calibration is a 2-step process. The first step is a onetime procedure to verify transducer linearity and is done at the time the meter is being setup. The second step is the routine calibration sequence.

Step 1 – Linearity Verification

1- Use a Decade box with 0-150 °F settings.
2- Connect RTD cable to this resistive element for verification of linearity. Verify low and high points. It must be within ½ degree.
3- Connect the actual RTD element and compare with a certified thermometer.
4- If not within ½ degree do a Full Calibration (See Full Calibration below). If problem persists verify other elements such as RTD Probe, connections, shield, conductivity of connectors, etc.

The purpose of the above procedure is to verify zero and span and make sure that the two points fall within the expected tolerance.

Step 2 – Routine Calibration

Once Linearity has been verified through Step 1, the routine calibration procedure is reduced to simply connecting the actual RTD and doing an offset point calibration (see offset calibration below).

Calibration after that will be simple verification for the stability of the transmitter. If it drifts abnormally then you need to verify the other parts involved.

Calibration Procedures through Windows™ Software

At the top menu, go to Calibration and Select RTD Input.

RESET TO DEFAULT CALIBRATION

1. Select Reset calibration method
2. **Now verify the live reading against the flow computer reading**

OFFSET CALIBRATION:

1. Select offset calibration method.
2. Induce a live value and wait for 10 seconds for the reading to stabilize. Then enter the live value. The value entered must be in Ohm only.
3. **Now verify the live reading against the flow computer reading**

FULL SCALE CALIBRATION:

Full Calibration – Three Points

Three reference values must be entered (generally low, medium, and high range)

Full Calibration – Two Points

Two reference values must be entered (generally low and high range)

1. Reset Calibration
2. Prepare low range resistive input (i.e., 80 Ohm) and High range resistive input (i.e., 120 Ohm).
3. Go to the calibration menu and select RTD full calibration method. Induce the low end (80 Ohm.) resistive signal and then wait 10 seconds, enter live value in Ohm, and click OK button
4. Induce the High range signal (120 Ohm.) and wait 10 seconds, then enter 120 Ohm and click OK button.
5. **Now verify the live reading against the flow computer reading**.

Calibration of Analog Output:

Follow the following steps to calibrate the analog output against the end device

1. Go to the calibration menu, select analog output, and then select method. Full calibration will cause the flow computer to output the minimum possible signal 4 mA. Enter the live output value reading in the end device i.e. 4 mA and click OK button. Now the flow computer will output full scale 20 mA. Enter the live output i.e. 20 then click OK button.
2. ***Now verify the output against the calibration device***.

Multi-Variable Transmitters (Model 205) – DP and Pressure

Calibrations are performed under **Calibration**. . Select inputs to be calibrated, and then select full, single, offset calibration method.

RESET CALIBRATION

1. Select Multivariable DP or pressure
2. Select Reset calibration method
3. ***Now verify the live reading against the flow computer reading***

OFFSET CALIBRATION

1. Induce live value for pressure or DP.
2. Select Multivariable DP or pressure.
3. Select offset calibration method, enter offset, and click OK button.
4. ***Now read induce live values to verify the calibration.***

FULL SCALE CALIBRATION – TWO POINTS

1. Select Multivariable DP or pressure.
2. Select Reset Calibration and induce live value for pressure or DP.
3. Select full calibration- two points method
4. Induce the low range signal, wait for the reading to stabilize, enter the first point, and then press Set button.
5. Induce the high range signal, wait for the reading to stabilize, enter the second point, and then press Set button.
6. ***Now verify the live reading against the flow computer reading***.

FULL SCALE CALIBRATION – THREE POINTS

1. Select Multivariable DP or pressure.
2. Reset Calibration and induce live value for pressure or DP.
3. Select full calibration – three point method
4. Induce the low range signal, wait for the reading to stabilize, enter the first point, and then press Set button
5. Induce the middle range signal, wait for the reading to stabilize, enter the second point, and then press Set button
6. Induce the high range signal, wait for the reading to stabilize, enter the third point, and then press Set button
7. Now verify the live reading against the flow computer reading

While doing calibration before downloading any of the calibrated values, it is a good practice to verify that the MicroMG close reading to the induced value.
The DP reading must be re-calibrated for the zero offset after applying line pressure.

Multi-Variable Transmitters (Model 205) –Temperature

RTD Calibration is a 2-step process. The first step is a onetime procedure to verify transducer linearity and is done at the time the meter is being setup. The second step is the routine calibration sequence.

Step 1 – Linearity Verification

1. Use a Decade box with 0-150 °F settings.
2. Connect RTD cable to this resistive element for verification of linearity. Verify low and high points. It must be within ½ degree.
3. Connect the actual RTD element and compare with a certified thermometer.
4. If not within ½ degree do a Full Calibration (See Full Calibration below). If problem persists verify other elements such as RTD Probe, connections, shield, conductivity of connectors, etc.

The purpose of the above procedure is to verify zero and span and make sure that the two points fall within the expected tolerance.

Step 2 – Routine Calibration

Once Linearity has been verified through Step 1, the routine calibration procedure is reduced to simply connecting the actual RTD and doing an offset point calibration (see offset calibration below).

Calibration after that will be simple verification for the stability of the transmitter. If it drifts abnormally then you need to verify the other parts involved.

Calibration Procedures through Windows™ Software

At the top menu, go to Calibration and Select RTD Input.

RESET TO DEFAULT CALIBRATION

1. Select Reset calibration method
2. **Now verify the live reading against the flow computer reading**

OFFSET CALIBRATION:

1. Select offset calibration method.
2. Induce a live value and wait for 10 seconds for the reading to stabilize. Then enter the live value. The value entered must be in Degrees only.
3. **Now verify the live reading against the flow computer reading**

FULL SCALE CALIBRATION:

Full Calibration – Three Points

Three reference values must be entered (generally low, medium, and high range)

Full Calibration – Two Points

Two reference values must be entered (generally low and high range)

1. Prepare low range resistive input (i.e., 80 Ohm.) and High range resistive input (i.e., 120. Ohm).
2. Go to the calibration menu and select RTD full calibration method. Induce the low end (80 Ohm.) resistive signal and then wait 10 seconds, enter the equivalent temperature in degrees, and click OK button.
3. Induce the High range signal (120 Ohm.) and wait 10 seconds, then enter the temperature degrees equivalent to 120 Ohm and click OK button.
4. **Now verify the live reading against the flow computer reading**.

Example: Screenshots of Calibration

Diagnostics

I/O Raw Values

Unit ID: 1 Fequency 1: 0 Frequency 2: 0 Densit. Frequency: 0

Switch Output Diagnostic: OFF Enable/Disable Diagnostic

ST/SW1: OFF ST/SW2: OFF ST/SW3: OFF ST/SW4: OFF

Analog Ins	Tag ID	Assignment	4-20 mA	Numerical	Fail Code	
1	AN1	None	0.000	0	0	Calibrate
2	AN2	Meter 1 Temperature	0.000	74	2	Calibrate
3	AN3	None	0.000	0	0	Calibrate
4	AN4	None	0.000	0	0	Calibrate
5	N/A	None	1.655	0	0	Calibrate
6	N/A	None	2.431	0	0	Calibrate
7	N/A	None	0.004	0	0	Calibrate
8	N/A	None	0.004	0	0	Calibrate
9	N/A	None	0.004	0	0	Calibrate
RTD	N/A	None	0.506	0	0	Calibrate

NOTE: To use Analog inputs 5-9, expansion configuration must be enabled.

Analog Outs	Tag ID	Assigment	4-20 mA	Value	
1	N/A	None	4.000	0	Calibrate
2	N/A	None	4.000	0	Calibrate
3	N/A	None	4.000	0	Calibrate
4	N/A	None	4.000	0	Calibrate

Multivariable	Tag	Value	
DP	MDP	100.0000	Calibrate
Pressure	MPF	501.00	Calibrate
Temperature	MTF	70.00	Calibrate

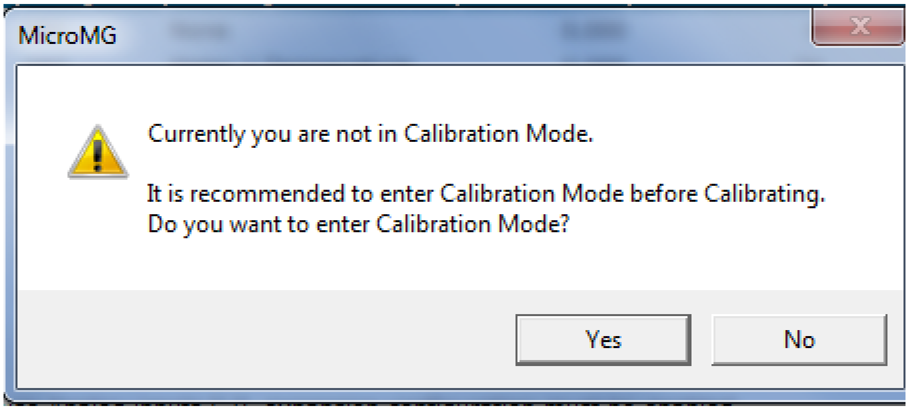
Calibration Mode Data Verification

Multivar Status: OK

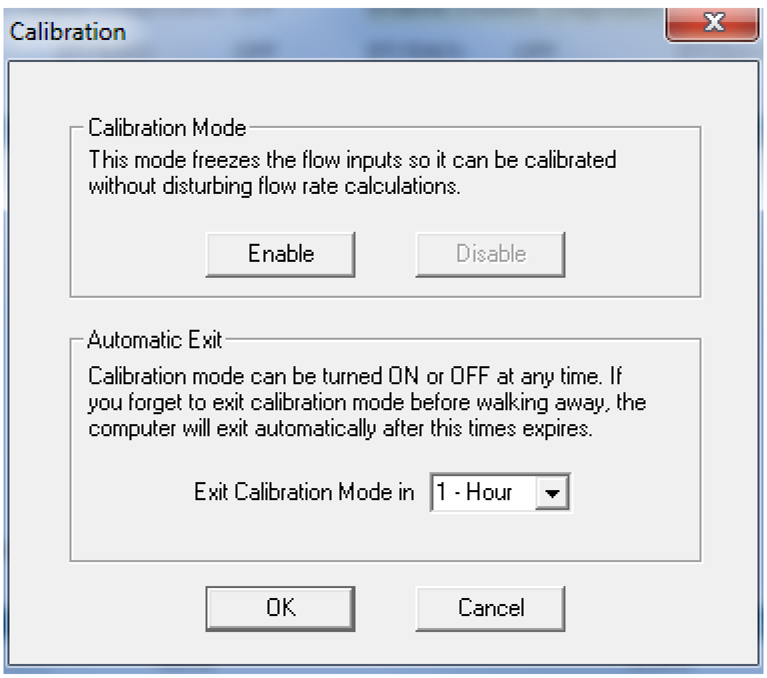
Battery Voltage: 23.50

GC Slave Status: N/A

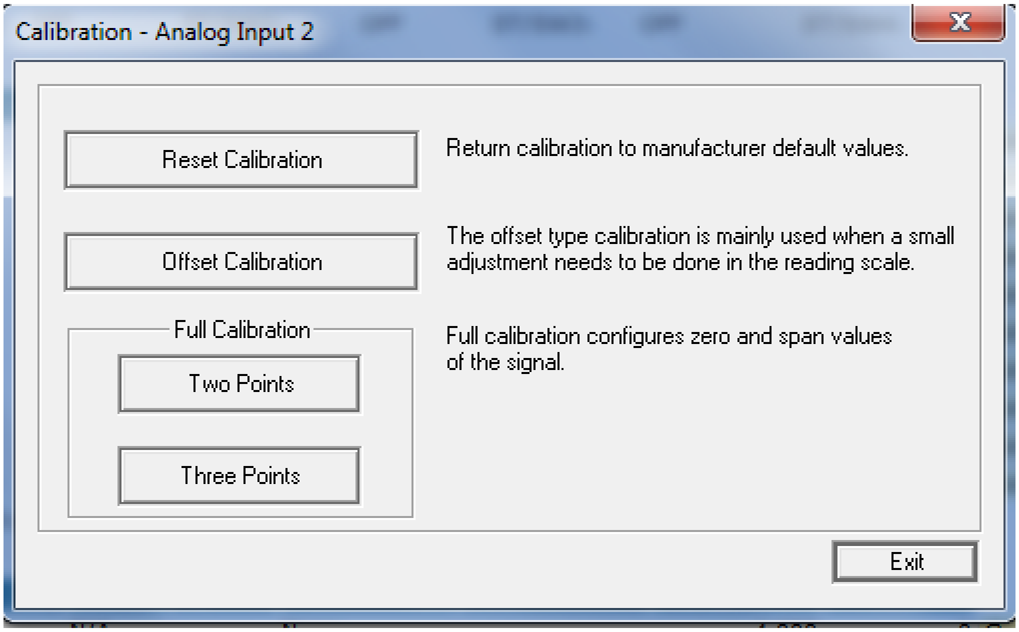
Calibration Mode is for freezing option prior to execution of calibration



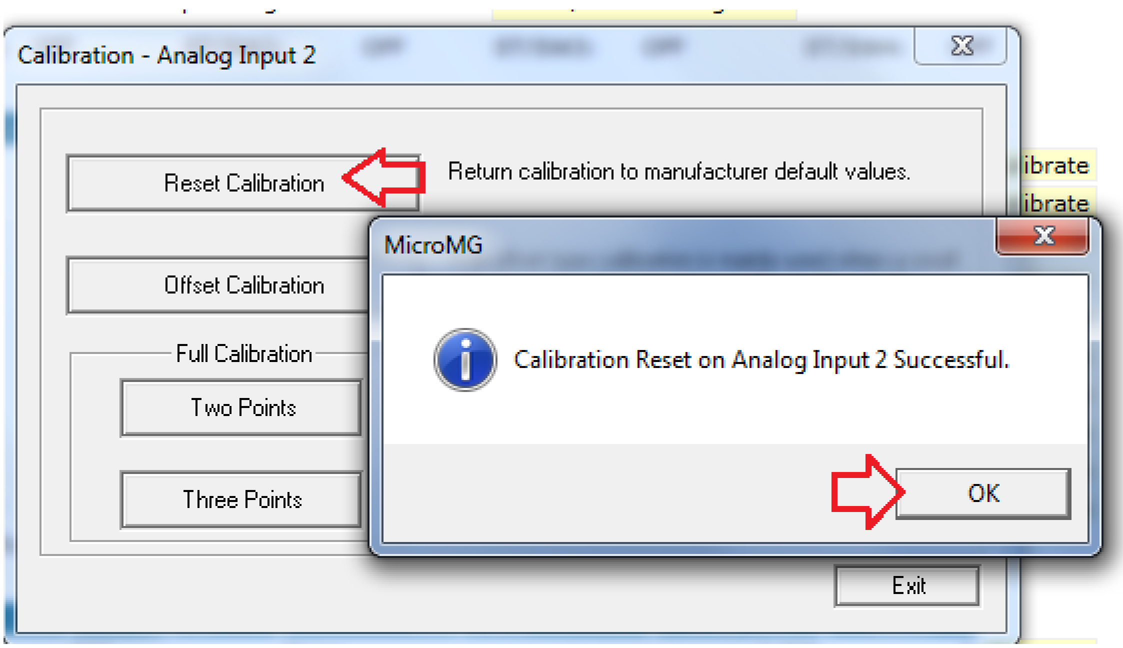
To calibrate Flow Computer, totalizers will continue at same rate where live parameters will show actual value, i.e. flow rate, DP, pressure etc. Press “Enable” button to enable or disable this feature.



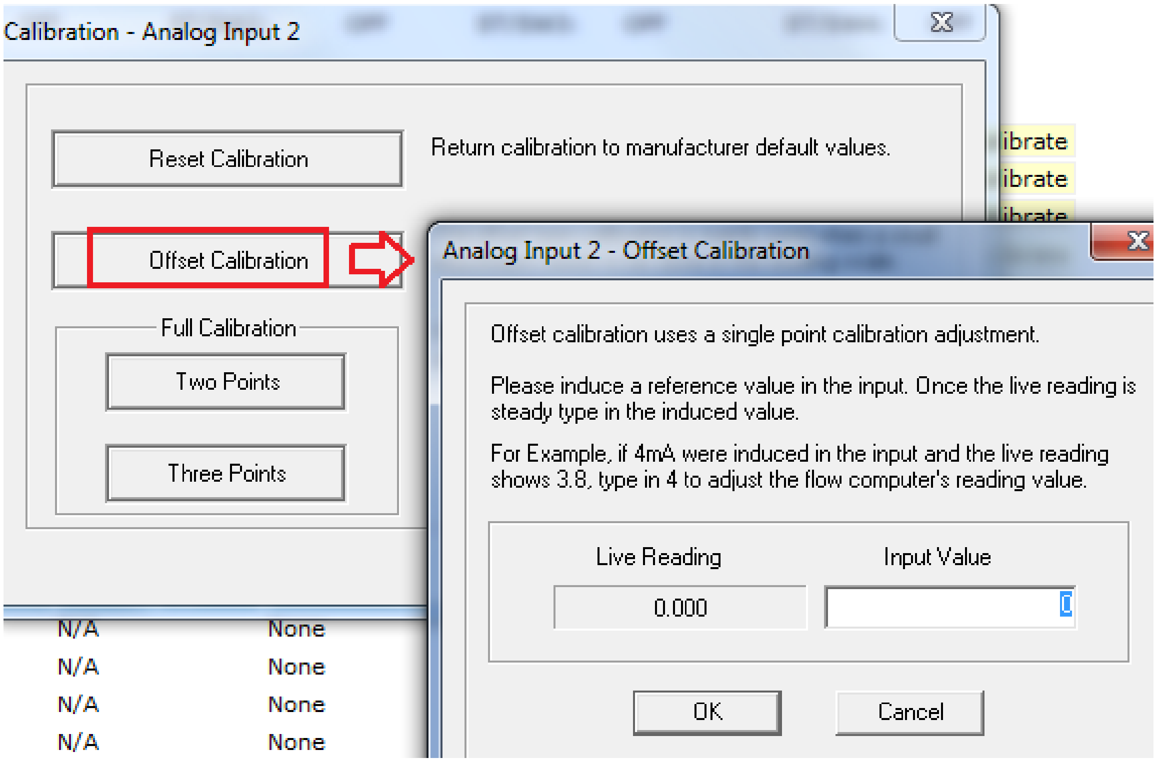
Calibration Selection



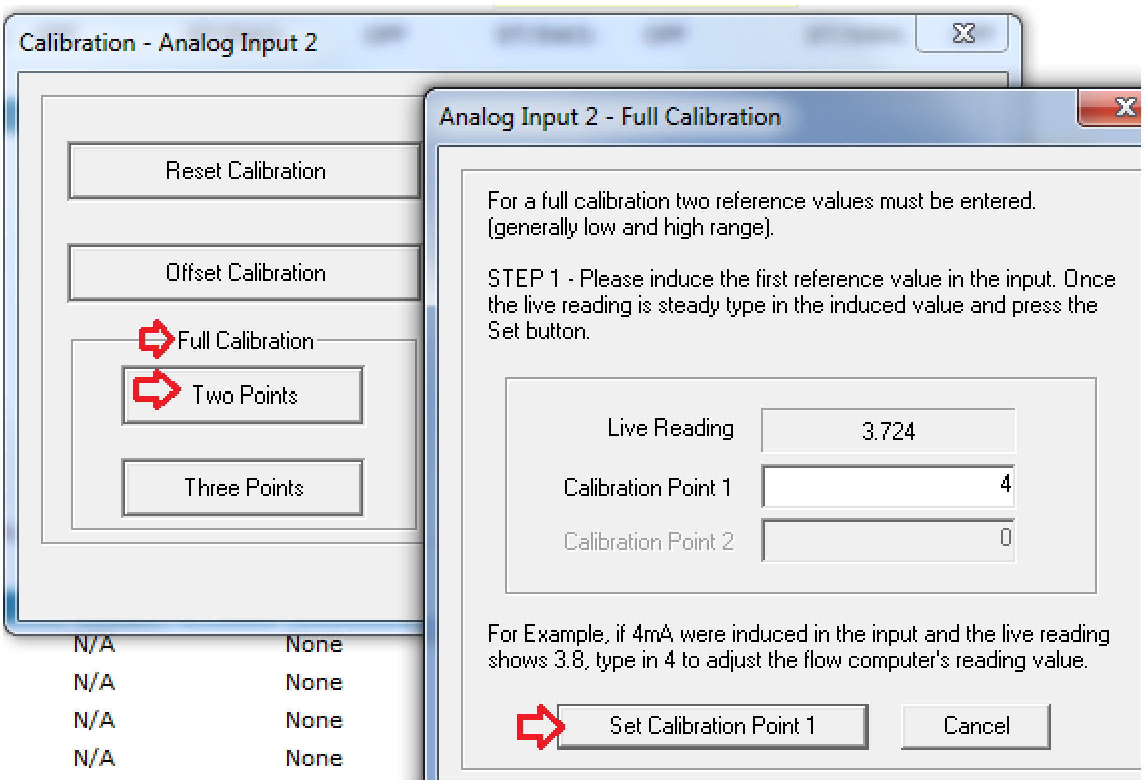
***Calibration Selection* – Reset**

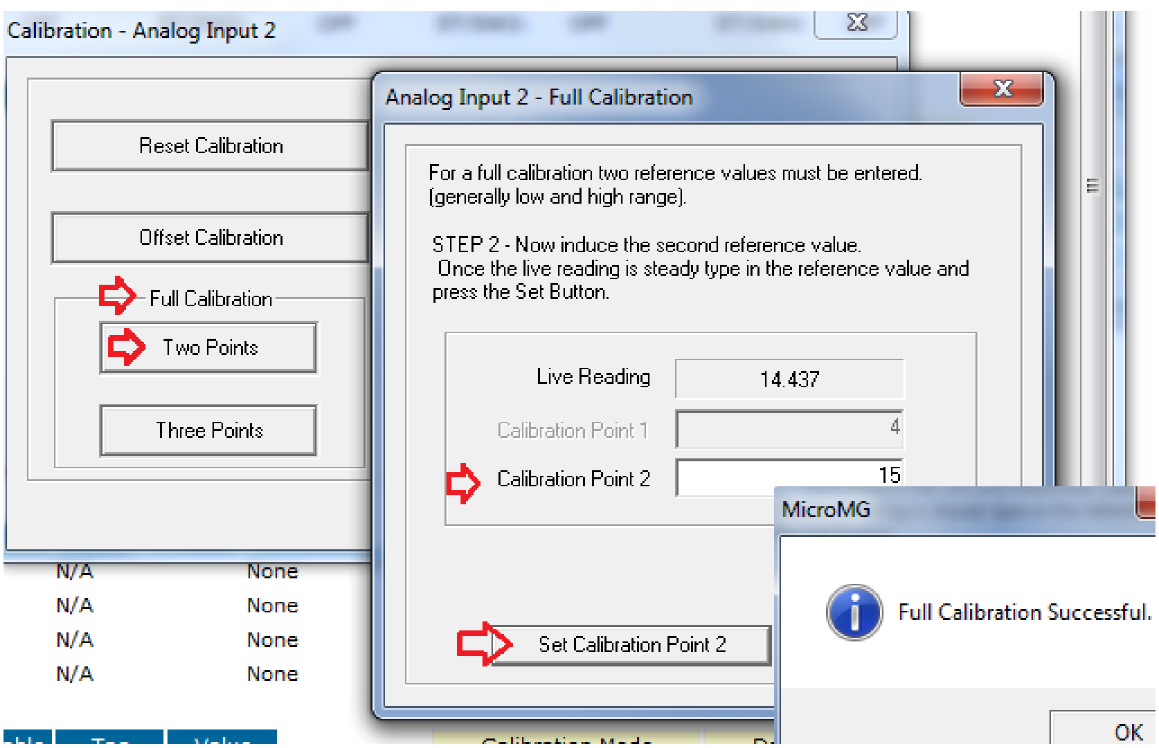


Calibration Selection **– Offset**

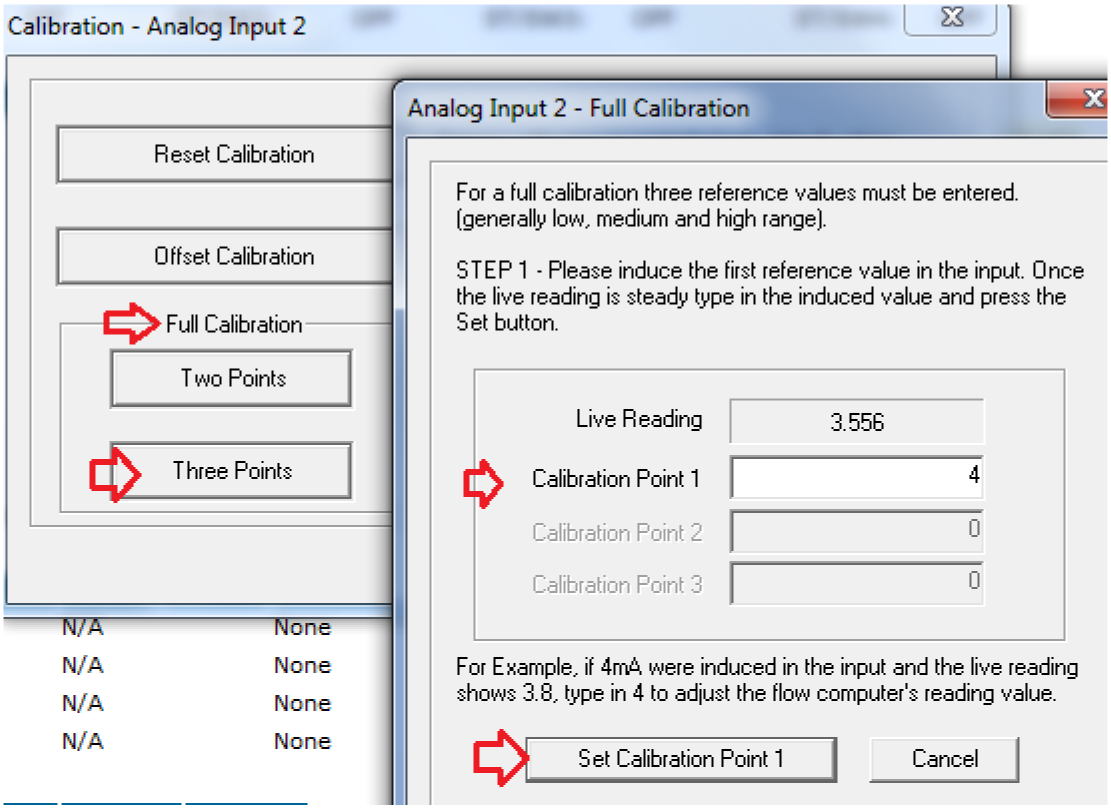


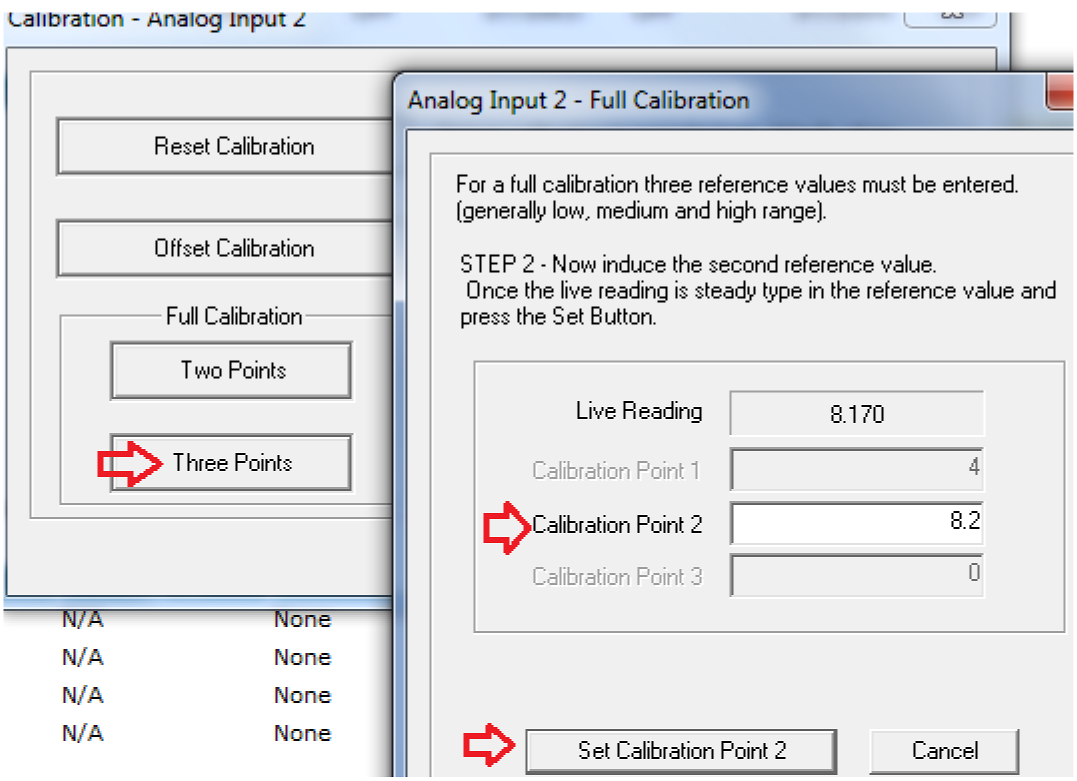
***Full Calibration Selection* – 2 Points**



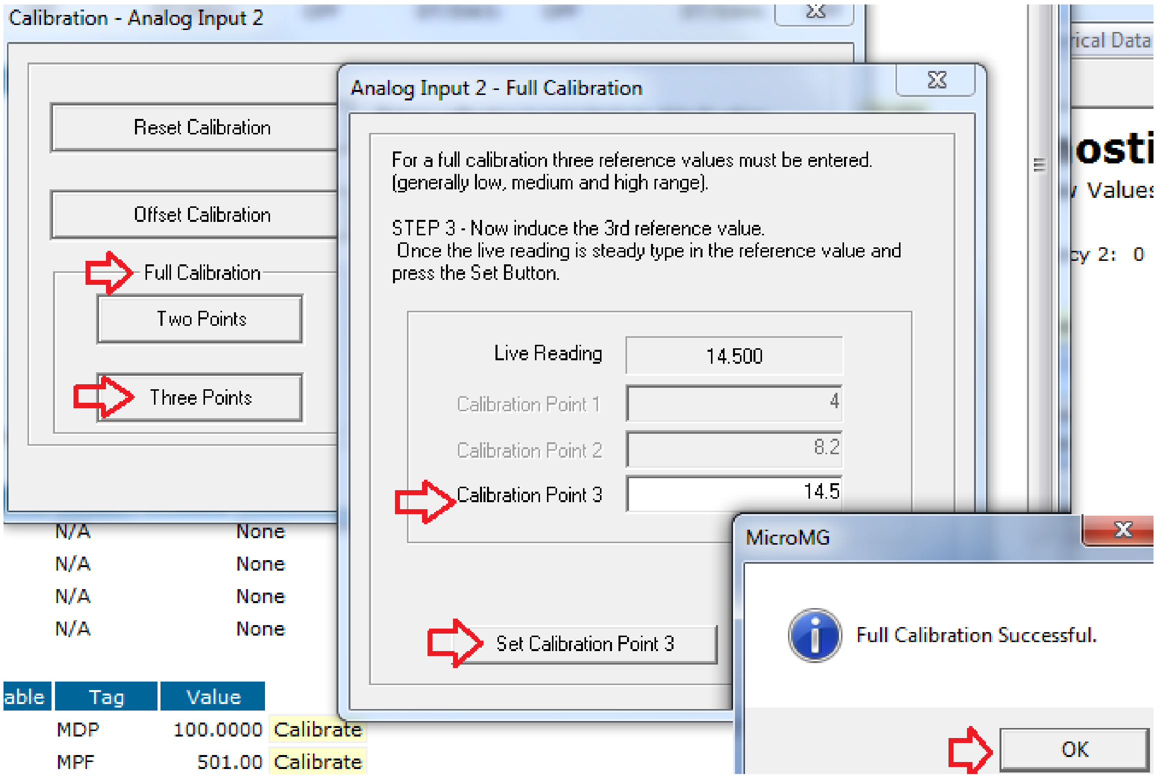


***Full Calibration Selection* – 3 Points (Continued)**



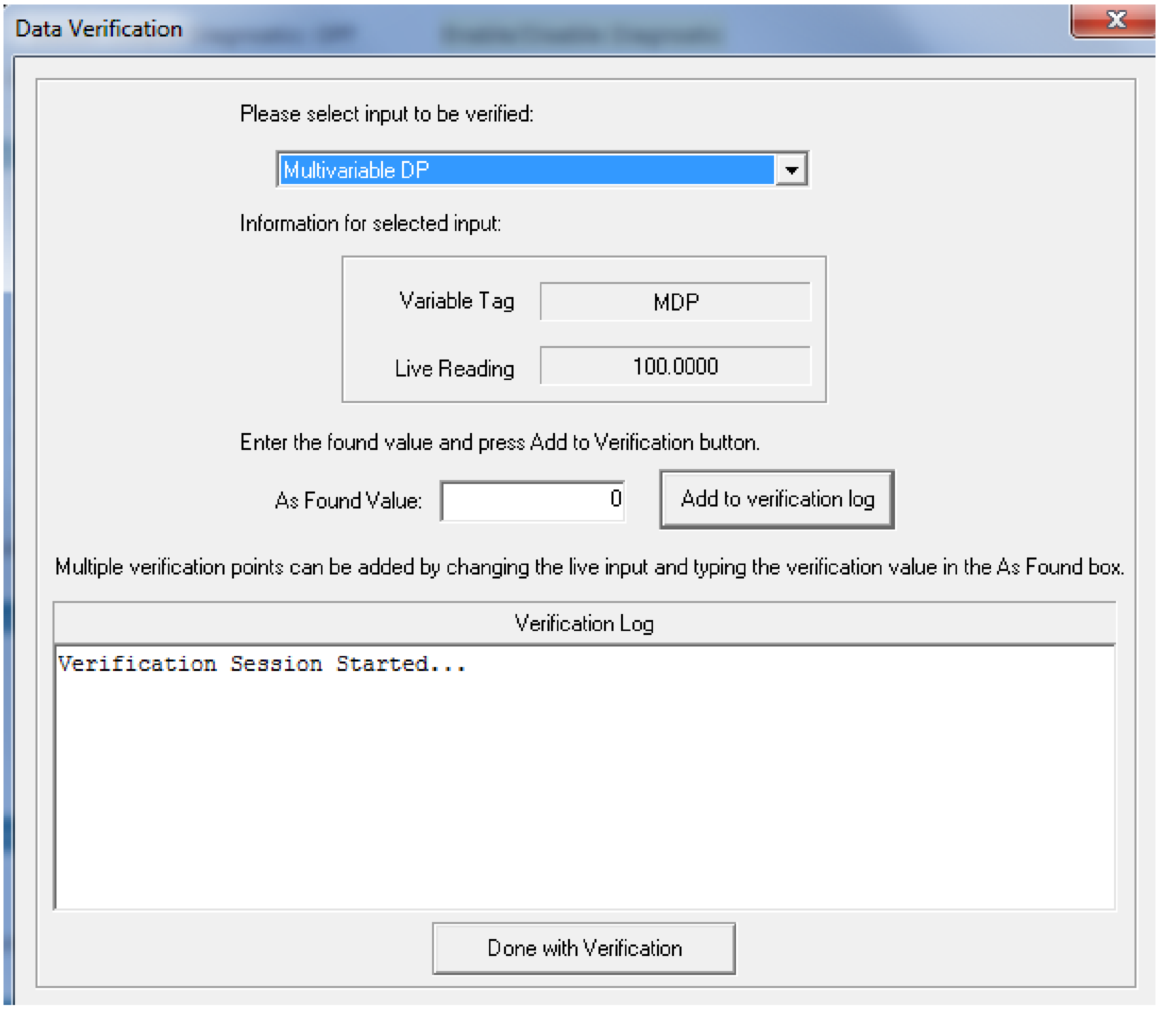


***Full Calibration Selection* – 3 Points (Continued)**



Data Verification

Data verification will not affect the calibration, but will be documented into calibration and verification report. Multiple verification points can be added by changing the live input and entering the verification value in the As Found box.



Verifying Digital Inputs and Outputs

Use the diagnostic menu. to verify all inputs and outputs. A live input and output is displayed. On the top of the screen pulse inputs and density frequency input are shown. Compare the live value against the displayed value on the screen. Failure to read turbine input could be a result of a bad preamplifier or the jumper selection for sine and square wave input are not in the correct position. Refer to wiring diagram **Wiring | Turbine** for proper turbine input wiring. Density input can be sine or square wave with or without DC offset. Minimum accepted signal has to be greater than 1.2 volt peak to peak. Status input is shown below the frequency input to the left of the screen. When the status input is on, the live diagnostic data will show **ON**. Minimum voltage to activate the status is 6 volts with negative threshold of 2 volts. To activate the switch outputs to the on and off position, click on "Enable/Disable Diagnostic" button in the diagnostic menu. After the screen freeze, click on "Toggle ON/OFF" button to toggle the switch on/off . To exit, click on "Enable/Disable Diagnostic" button again. The switch outputs are open collector and require external voltage.

CHAPTER 2: Data Entry and Configuration Menus

Configuration File through Window Program

Open a File

Go to the **Configuration File | Open...** (Left top corner of the screen)
Use this function to open an existing configuration file. After a file is opened it becomes the currently active file; its contents can be viewed and its parameters can be edited.
When this function is chosen a list of existing configuration files is displayed (files with extension .SFC). Use the cursor arrow keys to move the cursor to your selection. This function also can be reached pressing on the toolbar.

Open a New File

Go to the **Configuration File | New...** (Left top corner of the screen)
Create a new file to store all the programmed information for one MicroMG Flow Computer. You are prompted for the new file's name. If you enter the name of a pre-existing file, the software informs you of this and prompts you if you want to overwrite the old file. After a file is opened it becomes the currently active file; its contents can be viewed and its parameters can be edited. This option can be activated pressing on the toolbar.

Save As

Go to the **Configuration File | Save As...** (Left top corner of the screen)
Use Save As to save the parameters in the currently active file (that is, the parameter values currently being edited) to a new file. You are prompted for the new file's name. If you enter the name of a pre-existing file, the software asks you if you want to overwrite the old file. The original file will remain in memory.

Save

Go to the **Configuration File | Save ...** (Left top corner of the screen)
When permanent modifications are performed on a file, user must save the new changes before exiting the program, or proceeding to open a different file. The system will ask you for the name you want for this file. You can also save pressing on the toolbar.

Exit

Go to the **Configuration File | Exit...** (Left top corner of the screen)
Exit the application, if changes were made to the configuration and haven't been saved you will be asked if you want to save them.

Before the Exit option there is a list of the most recently used configuration files so you can select one of them without looking for it in the disk.

Export Configuration File as Text

Go to the **Configuration File | Export as Text..** (Left top corner of the screen)
Use "Export as Text" to save configuration file in a text format. Provide a file name and location to save the configuration data report.

VIEW

View Drawings

Select the wiring diagram to be displayed. (See details in chapter 1)

- Back Panel
- Analog Input
- RTD
- Analog Output
- Status Input
- Switch Output
- Turbine
- Densitometer
- RS 232
- RS 485

TOOLS

Communication Port Settings

You can access this window either through the **Tools | Comm Settings** menu option or the Comm button on the toolbar. (the fourth icon from the left)

This window let you set the port settings in order to communicate with the Flow Computer. You have the following options available:

SERIAL COMMUNICATION PARAMETERS

Port - Communication Port Number

Enter the PC port used to communicate with the MicroMG Flow Computer.

Baud Rate

> *Note: this parameter must be set the same for both the PC and the MicroMG Flow Computer for communication to occur.*

Baud rate is defined as number of bits per second. The available selections are 1200, 2400, 4800 or 9600

Parity

> *Note: this parameter must be set the same for both the PC and the MicroMG Flow Computer for communication to occur.*

RTU - NONE
ASCII - EVEN or ODD

Set the parity to match the **Modbus Type**.

Data Bits

Options available: 5, 6, 7, or 8.Generally used: 8 for RTU mode, 7 for ASCII mode. The MicroMG uses 8 data bits in RTU mode and 7 data bits in ASCII mode.

Stop Bits

The MicroMG uses 1 stop bit.

Modbus Type

> *Note: this parameter must be set the same for both the PC and the MicroMG Flow Computer for communication to occur.*

The Modbus Communication Specification is either Binary RTU or ASCII.

Auto Detect Settings

Click this button and the configuration program will attempt to communicate with a single MicroMG Flow Computer at different baud rates and formats.

Failure to communicate can occur because of a wiring problem, wrong PC port selection, communication parameter mismatch between PC and MicroMG Flow Computer. (Modbus type, parity, baud rate, etc.) or lack of power to the MicroMG Flow Computer. To use this feature, the user must insure that only one MicroMG Flow Computer is connected to the PC. More than one MicroMG Flow Computer in the loop will cause data collisions and unintelligible responses

USE INTERNET PROTOCOL

Check the box if an Ethernet connection is configured instead of a serial connection. To be able to communicate with the flow computer, both IP Address and Port must be configured.

IP Address

Enter IP Address of the target flow computer.
The standard addressing format is xxx.xxx.xxx.xxx

Port

Enter the port number of Modbus/Ethernet Bridges. The default port number is 502.

Protocol

Select a Modbus TCP or TCP/IP Encapsulation protocol to be used through Ethernet connection.

Modbus TCP –

Also known as Modbus Ethernet consists of a Modbus message without CRC wrapped by a TCP/IP message. This protocol is generally used by industrial Modbus to Ethernet converters.

TCP/IP Encapsulation –

Also known as TCP/IP Pass Through Mode consists of a regular Modbus message embedded in a TCP/IP message. This protocol is generally used by a general purpose Ethernet to Serial converters.

UNIT ID NUMBER

The Unit ID Number is used strictly for communication purposes; it can take any value from 1 to 247. Only one master can exist in each loop.

Note: Do not duplicate the Unit ID number in a single communication loop! This situation will lead to response collisions and inhibit communications to units with duplicate ID numbers.

TIME OUT

The amount of time in seconds the program will wait for an answer from the flow computer.

RETRY TIMES

Retry times for the program to communicate with the flow computer in case of timeout.

Meter Configuration

METER SETTINGS

***Data will be corrupted on changing Resolution or Unit Settings. User is responsible for saving and clearing memory before applying new settings**.

Units System – US or Metric Units

Selection	Description	Temperature	Pressure
0	US Units	DEG.F	PSIG
1	Metric Units	DEG.C	BAR, KG/CM2, KPA

Metric Pressure Units

Selection	Description	Pressure
0	Metric Units	BAR
1	Metric Units	KG/CM2
2	Metric Units	KPA

Gross/Net Flow Units

Selection	Description-Gross	Description-Net
0	MCF	MSCF
1	CF	SCF
2	MMCF (1 decimal)	MMSCF (1 decimal)
3	KM3	KSM3
4	M3	SM3
5	MMCF (4 decimal)	MMSCF (4 decimal)

Mass Flow Units

Selection	Description-US Units	Description-Metric
0	MLB	TONNE
1	LB	KG

Energy Flow Units

Selection	Description-US Units	Description-Metric
0	MMBTU (1 decimal)	GJ (1 decimal)
1	MBTU	MJ
2	MMBTU (4 decimal)	GJ (4 decimal)
3		*MCAL (Mega Calorie, 1 decimal)
4		*MBTU (Mega BTU, 1 decimal)

*Note: Only available for firmware version 6.00.9 or newer.

Pressure Resolution

Up to 2 decimal places can be configured for pressure resolution.

Temperature Resolution

Up to 2 decimal places can be configured for temperature resolution.

Company Name

Up to 20 characters. The company name appears in the reports.

Meter Location

Up to 20 characters. This entry appears only in the report and serves no other function.

Day Start Hour (0-23)

Day start hour is used for batch operation. If daily batch is selected, the batch will end at day start hour, all batch totalizers and flow-weighted values are reset.

Disable Alarms

Use Disable Alarms to ignore alarms. When the alarm function is disabled alarms are not logged. Alarms are also not logged if the DP is below the cut-off limit.

Common Parameters

This feature allows the Flow Computer to use the transmitters on meter one to substitute and compensate for meter two.

Select Scale Value

Scale value use high limit parameters. Full-scale value can be selected using 32767 with sign bit or as 4095 analog values. To use scale value feature, the high limit must be set to 32767 or 4095.

Example:
Current meter#1 temperature reading is 80 Degree F

Select Scale Value Data Entry	32767	4095
Meter#1 Temperature High Limit Data Entry	32767	4095
Value of Modbus Register <3059>	80	80

Meter Bank

Single or two meters run configuration per individual MicroMG Flow Computer. Enter '1', if two meters are connected to the flow computer.

Stream Selection

Single stream can be single meter or bank of two meters. Dual streams allow the user to monitor independent products on separate streams simultaneously.

Select Flow Rate Display

The flow rate will be based on daily basis, hourly, or minute.

Flow Rate Average Second

The flow rate is averaged for 1-10 seconds to minimize fluctuating flow rate conditions. This number averages the current flow rate by adding it to the previous seconds' flow rate, and then displays an averaged smoothed number. Only a low-resolution pulse meter requires this function.

Print Intervals in Minutes (0, 60, or 1440)

When the second port (RS-232) of the MicroMG Flow Computer is configured as printer port, enter 60 minutes to print hour, day, and month report, or 1440 to print day and month report.

Base Temperature

The basis reference temperature for all corrections. Used, for example, when seller contracts to sell to buyer at an agreed base temperature. Typically 60.0 °F in US units, 15 °C in Metric units.

Base Pressure

The basis reference pressure for all corrections. Used, for example, when seller contracts to sell to buyer at an agreed base pressure. Typical values are 14.73 PSIA for US units, 1.01325 bar in Metric units.

Atmospheric Pressure

This pressure is the local pressure or contracted atmospheric pressure to be used. Typical value is 14.696, 1.01325 bar in Metric units.

Use Analog Input Expansion (Inputs 5-9)

Addition analog input expansion board is required to have additional 5 analog inputs. Check this option to use analog input expansion #5-#9.

Daylight Saving Time (DST)

Enabling Daylight Saving Time (also called “Summer Time”) sets the Flow Computer to automatically forward its time by one hour at 2:00 AM on a preset day (“Spring Forward”) of the year and roll back on a second date(“Fall Back”).

If left in auto mode, the computer calculates the DST dates based on USA standards, which are, Spring Forward the first Sunday of April and Fall Back the last Sunday of October.

For countries with other DST dates, the user can enter dates manually. For example, European Summer Time starts the last Sunday in March and ends the last Sunday in October.

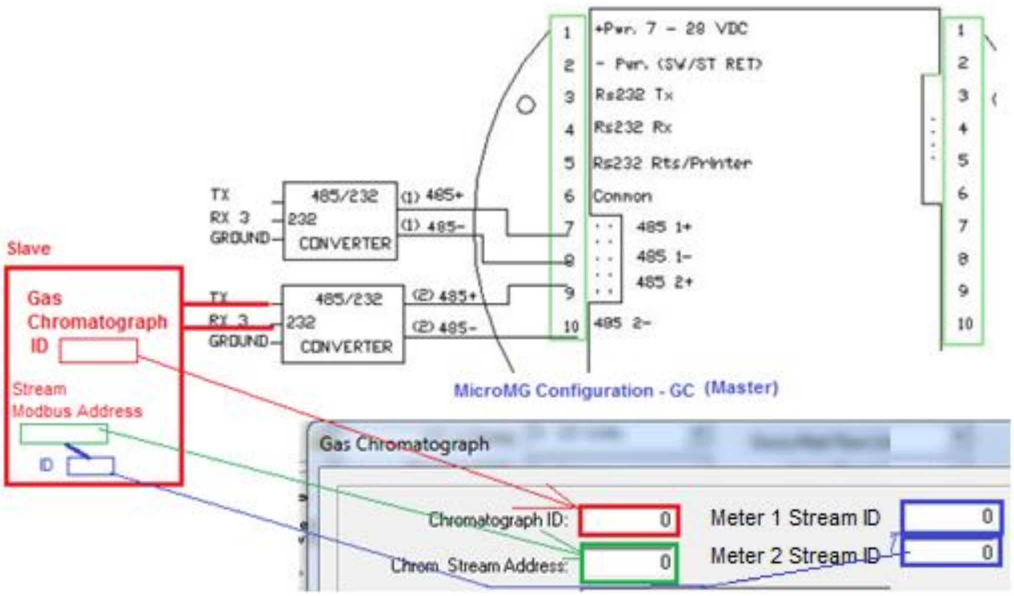
Effects of DST on Historical Data
Given the sudden time change that DST creates, the historical reports will show an hour with zero flow at 2:00 AM of Spring Forward Day and an hour with double flow at 1:00 AM of Fall Back Day, to achieve consistent 24-Hour a day flow records.

Averaging Method

Selection	Description
0	Flow-dependent time-weighted formulaic average
1	Flow-dependent time-weighted linear average
2	Flow-dependent linear average
3	Flow-dependent formulaic average

GAS CHROMATOGRAPH COMMUNICATION SET UP – (RS485 MASTER PORT)

Note: AGA8 Detailed Method must be selected, and G.C. Modbus registers have to be configured.



Gas Chromatograph Unit ID (Modbus Communication ID)

Gas Chromatograph Modbus Communication ID number to be polled by the Master Flow Computer. Flow Computers in listen mode must have the G.C. Modbus ID configured, so they can recognize the G.C. response.

Gas Chromatograph Stream Address (Modbus Address)

Modbus holding register where the current stream number resides. When the master flow computer reads this address, all flow computers will recognize the current stream composition.
Stream address range is from 3001 to 3999 and stream number is a16 or 32 bits integer format

Stream ID for Meters.

The stream ID for the flow computer to recognize the current meter composition.

Gas Chromatograph Floating Registers Type - Number of Bytes

Selection	Description
4 Bytes	One Register - 4 Bytes (1 register of 32 bits IEEE floating)
2 Bytes	Two Registers – 4 Bytes (2 registers of 16 bits IEEE floating)

Gas Chromatograph Floating Registers Type - Bytes Order

Variable type describes the position of high, low words of slave device. When 32 bits (two words) register is polled, it is essential to define where the highest significant word.

Byte Order Sequence
High / Low Byte
Low / High Byte

Gas Chromatograph MicroMG Flow Computer Destination Address

Destination defines where the polled variables are used in the flow computer. Variable statements and other pre-defined locations are accepted. Pre-defined locations are temperature, pressure, and density. Variables can be accessed through the display and reports.

0	Methane
1	Nitrogen
2	Carbon Dioxide
3	Ethane
4	Propane
5	Water
6	Hydrogen Sulfide
7	Hydrogen

8	Carbon Monoxide
9	Oxygen
10	i-Butane
11	n-Butane
12	i-Pentane
13	n-Pentane
14	n-Hexane
15	n-Heptane

16	n-Octane
17	n-Nonane
18	n-Decane
19	Helium
20	Argon
21	S.G.
22	Heating Value BTU

Source Address - Gas Chromatograph Compositions Address

Source defines the actual registers being polled from the slave device. Source address is considered to be continuous without zero address in between. The range for source address is from 7001 to 7999.

Example: Heating Value BTU

DEST=22, ***ADDR***=7081

B - METER DATA

Meter ID

Up to 8 characters. This function will serve as meter tag.

Flow Equation Type

1 = API 14.3 (NEW AGA3)
2 = AGA7 (TURBINE or Frequency Type Input)
3 = Venturi
4 = Nozzle
6 = V-Cone

Select the desired calculation mode. API 14.3 is the latest orifice calculations introduced in 1994 All new installations are recommended to use API 14.3 for orifice calculations.

Flow Rate Low/High Limit

The high/low net flow rate alarm is activated, when net flow rate exceeds or is below the set limit. The alarm will be documented with time, date, and totalizer.

Density of Dry Air MLB/MOL

Typical value would be 28.9625.

Relative Density

The real gas relative density is used in the calculations of the compressibility factor, flowing and reference densities (required only when AGA8 or NX19 is used).

Density Calculation Type

Calc. #	Calculation Type	Comments and Limitations
0 =	NX19	
1 =	AGA8 Gross Method 1	Relative Density: 0.554–0.87 Heating Value: 477–1150 BTU/SCF
2 =	AGA8 Gross Method 2	Relative Density: 0.554–0.87 Heating Value 477–1150 BTU/SCF
3 =	AGA8 Detail Method	Relative Density: 0.07–1.52 Heating Value 0–1800 BTU/SCF
4 =	Steam Equations	260 ≤ T ≤ 2500 Deg.K 0 ≤ P ≤ 3000 Mpa
5 =	Ethylene NBS 1045	up to 40 Mpa (5000 PSIG)
6 =	Parahydrogen (NBS 1048)	Gas Form only
7 =	Oxygen (NBS 1048)	Gas Form only
8 =	Nitrogen (NBS 1048)	Gas Form only
9 =	Argon (NBS 1048)	Gas Form only
10 =	Saturated Steam	14.7 < Pressure < 362. PSIA
11 =	Nist10 Superheated Steam	500 - 900 Deg.F, 300-975 PSIA

AGA 8 detail method can be used for gases other than natural gas, such as methane, carbon dioxide, ethane, and hydrogen sulfide.

Heating Value

Heating value is required and used in the AGA8 calculation GROSS METHOD 1.
For AGA8 detailed method, calorific calculation is used to calculate heating value if an override values is not entered. Steam equation also calculates heating value, otherwise without a heating value override entered, the Energy Flow Rate will always equal zero.

Heating Value Units	US Units	Metric Units
Density – Steam Equation	BTU/LB	MJ/KG
Density – Other Equations	BTU/SCF	MJ/SM3

API 14.3 DATA (NEW AGA3)

Pipe I.D.

Primary Element - Orifice ID

Pipe ID is the measured inside pipe diameter to 5 decimals at reference conditions. Orifice ID is the measured diameter of the orifice at reference conditions.

DP Cutoff

The MicroMG Flow Computer suspends all calculations whenever the DP is less than this value. This function is vital for suppressing extraneous data when the DP transmitter drifts around the zero mark under no-flow conditions.

Y Factor (0=None, 1=Upstream, 2=Downstream)

Y factor is the expansion factor through the orifice. The user must enter the position of the pressure sensor. Select y=1 if the sensor is installed upstream of the orifice plate. Select y=2 if the sensor is down stream of the orifice plate. When a multi-variable is used, the pressure sensor is always upstream and set to 1.

Isentropic Exponent (Specific Heat)

Ratio of specific heat is a constant associated with each product. Even though it varies slightly with temperature and pressure, in most cases it is assumed as a constant.

Viscosity in Centipoise

Even though viscosity will shift with temperature and pressure changes, the effect on the calculations is negligent. Therefore using a single value is appropriate in most cases. Enter viscosity in centipoise.

Reference Temperature of Orifice

Reference Temperature of Pipe

These parameters give temperature at which the bore internal diameter was measured on the orifice and pipe respectively. Commonly 68 °F (US Units), 20 °C (Metric Units) is used.

Primary Element Orifice Thermal Expansion Coefficient E-6

Pipe Thermal Expansion Coefficient E-6

These parameters give the linear expansion coefficients of the orifice and pipe materials respectively.

	Us Units	Metric Units
Type 304 and 316 Stainless	9.25 E-6	16.7 E-6
Monel	7.95 E-6	14.3 E-6
Carbon Steel	6.20 E-6	11.2 E-6

AGA 7 DATA (FREQUENCY)

Mass Pulses

The MicroMG Flow Computer can be configured as mass pulse input. Enter ‘1’ to enable this feature.

K Factor

Volume Pulses –
K Factor is the number of pulses per unit volume, i.e. 500 pules/CF (US), 500 pulses/M3 (Metric).
Mass Pulses –
K factor is the number of pulses per unit mass, i.e. 500 pules/LB (US), 500 pulses/M3 (Metric).
The meter’s tag would normally indicate the K Factor.

Meter Factor

Meter Factor is a correction to the K Factor for this individual meter, applied multiplicatively to the K factor.

Flow Cutoff Frequency

The MicroMG Flow Computer will quit totalizing when the turbine frequency (or other frequency input) is below this set limit. This feature is to reduce extraneous noise appearing as volume data when the meter is down for period of time.
This value is entered as pulses per second.

Linear Factor

Enter the different correction factors for the meter at different flow rates. The MicroMG Flow Computer will perform linear interpolation each second. Notice that even though using this feature enhances the measurement accuracy and range, performing audit trail on a linearized meter factor is very difficult.

VENTURI DATA

Pipe I.D.

Primary Element ID

Pipe ID is the measured inside pipe diameter to 5 decimals at reference conditions. Primary element ID is the measured Bore Inside diameter at reference conditions.

DP Cutoff

The MicroMG Flow Computer suspends all calculations whenever the DP is less than this value. This function is vital for suppressing extraneous data when the DP transmitter drifts around the zero mark under no-flow conditions.

Y Factor (0=None, 1=Upstream, 2=Downstream)

Y factor is the expansion factor through the Venturi. The user must enter the position of the pressure sensor. Select y=1 if the sensor is installed upstream of the Venturi. Select y=2 if the sensor is down stream of the Venturi. When a multi-variable is used, the pressure sensor is always upstream and set to 1.

Isentropic Exponent (Specific Heat)

Ratio of specific heat is a constant associated with each product. Even though it varies slightly with temperature and pressure, in most cases it is assumed as a constant.

Bore Reference Temperature

These parameters give temperature at which the bore internal diameter was measured on the. Commonly 68 °F (US Units), 20 °C (Metric Units) is used.

Thermal Coefficient of PE E-6

Pipe Coefficient Corner Tap E-6

	Us Units	Metric Units
Type 304 and 316 Stainless	9.25 E-6	16.7 E-6
Monel	7.95 E-6	14.3 E-6
Carbon Steel	6.20 E-6	11.2 E-6

Discharge Coefficient C

This value is the discharge coefficient for Venturi flow equations.

NOZZLE DATA

Pipe I.D.

Primary Element ID

Pipe ID is the measured inside pipe diameter to 5 decimals at reference conditions. Primary Element ID is the measured diameter of the nozzle outlet throat at reference conditions.

DP Cutoff

The MicroMG Flow Computer suspends all calculations whenever the DP is less than this value. This function is vital for suppressing extraneous data when the DP transmitter drifts around the zero mark under no-flow conditions.

Y Factor (0=None, 1=Upstream, 2=Downstream)

Y factor is the expansion factor through the nozzle. The user must enter the position of the sensor. Select y=1 if the sensor is installed upstream of the nozzle. Select y=2 if the sensor is installed downstream of the nozzle. When a multi-variable is used, the pressure sensor is always upstream and set to 1.

Isentropic Exponent (Specific Heat)

Ratio of specific heat is a constant associated with each product. Even though it varies slightly with temperature and pressure, in most cases it is assumed as a constant.

Bore Reference Temperature

These parameters give temperature at which the bore internal diameter was measured on the Reference temperature of orifice is the temperature at which the nozzle throat internal diameter was measured. Commonly 68 °F (US Units), 20 °C (Metric Units) is used.

Thermal Coefficient of PE E-6

Pipe Coefficient Corner Tap E-6

These parameters give the linear expansion coefficients of the nozzle and pipe materials respectively.

	Us Units	Metric Units
Type 304 and 316 Stainless	9.25 E-6	16.7 E-6
Monel	7.95 E-6	14.3 E-6
Carbon Steel	6.20 E-6	11.2 E-6

Nozzle Type

0 = ASME long radius
1 = ISA
2 = Venturi Nozzle (ISA inlet)

Viscosity in Centipoise

Even though viscosity will shift with temperature and pressure changes, the effect on the calculations is negligent. Therefore using a single value is appropriate in most cases. Enter viscosity in centipoise.

CONE/SMART CONE

Meter Inside Diameter
Enter the inside meter diameter to 5 decimals.

Cone Diameter
Enter cone diameter in inches.

DP Cutoff
The MicroMG Flow Computer suspends all calculations whenever the DP is less than this value. This function is vital for suppressing extraneous data when the DP transmitter drifts around the zero mark under no-flow conditions.

Isentropic Exponent (Specific Heat)
Fluid isentropic exponent at flowing conditions.

Y Factor

Selection	**Description**
0	Non-Compressible
1	Compressible Fluids – Precision
2	Compressible Fluids – Wafer & Cone

Flow Coefficient of the meter
Enter the flow coefficient of the meter.

Pipe and Cone Thermal Expansion Coefficient E-6
Enter pipe and cone material coefficient of thermal expansion. (Typically between 0.000005 and 0.000010).

	Us Unit	Metric Unit
Type 304 and 316 Stainless	9.25 E-6	16.7 E-6
Monel	7.95 E-6	14.3 E-6
Carbon Steel	6.20 E-6	11.2 E-6

C – COMMUNICATION PORTS

Unit ID Number

The Unit ID Number is used strictly for communication purposes; it can take any value from 1 to 247.

> *Note: Do not duplicate the Unit ID number in a single communication loop! This situation will lead to response collisions and inhibit communications to units with duplicate ID numbers.*

Only one master can exist in each loop.

Flow Computer Ports

Modbus Type

> *Note: this parameter must be set the same for both the PC and the MicroMG Flow Computer for communication to occur.*

The Modbus Communication Specification is either Binary RTU or ASCII.

Parity

> *Note: this parameter must be set the same for both the PC and the MicroMG Flow Computer for communication to occur.*

RTU - NONE

ASCII - EVEN or ODD

Set the parity to match the **Modbus Type**.

Baud Rate

> *Note: this parameter must be set the same for both the PC and the MicroMG Flow Computer for communication to occur.*

Baud rate is defined as number of bits per second. The available selections are 1200, 2400, 4800, 9600, or 19200.

RTS Delay

This function allows modem delay time before transmission. The MicroMG Flow Computer will turn the RTS line high before transmission for the entered time delay period.

RTU - NONE

ASCII - EVEN or ODD

Select 0=RTS, 1=Printer

RTS line has dual function selection: either RTS for driving request to send or transmit to serial printer. To use serial printer interface for printing reports, i.e. batch, daily, and interval Connect the serial printer to RTS and common return, and select 1 for printer.

Printer Baud rate

Baud rate is defined as number of bits per second. The available selections are 1200, 2400, 4800, or 9600.

Printer Number of Nulls

This function is used because no hand shaking with the printer is available and data can become garbled as the printer's buffer is filled. The MicroMG Flow Computer will send nulls at the end of each line to allow time for the carriage to return. Printers with large buffers do not require additional nulls. If data is still being garbled, try reducing the baud rate to 1200.

INPUTS/OUTPUTS (I/O)

D- METER INPUT ASSIGNMENT

DP

DP I/O Position

Selection	I/O Position	
0	None	
1	Analog Input #1	Enter the 4mA value for the transmitter. Enter the 20mA value for the transmitter
2	Analog Input #2	Enter the 4mA value for the transmitter. Enter the 20mA value for the transmitter
3	Analog Input #3	Enter the 4mA value for the transmitter. Enter the 20mA value for the transmitter
4	Analog Input #4	Enter the 4mA value for the transmitter. Enter the 20mA value for the transmitter
10	Multi. Variable DP	

DP Low/High Limit

Enter the low and high limits. When live value exceeds high limit or less than low limit, an alarm log will be generated.

DP Fail Code

Fail Code 0: always use the live value even if the transmitter failed.
Fail Code 1: always use the maintenance value
Fail Code 2: use maintenance value if transmitter failed. (i.e. Analog Input - 4-20mA is above 21.75 or below 3.25)

DP Maintenance Value

The value is to be used when the transmitter fails, or while calibrating. Set fail code to 1 while calibrating.

Use Stack DP

The MicroMG Flow Computer allows the user to select dual DP transmitters on each meter for better accuracy and a higher range flow. Use in conjunction with the DP Switch High % parameter setting.

DP High I/O Position

Selection	I/O Position	Description
0	None	
1	Analog Input #1	Enter the 4/20mA value for the transmitter.
2	Analog Input #2	Enter the 4/20mA value for the transmitter.
3	Analog Input #3	Enter the 4/20mA value for the transmitter.
4	Analog Input #4	Enter the 4/20mA value for the transmitter.
10	Multi. Variable DP	

DP Switch High %

The MicroMG Flow Computer will begin using the high DP when the low DP reaches the percent limit assigned in this entry. Example: DP low was ranged from 0-25 inches and switch % was set at 95%. When low DP reaches 23.75 in (= 0.95 * 25) the MicroMG Flow Computer will begin using the high DP provided the high DP did not fail. When the high DP cell drops below 23.75, the Flow Computer will start using the Low DP for measurement.

Density

Density Type

If live density is connected to the meter, user must enter the density type. Raw density frequency or a 4-20mA input can be selected. This density will be used to calculate mass flow and net flow.

<table>
<tr><th>Density Type</th><th>Densitometer</th><th colspan="2"></th></tr>
<tr><td>Type 0</td><td>None</td><td colspan="2"></td></tr>
<tr><td rowspan="3">Type 1</td><td rowspan="3">4–20 mA</td><td colspan="2">Density 4–20 mA Type</td></tr>
<tr><td>Type 0</td><td>Density Signal 4-20mA LB/FT3(US), KG/M3(Metric)</td></tr>
<tr><td>Type 1</td><td>SG Signal 4-20mA</td></tr>
<tr><td>Type 2</td><td>UGC</td><td colspan="2">Frequency Type – UGC Constants are required</td></tr>
<tr><td>Type 3</td><td>Sarasota</td><td colspan="2">Frequency Type – Sarasota Constants are required</td></tr>
<tr><td>Type 4</td><td>Solartron</td><td colspan="2">Frequency Type – Solartron Constants are required</td></tr>
</table>

Density Units (for Density 4-20mA Type only)

Note that this type of input requires the user to choose a subtype, as indicated in the table above.

Density Assignment

Density Type	Densitometer	I/O Position (Assignment)
0	None	
1	4-20 mA	Analog Input #1, #2, #3 or #4
2	UGC	Frequency (Not Selectable)
3	Sarasota	Frequency (Not Selectable)
4	Solartron	Frequency (Not Selectable)

Density Low/High Limit

Enter the low and high limits. When live-value exceeds high limit or less than low limit, an alarm log will be generated.

Density Maintenance Value

The value is to be used when the transmitter fails, or while calibrating. Set fail code to 1 while calibrating.

Densitometer Period Low/High Limits

Density Period is the time period in micro-second. The densitometer fails if the density period exceeds the density period low or high limits. If the densitometer fails and density fail code is set to 2, the maintenance value will be used.

Density Correction Factor

Enter the correction factor for the densitometer.

Density Fail Code

Fail Code 0: always use the live value even if the transmitter failed.
Fail Code 1: always use the maintenance value
Fail Code 2: use maintenance value if transmitter failed. (i.e. Analog Input - 4-20mA is above 21.75 or below 3.25, or frequency type – densitometer period is above densitometer high period or below densitometer low period)

Densitometer Temperature

Use Meter Temperature as Density Temperature

Allows the meter temperature to calculate the effect of temperature on the densitometer. Make sure the meter and density temperature are similar to avoid measurement errors.

Density Temperature I/O Position

Selection	I/O Position	
0	None	
1	Analog Input #1	Enter the 4/20mA value for the transmitter.
2	Analog Input #2	Enter the 4/20mA value for the transmitter.
3	Analog Input #3	Enter the 4/20mA value for the transmitter.
4	Analog Input #4	Enter the 4/20mA value for the transmitter.
5	RTD	

Density Temperature Low/High Limit

Enter the low and high limits. When live-value exceeds high limit or less than low limit, an alarm log will be generated.

Density Temperature Maintenance Value

The value is to be used when the transmitter fails, or while calibrating. Set fail code to 1 while calibrating.

Density Temperature Fail Code

Fail Code 0: always use the live value even if the transmitter failed.
Fail Code 1: always use the maintenance value
Fail Code 2: use maintenance value if transmitter failed. (i.e. Analog Input - 4-20mA is above 21.75 or below 3.25, RTD Input - OHMs is above 156 or below 50)

Meter Temperature

Meter Temperature I/O Position

Selection	I/O Position	
0	None	
1	Analog Input #1	Enter the 4/20mA value for the transmitter.
2	Analog Input #2	Enter the 4mA value for the transmitter.
3	Analog Input #3	Enter the 4mA value for the transmitter.
4	Analog Input #4	Enter the 4mA value for the transmitter.
5	RTD	
10	Multi. Variable	

Meter Temperature Low/High Limit

Enter the low and high limits. When live-value exceeds high limit or less than low limit, an alarm log will be generated.

Meter Temperature Maintenance Value

The value is to be used when the transmitter fails, or while calibrating. Set fail code to 1 while calibrating.

Meter Temperature Fail Code

Fail Code 0: always use the live value even if the transmitter failed.
Fail Code 1: always use the maintenance value
Fail Code 2: use maintenance value if transmitter failed. (i.e. Analog Input - 4-20mA is above 21.75 or below 3.25, RTD Input - OHM is above 156 or below 50)

Spare Inputs

Spare I/O Positions

Spare input is used for display and alarm purpose only. It is not used in the calculation process. To read spare input value, use the diagnostic screen

Selection	**I/O Position**	
0	None	
1	Analog Input #1	Enter the 4/20mA value for the transmitter.
2	Analog Input #2	Enter the 4/20mA value for the transmitter.
3	Analog Input #3	Enter the 4/20mA value for the transmitter.
4	Analog Input #4	Enter the 4/20mA value for the transmitter.
5	RTD	
10	Multi. Variable	

Spare#1/#2 Low/High Limit

Enter the low and high limits. When live-value exceeds high limit or less than low limit, an alarm log will be generated.

Spare#1/#2 Maintenance Value

The value is to be used when the transmitter fails, or while calibrating. Set fail code to 1 while calibrating.

Spare#1/#2 Fail Code

Fail Code 0: always use the live value even if the transmitter failed.
Fail Code 1: always use the maintenance value
Fail Code 2: use maintenance value if transmitter failed. (i.e. Analog Input - 4-20mA is above 21.75 or below 3.25, RTD Input - OHM is above 156 or below 50)

Transducer Tags

Up to 8 alphanumeric ID number. The transmitters are referred to according to the TAG ID. The multi-variables are referred to according to the TAG ID. All alarms are labeled according to TAG ID.

F - STATUS INPUT/SWITCH OUTPUT ASSIGNMENT

Status Input Assignment

User can select any one of status input and assign it to input point.

	Assignment	Comments
1.	Spare	
2.	Spare	
3.	Spare	N/A
4.	Alarm Acknowledge	Reset the previous occurred alarms output bit
5.	Spare	
6.	Spare	
7.	N/A	
8.	Calibration Mode	
9.	Event Status	

Examples:

```
Assign Status Input #1                      5
```

Switch Output Assignment

User can assign an output to each of the MicroMG Flow Computer's output switches from this list. The MicroMG Flow Computer switch outputs are open collector type, requiring external D.C power.
Outputs in the top list, "Pulse Outputs", require a definition of pulse output per unit volume. Therefore a Pulse Output Width must be defined when one of these switch types are chosen. These outputs are available through switches 1 or 2 only.
Outputs in the bottom list, "Contact Type Outputs", are ON/OFF type outputs. They can be assigned to any of the four switch outputs.

Switches 1 and 2 can be pulse or contact type output; switch 3 is contact-type output only.

Assignments - Pulse Outputs

	Meter 1	Meter 2
Gross	101	105
Net	102	106
Mass	103	107
Energy	104	108

Assignments - Contact Type Outputs

	Meter 1	Meter2
Temperature Low	126	136
Temperature High	127	137
Pressure Low	128	138
Pressure High	129	139
Density Low	130	140
Density High	131	141
Dens. Temperature Low	132	142
Dens. Temperature High	133	143
DP Low	134	144
DP High	135	145
Meter Down	120	123
Flow Rate Low	121	124
Flow Rate High	122	125

Meter-Independent Parameters	
Day Ended	119
Dens. Period Low	146
Dens. Period High	147
Temperature Out of Range	148
Gravity Out of Range	149
Pressure Out of Range	150
Active Alarms	151
Occurred Alarms	152
Status Input #1	157
Run Switch	158
Remote Control	159

Note: Assignments 113–118 are not used.

Pulse Output and **Pulse Output Width**

Pulse Output is used to activate a sampler or external totalizer. The number selected will be pulses per unit volume or per unit mass. If 0.1 pulse is selected, the one pulse will be given every 10-unit volumes has passed through the meter.
Pulse Output Width is the duration, in milliseconds, of one complete pulse cycle (where each cycle is the pulse plus a wait period, in a 50/50 ratio). For example: If POW = 500 mSec, the MicroMG Flow Computer at most can produce one pulse each second regardless of the pulse per unit volume selected (500 mSec pulse + 500 mSec wait). If POW = 10 mSec the MicroMG Flow Computer can produce up to 50 pulses per second.
The MicroMG Flow Computer's maximum pulse output is 125 pulses/sec. The Pulse Output in combination with the Pulse Output Width should be set so that this number is not exceeded.

H - ANALOG OUTPUT ASSIGNMENT

TAG ID

Up to 8 alphanumeric ID number. The transmitters are referred to according to the TAG ID. All alarms are labeled according to TAG ID
4-20mA selection must be proportional and within the range of the selected parameter.

Assignments:

	Meter 1	Meter 2
Gross Flow Rate	1	5
Net Flow Rate	2	6
Mass Flow Rate	3	7
Energy Flow Rate	4	8

	Mete1	Meter2
DP	13	21
Temperature	14	22
Pressure	15	23
Density	16	24
Density Temp	17	25
Base Density	18	26
DP LOW	19	27
DP HIGH	20	28
Specific Gravity	30	32
PID	36	37

Meter-Independent Parameters	
Spare #1	33
Spare #2	34
Remote Control*	35

Examples:
30 = Meter 1 Specific Gravity
25 = Meter 2 Density Temperature

**Note : Remote control output can be controlled through the Modbus communication link.*

4-20mA

4-20mA selection must be proportional and within the range of the selected parameter. 4-20mA signals are 12 bits.

I - MicroMG Flow Computer Display Assignment

Display assignment selects up to 16 assignments. The MicroMG Flow Computer will scroll through them at the assigned delay time.

Assignment

3 Digit Selection, where

1st Digit: **1: Meter#1** **2: Meter#2**
2nd and 3rd Digit: **Selection** (see table below)

Selection	Description
01	Flow Rate
02	Daily Total
03	Cum. Total
04	Previous Daily total
05	DP/DP Low, High
06	Temperature, Pressure
07	Density, Density at Base
08	Density Frequency, Densitometer Period, Un-Corr. Density
09	Density Temperature
10	Flow and Density Calculation Type
11	Spare #1, Spare #2
12	Yesterday Averaged Temperature, Pressure, Density
13	Alarms
14	Heating Value
15	Last Month Total
16	Primary Element/Pipe ID
17	Zf/Zb (AGA8)

2 Digits Selection

Selection	Description
11	Spare Data #1/#2
12	Battery Voltage and Image Version
14	Date/Time

Examples:

113 Display Meter #1 Previous Daily Gross Total
104 Display Meter #1 Batch Gross Total
138 Display Meter #1 Temperature

J - MODBUS SHIFT

Reassigns Modbus address registers on one MicroMG Flow Computer to variables for easy polling and convenience. Modbus Shift to collect values in scattered Modbus registers into a consecutive order. The MicroMG Flow Computer will repeat the assigned variables into the selected locations.
Note: Modbus shift registers are for READ ONLY. Some Modbus registers are **2 byte/16 bit**, some are **4 byte/32 bit** and some are **floating point registers.** Register size incompatibility could cause rejection to certain address assignments. Refer to the manual for more details and a listing of the Modbus Address Table Registers.
Example: you want to read the current status of switches #1 and #2 (addresses 2617 and 2618)
Make assignments such as:

```
3082=2617
3083=2618
```

***Note: Modbus shift registers are READ ONLY registers.**

***Note: Modbus Shift – IEEE Floating Register (Read only)**

Firmware Version 11_00_12_13 (Customized)	**Firmware Version 11_00_12_14**
2x16 bit-IEEE Floating Point	**1x 32 bit-IEEE Floating Point**

L - PID PARAMETERS

PID Configuration

(PID) Proportional Integral Derivative control– We call this function PID, however the flow computer performs Proportional Integral control. And does not apply the Derivative. The Derivative is not normally used in flow and pressure control operations and complicates the tuning operation

Use Flow Loop

(Valid entries are 0 or 1)
Enter 1 if the computer performs flow control.
Enter 0 if the flow computer does not perform flow control.

Flow Loop Maximum Flow Rate

Enter the maximum flow rate for this meter. This rate will be basis for maximum flow rate to control at.

Flow Set Point

Enter the set point. The set point is the flow rate that the flow computer will try to control at.

Flow Acting – Forward or Reverse

Enter 0 if the control is direct acting, Enter 1 if the control is reverse acting.
Direct acting is when the output of the controller causes the flow rate to follow in the same direction. The output goes up and the flow rate increases. A fail Close valve located in line with the meter will typically be direct acting. If the Controller output signal increases, the control valve will open more causing the flow rate to increase.
Reverse acting is when the output of the controller causes the opposite action in the flow rate. A fail open valve in line with the meter will typically be reverse acting. If the Controller output increases the control valve will close some causing the flow rate to decrease.
Care must be taken to study where the valves are located in relation to the meter and whether the valves are fail open or fail close to understand if the controller should be direct or reverse acting. Some control valves can be fail in position (Especially electrically actuated control valves). This valve should be studied to understand if the actuators themselves are direct or reverse acting.

Use Pressure Loop

(Valid entries are 0 or 1)
Enter 1 if the computer performs pressure control.
Enter 0 if the flow computer does not perform pressure control.

Pressure Maximum

Enter the Maximum pressure for this meter. This pressure will be basis for Maximum pressure to control at.

Pressure Set Point

Enter the set point. The set point is the pressure that the flow computer will try to control at.

Pressure Acting – Forward or Reverse

Enter 0 if the control is direct acting, Enter 1 if the control is reverse acting.
Direct acting is when the output of the controller causes the pressure to follow in the same direction. The output goes up and the pressure increases. A fail open valve located in the line downstream of the meter will typically be direct acting to maintain the pressure at the meter. An Increase in the output from the controller will cause the control valve to close thus causing the pressure to increase.
Reverse acting is when the output of the controller causes the opposite action in the flow rate. A fail close valve in the line downstream of the meter will typically be reverse acting to maintain the pressure at the meter. An increase in the output signal will cause the valve to open, which will cause the pressure to be released thus causing the pressure to decrease.
Care must be taken to study where the valves are located in relation to the meter and whether the valves are fail open or fail close to understand if the controller should be direct or reverse acting. Some control valves can be fail in position (especially electrically actuated control valves). These valves should be studied to understand if the actuators themselves are direct or reverse acting.

System Data Minimum Output

Enter the minimum output percent (default to 0)

System Data Maximum Output

Enter the maximum output percent (default to 100.0)

Signal Selection

If flow loop and pressure loops are both configured in the PID control loop, select high or low signal to be the output.

PID Flow Base

PID flow rate base can be gross, net, or mass flow rate.

PID Pressure Base

PID pressure base can be meter pressure, spare#1, or spare#2.

PID Tuning

Flow Controller Gain

(Allowable Entries 0.0 – 9.99)
The gain is effectively 1/Proportional Band.
The basis of theory for proportional band is the relationship of the percentage of the output of the controller to the percentage of the change of the process. In this case, if the control output changes 5% the flow rate should change 5%, the proportional band would be 1.0 and the gain would be 1.0.
If the percentage of the output is 5% and the flow rate would change by 10%, the proportional band would be 2 and the Gain would be 0.5
However since you do not know until you are flowing the effect of the output on the flow rate, you have to start somewhere. A good starting point is to use a proportional band of 0.5 if the valve is properly sized.

Flow Controller Reset

(Allowable Range 0.0 – 9.99)
Reset is the number of minutes per repeat is the time interval controller adjusts the output to the final control element. If the reset is set at 2, the flow computer will adjust the signal to the flow control valve every 2 minutes. If the Reset is set at 0.3, the output signal will be adjusted approximately every 20 seconds, until the process and set point are the same.
The rule of thumb is the reset per minute should be set slightly slower that the amount of time it takes for the control valve and the flow rate to react to the flow computer output signal changing.
This can only be determined when there is actual flow under normal conditions. It is best to start the reset at 0.3 or reset the signal every 3 minutes, if the control valve is properly sized.

Pressure Controller Gain

(Allowable Entries 0.0 – 9.99)
The gain is effectively 1/Proportional Band.
The basis of theory for proportional band is the relationship of the percentage of the output of the controller to the percentage of the change of the process. In this case, if the control output changes 5% the pressure should change 5%, the proportional band would be 1.0 and the gain would be 1.0.
If the percentage change of the output is 5% and the pressure would change by 10%, the proportional band would be 2 and the Gain would be 0.5.
However since you do not know until you are flowing the effect of the output on the pressure, you have to start somewhere. A good starting point is to use a proportional band of 0.5 if the control element is properly sized.

Pressure Controller Reset

(Allowable Range 0.0 – 9.99)
Reset is the number of times per minute the controller adjusts the output to the control valve. If the reset is set at 2, the flow computer will adjust the signal to the final control element every 2 minutes. If the Reset is set at 0.3, the output signal will be adjusted approximately every 20 seconds, until the process and the set point are the same.
The rule of thumb is the reset per minute should be set slightly slower that the amount of time it takes for the control valve and the pressure to react to the flow computer changing the output.
This can only be determined when there is actually flow under normal conditions. It is best to start the reset at 0.3 or reset the signal every 3 minutes, if the control element is properly sized.

Download Firmare/Image File

To Download an Image File to the Flow Computer select the Tools option form the menu, and then Download Program.

A small dialog will appear asking for the file name of the image file. Type it in or use the Browse option to locate it. Once the file name is in place press Download. This task will take about 5-8 minutes to be completed.

Security

Security Codes

The desktop application provides 4 security areas to prevent users from entering data into certain areas. The four areas are:

Configuration: Allow user to modify device configuration settings.

Override: Allow user to change values directly on the device.

Calibration: Let the user to calibrate the device inputs.

Image File Download: Let user download an image file to the device. This procedure will erase all the information and configuration stored in the device.

Master Access: Once the master access is granted, the user can access to all four areas.

Use the **Tools|Security Codes** option to modify the access code; a form will appear showing the five different security areas and the actual access status (at bottom of the form). To put a new access code log in to the desired security area and press Change security Code, type in the code and retype it on the confirm space to avoid mistyped codes. Then click [OK].

The system will update the security access every time the application connects to the device and every time data is written to the device it will check for security access before writing.

NOTE: In case the access code is forgotten contact our offices for a reset code.

Connect to Device

Click 

to establish the communication. If the communication is failed, check information in the “Communication Port Settings”.

Go Offline

Click 

to disconnect the communication.

Modbus Driver

DFM provides this tool to read and write Modbus registers from and to the MicroMG flow computers. It will display transmitting and receiving message in HEX format. It should be used for testing purpose only.

Settings

Report Templates

Each report has its own default template. The user can edit, modify and save as a new personal report. Specify the new location if you want to use the formatted report.

CALIBRATION

Calibrations are performed under **Calibration**. . Select inputs to be calibrated, and then select full, single, offset calibration method. (See details in chapter 1)

Calibrate Mode

To calibrate Flow Computer, totalizers will continue at same rate where live parameters will show actual value, i.e. flow rate, DP, pressure etc. Enter '1' to enable this feature.

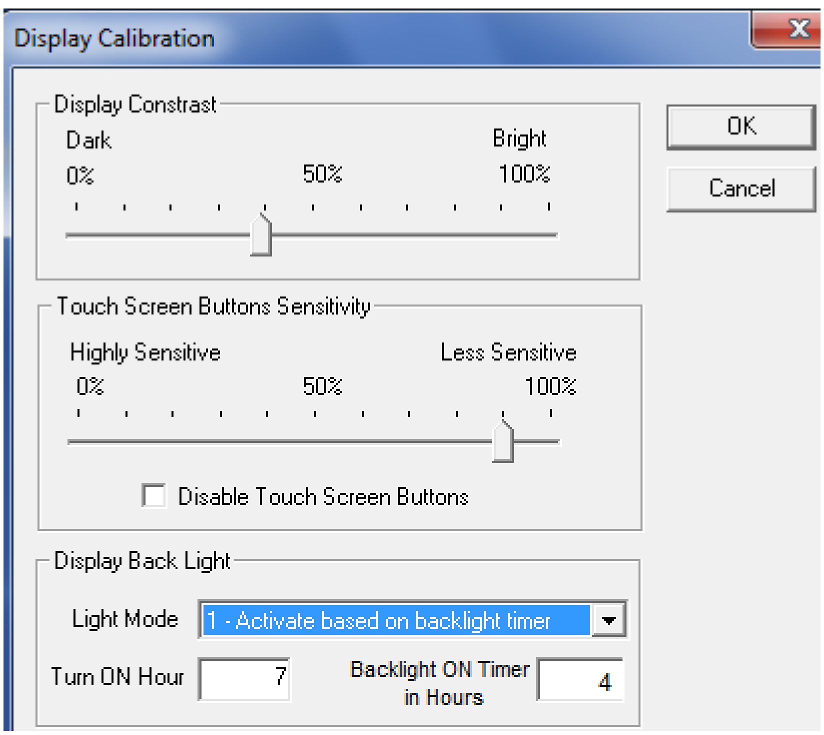
SET TIME (1-9 HOUR)

This entry is the duration for the calibrate mode. After time expires, the MicroMG Flow Computer will resume its normal operation.

Calibration

See details in chapter 1.

Calibration - Display



Display backlight mode

Display Backlight Mode	Description
0	60 seconds ON after a touch screen sensor is activated
1	Activate based on backlight timer Turn ON Hour and Backlight ON Timer in Hours
2	Backlight always OFF

Parameter Overrides:

Temperature Override

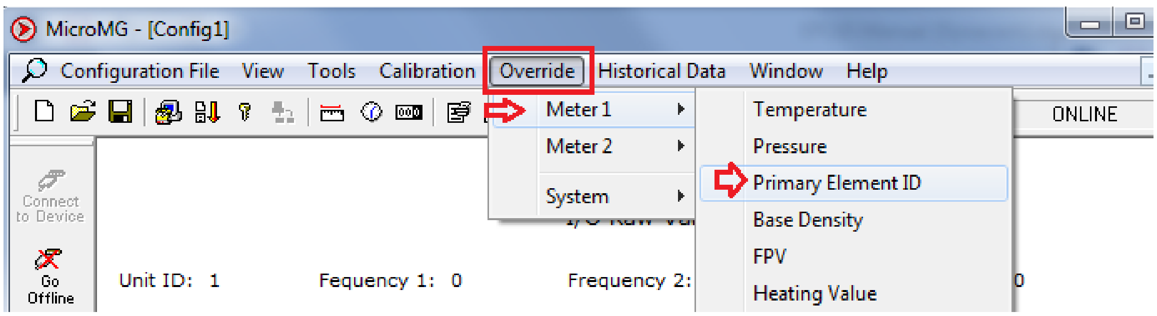
This value is entered when no live temperature is available, or when a different value from the live value should be used.

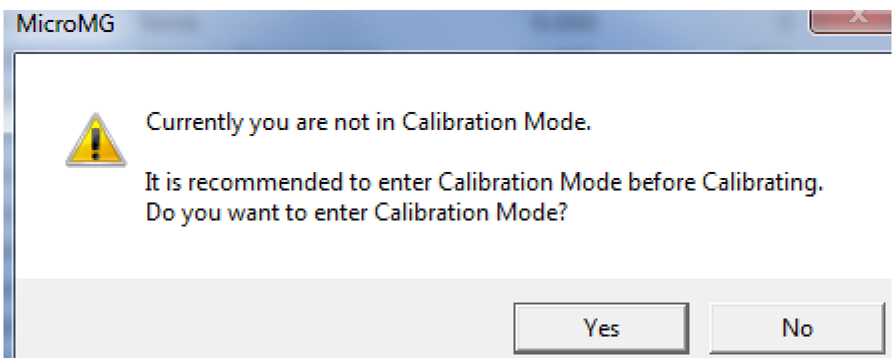
Pressure Override

Pressure override can be used when no live pressure transmitter is connected to the MicroMG Flow Computer.

Primary Element ID Override

Primary Element ID in is the measured diameter of the primary element at reference conditions.
Calibration Mode is for freezing option prior to execution of changing primary element ID
The audit report will log primary element plate if changed. The current hour and day data will be logged before applying a new primary element ID.





Base Density Override

In the event the user would like to override the calculated base density. This number would affect the net calculations only. Using zero is a command to use the live value. Base density is used to convert mass volume into corrected standard volume

FPV Override

Entering a value to override NX19 super-compressibility factor. Using zero is a command to use the live value.

Heating Value Override

BTU override is used in the AGA8 calculation Gross Method 1. In addition the heating value totalizer requires the heating value.
For AGA8 Detail Method, using zero is a command to use ISO6976 to calculate a heating value.

SYSTEM

DATE AND TIME

Change the date and time for the flow computer.

START AND STOP PROVING

To start or stop proving.

RESET CUMULATIVE TOTALIZER

Enter reset code to reset accumulated volume.
Non-resettable gross and net accumulated volume will roll over at 99999999.9.
Non-resettable mass accumulated volume will roll over at 9999999.99.

CLEAR SYSTEM

Enter reset system code to reset all data.

PID OPERATING

Click PID Loops icon to display PID output percentage, flow, and pressure data. To change setup, select entries under PID menu.

Flow Loop Set Point

Enter the set point. The set point is the flow rate that the flow computer will try to control at.

Flow Loop In Service OR Out of Service

The device can perform either flow control or pressure control, or both flow and pressure control. Check if the flow loop is in service or not.

Pressure Loop Set Point

Enter the set point. The set point is the pressure that the flow computer will try to control at.

Pressure Loop In Service OR Out of Service

The device can perform either flow control or pressure control, or both flow and pressure control. Check if the flow loop is in service or not.

Set Output Percentage

If PID output mode is in automatic mode, then enter the output percentage to control PID loop.

Auto/Manual Mode

PID mode can be configured as manual or automatic mode.

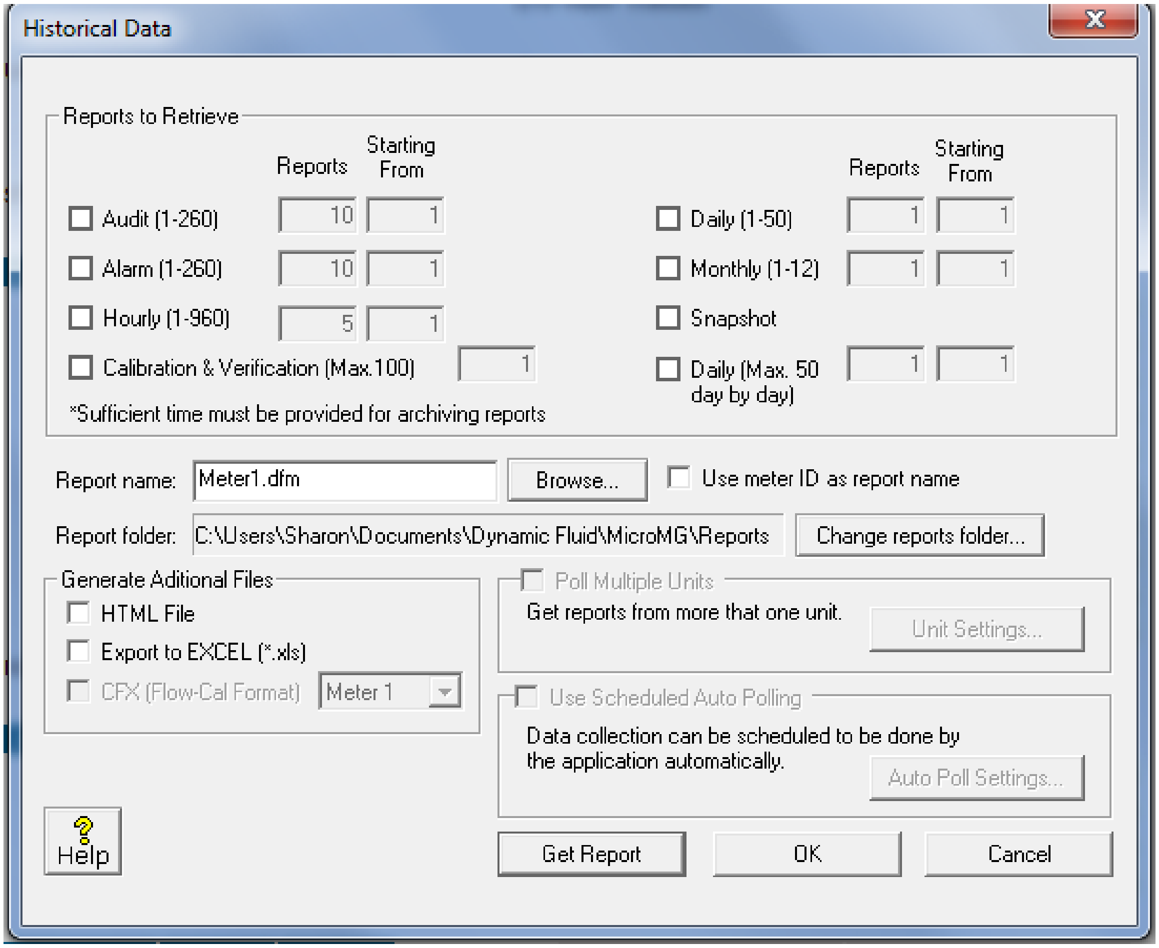
Reset PID

Reset PID data if PID configuration parameters are changed.

HISTORICAL DATA

CAPTURE AND STORE

To retrieve historical data, go to **Historical Data** menu. Check the report to retrieve and then click "Get Report" option. The **Get Report** option retrieves the information from the flow computer, shows it on the screen and stores it on the database.



The valid data entries are shown at the bottom of the dialog. The available types of reports are:

AUDIT REPORT

The audit trail report shows configuration parameter that has changed which could influence the calculated numbers. The Flow Computer provides up to 260 event logs. One purpose for audit trail is to back track calculation errors that result from mistakes by the operator of the flow computer operator.

ALARM REPORT

Up to 260 previous alarm data can be retrieved. The data are starting from the most recent to the oldest.

PREVIOUS HOURLY DATA

Up to 960 previous hourly data are stored in the Flow Computer. Enter date and hour and the Flow Computer will go backward from that selected report. Current hour cannot be selected.

PREVIOUS DAILY DATA

Up to 50 previous daily reports can be retrieved.

LAST MONTH DATA

Last 12 months data are stored in the Flow Computer. Current month data cannot be retrieved.

PREVIOUS DAILY DATA – DAY BY DAY

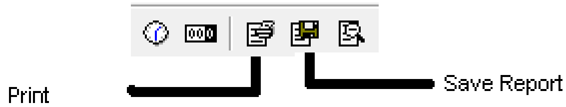
Up to 50 previous day by day reports can be retrieved.

Viewing previously captured reports

Once a report is stored in the database using the **Historical Data|Open Saved Report** option to view the **Previously Captured Reports**.

When the option is selected, a dialog will appear asking for the name of the report you want to see. The browse button can be used to locate the list of reports stored in the disk.

Printing Reports



- The **Print** Button (shown on the picture) lets you print the report to any printer installed in your computer. The printed version will look just like it is shown on the screen.

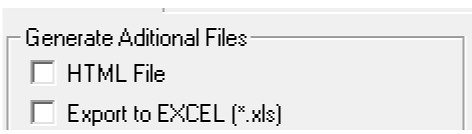
- The **Save Report** Button allows the user to save the report as HTML.

Historical Report in HTML Format

Check **HTML FILE** box to generate additional historical reports in HTML format.

Export Historical Report to EXCEL

Check **Export to EXCEL** box to generate additional EXCELfile



View System Snapshot or Diagnostic Data in Modubs Address Format

Toggle “Show Modbus Address” button to display report in Modbus address or value format.

HISTORICAL REPORT EXAMPLES

Audit Report

AUDIT REPORT

Company Name:	DFC	**Meter 1 ID:**	Meter1
Meter Location:	Houston	**Meter 2 ID:**	Meter2

Date	Time	Description	Old Value	New Value	M1 Net Cumulative	M2 Net Cumulative
10/23/16	18:20:58	Meter1 (Meter 1) Density Correction Factor	0.00000	1.00000	0.000	0.000
10/23/16	18:20:58	Meter1 (Meter 1) Pressure Maintenance	0.00	200.00	0.000	0.000
10/23/16	18:20:58	Meter1 (Meter 1) Temperature Maintenance	0.00	70.00	0.000	0.000
10/23/16	18:20:58	Meter1 (Meter 1) DP Low Maintenance	0.0000	100.0000	0.000	0.000
10/23/16	18:20:52	Meter2 (Meter 2) Mol % Ethane	0.0000	5.0000	0.000	0.000
10/23/16	18:20:52	Meter2 (Meter 2) Mol % CO2	0.0000	3.0000	0.000	0.000
10/23/16	18:20:52	Meter2 (Meter 2) Mol % Nitrogen	0.0000	2.0000	0.000	0.000
10/23/16	18:20:52	Meter2 (Meter 2) Mol % Methane	0.0000	90.0000	0.000	0.000
10/23/16	18:20:52	Meter1 (Meter 1) Mol % Methane	0.0000	100.0000	0.000	0.000
10/23/16	18:20:48	Meter2 (Meter 2) Calculation Type	0	1	0.000	0.000

Alarm Report

ALARMS REPORT

Company Name:	DFC	**Meter 1 ID:**	Meter1
Meter Location:	Houston	**Meter 2 ID:**	Meter2

Date	Time	Description	M1 Net Cumulative	M2 Net Cumulative
10/23/16	18:20:59	Meter2 (Meter 2) AGA8 OUT OF RANGE OK	0.000	0.000
10/23/16	18:20:55	Meter1 (Meter 1) START	0.000	0.000
10/23/16	18:20:49	Meter2 (Meter 2) AGA8 OUT OF RANGE	0.000	0.000
10/23/16	18:20:47	Meter2 (Meter 2) START	0.000	0.000
10/23/16	18:20:41	Meter2 (Meter 2) DOWN	0.000	0.000
01/01/00	00:00:01	Meter1 (Meter 1) DOWN	0.000	0.000

Hourly Report

HOURLY REPORT

Company Name:	DFC	Base Pressure:	14.7000
Meter Location:	Houston	Base Temperature:	60.000
Meter 1 ID:	Meter1	Atmospheric Pressure:	14.6960
Meter 2 ID:	Meter2	Contract Hour:	0

Meter	Date	Hour	Flow Time (Seconds)	Net (MSCF)	Mass (MLB)	Energy (MMBTU)	Temperat. (°F)	Pressure (PSIG)	SG	DP (H2O Inch)	IV	IMV
M1F	11/11/17	8	3600	4140.3	175.43	4198.4	70	200	0.62250	100.0000	146.5251	28.2572
M1F	11/11/17	7	3600	4140.4	175.43	4198.4	70	200	0.62250	100.0000	146.5251	28.2572
M1F	11/11/17	6	3600	4140.4	175.43	4198.4	70	200	0.62250	100.0000	146.5251	28.2572
M1F	11/11/17	5	3600	4140.4	175.43	4198.4	70	200	0.62250	100.0000	146.5251	28.2572
M1F	11/11/17	4	3600	4140.4	175.43	4198.4	70	200	0.62250	100.0000	146.5251	28.2572
M1F	11/11/17	3	1457	1675.7	71.00	1699.2	70	200	0.62250	100.0000	59.3020	28.2572

Historical Report Examples – Continued

DAILY REPORT

		Ticket No.	A-1
Day:	01/31/17	Time:	00:00:00
Company Name:	DFC	Unit ID :	1
Meter Location:	Houston	Contract Hour:	0

	Meter 1
Meter ID	Meter1
Daily Totals	
Daily Gross (MCF)	87.0
Daily Net (MSCF)	1256.1
Daily Mass (MLB)	68.71
Daily Energy (MMBTU)	1489.8
Flow Time (Minutes)	20
Idle Time (Hours)	23.65
Average Net Flow Rate	86132.57
Cumulative Totals	
Cum. Gross (MCF)	87.0
Cum. Net (MSCF)	1256.1
Cum. Mass (MLB)	68.71
Cum. Energy (MMBTU)	1489.8
Day FWA Values	
IV	51.4307
IMV	602.3070
Temperature (°F)	93.7
Pressure (PSIG)	204.0
Density (LB/FT3)	0.78962
Density Base	0.054700
SG	0.600000
Y Factor	0.000000
K/CD/LMF	0.602888
FA	0.000000
FPV	1.016565
Heating Value (BTU)	1186.051
DP (H2O Inch)	100.0000

Parameters	Meter 1
Primary Element	Orifice
Pipe ID (Inches)	20.00000
Primary Element ID (Inches)	10.02000
Dens.Corr.Factor	1.00000
Dens. Dry. Air (LBM/MOL)	28.96250
K Factor	90.000

Historical Report Examples – Continued

CALIBRATION AND VERIFICATION REPORT

Unit ID:	1		
Company Name:	DFC	Meter 1 ID:	Meter1
Meter Location:	Houston		

Date	Time	Variable	Type	As Found	As Left	Deviation %
02/01/17	00:04:28	Analog Input 1	Calibration	14.998	15.000	0.01
02/01/17	00:04:10	Analog Input 1	Verification	15.000	14.996	0.03

DAILY REPORT

Company Name:	DFC	Base Pressure:	14.7000
Meter Location:	Houston	Base Temperature:	60.000
Meter 1 ID:	Meter1	Atmospheric Pressure:	14.6960
		Contract Hour:	0

Meter	Date	Time	Flow Time (Minutes)	Gross (MCF)	Net (MSCF)	Mass (MLB)	Energy (MMBTU)	Temperat. (°F)	Pressure (PSIG)	DP (H2O Inch)	IV	IMV
M1	02/01/17	00:00:00	314	1288.2	19447.1	1063.75	23065.2	72.5	204.0	100.0000	775.1162	629.4689
M1	01/31/17	00:00:00	20	87.0	1256.1	68.71	1489.8	93.7	204.0	100.0000	51.4307	602.3070

CHAPTER 3: Data Entry
Through Front Panel Display

The Data entry is a menu driven type construction.

Four Keys – **ESC/Mode, Enter/Select, ↓ ,→**
These keys can be operated with a reflective object. The reflective object must be placed in front of the key to get a response.

Function

ESC/Mode Key
This key serves dual functions. In order to access the data entry, the mode key has to be activated. The mode key is on/off type key. This key will get the security code prompt, and then using select, enter key with the arrow keys to access the program. Place the reflective object on and then off for each step. Once the data menu function access is completed, exit by using the escape key.

Select/Enter Key

It is used to stop screen from scrolling, to select data entry, and accept the data configurations. It is on/off type key. Place the reflective object in front of key, and then move away before the next step.

↓ Key, → Key

Scrolling keys, the **→ Key** function is to scroll → way for selecting the number to be changed, and then changing the number by using **↓ Key**

MAIN MENU

It consists primarily of series of topics. Your valid choices are the two Arrow Keys (**Down, Right**) and select/enter key. Use Down or Right Arrow keys to make your selection and then use select/enter key. Use Esc/Mode key to go back to previous mode.

Security Code

```
Enter Security Code          00000
```

Enter the right security code to be able to change data.

```
Calibrate/1=M.Var
Override Meter No.
Date Time
Print/Configuration
```

Calibrate /1=M.Var

Enter 0 to calibrate analog input 1-4, RTD, analog output 1-4, or enter '1' to calibrate multi.variable.

```
Enable Calib. Mode
Analog Input (1-4)
RTD Input
Analog Output (1-4)
```

Enable Calibrate Mode

Enter '1' to enable calibrate mode. Calibration mode will set the flow computer to continue totalizing at same rate while all values are still showing live readings.

Calibrate Analog Input, RTD

0=**Offset** is a single point calibration that will offset zero and span.
1=**Full** – zero and span must be calibrated.
2=**Reset** to factory calibration.

```
0=Offset,1=Full
2=Reset
```

Offset (Single Point)

Induce the signal into the analog input, wait for 10 seconds for the reading to stabilize, then enter the offset.

```
Enter Offset          8.000

Current Value
           7.9000
```

Full (Zero and Span Calibration)

Calibrate Low Point (4mA or 75 Ω,), induce the known live value for the low set point, and wait for 10 seconds for the reading to stabilize. Now enter in that value.

```
First Point                0.000

Current Value
            0.9000
```

Calibrate High Point (20mA or 120 Ω), induce the known live value for the high set point, and then wait for 10 seconds for the reading to stabilize. Now enter in that value.

```
Second Point               20.000

Current Value
            19.900
```

Reset (Use Default)

Enter ‘2’ to use manufacture default.

Calibrate Analog Output

0=Offset is a single point calibration that will offset zero and span.
1=Full – zero and span must be calibrated.
2=Reset to factory calibration.

```
0=Offset,1=Full
2=Reset
```

Full (Zero and Span Calibration)

The screen will show the minimum possible signal 4mA. Enter the live output value reading in the end device i.e. 4mA.

```
Enter 4mA                4.000

Reading mA
           4.000
```

Now the flow computer will output full scale 20mA. Enter the live output i.e. 20mA

```
Enter 20mA               20.000

Reading mA
           20.000
```

Reset (Use Default)

Enter ‘2’ to use manufacture default.

Calibrate Multivariable

Select DP, Pressure, or Temperature to be calibrated.

```
Calibrate Muli.Var.
DP Inches
Pressure PSIG
Temperature DEG.F
```

Enter the calibrate method (0=Offset, 1=Full, 2=Reset).

```
0=Offset,1=Full
2=Reset
```

OFFSET (SINGLE POINT)

Induce the live value, then enter the offset.

Enter Offset	10.0000
Current Value	
10.9000	

FULL (ZERO AND SPAN CALIBRATION)

Calibrate Low Point - induce the low range signal, and enter in that value.

First Point	0.0000
Current Value	
0.9000	

Calibrate High Point - induce the high range signal, and enter in that value.

Second Point	250.0000
Current Value	
250.0000	

RESET (USE DEFAULT)

Enter ‘2’ to use manufacture default.

Override Meter No.

Enter the meter number 1 or 2 to change meter override value

TF/PF/MF
HV/FPV/FA/KD2
Dens.b/DCF
Orifice/Pipe/DP

TF/PF/MF

TF - Temperature

This value is entered when no live temperature is available, or when a different value from the live value should be used.

PF – Pressure

This value is entered when no live temperature is available, or when a different value from the live value should be used.

MF – Meter Factor

Enter the value to change current meter factor (AGA7 Method)

HV/FPV

Heating Value Override Heating value is required and used in the AGA8 GROSS METHOD 1.
For AGA8 detailed method, ISO6976 calorific calculation is used to calculate heating value if an override values is not entered. Steam equation also calculates heating value, otherwise without a heating value override entered, the Energy Flow Rate will always equal zero.

Heating Value Units	US Units	Metric Units
Density – Steam Equation	BTU/LB	MJ/KG
Density – Other Equations	BTU/SCF	MJ/SM3

FPV override: used to enter a value to override the NX19 super-compressibility factor.

Dens.b/DCF

Base Density Override is used to override the calculated base density and affects the net calculations only. For products other than natural gas, you must enter base density override for net calculations.

DCF- Density Correction Factor

Orifice/Pipe/DP

Orifice ID in inches is the measured inside pipe diameter to 5 decimals at reference conditions

Pipe ID in inches is the measured diameter of the orifice at reference conditions.

DP Override in inches of water.

Date/Time

Change Date
Change Time

CHANGE DATE

Month	09
Day	08
Year	00
Change Date 1=Yes	

Enter Month (1-12), Day (1-31), Year(0-99) and then enter '1' to change date.

CHANGE TIME

Hour	09
Minute	08
Second	00
Change Time 1=Yes	

Enter Hour (0-23), Minute (0-59), Second (0-59) and then enter '1' to change time.

Print/Configuration

Configuration
Snapshot 1=Y
Day/Hour/Month

Configuration

Configure Meter No	1
Configure I/O	
Pulse Output	
Others	

Configue Meter

Flow Equation 1-6	1
1=New AGA3,	
2=AGA7,3=Ven,4=Nozzle	
6=Cone/Smart Cone	

FLOW EQUATION TYPE (1-6)

1 = API 14.3 (NEW AGA3, 1992 Orifice Equations)
2 = AGA7 (Frequency Type Input)
3 = Venturi
4 = Nozzle
6 = V-Cone Flow Calculations

NEW AGA3/VENTURI/NOZZLE/V-CON

Orifice ID	10.00000
Pipe ID,	5.00000
DP Cut Off	1.0000
Viscosity	.024500

Pipe I.D.

Primary Element ID

Pipe ID in inches is the measured inside pipe diameter to 5 decimals at reference conditions

DP Cutoff

The MicroMG Flow Computer suspends all calculations whenever the DP is less than this value. This function is vital for suppressing extraneous data when the DP transmitter drifts around the zero mark under no-flow conditions.

Viscosity in Centipoise

Even though viscosity will shift with temperature and pressure changes, the effect on the calculations is negligent. Therefore using a single value is appropriate in most cases. Enter viscosity in centipoise.

CONFIGURE I/O

Analog Output
Meter I/O
Status/Switch
F.C.Display

Analog Output

Ana.Out#1 Assign	1
Ana.Out#2 Assign	0
Ana.Out#3 Assign	0
Ana.Out#4 Assign	0

Assignments:

	Meter 1	**Meter 2**
Gross Flow Rate	1	5
Net Flow Rate	2	6
Mass Flow Rate	3	7
Energy Flow Rate	4	8

	Mete1	**Meter2**
DP	13	21
Temperature	14	22
Pressure	15	23
Density	16	24
Density Temp	17	25
Base Density	18	26
DP LOW	19	27
DP HIGH	20	28
Specific Gravity	30	32
PID	36	37

Meter-Independent Parameters	
Spare #1	33
Spare #2	34
Remote Control*	35

Examples:
30 = Meter 1 Specific Gravity
25 = Meter 2 Density Temperature

**Note : Remote control output can be controlled through the Modbus communication link.*

Meter I/O

Temperature

Pressure

DP
Densitometer

ASSIGNMENTS

0=	Not Used
1=	Analog#1
2=	Analog#2
3=	Analog#3

4=	Analog#4
5=	RTD

7 =	Dens.Freq (Not Selectable)
10 =	Multi. Variable Module #1

4MA
Enter the 4mA value for the transducer.

20MA
Enter the 20mA value for the transducer.

Status Input Assignment

Status/Switch#1	000
Status/Switch#2	001
Status/Switch#3	000
Status/Switch#4	000

	Assignment	Comments
1.	Spare	
2.	Spare	
3.	Spare	N/A
4.	Alarm Acknowledge	Reset the previous occurred alarms output bit
5.	Spare	
6.	Spare	
7.	N/A	
8.	Calibration Mode	
9.	Event Status	

Switch Output Assignment

User can assign an output to each of the MicroMG Flow Computer's output switches from this list. The MicroMG Flow Computer switch outputs are sourcing through switch power input power.
Outputs in the top list,"Pulse Outputs", require a definition of pulse output per unit volume. Therefore a Pulse Output Width must be defined when one of these switch types are chosen. These outputs are available through swtiches 1 or 2 only.
Outputs in the bottom list,"Contact Type Outputs", are ON/OFF type outputs. They can be assigned to any of the four switch outputs.
Switches 1 and 2 can be pulse or contact type output; switches 3, 4 are contact-type output only.

ASSIGNMENTS - PULSE OUTPUTS

	Meter 1	Meter 2
Gross	101	105
Net	102	106
Mass	103	107
Energy	104	108

ASSIGNMENTS - CONTACT TYPE OUTPUTS

	Meter 1	Meter2
Temperature Low	126	136
Temperature High	127	137
Pressure Low	128	138
Pressure High	129	139
Density Low	130	140
Density High	131	141
Dens. Temperature Low	132	142
Dens. Temperature High	133	143
DP Low	134	144
DP High	135	145
Meter Down	120	123
Flow Rate Low	121	124
Flow Rate High	122	125

Meter-Independent Parameters	
Day Ended	119
Dens. Period Low	146
Dens. Period High	147
Temperature Out of Range	148
Gravity Out of Range	149
Pressure Out of Range	150
Active Alarms	151
Occurred Alarms	152
Status Input #1	157
Run Switch	158
Remote Control	159

Examples:

148= Temperature out of Range

Flow Computer Display Assignment

FC.Display#1	000
FC.Display#2	001
FC.Display#3	000
FC.Display#4	000

Display assignment select up to 16 assignments. The MicroMG Flow Computer will scroll through them at the assigned delay time.

Assignment

4 Digits – 1st : – 0
2nd – Meter Number – 1:Meter#1, 2:Meter#2
3rd, 4th : Selection

Selection	Description
01	Flowrate
02	Daily Total
03	Cum. Total
04	Previous .Daily total
05	DP/DP Low, High
06	Temperature, Pressure
07	Density, Density at Base
08	Density Freq, Dens.Period, Un-Corr. Density
09	Density Temperature, Pressure
10	Flow and Density Calculation Type
11	Spare #1, Spare #2
12	Previous Day.AVG Temperature, Pressure, Density
13	Alarms

Examples:

102= Meter #1 Daily Total
14= Date, Time

2 Digits Selection

Selection	Description
11	Spare Data #1/#2
12	Battery Voltage and Image Version
14	Date/Time

Pulse Output

Pulse Output	
#1 P/Unit#1	1.000
#2 P/Unit#2	1.000
Pulse Width	50

PULSE OUTPUT AND PULSE OUTPUT WIDTH

Pulse Output is used to activate a sampler or external totalizer. The number selected will be pulses per unit volume or per unit mass. If 0.1 pulse is selected, the one pulse will be given every 10 unit volumes has passed through the meter.

Pulse Output Width is the duration, in milliseconds, of one complete pulse cycle (where each cycle is the pulse plus a wait period, in a 50/50 ratio). For example: if POW = 500 msec, the MicroMG Flow Computer at most can produce one pulse each second regardless of the pulse per unit volume selected (500 msec pulse + 500 msec wait). If POW = 10 msec the MicroMG Flow Computer can produce up to 50 pulses per second.

The MicroMG Flow Computer's maximum pulse output is 125 pulses/sec. The Pulse Output in combination with the Pulse Output Width should be set appropriately.

Others

Day Start Hour	7
Print Interval	1440
0=Hour,1=Day,2=Min	0
Disable Alarms	0

DAY START HOUR (0-23)

Day start hour is used for daily totalizer reset operation.

FLOW RATE SELECTION

The flow rate will be based on hourly basis, daily, or minute.

DISABLE ALARMS

Use Disable Alarms to ignore alarms. When the alarm function is disabled alarms are not logged. Alarms are also not logged if the DP is below the cut-off limit.

CHAPTER 4: FLOW EQUATIONS

Common Terms

The following terms are used throughout this chapter.

Term	Definition	**US Units**	**Metric Unit**	Examples
q	Flow rate: volume or mass displaced per unit time	See equations	See equations	q_{mass} , q_{energy}
T	Temperature	°F unless noted	°C unless noted	
DP	Differential Pressure across measuring device	Inches H_2O	m.Bar	
d	Orifice Diameter	Inches	Millimeter	d , d_r , d_m
D	Pipe Diameter	Inches	Millimeter	D , D_r , D_m
β	$= \frac{d}{D} = \frac{\text{Orifice diameter}}{\text{Pipe diameter}}$			β , β_r
ρ	Density (usually of the fluid)	Lb/ft^3	Kg/M^3	$\rho_{flowing}$, ρ_m
μ	Viscosity	centipoise	centipoise	
HN	Heating Value Heating Value – Steam Equation	BTU/ ft^3 BTU/LB	MJ/ M^3 MJ/ KG	
Y	Expansion factor			

Subscripts: Conventions Used

This Subscript	Means	Examples
r	At reference conditions	$T_{r,p}$ = reference temperature of the pipe
O (letter o)	Refers to the orifice	$T_{r,O}$ = reference temperature of the orifice
P	Refers to the pipe	
flowing	At flow conditions	$\rho_{flowing}$ = density at flow conditions
cal	Calibration conditions	T_{cal} , P_{cal}
m	At measured conditions	D_m = pipe diameter at measured temp.

API 14.3

For more information, please see *Orifice Metering of Natural Gas*, 3rd edition.

Mass Flow Rate $= \frac{\pi}{4} \times N_c \times C_d \times E_v \times d^2 \times Y \times \sqrt{2DP \times Density} \times .001$

Net Flow Rate $= \frac{Mass\ Flow}{Base\ Density} \times Conversion\ Factor$

Gross Flow Rate $= \frac{Mass\ Flow}{Flowing\ Density} \times Conversion\ Factor$

Energy Flow Rate $= Net\ Flow \times Heating\ Value \times Conversion\ Factor$

Where:
N_c = *Units Conversion Constant*
C_d = *Orifice Plate Coefficient of Discharge*
$E_v = \frac{1}{\sqrt{1-\beta^4}}$ = *Velocity of Approach Factor*
d = *Orifice plate bore diameter*
Y = *Expansion Factor*
DP = *Orifice Differential Pressure*

	US unit	Metric Unit
N_c	323.279	.036
Density	lb/ft^3	kg/m^3
Gross Flow Rate/HR	Selectable by Data Entry	Selectable by Data Entry
Net Flow Rate/HR	Selectable by Data Entry	Selectable by Data Entry
Mass Flow Rate/HR	MLB/LB (M=1000_	TONNE/KG
Energy Flow Rate/HR	MMBTU/MBTU (M=1000)	GJ/MJ/MCAL/Mega BTU

AGA 7

Please see ***Common Terms*** at the beginning of this chapter.

$$Gross\ Flow\ Rate = \frac{Frequency\ Pulse\ per\ Second\ \times LMF\ \times 3600}{K\ Factor} \times Units\ Conversion\ Factor$$

$$Net\ Flow\ Rate = \frac{Mass\ Flow\ Rate}{Base\ Density} \times Units\ Conversion\ Factor$$

$$Mass\ Flow\ Rate = Gross\ Flow\ Rate\ \times Flowing\ Density\ \times Units\ Conversion\ Factor$$

$$Energy\ Flow\ Rate = Net\ Flow\ Rate\ \times Heating\ Value \times Units\ Conversion\ Factor$$

Where:
LMF = Linear Meter Factor

	US unit	Metric Unit
Density	lb/ft^3	kg/m^3
Gross Flow Rate/HR	Selectable by Data Entry	Selectable by Data Entry
Net Flow Rate/HR	Selectable by Data Entry	Selectable by Data Entry
Mass Flow Rate/HR	Selectable by Data Entry	Selectable by Data Entry
Energy Flow Rate/HR	Selectable by Data Entry	Selectable by Data Entry

Venturi

$$\boldsymbol{Mass\ Flow}\ (\boldsymbol{MLB/Hour}) = 0.0997424 \times 3.6 \times \sqrt{DP \times \rho} \times \frac{C \times Y \times Fa \times d^2}{\sqrt{1-\beta^4}}$$

$$\boldsymbol{Net\ Flow} = \frac{Mass\ Flow}{Density\ at\ Base}$$

$$\boldsymbol{Gross\ Flow} = \frac{Mass\ Flow}{Flowing\ Density}$$

Where:

C = Discharge Coefficient (Manual Data Entry)

Y = Expansion Factor

$\beta = \frac{d}{D} = \frac{Venturi\ Bore\ Diameter\ at\ Reference}{Meter\ Tube\ Internal\ Diameter\ at\ Reference}$

ρ = Flowing Density

DP = Differential Pressure

(Refer to **Miller Measurement Engineering Handbook**)

Nozzle

$$\textbf{Mass Flowrate} = 0.3590722\sqrt{\rho_{flowing} \times DP} \times \frac{C \times F_a \times d^2 Y}{\sqrt{1-\beta^4}}$$

$$= \boldsymbol{q_{mass}}\ \textbf{(MLB/HR)}$$

$$\textbf{Net Flowrate} = \frac{q_{mass}}{\rho_{reference}} = \textbf{MCF/HR}$$

$$\textbf{Gross Flowrate} = \frac{q_{mass}}{\rho_{flowing}} = \textbf{MCF/HR}$$

$Where:$

$$C = Discharge\ Coefficient\ C\ of\ the\ Nozzle$$

$$= C_\infty + \frac{b}{Rd^n}\ (see\ table\ below)$$

$$Rd = Reynolds\ Number = \frac{22737.47 q_{pps}}{\mu D}$$

$$q_{pps} = Mass\ Flowrate, expressed\ in\ Lb/sec$$

Nozzle type	C_∞	b	n
ASME long radius	0.9975	$-6.53\beta^{0.5}$	0.5
ISA	$0.9900 - 0.2262\beta^{4.1}$	$1708 - 8936\beta + 19779\beta^{4.7}$	1.15
Venturi Nozzle (ISA inlet)	$0.9858 - 0.196\beta^{4.5}$	0.0	0.0

Cone/Smart Cone

$$\text{Mass Flowrate per second} = \frac{\pi}{4} \times \sqrt{2g_c \times \rho} \times \frac{D^2 \times \beta^2}{\sqrt{1-\beta^4}} \times Cf \times Y \times \sqrt{Psf} \times Fa$$

$$= \boldsymbol{q_{mass/second}}\,(LB-US, KG-Metric)$$

$$\text{Net Flowrate per second} = \frac{q_{mass}}{\rho_{reference}}$$

$$\text{Gross Flowrate per second} = \frac{q_{mass}}{\rho_{flowing}}$$

$$\text{Energy Flowrate per second} = \text{Net Flowrate per second} \times HeatingValue/1000$$

Where:

g_c = Dimensional Conversion Constant

C_f = Flow Coefficient of the Meter

ρ = Density (LB/FT3-US, KG/M3-Metric)

D = Meter Inside Diameter (Feet-US, Meters-Metric)

Psf = D.Pressure(Pounds force per square foot-US, Pascal-Metric)

Y = Adiabatic Expansion Factor for Contoured Elements

$\beta = \sqrt{1 - \frac{d^2}{D^2}}$

d = Cone Diameter, D=Meter Inside Diameter (Inches-US, Millimeters-Metric)

Fa = Thermal Expansion Factor

DENSITY EQUATIONS

Sarasota Density(GM/CC)

Sarasota density is calculated using the frequency signal produced by a Sarasota densitometer, and applying temperature and pressure corrections as shown below.

$$\textbf{Corrected Density} = DCF \times \frac{2D_0(t\text{-}T_{0p})}{T_{0p} \times \frac{1+K(t\text{-}T_{0p})}{2T_{0p}}}$$

$Where:$

$T_{0p} = T_{coef} \times (T - T_{cal}) + P_{coef} \times (P - P_{cal}) + T_0$

$DCF = Density\ Correction\ Factor$

$D_0 = Calibration\ constant, mass/volume, gm/cm^3$

$t = Densitometer\ oscillation\ period\ in\ microseconds.$

$t_0 = A\ calibration\ constant\ in\ microseconds$

$T_{coef} = Temperature\ coefficient\ in\ microseconds/°F$

$P = Flowing\ pressure\ in\ PSIG$

$P_{coef} = Pressure\ coefficient\ in\ microseconds/PSIG$

$P_{cal} = Calibration\ pressure\ in\ PSIG$

UGC Density(GM/CC)

UGC density is calculated using the frequency signal produced by a UGC densitometer, and applying temperature and pressure corrections as shown below

$$\textbf{Corrected Density} = DCF \times P_{flowing}\{[K(P_{off} + d) \times 10^{-6}] + [K_T(T_{flowing} - T_{cal})] + d\}$$

$$\begin{aligned}
&Where: \\
d &= K_0 + K_1 t + K_2 t^2 \\
K_0, K_1, K_2 &= Calibration\ Constants \\
t &= Densitometer\ oscillation\ period\ in\ microseconds \\
DCF &= Density\ Correction\ Factor \\
K &= Pressure\ Constant \\
P_{off} &= Pressure\ Offset \\
K_T &= Temperature\ Coefficient \\
T_{cal} &= Temperature\ coefficient\ in\ microseconds/{}^\circ F
\end{aligned}$$

Solartron Density (GM/CC)

Solartron density is calculated using the frequency signal produced by a Solartron densitometer, and applying temperature and pressure corrections as shown below.

Density at 20 Deg.C and 0 BAR

$$D = K_0 + K_1 t + K_2 t^2$$

Where :

$$t = \text{Densitometer Oscillation Period in microseconds}$$

$$K_0, K_1, K_2 = \text{Calibration Constants Supplied by Solartron}$$

Temperature Corrected Density

$$DT = D[1 + K_{18}(T - 20) + K_{19}(T - 20)]$$

Additional Equation for Gas offset data

The following equation can provide more accurate measurement for Argon/Methane Gas Mixture over density range 60 to 200 kg/m^3.

$$DA = DT + (1 + K3/(DT + K4)x0.00236 - G/(T + 273))$$

G = Gas Specific Gravity / Ratio of Specific Heats.

Density (GM/CC)= Density(KG/M3) / 1000.0

AGA8 Gross Method 1

Refer to Transmission Measurement Committee Report No. 8

AGA8 Gross Method 2

Refer to Transmission Measurement Committee Report No. 8

AGA8 Detail Method

Refer to Transmission Measurement Committee Report No. 8

Steam NBS Equation

Refer to NBS/NRC Steam Tables.

Ethylene NBS1045

Refer to NBS technical Note 1045.

Parahydrogen - NBS 1048

Refer to Journal of physical and chemical reference data (volume 11, 1982, published by the ACS, AIP, NBS)

Oxygen - NBS 1048

Refer to Journal of physical and chemical reference data (volume 11, 1982, published by the ACS, AIP, NBS)

Nitrogen - NBS 1048

Refer to Journal of physical and chemical reference data (volume 11, 1982, published by the ACS, AIP, NBS)

Argon - NBS 1048

Refer to Journal of physical and chemical reference data (volume 11, 1982, published by the ACS, AIP, NBS)

Saturated Steam

Pressure Range 70.3 – 110.3 PSIG

ISO6976 -2016

Calculation of calorific value on a volume basis
Real-gas gross calorific value and Real-gas net calorific value

CHAPTER 5: MODBUS DATA

MODBUS PROTOCOL

TRANSMISSION MODE

	ASCII	RTU
DATA BITS	7	8
START BITS	1	1
PARITY	EVEN, ODD	NONE
STOP BITS	1	1
ERROR CHECKING	LRC	CRC
BAUD RATE	1200-9600	1200-9600

ASCII FRAMING

Framing is accomplished by using colon (:) character indicating the beginning of frame and carriage (CR), line feed (LF) for the end of frame

ASCII MESSAGE FORMAT

	ADDRESS	FUNCTION	DATA	ERR\CHECK		
:	2 CHAR	2 CHAR	Nx2 CHAR	2 CHAR	CR	LF
8 BITS	16 BITS	16 BITS	Nx16 BITS	16 BITS	8 BITS	8 BITS

RTU FRAMING

Frame synchronization is done by time basis only. The Smart Flow Computer allows 3.5 characters time without new characters coming in before proceeding to process the message and resetting the buffer.

RTU MESSAGE FORMAT

ADDRESS	FUNCTION	DATA	CRC
8 BITS	8 BITS	Nx8 BITS	16 BITS

FUNCTION CODE

To inform the slave device of what function to perform

FUNCTION CODE	ACTION
01	
03	Read Strings or Multiple 16 Bits
16	Write Strings or Multiple 16 Bits

ERROR CHECK

LRC MODE

The LRC check is transmitted as two ASCII hexadecimal characters. First, the message has to be stripped of the: LF, CR, and then converted the HEX ASCII to Binary. Add the Binary bits and then two's complement the result.

CRC MODE

The entire message is considered in the CRC mode. Most significant bit is transmitted first. The message is pre-multiplied by 16. The integer quotient digits are ignored and the 16-bit remainder is appended to the message as the two CRC check bytes. The resulting message including the CRC, when divided by the same polynomial (X16+X15+X2+1) at the receiver, which will give zero remainder if no error, has occurred.

EXCEPTION RESPONSE

Exception response comes from the slave if it finds errors in communication. The slave responds to the master echoing the slave address, function code (with high bit set), exception code and error check. To indicate that the response is notification of an error, the high order bit of the function code is set to 1.

EXCEPTION CODE	DESCRIPTION
01	Illegal Function
02	Illegal Data Address
03	Illegal Data Value

BROADCAST COMMAND

All units listen to Unit ID Zero, and no one will respond when the write function is broadcasted.

MODBUS EXAMPLES

FUNCTION CODE 03 (Read Single or Multiple Register Points)

Each Modbus System has a different Modbus address range. For example, 40000 or 90000 is the high level message generated through the host Modbus system. The set up and offset are different for each host Modbus system.

READ A SHORT (SINGLE) WORD NUMERIC VARIABLE

The short word numeric variable is a 16-bit integer
Data: 16 bits (short word: two 8-bit bytes- high byte, low byte),
Short Integer Variable Modbus Address: from 1801 to 3030

RTU MODE - Read Address 3076

ADDR	FUNC CODE	STARTING POINT		# OF POINTS		CRC CHECK	
		HI	LO	HI	LO		
01	03	0C	04	00	01	C6	9B

Response

ADDR	FUNC CODE	BYTE COUNTS	DATA		CRC CHECK	
			HI	LO		
01	03	02	00	01	79	84

ASCII MODE - Read Address 3076

ADDR			FUNC CODE		STARTING POINT				# OF POINTS				LRC CHECK			
					HI		LO		HI		LO					
:	30	31	30	33	30	43	30	43	30	30	30	31	45	42	CR	LF

Response

ADDR			FUNC CODE		BYTE COUNT		DATA				LRC CHECK			
							HI		LO					
:	30	31	30	33	30	32	30	30	30	31	46	39	CR	LF

READ A LONG WORD NUMERIC VARIABLE

The long word numeric variable is a *two 16-bit integers* with decimal inferred
Data: two 16-bit (32 bits, two words: high word, low word).
Sign bit - first bit of high word (0:positive, 1:negative)
Long Integer Variable Modbus Address: from 3131 to 9403

Read Address 3131

ADDR	FUNC CODE	STARTING Address		# OF Registers		CRC CHECK	
		HI	LO	HI	LO		
01	03	0C	3B	00	**02**	B6	96

Response - Data **- 4 Bytes - 00 05 6A 29 (Hex), 611 (Decimal)**

ADDR	FUNC CODE	BYTE COUNTS	**DATA**				CRC CHECK	
			HI Word		**LO Word**			
01	03	04	**00**	**05**	**6A**	**29**	05	4C

Data Bytes - 00 05 6A 29 (Hex) = 354857 (decimal)
Data with 2 decimal places inferred = 3548.57

For Example:
Honeywell Modbus system - read address **93131**
Delta-V Modbus system - read address **43131**
Data Calculation
Value = High Word x 65536 + Low Word

High Word = 00 05 (Hex), 5 (Decimal)
Low Word = 6A 29 (Hex), 27177 (Decimal)
= 5 x 65536 + 27177
= 354857
Two decimal places inferred
= 3548.57

READ A FLOATING POINT VARIABLE

The floating point variable is a single precision floating point value

IEEE Floating Point Format

Sign	Exponent	Mantissa
1 bit	8 bits	23 bits

Byte 3	Byte 2	Byte 1	Byte 0
SEEEEEEE	EMMMMMMM	MMMMMMMM	MMMMMMMM

Modbus Address: From 7001 to 7999

Sample Floating Point Value

Read Register 7047 (**one register with 4 data bytes**)

ADDR	FUNC CODE	STARTING Address		# OF Registers		CRC CHECK	
		HI	LO	HI	LO		
01	03	1B	87	00	**01**	32	C7

Response - Four Data Bytes - **47 6C 4A 00 (HEX) = 60490.0**

ADDR	FUNC CODE	BYTE COUNTS	DATA				CRC CHECK	
			HI Word		**LO Word**			
01	03	04	**47**	**6C**	**4A**	**00**	19	FA

Modbus Address Table – 16 Bits Integer

ADDRESS	DESCRIPTION	DECIMAL	READ/WRITE
Slave - Gas Chromatograph			
1801	Gas Chromatograph ID	0 Inferred	Read/Write
1802	Gas Chromatograph Stream Address	0 Inferred	Read/Write
1803	Meter#1 Gas Chromatg. Communication ID	0 Inferred	Read/Write
1804	Meter#2 Gas Chromatg. Communication ID	0 Inferred	Read/Write
1805	Gas Chromatograph Modbus Floating Registers 0 = Byte Order: High Byte, Low Byte 1 = Byte Order: Low Byte, High Byte	0 Inferred	Read/Write
1806	Variable #1 Destination	0 Inferred	Read/Write
1807	Variable #2 Destination	0 Inferred	Read/Write
1808	Variable #3 Destination	0 Inferred	Read/Write
1809	Variable #4 Destination	0 Inferred	Read/Write
1810	Variable #5 Destination	0 Inferred	Read/Write
1811	Variable #6 Destination	0 Inferred	Read/Write
1812	Variable #7 Destination	0 Inferred	Read/Write
1813	Variable #8 Destination	0 Inferred	Read/Write
1814	Variable #9 Destination	0 Inferred	Read/Write
1815	Variable #10 Destination	0 Inferred	Read/Write
1816	Variable #11 Destination	0 Inferred	Read/Write
1817	Variable #12 Destination	0 Inferred	Read/Write
1818	Variable #13 Destination	0 Inferred	Read/Write
1819	Variable #14 Destination	0 Inferred	Read/Write
1820	Variable #15 Destination	0 Inferred	Read/Write
1821	Variable #16 Destination	0 Inferred	Read/Write
1822	Variable #17 Destination	0 Inferred	Read/Write
1823	Variable #18 Destination	0 Inferred	Read/Write
1824	Variable #19 Destination	0 Inferred	Read/Write
1825	Variable #20 Destination	0 Inferred	Read/Write

Destination	Description
0	Methane
1	Nitrogen
2	Carbon Dioxide
3	Ethane
4	Propane
5	Water
6	Hydrogen Sulf.
7	Hydrogen
8	Carbon Monoxide
9	Oxygen
10	i-Butane
11	n-Butane

Destination	Description
12	i-Pentane
13	n-Pentane
14	n-Hexane
15	n-Heptane
16	n-Octane
17	n-Nonane
18	n-Decane
19	Helium
20	Argon
21	SG
22	BTU

Modbus Address Table – 16 Bits Integer

ADDRESS	DESCRIPTION	DECIMAL	READ/WRITE
1826	Variable #1 Source Address	0 Inferred	Read/Write
1827	Variable #2 Source Address	0 Inferred	Read/Write
1828	Variable #3 Source Address	0 Inferred	Read/Write
1829	Variable #4 Source Address	0 Inferred	Read/Write
1830	Variable #5 Source Address	0 Inferred	Read/Write
1831	Variable #6 Source Address	0 Inferred	Read/Write
1832	Variable #7 Source Address	0 Inferred	Read/Write
1833	Variable #8 Source Address	0 Inferred	Read/Write
1834	Variable #9 Source Address	0 Inferred	Read/Write
1835	Variable #10 Source Address	0 Inferred	Read/Write
1836	Variable #11 Source Address	0 Inferred	Read/Write
1837	Variable #12 Source Address	0 Inferred	Read/Write
1838	Variable #13 Source Address	0 Inferred	Read/Write
1839	Variable #14 Source Address	0 Inferred	Read/Write
1840	Variable #15 Source Address	0 Inferred	Read/Write
1841	Variable #16 Source Address	0 Inferred	Read/Write
1842	Variable #17 Source Address	0 Inferred	Read/Write
1843	Variable #18 Source Address	0 Inferred	Read/Write
1844	Variable #19 Source Address	0 Inferred	Read/Write
1845	Variable #20 Source Address	0 Inferred	Read/Write
1846	Slave Unit Update Flag Set 1 to Update Slave Setting	0 Inferred	Read/Write
1847-1850	Analog Input #5 Tag Name	8 Chars.	Read/Write
1851-1854	Analog Input #6 Tag Name	8 Chars.	Read/Write
1855-1858	Analog Input #7 Tag Name	8 Chars.	Read/Write
1859-1862	Analog Input #8 Tag Name	8 Chars.	Read/Write
1863-1866	Analog Input #9 Tag Name	8 Chars.	Read/Write
1867	Analog Input #5 Calibration Index	0 Inferred	Read/Write
1868	Analog Input #6 Calibration Index	0 Inferred	Read/Write
1869	Analog Input #7 Calibration Index	0 Inferred	Read/Write
1870	Analog Input #8 Calibration Index	0 Inferred	Read/Write
1871	Analog Input #9 Calibration Index	0 Inferred	Read/Write
1872-1879	Spare		
1880-1980	Reserved		

Modbus Address Table – 16 Bits Integer

ADDRESS	DESCRIPTION	DECIMAL	READ/WRITE
2359	Analog Input #5 Value Fail Code	0 Inferred	Read
2360	Analog Input #6 Value Fail Code	0 Inferred	Read
2361	Analog Input #7 Value Fail Code	0 Inferred	Read
2362	Analog Input #8 Value Fail Code	0 Inferred	Read
2363	Analog Input #9 Value Fail Code	0 Inferred	Read
2364-2533	Reserved		
2534	Flow Computer Display Delay	0 Inferred	Read/Write
2535	Flow Computer Assignment #1	0 Inferred	Read/Write
2536	Flow Computer Assignment #2	0 Inferred	Read/Write
2537	Flow Computer Assignment #3	0 Inferred	Read/Write
2538	Flow Computer Assignment #4	0 Inferred	Read/Write
2539	Flow Computer Assignment #5	0 Inferred	Read/Write
2540	Flow Computer Assignment #6	0 Inferred	Read/Write
2541	Flow Computer Assignment #7	0 Inferred	Read/Write
2542	Flow Computer Assignment #8	0 Inferred	Read/Write
2543	Flow Computer Assignment #9	0 Inferred	Read/Write
2544	Flow Computer Assignment #10	0 Inferred	Read/Write
2545	Flow Computer Assignment #11	0 Inferred	Read/Write
2546	Flow Computer Assignment #12	0 Inferred	Read/Write
2547	Flow Computer Assignment #13	0 Inferred	Read/Write
2548	Flow Computer Assignment #14	0 Inferred	Read/Write
2549	Flow Computer Assignment #15	0 Inferred	Read/Write
2550	Flow Computer Assignment #16	0 Inferred	Read/Write
2551	Flow Computer ID or Unit ID	0 Inferred	Read/Write
2552	reserved		
2553	Port 1 Modbus Type (0=RTU,1=ASCII)	0 Inferred	Read/Write
2554	Port 1 Parity(0=None,1=Odd,2=Even)	0 Inferred	Read/Write
2555	Port 1 Baud Rate(0=1200,1=2400,3=4800,4=9600)		
2556	reserved		
2557	Port 1 RTS Delay in Milliseconds	0 Inferred	Read/Write
2558-2559	reserved		
2560	Port 2 Select 0=RTS,1=Printer	0 Inferred	Read/Write
2561	Port 2 Modbus Type (0=RTU,1=ASCII)	0 Inferred	Read/Write
2562	Port 2 Parity(0=None,1=Odd,2=Even)	0 Inferred	Read/Write
2563	Port 2 Baud Rate(0=1200,1=2400,3=4800,4=9600)		
2564	Printer Baud Rate(0=1200,1=2400,3=4800,4=9600)		
2565	Port 2 RTS Delay in Milliseconds	0 Inferred	Read/Write
2566	Printer- Number of Nulls	0 Inferred	Read/Write
2567	Printer – Baud Rate	0 Inferred	Read/Write
2568	Reserved		
2569	Meter Bank 0=One Meter,1=Two Meters	0 Inferred	Read/Write
2570	Select 0=Single, 1=Dual Streams	0 Inferred	Read/Write
2571	Reserved		
2572	Meter #1 Use Stack DP (1=Yes)	0 Inferred	Read/Write
2573	Meter #2 Use Stack DP (1=Yes)	0 Inferred	Read/Write
2574	Common Temperature 1=Yes	0 Inferred	Read/Write
2575	Common Pressure 1=Yes	0 Inferred	Read/Write
2576	Density#1 0=None,1=4-20mA,2=S,3=U,3=S	0 Inferred	Read/Write

Modbus Address Table – 16 Bits Integer

ADDRESS	DESCRIPTION	DECIMAL	READ/WRITE
2577	Den#1 Unit 0=Lb/ft3(US),Kg/m3(Metric),1=SG	0 Inferred	Read/Write
2578	Use Meter Temp as Dens.Temp#1 0=N,1=Y	0 Inferred	Read/Write
2579	Spare		
2580	Common Density 1=Yes	0 Inferred	Read/Write
2581	Density#2 0=None,1=4-20mA,2=S,3=U,3=S	0 Inferred	Read/Write
2582	Den#2 Unit 0=Lb/ft3(US),kg/m3(Metric),1=SG)	0 Inferred	Read/Write
2583	Use Meter Temp#2 as Dens.Temp 1=Yes	0 Inferred	Read/Write
2584	Spare		
2585-2590	Reserved		
2591	Scale Selection (0=32767,1=4095)	0 Inferred	Read/Wrte
2592	Spare		
2593	Flow Rate Display 0=Hour,1=Day,2=Minute	0 Inferred	Read/Write
2594	Flowrate Averaged Seconds (1-10)	0 Inferred	Read/Write
2595	Day Start Hour (0-23)	0 Inferred	Read/Write
2596-2605	Company Name	40 Chars	Read/Write
2606	Disable Alarms ? (0=No, 1=Yes)	0 Inferred	Read/Write
2607	Print Interval in Minutes (0-1440)	0 Inferred	Read/Write
2608	Run Switch Delay	0 Inferred	Read/Write
2609	Pulse Width	0 Inferred	Read/Write
2610	Analog Input Expansion 1=Yes	0 Inferred	Read/Write
2611	Gas Chromatograph Floating Point Number of Bytes per register 0=1x32 bits (one register), 1=2x16bits (two registers)		
2612	Averaging Method	0 Inferred	Read/Write
2612-2616	Spare		
2617	Status Input/Switch Output #1 (0=OFF,1=ON)	0 Inferred	Read/Write
2618	Status Input/Switch Output #2 (0=OFF,1=ON)	0 Inferred	Read/Write
2619	Status Input/Switch Output #3 (0=OFF,1=ON)	0 Inferred	Read/Write
2620	Status Input/Switch Output #4 (0=OFF,1=ON)	0 Inferred	Read/Write
2621	Spare		
2622	Meter #1 Flow Cut Off Freq. (0-99)	0 Inferred	Read/Write
2623	Meter #2 Flow Cut Off Freq. (0-99)	0 Inferred	Read/Write
2624-2633	Meter Location	40 Chars.	Read/Write
2634-2637	Meter #1 ID	8 Chars.	Read/Write
2638	Meter#1 Density Calculation Type	0 Inferred	Read/Write
2639	Enable Battery Alarm (1=Y)	0 Inferred	Read/Write
2640-2643	Meter #2 ID	8 Chars.	Read/Write
2644	Meter#2 Density Calction Type	0 Inferred	Read/Write
2645	Re-Calculate Meter #1 AGA8 Flag	0 Inferred	Read/Write
2646	Re-Calculate Meter #2 AGA8 Flag	0 Inferred	Read/Write
2647	Meter #1 AGA7 Select Mass Pulses (1=Yes)	0 Inferred	Read/Write
2648	Meter #2 AGA7 Select Mass Pulses (1=Yes)	0 Inferred	Read/Write
2649-2651	Reserved		
2652-2670	Sapre		
2671	Meter#1 PID Auto/Manual	0 Inferred	Read/Write
2672	Meter#1 PID Flow Loop Used (1=Yes)	0 Inferred	Read/Write
2673	Meter#1 PID Flow Direct/Reverse Act	0 Inferred	Read/Write
2674	Meter#1 PID Pressure Loop Used (1=Yes)	0 Inferred	Read/Write
2675	Meter#1 PID Pressure Direct/Reverse Act	0 Inferred	Read/Write
2676	Meter#1 PID Flow Loop in Service	0 Inferred	Read/Write

Modbus Address Table – 16 Bits Integer

ADDRESS	DESCRIPTION	DECIMAL	READ/WRITE
2677	Meter#1 PID Pressure Loop in Service	0 Inferred	Read/Write
2678	Meter#1 PID 0=Low,1=High Signal	0 Inferred	Read/Write
2679	Meter#1 PID Flow Base 0=Gross,1=Net,2=Mass	0 Inferred	Read/Write
2680	Meter#2 PID Auto/Manual	0 Inferred	Read/Write
2681	Meter#2 PID Flow Loop Used (1=Yes)	0 Inferred	Read/Write
2682	Meter#2 PID Flow Direct/Reverse Act	0 Inferred	Read/Write
2683	Meter#2 PID Pres.Loop Used (1=Yes)	0 Inferred	Read/Write
2684	Meter#2 PID Pres.Direct/Reverse Act	0 Inferred	Read/Write
2685	Meter#2 PID Flow Loop in Service	0 Inferred	Read/Write
2686	Meter#2 PID Pres.Loop in Service	0 Inferred	Read/Write
2687	Meter#2 PID 0=Low,1=High Signal	0 Inferred	Read/Write
2688	Meter#2 PID Flow Base 0=Gross,1=Net,2=Mass	0 Inferred	Read/Write
2689	Meter#1 PID PF Base 0=Meter,1=SP1,2=SP2	0 Inferred	Read/Write
2690	Meter#2 PID PF Base 0=Meter,1=SP1,2=SP2	0 Inferred	Read/Write
2691-2797	Spare		
2798	Meter #1 DP Low Assignment	0 Inferred	Read/Write
2799	Meter #1 Temperature Assignment	0 Inferred	Read/Write
2800	Meter #1 Pressure Assignment	0 Inferred	Read/Write
2801	Meter #1 Density Assignment	0 Inferred	Read/Write
2802	Meter #1 Density Temp. Assignment	0 Inferred	Read/Write
2803	Meter #1 DP High Assignment	0 Inferred	Read/Write
2804	Meter #2 DP Low Assignment	0 Inferred	Read/Write
2805	Meter #2 Temperature Assignment	0 Inferred	Read/Write
2806	Meter #2 Pressure Assignment	0 Inferred	Read/Write
2807	Meter #2 Density Assignment	0 Inferred	Read/Write
2808	Meter #2 Density Temp. Assignment	0 Inferred	Read/Write
2809	Meter #2 DP High Assignment	0 Inferred	Read/Write
2810	Spare #1 Assignment	0 Inferred	Read/Write
2811	Spare #2 Assignment	0 Inferred	Read/Write
2812	Meter #1 DP Fail Code	0 Inferred	Read/Write
2813	Meter #1 Temperature Fail Code	0 Inferred	Read/Write
2814	Meter #1 Pressure Fail Code	0 Inferred	Read/Write
2815	Meter #1 Density Fail Code	0 Inferred	Read/Write
2816	Meter #1 Density Temp Fail Code	0 Inferred	Read/Write
2817	Spare		
2818	Meter #2 DP Fail Code	0 Inferred	Read/Write
2819	Meter #2 Temperature Fail Code	0 Inferred	Read/Write
2820	Meter #2 Pressure Fail Code	0 Inferred	Read/Write
2821	Meter #2 Density Fail Code	0 Inferred	Read/Write
2822	Meter #2 Density Temp Fail Code	0 Inferred	Read/Write
2823	Spare		
2824	Spare #1 Failure Code	0 Inferred	Read/Write
2825	Spare #2 Failure Code	0 Inferred	Read/Write
2826	Spare		
2827	Analog Output #1 Assign	0 Inferred	Read/Write
2828	Analog Output #2 Assign	0 Inferred	Read/Write
2829	Analog Output #3 Assign	0 Inferred	Read/Write
2830	Analog Output #4 Assign	0 Inferred	Read/Write
2831	Meter#1 NX19 Method (1=Analysis Method)	0 Inferred	Read/Write

Modbus Address Table – 16 Bits Integer

ADDRESS	DESCRIPTION	DECIMAL	READ/WRITE
2832	Meter#2 NX19 Method (1=Analysis Method)	0 Inferred	Read/Write
2833	Meter #1 Nozzle Type	0 Inferred	Read/Write
2834	Meter#1 Y Factor Select (1=Y1, 2=Y2)	0 Inferred	Read/Write
2835	Meter#1 Tap Select (0=Flange, 1=Pipe)	0 Inferred	Read/Write
2836	Meter#2 Y Factor Select (1=Y1, 2=Y2)	0 Inferred	Read/Write
2837	Meter#2 Tap Select (0=Flange, 1=Pipe)	0 Inferred	Read/Write
2838	Meter#1 Calculation Method	0 Inferred	Read/Write
2839	Meter#2 Calculation Method	0 Inferred	Read/Write
2840	Meter#2 Nozzle Type	0 Inferred	Read/Write
2841-2844	Analog Input #1 Tag Name	8 Chars	Read/Write
2845-2848	Analog Input #2 Tag Name	8 Chars	Read/Write
2849-2852	Analog Input #3 Tag Name	8 Chars	Read/Write
2853-2856	Analog Input #4 Tag Name	8 Chars	Read/Write
2857-2860	RTD Input Tag Name	8 Chars	Read/Write
2861-2864	Density Input Tag Name	8 Chars	Read/Write
2865-2868	Analog Output #1 Tag Name	8 Chars	Read/Write
2869-2872	Analog Output #2 Tag Name	8 Chars	Read/Write
2873-2876	Analog Output #3 Tag Name	8 Chars	Read/Write
2877-2880	Analog Output #4 Tag Name	8 Chars	Read/Write
2881-2895	Spare		
2896-2919	Spare		
2920	Pressure Resolution (0,1,2 Decimal Places)	0 Inferred	Read/Write
2921	Temperature Resolution(0,1,2 Decimal)	0 Inferred	Read/Write
2922	0=US Units, 1=Metric Units	0 Inferred	Read/Write
2923	Metric Pressure Units, 0:Bar,1:Kg/cm2,2=Kpa	0 Inferred	Read/Write
2924	Metric DP Units, 0:mBar, 1=KPA	0 Inferred	Read/Write
2925	Gross/Net Flow Units, 0=MCF,1=CF,2=MMCF, 3=KM3, 4=M3, 5=MMCF (4 decimal)	0 Inferred	Read/Write
2926	Mass Flow Units, 0=MLB (US Units), Tonne (Metric Units) 1=LB (US Units) , KG (Metric)	0 Inferred	Read/Write
2927	Energy Flow Units,	0 Inferred	Read/Write

US Units	Metric Units
0 – MMBTU	0 – GJ
1 - MBTU	1 – MJ
2 – MMBUT(4 decimal)	2 – GJ(4 decimal)
	3 – MCAL(Mega CAL)
	4 – MBTU(Mega BTU)

ADDRESS	DESCRIPTION	DECIMAL	READ/WRITE
2928	Spring Forward Month	0 Inferred	Read/Write
2929	Spring Forward Day	0 Inferred	Read/Write
2930	Fall Back Month	0 Inferred	Read/Write
2931	Fall Back Day	0 Inferred	Read/Write
2932	Enable Daylight Time Saving	0 Inferred	Read/Write
2933	Status Input/Switch Output #1 Assign	0 Inferred	Read/Write
2934	Status Input/Switch Output #2 Assign	0 Inferred	Read/Write

Modbus Address Table – 16 Bits Integer

ADDRESS	DESCRIPTION	DECIMAL	READ/WRITE
2935	Status Input/Switch Output #3 Assign	0 Inferred	Read/Write
2936	Status Input/Switch Output #4 Assign	0 Inferred	Read/Write
2937-2941	Spare		
2942	Activiate Backlight Start Hour (0-23)	0 Inferred	Read/Write
2943	Backlight On Timer in Hours	0 Inferred	Read/Write
2944	Backlignt Mode	0 Inferred	Read/Write
2945-2947	Reserved		
2948-2960	Spare		
2961-2964	Multi.Variable DP Tag	8 Chars.	Read/Write
2965-2968	Multi.Variable Pressure Tag	8 Chars.	Read/Write
2969-2972	Multi.Variable Temperature Tag	8 Chars.	Read/Write
2973-2976	Reserved		
2977-2980	Reserved		
2981-2984	Reserved		
2985	Analog Output#1 –Remote Control (0-100)	0 Inferred	Read/Write
2986	Analog Output#2 –Remote Control (0-100)	0 Inferred	Read/Write
2987	Analog Output#3 –Remote Control (0-100)	0 Inferred	Read/Write
2988	Analog Output#4 –Remote Control (0-100)	0 Inferred	Read/Write
2989-2990	Reserved		
2991	Reset PID	0 Inferred	Read/Write

Modbus Address Table – 16 Bits Integer

ADDRESS	DESCRIPTION	DECIMAL	READ/WRITE
3001	Version Number	2 Inferred	Read
3002	Display/Report Units- 0:US, 1:Metric Units US Units – Temperature Deg.F, Density lb/ft3, Pipe/Primary Element ID Inches Metric Units – Temperature Deg.C, Density kg/m3, Pipe/Primary Element ID Millimeters	0 Inferred	Read
3003	Display/Report Pressure Units 0=Psig, 1=Bar, 2=Kg/cm2, 3=Kpa	0 Inferred	Read
3004	Display/Report DP Units 0=h2o inch, 1=mbar, 2=Kpa	0 Inferred	Read
3005	Display/Report Gross/Net Flow Units Gross Units 0=MCF, 1=CF, 2=MMCF, 3=KM3, 4=M3 Net Units 0=MSCF, 1=SCF, 2=MMSCF, 3=KSM3, 4=SM3	0 Inferred	Read
3006	Display/Report Mass Flow Units 0=MLB, 1=LB, 2=Tonne, 3=KG	0 Inferred	Read
3007	Display/Report Energy Flow Units 0=MMBTU, 1=MBTU, 2=GJ, 3=MJ 4=	0 Inferred	Read
3008	Display/Report Heating Value Units 0=BTU, 1=MJ	0 Inferred	Read
3009	K Factor Units 0=None, 1=CF,2=LB, 3=M3, 4=KG	0 Inferred	Read
3010	Pressure Resolution (0,1,2, Decimal Places)	0 Inferred	Read
3011	Temperature Resolution (0,1,2, Decimal)	0 Inferred	Read
3012	Reserved		
3013-3015	Spare	0 Inferred	Read
3016	Meter #1 Primary Element 0, 1:Orifice, 2:AGA7/Freq, 3:Venturi,4=Nozzle,5=Annubar, 6=SmartCone/Cone	0 Inferred	Read
3017	Meter #2 Primary Element 0, 1:Orifice, 2:AGA7/Freq, 3:Venturi,4=Nozzle,5=Annubar, 6=SmartCone/Cone	0 Inferred	Read
3018	Flow Computer Unit Number	0 Inferred	Read
3019	Disable Alarms (1=Yes)	0 Inferred	Read/Write
3020-3023	Spare		
3024	Enable Calibration Mode (1=Yes)	0 Inferred	Read/Write
3025	Calibration – Set Time (1-9 Hours)	0 Inferred	Read/Write

Modbus Address Table – 16 Bits Integer

ADDRESS	DESCRIPTION	DECIMAL	READ/WRITE
3026	Last Daily Report Request (1=Latest,50=Oldest) Daily Data Area in Location 3431-3757,3131-3255	0 Inferred	Write
3027	Last Monthly Report Request(1=Latest,12=Oldest) Set Last Monthly Report Request to 1 Monthly Data Area in Location 3431-3757,3131-3255	0 Inferred	Write
3028	Reserved		
3029	Last Hourly Report Request (1=Latest,960=Oldest)	0 Inferred	Write
3030	Last Alarm Report Request	0 Inferred	Write
3031	Last Audt Report Request	0 Inferred	Write

Modbus Address Table – 16 Bits Integer

ADDRESS	DESCRIPTION	DECIMAL	READ/WRITE

Scaled Data Area

ADDRESS	DESCRIPTION	DECIMAL	READ/WRITE
3032	Meter #1 Gross Flowrate	0 Inferred	Read
3033	Meter #1 Net Flowrate	0 Inferred	Read
3034	Meter #1 Mass Flowrate	0 Inferred	Read
3035	Meter #1 Energy Flowrate	0 Inferred	Read
3036	Meter #1 Mass Flowrate	2 Inferred	Read
3037-3043	Spare		
3044	Meter #2 Gross Flowrate	0 Inferred	Read
3045	Meter #2 Net Flowrate	0 Inferred	Read
3046	Meter #2 Mass Flowrate	0 Inferred	Read
3047	Meter #2 Energy Flowrate	0 Inferred	Read
3048	Meter #2 Mass Flowrate	2 Inferred	Read
3049-3055	Spare		
3056	Spare #1 Data	0 Inferred	Read
3057	Spare #2 Data	0 Inferred	Read
3058	Meter #1 DP	0 Inferred	Read
3059	Meter #1 Temperature	0 Inferred	Read
3060	Meter #1 Pressure	0 Inferred	Read
3061	Meter #1 Density	0 Inferred	Read
3062	Meter #1 Dens.Temperature	0 Inferred	Read
3063	Meter #2 DP	0 Inferred	Read
3064	Meter #2 Temperature	0 Inferred	Read
3065	Meter #2 Pressure	0 Inferred	Read
3066	Meter #2 Density	0 Inferred	Read
3067	Meter #2 Dens.Temperature	0 Inferred	Read

Scaled Data Area Ends

3082-3122 Reserved

Modbus 16-bit Address Table End

Modbus Address Table – 2x16 Bits Integer

ADDRESS	DESCRIPTION	DECIMAL	READ/WRITE
3131-3255	Reserved		
3257-3273	Spare		
3275	AGA7 Meter#1 Linear Factor	6 Inferred	Read
3277	AGA7 Meter#2 Linear Factor	6 Inferred	Read
3279-3317	Reserved		
3319	Meter #1 Hourly Gross Total	1 or 4* Inferred	Read
3321	Meter #1 Hourly Net Total	1 or 4* Inferred	Read
3323	Meter #1 Hourly Mass Total	2 Inferred	Read
3325	Meter #1 Hourly Energy Total	1 or 4* Inferred	Read
3327	Meter #2 Hourly Gross Total	1 or 4* Inferred	Read
3329	Meter #2 Hourly Net Total	1 or 4* Inferred	Read
3331	Meter #2 Hourly Mass Total	2 Inferred	Read
3333	Meter #2 Hourly Energy Total	1 or 4* Inferred	Read
3335	Meter #1 Monthly Gross Total	1 or 4* Inferred	Read
3337	Meter #1 Monthly Net Total	1 or 4* Inferred	Read
3339	Meter #1 Monthly Mass Total	2 Inferred	Read
3341	Meter #1 Monthly Energy Total	1 or 4* Inferred	Read
3343	Meter #2 Monthly Gross Total	1 or 4* Inferred	Read
3345	Meter #2 Monthly Net Total	1 or 4* Inferred	Read
3347	Meter #2 Monthly Mass Total	2 Inferred	Read
3349	Meter #2 Monthly Energy Total	1 or 4* Inferred	Read
3351-3381	Spare		
3383	Spare #1	4 Inferred	Read
3385	Spare #2	4 Inferred.	Read
3387	Analog Output #1 Output %	2 Inferred	Read
3389	Analog Output #2 Output %	2 Inferred	Read
3391	Meter #1 Uncorrected Density	5 Inferred	Read
3393	Meter #2 Uncorrected Density	5 Inferred	Read
3395-3409	Reserved		
3411	Analog Output #3 Output %	2 Inferred	Read
3413	Analog Output #4 Output %	2 Inferred	Read
3415	Battery Voltage	2 Inferred	Read
3417-3427	Spare		

***Note**: Modbus Address 3013: Gross/Net Decimal, 3014:Energy Decimal

Modbus Address Table – 2x16 Bits Integer

ADDRESS DESCRIPTION DECIMAL READ/WRITE

Last Daily or Monthly Data Area

To retrieve Last Daily data:

Set Last Daily Report Request (3026) to 1=Latest,50=Oldtest

(3026,16 bits Integer, Write only)

Daily Data Area in Location 3429-3759, 3173-3215

To Retrieve Last Monthly Data

Set Last Monthly Report Request (3027) to 1=Latest,12=Oldtest

(3027,16 bits Integer, Write only)

Monthly Data Area in Location 3429-3759 , 3173-3215

3429 Meter#1/Meter#2 Primary Element ID 0 Inferred Read

1st byte	2th byte	3rd byte	4th byte
Meter#2		**Meter #1**	
Part 2 Compositions	Primary Element ID	Part 2 Compositions	Primary Element ID
1: Yes 0: No	1: Orifice 2: AGA7(Freq) 3: Ventrui 4: Nozzle 5: Annubar 6: SmartCone	1: Yes 0: No	1: Orifice 2: AGA7(Freq) 3: Ventrui 4: Nozzle 5: Annubar 6: SmartCone

3431	Batch Type/Disp/Bank/Flag	0 Inferred	Read
3433	Meter #1 Density Calculation Type	0 Inferred	Read
3435	Meter #2 Density Calculation Type	0 Inferred	Read
3437	Day/Month Start Date	0 Inferred	Read
3439	Day/Month Start Time	0 Inferred	Read
3441	Day/Month End Date	0 Inferred	Read
3443	Day/Month End Time	0 Inferred	Read
3445	Meter #1 Cum. Gross Total	1 or 4* Inferred	Read
3447	Meter #1 Cum. Net Total	1 or 4* Inferred	Read
3449	Meter #1 Cum. Mass Total	2 Inferred	Read
3451	Meter #1 Cum. Energy Total	1 or 4* Inferred	Read
3453	Meter #1 Daily/Monthly Gross Total	1 or 4* Inferred	Read
3455	Meter #1 Daily/Monthly Net Total	1 or 4* Inferred	Read
3457	Meter #1 Daily/Monthly Mass Total	2 Inferred	Read
3459	Meter #1 Daily/Monthly Energy Total	1 or 4* Inferred	Read
3461	Meter #1 IV	4 Inferred	Read
3463	Meter #1 Average Temperature	2 Inferred	Read
3465	Meter #1 Average Pressure	2 Inferred	Read
3467	Meter #1 Average Density	5 Inferred	Read
3469	Meter #1 Average Density Temp	2 Inferred	Read
3471	Meter #1 Average Dens.b	6 Inferred	Read
3473	Meter #1 Average SG	6 Inferred	Read
3475	Meter #1 Average Y Factor	6 Inferred	Read
3477	Meter #1 Average K/CD/lMF	6 Inferred	Read
3479	Meter #1 Average FA	6 Inferred	Read

***Note**: Modbus Address 3013: Gross/Net Decimal, 3014:Energy Decimal

Modbus Address Table – 2x16 Bits Integer

ADDRESS	DESCRIPTION	DECIMAL	READ/WRITE
3481	Meter #1 Average FPV/FRA	6 Inferred	Read
3483	Meter #1 Average Heating Value	3 Inferred	Read
3485	Meter #1 Average DP	4 Inferred	Read
3487	Meter #1 Day/Month Opening Cum. Gross Total	1 or 4* Inferred	Read
3489	Meter #1 Day/Month Opening Cum. Net Total	1 or 4* Inferred	Read
3491	Meter #1 Day/Month Opening Cum. Mass Total	2 Inferred	Read
3493	Meter #1 Day/Month Opening Cum. Energy Total	1 or 4* Inferred	Read
3495-3527	Reserved		
3529-3531	Meter #1 ID	8 Chars.	Read
3533	Meter #1 Pipe ID	5 Inferred	Read
3535	Meter #1 Orifice ID	5 Inferred	Read
3537	Meter #1 Density Correction Factor	5 Inferred	Read
3539	Meter #1 Density Dry Air	5 Inferred	Read
3541	Meter #1 Calculation Type	0 Inferred	Read
3543	Meter #1 IMV	4 Inferred	Read
3545	Meter #1 K Factor	3 Inferred	Read
3547	M#1 Average Net Flow Rate(Daily Report only)	2 Inferred	Read
3549	Meter #1 Flow Time in Minutes	0 Inferred	Read
3551	Meter #1 Flow Time in Hours	2 Inferred	Read
3553	Meter #1 Idle Time in Hours (Daily Report only)	2 Inferred	Read
3555	Meter #2 Cum. Gross Total	1 or 4* Inferred	Read
3557	Meter #2 Cum. Net Total	1 or 4* Inferred	Read
3559	Meter #2 Cum. Mass Total	2 Inferred	Read
3561	Meter #2 Cum. Energy Total	1 or 4* Inferred	Read
3563	Meter #2 Daily/Monthly Gross Total	1 or 4* Inferred	Read
3565	Meter #2 Daily/Monthly Net Total	1 or 4* Inferred	Read
3567	Meter #2 Daily/Monthly Mass Total	2 Inferred	Read
3569	Meter #2 Daily/Monthly Energy Total	1 or 4* Inferred	Read
3571	Meter #2 IV	4 Inferred	Read
3573	Meter #2 Average Temperature	2 Inferred	Read
3575	Meter #2 Average Pressure	2 Inferred	Read
3577	Meter #2 Average Density	5 Inferred	Read
3579	Meter #2 Average Density Temp	2 Inferred	Read
3581	Meter #2 Average Density.b	6 Inferred	Read
3583	Meter #2 Average SG	6 Inferred	Read
3585	Meter #2 Average Y Factor	6 Inferred	Read
3587	Meter #2 Average K/CD/LMF	6 Inferred	Read
3589	Meter #2 Average FA	6 Inferred	Read
3591	Meter #2 Average FPV	6 Inferred	Read
3593	Meter #2 Average Heating Value	3 Inferred	Read
3595	Meter #2 Average DP	4 Inferred	Read
3597	Meter #2 Day/Month Opening Cum. Gross Total	1 or 4* Inferred	Read
3599	Meter #2 Day/Month Opening Cum. Net Total	1 or 4* Inferred	Read
3601	Meter #2 Day/Month Opening Cum. Mass Total	2 Inferred	Read
3603	Meter #2 Day/Month Opening Cum. Energy Total	1 or 4* Inferred	Read
3605-3611	Reserved		
3639-3641	Meter #2 ID	8 Chars.	Read
3643	Meter #2 Pipe ID	5 Inferred	Read

*__Note__: Modbus Address 3013: Gross/Net Decimal, 3014:Energy Decimal

Modbus Address Table – 2x16 Bits Integer

ADDRESS	DESCRIPTION	DECIMAL	READ/WRITE
3645	Meter #2 Orifice ID	5 Inferred	Read
3647	Meter #2 Density Correction Factor	5 Inferred	Read
3649	Meter #2 Density Dry Air	5 Inferred	Read
3651	Meter #2 Calculation Type	0 Inferred	Read
3653	Meter #2 IMV	4 Inferred	Read
3655	Meter #2 K Factor	3 Inferred	Read
3657	M#2 Average Net Flow Rate (Daily Report only)	2 Inferred	Read
3659	Meter #2 Flow Time in Minutes	0 Inferred	Read
3661	Meter #2 Flow Time in Hours	2 Inferred	Read
3663	Meter #2 Idle Time in Hours (Daily Report only)	2 Inferred	Read
3665-3667	Daily Report Ticket Number (Daily Report only)	8 Chars	Read
3669-3699	Reserved		
3701	Spare #1 Data	4 Inferred	Read
3703	Spare #2 Data	4 Inferred	Read
3705-3715	Spare		
3717	M#1 Average Mol % of Methane	4 Inferred	Read
3719	M#1 Average Mol % of Nitrogen	4 Inferred	Read
3721	M#1 Average Mol% of Carbon Dioxide	4 Inferred	Read
3723	M#1 Average Mol% of Ethane	4 Inferred	Read
3725	M#1 Average Mol% of Propane	4 Inferred	Read
3727	M#1 Average Mol% of Water	4 Inferred	Read
3729	M#1 Average Mol% of Hydrogen Sulfide	4 Inferred	Read
3731	M#1 Average Mol% of Hydrogen	4 Inferred	Read
3733	M#1 Average Mol% of Carbon Monoxide	4 Inferred	Read
3735	M#1 Average Mol% of Oxygen	4 Inferred	Read
3737	M#1 Average Mol% of i-Butane	4 Inferred	Read
3739	M#1 Average Mol% of n-Butane	4 Inferred	Read
3741	M#1 Average Mol% of i-Pentane	4 Inferred	Read
3743	M#1 Average Mol% of n-Pentane	4 Inferred	Read
3745	M#1 Average Mol% of i-Hexane	4 Inferred	Read
3747	M#1 Average Mol% of n-Heptane	4 Inferred	Read
3749	M#1 Average Mol% of i-Octane	4 Inferred	Read
3751	M#1 Average Mol% of i-Nonane	4 Inferred	Read
3753	M#1 Average Mol% of i-Decane	4 Inferred	Read
3755	M#1 Average Mol% of Helium	4 Inferred	Read
3757	M#1 Average Mol% of Argon	4 Inferred	Read
3759	M#1 Average Mol% of C6 Plus	4 Inferred	Read
3173	M#2 Average Mol % of Methane	4 Inferred	Read
3175	M#2 Average Mol % of Nitrogen	4 Inferred	Read
3177	M#2 Average Mol% of Carbon Dioxide	4 Inferred	Read
3179	M#2 Average Mol% of Ethane	4 Inferred	Read
3181	M#2 Average Mol% of Propane	4 Inferred	Read
3183	M#2 Average Mol% of Water	4 Inferred	Read
3185	M#2 Average Mol% of Hydrogen Sulfide	4 Inferred	Read
3187	M#2 Average Mol% of Hydrogen	4 Inferred	Read
3189	M#2 Average Mol% of Carbon Monoxide	4 Inferred	Read

Modbus Address Table – 2x16 Bits Integer

ADDRESS	DESCRIPTION	DECIMAL	READ/WRITE
3191	M#2 Average Mol% of Oxygen	4 Inferred	Read
3193	M#2 Average Mol% of i-Butane	4 Inferred	Read
3195	M#2 Average Mol% of n-Butane	4 Inferred	Read
3197	M#2 Average Mol% of i-Pentane	4 Inferred	Read
3199	M#2 Average Mol% of n-Pentane	4 Inferred	Read
3201	M#2 Average Mol% of i-Hexane	4 Inferred	Read
3203	M#2 Average Mol% of n-Heptane	4 Inferred	Read
3205	M#2 Average Mol% of i-Octane	4 Inferred	Read
3207	M#2 Average Mol% of i-Nonane	4 Inferred	Read
3209	M#2 Average Mol% of i-Decane	4 Inferred	Read
3211	M#2 Average Mol% of Helium	4 Inferred	Read
3213	M#2 Average Mol% of Argon	4 Inferred	Read
3215	M#2 Average Mol % of C6 Plus	4 Inferred	Read

Last Daily or Monthly Data Area Ends

Modbus Address Table – 2x16 Bits Integer

ADDRESS	DESCRIPTION	DECIMAL	READ/WRITE
3767-3787	Reserved		
3789-3999	Reserved		
4001-4149	Reserved – Alarm Data		
4151	Meter #1 Densitometer Period	3 Inferred	Read
4153	Meter #2 Densitometer Period	3 Inferred	Read
4155-4199	Reserved		
4201	Date (MMDDYY)	0 Inferred	Read/Write
4203	Time (HHMMSS)	0 Inferred	Read/Write
4205-4243	Spare		

NX19 Method

ADDRESS	DESCRIPTION	DECIMAL	READ/WRITE
4245	Meter#1 Mol Percentage of Methane	4 Inferred	Read/Write
4247	Meter#1 Mol Percentage of Ethane	4 Inferred	Read/Write
4249	Meter#1 Mol Percentage of Propane	4 Inerred	Read/Write
4251	Meter#1 Mol Percentage of Iso-Butane	4 Inferred	Read/Write
4253	Meter#1 Mol Percentage of N-Butane	4 Inferred	Read/Write
4255	Meter#1 Mol Percentage of Iso-Pentane	4 Inferred	Read/Write
4257	Meter#1 Mol Percentage of N-Pentane	4 Inferred	Read/Write
4259	Meter#1 Mol Percentage of N-Hexane	4 Inferred	Read/Write
4261	Meter#1 Mol Percentage of Heptane	4 Inferred	Read/Write
4263	Meter#1 Mol Percentage of N-Octane	4 Inferred	Read/Write
4265	Meter#1 Mol Percentage of CO2	4 Inferred	Read/Write
4267	Meter#1 Mol Percentage of N2	4 Inferred	Read/Write
4269-4285	Spare		
4287	Meter#2 Mol Percentage of Methane	4 Inferred	Read/Write
4289	Meter#2 Mol Percentage of Ethane	4 Inferred	Read/Write
4291	Meter#2 Mol Percentage of Propane	4 Inerred	Read/Write
4293	Meter#2 Mol Percentage of Iso-Butane	4 Inferred	Read/Write
4295	Meter#2 Mol Percentage of N-Butane	4 Inferred	Read/Write
4297	Meter#2 Mol Percentage of Iso-Pentane	4 Inferred	Read/Write
4299	Meter#2 Mol Percentage of N-Pentane	4 Inferred	Read/Write
4301	Meter#2 Mol Percentage of N-Hexane	4 Inferred	Read/Write
4303	Meter#2 Mol Percentage of Heptane	4 Inferred	Read/Write
4305	Meter#2 Mol Percentage of N-Octane	4 Inferred	Read/Write
4307	Meter#2 Mol Percentage of CO2	4 Inferred	Read/Write
4309	Meter#2 Mol Percentage of N2	4 Inferred	Read/Write
4311-4327	Spare		

Modbus Address Table – 2x16 Bits Integer

ADDRESS	DESCRIPTION	DECIMAL	READ/WRITE
AGA 8 GROSS METHOD 1			
4245	Meter#1 Mol % of Carbon Dioxide	4 Inferred	Read/Write
4247	Meter#1 Mol % of Hydrogen	4 Inferred	Read/Write
4249	Meter#1 Mol % of Carbon Monoxide	4 Inferred	Read/Write
4251-4285	Spare		
4287	Meter#2 Mol % of Carbon Dioxide	4 Inferred	Read/Write
4289	Meter#2 Mol % of Hydrogen	4 Inferred	Read/Write
4291	Meter#2 Mol % of Carbon Monoxide	4 Inferred	Read/Write
4293-4327	Spare		
AGA 8 GROSS METHOD 2			
4245	Meter#1 Mol % of Nitrogen	4 Inferred	Read/Write
4247	Meter#1 Mol % of Carbon Dioxide	4 Inferred	Read/Write
4249	Meter#1 Mol % of Hydrogen	4 Inferred	Read/Write
4251	Meter#1 Mol % of Carbon Monoxide	4 Inferred	Read/Write
4253-4285	Spare		
4287	Meter#2 Mol % of Nitrogen	4 Inferred	Read/Write
4289	Meter#2 Mol % of Carbon Dioxide	4 Inferred	Read/Write
4291	Meter#2 Mol % of Hydrogen	4 Inferred	Read/Write
4293	Meter#2 Mol % of Carbon Monoxide	4 Inferred	Read/Write
4295-4327	Spare		

Modbus Address Table – 2x16 Bits Integer

ADDRESS	DESCRIPTION	DECIMAL	READ/WRITE
AGA 8 Detail Method			
4245	Meter#1 Mol % of Methane	4 Inferred	Read/Write
4247	Meter#1 Mol % of Nitrogen	4 Inferred	Read/Write
4249	Meter#1 Mol % of Carbon Dioxide	4 Inferred	Read/Write
4251	Meter#1 Mol % of Ethane	4 Inferred	Read/Write
4253	Meter#1 Mol % of Propane	4 Inferred	Read/Write
4255	Meter#1 Mol % of Water	4 Inferred	Read/Write
4257	Meter#1 Mol % of Hydrogen Sulfide	4 Inferred	Read/Write
4259	Meter#1 Mol % of Hydrogen	4 Inferred	Read/Write
4261	Meter#1 Mol % of Carbon Monoxide	4 Inferred	Read/Write
4263	Meter#1 Mol % of Oxygen	4 Inferred	Read/Write
4265	Meter#1 Mol % of i-Butane	4 Inferred	Read/Write
4267	Meter#1 Mol % of n-Butane	4 Inferred	Read/Write
4269	Meter#1 Mol % of i-Pentane	4 Inferred	Read/Write
4271	Meter#1 Mol % of n-Pentane	4 Inferred	Read/Write
4273	Meter#1 Mol % of i-Hexane	4 Inferred	Read/Write
4275	Meter#1 Mol % of n-Heptane	4 Inferred	Read/Write
4277	Meter#1 Mol % of i-Octane	4 Inferred	Read/Write
4279	Meter#1 Mol % of i-Nonane	4 Inferred	Read/Write
4281	Meter#1 Mol % of i-Decane	4 Inferred	Read/Write
4283	Meter#1 Mol % of Helium	4 Inferred	Read/Write
4285	Meter#1 Mol % of Argon	4 Inferred	Read/Write
4287	Meter#2 Mol % of Methane	4 Inferred	Read/Write
4289	Meter#2 Mol % of Nitrogen	4 Inferred	Read/Write
4291	Meter#2 Mol % of Carbon Dioxide	4 Inferred	Read/Write
4293	Meter#2 Mol % of Ethane	4 Inferred	Read/Write
4295	Meter#2 Mol % of Propane	4 Inferred	Read/Write
4297	Meter#2 Mol % of Water	4 Inferred	Read/Write
4299	Meter#2 Mol % of Hydrogen Sulfide	4 Inferred	Read/Write
4301	Meter#2 Mol % of Hydrogen	4 Inferred	Read/Write
4303	Meter#2 Mol % of Carbon Monoxide	4 Inferred	Read/Write
4305	Meter#2 Mol % of Oxygen	4 Inferred	Read/Write
4307	Meter#2 Mol % of i-Butane	4 Inferred	Read/Write
4309	Meter#2 Mol % of n-Butane	4 Inferred	Read/Write
4311	Meter#2 Mol % of i-Pentane	4 Inferred	Read/Write
4313	Meter#2 Mol % of n-Pentane	4 Inferred	Read/Write
4315	Meter#2 Mol % of i-Hexane	4 Inferred	Read/Write
4317	Meter#2 Mol % of n-Heptane	4 Inferred	Read/Write
4319	Meter#2 Mol % of i-Octane	4 Inferred	Read/Write
4321	Meter#2 Mol % of i-Nonane	4 Inferred	Read/Write
4323	Meter#2 Mol % of i-Decane	4 Inferred	Read/Write
4325	Meter#2 Mol % of Helium	4 Inferred	Read/Write
4327	Meter#2 Mol % of Argon	4 Inferred	Read/Write

AGA 8 Detail Method Ends

Modbus Address Table – 2x16 Bits Integer

ADDRESS	DESCRIPTION	DECIMAL	READ/WRITE
4329	Meter #1 Heating Value BTU(US), MJ(Metric)	3 Inferred	Read/Write
4331	Meter #2 Heating Value BTU(US), MJ(Metric)	3 Inferred	Read/Write
4333	Meter #1 FPV Override	6 Inferred	Read/Write
4335	Meter #2 FPV Override	6 Inferred	Read/Write
4337	Meter #1 Temperature Override	2 Inferred	Read/Write
4339	Meter #2 Temperature Override	2 Inferred	Read/Write
4341	Meter #1 Pressure Override	2 Inferred	Read/Write
4343	Meter #2 Pressure Override	2 Inferred	Read/Write
4345	Meter #1 Base Density Override	6 Inferred	Read/Write
4347	Meter #2 Base Density Override	6 Inferred	Read/Write
4349	Meter #1 DP Cut Off	4 Inferred	Read/Write
4351	Meter #1 Net Flow Rate Low Limit	2 Inferred	Read/Write
4353	Meter #1 Net Flow Rate High Limit	2 Inferred	Read/Write
4355	Meter #1 Pipe ID	5 Inferred	Read/Write
4357	Meter #1 Primary Element ID	5 Inferred	Read/Write
4359	Meter #2 DP Cut Off	4 Inferred	Read/Write
4361	Meter #2 Net Flow Low Limit	2Inferred	Read/Write
4363	Meter #2 Net Flow High Limit	2Inferred	Read/Write
4365	Meter #2 Pipe ID	5 Inferred	Read/Write
4367	Meter #2 Primary Element ID	5 Inferred	Read/Write
4369	Meter #1 Density Dry Air	5 Inferred	Read/Write
4371	Meter #1 Relative Density	6 Inferred	Read/Write
4373	Meter #1 Ratio of Heat	4 Inferred	Read/Write
4375	Meter #1 Viscosity	6 Inferred	Read/Write
4377	Meter #1 Pipe Thermal E-6	2 Inferred	Read/Write
4379	Meter #1 Primary Element Thermal E-6	2 Inferred	Read/Write
4381	Meter #1 Reference Temp of Pipe	2 Inferred	Read/Write
4383	Meter #1 Reference Temp of Primary Element	2 Inferred	Read/Write
4385	Meter #2 Density Dry Air	5 Inferred	Read/Write
4387	Meter #2 Relative Density	6 Inferred	Read/Write
4389	Meter #2 Ratio of Heat	4 Inferred	Read/Write
4391	Meter #2 Viscosity	6 Inferred	Read/Write
4393	Meter #2 Pipe Thermal E-6	2 Inferred	Read/Write
4395	Meter #2 Primary Element Thermal E-6	2 Inferred	Read/Write
4397	Meter #2 Refernece Temp of Pipe	2 Inferred	Read/Write
4399	Meter #2 Reference Temp of Primary Element	2 Inferred	Read/Write
4401	Meter #1 DP Switch High %	2 Inferred	Read/Write
4403	Meter #2 DP Switch Low %	2 Inferred	Read/Write
4405	Meter #1 K Factor	3 Inferred	Read/Write
4407	Meter #1 Meter Factor	6 Inferred	Read/Write
4409	Meter #2 K Factor	3 Inferred	Read/Write
4411	Meter #2 Meter Factor	6 Inferred	Read/Write
4413	Meter #1 Flow Threshold #1	2 Inferred	Read/Write
4415	Meter #1 Flow Threshold #2	2 Inferred	Read/Write
4417	Meter #1 Flow Threshold #3	2 Inferred	Read/Write
4419	Meter #1 Flow Threshold #4	2 Inferred	Read/Write
4421	Meter #1 Linear Factor #1	6 Inferred	Read/Write

Modbus Address Table – 2x16 Bits Integer

ADDRESS	DESCRIPTION	DECIMAL	READ/WRITE
4423	Meter #1 Linear Factor #2	6 Inferred	Read/Write
4425	Meter #1 Linear Factor #3	6 Inferred	Read/Write
4427	Meter #1 Linear Factor #4	6 Inferred	Read/Write
4429	Meter #2 Flow Threshold #1	2 Inferred	Read/Write
4431	Meter #2 Flow Threshold #2	2 Inferred	Read/Write
4433	Meter #2 Flow Threshold #3	2 Inferred	Read/Write
4435	Meter #2 Flow Threshold #4	2 Inferred	Read/Write
4437	Meter #2 Linear Factor #1	6 Inferred	Read/Write
4439	Meter #2 Linear Factor #2	6 Inferred	Read/Write
4441	Meter #2 Linear Factor #3	6 Inferred	Read/Write
4443	Meter #2 Linear Factor #4	6 Inferred	Read/Write
4445	Meter #1 Flow Threshold #5	2 Inferred	Read/Write
4447	Meter #1 Flow Threshold #6	2 Inferred	Read/Write
4449	Meter #1 Linear Factor #5	6 Inferred	Read/Write
4451	Meter #1 Linear Factor #6	6 Inferred	Read/Write
4453	Meter #2 Flow Threshold #5	2 Inferred	Read/Write
4455	Meter #2 Flow Threshold #6	2 Inferred	Read/Write
4457	Meter #2 Linear Factor #5	6 Inferred	Read/Write
4459	Meter #2 Linear Factor #6	6 Inferred	Read/Write
4461-4467	Reserved		
4469	M#1 Venturi Discharge Coeff./Cone Coeff	6 Inferred	Read/Write
4471	M#2 Venturi Discharge Coeff / Cone Coeff.	6 Inferred	Read/Write
4473	Reserved	6 Inferred	Read/Write
4475	Reserved	6 Inferred	Read/Write
4477	Reserved	6 Inferred	Read/Write
4479	Reserved	6 Inferred	Read/Write
4481-4515	Spare		
4517	Meter#1 PID Output %	2 Inferred	Read/Write
4519	Meter#1 PID Flow	2 Inferred	Read/Write
4521	Meter#1 PID Flow Set Point	2 Inferred	Read/Write
4523	Meter#1 PID Flow Controller Gain	2 Inferred	Read/Write
4525	Meter#1 PID Flow Controller Reset(M	2 Inferred	Read/Write
4527	Meter#1 PID Pressure Maximum	2 Inferred	Read/Write
4529	Meter#1 PID Pres.Set Point	2 Inferred	Read/Write
4531	Meter#1 PID Pres.Controller Gain	2 Inferred	Read/Write
4533	Meter#1 PID Pres.Controller Reset(M.)	2 Inferred	Read/Write
4535	Meter#1 PID Minimum Output %	2 Inferred	Read/Write
4537	Meter#1 PID Maximum Output %	2 Inferred	Read/Write
4539	Meter#2 PID Output %	2 Inferred	Read/Write
4541	Meter#2 PID Flow Maximum	2 Inferred	Read/Write
4543	Meter#2 PID Flow Set Point	2 Inferred	Read/Write
4545	Meter#2 PID Flow Controller Gain	2 Inferred	Read/Write
4547	Meter#2 PID Flow Controller Reset(M.)	2 Inferred	Read/Write

Modbus Address Table – 2x16 Bits Integer

ADDRESS	DESCRIPTION	DECIMAL	READ/WRITE
4549	Meter#2 PID Pressure Maximum	2 Inferred	Read/Write
4551	Meter#2 PID Pres.Set Point	2 Inferred	Read/Write
4553	Meter#2 PID Pres.Controller Gain	2 Inferred	Read/Write
4555	Meter#2 PID Pres.Controller Reset(M.)	2 Inferred	Read/Write
4557	Meter#2 PID Minimum Output %	2 Inferred	Read/Write
4559	Meter#2 PID Maximum Output %	2 Inferred	Read/Write
4561-4617	Spare		
4617-4657	Reserved		
4657	Meter #1 DP Low @4mA	4 Inferred	Read/Write
4659	Meter #1 DP Low @20mA	4 Inferred	Read/Write
4661	Meter #1 DP Low Limit	4 Inferred	Read/Write
4663	Meter #1 DP High Limit	4 Inferred	Read/Write
4665	Meter #1 DP Maintenance	4 Inferred	Read/Write
4667	Meter #1 Temperature @4mA	2 Inferred	Read/Write
4669	Meter #1 Temperature @20mA	2 Inferred	Read/Write
4671	Meter #1 Temperature Low Limit	2 Inferred	Read/Write
4673	Meter #1 Temperature High Limit	2 Inferred	Read/Write
4675	Meter #1 Temperature Maintenance	2 Inferred	Read/Write
4677	Meter #1 Pressure @4mA	2 Inferred	Read/Write
4679	Meter #1 Pressure @20mA	2 Inferred	Read/Write
4681	Meter #1 Pressure Low Limit	2 Inferred	Read/Write
4683	Meter #1 Pressure High Limit	2 Inferred	Read/Write
4685	Meter #1 Pressure Maintenance	2 Inferred	Read/Write
4687	Meter #1 Density @4mA	5 Inferred	Read/Write
4689	Meter #1 Density @20mA	5 Inferred	Read/Write
4691	Meter #1 Density Low Limit	5 Inferred	Read/Write
4693	Meter #1 Density High Limit	5 Inferred	Read/Write
4695	Meter #1 Density Maintenance	5 Inferred	Read/Write
4697	Meter #1 Density Temperature @4mA	2 Inferred	Read/Write
4699	Meter #1 Density Temperature @20mA	2 Inferred	Read/Write
4701	Meter #1 Density Temperature Low Limit	2 Inferred	Read/Write
4703	Meter #1 Density Temperature High Limit	2 Inferred	Read/Write
4705	Meter #1 Density Temperature Maintenance	2 Inferred	Read/Write
4707	Meter #1 DP High @4mA	4 Inferred	Read/Write
4709	Meter #1 DP High @20mA	4 Inferred	Read/Write
4711-4715	Spare		
4717	Meter #1 Density Correction Factor	5 Inferred	Read/Write
4719	Meter #1 Dens.Period Low Limit	3 Inferred	Read/Write
4721	Meter #1 Dens.Period High Limit	3 Inferred	Read/Write
4723-4725	Spare		
4727	Meter #2 DP Low @4mA	4 Inferred	Read/Write
4729	Meter #2 DP Low @20mA	4 Inferred	Read/Write
4731	Meter #2 DP Low Limit	4 Inferred	Read/Write

Modbus Address Table – 2x16 Bits Integer

ADDRESS	DESCRIPTION	DECIMAL	READ/WRITE
4733	Meter #2 DP High Limit	4 Inferred	Read/Write
4735	Meter #2 DP Maintenance	4 Inferred	Read/Write
4737	Meter #2 Temperature @4mA	2 Inferred	Read/Write
4739	Meter #2 Temperature @20mA	2 Inferred	Read/Write
4741	Meter #2 Temperature Low Limit	2 Inferred	Read/Write
4743	Meter #2 Temperature High Limit	2 Inferred	Read/Write
4745	Meter #2 Temperature Maintenance	2 Inferred	Read/Write
4747	Meter #2 Pressure @4mA	2 Inferred	Read/Write
4749	Meter #2 Pressure @20mA	2 Inferred	Read/Write
4751	Meter #2 Pressure Low Limit	2 Inferred	Read/Write
4753	Meter #2 Pressure High Limit	2 Inferred	Read/Write
4755	Meter #2 Pressure Maintenance	2 Inferred	Read/Write
4757	Meter #2 Density @4mA	5 Inferred	Read/Write
4759	Meter #2 Density @20mA	5 Inferred	Read/Write
4761	Meter #2 Density Low Limit	5 Inferred	Read/Write
4763	Meter #2 Density High Limit	5 Inferred	Read/Write
4765	Meter #2 Density Maintenance	5 Inferred	Read/Write
4767	Meter #2 Density Temperature @4mA	2 Inferred	Read/Write
4769	Meter #2 Density Temperature @20mA	2 Inferred	Read/Write
4771	Meter #2 Density Temperature Low Limit	2 Inferred	Read/Write
4773	Meter #2 Density Temperature High Limit	2 Inferred	Read/Write
4775	Meter #2 Denstiy Temperature Maintenance	2 Inferred	Read/Write
4777	Meter #2 DP High @4mA	4 Inferred	Read/Write
4779	Meter #2 DP High @20mA	4 Inferred	Read/Write
4781-4785	Spare		
4787	Meter #2 Density Correction Factor	5 Inferred	Read/Write
4789	Meter #2 Dens.Period Low Limit	3 Inferred	Read/Write
4791	Meter #2 Dens.Period High Limit	3 Inferred	Read/Write
4793-4796	Spare		
4797	Spare#1 @4mA	4 Inferred	Read/Write
4799	Spare#1 @20mA	4 Inferred	Read/Write
4801	Spare#1 Lo-Limit	4 Inferred	Read/Write
4803	Spare#1 Hi-Limit	4 Inferred	Read/Write
4805	Spare#1 Maintenance	4 Inferred	Read/Write
4807	Spare#2 @4mA	4 Inferred	Read/Write
4809	Spare#2 @20mA	4 Inferred	Read/Write
4811	Spare#2 Lo-Limit	4 Inferred	Read/Write
4813	Spare#2 Hi-Limit	4 Inferred	Read/Write
4815	Spare#2 Maintenance	4 Inferred	Read/Write
4817	Spare		
4819	Base Temperature	3 Inferred	Read/Write
4821	Base Pressure	4 Inferred	Read/Write
4823	Run Switch Low Set Point	2 Inferred	Read/Write
4825	Run Switch High Set Point	2 Inferred	Read/Write
4827	Atmospheric Pressure	4 Inferred	Read/Write

Modbus Address Table – 2x16 Bits Integer

ADDRESS	DESCRIPTION	DECIMAL	READ/WRITE
4829	Pulse Output Volume #1 Pulses/Unit	3 Inferred	Read/Write
4831	Pulse Output Volume #2 Pulses/Unit	3 Inferred	Read/Write
4833	Analog Output #1 at 4 mA	*decimal Inferred	Read/Write
4835	Analog Output #1 at 20 mA	*decimal Inferred	Read/Write
4837	Analog Output #2 at 4 mA	*decimal Inferred	Read/Write
4839	Analog Output #2 at 20 mA	*decimal Inferred	Read/Write
4841	Analog Output #3 at 4 mA	*decimal Inferred	Read/Write
4843	Analog Output #3 at 20 mA	*decimal Inferred	Read/Write
4845	Analog Output #4 at 4 mA	*decimal Inferred	Read/Write
4847	Analog Output #4 at 20 mA	*decimal Inferred	Read/Write

Analog Output Assignment	**Decimal Inferred**
1: M1 Gross Flow Rate 2: M1 Net Flow Rate 3: M1 Mass Flow Rate 4: M1 Energy Flow Rate 5: M2 Gross Flow Rate 6: M2 Net Flow Rate 7: M2 Mass Flow Rate 8: M2 Energy Flow Rate	**2**
13: M1 DP 19: M1 DP Low 20: M1 DP High 21: M2 DP 27: M2 DP Low 28: M2 DP High 33: Spare 1 34: Spare 2	**4**
14: M1 Temperature 15: M1 Pressure 17: M1 Density Temperature 22: M2 Temperature 23: M2 Pressure 25: M2 Density Temperature	**1**
16: M1 Density 18: M1 Density at Base 24: M2 Density 26: M2 Density at Base 30: M1 SG 32: M2 SG	**6**
Others	0

4849-4851	Reserved
4853-4869	Spare
4871	Reserved

Modbus Address Table – 2x16 Bits Integer

ADDRESS	DESCRIPTION	DECIMAL	READ/WRITE

Historical Hourly Data Area

To Retrieve Previous Hourly Data
Set Last Hourly Report Request (3029) to 1=Latest,960=Oldtest
3029 = Last Hourly Report Request (16 bits Integer, Write only)

ADDRESS	DESCRIPTION	DECIMAL	READ/WRITE
8001	Date (mm/dd/yy) / (Hour)	0 Inferred	Read

1st Byte	2nd byte	3rd byte	4th byte
mm/dd/yy			Hour (0-23)

ADDRESS	DESCRIPTION	DECIMAL	READ/WRITE
8003	Meter#1 Duration of Flow Seconds	0 Inferred	Read
8005	Meter#1 Net Total	1 or 4* Inferred	Read
8007	Meter#1 Mass Total	2 Inferred	Read
8009	Meter#1 Energy Total	1 or 4* Inferred	Read
8011	Meter#1 Averaged Temperature	2 Inferred	Read
8013	Meter#1 Average Pressure	2 Inferred	Read
8015	Meter#1 Average Density	5 Inferred	Read
8017	Meter#1 Average DP	4 Inferred	Read
8019	Meter#1 IV	4 Inferred	Read
8021	Meter#1 Integral Multiplier Value	4 Inferred	Read
8023	Meter#1 Gross Total	1 or 4* Inferred	Read
8025	Spare		
8027-8049	Spare		
8051	Meter#2 Duration of Flow Seconds	0 Inferred	Read
8053	Meter#2 Net Total	1 or 4* Inferred	Read
8055	Meter#2 Mass Total	2 Inferred	Read
8057	Meter#2 Energy Total	1 or 4* Inferred	Read
8059	Meter#2 Average Temperature	2 Inferred	Read
8061	Meter#2 Average Pressure	2 Inferred	Read
8063	Meter#2 Average Density	5 Inferred	Read
8065	Meter#2 Average DP	4 Inferred	Read
8067	Meter#2 DPEXT	4 Inferred	Read
8069	Meter#2 Integral Multiplier Value	4 Inferred	Read
8071	Meter#2 Gross Total	1 or 4* Inferred	Read
8073	Spare		
8073-8097	Spare		

*__Note__: Modbus Address 3013: Gross/Net Decimal, 3014:Energy Decimal

Historical Hourly Data Area Ends

Modbus Address Table – 2x16 Bits Integer

ADDRESS	DESCRIPTION	DECIMAL	READ/WRITE

Previous Hour Data Area

ADDRESS	DESCRIPTION	DECIMAL	READ/WRITE
8351	Date mm/dd/yy	0 Inferred	Read
8353	Hour	0 Inferred	Read
8355	Meter#1 Flow Second	0 Inferred	Read
8357	Meter#1 Net	1 or 4* Inferred	Read
8359	Meter#1 Mass	2 Inferred	Read
8361	Meter#1 Energy	1 or 4* Inferred	Read
8363	Meter#1 Gross	1 Inferred	Read
8365	Meter#1 Average Temperature	2 Inferred	Read
8367	Meter#1 Average Pressure	2 Inferred	Read
8369	Meter#1 Average Density	5 Inferred	Read
8371	Meter#1 Average DP	4 Inferred	Read
8373	Meter#1 IV	4 Inferred	Read
8375	Meter#1 Integral Multiplier Value	4 Inferred	Read
8377-8389	Spare		
8391	Meter#2 Flow Second	0 Inferred	Read
8393	Meter#2 Net	1 or 4* Inferred	Read
8395	Meter#2 Mass	2 Inferred	Read
8397	Meter#2 Energy	1 or 4* Inferred	Read
8399	Meter#2 Gross	1 or 4* Inferred	Read
8401	Meter#2 Average Temperature	2 Inferred	Read
8403	Meter#2 Average Pressure	2 Inferred	Read
8405	Meter#2 Average Density	5 Inferred	Read
8407	Meter#2 Average DP	4 Inferred	Read
8409	Meter#2 DPEXT	4 Inferred	Read
8411	Meter#2 Integral Multiplier Value	4 Inferred	Read

*__Note__: Modbus Address 3013: Gross/Net Decimal, 3014:Energy Decimal

Previous Hour Data Area Ends

Modbus Address Table – 2x16 Bits Integer

Yesterday Data Area

ADDRESS	DESCRIPTION	DECIMAL	READ/WRITE
8501	Primary Element	0 Inferred	Read
8503	Settings		
8505	Meter#1 Density Calculation Type	0 Inferred	Read
8507	Meter#2 Density Calculation Type	0 Inferred	Read
8509-8511	Daily Ticket Number	8 Chars	Read
8513	Date (mm/dd/yy)	0 Inferred	Read
8515	Time (hh:mm:ss)	0 Inferred	Read
8517	Day Stat Date (mm/dd/yy)	0 Inferred	Read
8519	Day Start Time (hh:mm:ss)	0 Inferred	Read
8521	Meter #1 Daily Flow Time in Minutes	0 Inferred	Read
8523	Meter #1 Flow Time in Hours	2 Inferred	Read
8525	Meter #1 Idle Time in Hours	2 Inferred	Read
8527	Meter #1 Average Net Flow Rate	2 Inferred	Read
8529	Meter #1 Day Closing Cum. Gross Total	1 or 4* Inferred	Read
8531	Meter #1 Day Closing Cum. Net Total	1 or 4* Inferred	Read
8533	Meter #1 Day Closing Cum. Mass Total	2 Inferred	Read
8535	Meter #1 Day Closing Cum. Energy Total	1 or 4* Inferred	Read
8537	Meter #1 Daily Gross Total	1 or 4* Inferred	Read
8539	Meter #1 Daily Net Total	1 or 4* Inferred	Read
8541	Meter #1 Daily Mass Total	2 Inferred	Read
8543	Meter #1 Daily Energy Total	1 or 4* Inferred	Read
8545	Meter #1 Day Opening Cum. Gross Total	1 or 4* Inferred	Read
8547	Meter #1 Day Opening Cum. Net Total	1 or 4* Inferred	Read
8549	Meter #1 Day Opening Cum. Mass Total	2 Inferred	Read
8551	Meter #1 Day Opening Cum. Energy Total	1 or 4* Inferred	Read
8553	Meter #1 IV	4 Inferred	Read
8555	Meter #1 Average DP	4 Inferred	Read
8557	Meter #1 Average Temperature	2 Inferred	Read
8559	Meter #1 Average Pressure	2 Inferred	Read
8561	Meter #1 Average Heating Value	6 Inferred	Read
8563	Meter #1 Average Density	5 Inferred	Read
8565	Meter #1 Average Dens.b	6 Inferred	Read
8567	Meter #1 Average K/CD/lMF	6 Inferred	Read
8569	Meter #1 Average Y Factor	6 Inferred	Read
8571	Meter #1 Average SG	6 Inferred	Read
8573	Meter #1 Average FA	6 Inferred	Read
8575	Meter #1 Average FPV/FRA	6 Inferred	Read
8577	Meter #1 Average Density Temp	2 Inferred	Read
8579	Meter #1 IMV	4 Inferred	Read
8581-8583	Meter #1 ID	8 Chars.	Read
8585	Meter #1 Pipe ID	5 Inferred	Read
8587	Meter #1 Primary Element ID	5 Inferred	Read
8589	Meter #1 Density Correction Factor	5 Inferred	Read
8591	Meter #1 Density Dry Air	5 Inferred	Read
8593	Meter #1 Calculation Type	0 Inferred	Read
8595	Meter #1 K Factor	3 Inferred	Read
8597-8599	Spare		

*Note: Modbus Address 3013: Gross/Net Decimal, 3014:Energy Decimal

Modbus Address Table – 2x16 Bits Integer

ADDRESS	DESCRIPTION	DECIMAL	READ/WRITE
8601	M#1 Average Mol % of Methane	4 Inferred	Read
8603	M#1 Average Mol % of Nitrogen	4 Inferred	Read
8605	M#1 Average Mol% of Carbon Dioxide	4 Inferred	Read
8607	M#1 Average Mol% of Ethane	4 Inferred	Read
8609	M#1 Average Mol% of Propane	4 Inferred	Read
8611	M#1 Average Mol% of Water	4 Inferred	Read
8613	M#1 Average Mol% of Hydrogen Sulfide	4 Inferred	Read
8615	M#1 Average Mol% of Hydrogen	4 Inferred	Read
8617	M#1 Average Mol% of Carbon Monoxide	4 Inferred	Read
8619	M#1 Average Mol% of Oxygen	4 Inferred	Read
8621	M#1 Average Mol% of i-Butane	4 Inferred	Read
8623	M#1 Average Mol% of n-Butane	4 Inferred	Read
8625	M#1 Average Mol% of i-Pentane	4 Inferred	Read
8627	M#1 Average Mol% of n-Pentane	4 Inferred	Read
8629	M#1 Average Mol% of i-Hexane	4 Inferred	Read
8631	M#1 Average Mol% of n-Heptane	4 Inferred	Read
8633	M#1 Average Mol% of i-Octane	4 Inferred	Read
8635	M#1 Average Mol% of i-Nonane	4 Inferred	Read
8637	M#1 Average Mol% of i-Decane	4 Inferred	Read
8639	M#1 Average Mol% of Helium	4 Inferred	Read
8641	M#1 Average Mol% of Argon	4 Inferred	Read
8643	M#1 Average Mol% of C6+	4 Inferred	Read
8645-8649	Spare		
8651	Meter #2 Daily Flow Time in Minutes	0 Inferred	Read
8653	Meter #2 Flow Time in Hours	2 Inferred	Read
8655	Meter #2 Idle Time in Hours	2 Inferred	Read
8657	Meter #2 Average Net Flow Rate	2 Inferred	Read
8659	Meter #2 Day Closing Cum. Gross Total	1 or 4* Inferred	Read
8661	Meter #2 Day Closing Cum. Net Total	1 or 4* Inferred	Read
8663	Meter #2 Day Closing Cum. Mass Total	2 Inferred	Read
8665	Meter #2 Day Closing Cum. Energy Total	1 or 4* Inferred	Read
8667	Meter #2 Daily Gross Total	1 or 4* Inferred	Read
8669	Meter #2 Daily Net Total	1 or 4* Inferred	Read
8671	Meter #2 Daily Mass Total	2 Inferred	Read
8673	Meter #2 Daily Energy Total	1 or 4* Inferred	Read
8675	Meter #2 Day Opening Cum. Gross Total	1 or 4* Inferred	Read
8677	Meter #2 Day Opening Cum. Net Total	1 or 4* Inferred	Read
8679	Meter #2 Day Opening Cum. Mass Total	2 Inferred	Read
8681	Meter #2 Day Opening Cum. Energy Total	1 or 4* Inferred	Read

***Note**: Modbus Address 3013: Gross/Net Decimal, 3014:Energy Decimal

Modbus Address Table – 2x16 Bits Integer

ADDRESS	DESCRIPTION	DECIMAL	READ/WRITE

Yesterday Data Area – Continued

ADDRESS	DESCRIPTION	DECIMAL	READ/WRITE
8683	Meter #2 IV	4 Inferred	Read
8685	Meter #2 Average DP	4 Inferred	Read
8687	Meter #2 Average Temperature	2 Inferred	Read
8689	Meter #2 Average Pressure	2 Inferred	Read
8691	Meter #2 Average Heating Value	6 Inferred	Read
8693	Meter #2 Average Density	5 Inferred	Read
8695	Meter #2 Average Dens.b	6 Inferred	Read
8697	Meter #2 Average K/CD/lMF	6 Inferred	Read
8699	Meter #2 Average Y Factor	6 Inferred	Read
8701	Meter #2 Average SG	6 Inferred	Read
8703	Meter #2 Average FA	6 Inferred	Read
8705	Meter #2 Average FPV/FRA	6 Inferred	Read
8707	Meter #2 Average Density Temp	2 Inferred	Read
8709	Meter #2 IMV	4 Inferred	Read
8711-8713	Meter #2 ID	8 Chars.	Read
8715	Meter #2 Pipe ID	5 Inferred	Read
8717	Meter #2 Primary Element ID	5 Inferred	Read
8719	Meter #2 Density Correction Factor	5 Inferred	Read
8721	Meter #2 Density Dry Air	5 Inferred	Read
8723	Meter #2 Calculation Type	0 Inferred	Read
8725	Meter #2 K Factor	3 Inferred	Read
8727-8729	Spare		
8731	M#2 Average Mol % of Methane	4 Inferred	Read
8733	M#2 Average Mol % of Nitrogen	4 Inferred	Read
8735	M#2 Average Mol% of Carbon Dioxide	4 Inferred	Read
8737	M#2 Average Mol% of Ethane	4 Inferred	Read
8739	M#2 Average Mol% of Propane	4 Inferred	Read
8741	M#2 Average Mol% of Water	4 Inferred	Read
8743	M#2 Average Mol% of Hydrogen Sulfide	4 Inferred	Read
8745	M#2 Average Mol% of Hydrogen	4 Inferred	Read
8747	M#2 Average Mol% of Carbon Monoxide	4 Inferred	Read
8749	M#2 Average Mol% of Oxygen	4 Inferred	Read
8751	M#2 Average Mol% of i-Butane	4 Inferred	Read
8753	M#2 Average Mol% of n-Butane	4 Inferred	Read
8755	M#2 Average Mol% of i-Pentane	4 Inferred	Read
8757	M#2 Average Mol% of n-Pentane	4 Inferred	Read
8759	M#2 Average Mol% of i-Hexane	4 Inferred	Read
8761	M#2 Average Mol% of n-Heptane	4 Inferred	Read
8763	M#2 Average Mol% of i-Octane	4 Inferred	Read
8765	M#2 Average Mol% of i-Nonane	4 Inferred	Read
8767	M#2 Average Mol% of i-Decane	4 Inferred	Read
8769	M#2 Average Mol% of Helium	4 Inferred	Read
8771	M#2 Average Mol% of Argon	4 Inferred	Read
8773	M#1 Average Mol% of C6+	4 Inferred	Read
8775-8779	Spare		
8781	Spare#1 Data	4 Inferred	Read
8783	Spare#2 Data	4 Inferred	Read

Yesterday Data Area Ends

Modbus Address Table – 2x16 Bits Integer

ADDRESS DESCRIPTION DECIMAL READ/WRITE

Non-resettable gross and net accumulated volume will roll over at 99999999.9.
Non-resettable mass accumulated volume will roll over at 9999999.99.

Current Data Area

ADDRESS	DESCRIPTION	DECIMAL	READ/WRITE
9001	Meter #1 Calculation Type	0 Inferred	Read

Primary Element Description Register
[9001] Meter#1 the first 4 bits of 4th byte/ [9201] Meter#2 the first 4 bits of 4th byte
0, 1: Orifice
2:AGA7/Freq.
3: Venturi
4: Nozzle
6: SmartCone

ADDRESS	DESCRIPTION	DECIMAL	READ/WRITE
9003	Meter #1 Flow Flag	0 Inferred	Read
9005	Meter #1 Alarm Status Flag	0 Inferred	Read
9007	Meter #1 Daily Gross	1 or 4* inferred	Read
9009	Meter #1 Daily Net	1 or 4* inferred	Read
9011	Meter #1 Daily Mass	2 inferred	Read
9013	Meter #1 Daily Energy	1 or 4* inferred	Read
9015	Meter #1 Average DP	4 Inferred	Read
9017	Meter #1 Average Temperature	2 Inferred	Read
9019	Meter #1 Average Pressure	2 Inferred	Read
9021	Meter #1 Average Density	5 Inferred	Read
9023	Meter #1 Average Dens.Temp	2 Inferred	Read
9025	Meter #1 Average Dens.b	6 Inferred	Read
9027	Meter #1 Average SG	6 Inferred	Read
9029	Meter #1 Average Y Factor.	6 Inferred	Read
9031	Meter #1 Average K/CD/LMF	6 Inferred	Read
9033	Meter #1 Average FA	6 Inferred	Read
9035	Meter #1 Average FPV/FRA	6 Inferred	Read
9037-9039	Spare		
9041	Meter #1 Gross Flowrate	2 or 4* Inferred	Read
9043	Meter #1 Net Flowrate	2 or 4* Inferred	Read
9045	Meter #1 Mass Flowrate	2 Inferred	Read
9047	Meter #1 Energy Flowrate	2 or 4* Inferred	Read
9049	Meter #1 DP	4 Inferred	Read
9051	Meter #1 Temperature	2 Inferred	Read
9053	Meter #1 Pressure	2 Inferred	Read
9055	Meter #1 Density	5 Inferred	Read
9057	Meter #1 Dens.Temp	2 Inferred	Read
9059	Meter #1 Dens.b	6 Inferred	Read

*__Note__:
Modbus Address 3013: Gross/Net data Decimal Inferred
Gross/Net Totalizer [3013] 1: 1 Decimal Inferred, 4 :4 Decimal Inferred
Gross/Net Flow Rate [3013] 1: 2 Decimal Inferred, 4 :4 Decimal Inferred
Modbus Address 3014:Energy data Decimal Inferred
EnergyTotalizer [3014] 1: 1 Decimal Inferred, 4 :4 Decimal Inferred
Energy Flow Rate [3014] 1: 2 Decimal Inferred, 4: 4 Decimal Inferred

Modbus Address Table – 2x16 Bits Integer

ADDRESS	DESCRIPTION	DECIMAL	READ/WRITE
9061	Meter #1 SG	6 Inferred	Read
9063	Meter #1 Y Factor	6 Inferred	Read
9065	Meter #1 K /CD/LMF	6 Inferred	Read
9067	Meter #1 FA	6 Inferred	Read
9069	Meter #1 FPV/FRA	6 Inferred	Read
9071	Meter #1 AGA8-Zf	6 Inferred	Read
9073	Meter #1 AGA8-Zb	6 Inferred	Read
9075	M#1 Net Calorific Vaue*(US:BTU,Metric:MJ)	3 Inferred	Read
9077	M#1Gross Calorific Vaue*(US:BTU,Metric:MJ)	3 Inferred	Read
*AGA8 Detailed Method-ISO2016 (Heating Value Gross or Net Method)			
9079-9105	Spare		
9107	Meter #1 Averaged Calorific Vaue	3 Inferred	Read
9109	Meter#1 Composition - Methane	4 Inferred	Read
9111	Meter#1 Composition – N2	4 Inferred	Read
9113	Meter#1 Composition – CO2	4 Inferred	Read
9115	Meter#1 Composition – Ethane	4 Inferred	Read
9117	Meter#1 Composition – Propane	4 Inferred	Read
9119	Meter#1 Composition - Water	4 Inferred	Read
9121	Meter#1 Composition – H2S	4 Inferred	Read
9123	Meter#1 Composition – H2	4 Inferred	Read
9125-9131	Spare		
9133	Meter #1 Cum. Gross	1 or 4* Inferred	Read
9135	Meter #1 Cum. Net	1 or 4* Inferred	Read
9137	Meter #1 Cum. Mass	2 Inferred	Read
9139	Meter #1 Cum. Energy	1 or 4* Inferred	Read
9141	Meter #1 Density Calc. Type	0 Inferred	Read
9143-9145	Meter #1 Meter ID	8 Chars.	Read
9147	Meter #1 Pipe ID	5 Inferred	Read
9149	Meter #1 Orifice ID	5 Inferred	Read
9151	Meter #1 Density Correction Factor	5 Inferred	Read
9153	Meter #1 Density of Dry Air	5 Inferred	Read
9155	M#1 Calorific Vaue(US:BTU,Metric:MJ)	3 Inferred	Read
9157	Meter #1 K Factor	3 Inferred	Read
9159	Current Date	0 Inferred	Read
9161	Current Time	0 Inferred	Read
9163	Meter#1 Composition – CO	4 Inferred	Read
9165	Meter#1 Composition – Oxygen	4 Inferred	Read
9167	Meter#1 Composition - i-Butane	4 Inferred	Read
9169	Meter#1 Composition – n-Butane	4 Inferred	Read
9171	Meter#1 Composition – i-Pentane	4 Inferred	Read
9173	Meter#1 Composition – n-Pentane	4 Inferred	Read
9175	Meter#1 Composition – n-Hexane	4 Inferred	Read
9177	Meter#1 Composition – n-Heptane	4 Inferred	Read
9179	Meter#1 Composition – n-Octane	4 Inferred	Read
9181	Meter#1 Composition – n-Nonane	4 Inferred	Read
9183	Meter#1 Composition – n-Decane	4 Inferred	Read
9185	Meter#1 Composition – Helium	4 Inferred	Read
9187	Meter#1 Composition – Argon	4 Inferred	Read

***Note**: Modbus Address 3013: Gross/Net Decimal, 3014:Energy Decimal

Modbus Address Table – 2x16 Bits Integer

ADDRESS	DESCRIPTION	DECIMAL	READ/WRITE
9189	Meter#2 Composition – Methane	4 Inferred	Read
9191	Meter#2 Composition – N2	4 Inferred	Read
9193	Meter#2 Composition – CO2	4 Inferred	Read
9195	Meter#2 Composition – Ethane	4 Inferred	Read
9197	Meter#2 Composition – Propane	4 Inferred	Read
9199	Meter#2 Composition - Water	4 Inferred	Read
9201	Meter #2 Calculation Type ***Primary Element Description Register*** ***[9201] Meter#2 the first 4 bits of 4th byte*** 0, 1: Orifice 2:AGA7/Freq. 3: Venturi 4: Nozzle 6: SmartCone	0 Inferred	Read
9203	Meter #2 Flow Flag/Flow Dir	0 Inferred	Read
9205	Meter #2 Alarm Status Flag	0 Inferred	Read
9207	Meter #2 Daily Gross	1 or 4* inferred	Read
9209	Meter #2 Daily Net	1 or 4* inferred	Read
9211	Meter #2 Daily Mass	2 inferred	Read
9213	Meter #2 Daily Energy	1 or 4* inferred	Read
9215	Meter #2 Average DP	4 Inferred	Read
9217	Meter #2 Average Temperature	2 Inferred	Read
9219	Meter #2 Average Pressure	2 Inferred	Read
9221	Meter #2 Average Density	5 Inferred	Read
9223	Meter #2 Average Dens.Temp	2 Inferred	Read
9225	Meter #2 Average Dens.b	6 Inferred	Read
9227	Meter #2 Average SG	6 Inferred	Read
9229	Meter #2 Average Y Factor.	6 Inferred	Read
9231	Meter #2 Average K/CD/LMF	6 Inferred	Read
9233	Meter #2 Average FA	6 Inferred	Read
9235	Meter #2 Average FPV/FRA	6 Inferred.	Read
9237-9239	Spare		

***Note**: Modbus Address 3013: Gross/Net Decimal, 3014:Energy Decimal

Modbus Address Table – 2x16 Bits Integer

ADDRESS	DESCRIPTION	DECIMAL	READ/WRITE
9241	Meter #2 Gross Flowrate	2 or 4* Inferred	Read
9243	Meter #2 Net Flowrate	2 or 4* Inferred	Read
9245	Meter #2 Mass Flowrate	2 Inferred	Read
9247	Meter #2 Energy Flowrate	2 or 4* Inferred	Read
9249	Meter #2 DP	4 Inferred	Read
9251	Meter #2 Temperature	2 Inferred	Read
9253	Meter #2 Pressure	2 Inferred	Read
9255	Meter #2 Density	5 Inferred	Read
9257	Meter #2 Dens.Temp	2 Inferred	Read
9259	Meter #2 Dens.b	6 Inferred	Read
9261	Meter #2 SG	6 Inferred	Read
9263	Meter #2 Y Factor	6 Inferred	Read
9265	Meter #2 K/CD/LMF	6 Inferred	Read
9267	Meter #2 FA	6 Inferred	Read
9269	Meter #2 FPV/FRA	6 Inferred	Read
9271	Meter #2 AGA8-Zf	6 Inferred	Read
9273	Meter #2 AGA8-Zb	6 Inferred	Read
9275	M#2 Net Calorific Vaue*(US:BTU,Metric:MJ)	3 Inferred	Read
9277	M#2 Gross Calorific Vaue*(US:BTU,Metric:MJ)	3 Inferred	Read

*AGA8 Detailed Method-ISO2016 (Heating Value Gross or Net Method)

9279-9305	Spare		
9307	M#2 Averaged Heating Value	3 Inferred	Read
9309-9331	Spare		
9333	Meter #2 Cum. Gross	1 or 4* Inferred	Read
9335	Meter #2 Cum. Net	1 or 4* Inferred	Read
9337	Meter #2 Cum. Mass	2 Inferred	Read
9339	Meter #2 Cum. Energy	1 or 4* Inferred	Read
9341	Meter #2 Density Calc. Type	0 Inferred	Read
9343-9345	Meter #2 Meter ID	8 Chars.	Read
9347	Meter #2 Pipe ID	5 Inferred	Read
9349	Meter #2 Orifice ID	5 Inferred	Read
9351	Meter #2 Density Correction Factor	5 Inferred	Read
9353	Meter #2 Density of Dry Air	5 Inferred	Read
9355	M#2 Heating Value - Calorific	3 Inferred	Read
9357	Meter #2 K Factor	3 Inferred	Read
9359	Meter#2 Composition – H2S	4 Inferred	Read
9361	Meter#2 Composition – H2	4 Inferred	Read
9363	Meter#2 Composition – CO	4 Inferred	Read
9365	Meter#2 Composition – Oxygen	4 Inferred	Read
9367	Meter#2 Composition - i-Butane	4 Inferred	Read
9369-9379	Reserved		

***Note**: Modbus Address 3013: Gross/Net Decimal, 3014:Energy Decimal

Modbus Address Table – 2x16 Bits Integer

ADDRESS	DESCRIPTION	DECIMAL	READ/WRITE
9381	Meter#1 Composition – n-Butane	4 Inferred	Read
9383	Meter#1 Composition – i-Pentane	4 Inferred	Read
9385	Meter#1 Composition – n-Pentane	4 Inferred	Read
9387	Meter#1 Composition – n-Hexane	4 Inferred	Read
9389	Meter#1 Composition – n-Heptane	4 Inferred	Read
9391	Meter#1 Composition – n-Octane	4 Inferred	Read
9393	Meter#1 Composition – n-Nonane	4 Inferred	Read
9395	Meter#1 Composition – n-Decane	4 Inferred	Read
9397	Meter#1 Composition – Helium	4 Inferred	Read
9399	Meter#1 Composition – Argon	4 Inferred	Read
9401	Spare #1 Data	4 Inferred	Read
9403	Spare #2 Data	4 Inferred	Read

Modbus Address Table – 1x32 bit Floating Point

ADDRESS	DESCRIPTION	READ/WRITE
Meter#1 Sarasota Constants		
7001	Sarasota Constant D0	Read/Write
7002	Sarasota Constant T0	Read/Write
7003	Sarasota Constant K	Read/Write
7004	Sarasota Constant Temperature Conefficient	Read/Write
7005	Sarasota Constant Temperature Cal	Read/Write
7006	Sarasota Constant Pressure Coefficient	Read/Write
7007	Sarasota Constant Pressure Cal	Read/Write
Meter#1 UGC Constants		
7001	UGC Constant K0	Read/Write
7002	UGC Constant K1	Read/Write
7003	UGC Constant K2	Read/Write
7004	UGC Constant KT	Read/Write
7005	UGC Temperature Cal	Read/Write
7006	UGC Constant K	Read/Write
7007	UGC Constant P0	Read/Write
Meter#1 Solartron Constants		
7001	Constant K0	Read/Write
7002	Constant K1	Read/Write
7003	Constant K2	Read/Write
7004	Constant K18	Read/Write
7005	Constant K19	Read/Write
7006	Constant K3	Read/Write
7007	Constant K4	Read/Write
7008-7011	Spare	
Meter#2 Sarasota Constants		
7012	Sarasota Constant D0	Read/Write
7013	Sarasota Constant T0	Read/Write
7014	Sarasota Constant K	Read/Write
7015	Sarasota Constant Temperature Conefficient	Read/Write
7016	Sarasota Constant Temperature Cal	Read/Write
7017	Sarasota Constant Pressure Coefficient	Read/Write
7018	Sarasota Constant Pressure Cal	Read/Write
Meter#2 UGC Constants		
7012	UGC Constant K0	Read/Write
7013	UGC Constant K1	Read/Write
7014	UGC Constant K2	Read/Write
7015	UGC Constant KT	Read/Write
7016	UGC Temperature Cal	Read/Write
7017	UGC Constant K	Read/Write
7018	UGC Constant P0	Read/Write
Meter#2 Solartron Constants		
7012	Constant K0	Read/Write
7013	Constant K1	Read/Write
7014	Constant K2	Read/Write
7015	Constant K18	Read/Write
7016	Constant K19	Read/Write
7017	Constant K3	Read/Write
7018	Constant K4	Read/Write

Modbus Address Table

***Note: 7301-7342 Register (Read/Write)**

Firmware Version 11_00_12/ 11_00_13 (Customized)	Firmware Version 11_00_12_14
2x16 bit-IEEE Floating Point	**1x 32 bit-IEEE Floating Point**

7301	Meter#1 Mol % of Methane	Read/Write
7302	Meter#1 Mol % of Nitrogen	Read/Write
7303	Meter#1 Mol % of Carbon Dioxide	Read/Write
7304	Meter#1 Mol % of Ethane	Read/Write
7305	Meter#1 Mol % of Propane	Read/Write
7306	Meter#1 Mol % of Water	Read/Write
7307	Meter#1 Mol % of Hydrogen Sulfide	Read/Write
7308	Meter#1 Mol % of Hydrogen	Read/Write
7309	Meter#1 Mol % of Carbon Monoxide	Read/Write
7310	Meter#1 Mol % of Oxygen	Read/Write
7311	Meter#1 Mol % of i-Butane	Read/Write
7312	Meter#1 Mol % of n-Butane	Read/Write
7313	Meter#1 Mol % of i-Pentane	Read/Write
7314	Meter#1 Mol % of n-Pentane	Read/Write
7315	Meter#1 Mol % of i-Hexane	Read/Write
7316	Meter#1 Mol % of n-Heptane	Read/Write
7317	Meter#1 Mol % of i-Octane	Read/Write
7318	Meter#1 Mol % of i-Nonane	Read/Write
7319	Meter#1 Mol % of i-Decane	Read/Write
7320	Meter#1 Mol % of Helium	Read/Write
7321	Meter#1 Mol % of Argon	Read/Write
7322	Meter#2 Mol % of Methane	Read/Write
7323	Meter#2 Mol % of Nitrogen	Read/Write
7324	Meter#2 Mol % of Carbon Dioxide	Read/Write
7325	Meter#2 Mol % of Ethane	Read/Write
7326	Meter#2 Mol % of Propane	Read/Write
7327	Meter#2 Mol % of Water	Read/Write
7328	Meter#2 Mol % of Hydrogen Sulfide	Read/Write
7329	Meter#2 Mol % of Hydrogen	Read/Write
7330	Meter#2 Mol % of Carbon Monoxide	Read/Write
7331	Meter#2 Mol % of Oxygen	Read/Write
7332	Meter#2 Mol % of i-Butane	Read/Write
7333	Meter#2 Mol % of n-Butane	Read/Write
7334	Meter#2 Mol % of i-Pentane	Read/Write
7335	Meter#2 Mol % of n-Pentane	Read/Write
7336	Meter#2 Mol % of i-Hexane	Read/Write
7337	Meter#2 Mol % of n-Heptane	Read/Write
7338	Meter#2 Mol % of i-Octane	Read/Write
7339	Meter#2 Mol % of i-Nonane	Read/Write
7340	Meter#2 Mol % of i-Decane	Read/Write
7341	Meter#2 Mol % of Helium	Read/Write
7342	Meter#2 Mol % of Argon	Read/Write

***Note: Modbus Shift – IEEE Floating Register (Read only)**

Firmware Version 11_00_12/11_00_13 (Customized)	Firmware 11_00_11, 11_00_14 Newer
2x16 bit-IEEE Floating Point	**1x 32 bit-IEEE Floating Point**

Alarm, Audit Trail, and Calibration Data

Previous Data Alarm Area

Set last alarm status request (3030) to 1. ((3030,16 bits Integer, Write only)

4001-4009 (2x16bits Integer, Read only)

4001	last alarm date mmddyy
4003	last alarm time hhmmss
4005	last alarm flag - IDx1000000 + CODE x10000 +ACODEx100 +STATUS
4007	last alarm meter #1 cum net total (1 or 4* decimal inferred)
4009	last alarm meter #2 cum net total (1 or 4* decimal inferred)

Alarms and Status Codes

Last Alarm Flag

ID	CODE	ACODE	STATUS

ID

0	Analog Input #1
1	Analog Input #2
2	Analog Input #3
3	Analog Input #4
4	RTD Input
80	Battery Alarm
5	Analog Output #1
6	Analog Output #2
7	Analog Output #3
8	Analog Output #4
9,10	Densitometer

17	Event Status
18	Calibration Mode
19	G.C. Communication Failed
20	Multi.Var#1 DP
21	Multi.Var#1 Pressure
22	Multi.Var#1 Temperature
23	Multi.Var#2 DP
24	Multi.Var#2 Pressure
25	Multi.Var#2 Temperature
11	Meter#1
12	Meter#2
26	Analog Input 5
27	Analog Input 6
28	Analog Input 7
29	Analog Input 8
30	Analog Input 9

CODE (Only For ID=Meter#1, ID=Meter#2)

1	Flow Rate
2	NX19 Out of Range
3	AGA8 Out of Range
4	STEAM Out of Range
5	ETHYLENE Out of Range

6	NBS1048 Out of Range
7	Down
8	Start
9	Saturated Steam Out of Range

ACODE

Given in one hexadecimal byte (HEX 00): (in binary bit7, bit6, bit5, bit4, bit3, bit2, bit1, bit0

Bit **6** = :	0	1 meter configuration
	1	2 meters configuration

STATUS

0	ID =10:	FAILED OK
	ID = 5-8:	OVERRANGE OK
	ID=Others	OK
Others	Not Used	

1	HI
2	LO
4	FAILED
5	OVERRANGE

Example: Last Alarm Flag – (Hex:A8EA33, Decimal:11070003)

ID= 11, CODE=7,ACODE=0,STATUS=3 -> METER #1 DOWN

Previous Alarm Data Area Ends

Previous Audit Data Area

Set last audit data request (3031) to 1. (3031,16 bits Integer, Write only)
8101-8113(2x16bits, Read only)

8101	Last Audit Date mmddyy
8103	Last Audit Time hhmmss
8105	Old Value (Decimal Inferred in the 4th byte of 8113)
8107	New Vaule(Decimal Inferred in the 4th byte of 8113)
8109	Meter #1 Cum. Net Total (1 or 4* decimal inferred)
8111	Meter #2 Cum. Net Total (1 or 4* decimal inferred)
8113	Code Flag-Given in four hexadecimal bytes (config code, no,audit code,dec)

*[3031] 1: 1 decimal inferred, 4: 4 decimal inferred

Code Flag

Config Code	No.	Audit Code	Old/New Value Decimal Inferred

Config Code

in binary – bit7, bit6, bit5, bit4, bit3, bit2, bit1, bit0

bit **6** = :	0	1 meter configuration
	1	2 meters configuration

NO.

The following table is only for audit code is less than 200
Value 0 : this field is not used.

1	Meter #1
2	Meter #2

31	DP Low	***Meter #1***	***Tag ID Assignments***
32	DP High		
33	Temperature		
35	Pressure		
37	Density		
39	Density Temperature		
41	DP Low	***Meter #2***	
42	DP High		
34	Temperature		
36	Pressure		
38	Density		
40	Density Temperature		
43	Spare #1		
44	Spare #2		
45	Analog Output #1		
46	Analog Output #2		
47	Analog Output #3		
48	Analog Output #4		

Examples:

33:Temp.Assignment@ Meter 1

Audit Codes

1	DP Cut Off
2	DP High Switch Percentage
3	Calibration Net Flow
4	BTU
5	Base Density Override
6	Pipe ID
7	Orifice ID
8	Temperature Override
9	Pressure Override
10	Density Dry Air
11	Base SG
12	Ratio of Heat
13	Viscosity
14	Pipe Thermal Expansion E-6
15	Orifice Thermal Expansion E-6
16	Reference Temperature of Pipe
17	Reference Temperature of Orifice
18	MOL% of Methane (nx19,aga8d) CO2 (AGA8 Gross Method 1) Nitrogen(AGA8 Gross Method 2)
19	MOL% of Ethane (NX19) Hydrogen (AGA8 Gross Method 1) CO2 (AGA8 Gross Method 2) Nitrogen(AGA8 Detail Method)
20	MOL% of Propane (NX19) CO (AGA8 Gross Method 1) Hydrogen(AGA8 Gross Method 2) CO2 (AGA8 Detail Method)
21	MOL% of Iso-Butane CO (AGA8 Gross Method 2) Ethane (AGA8 Detail Method)
22	MOL% of n-Butane (NX19) Propane (AGA8 Detail Method)
23	MOL% of Iso-Pentane (NX19) Water (AGA8 Detail Method)
24	MOL% of n-Pentane (NX19) H2S (AGA8 Detail Method)
25	MOL% of n-Hexane (NX19) Hydrogen (AGA8 Detail Method)
26	MOL% of n-Heptane (NX19) CO (AGA8 Detail Method)
27	MOL% of n-Octane (NX19) Oxygen (AGA8 Detail Method)
28	MOL% of Carbon Dioxide (NX19) i-Butane (AGA8 Detail Method)
29	MOL% of Nitrogen (NX19) n-Butane (AGA8 Detail Method)
30	DP Low @4mA
31	DP Low @20mA
32	DP Maintenance
33	DP High @4mA
34	DP High @20mA
35	Temperature @4mA

81	Energy Flow Unit
82	Averaging Method
142	Flow Rate Threshold #1
143	Flow Rate Threshold #2
144	Flow Rate Threshold #3
145	Flow Rate Threshold #4
146	Linearization Factor #1
147	Linearization Factor #2
148	Linearization Factor #3
149	Linearization Factor #4
150	Common Temperature
151	Common Pressure
153	Flow Rate Display
154	Calculation Type
155	Y Factor Select
156	Tap Select 0=Flange,1=Pipe
157	Use Stack DP 0=No, 1=Yes
158	Densitometer Type
159	Density Unit
160	Use Meter Temp as Density Temp
161	Day Start Hour
162	Disable Alarms
163	Flow Coefficient (V-Cone Data) Discharge Coefficient (Venturi Data)
164	Product Type
165	DP Low Assignment
166	Temperature Assignment
167	Pressure Assignment
168	Densitometer Assignment
169	Density Temperature Assignment
170	DP High Assignment
171	Spare#1 Assignment
172	Spare#2 Assignment
173	DP Fail Code
174	Temperature Fail Code

36	Temperature @20mA
37	Temperature Maintenance
38	Pressure @4mA
39	Pressure @20mA
40	Pressure Maintenance
41	Density/Gravity @4mA
42	Density/Gravity @20mA
43	Density/Gravity Maintenance
44	Density Temperature @4mA
45	Density Temperature @20mA
46	Density Temperature Maintenance
50	Spare #1 @4mA
51	Spare #1 @20mA
52	Spare #1 Maintenance
53	Spare #2 @4mA
54	Spare #2 @20mA
55	Spare #2 Maintenance
56	Analog Output Limit @4mA
57	Analog Output Limit@20mA
58	Density Correction Factor
59	
60	Base Temperature
61	Base Pressure
62	Atmospheric Pressure PSIA
63	Pulse Output #1 Volume
64	Pulse Output #2 Volume
65	Mol % of I-Pentane
66	Mol % of n-Pentane
67	Mol % of n-Hexane
68	Mol % of n-Heptane
69	Mol % of n-Octane
70	Mol % of n-Nonane
71	Mol % of n-Decane
72	Mol % of Helium
73	Mol % of Argon
74	Temperature Resolution
75	Pressure Resolution
76	US or Metric Units
77	Pressure Unit
78	DP Unit
79	Gross/Net Flow Unit
80	Mass Flow Unit

175	Pressure Fail Code
176	Densitometer Fail Code
177	Dens. Temp Fail Code
178	Spare#1 Fail Code
179	Spare#2 Fail Code
180	*****SEE NOTE (next page)**
181	Flow Cut Off Hertz
182	K Factor
183	Meter Factor
184	Flow Rate Threshold #5
185	Flow Rate Threshold #6
186	Linearization Factor #5
187	Linearization Factor #6
188	Annubar Flow Coefficient K
201	Analog Input #1 Calibration
202	Analog Input #2 Calibration
203	Analog Input #3 Calibration
204	Analog Input #4 Calibration
205	RTD Input Calibration
207	Analog Output#1 Calibration
208	Analog Output#2 Calibration
209	Analog Output#3 Calibration
210	Analog Output#4 Calibration
211	Multi. Variable DP Calibration
212	Multi. Variable Pressure Calibration
213	Multi. Variable Temperature Calib.

254 Date Changed
255 Time Changed

***Note:**
Audit Code 3: Report Description

Date	Time	Description	Old Value	New Value	M1 Net Cumulative
05/12/20	00:00:37	Calibration Mode ON (Old:M1,New:M2 Net Flow Rate)	172.46	0.00	3329.2
		Audit Code 3	M1 Flow Rate	M2 Flow Rate	

***Example*:**M2 Density Correction Factor change from 1.00000 to 1.10000

8101 **Last Audit Date mmddyy**
00 00 C8 C8 (Hex), 051400 (Decimal) – May 14, 2000

8103 **Last Audit Time hhmmss**
00 03 0d 40 (Hex), 200000(Decimal) – 8 PM

8105 **Old Value (Decimal Inferred in the 4th byte of 8113)**
00 01 87 a0 (Hex) 100000 (Decimal)
4th byte of 8513 = 5 (Decimal Places)
result = 1.00000

8107 **New Vaule(Decimal Inferred in the 4th byte of 8113)**
00 01 ad b0 (Hex) 110000 (Decimal)
4th byte of 8513 = 5 (Decimal Places)
Rsult = 1.10000

8109 **Meter #1 Cum Total**
00 00 01 F4 (Hex), 500 (Decimal)
Result = 5.00 (2 decimal Inferred)

8111 **Meter #1 Cum Total**
00 00 01 F4 (Hex), 500 (Decimal)
Result = 5.00 (2 decimal inferred)

8113 **Code Flag**
00 26 3a 05 in Hex
1st Byte – Config Code in Binary 01000000 – bit 6 is on (2 Meters Configuration)
2nd Byte – NO 26 (Hex) 38 (Decimal) Meter#2 Density,
3rd Byte – Audit Code – 3A(Hex) 58 (Decimal) – Density Correction Factor
4th Byte – Decimal Places – 05(Hex) – 5 Decimal Places

> ***NOTE:***
>
> *When Audit Code = 180, then the following Modbus Addresses store the parameters indicated.*
>
> *8101 System Start Date*
>
> *8103 System Start Time*
>
> *8105 System Failed Date*
>
> *8107 System Failed Time*
>
> *8109 M1 Net Cumulative Total*
>
> *8111 M2 Net Cumulative*

Previous Audit Data Area Ends

Audit Code 3:

Previous Calibration/Verification Data Area

3129 Last Calib./Verification Rpt Req.(1=Latest,100=Oldest)
(3129,16 bits Integer, Write only)

8101-8113 (2x16bits Integers, Read only)

8101	Last Calibration/Verification Date mmddyy
8103	Last Calibration/Verification Time hhmmss
8105	As Found / Verification Point (Decimal Inferred in the 4th byte of 8113)
8107	As Left (Decimal Inferred in the 4th byte of 8113)
8109-8111	N/A
8113	Code Flag-Given in four hexadecimal bytes (ID,Code,Decimal Inferreed)

Code Flag

	Code	ID	Value Decimal Inferred

Code

0	Calibration
1	Verification

Calibration / Verification ID

Description	ID
Multivariable DP	211
Multivariable Pressure	212
Multivariable Temperature	213
Analog Input#1	201
Analog Input#2	202
Analog Input#3	203
Analog Input#4	204
RTD	205
Analog Input#5	221
Analog Input#6	222
Analog Input#7	223
Analog Input#8	224
Analog Input#9	225

Decimal Inferred

4	4 Decimal Inferred
3	3 Decimal Inferred
2	2 Decimal Inferred
1	1 Decimal Inferred

Current Alarm Status

4 Bytes in Hex - FF

METER#1: MODBUS ADDRESS 9497

METER#2: MODBUS ADDRESS 9499

The Current Alarm Status is a 4-byte string that resides at **Modbus address 9497 for Meter #1** and **Modbus address 9499 for Meter #2**. The alarm status codes are the same for both meters.

1st byte	2nd byte	3rd byte	4th byte	
01	00	00	00	Net Flow Rate High
02	00	00	00	Net Flow Rate Low
04	00	00	00	Temperature Assignment High
08	00	00	00	Temperature Assignment Low
10	00	00	00	Pressure Assignment High
20	00	00	00	Pressure Assignment Low
40	00	00	00	Gravity/Density Assignment High
80	00	00	00	Gravity/Density Assignment Low
00	01	00	00	Dens. Temperature Assignment High
00	02	00	00	Dens. Temperature Assignment Low
00	04	00	00	DP Used Assignment High
00	08	00	00	DP Used Assignment Low
00	10	00	00	Densitometer Failed (Dens .Period High)
00	20	00	00	Densitometer Failed (Dens. Period Low)
00	00	00	01	Meter Down
00	00	00	02	NX19 Out of Range
00	00	00	04	AGA8 Out of Range
00	00	00	08	Steam Out of Range
00	00	00	10	Ethylene Out of Range
00	00	00	20	NBS1048 Out of Range
00	00	00	40	Saturated Steam Out of Range

OTHER ALARMS (MODBUS ADDRESS 9495)

4 Bytes in Hex - FF

01	00	00	00	Analog Output #1 Over Range
02	00	00	00	Analog Output #2 Over Range
04	00	00	00	Analog Output #3 Over Range
08	00	00	00	Analog Output #4 Over Range
10	00	00	00	Spare #1 Assignment High
20	00	00	00	Spare #1 Assignment Low
40	00	00	00	Spare #2 Assignment High
80	00	00	00	Spare #2 Assignment Low
00	02	00	00	Event Status ON
00	04	00	00	Calibration Mode ON
00	08	00	00	GC Communication Failed
00	40	00	00	Battery Voltage Low Alarm

Current Alarms Status Section Ends

INPUT ASSIGNMENTS

1 – Analog Input #1
2 – Analog Input #2
3 – Analog Input #3
4 – Analog Input #4
5 – RTD
10 – Multi.Variable #1
11 – Multi.Variable #2

ADDRESS	DESCRIPTION	
2798	Meter #1 DP Assignment	
2799	Meter #1 Temperature Assignment	
2800	Meter #1 Pressure Assignment	
2801	Meter #1 Density Assignment	
2802	Meter #1 Dens.Temperature Assignment	
2803	Meter #1 DP High Assignment	
2804	Meter #2 DP Assignment	
2805	Meter #2 Temperature Assignment	
2806	Meter #2 Pressure Assignment	
2807	Meter #2 Density Assignment	
2808	Meter #2 Dens.Temperature Assignment	
2809	Meter #2 DP High Assignment	
2810	Spare #1 Assignment	
2811	Spare #2 Assignment	
2841-2844	Analog Input #1 TAG ID	8 Chars.
2845-2848	Analog Input #2 TAG ID	8 Chars.
2849-2852	Analog Input #3 TAG ID	8 Chars.
2853-2856	Analog Input #4 TAG ID	8 Chars.
2857-2870	RTD TAG ID	8 Chars.
2871-2874	Densitometer TAG ID	8 Chars
2875-2878	Analog Output #1 TAG ID	8 Chars
2879-2872	Analog Output #2 TAG ID	8 Chars
2873-2876	Analog Output #3 TAG ID	8 Chars
2877-2880	Analog Output #4 TAG ID	8 Chars

Data Packet

Previous Hourly Data Packet (711:Meter#1, 712:Meter#2)

Hourly archive flow data 711 and 712, are fixed length arrays. The data field is used to address a 5 hours individual group record.(1=Latest Hour, 960=Oldest)

RTU MODE –

ADDR	FUNC CODE	STARTING POINT		Hour		CRC CHECK	
		HI	LO	HI	LO		
01	03	02	C7	00	01		

Response

ADDR	FUNC CODE	BYTE COUNTS	DATA …(Repeat n Times)		CRC CHECK	
			HI	LO		
01	03	F0	00	01..		

DESCRIPTION (Standard)	Decimal	HOUR
Date (3 bytes)/Hour (one byte)	0 Inferred	First Hour
Duration of Flow Seconds (4 bytes)	0 Inferred	First Hour
Net Total (4 bytes)	1 or 4* inferred	First Hour
Mass Total (4 bytes)	2 Inferred	First Hour
Energy Total (4 bytes)	1 or 4* inferred	First Hour
Temperature (4 bytes)	2 inferred	First Hour
Pressure(4 bytes)	2 Inferred	First Hour
Density(4 bytes)	5 Inferred	First Hour
DP(4 bytes)	4 Inferred	First Hour
IV(4 bytes)	4 Inferred	First Hour
Integral Multiplier Value(4 bytes)	4 Inferred	First Hour
Gross Total(4 bytes)	1 or 4* inferred	First Hour
…		
…		
..		
Date (3 bytes)/Hour (one byte)	0 Inferred	Fifth Hour
Duration of Flow Seconds (4 bytes)	0 Inferred	Fifth Hour
Net Total (4 bytes)	1 or 4* inferred	Fifth Hour
Mass Total (4 bytes)	2 Inferred	Fifth Hour
Energy Total (4 bytes)	1 or 4* inferred	Fifth Hour
Temperature (4 bytes)	2 inferred	Fifth Hour
Pressure(4 bytes)	2 Inferred	Fifth Hour
Density(4 bytes)	5 Inferred	Fifth Hour
DP(4 bytes)	4 Inferred	Fifth Hour
IV(4 bytes)	4 Inferred	Fifth Hour
Integral Multiplier Value(4 bytes)	4 Inferred	Fifth Hour
Gross Total(4 bytes)	1 or 4* inferred	Fifth Hour

*__Note__: Modbus Address 3013: Gross/Net Decimal, 3014:Energy Decimal

Description	Units	Decimal
Pressure	PSIG	2 Inferred
	BAR, KG/CM2	2 Inferred
	KPA	2 Inferred
Temperature	Degrees F, Degrees C	2 Inferred

CHAPTER 6: Installation Drawings

Explosion-Proof Installation Drawings

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AA				

⚠12. INSTALLATION TO BE IN ACCORDANCE WITH NATIONAL ELECTRICAL CODE.

⚠9. NON-INCENDIVE FIELD WIRING METHODS MAY BE USED FOR CONNECTING THE TEMPERATURE SENSING ASSEMBLY. WHEN USING NON-INCENDIVE FIELD WIRING, THE CONNECTION HEAD AND TEMPERATURE SENSOR ASSEMBLY NEED NOT BE EXPLOSION PROOF, BUT ALL COMPONENTS CONNECTED TO THE TEMP SENSOR CONNECTOR MUST BE CLASSIFIED "SIMPLE APPARATUS". SIMPLE APPARATUS ARE DEVICES WHICH ARE INCAPABLE OF GENERATING OR STORING MORE THAN 1.2V, 0.1A, 25MW, OR 20uJ (RTD'S QUALIFY AS SIMPLE APPARATUS).

⚠8. DIVISION 2 WIRING METHOD.

6. CLASS II INSTALLATIONS MUST USE A CSA APPROVED DUST-INGITIONPROOF SENSOR.

5. IN AMBIENTS GREATER THAN 40°C, SPRING LOADED TEMPERATURE SENSORS USED WITHOUT AN EXPLOSION PROOF THERMOWELL MUST BE RATED FOR AT LEAST 85°C.

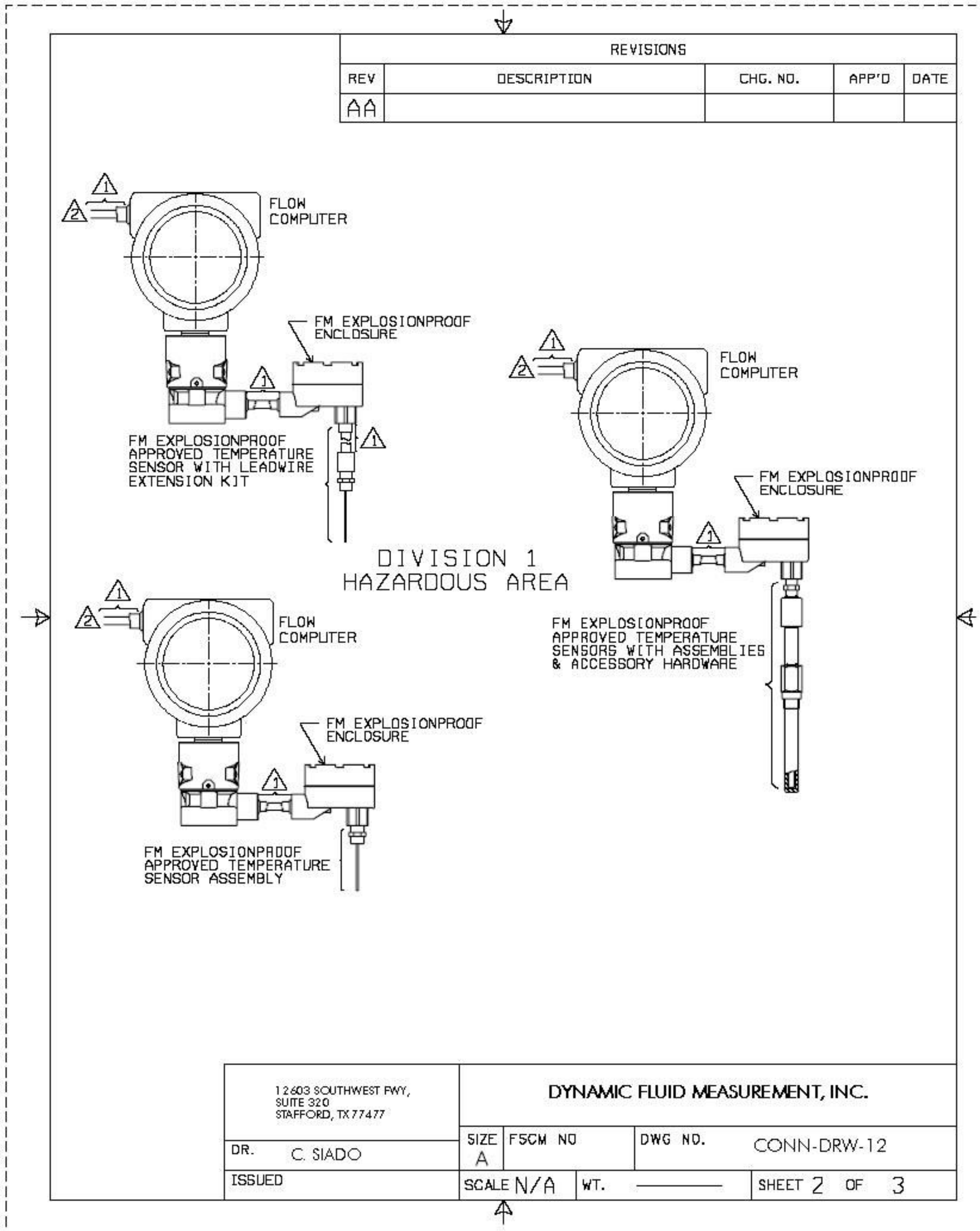
4. COMPONENTS REQUIRED TO BE APPROVED MUST BE FOR GAS GROUP APPROPIATE TO AREA CLASSIFICATION.

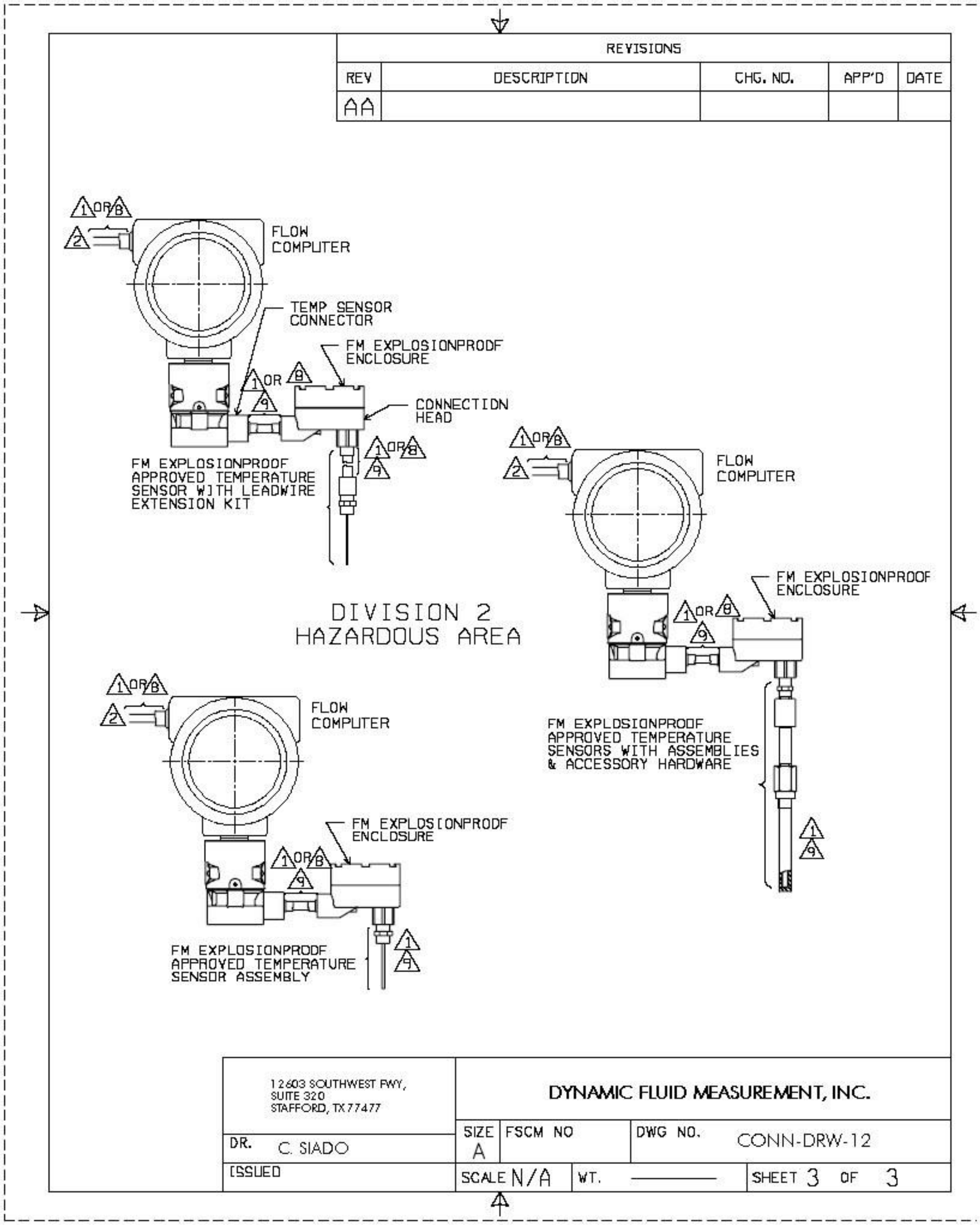
3. ALL CONDUITS THREADS TO BE ASSEMBLED WITH FIVE FULL THREADS MINIMUM.

⚠2. TRANSMITTER MUST NOT BE CONNECTED TO EQUIPMENT GENERATING MORE THAN 250VAC.

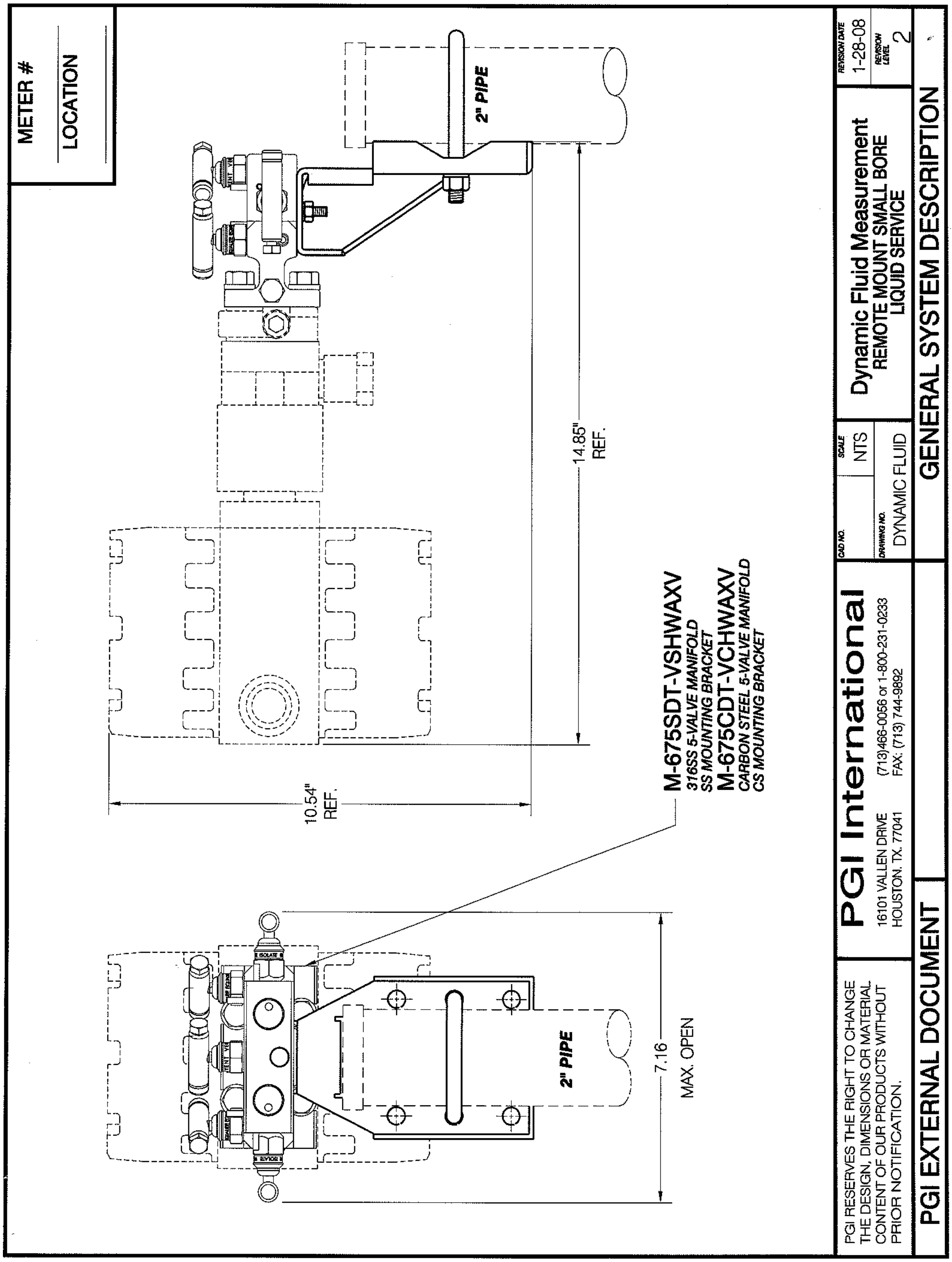
⚠1. WIRING METHOD SUITABLE FOR CLASS I, DIV 1, ANY LENGTH.

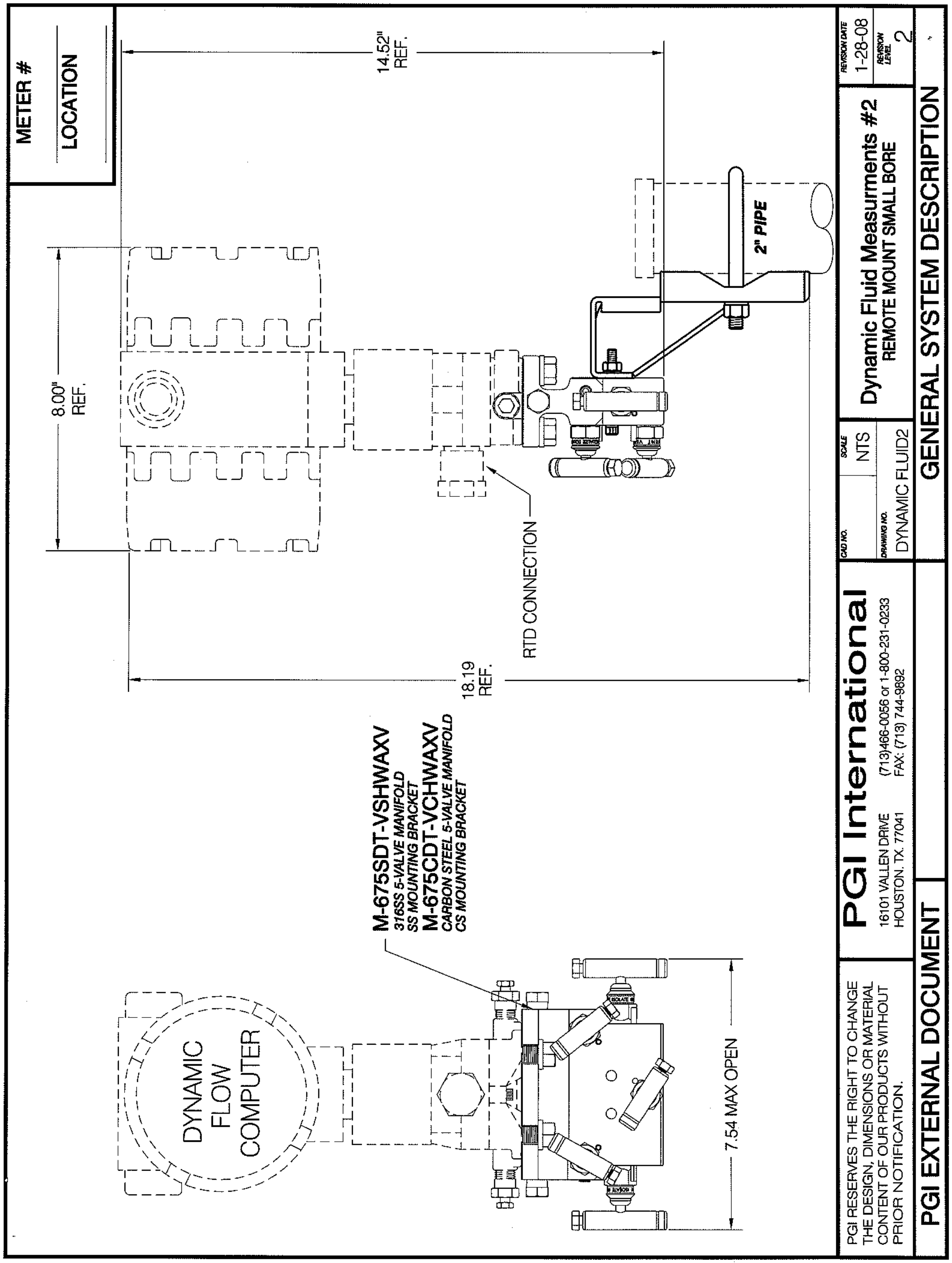
UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES [mm]. REMOVE ALL BURRS AND SHARP EDGES. MACHINE SURFACE FINISH 125	CONTRACT NO.	DYNAMIC FLUID MEASUREMENT, INC.	12603 SOUTHWEST FWY, SUITE 320 STAFFORD, TX 77477
	DR. C. SIADO	TITLE MODEL MICROMV AND ECHART EXPLOSIONPROOF INSTALLATION DRAWING, FACTORY MUTUAL	
-TOLERANCE- .X = .1 [2.5] .XX = .02 [0.5] .XXX = .010[0.25] FRACTIONS = 1/32 ANGLES = 2°	CHK'D		
	APP'D. S. HALILAH		
		SIZE A / FSCM NO	DWG NO. CONN-DRW-12
DO NOT SCALE PRINT	APP'D. GOVT.	SCALE / WT.	SHEET 1 OF 3


REVISIONS
REV
DESCRIPTION
CHG. NO.
APP'D
DATE
AA
FLOW COMPUTER
FM EXPLOSIONPROOF ENCLOSURE
FM EXPLOSIONPROOF APPROVED TEMPERATURE SENSOR WITH LEADWIRE EXTENSION KIT
FLOW COMPUTER
FM EXPLOSIONPROOF ENCLOSURE
DIVISION 1 HAZARDOUS AREA
FM EXPLOSIONPROOF APPROVED TEMPERATURE SENSORS WITH ASSEMBLIES & ACCESSORY HARDWARE
FLOW COMPUTER
FM EXPLOSIONPROOF ENCLOSURE
FM EXPLOSIONPROOF APPROVED TEMPERATURE SENSOR ASSEMBLY
12603 SOUTHWEST FWY, SUITE 320 STAFFORD, TX 77477
DYNAMIC FLUID MEASUREMENT, INC.
DR. C. SIADO
SIZE A
FSCM NO
DWG NO. CONN-DRW-12
ISSUED
SCALE N/A
WT.
SHEET 2 OF 3

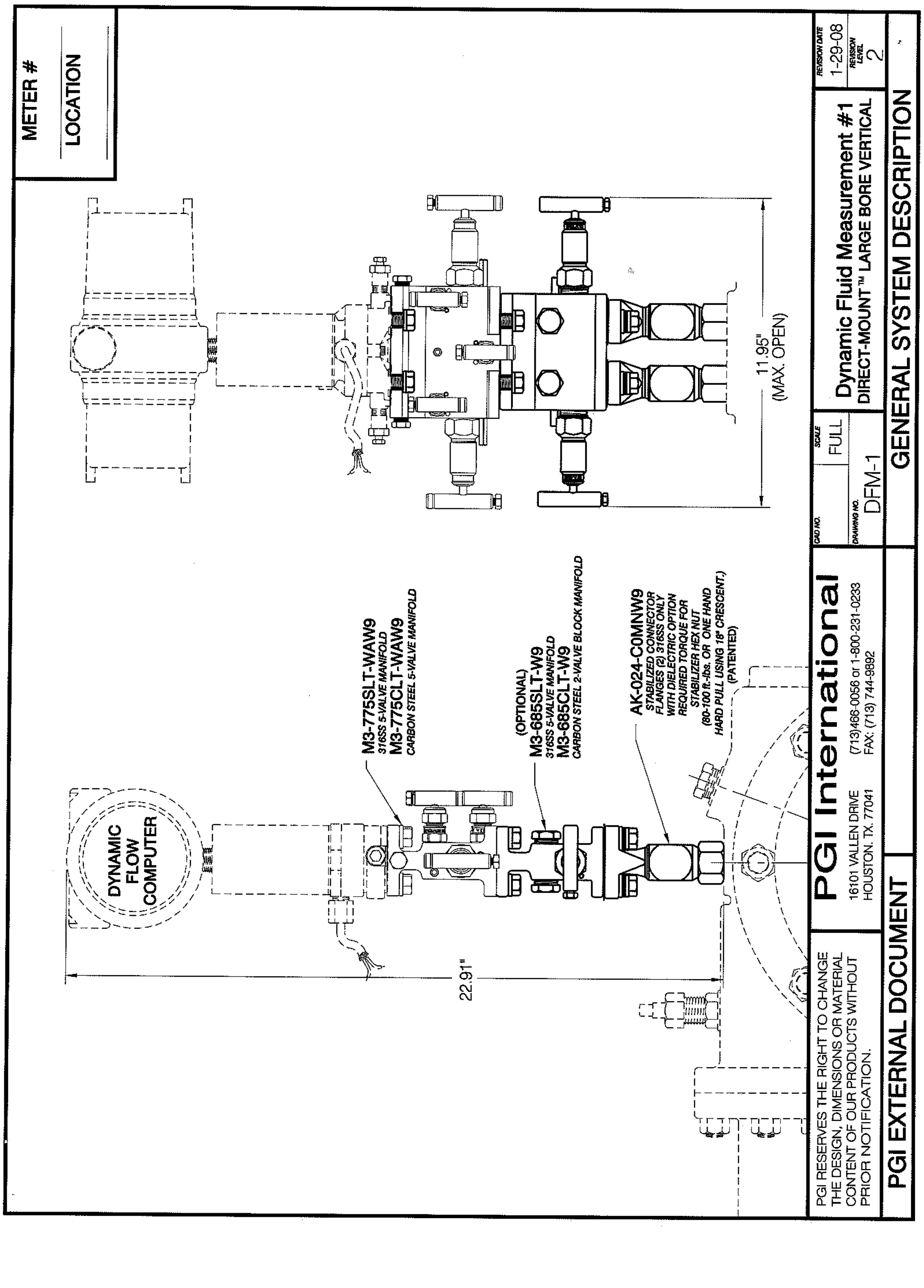

REVISIONS
REV
DESCRIPTION
CHG. NO.
APP'D
DATE
AA
1 OR 8
2
FLOW COMPUTER
TEMP SENSOR CONNECTOR
FM EXPLOSIONPROOF ENCLOSURE
CONNECTION HEAD
9
FM EXPLOSIONPROOF APPROVED TEMPERATURE SENSOR WITH LEADWIRE EXTENSION KIT
DIVISION 2 HAZARDOUS AREA
FM EXPLOSIONPROOF APPROVED TEMPERATURE SENSORS WITH ASSEMBLIES & ACCESSORY HARDWARE
FM EXPLOSIONPROOF APPROVED TEMPERATURE SENSOR ASSEMBLY
12603 SOUTHWEST FWY, SUITE 320 STAFFORD, TX 77477
DYNAMIC FLUID MEASUREMENT, INC.
DR. C. SIADO
ISSUED
SIZE A
FSCM NO
DWG NO. CONN-DRW-12
SCALE N/A
WT.
SHEET 3 OF 3

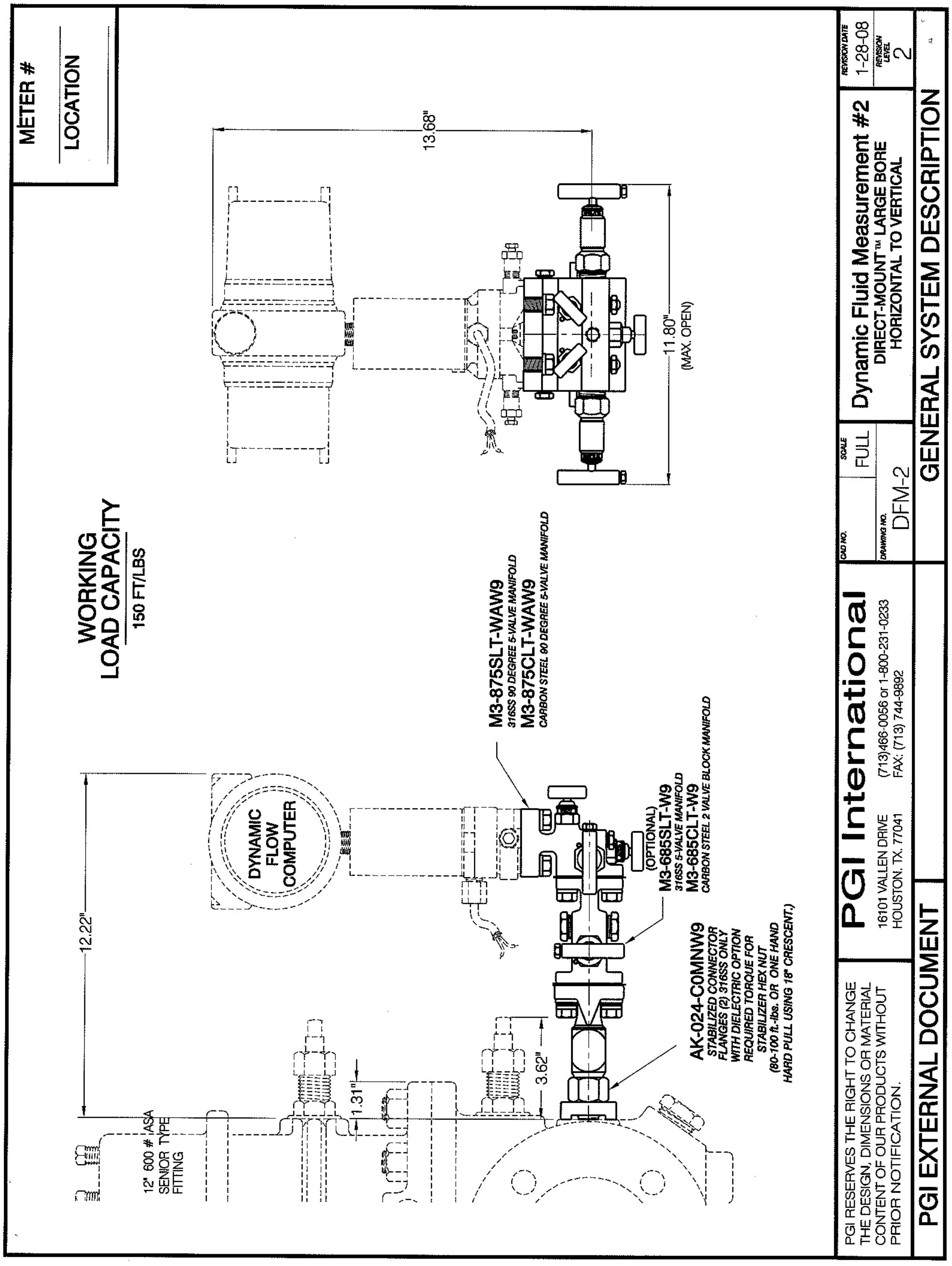
Manifold Installation Drawings





METER #
LOCATION
14.52" REF.
8.00" REF.
18.19 REF.
RTD CONNECTION
2" PIPE
M-675SDT-VSHWAXV
316SS 5-VALVE MANIFOLD
SS MOUNTING BRACKET
M-675CDT-VCHWAXV
CARBON STEEL 5-VALVE MANIFOLD
CS MOUNTING BRACKET
DYNAMIC FLOW COMPUTER
7.54 MAX OPEN
PGI RESERVES THE RIGHT TO CHANGE THE DESIGN, DIMENSIONS OR MATERIAL CONTENT OF OUR PRODUCTS WITHOUT PRIOR NOTIFICATION.
PGI International
16101 VALLEN DRIVE HOUSTON, TX. 77041
(713)466-0056 or 1-800-231-0233
FAX: (713) 744-9892
SCALE NTS
DRAWING NO. DYNAMIC FLUID2
Dynamic Fluid Measurments #2
REMOTE MOUNT SMALL BORE
REVISION DATE 1-28-08
REVISION LEVEL 2
PGI EXTERNAL DOCUMENT
GENERAL SYSTEM DESCRIPTION


METER #
LOCATION
DYNAMIC FLOW COMPUTER
22.91"
M3-775SLT-WAW9
316SS 5-VALVE MANIFOLD
M3-775CLT-WAW9
CARBON STEEL 5-VALVE MANIFOLD
(OPTIONAL)
M3-685SLT-W9
316SS 5-VALVE MANIFOLD
M3-685CLT-W9
CARBON STEEL 2-VALVE BLOCK MANIFOLD
AK-024-C0MNW9
STABILIZED CONNECTOR FLANGES (2) 316SS ONLY WITH DIELECTRIC OPTION
REQUIRED TORQUE FOR STABILIZER HEX NUT (80-100 ft.-lbs. OR ONE HAND HARD PULL USING 18" CRESCENT.)
(PATENTED)
11.95"
(MAX. OPEN)
PGI RESERVES THE RIGHT TO CHANGE THE DESIGN, DIMENSIONS OR MATERIAL CONTENT OF OUR PRODUCTS WITHOUT PRIOR NOTIFICATION.
PGI International
16101 VALLEN DRIVE
HOUSTON, TX. 77041
(713)466-0056 or 1-800-231-0233
FAX: (713) 744-9892
CAD NO.
DRAWING NO.
DFM-1
SCALE
FULL
Dynamic Fluid Measurement #1
DIRECT-MOUNT™ LARGE BORE VERTICAL
REVISION DATE
1-29-08
REVISION LEVEL
2
PGI EXTERNAL DOCUMENT
GENERAL SYSTEM DESCRIPTION


METER #
LOCATION
WORKING
LOAD CAPACITY
150 FT/LBS
13.68"
11.80"
(MAX. OPEN)
12.22"
3.62"
1.31"
DYNAMIC
FLOW
COMPUTER
M3-875SLT-WAW9
316SS 90 DEGREE 5-VALVE MANIFOLD
M3-875CLT-WAW9
CARBON STEEL 90 DEGREE 5-VALVE MANIFOLD
(OPTIONAL)
M3-685SLT-W9
316SS 5-VALVE MANIFOLD
M3-685CLT-W9
CARBON STEEL 2 VALVE BLOCK MANIFOLD
AK-024-COMNW9
STABILIZED CONNECTOR
FLANGES (2) 316SS ONLY
WITH DIELECTRIC OPTION
REQUIRED TORQUE FOR
STABILIZER HEX NUT
(80-100 ft.-lbs. OR ONE HAND
HARD PULL USING 18" CRESCENT.)
12" 600 # ASA
SENIOR TYPE
FITTING
PGI RESERVES THE RIGHT TO CHANGE
THE DESIGN, DIMENSIONS OR MATERIAL
CONTENT OF OUR PRODUCTS WITHOUT
PRIOR NOTIFICATION.
PGI International
16101 VALLEN DRIVE
HOUSTON, TX. 77041
(713)466-0056 or 1-800-231-0233
FAX: (713) 744-9892
CAD NO.
DRAWING NO.
DFM-2
SCALE
FULL
Dynamic Fluid Measurement #2
DIRECT-MOUNT™ LARGE BORE
HORIZONTAL TO VERTICAL
REVISION DATE
1-28-08
REVISION LEVEL
2
PGI EXTERNAL DOCUMENT
GENERAL SYSTEM DESCRIPTION