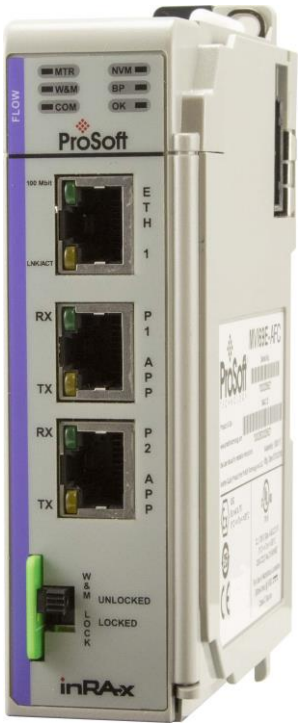
ProSoft TECHNOLOGY

Where Automation Connects.



MVI69E-AFC

Enhanced Liquid and Gas Flow Computer for CompactLogix®

Version 4.04

December 18, 2018

SETUP AND CONFIGURATION GUIDE

Your Feedback Please

We always want you to feel that you made the right decision to use our products. If you have suggestions, comments, compliments or complaints about our products, documentation, or support, please write or call us.

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MVI69E-AFC Setup and Configuration Guide

December 18, 2018

In an effort to conserve paper, ProSoft Technology no longer includes printed manuals with our product shipments. User Manuals, Datasheets, Sample Ladder Files, and Configuration Files are available at:

https://www.prosoft-technology.com/

For professional users in the European Union

If you wish to discard electrical and electronic equipment (EEE), please contact your dealer or supplier for further information.

Warning – Cancer and Reproductive Harm – www.P65Warnings.ca.gov

Important Installation Instructions

Power, Input, and Output (I/O) wiring must be in accordance with Class I, Division 2 wiring methods, Article 501 to 4 (b) of the National Electrical Code, NFPA 70 for installation in the U.S., or as specified in Section 18-1J2 of the Canadian Electrical Code for installations in Canada, and in accordance with the authority having jurisdiction. The following warnings must be heeded:

WARNING - EXPLOSION HAZARD - SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I, DIV. 2.

WARNING - EXPLOSION HAZARD - WHEN IN HAZARDOUS LOCATIONS, TURN OFF POWER BEFORE REPLACING OR WIRING MODULES.

WARNING - EXPLOSION HAZARD - DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS.

Class 2 Power

MVI (Multi Vendor Interface) Modules

WARNING - EXPLOSION HAZARD - DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS.

AVERTISSEMENT - RISQUE D'EXPLOSION - AVANT DE DÉCONNECTER L'ÉQUIPEMENT, COUPER LE COURANT OU S'ASSURER QUE L'EMPLACEMENT EST DÉSIGNÉ NON DANGEREUX.

Warnings

North America Warnings

Power, Input, and Output (I/O) wiring must be in accordance with Class I, Division 2 wiring methods, Article 501 to 4 (b) of the National Electrical Code, NFPA 70 for installation in the U.S., or as specified in Section 18-1J2 of the Canadian Electrical Code for installations in Canada, and in accordance with the authority having jurisdiction. The following warnings must be heeded:

A Warning - Explosion Hazard - Substitution of components may impair suitability for Class I, Division 2.
B Warning - Explosion Hazard - When in hazardous locations, turn off power before replacing or rewiring modules.
C Warning - Explosion Hazard - Do not disconnect equipment unless power has been switched off or the area is known to be non-hazardous.

Avertissement - Risque d'explosion - Avant de déconnecter l'équipement, couper le courant ou s'assurer que l'emplacement est désigné non dangereux.

D Suitable for use in Class I, Division 2 Groups A, B, C and D Hazardous Locations or Non-Hazardous Locations.

ATEX Warnings and Conditions of Safe Usage

Power, Input, and Output (I/O) wiring must be in accordance with the authority having jurisdiction.

A Warning - Explosion Hazard - When in hazardous locations, turn off power before replacing or wiring modules.
B Warning - Explosion Hazard - Do not disconnect equipment unless power has been switched off or the area is known to be non-hazardous.
C These products are intended to be mounted in an IP54 enclosure. The devices shall provide external means to prevent the rated voltage being exceeded by transient disturbances of more than 40%. This device must be used only with ATEX certified backplanes.
D DO NOT OPEN WHEN ENERGIZED.

Battery Life Advisory

The MVI46, MVI56, MVI69E, MVI69, and MVI71 modules use a rechargeable Lithium Vanadium Pentoxide battery to back up the real-time clock and CMOS. The battery should last for the life of the module. The module must be powered for approximately twenty hours before the battery becomes fully charged. After it is fully charged, the battery provides backup power for the CMOS setup and the real-time clock for approximately 21 days. When the battery is fully discharged, the module will revert to the default BIOS and clock settings.

Note: The battery is not user replaceable.

Electrical Ratings

- Backplane Current Load: 800 mA @ 5.1 Vdc; 3 mA @ 24 Vdc
- Operating Temperature: 0°C to 60°C (32°F to 140°F)
- Storage Temperature: -40°C to 85°C (-40°F to 185°F)
- Shock: 30 g, operational; 50 g, non-operational; Vibration: 5 g from 10 Hz to 150 Hz
- Relative Humidity: 5% to 95% with no condensation
- All phase conductor sizes must be at least 1.3 mm(squared) and all earth ground conductors must be at least 4mm(squared).

Agency Approvals and Certifications

Please visit our website: www.prosoft-technology.com

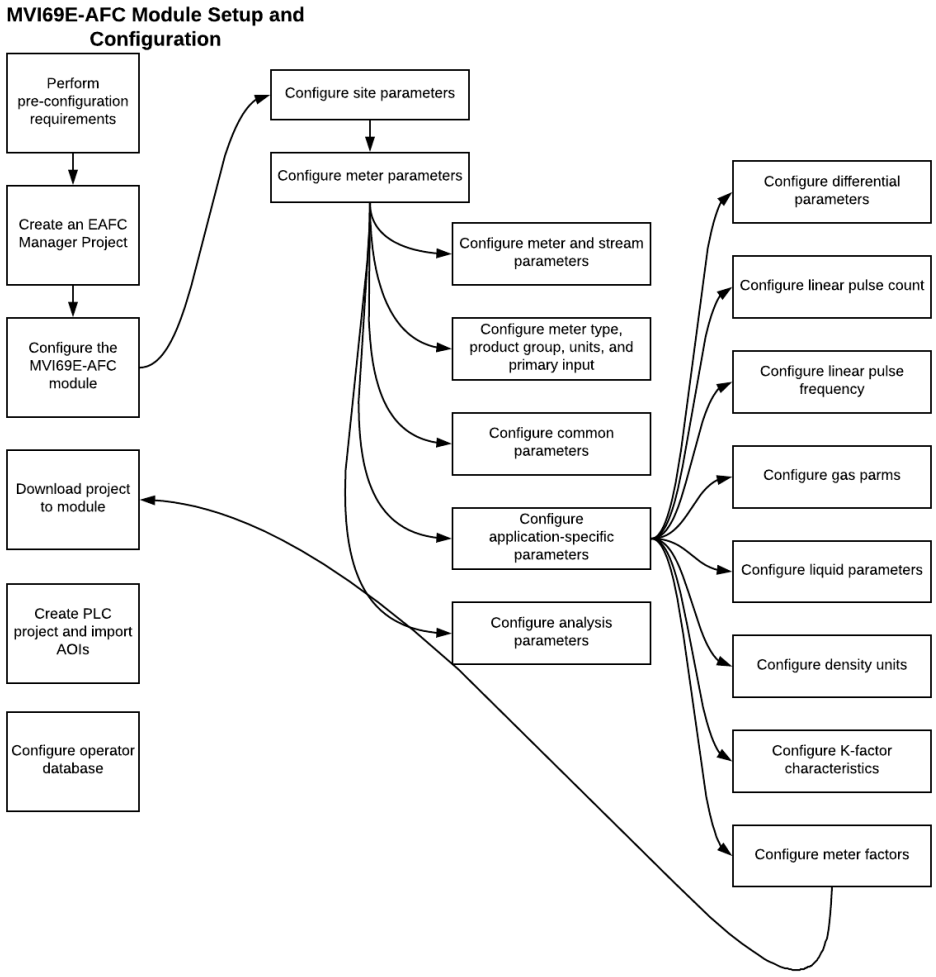
Contents

1 Before You Begin

1.1 Pre-Configuration Processes

This section describes the pre-configuration process. There are a small number of tasks to complete before configuring your MVI69E-AFC project.

The following flow illustrates the full configuration process.



1.2 Module Pre-Configuration Requirements

Before you start to configure the MVI69E-AFC, you must:

- Download EAFC Manager software
- Download the MVI69E-AFC Add-On Instructions (AOIs)

1.2.1 Downloading EAFC Manager

The EAFC Manager can be downloaded to your PC from the ProSoft Technology website at www.prosoft-technology.com.

1. Navigate to the MVI69E-AFC webpage.
2. Click on the **DOWNLOADS** tab.
3. Click on the **PROSOFT EAFC MANAGER** link and follow the prompts to download and install the application.

Note: Leave this page open. You will also be downloading AOIs from this page as described in the next section.

1.2.2 Downloading AOIs To Your System

The AOIs can be downloaded to your PC from the ProSoft Technology website at www.prosoft-technology.com.

1. Navigate to the MVI69E-AFC webpage.
2. Click on the **DOWNLOADS** tab.
3. Select **MVI69E-AFC ADD ON INSTRUCTIONS**.

The AOIs are downloaded as a zip file.

The zip file contains the Main AOI as well as four additional AOIs that pertain to your meter application. The four additional AOIs include:

- Linear Gas (*MVI69E-AFC_AddOn_Rung_MeterLinearGas_vx_x.L5X*)
- Linear Liquid (*MVI69E-AFC_AddOn_Rung_MeterLinearLiquid_vx_x.L5X*)
- Differential Liquid (MVI69E-(*AFC_AddOn_Rung_MeterDifferentialLiquid_vx_x.L5X*)
- Differential Gas (*MVI69E-AFC_AddOn_Rung_MeterDifferentialGas)vx_x.L5X*)

Download the Main AOI and the AOI file that pertains to your meter type. For instance, if the MVI69E-AFC module is going to be used for Differential Gas meter runs, you only need the *MVI69E-AFC_MeterDifferentialGas_Vx_x.L5X* file. You will use these files when you set up your RSLogix project later in this guide.

1.3 Locating Information For Your Meter Type

MVI69E-AFC supports the following meters:

Meter Type	Configured As (Differential or Linear)
Turbine	Linear
Positive Displacement	Linear
Magnetic	Linear
Orifice	Differential
V-Cone	Differential. You must configure the meter as V-Cone type in the MVI69E-AFC Manager (**Meter Configuration > Calculation Options**)
Wedge	Differential. Refer to Wedge Meter Applications for information about using the wedge meters.
Vortex	Linear or Differential
Ultrasonic	Linear or Differential
Coriolis	Linear or Differential

Note: Due to the broad range of meters in the market today, refer to the manufacturer specification to evaluate the use of the module (even if listed here).

Note: For Vortex, Ultrasonic, or Coriolis meters, the selection depends on the output generated by the meter.

If the meter provides a pulse train representing the volume increment, the MVI69E-AFC should be configured as linear with the primary input set to *Pulse Count*.

If the meter provides instantaneous flow rate, the MVI69E-AFC should be configured as differential with the primary input set to *Flow Rate*.

To locate configuration information about your meter, refer to the following table:

What type of meter are you configuring?	What is the primary output from your flow meter and associated instrumentation?	Configure your meter type as…	Configure your primary input as…
Orifice Meter	Differential Pressure	Differential	Differential Pres
V-Cone Meter	Differential Pressure	Differential	Differential Pres
Wedge Meter	Differential Pressure	Differential	Differential Pres
Coriolis Meter	Flow Rate	Differential	Flow Rate
	Pulse Count and Pulse Frequency	Linear	Pulse Count
	Pulse Frequency Only	Linear	Pulse Frequency
Vortex Meter	Flow Rate	Differential	Flow Rate
	Pulse Count and Pulse Frequency	Linear	Pulse Count
	Pulse Frequency Only	Linear	Pulse Frequency
Ultrasonic Meter	Flow Rate	Differential	Flow Rate
	Pulse Count and Pulse Frequency	Linear	Pulse Count
	Pulse Frequency Only	Linear	Pulse Frequency
Turbine Meter	Pulse Count and Pulse Frequency	Linear	Pulse Count
	Pulse Frequency	Linear	Pulse Frequency
	Pulse Count	Linear	Pulse Count
Positive Displacement	Same as Turbine		
Magnetic	Same as Turbine		

The following sections provide configuration steps based on:

- Meter Type
- Primary Meter Output
- What's being measured

Locate the configuration steps for your application and then use the links provided to jump to the sections of this manual that only apply to you.

1.4 Configuration Aids

This manual contains icons within each section. Each icon represents a relationship to the topic.

Accumulator		Alarm		Back	
Calculate		Calibrate		Calibrate 2	
Ethernet		Event		Export	
Flow		Gas		Liquid	
Login		Logout		Meter	
Meter		Network		Delete Permission	
Add Permission		Edit Permission		Generic Permission	
Port		Pressure		Prover	
Pulse		Delete Role		Add Role	
Edit Role		Generic Role		Serial Connection	
Site		Stream		Temp	

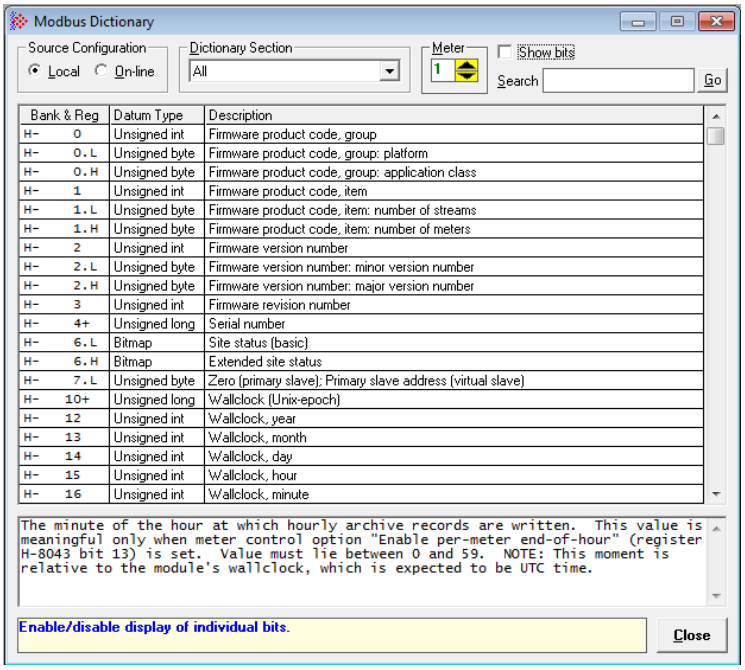
User		Delete User		Add User	
Edit User		View		Delete View	
Add View		Edit View		Volume	

The icons are used as visual cues to provide a hint of the type of information contained within a section.

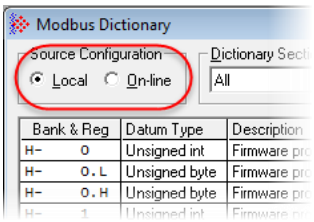
1.5 Using the Modbus Dictionary

Important: Although this manual is continuously maintained to bring you the latest information, the Modbus Dictionary contains the latest information on registers and dictionary sections. It is recommended that you use the Modbus Dictionary to locate bank and register values to ensure that you are looking at the latest information.

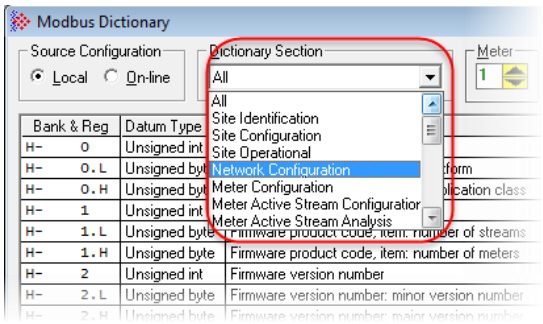
The Modbus dictionary provides a means to locate data anywhere in the module. The dictionary allows you to select various data types from database regions. It then displays Modbus bank and register values.



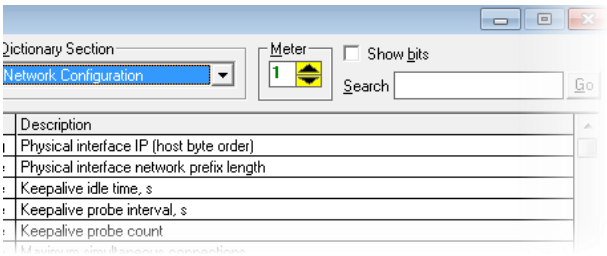
You can use the Modbus Dictionary locally or while EAFC manager is directly connected to the MVI69E-AFC module. From the *Source Configuration* section, select **LOCAL** if you are just running Modbus Dictionary locally or select **ON-LINE** if connected to a module.



The *Dictionary Section* drop-down list allows you to select different types of data from different sections of the module.



The *Meter* selection allows you to specify a specific meter in order to view only information pertaining to the selected meter.



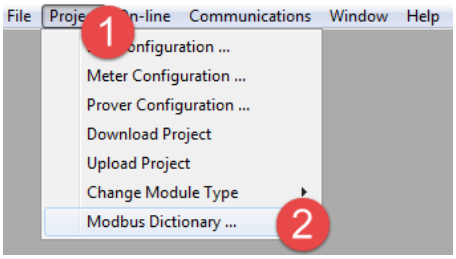
If selected, the **SHOW BITS** checkbox allows the bits to be displayed in the *Bank & Reg* column.

The *Search* box allows you to search for specific data. The search is applied to entries in the *Description* column and is case insensitive.

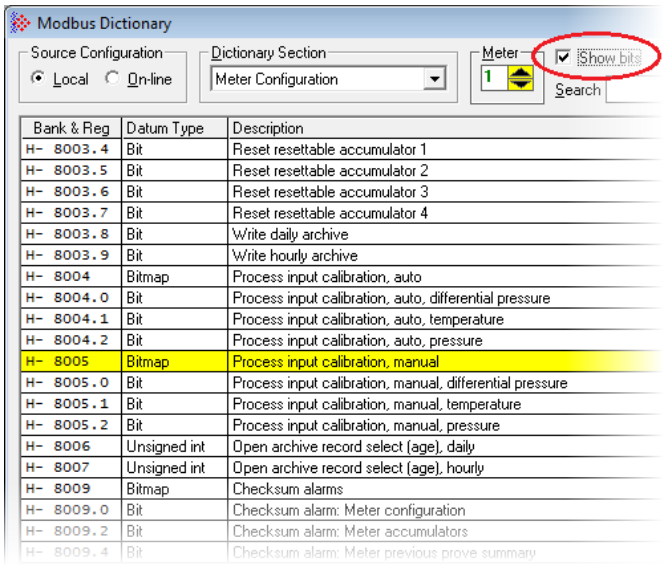
1.5.1 Procedure

Ensure that you have a suitable project loaded, especially its version. This ensures that dictionary items present for your module are available for display.

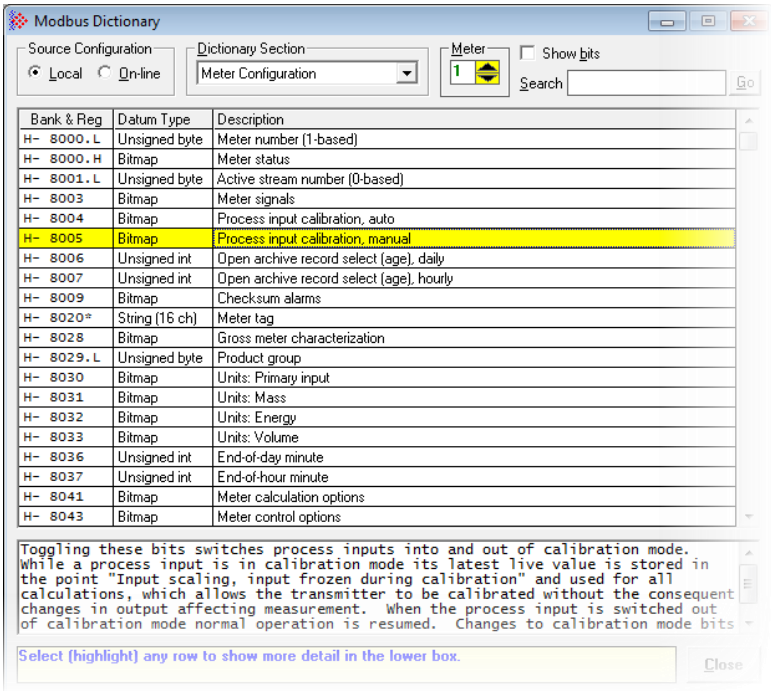
1. In EAFC Manager, select the PROJECT tab.
2. Select Modbus Dictionary, See Starting EAFC Manager for information on setting your module type.



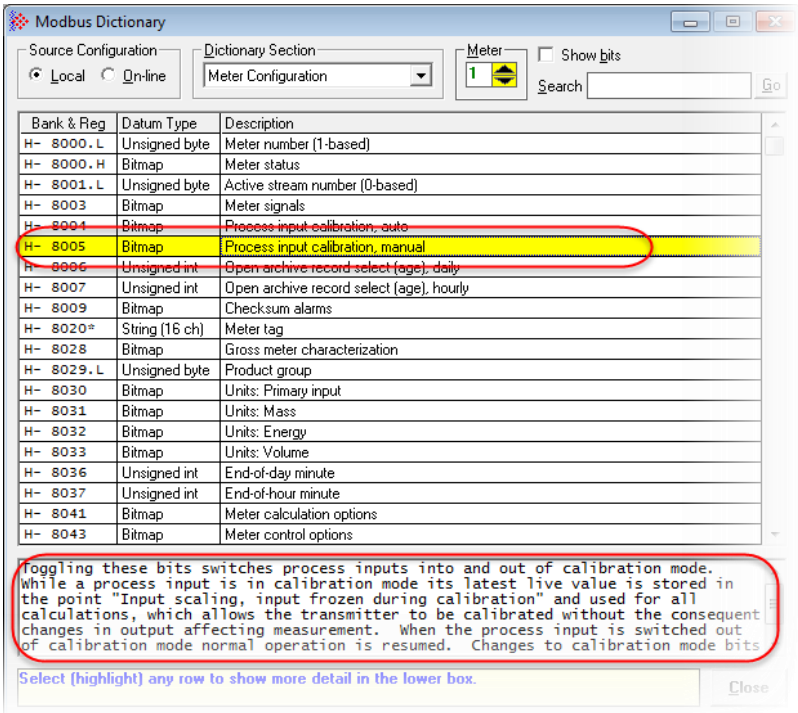
3. Select the **SOURCE CONFIGURATION** (*Local* or *On-line*).
4. Select the **DICTIONARY SECTION** from the drop-down list.
5. Select the **METER** stream.
6. Check the **SHOW BITS** checkbox to enable the display of individual bits.



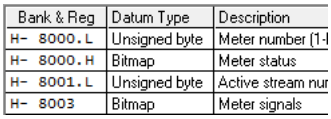
7 Click on the appropriate row.



8 Once a row is selected, additional information is displayed at the bottom of the window.



9 Observe the *Bank and Reg* information in the first column. This column may contain a number of items with different representations.



Bank & Reg	Datum Type	Description
H- 8000.L	Unsigned byte	Meter number (1-
H- 8000.H	Bitmap	Meter status
H- 8001.L	Unsigned byte	Active stream nur
H- 8003	Bitmap	Meter signals

In the first row, the first position indicates whether the register is a Holding Register (**H-**) or an Input Register (**I-**), the second position represents the register (**8000**). The third position indicates high order bytes (**H**), low order bytes (**L**), multiple registers (*****), and a plus sign (**+**) indicates that there are two registers (used for 32-bit quantities, i.e., long integer and floating point elements).

If **SHOW BITS** is checked, a number in the third position is the bit number. For Datum Type “String”, each register holds two characters.

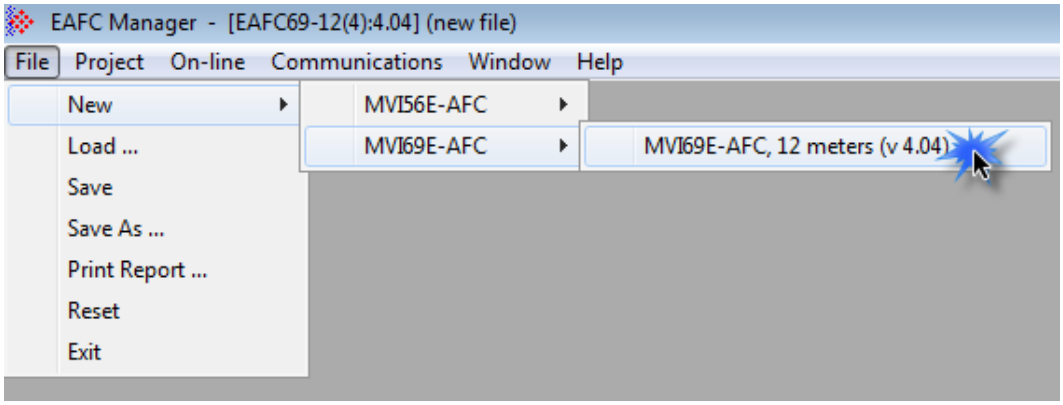
2 Creating an EAFC Manager Project

2.1 Starting EAFC Manager

1 Click **START > PROGRAMS**.
2 From the Programs menu, choose **PROSOFT TECHNOLOGY**.
3 From the ProSoft Technology folder, choose **EAFC MANAGER**.

The EAFC Manager opens.

4 Select **File > New > MVI69E-AFC > MVI69E-AFC, 12 meters (vx.xx)**. The EAFC Manager project must match the firmware running on the EAFC.



From here, you'll begin configuring your module. Communications between the module EAFC Manager and the MVI69E-AFC module is not required during the configuration stage. However, you can establish communications at this point if you wish. Simply follow the instructions Chapter 19 "Installing the Module in the Rack" and Chapter 20 "Connecting the MVI69E-AFC Module to the EAFC Manager".
When you are ready to download the EAFC Manager project to the module, see Chapter 21 "Downloading the Project to the Module ". For information on creating an RSLogix project and importing and using the AOIs, see Chapter 22 "Create your RSLogix Project and Import the AOIs".

3 Configuring Site Parameters

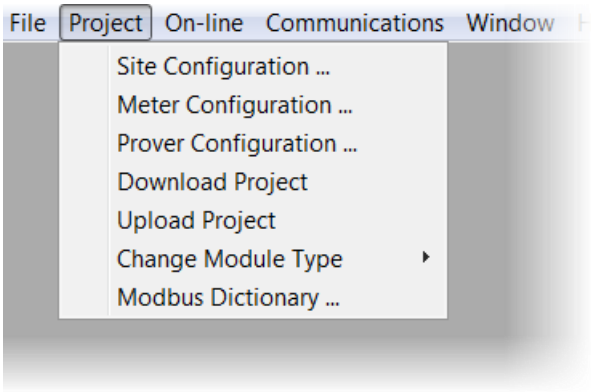
Configure the overall settings for the site. The *Site Configuration* dialog box is where you assign the settings that apply to the entire project.

- Project name
- Modbus slave addresses
- Memory allocation
- Port configuration and mapping
- Site options and status

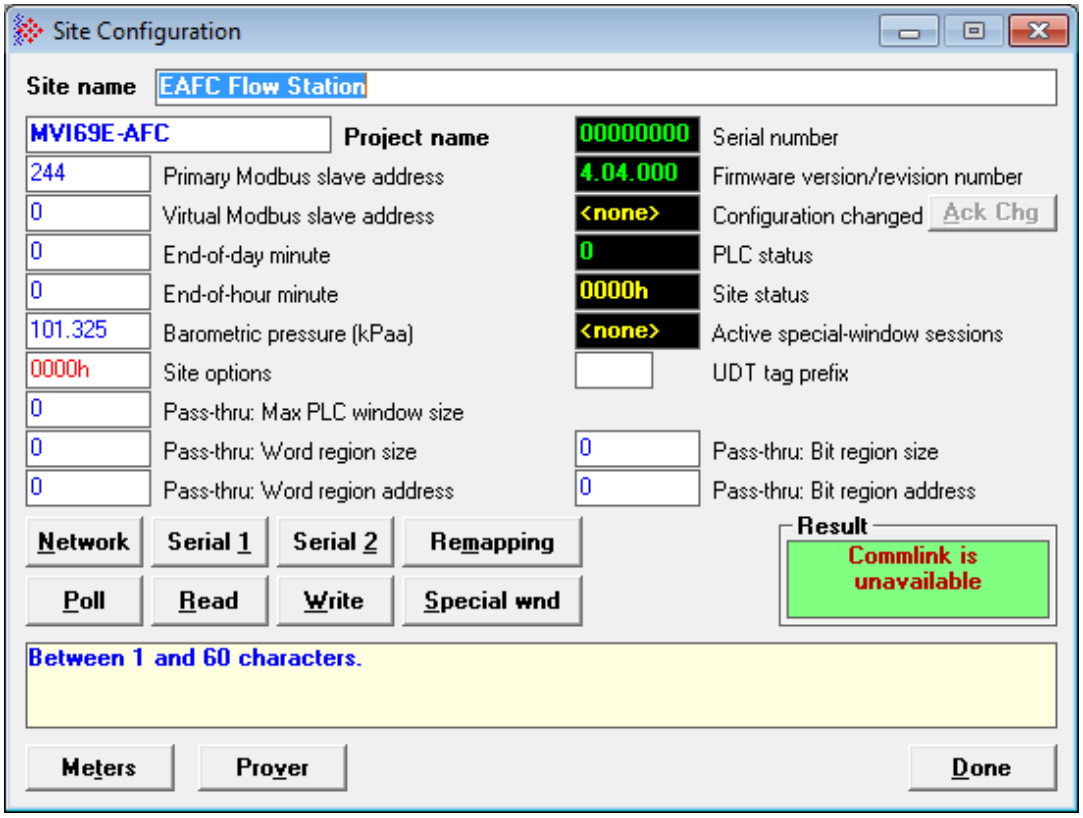
You can also obtain the MVI69E-AFC firmware version from this window.

3.1 Accessing Site Configuration Parameters

From the *Project* menu, choose **SITE CONFIGURATION**.



This action opens the *Site Configuration* dialog box.

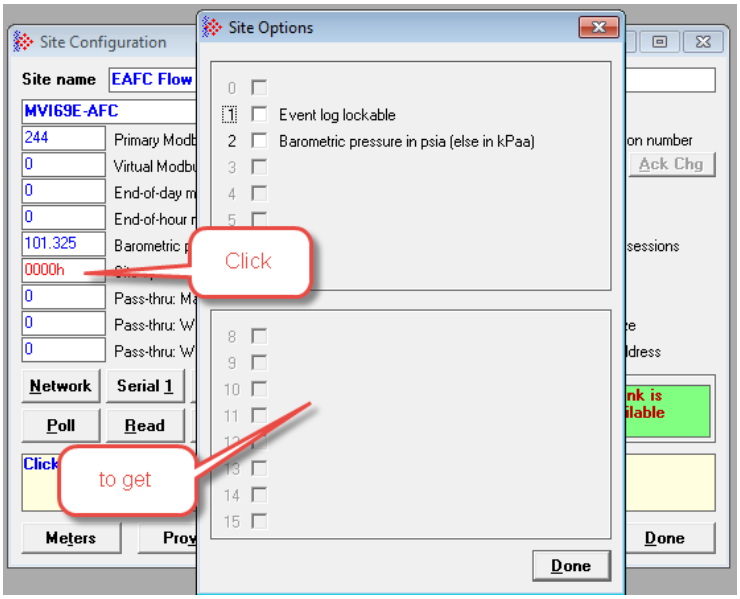


Parameter	Description
Site Name	Enter a site name. This parameter identifies the site (1 to 64 characters). The default is “AFC Flow Station”. Edit this if needed.
Project Name	This parameter allows an external application such as *EAFC Manager* to synchronize its database with the database resident in the module. Default is "MVI69E-AFC".
Primary and Virtual Modbus Slave Address	If you plan on setting these parameters, please refer to the *MVI69E-AFC Reference Guide* for additional details.
End of Day Minute	This parameter sets the minute of the day when the daily archives are created. The default value of 0 (zero) creates the daily archive at midnight. Valid values are between 0 and 1439. This moment is relative to the module’s wallclock, which is expected to be UTC time. **Important:** The End of Period (End-of-day minute and End-of-hour minute) settings are global settings, unless these settings are set by meter on the Meter Configuration page. If these parameters are set per meter, and enabled under control options, the options specified per meter take precedence over the same settings on the Site Configuration page.

Parameter	Description
End of Hour Minute	This parameter sets the minute of the hour when the hourly archives are created. The default value of 0 (zero) creates hourly archives at the top of each hour. Valid values are between 0 and 59. This moment is relative to the module's wallclock, which is expected to be UTC time. **Important:** The End of Period (End-of-day minute and End-of-hour minute) settings are global settings, unless these settings are set by meter on the Meter Configuration page. If these parameters are set per meter, and enabled under control options, the options specified per meter take precedence over the same settings on the Site Configuration page.
Barometric Pressure	This parameter sets the barometric pressure used on the module calculations. The module expects each meter's pressure input to be in gauge units. Because the AGA8, AGA3, and some API2540 calculations require the pressure of the fluid to be in absolute units, the module adds barometric pressure to the gauge pressure in order to obtain the absolute pressure. The calculation assumes that all meters measured by a single MVI69E-AFC are located at the same site and have the same barometric pressure.

3.1.1 Configuring Site Options

The *Site Options* dialog box opens when you click the **SITE OPTIONS** field in the *Site Configuration* dialog box. Not all options are available unless other parameters and options are selected during the configuration process.

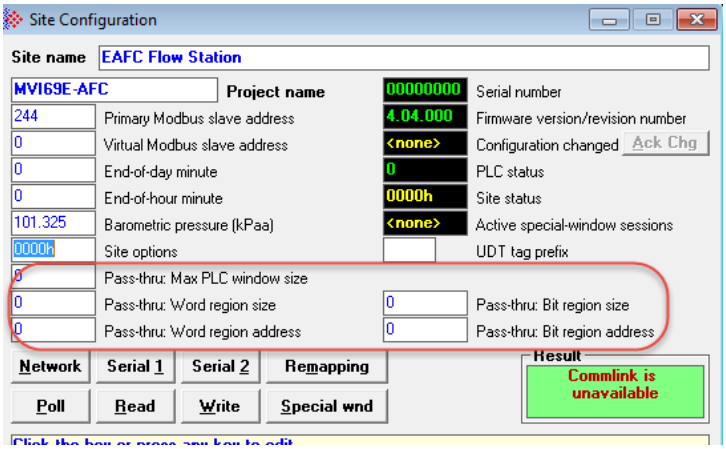


Parameter	Description
Event log lockable	If clear, the event log behaves as a FIFO buffer; a new record overwrites the old one even if the overwritten event has never been downloaded, in which case, the event is permanently lost. If set, and the log is full with never downloaded events, then the log is locked. Controllable events (changes to most datum points) are not allowed to occur. Non-critical, non-controllable events (e.g. checksum alarms) are discarded and are permanently lost, and critical non-controllable events (e.g. PLC mode change) are written as usual and the overwritten, never downloaded events are permanently lost. A locked log must be downloaded to unlock it for normal behavior.
Barometric pressure in psia	If set, the barometric pressure will be expressed in psia units, otherwise it will use kPaa.

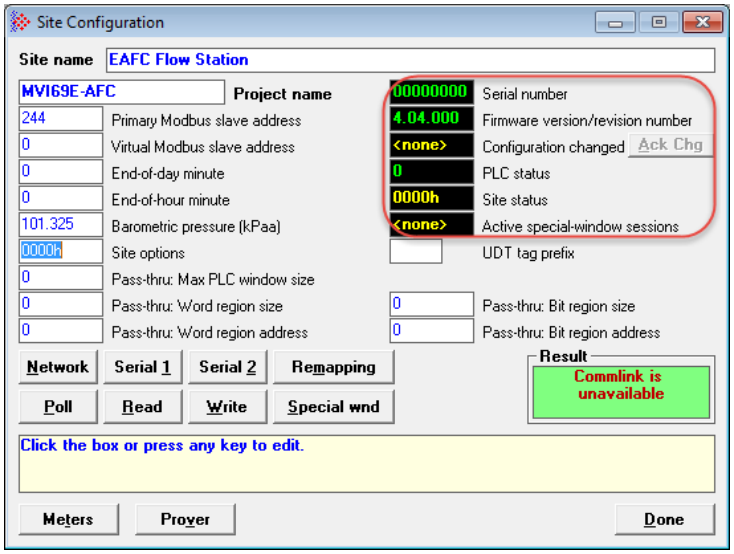
3.1.2 Configuring Pass-thru Options

The Pass-Thru feature can be used for delivering data written by Modbus packets directly to the PLC logic, bypassing the MVI69E-AFC's Modbus database. For details on configuring this option, please refer to the *MVI69E-AFC Reference Guide*.

The module supports the Modbus Pass-Thru feature for write commands. When the pass-thru region in the virtual slave is properly configured, all Modbus write commands pointing inside that area will be handled by ladder logic using the Modbus Pass-Thru function block.



3.2 Viewing Site Configuration Status

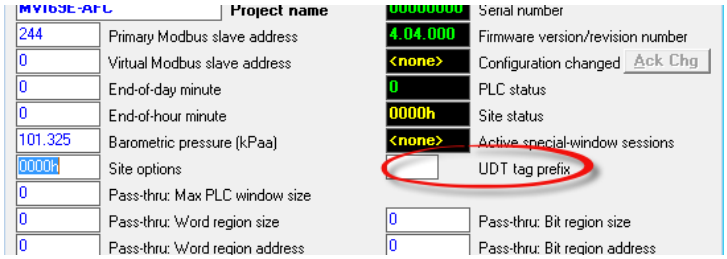


This section of the *Site Configuration* screen is used to provide Site status information. Site status features are discussed in the *MVI69E-AFC Reference Guide*.

3.3 UDT Tag Prefix

Prefix for generated UDT names. UDT definition files generated for the AFC project, including those for backplane-return layouts and archive record layouts, may be imported into the RSLogix project. To avoid conflict with names of other types, tags, and files, especially those generated for other EAFC modules in the same rack, this optional prefix may be prepended to each generated name (after the leading “EAFC_”).

If not specified, generated names are not prefixed. If specified, the prefix must be an alphanumeric string of not more than 3 characters, and it is prepended to each generated name with an underscore (“_”) separator.



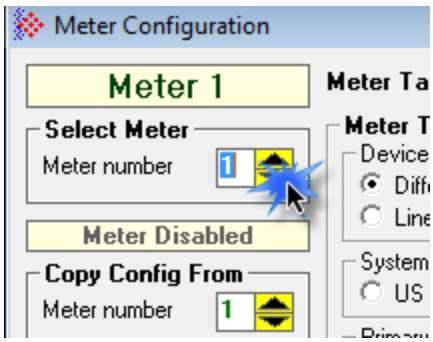
3.3.1 Exporting UDT Files

You can export UDT files through the Backplane Return window.

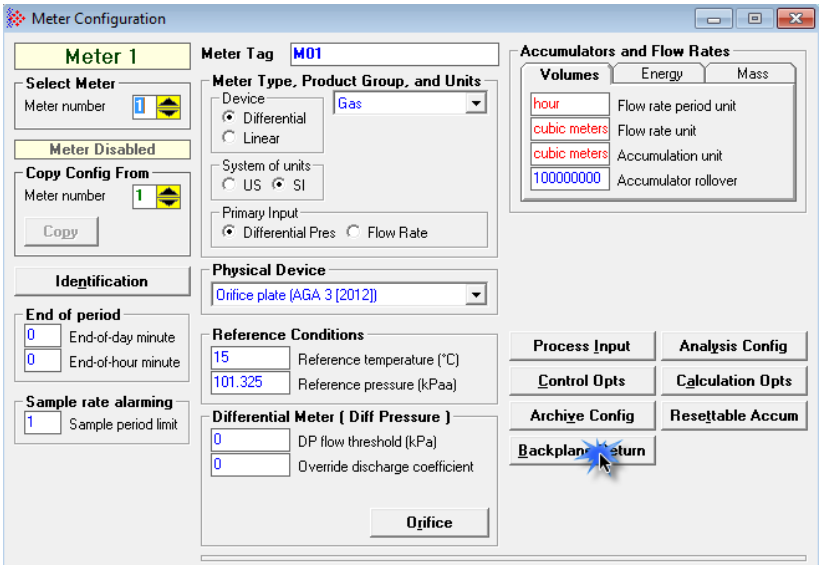
Important: The backplane return window exports Backplane Return UDTs. Archive record layout UDTs are exported from the Archive Configuration Window (after saving the project).

From the *Meter Configuration* page…

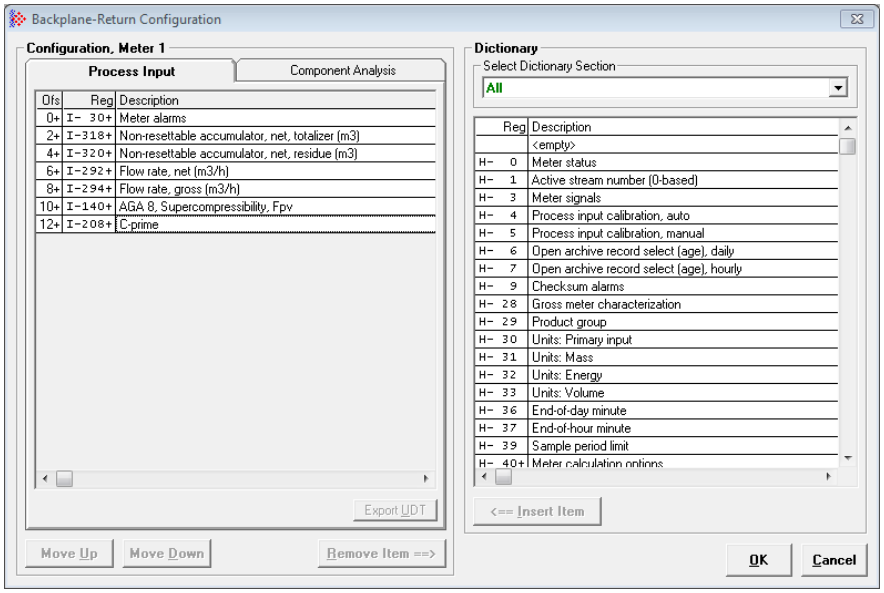
1. Select the meter number.



2. Click on the **BACKPLANE RETURN** button.

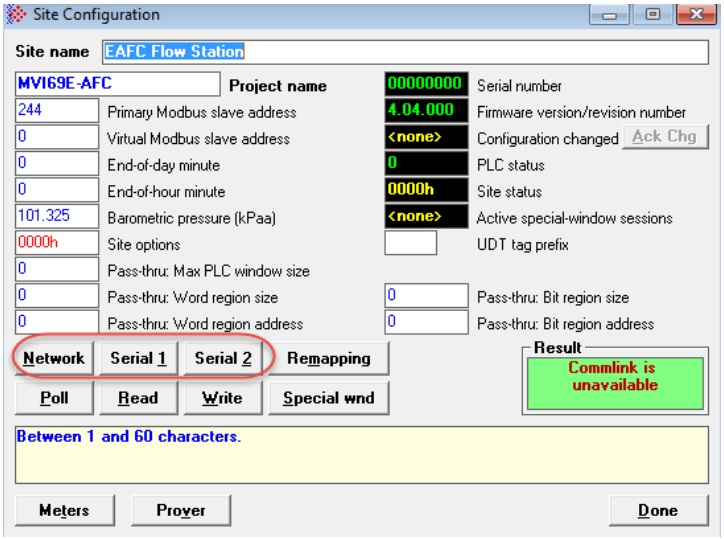


This opens the *Backplane Return* window.



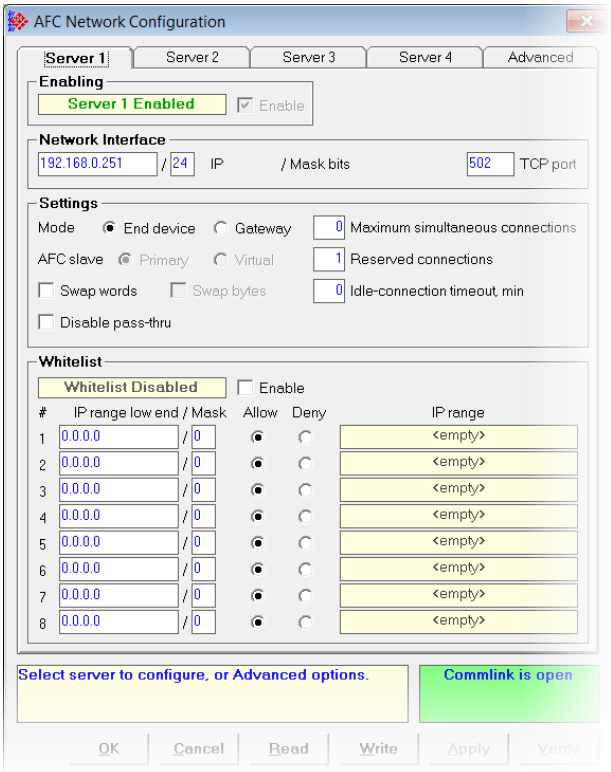
3. From the *Dictionary* side of the page, select the UDT files.
4. Click the **INSERT ITEM** button to add the file to the *Process Input* side of the page.
5. Do the same from the *Component Analysis* tab.
6. Save the Project.
7. When you've finished adding the UDT files, click the **EXPORT UDT** button. (This button will not appear unless the Project has been saved). The files are placed in a sub-directory of the directory that contains the project. The directory is named using the name of the project and extension **.PLC**.

3.4 Configuring Communication Parameters



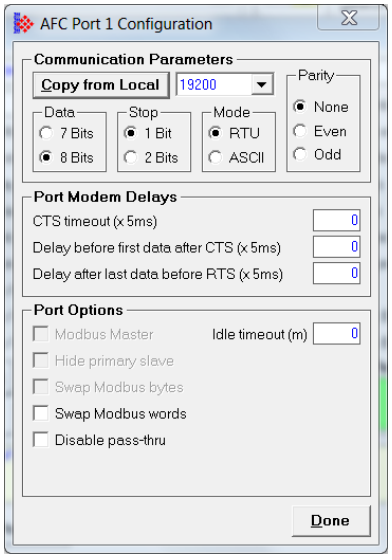
Network

Use the **Network** button to configure Modbus TCP/IP communication settings.



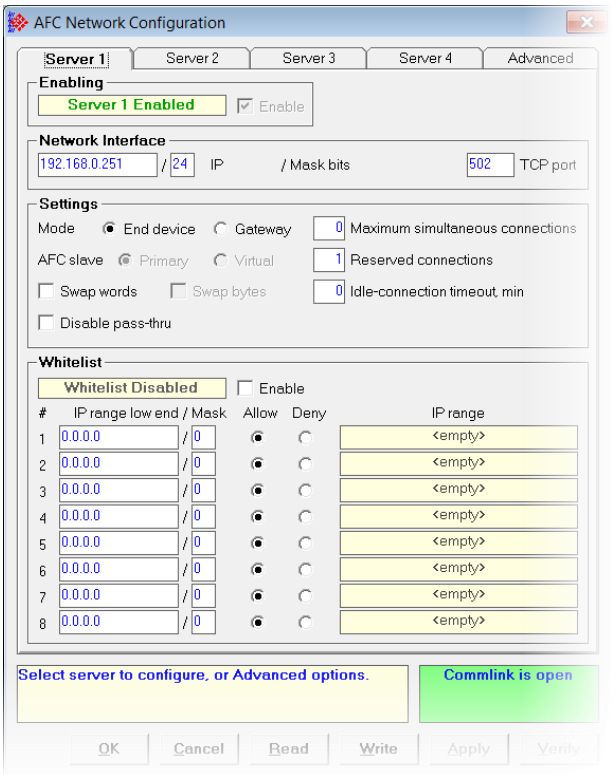
Serial 1 or **Serial 2**

Use the **Serial 1** or **Serial 2** buttons to configure serial communication settings. Use Serial 2 to set up a Modbus Master.



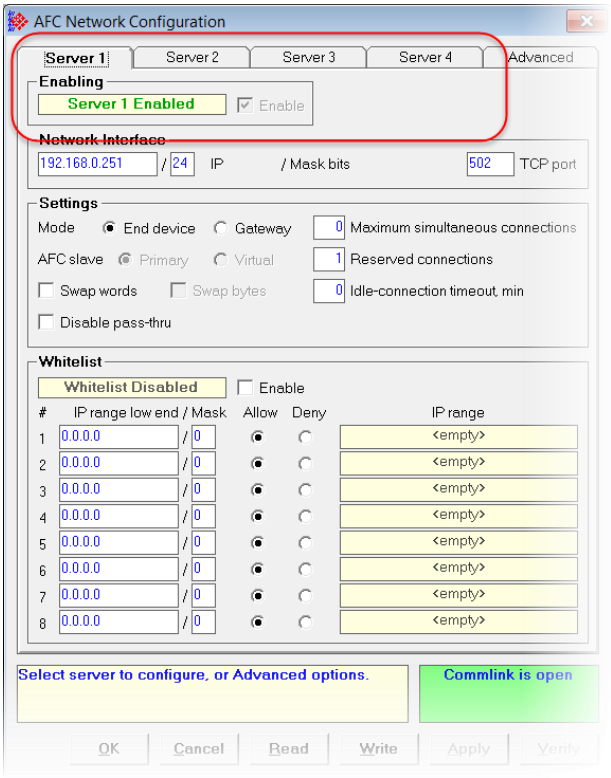
3.4.1 Configuring Modbus TCP/IP

You must configure the communication parameters for the Ethernet port using the EAFC Manager software (*Site Configuration*):

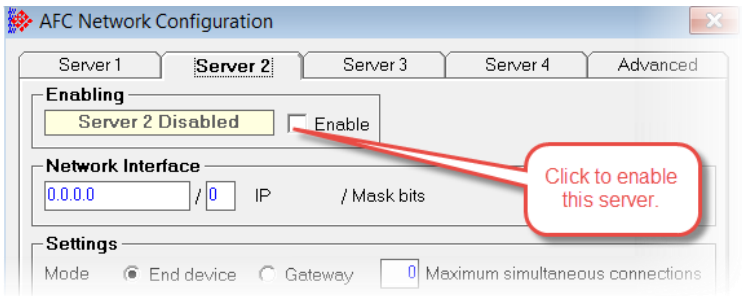


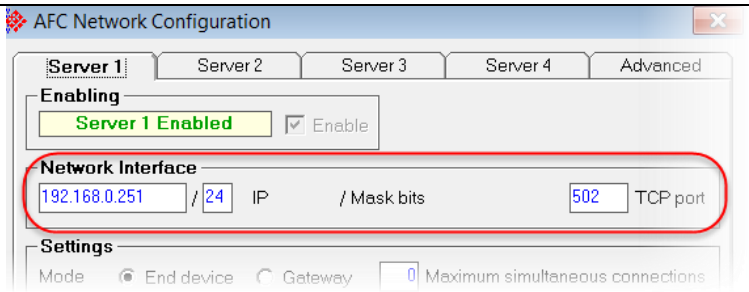
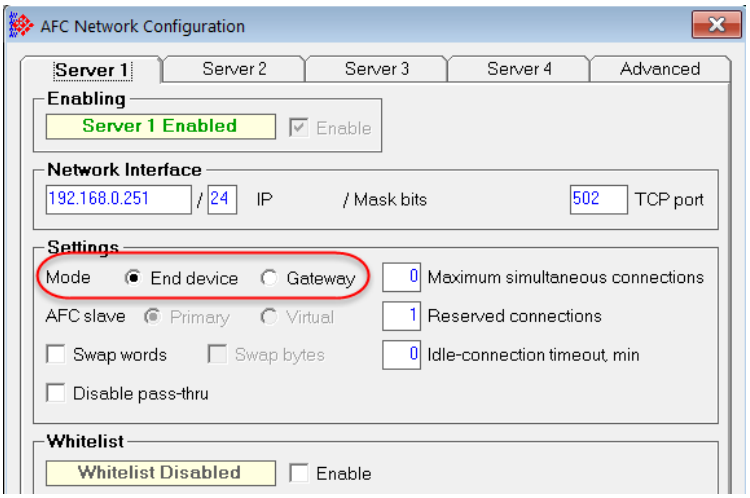
Server Configuration

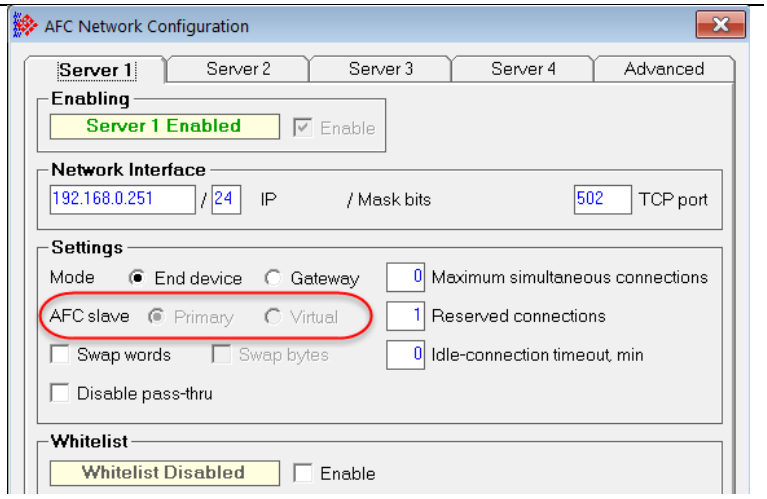
The server tabs allow you set different configurations for up to four servers.



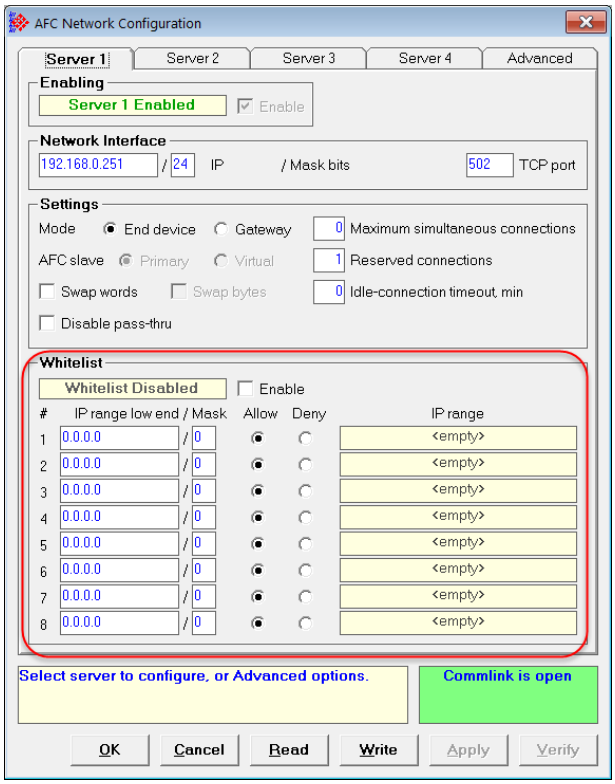
The following process applies to each server.

Step	Task	Description/Example
1	Click on the tab of the server that you want to configure. Enable the server by clicking the *Enable* checkbox.	
2	Configure the network Interface.	This field indicates the IP address of the physical interface in dotted decimal format.

Step	Task	Description/Example
		 The *Mask bits* indicate the network prefix length of the physical interface. This is a number between 1 and 31. *TCP port* is the Modbus TCP/IP port for the selected server. This the MBAP listener port, typically 502 (default). You can use a range between 1024 and 65535.
3	Set up *Mode* and *AFC Slave* settings	Set the module as an *End Device* or a *Gateway*.  If set to an *End Device* (has its own Modbus database), the unit code is ignored and is echoed verbatim in the response regardless of its value. If set to *Gateway* (protocol converter between the TCP network on one end, and a traditional serial Modbus network on the other end), the serial Modbus network is virtual consisting of the MVI69E-AFC's primary and virtual slaves (only), and the unit code must be the configured slave address of the targeted MVI69E-AFC slave.
4	AFC Slave	The effect of the *AFC Slave* option depends on *Mode* setting. If the device is set as *End Device*, then this option selects which of the two MVI69E-AFC slaves is to be the addressed end device. If the device is set to *Gateway*, then this option changes to a checkbox that hides the primary slave. If not selected, both slaves are addressable, but if set, only the virtual slave is addressable. In either case, if a command addresses the virtual slave but the virtual slave does not exist, no response is issued. *AFC slave* indicates whether this is a primary or virtual slave.

Step	Task	Description/Example
		
5	Swap Words	If checked, swaps the Modbus words transferred through this port. This parameter is only accessible to those data points that hold 32-bit quantities (long integers, floats, totalizers).
6	Disable pass-thru	The Modbus Pass-thru feature allows you to configure a Modbus Pass-Thru region in the Virtual Slave (**Project > Site Configuration**). See the *MVI69E-AFC Reference Guide* for detailed information.
7	Maximum simultaneous connections	Set the maximum number of connections for this server. Eight (8) total connections are available and can be configured as required. For example, each server might represent a different network. Server 1 might have a single connection while server 2 may have 3, server 3 with 2, and server 4 with 2 for a total of 8.
8	Reserved connections	A “reserved connection” is one whose resources are always available for use by this server, whether or not such a connection is currently in use, so that regardless of activity on other servers, this number of connections to this server can always simultaneously exist. This setting must not exceed the maximum number of connections permitted for this server if that maximum is non-zero. The total number of reserved connections over all servers must not exceed the maximum number of connections permitted overall. Server #1 always has at least one reserved connection. Range 1 to 8, default 1 with corresponding for others as 0 to 8..
9	Idle connection timeout, min.	Specify the number of minutes that a connection may be idle before being disconnected. A timeout of 0 means no timeout (the connection may remain idle indefinitely).

3.5 Configuring Whitelist Options



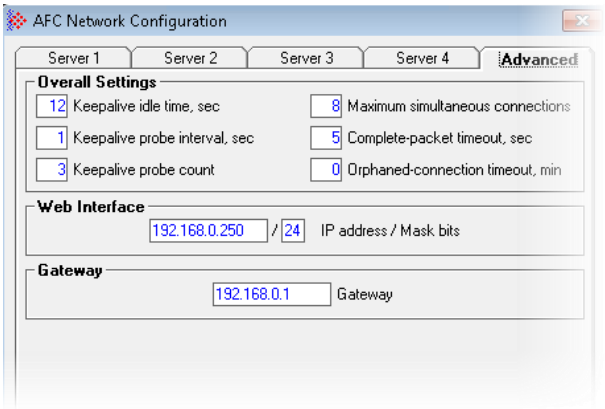
Whitelist configuration is an ordered sequence of eight entries, each of which comprises:

- An IP range (network IP and mask length)
- A boolean "color" flag; White = Allow, Black = Deny.

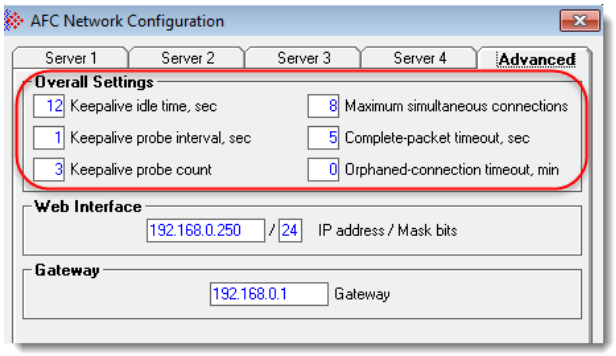
An entry whose components are all zero (IP 0.0.0.0, prefix length is 0, color is "white") is empty. It is ignored during application of the whitelist and its position in the sequence is irrelevant. The relative positioning of non-empty entries is relevant however, as a later entry can override the effect of an earlier entry.

See the *MVI69E-AFC Reference Guide* for detailed information.

3.5.1 Advanced Tab



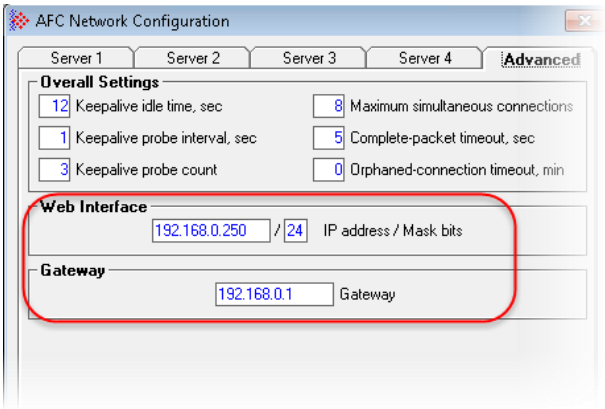
Overall Settings



Parameter	Description
Keepalive idle time	This setting enables a network server to free up resources allocated to broken connections. The three settings are: • Idle time • Probe interval • Probe count When a connection becomes idle (no requests to the server), it could be merely because the client has nothing to say or it could be due to a broken connection. “Keepalive” enables the server to reasonably determine which and act accordingly. When a connection has been idle for the “idle time”, the server sends up to “probe count” probes at the rate of the “probe interval” delay between each. A “probe” is a TCP/IP packet that asks the client “Are you still there?”. If the client answers any probe with “Yes, I’m still here”, then the connection is good. The client is merely silent and the server resets “keepalive” logic for another cycle. If the client does not answer any probe, then the server deems the connection to be broken and closes it to free up its resources for allocation.

Parameter	Description
Keepalive probe interval	See above.
Keepalive probe count	See above.
Maximum simultaneous connections	The maximum concurrently active connections over all servers. This should be a number between 1 and 8. The default is 8.
Complete packet timeout	The timeout for receiving a complete packet. The timeout becomes effective upon receipt of the first octet of a packet's MBAP header and imposes a limit on the time that may elapse before receiving the last octet of that packet. If the timeout expires, the connection is shut down. Valid range is 1 through 60 with a default of 5 seconds.
Orphaned connection timeout	This timeout (in minutes) becomes active when a connection is orphaned by a sufficiently significant change to its parent server's configuration. This setting provides a window of time during which the connection remains alive so that the client can gracefully close it before establishing a replacement connection according to the network's updated requirements. Server changes causing orphanization include (but not limited to): • Disabling the server • Change of IP address • Change to whitelist the disallows the client's IP • Reduction or removal of access permitted, e.g. primary vs virtual slave. • Change of protocol; e.g., gateway vs end-device mode, swap options. Orphanization of a connection breaks the association between the connection and its parent server so that the connection no longer belongs to any server. Server settings in effect prior to orphanization become frozen for that orphan for the remainder of its limited life. A subsequent reconfiguration of this or any other server that reestablishes the frozen settings does not re-associate the connection with the server; the connection remains orphaned and its timeout remains active. Upon timeout expiry, the connection is shut down. A timeout of 0 causes an immediate shutdown. Changing this setting does not adjust timeouts in effect for already existing orphans. Valid values: 0 to 60, Default is 0.

Web Interface/Gateway



This IP address and Mask bits pertain to the address of the module itself. This is not a Modbus TCP/IP address used by the MVI69E-AFC application. The default web interface address is 192.168.0.250.

Once configured, click **READ** from the *Site* page to save changes.

3.5.2 Configuring Serial 1 and Serial 2

The module contains two serial port connections. Serial 2 may be used as a Modbus Master.

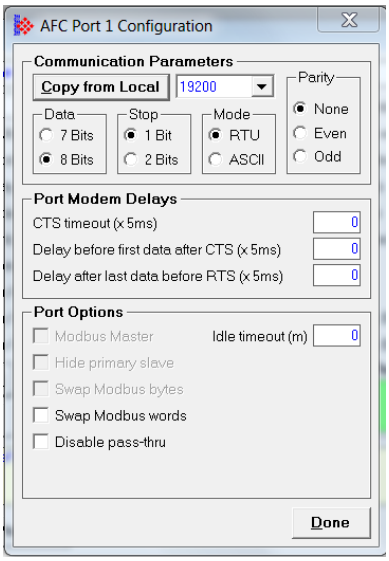
Serial Only

The module supports the following communication parameters for each communication port:

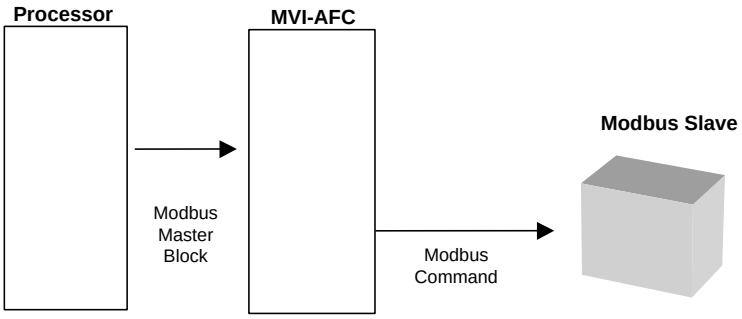
Parameter	Values
Baud Rate	9600, 19200, 28800, 38400, 57600, 115200, 230400
Data Bits	7 or 8
Stop Bits	1 or 2 Bits
Mode	RTU or ASCII
Parity	None, Even or Odd

Note: Do not configure a port for both RTU mode and 7 data bits as this combination is not supported by the Modbus protocol.

You must configure the communication parameters for each communication port using the MVI69E-AFC *Manager* software (Site Configuration):



Port Options

Option	Description
Modbus Master	Enables the Modbus Master for the port (Serial 2). The Modbus Master command is generated from the processor using ladder logic (Modbus master block). After the Modbus Master transaction is completed the module is ready to receive another Modbus Master request from the ladder logic:  The following Modbus functions are support for Modbus Master operation:

Modbus Function Code	Description
1	Read Coil Status
2	Read Input Status
3	Read Holding Registers
4	Read Input Registers
15	Force (Write) Multiple Coils
16	Preset (Write) Multiple Registers

The module offers flexibility for Modbus Master operation, allowing ladder logic to select one of the following data types:

- Bit (packed 16 to a word)
- Word (16-bit register)
- Long (32-bit items as register pairs)
- Long Remote (32-bit items as single registers)

Note: Long data type implements each data unit as one pair of 16-bit registers (words). Each register contains two bytes. Long remote data type implements each data unit as one 32-bit register. Each register contains four bytes. The proper choice depends on the remote slave's Modbus implementation.

Hide Primary Slave	When checked, protects the Primary Modbus Slave from any read or write command from a Modbus master device. In this case, you could also remap the register from the Primary Slave to the Virtual Slave protecting each register from write commands (refer to the Primary & Virtual Modbus Slaves Configuration section).
Swap Modbus Words	If checked, the words transferred by a Modbus master device will be swapped. This setting only applies to double-register data items (floating point and long integer).

Option	Description
Disable Pass-thru	The Modbus pass-through feature allows you to configure a Modbus Pass-through region in the virtual slave (**Project > Site Configuration**). After the module receives a holding register write command (Modbus functions 6 or 16) or a bit write command (Modbus functions 5 or 15), it generates a pass-through block to be sent to the processor containing the Modbus command data. You can define a word pass-through region for words or bits. **Note:** You must enable the Virtual Slave by configuring a Modbus address greater than 0 (**Project > Site Configuration**). You can control which communication parts will support the pass-through (**Project > Site Configuration > Port X button**). This feature requires ladder logic to read the pass-through block from the module to the processor. Refer to the Ladder Logic section in the *MVI69E-AFC Reference Guide* for more information about the pass-through feature.

3.6 Poll Button

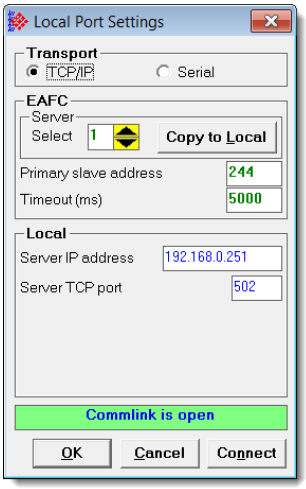
The function of the poll button is to update the display of site status (the black-background boxes in the upper right quadrant of Site Configuration).

3.7 Local Port Settings Dialog Box

This dialog is displayed whenever menu item *Communications/Local Port Settings* is clicked, or any other action that requires a connection to the module is invoked while such a connection is not yet present. Such “other actions” include the **READ**, **WRITE**, and **POLL** buttons of the *Site Configuration* pane, but also numerous other actions such a Read and Write of Meter Configuration, menu item *Project/Download Project*, and menu item *Communications/Login Module*.

If a connection is already present, this dialog is not automatically displayed upon any “other action” but only upon the *Local Port Settings* menu item. Similarly, if the connection exists but the operator has not logged in, while the “other action” requires login, the *Login Module* window is automatically displayed.

Both conditions are cascaded. For example, a Read when not connected displays first the *Local Port Settings* window to connect and then the *Login Module* window to log in.



Adjust the communication settings if necessary. Click **CONNECT** to save the settings and **OK** to connect.

3.8 Read Button

The **READ** button reads the current site configuration from the module to the local PC. Look at the result area (green rectangle) on the *Site Configuration* dialog box for the status of the read operation. When a "Success" indication shows in the result area, it indicates that the site configuration has been successfully read to the local PC.

3.9 Write Button

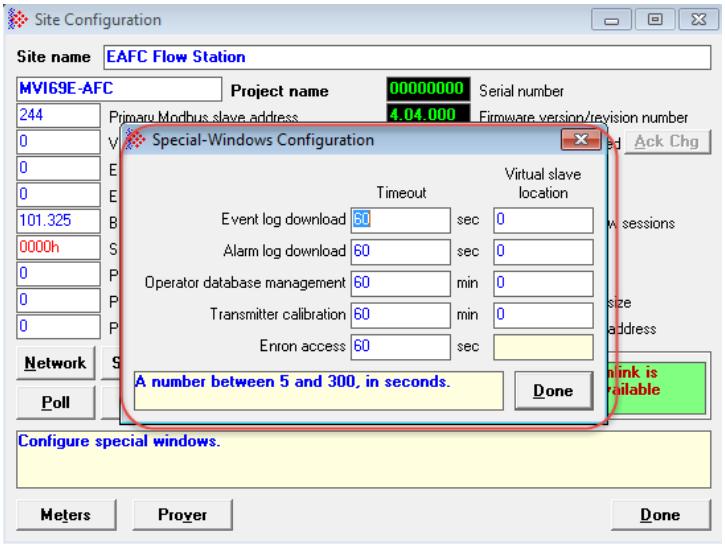
After you have completed the site configuration on the local PC *EAFC Manager* software, click the **WRITE** button to transfer the configuration to the module. When the *Result* area shows "Success", the site configuration has been successfully written to the module.

Click the **READ** button to read the current module site configuration. The configuration should match the last write operation data.

If the result area shows "Time out", verify the network connections.

3.10 Special wnd Button

This button displays the *Special Windows* dialog.



This dialog allows you to set times in minutes or seconds. The times represent times of no activity. For example, if you set Event log download to 60 seconds, and no download activity has occurred within that time period, the Event Log activity is abandoned and no data is logged or committed. The same holds true for the alarm log, transmitter calibration, and Enron access. You must enter the time interval and optionally the Virtual Slave location of the data. When you are satisfied with your settings, click **DONE**. You can come back at any time and change your settings.

If you want to access these special windows via the virtual slave, assign an address in the virtual slave to the special window in the Virtual slave location column. If the Virtual slave location is set to “0”, the special window is unavailable in the virtual slave.

3.11 Done Button

This button stores your settings temporarily and closes the *Site Configuration* dialog box. Note that you must also save your project before closing EAFC Manager, otherwise your configuration will be discarded.

3.12 Remapping Button

Refer to the *MVI69E-AFC Reference Guide*.

3.13 Accessing the Data

Information on accessing data is discussed in the *MVI69E-AFC Reference Guide*.

3.14 Site Status

Site status information is discussed in the *MVI69E-AFC Reference Guide*.

4 Configuring Meter Parameters

4.1 Prerequisites

Ensure that all site information is configured as described in the previous chapters.

4.2 What Parameters Do I Have to Configure?

The *Meter Configuration* page allows you to configure your meter based on your application. Parameters on this page are based on information that you initially provide to EAFC Manager.

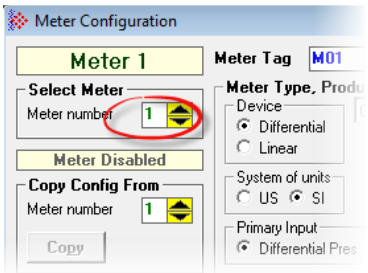
Configuring a Meter consists of the following steps:

1. Configure Meter Type, Product Group, Units, and Primary Input
2. Configure Meter Identification and Stream Identification Parameters
3. Configure Common Parameters
4. Configure Application-specific Parameters
5. Configure Analysis Parameters

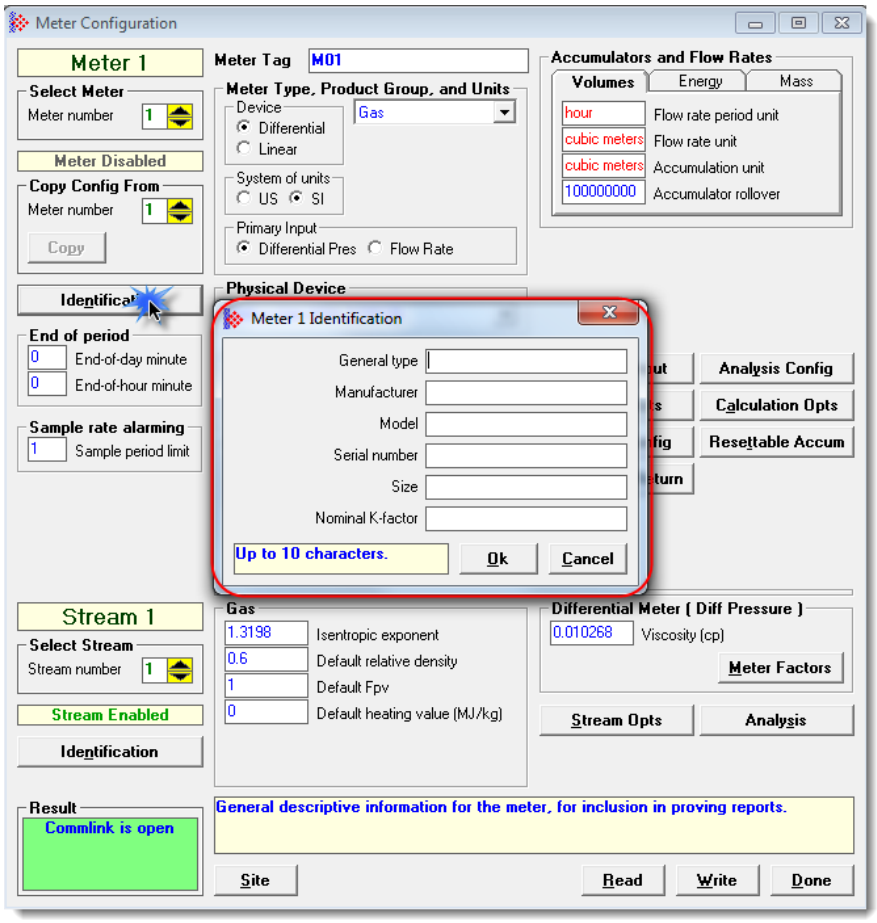
4.3 Configuring Meter and Stream Identification Parameters

Identification Parameters identify the meter.

1 Select the Meter number.



2 Click the **IDENTIFICATION** button to display the *Meter Identification* dialog.



3 Add the following identifying parameters:

- General Type
- Manufacturer
- Model
- Serial Number
- Size
- Nominal K Factor

4 Click **OK** when complete. Repeat this for every configured meter.

4.3.1 Setting End of Period Parameters

These parameters set the *End-of-day minute* and *End-of-hour minute*.

End-of-Day Minute

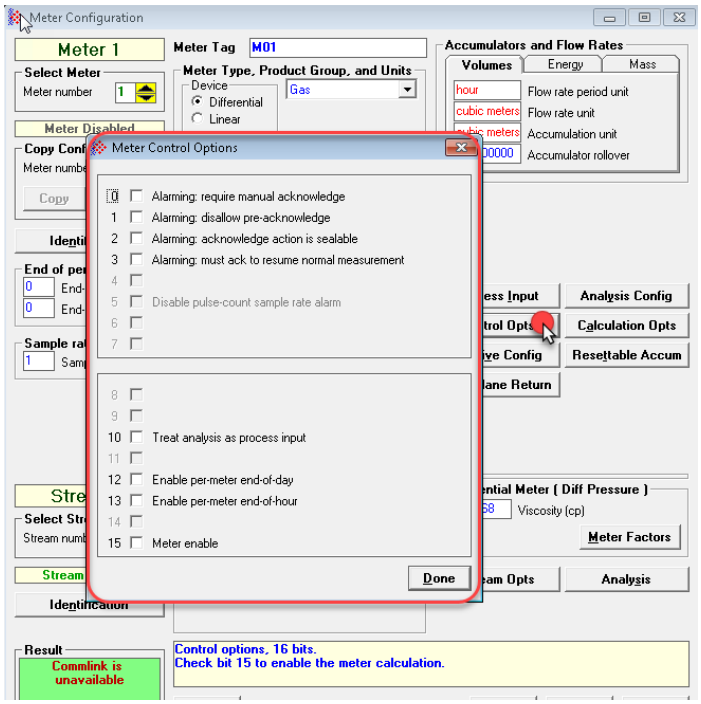
This parameter sets the minute of the day when the daily archives are created. The default value of 0 (zero) creates the daily archive at midnight. Valid values are between 0 and 1439.

End-of-hour minute

This parameter sets the minute of the hour when the hourly archives are created. The default value of 0 (zero) creates hourly archives at the top of each hour. Valid values are between 0 and 59.

Setting Precedence

You can set the *End-of-day minute* and *End-of-hour minute* on the *Site* page as well. The parameters set on the site page represent a global setting and *End of Period* parameters set on the Meter Configuration are ignored. However, you can give the Meter setting precedence using the *Meter Control Options* dialog.



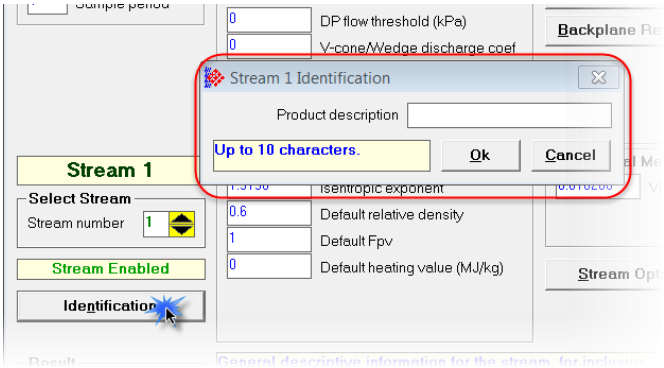
1. Click on the **CONTROL OPTS** button.
2. Click on the *Enable per meter end-of-day* and *Enable per meter end-of-hour* check boxes.
3. Click **DONE**.

The settings in the *End of Period* section for the meter now take precedence over those set on the Site page.

Sample rate alarming – This is the longest period that can elapse between successive fresh samples of process input values without raising the "sample rate too low" alarm. This value is specified in seconds with a range of 0 through 30. Zero "0" means that the sample rate test is not performed and alarms are not raised. The complete implementation requires supporting logic in the PLC. The default for gas product is 1 second and for any liquid product is 5 seconds.

4.3.2 Setting a Stream Name

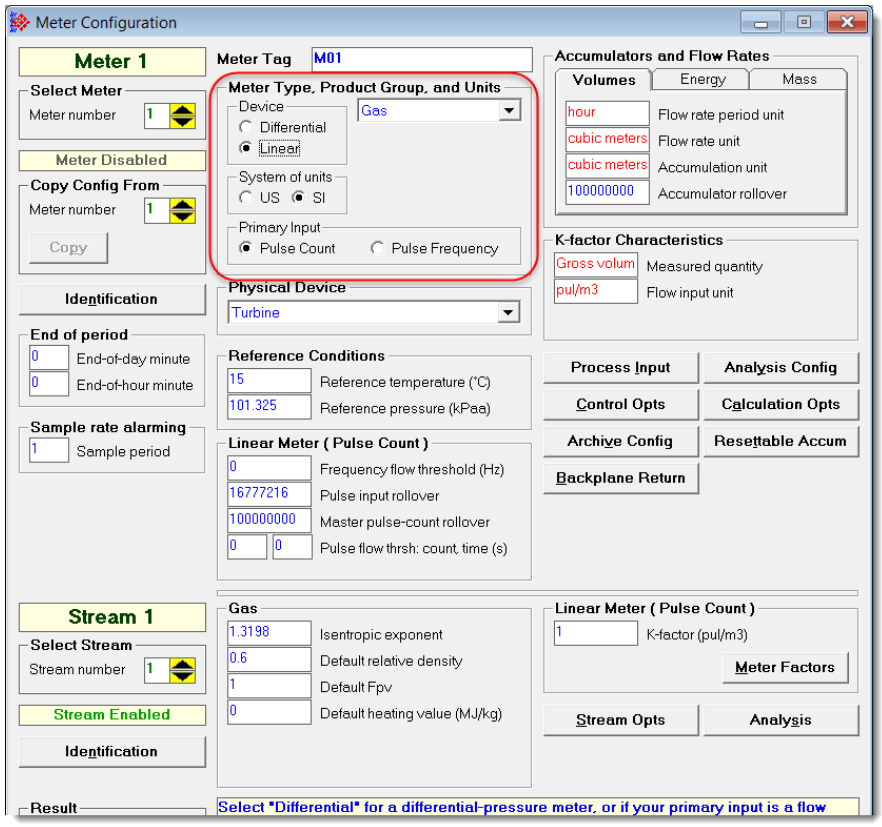
1. To set a *Stream Name*, click on the **IDENTIFICATION** button under the *Stream Enabled* indicator.



2. Enter a product description and click **OK**.

4.4 Configuring Meter Type, Product Group, Units, and Primary Input

These parameters must be configured before you configure any common or application detail parameters. What you select here affects the available parameters that must be configured for your application.



EAFC Manager needs these parameters in order to hide or show parameters that pertain specifically to your meter and its primary output based on your meter and associated instrumentation.

For example, a meter that measures the flow of Crude oils requires that specific parameters be provided that may not be required of a meter that measures the flow of gas.

Parameters available to you are determined by these selections.

Based on the previous examples, you essentially have to answer 3 questions before you begin meter configuration:

1. What kind of meter are you configuring?
2. What is the primary output from your flow meter and associated instrumentation?
3. What are you measuring (Gas or Liquid)?

4.4.1 Selecting and Configuring Meter Type, Product Group, Units and Primary Input Parameters

The following table helps you determine what *Meter Type* and *Primary Input* parameters must be entered in EAFC Manager based on the kind of meter you are configuring and the primary output of the meter and associated instrumentation.

To use the following table:

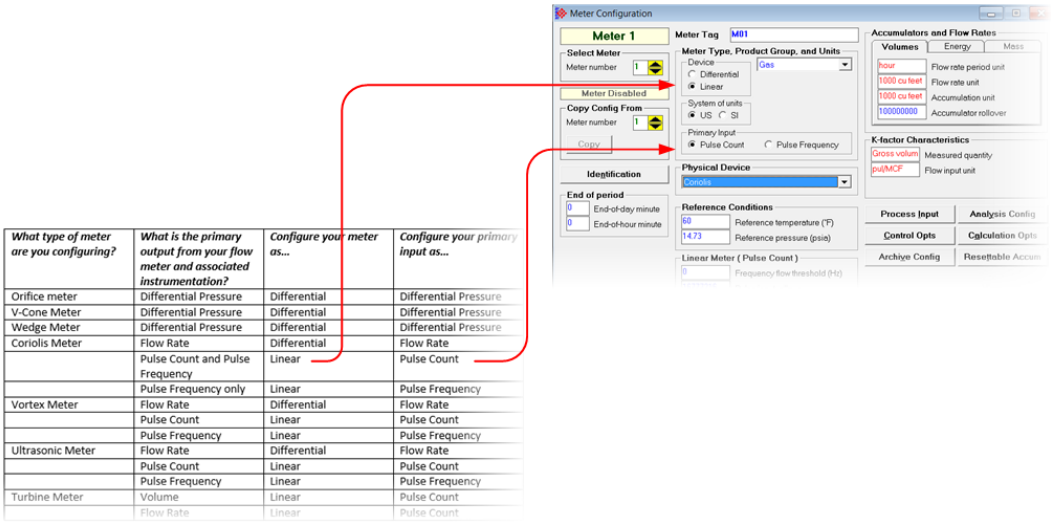
1. Locate the type of meter you are using from Column 1.
2. Determine the primary output of your meter and associated instrumentation from Column 2.
3. Note your Meter Type from Column 3.
4. Note your Primary Input from Column 4.

You will use the information from Columns 3 and 4 to select your first two parameters in EAFC Manager.

Column 1	Column 2	Column 3	Column 4
What kind of meter are you configuring?	What is the primary output from your flow meter and associated instrumentation?	Configure your meter type as…	Configure your primary input as…
Orifice Meter	Differential Pressure	Differential	Differential Pres
V-Cone Meter	Differential Pressure	Differential	Differential Pres
Wedge Meter	Differential Pressure	Differential	Differential Pres
Coriolis Meter	Flow Rate	Differential	Flow Rate
	Pulse Count and Pulse Frequency	Linear	Pulse Count
	Pulse Frequency Only	Linear	Pulse Frequency
Vortex Meter	Flow Rate	Differential	Flow Rate
	Pulse Count and Pulse Frequency	Linear	Pulse Count
	Pulse Frequency Only	Linear	Pulse Frequency
Ultrasonic Meter	Flow Rate	Differential	Flow Rate
	Pulse Count and Pulse Frequency	Linear	Pulse Count
	Pulse Frequency Only	Linear	Pulse Frequency
Turbine Meter	Pulse Count and Pulse Frequency	Linear	Pulse Count
	Pulse Frequency	Linear	Pulse Frequency
	Pulse Count	Linear	Pulse Count
Positive Displacement	Same as Turbine		
Magnetic	Same as Turbine		

Columns 3 and 4 of this table have a direct relationship with the *Meter Configuration* page of EAFC Manager.

For example, if you are configuring a **Coriolis Meter** with a primary output of **Pulse Count and Pulse Frequency**, your settings in EAFC Manager for Meter Type and Primary Input would be **Linear** and **Pulse Count** as shown in the following example.



What type of meter are you configuring?	*What is the primary output from your flow meter and associated instrumentation?*	*Configure your meter as...*	*Configure your primary input as...*
Orifice meter	Differential Pressure	Differential	Differential Pressure
V-Cone Meter	Differential Pressure	Differential	Differential Pressure
Wedge Meter	Differential Pressure	Differential	Differential Pressure
Coriolis Meter	Flow Rate	Differential	Flow Rate
	Pulse Count and Pulse Frequency	Linear	Pulse Count
	Pulse Frequency only	Linear	Pulse Frequency
Vortex Meter	Flow Rate	Differential	Flow Rate
	Pulse Count	Linear	Pulse Count
	Pulse Frequency	Linear	Pulse Frequency
Ultrasonic Meter	Flow Rate	Differential	Flow Rate
	Pulse Count	Linear	Pulse Count
	Pulse Frequency	Linear	Pulse Frequency
Turbine Meter	Volume	Linear	Pulse Count
	Flow Rate	Linear	Pulse Count

It is important to note that the settings selected within the **Meter Type**, **Product Group** and **Units** section of the page, determine what configuration parameters are viewable on the EAFC Manager *Meter Configuration* page.

Once you've selected the correct *Meter Type* and *Primary Input* settings based on the table, you can select the *Product Group*, and *System of Units*.

4.4.2 Product Group

The *Product Group* represents what you are measuring (i.e., gas or liquid). The *Product Group* drop-down list allows you to select the appropriate *Product Group* for your application. Refer to the *MVI69E-AFC Reference Guide* for detailed information.

Note: The Product Injected Meter Type feature produces an Accumulation Overflow error. The associated flow calculations will be invalid.

4.4.3 System of Units

System of Units pertains to how measurements are displayed and are used for calculations.

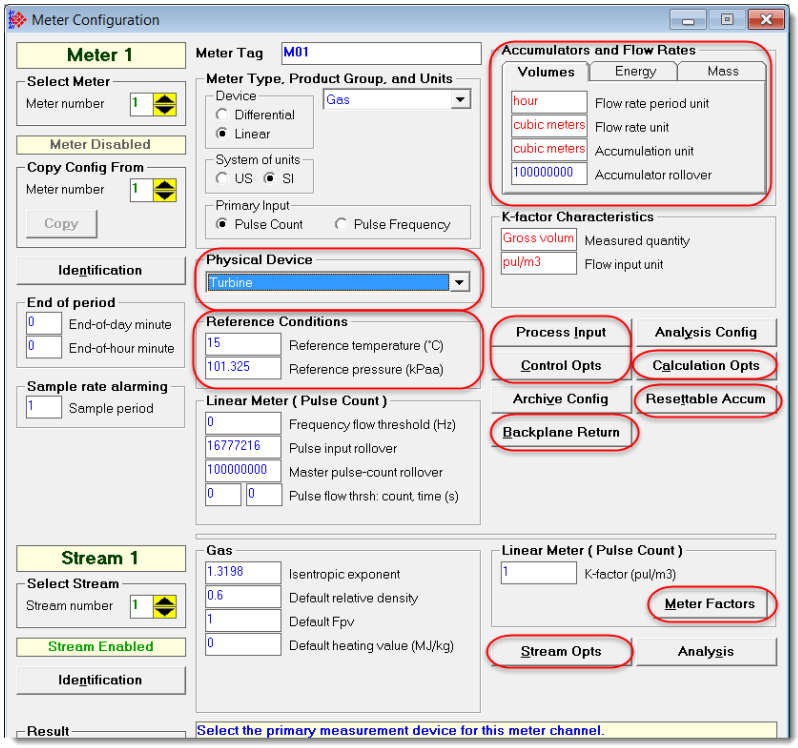
- ***US*** – Temperature in °F, Pressure in psi, Differential Pressure in hw@60°F.
- ***SI*** – Temperature in °C, Pressure and Differential Pressure in kPa.

Once these parameters are configured, the parameters that you see on EAFC Manager are those that apply to your application. That is, what you see on the MVI69E-AFC Manager page is dependent on these parameter configuration settings.

Troubleshooting Tip: If the EAFC Manager displays an "Illegal Data Value" message, it typically indicates an invalid meter type or product group configuration. The module does not accept a configuration file that attempts to change a meter type or product group for a meter that is currently enabled. Disable all meters, change the meter types and product groups, and then enable the meters again.

5 Configuring Common Parameters

Common parameters are common to all applications. These parameters are always visible and should be configured.

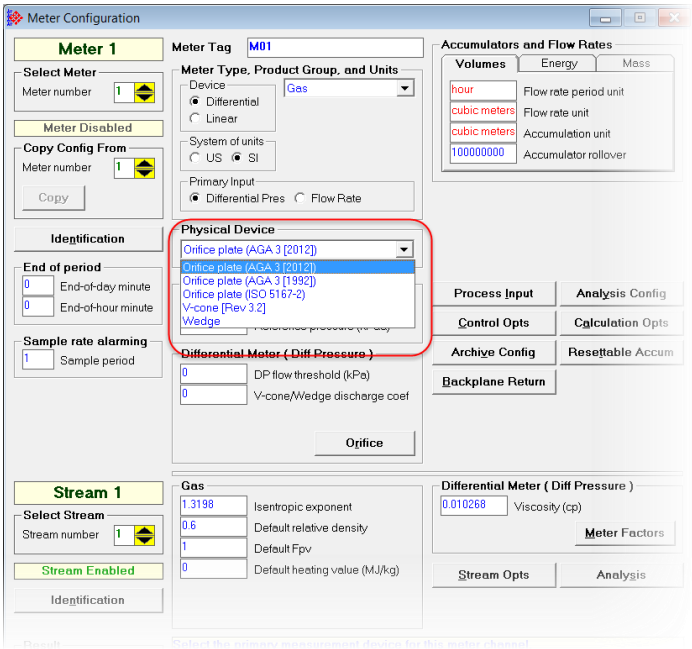


Common parameters include:

- Physical Device
- Reference Conditions
- Accumulators and Flow Rates
- Process Input
- Control Options
- Backplane Return
- Calculation Options
- Resettable Accumulators
- Meter Factors
- Stream Options

5.1 Selecting the Physical Device

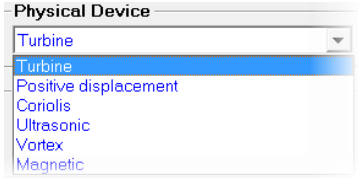
Select your device from the drop-down list. Selects here change calculation methods based on the meter.



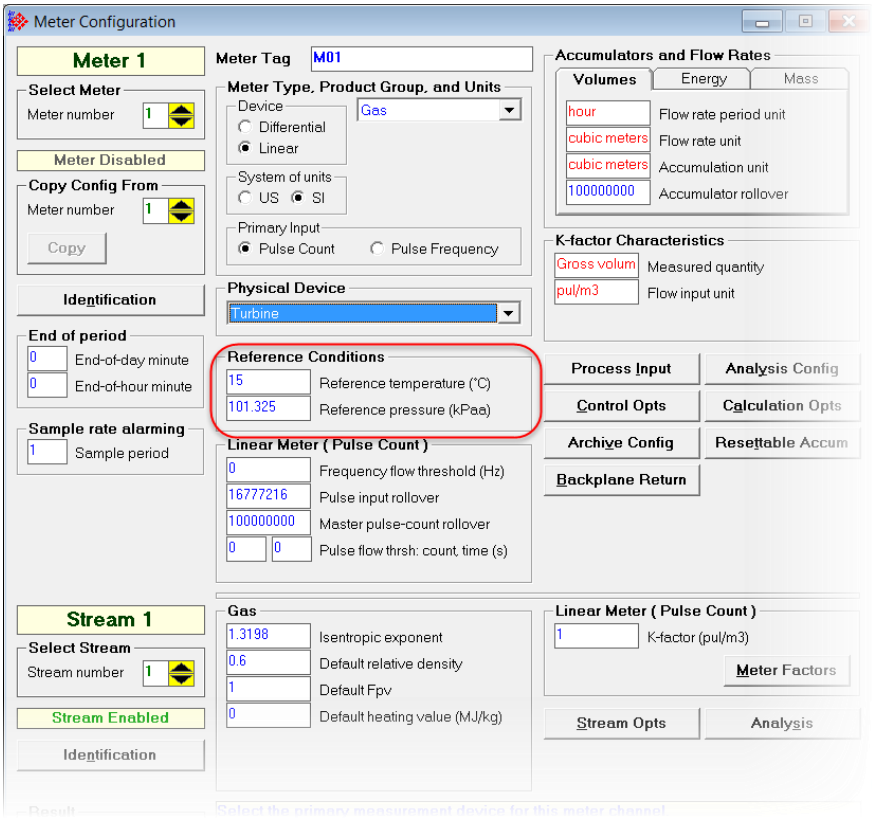
If you are using a differential gas type meter, measuring differential pressure, you have the option of selecting from the following standards:

- Orifice plate (AGA 3 [2012])
- Orifice plate (AGA 3 [1992])
- Orifice plate (ISO 5167-2)
- Nozzle, ISA 1932 (ISO 5167-3 type 1)
- Nozzle, long radius (ISO 5167-3 type 2)
- Nozzle, Venturi (ISO 5167-3 type 3)
- Venturi tube, cast (ISO 5167-4 type 1)
- Venturi tube, machined (ISO 5167-4 type 2)
- Venturi tube, rough (ISO 5167-4 type 3)
- V-cone [Rev 3.2]
- V-cone [Rev 2.5]
- Wafer-cone
- Wedge

The options in the drop-down list change depending on your selections to meter types. For example, if you select a Linear device type, the following physical device types are available:



5.2 Specifying Reference Temperature and Pressure (Reference Conditions)

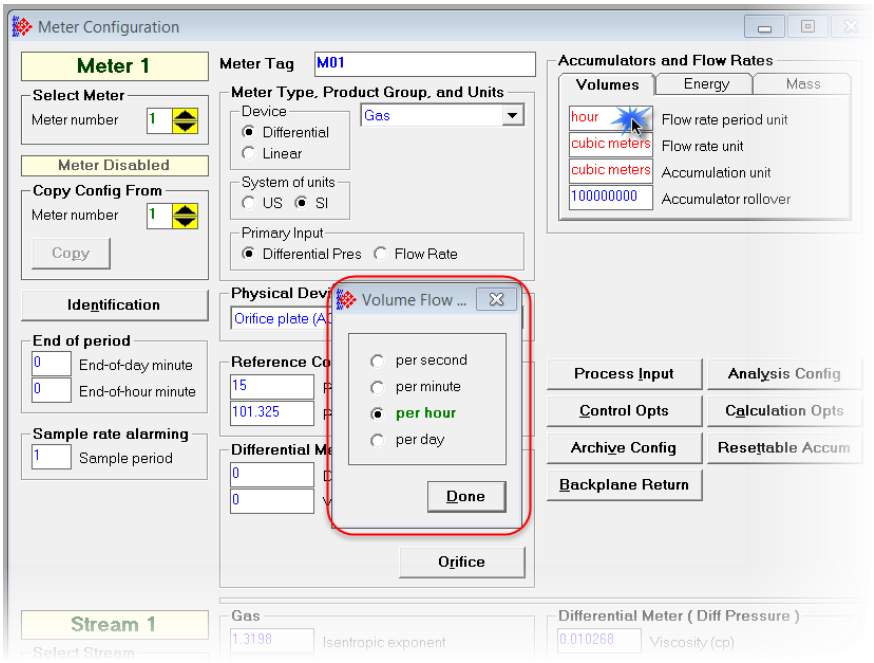


Measurements of gas and liquids are calculated based on their characteristics at a specific temperature and atmospheric pressure. Specify the reference conditions in this area. The default values are 15°C/101.325 kPaa (SI) and 60°F/14.696psia (US), which are the standard API base conditions. If configured reference conditions are different from API base, the API calculations are done twice as necessary to correct from flowing conditions to API base and then de-correct from API base to your selected reference.

5.3 Setting Accumulators and Flow Rates

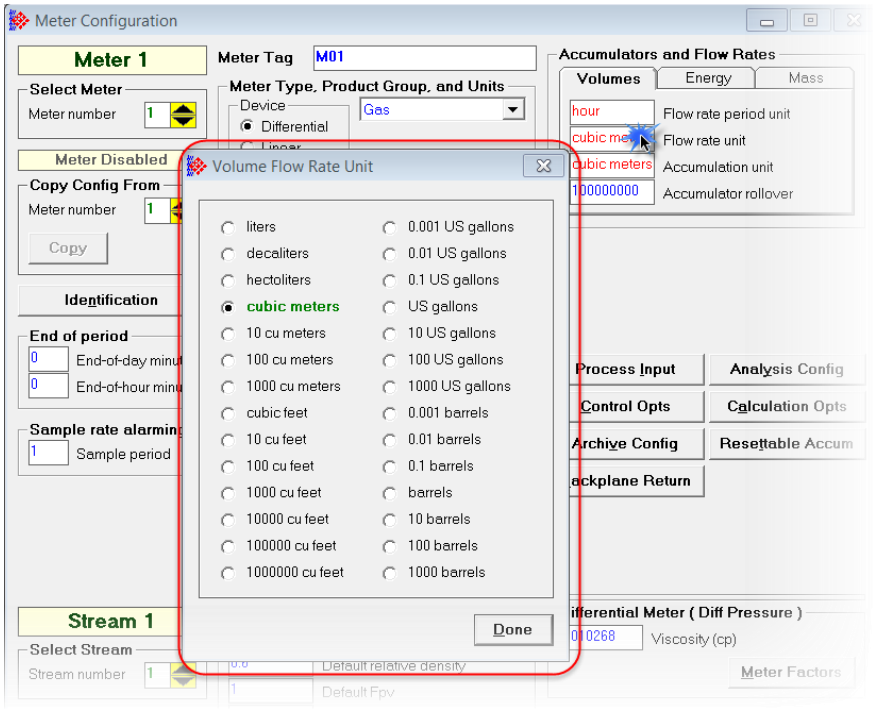
5.3.1 Flow Rate Period Unit

Click on the **FLOW RATE PERIOD UNIT** box to change the flow rate period.



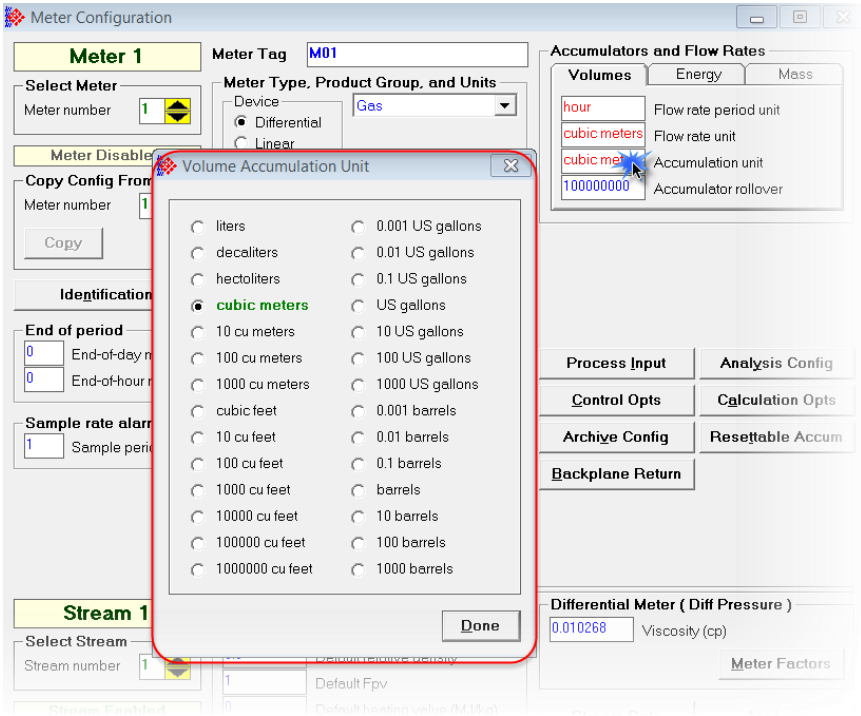
5.3.2 Flow Rate Unit

Click on the **FLOW RATE UNIT** box to change the flow rate unit.



5.3.3 Accumulation Unit

Click on the **ACCUMULATOR UNIT** box to change volume accumulator units.



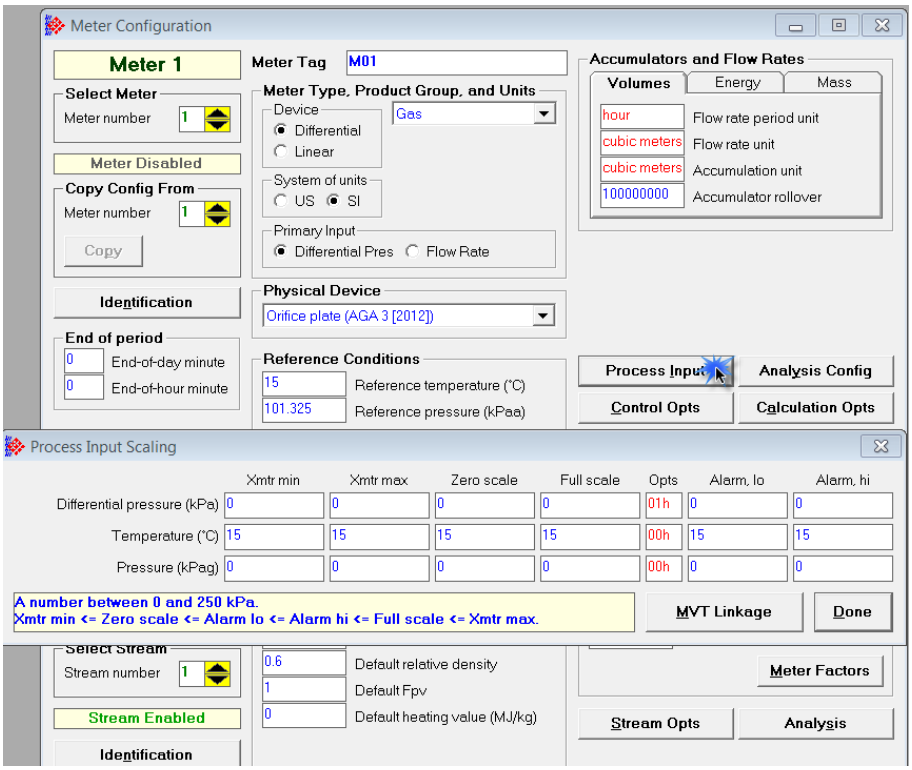
5.3.4 Accumulator Rollover

This is the value when mass accumulators are reset to zero and it 1 greater than the highest value that the accumulator may hold.

A value of 1000000 specifies a 6-digit accumulator that rolls over to 0 from 999999. Any unsigned 32-bit value may be entered. A value of 0 indicates a free-running accumulator, which rolls over to 0 from 4294967295. The default value is 100000000 (8 zeros).

5.4 Configuring Process Input Scaling

Click the **PROCESS INPUT** button to configure the valid input ranges. If input data is not within the configured range, the MVI69E-AFC will flag an alarm on the *Meter Monitor* dialog box (refer to *Meter Monitor* section) and the alarm bit for the meter is set.



The entries available on this dialog box depend on the selected product group, device, and primary input:

Product Group	Input Variables
Gas	Temperature, Pressure, Flow Rate, Differential Pressure, Pulse Frequency
Liquid	Temperature, Pressure, Flow Rate, Differential Pressure, Pulse Frequency, Density, Water Content

5.4.1 Zero Scale

This value is the minimum valid value for the input variable.

5.4.2 Full Scale

This value is the maximum valid value for the input variable.

5.5 Enabling/Disabling the Meter (Control Opts)

When this option is selected, the meter will begin processing calculations. You must disable the meter by unchecking this box before you can change the meter type or product group. You should also disable any meter that is not being used to allow for best possible module performance. After enabling or disabling the meter, click **DONE**, and then click the **WRITE** button in the *Meter Configuration* area. To retrieve the status of a meter, click the **READ** button in the *Meter Configuration* area.

Note: The meter can also be enabled or disabled from ladder logic (refer to the MVI69E-AFC Setup and Configuration Guide).

5.6 Backplane Return

There is at least one backplane function block that is repeatedly and frequently delivered from the processor (PLC) to the module. This is the block delivers process inputs used for measurement.

5.6.1 Process Inputs

The backplane transfer protocol specifies that each function block output by the PLC to the module must elicit a corresponding input function block at the same location in the overblock with the same size. This returned block contains no data (contents are all zero).

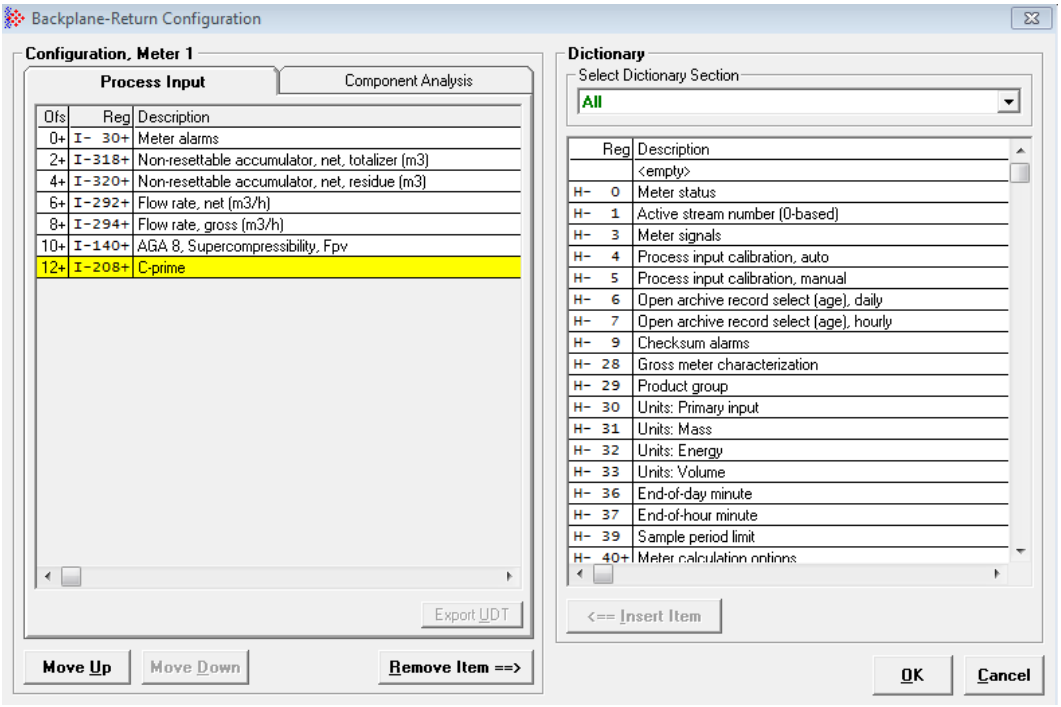
In order to make use of the empty function block, functionality was developed to increase efficiency. The normally empty function block from the module to the PLC now contains selected values that would likely be required by the PLC program on a regular basis. This is done by mapping slots in the input function block to points in the Modbus address space. This process is known as Backplane Return.

5.6.2 Component Analysis Function Block

Another function block that delivers a new component analysis for a gas stream is similar. When required, it is delivered regularly and although output contents are relevant, there are no matching input contents that are meaningful for such an analysis.

The default configuration in the GUI shows the database points that were pre-selected from the process input return and the empty mapping for the analysis return.

This provides you with full functionality for the configuration of both backplane return blocks.



You can select desired values from the Modbus database which the module delivers to the PLC automatically and on a regular basis without having to create and issue a separate backplane transaction, such as Modbus Gateway in order to retrieve those values.

You have the responsibility to re-trigger the analysis function block when the previous one has completed. This makes the behavior semi-automatic (in contrast to Process Input behavior which is fully automatic.

Using the Window

Move files from the Dictionary side of the page to the Process Input or Component Analysis tabs.

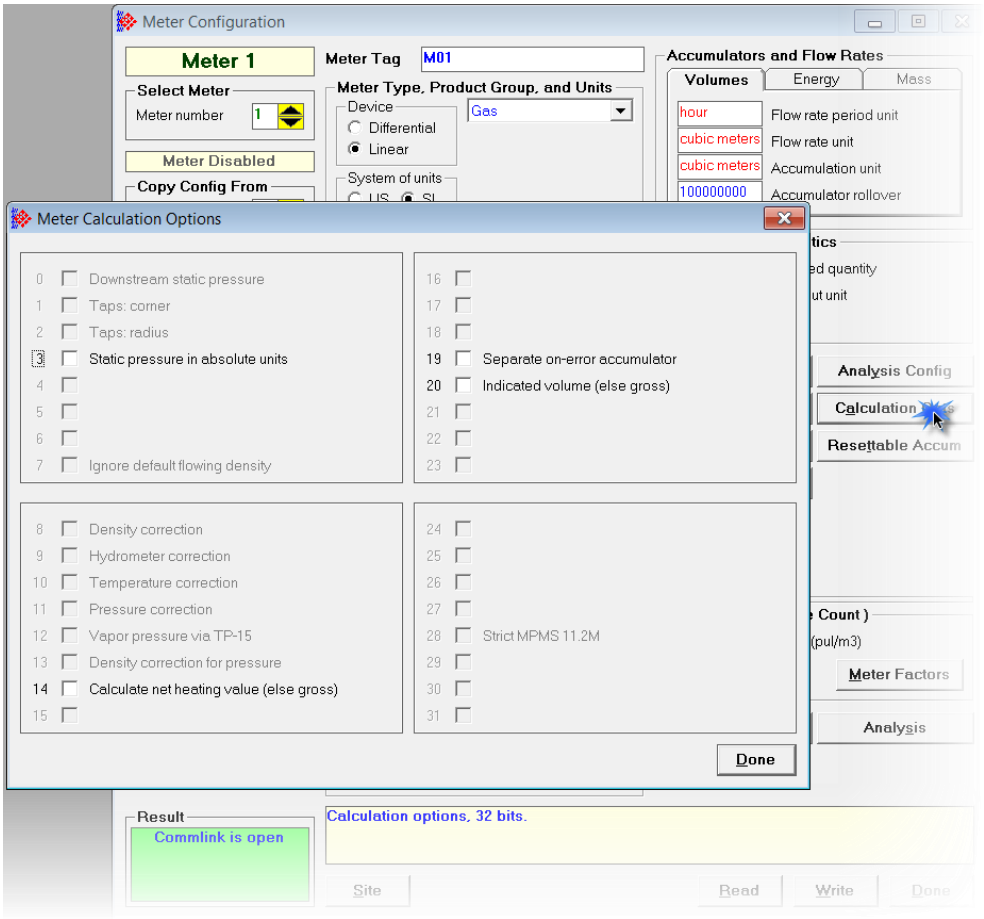
1. Select the file.
2. Click on the *Process Input* or *Component Analysis* tabs.
3. Click the **Insert Item** button.
4. Use the **MOVE UP** or **MOVE DOWN** buttons to move the file up or down in the list.
5. Click **OK**.

If you are moving UDT files, move them from the *Dictionary* to the *Process Input* tab as described for any files.

Click the **UDT EXPORT** button to export the UDT files.

5.7 Configuring Calculation Options

Click on the **CALCULATION OPTS** button to access the *Meter Calculations Options* dialog. Details on each option can be found in the Modbus Dictionary.

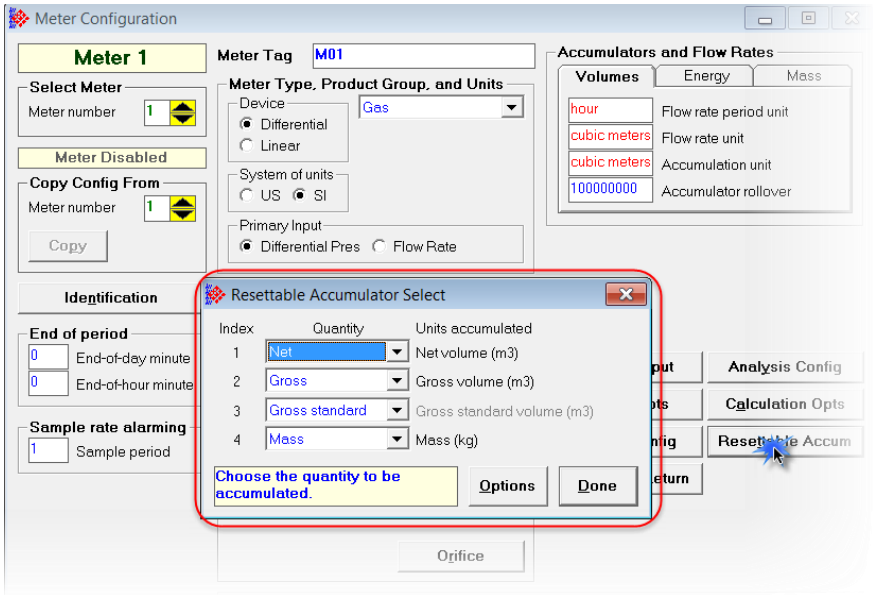


Options that to not apply to the current application are grayed out. See *Calculations Options* in the *MVI69E-AFC Reference Guide* for detailed information.

5.8 Configuring Resettable Accumulators

The module supports a total of 12 accumulators per meter channel divided into categories:

- Non-Resettable Accumulators (6)
- Resettable Accumulators (4)
- Archive Accumulators (2)



Click the **RESETTABLE ACCUM** button.

The accumulator types are independent. For example, resetting a resettable accumulator does not affect the other accumulators.

For multiple-stream firmware, each stream also has a set of ten accumulators (six non-resettable, and four resettable). Increments are applied both to the meter accumulators and to the accumulators for the active stream.

5.8.1 Non-Resettable Accumulators

The non-resettable accumulators are only reset when the accumulator rollover value is reached. The accumulator rollover value, and the accumulator unit must be configured using the EAFC Manager.

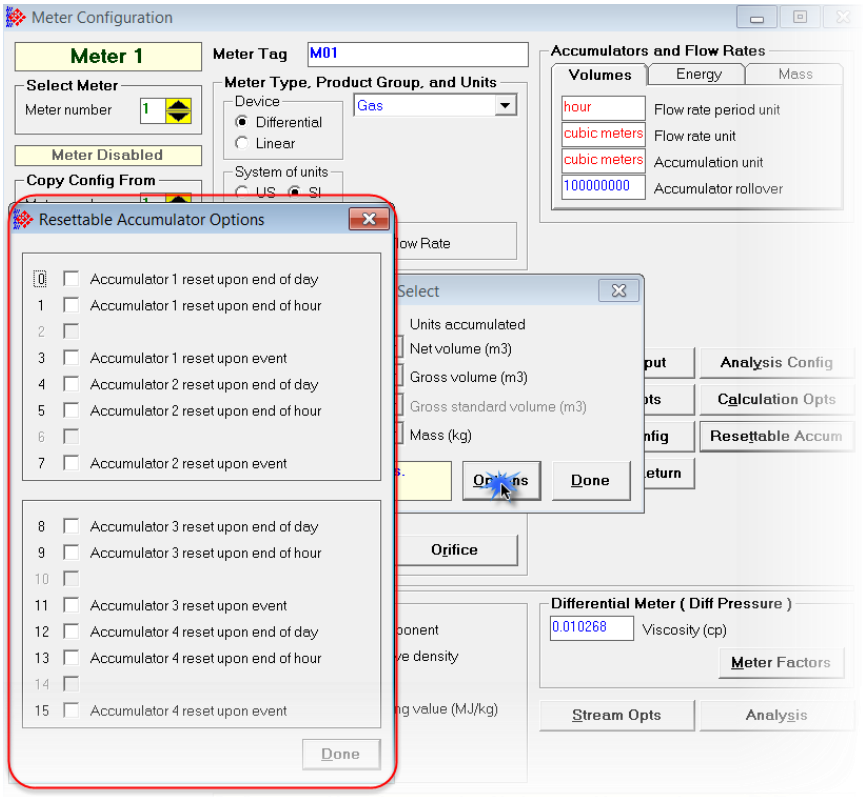
The module supports six non-resettable accumulators in order to show the measure quantity to be totalized.

- Non-resettable accumulator mass
- Non-resettable accumulator energy (Gas applications)
- Non-resettable accumulator net
- Non-resettable accumulator gross
- Non-resettable accumulator gross standard (Liquid apps only). For Oil-water emulsion, this is a non-resettable accumulator for gross clean oil.
- Non-resettable accumulator water (Liquid apps only)

Refer to the *Modbus Dictionary* in EAFC Manager for more information about the Modbus addresses for these registers.

5.8.2 Resettable Accumulators

From the *Resettable Accumulator Select* dialog, click **OPTIONS**.



The resettable accumulators are referred to as:

- Resettable Accumulator 1
- Resettable Accumulator 2
- Resettable Accumulator 3
- Resettable Accumulator 4

Resettable Accumulators are configured from the *Resettable Accumulator Select* dialog box. To open this dialog box, click the **RESETTABLE ACCUM** button on the *Meter Configuration* dialog box.

Each Resettable Accumulator can be configured to represent a different quantity as follows:

Accumulator	Modbus address for accumulator select (Meter-relative)	Default Value
Resettable accumulator 1	126	Net (code 3)
Resettable accumulator 2	127	Gross (code 4)
Resettable accumulator 3	128	Gross Standard (code 5)
Resettable accumulator 4	129	Mass (code 1)

Valid Configuration Codes

The valid codes are:

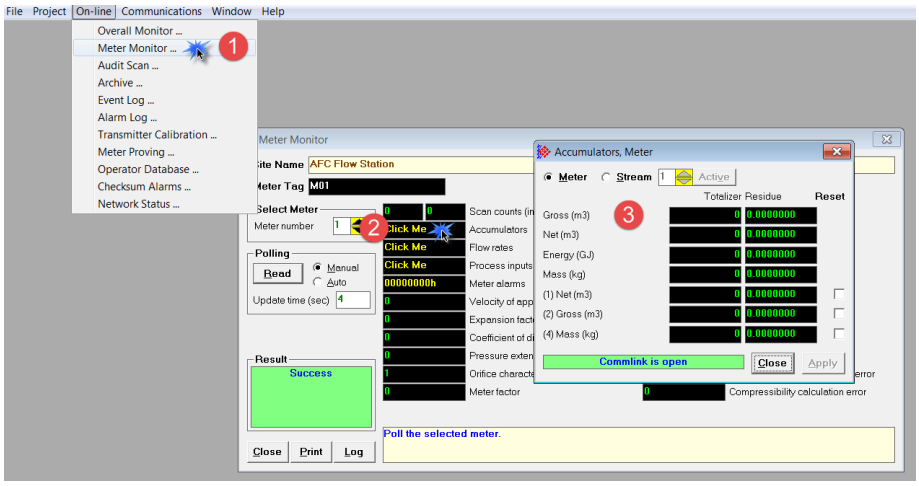
Code	Quantity
0	None
1	Mass
2	Energy (Gas Only)
3	Net
4	Gross
5	Gross Standard (Liquid Only)
6	Water (Liquid Applications Only)

For example, moving a value of 4 to holding register 8126 will configure Meter 1's resettable accumulator 1 as "Gross Volume". Moving "0" to holding register 9128 configures Meter 2's Resettable Accumulator 3 to accumulate nothing (takes it out of service).

The resettable accumulators are reset when one of the following situations occur.

Resetting from EAFC Manager

You may reset any of the resettable accumulators using the EAFC Manager (Meter Monitor):

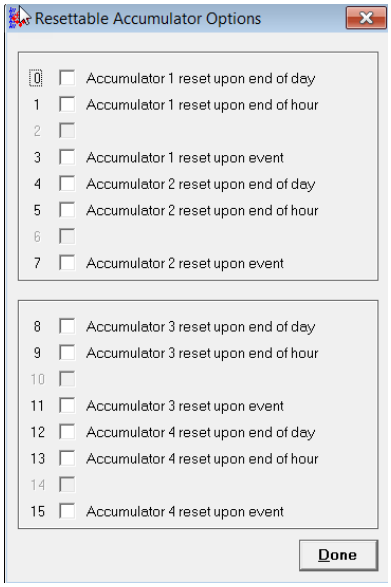


Resetting from Ladder Logic

The ladder logic may send a meter signals block to command one or more resettable accumulators to be reset. This feature is especially important for applications involving field installations that require shipping and/or receiving product batches of predetermined size. Refer to the *Ladder Logic* section for your module type for more information.

Resetting upon Archive Period End or Reset upon Event

Use EAFC Manager to configure the resettable accumulator to be reset when the archive period ends or when an event occurs. Refer to *Event Log* in the MVI69E-AFC *Reference Guide* for more information on configuring and monitoring events.



Resetting when the Accumulator Rollover Value is reached

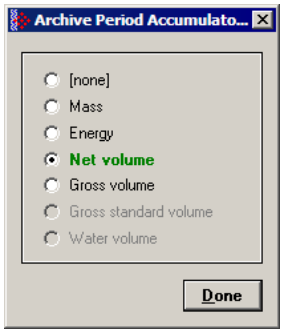
The resettable accumulator is reset when the accumulator rollover value is reached. You must configure the accumulator rollover value using the MVI69E-AFC Manager software (Meter Configuration).

Resetting a resettable accumulator resets that accumulator for both the meter and for all its streams.

Archive Accumulators

The archive accumulators are part of the current archive (archive 0) data. These accumulators are automatically reset when a new archive is generated. Refer to the Modbus Dictionary – *Meter Accumulator* section.

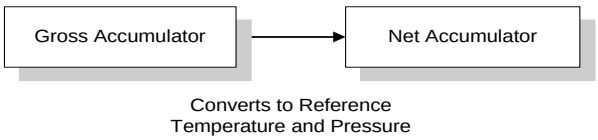
You may configure the accumulator quantity to be used for each archive accumulator using the EAFC Manager (**Meter Configuration > Archive Config > Accumulator Select**):



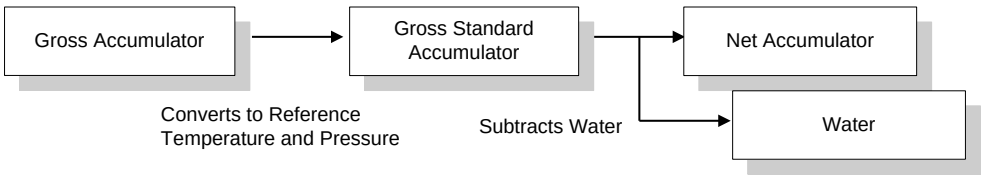
5.8.3 Net Accumulator Calculation

The Net Accumulator Calculation depends on the product group (gas or liquid).

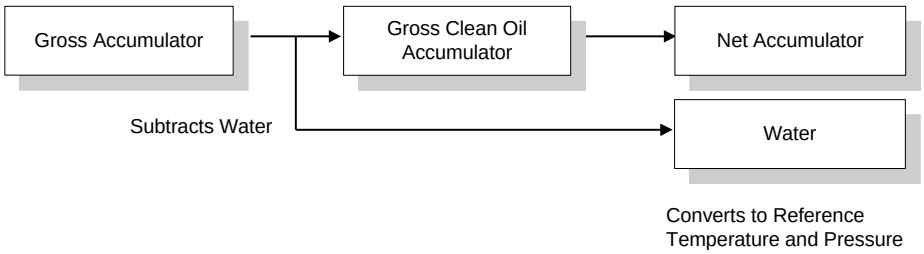
For gas applications, the Net Accumulator is calculated as follows:



For liquid applications (all except Emulsion), the Net Accumulator is calculated as follows:



For liquid applications (Oil-Water Emulsion), the net accumulator is calculated as follows, using API ch 20.1:



5.8.4 Accumulator Totalizer and Residue

The accumulators are expressed as the totalizer and residue parts. This implementation allows the accumulation of a wide range of increments, while keeping a high precision of fractional part with an approximately constant and small round off error.

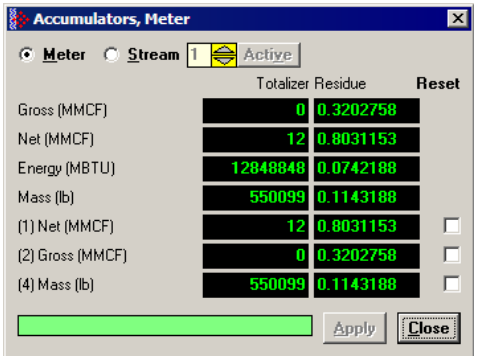
The totalizer stores the integral part of an accumulator as a 32-bit unsigned integer. The residue is the fractional part (always less than 1.0) expressed as a 32-bit IEEE floating point.

The *Total Accumulator* value is given by the formula:

```
ACCUMULATOR = TOTALIZER + RESIDUE
```

Example:

If the meter monitor window shows the following values for the accumulators:



The total resettable accumulator 1 value (net) is 12.8031153.

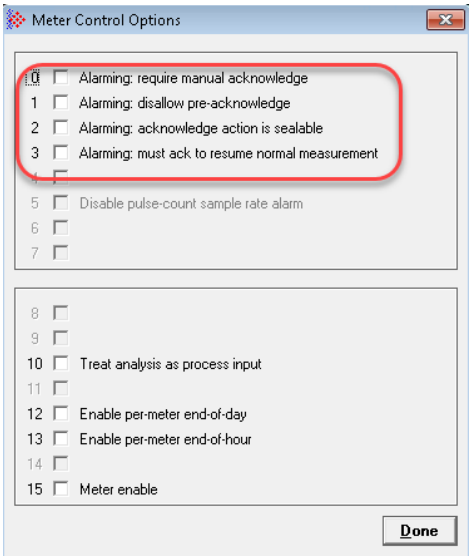
5.9 Meter Factors

See *Configuring Meter Factors.*

5.10 Meter Alarm Control Options

Click **CONTROL OPTIONS** from the *Meter Configuration* page.

Bits 0 through 4 allow you to set up alarm configurations.

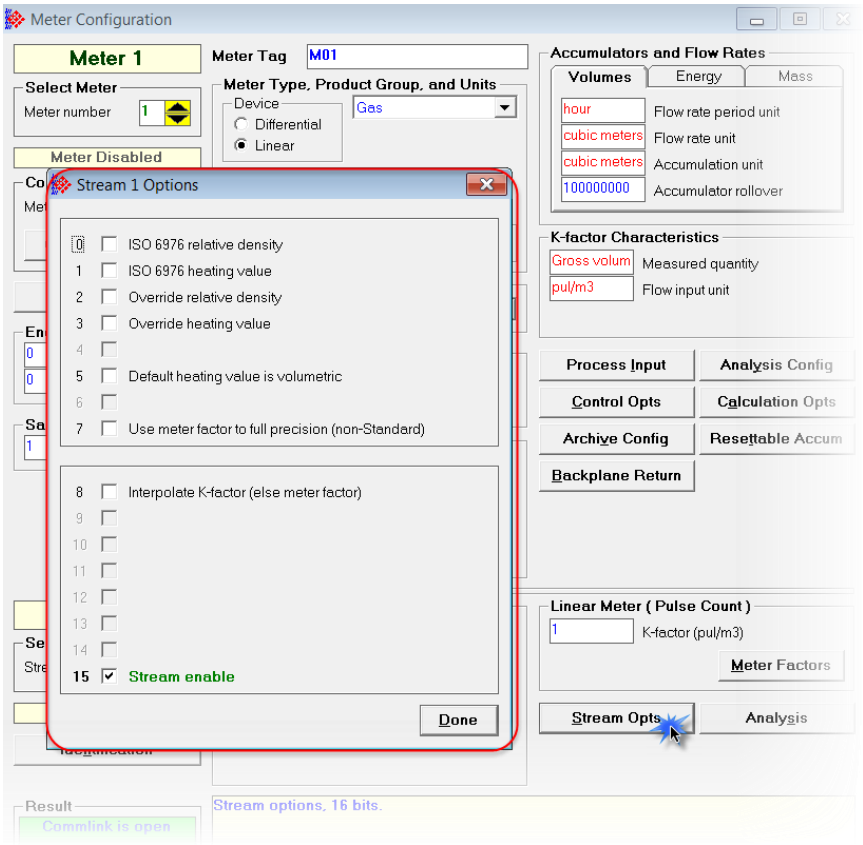


Alarming	Action
Alarming: require manual acknowledge	If set, then any alarm appearing in the Meter Alarms, registers (I-30 through I-37) must be manually acknowledged by writing a “1” bit to the corresponding bit in the “Acknowledgement Required” registers (meter relative), subject to further constraints configured by the other three “Alarming” meter control options (this register, bits 1, 2, and 3). If clear, then any alarm is deemed to be automatically acknowledged at the moment that it occurs: the “Acknowledgement required” bit is never raised, so no “Alarm Acknowledged” record is written to the Alarm Log., and the following three meter control options have no effect. For more information, see the other three “Alarming” meter control alarms, the “Acknowledgement required” registers and the “Meter alarms” registers themselves.
Alarming: Disallow pre-acknowledge	If set, then the acknowledgement of any alarm requires the alarm condition to have been resolved and its corresponding bit in the "Meter alarms" registers to be clear. If clear, then alarm acknowledgement may be performed at any time after the "Acknowledgement required" bit has been raised, even if the alarm condition itself has not yet been resolved and the alarm bit is still set; in this case, the continuing presence of the alarm condition does not cause the "Acknowledgement required" bit to be re-raised, but after the alarm condition has been resolved (and its alarm bit cleared) a recurrence of the alarm will again raise the "Acknowledgement required" bit. If meter control option "Require manual acknowledge" is clear (this register bit 0), then this option is deemed to be clear and has no effect. For more information, see the other three "Alarming" meter control options (this register, bits 0, 2, and 3), the "Acknowledgement required" registers (meter relative), and the "Meter alarms" registers (meter relative).

Alarming	Action
Alarming: Acknowledge action is sealable	If set, then the acknowledgement of any alarm requires that the Weights & Measures switch be in the "unlocked" position. If clear, then alarm acknowledgement requires only that the acknowledging operator have the necessary permission ("Troubleshooting", permission bit 13). If meter control option "Require manual acknowledge" is clear (this register bit 0), then this option is deemed to be clear and has no effect. For more information, see the other three "Alarming" meter control options (this register, bits 0, 1, and 3), the "Acknowledgement required" registers (meter relative), and the "Meter alarms" registers (meter relative).
Alarming: Must Ack to resume normal measurement	If set, then any divergent measurement behavior that occurs consequent to an alarm (e.g. value subsitution, separate accumulation) persists until both the alarm condition has disappeared and the alarm has been acknowledged, at which time normal measurement is resumed. If clear, then normal measurement is resumed when the alarm condition has disappeared, regardless of whether or not the alarm has been acknowledged. This option causes value substitution persistence for only analog process input alarms; the clearing of a pulse count, calculation, or configuration alarm condition always allows resumption of normal counting and/or calculation even if that alarm has not yet been acknowledged. However, this option causes separate accumulation persistence for any alarm that affects calculated quantities, including pulse count failure and calculation alarms. If meter control option "Require manual acknowledge" is clear (this register bit 0), then this option is deemed to be clear and has no effect. For more information, see the other three "Alarming" meter control options (this register, bits 0, 1, and 2), the "Acknowledgement required" registers meter relative), and the "Meter alarms" registers (meter relative).

5.11 Setting Stream Options and Enabling/Disabling Meters

Meters are often used for the measurement of different products at different times. The reasons for doing so include cost and convenience (a pipeline may carry gasoline one day and fuel oil the next) and accounting (a plant may receive product from several different suppliers who must be paid).



A meter always has one active stream which corresponds to the particular product that flows though the meter at that moment.

The active stream may be switched to any enabled stream via a Modbus transaction. Enabling a stream allows it to become active and disabling it prevents it from becoming active. The currently active stream may not be disabled.

As the physical switching of a product stream through a meter is almost always accompanied by additional actions such as the swinging of valves, it is expected that the stream-switching transaction will be issued by the processor, hence to reduce the likelihood of unfortunate errors, the MVI69E-AFC *Manager* provides no specific method for issuing that transaction. Issuing a stream-switch transaction however, is like issuing any other Modbus transaction, which in this case writes the number of the new active stream to the “active stream number” Modbus register, hense in exceptional circumstances it can be issued from anywhere, such as by a SCADA system connected to one of the Modbus ports or by the MVI69E-AFC *Manager* itself via the Modbus Master window.

Parameters whose values may depend on the properties of the product being measured are configured for each stream separately. Such parameters include both those that describe the product directly (e.g. density, viscosity, analysis) and those that describe indirect effects of the product (e.g. meter factor). Measurement calculations always use the parameters for the active stream.

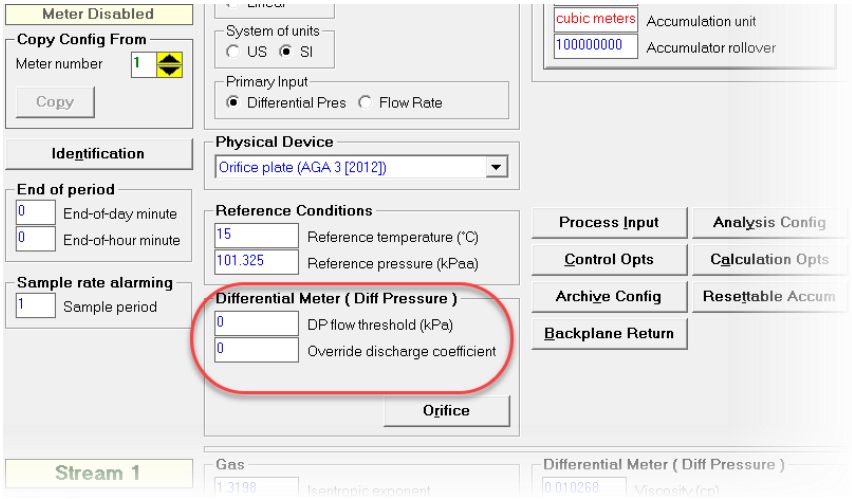
The output of each stream consists of a complete set of accumulators laid out like those of the meter itself. Computed increments are accumulated simultaneously in both the meter accumulators and those of the active stream.

Stream Option	Definition
ISO 6976 relative density	If selected, ISO 6976 is used instead of AGA 8 calculations for relative density.
ISO 6976 heating value	If selected, ISO 6976 is used instead of AGA 8 calculations for heating values.
Override relative density	Use the configured “Default relative density” (for the active stream – Register (meter relative)) for all volumetric calculations, instead of that calculated by AGA 8 at “AGA 8 Relative density at reference” (Register (meter relative)). The relative density actually used in calculations is found at the point “Relative density at reference” ((meter relative)).
Override heating value	Use the configured “Default heating value” (for the active stream, register H-8630) for all energy calculations, instead of the three calculated by AGA 8 starting at “AGA 8 Molar heating value” (meter relative). The heating values actually used in the calculations are found in the three points starting at “Molar heating value”.
Default heating value is volumetric	If this option is set, then the point “Default heating value” is configured in volumetric units (energy per volume at reference conditions); if clear, then the point is considered in mass units (energy per mass).
Use meter factor to full precision (non-Standard)	If "Use meter factor to full precision" is clear, the Meter Factor is rounded to four decimal places before being used to calculate gross volume (gross = pulses / KF * MF). If the option is set, the MF is used as is without rounding. Rounding applies only to the meter factor; the K-factor is always used to its full precision.
Interpolate K-factor	This option bit swaps the roles of K-factor and meter factor, so that when this option is selected, the "K-factor" entry becomes "Meter factor" and the "Meter Factor Linearization" table becomes "K-factor Linearization".

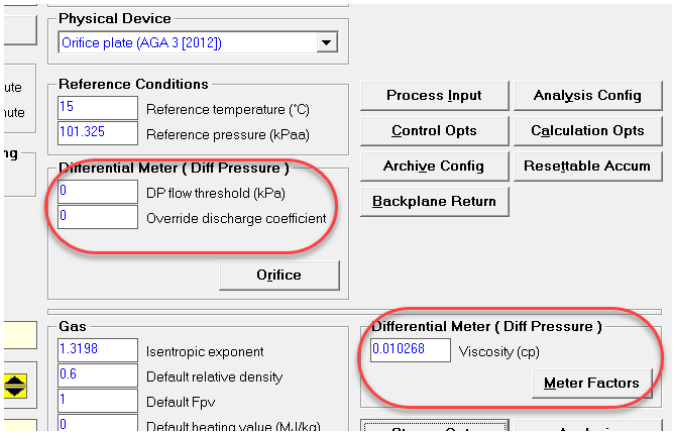
Stream Option	Definition
	The calculations described up to this point are those recommended by API and performed by the vast majority of users of linear meters. Some users, however, may prefer to keep the meter factor at exactly 1.0000 and periodically adjust the K-factor with a meter prove; and then the K-factor may depend on the flow rate.
Stream Enable	Select (check) to enable the current stream. Unselect (uncheck) to disable the current stream. A disabled stream cannot be made active. When downloading the configuration to the module, this option is silently forced for the active stream.

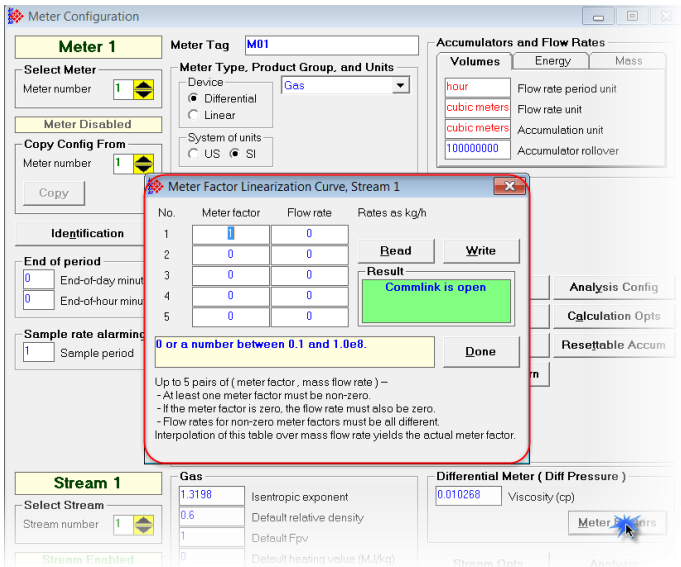
6 Configuring Differential Meter Parameters

If you select *Differential Meter* as the Meter Type, you will select either *Differential Pressure* or *Flow Rate* as the Primary input.

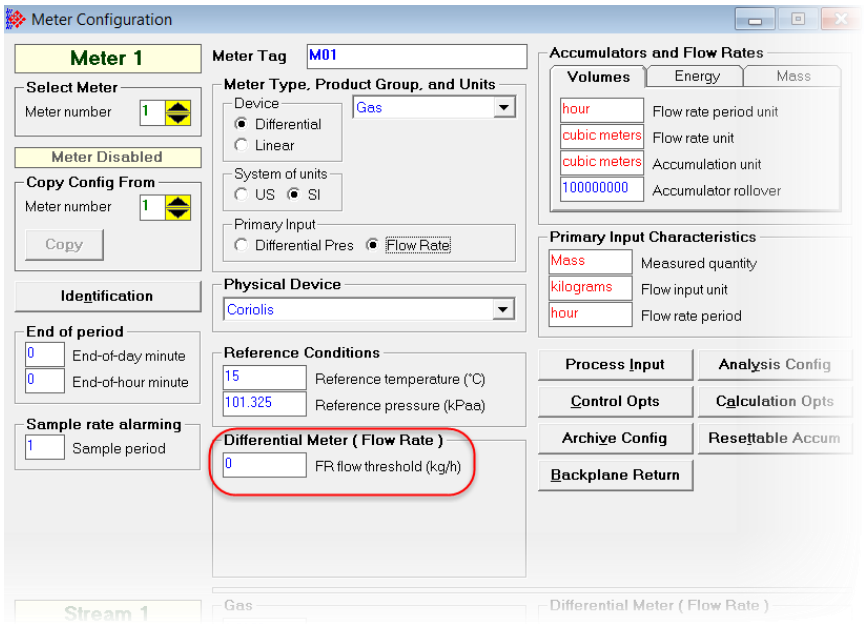


If you select *Differential Pressure* as the Primary Input, you must configure the following parameters:



Parameter	Description
DP Flow Threshold	If at any time the differential pressure input value is less than the DP Flow Threshold parameter, the module will treat the differential pressure as zero (no flow).
Override discharge coefficient	For an Orifice meter, AGA3 dictates the calculation of the "Coefficient of Discharge", a multiplicative factor used in calculating the flow rate. For a V-cone meter, there is no corresponding calculation, so the Coefficient of Discharge must be entered from the manufacturer's data sheet. The "V-Cone Discharge Coefficient" has no meaning unless the "V-Cone Device" option is selected (see Calculation Options button).
Viscosity	The viscosity of the fluid, used only in the calculation of the meter's coefficient of discharge. For this product group, the default value for this point is the viscosity recommended by AGA 3 for natural gas fluids, 0.010268. For liquid fluids, a more representative value should be chosen.
Meter Factors	Displays the Meter Factor Linearization Curve for this stream. 

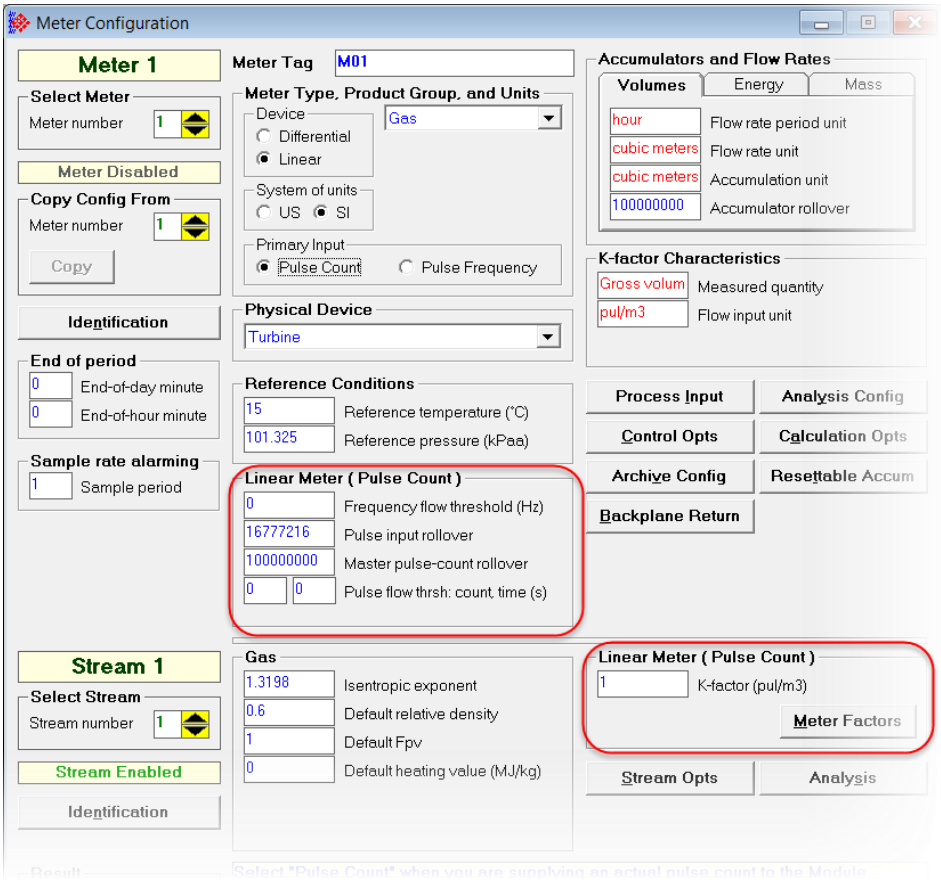
If you select *Flow Rate* as the primary input, you must configure the following parameter:



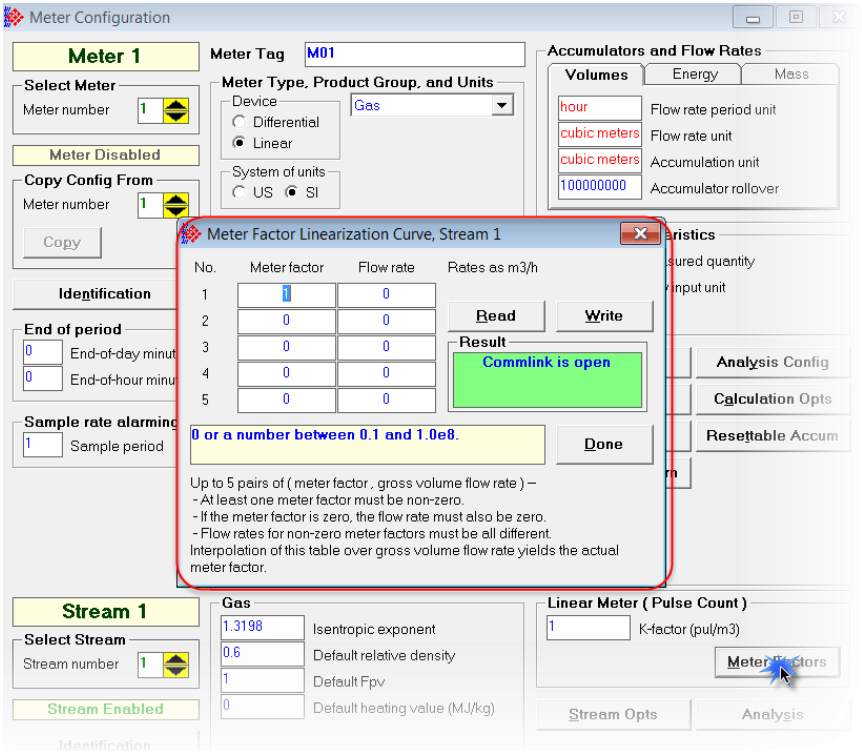
FR Flow Threshold – If at any time, the flow rate value is less than the FR Flow Threshold parameter, the module will treat the flow rate as zero (no flow).

7 Configuring Linear Meter Pulse Count Options

If you select *Linear Meter* with Pulse count as the main Input parameter, you must configure the following parameters:

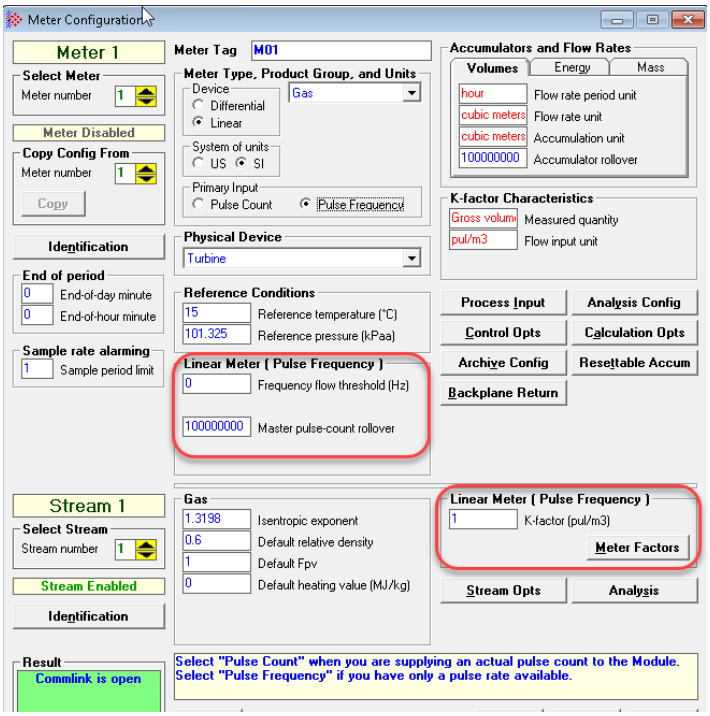


Parameter	Description
Frequency flow threshold	This is the threshold value for pulse frequency. If the received value is less than the configured threshold, it is deemed to be zero.
Pulse input rollover	When the meter is selected as a Pulse Meter, one of the input variables transferred from the programmable logic controller is Pulse Count value. This is the number of pulses transferred from the Pulse Meter or the High Speed Counter module. This parameter sets the value at which the pulse count will rollover to zero. It is essential that this value match the actual pulse rollover used in the field by the pulse meter or counter module, otherwise the flow calculation will generate unexpected values. Enter this value as (maximum value)+1.
Master pulse-count rollover	This is a value that is 1 greater than the highest value that master pulse counters will contain. Enter 0 for free-running counters which rollover to 0 from 4294967295.
Pulse flow threshold; count, time (s)	The first field should be 0 or a number between 2 and 20. The default is0. The second field should be 0 or a number between 5 and 60 in seconds. The default is 0.
K-factor (pul/m3)	A number between 0.1 and 1.0e+8. The default is 1.0. Units show is the setting of “Flow input unit” of the “K-factor Characteristics” panel shown in the previous screen example.
Meter Factors	Click the **Meter Factors** button to display the *Meter Factor Linearization Curve* for this stream. See above.



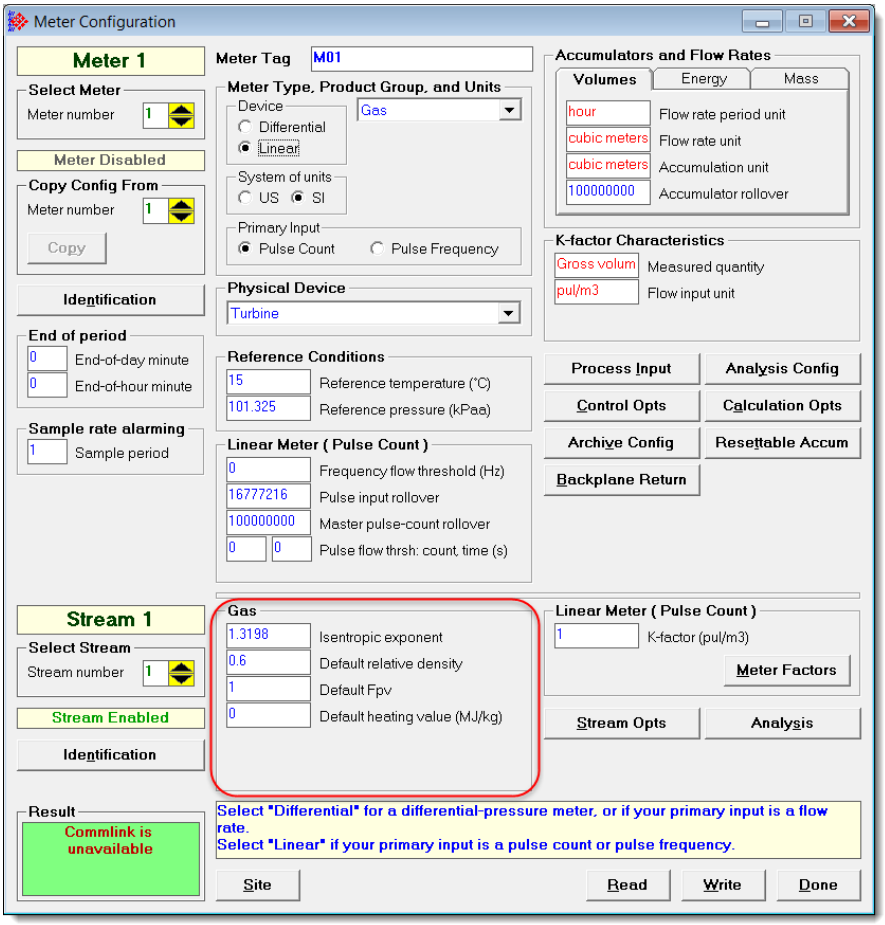
8 Configuring Linear Meter Pulse Frequency Options

If you are configuring a *Linear Meter* with the main input as *Pulse Frequency*, you must configure the following parameters:

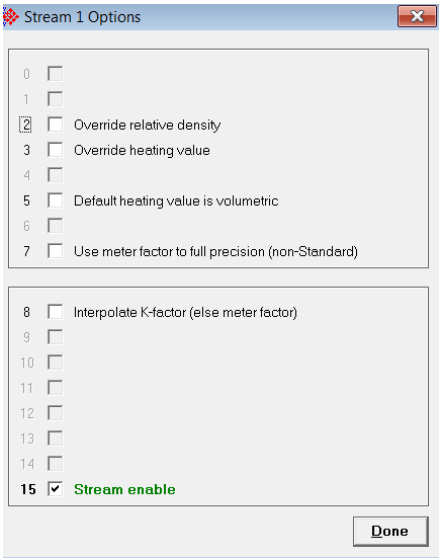
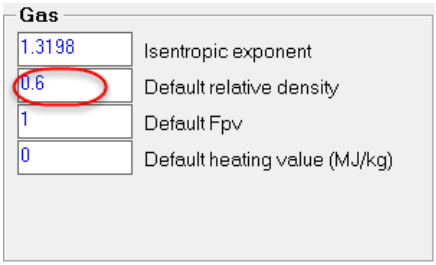


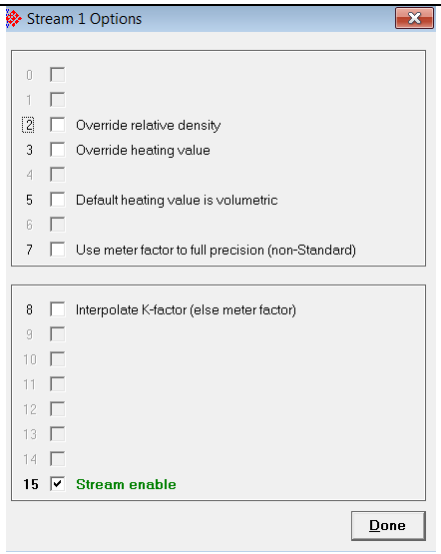
Parameter	Description
Frequency Flow Threshold	This is the threshold value for pulse frequency. Values can range between 0 and 1.0e+06 Hz. The default is 0.0.
Master pulse-count rollover	This is a value that is 1 greater than the highest value that master frequency counters will contain. Enter 0 for free-running counters which rollover to 0 from 4294967295.
K-factor (pul/m3)	This is the expected number of pulses expected per unit of fluid passing through a flow meter. Values can range between 0.1 and 1.0e+8. The default is 1.0. Units shown is the setting of *Flow input unit* of the *K-factor Characteristics* panel above.
Meter Factors	Click the **Meter Factors** button to display the *Meter Linearization Curve* setting for this stream.

9 Configuring Gas Parameters

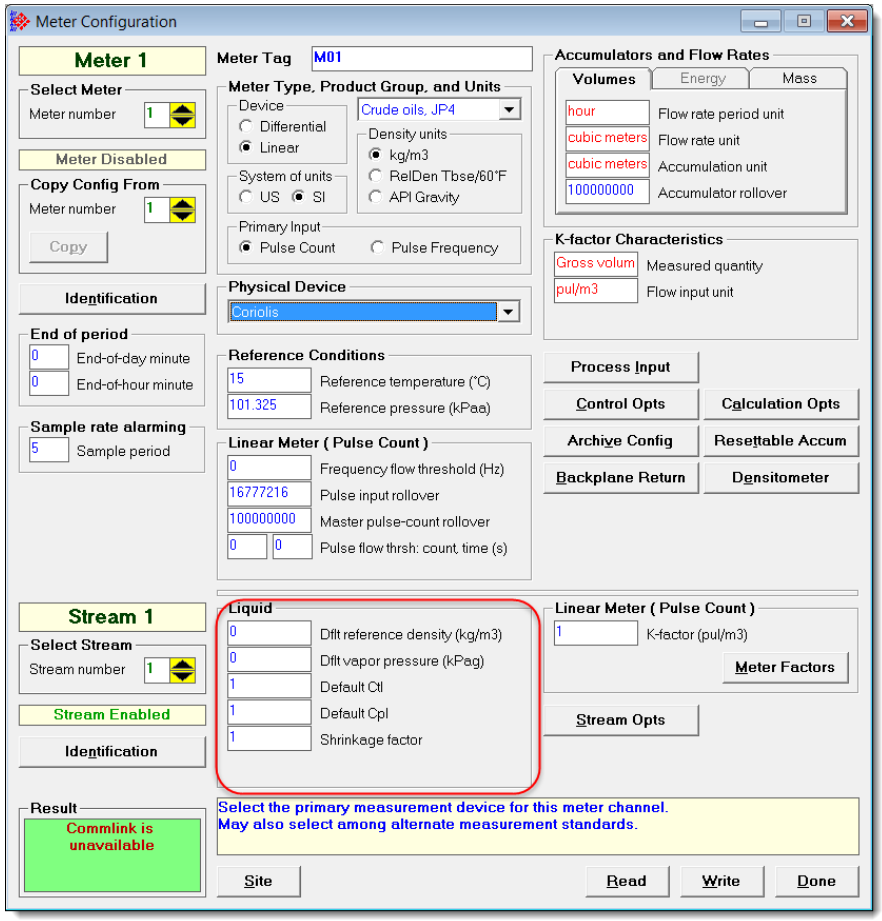


Parameter	Description
Isentropic exponent	The ratio of (specific heat and constant pressure) to (specific heat at constant volume).
Default relative density	Normally, the MVI69E-AFC uses the *Detail Characterization Method* of the AGA 8 standard to calculate the density of the gas from its composition as given by the molar analysis. The density is used in all subsequent calculations. When AGA 8 cannot be applied because no analysis is available (no components selected, or analysis is all zero), then this value supplies the density at reference conditions (relative to the density of air at reference conditions) to be submitted for the output of AGA 8.

Parameter	Description
	A user can override the default relative density value. In order to do so, you must enable the override. Click the **Stream Options** button to open the *Stream x Options* dialog.  Check the **Override relative density** box, then click **Done**. You can now change the default relative density value. 
Default Fpv	Normally, the MVI69E-AFC uses the *Detail Characterization Method* of the AGA 8 standard to calculate the compressibilities of the gas from its composition as given by the molar analysis. The compressibilities are used in all subsequent calculations. When AGA 8 cannot be applied because no analysis is available (no components selected, or analysis is all zero), then this value supplies the supercompressibility (which combines the effects of the compressibility at both reference and operating conditions) to be substituted for the output of AGA 8.
Default heating value (MBTU/lb or MBTU/cf))	Typically, the AFC uses the *Detail Characterization Method* of the AGA 8 standard to calculate the heating value of the gas from its composition as given by the molar analysis. The heating value is used in all subsequent calculations. When AGA 8 cannot be applied because no analysis is available (no components selected, or analysis is all zero), then this value supplies the mass heating value to be substituted for the output of AGA 8. Units shown depend on the **System of Units** selected in the *Meter Type*, *Product Group*, and *Units* panel. A user can override the default heating value. In order to do so, you must enable the override. Click the **Stream Options** button to open the *Stream x Options* dialog.

Parameter	Description
	 Check the **Override heating value** box, then click **Done**. You can now change the default relative density value. If you check **Default heating value is volumetric**, the output value is indicated as volume versus mass.

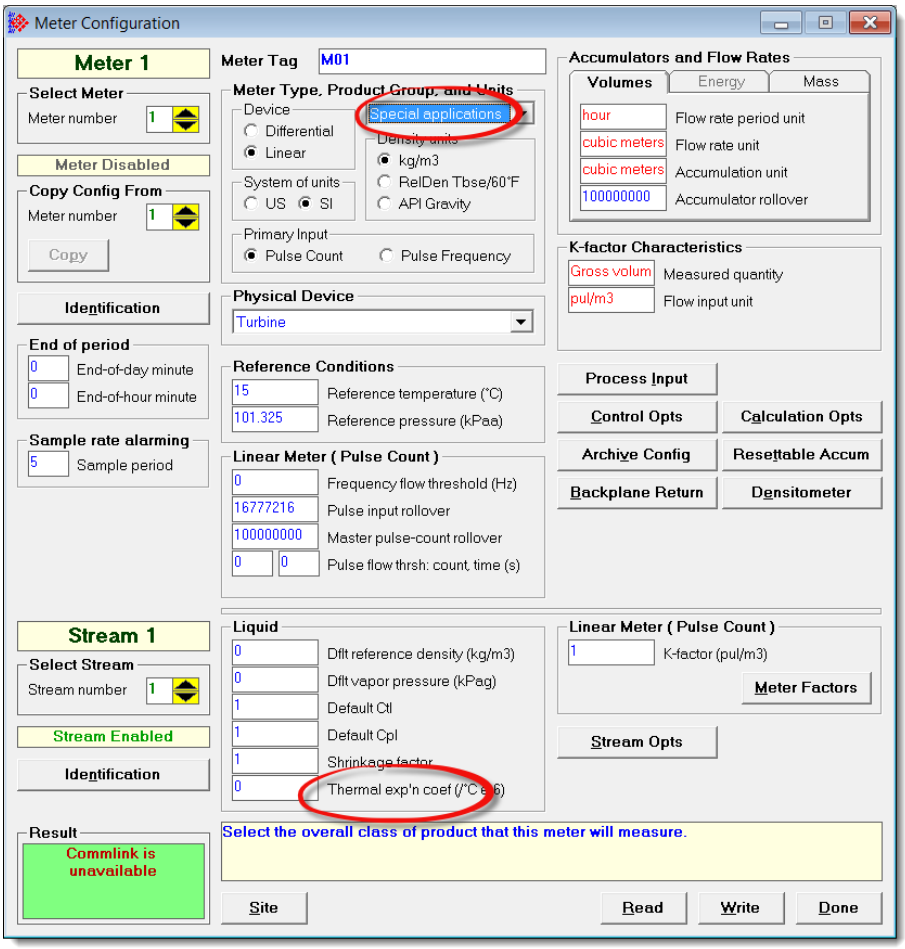
10 Configuring Liquid Parameters



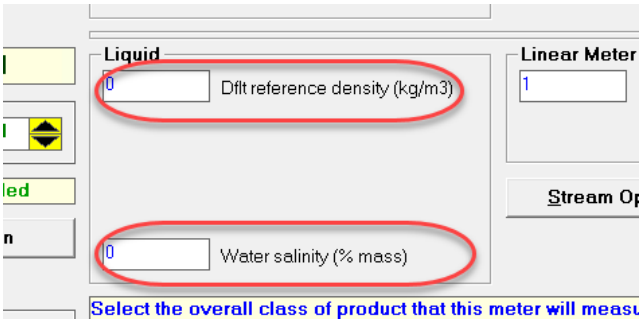
This area is visible when the product group is set to a liquid group. Enter the values for *Default Reference Density, Vapor Pressure, Default Ctl, Default Cpl* and *Shrinkage factor*.

Units shown depend on settings selected in the *Meter Type, Product Group*, and *Units* pane.

If the *Product Group* is set to **Special applications**, the **Thermal exp'n coef (/°C e-6)** parameter is visible.



If the *Product Group* is set to **Oil-wtr emulsions (Crd)**, **Oil-wtr emulsions (NGL)**, all parameters are visible and **Water density @ 60°F (kg/m3)** is added. If the *Product Group* is set to **Produced/injected water**, the **Water Salinity (% mass)** parameter, along with the **Dflt reference density (°API)** are the only two parameters available.

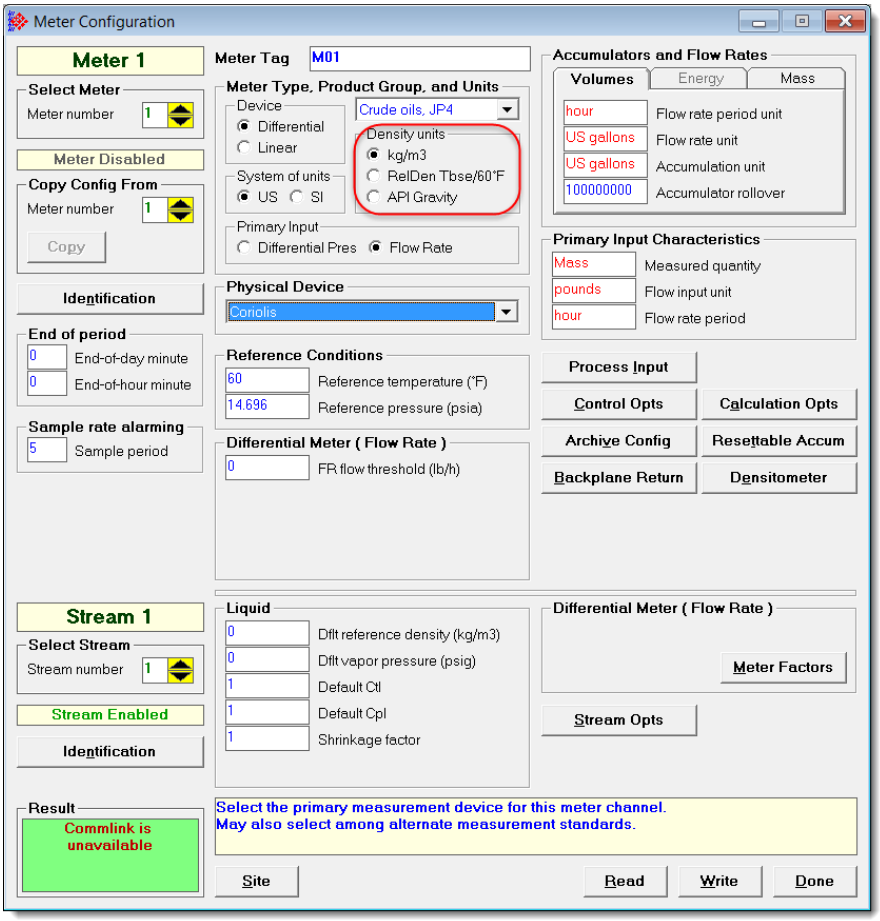


The following parameters describe all requirements for the calculations:

Parameter	Low Limit	High Limit	Default
Dflt Reference Density	0 kg/m^3 0 Rd60 -60.75°API	2000 kg/m^3 2.0 Rd60 320°API	0
Default Vapor Pressure	0	100,000 kPa (14,000 psi)	0
Default Ctl	0.5	2.0	1
Default Cpl	0.5	2.0	1
Shrinkage factor	0	1.0	1
Water Salinity (% mass)	0	36.25	0
Thermal exp'n coef (/°C e-6)	414	1674	0

Tip: To see the limits and defaults for each parameter, view the blue text in the *Note* box when you click in the entry text box.

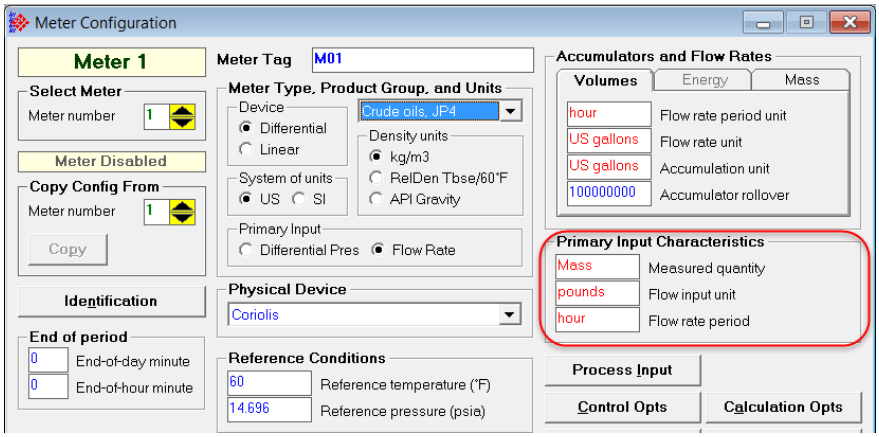
11 Configuring Density Units



Liquid density units may be expressed as:

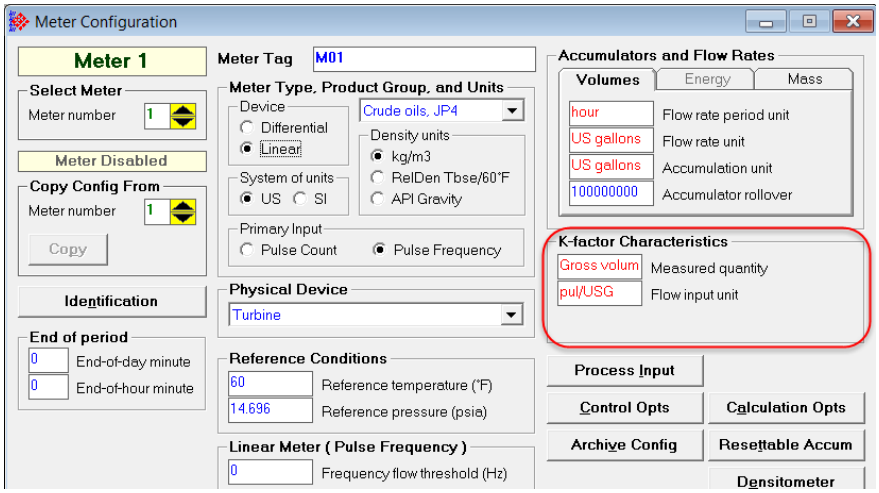
- Density is in kg/m^3
- Relative density Tbse/60ºF
- API gravity

12 Configuring Primary Input Characteristics



Parameter	Description
Primary Input Measured quantity	This value specifies the physical property of the fluid that is measured directly or indirectly by the primary input. • Mass • Energy (heating value) • Gross volume (volume at operating conditions) For some meter types (notably a traditional orifice) this value is fixed and cannot be changed. For a linear (pulse) meter it characterizes the K-factor. For a traditional pulse meter such as a turbine, this quantity is Gross Volume.
Flow input unit	This value specifies the engineering units base and scaling of the measured quantity selected for the primary input. For some meter types, for example a traditional orifice, this value is fixed and cannot be changed. For a linear (pulse) meter, it specifies K-Factor characteristics.
Flow Rate Period	This value specifies the time period to which the primary input flow rate is referenced. • Second • Minute • Hour • Day For all meter types except flow rate integration, this value is fixed and cannot be changed.

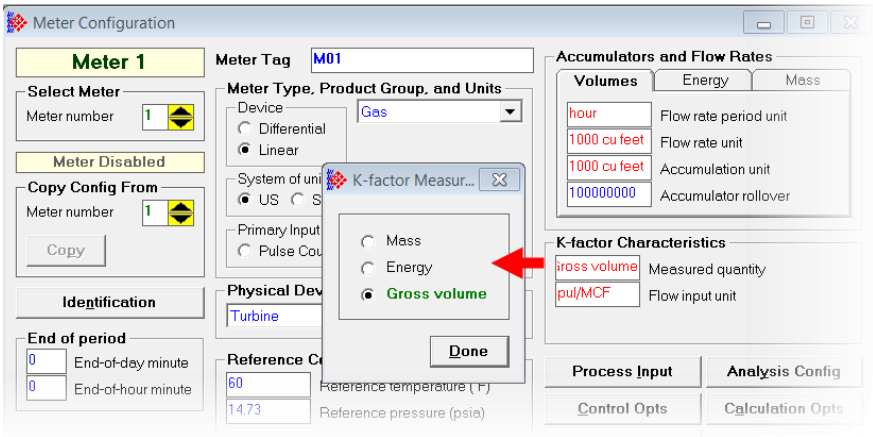
13 Configuring K-factor Characteristics

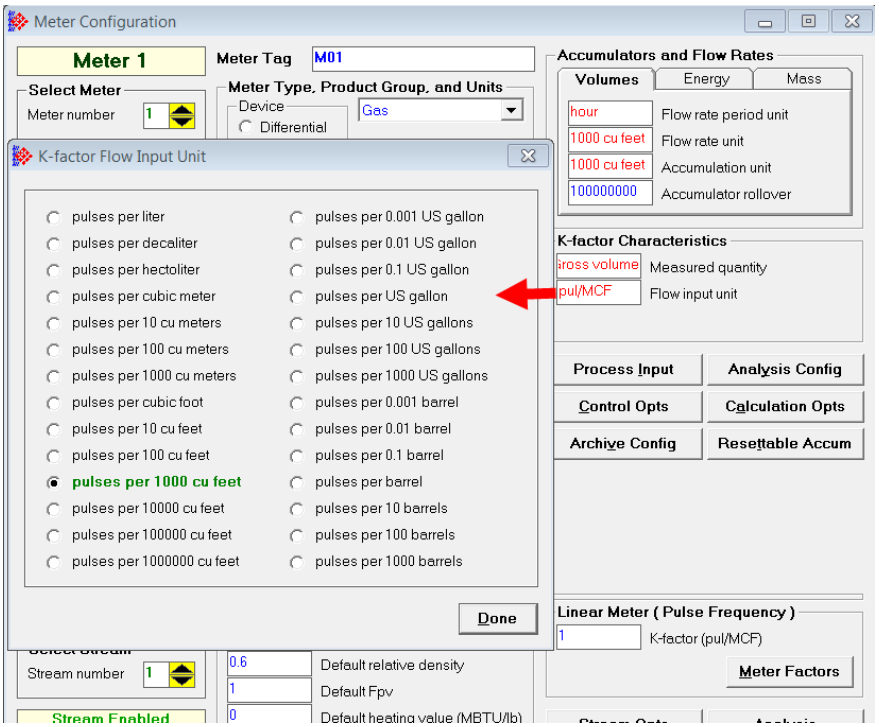


This area is visible when the meter type is Linear.

Click the *Measured quantity* and *Flow input unit* fields to choose the quantity type and Flow input unit for this meter.

The K-factor itself is entered as a stream parameter.





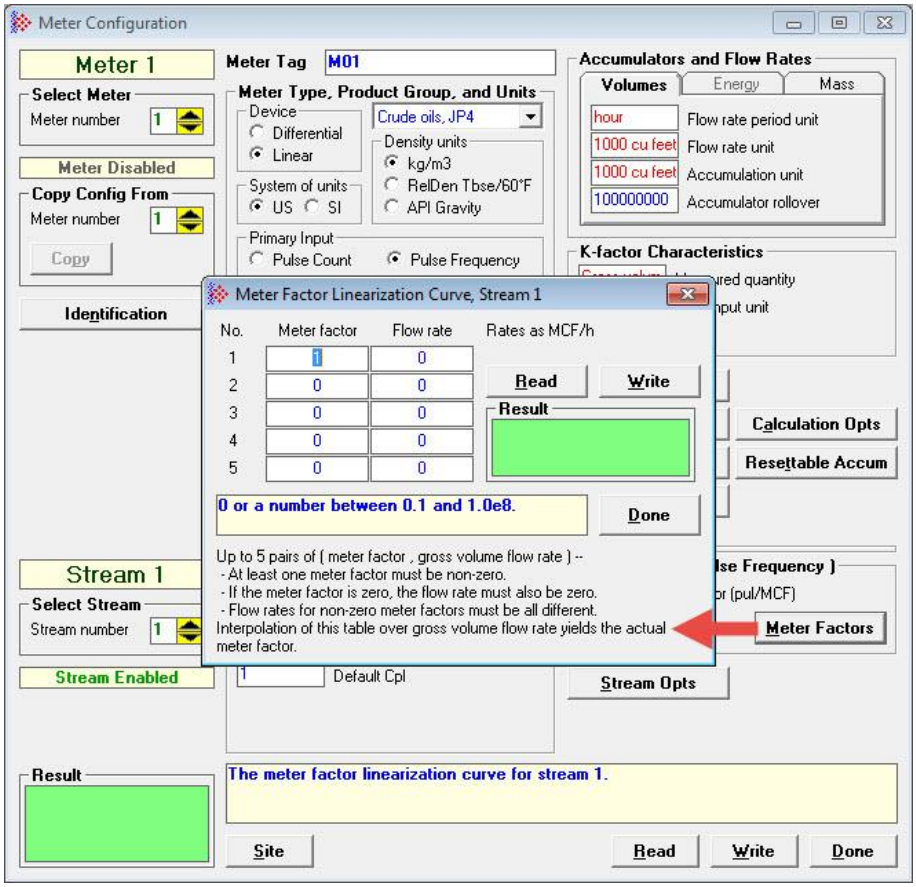
The K-factor units available for selection will depend on the selected measured quantity.

For a linear (pulse) meter:

```
gross volume = (pulses/K-factor) x meter factor
```

The K-factor is a factor that converts raw pulse count (from the Pulse Meter) to a volume and is expressed as *Pulses per unit volume*, such as "1000 pulses per gallon" or "3578.224 pulses per cubic meter". This number, found on the manufacturer's data sheet for the meter, is determined at the factory for the specific unit before shipping. So, dividing "pulses" by "pulses per gallon" gives you "gallons". API calls the value "*pulses / K-factor" as "indicated volume"*.

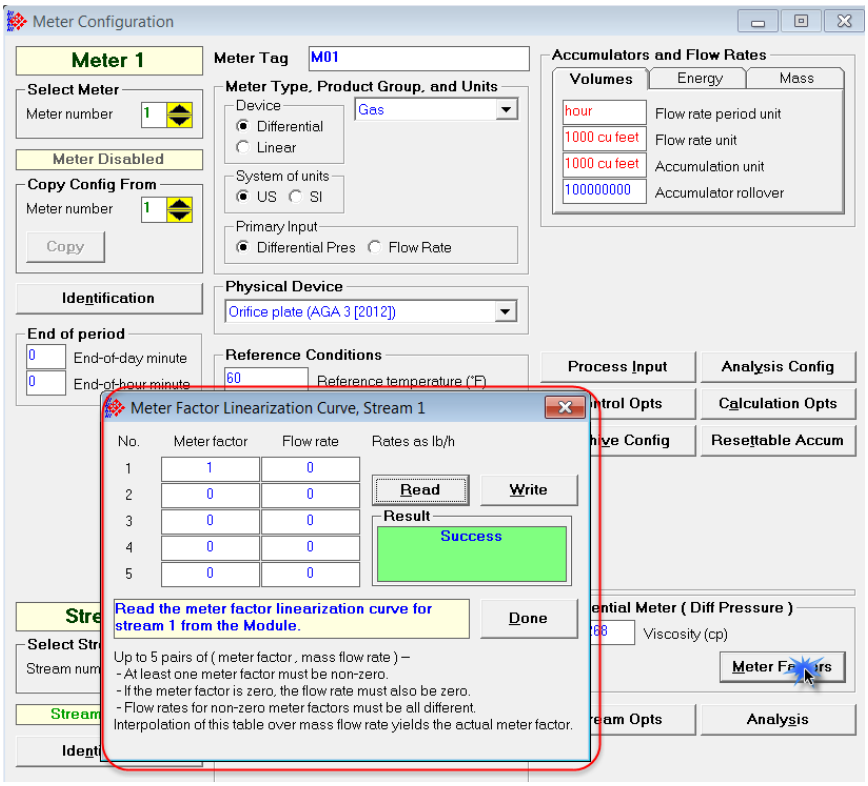
14 Configuring Meter Factors



Meters may begin to wear out over time and the actual measured volume (the "gross volume") will tend to drift from the nominal measured volume (the "indicated volume"). The factor that corrects "indicated" to "gross" is called the "meter factor", and is a number very close to 1. The procedure that is performed periodically to determine a (new) meter factor is called "proving". A pulse type meter is "proved" periodically to ensure that the meter performs as expected over a period of time.

A prover passes a known volume of product through the meter and compares the volume indicated by the meter against the fixed volume of the prover (measured with a high degree of precision). If the meter indicates the measured volume to be exactly the same as the known prover volume, the Meter Factor is said to be equal to 1.00000 (*Meter Factor = Prover Volume/Metered Volume*).

A meter's behavior may differ depending on the rate of flow through the meter. That is, the meter factor may depend on the flow rate at which the measurement is performed. The EAFC Manager accommodates this by allowing you to enter up to 5 factor-flowrate pairs (the "Meter Factor Linearization" table); the MVI69E-AFC determines the meter factor to be used by linear interpolation on this table from flow rate at operating conditions (Since flow rate depends on the meter factor according to API, but meter factor depends on flow rate according to the linearization table, the MVI69E-AFC performs a second iteration of the interpolation in order to obtain an accurate meter factor).

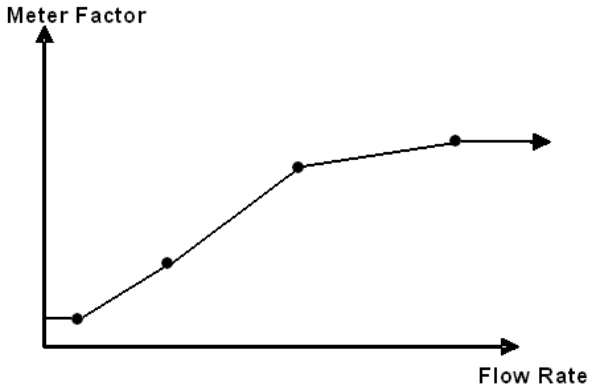


In the *Meter Factor Linearization Curve* dialog box, click the **READ** button to transfer the current Meter Factor Linearization configuration from the MVI69E-AFC to the local PC.

When the Meter Factor Linearization configuration is concluded, click the **WRITE** button to transfer it to the MVI69E-AFC.

The module will use the values you entered in the *Meter Factor Linearization Curve* dialog box and interpolate the values so it can use a specific meter factor depending on the current flow rate.

For example, if you enter four points (flow rate, meter factor) the module would interpolate the points as shown below:



In order for the module to accept the values you entered, the following conditions are required:

- All values are non-negative (≥ 0.0).
- At least one meter factor is non-zero.
- If a meter factor is zero, the corresponding flow rate is also zero.
- The flow rates corresponding to non-zero meter factors are all different.

You do not need to enter factor-flowrate pairs in any particular order, or even enter them all as a contiguous group, but you may enter each factor-flowrate pair into any of the five table entries and the MVI69E-AFC will sort it all out.

If you do not want to enter meter factor linearization data, then populate only one entry (e.g., the first) leaving the other four empty (all zero). In this case, the flow rate value does not matter and the single meter factor applies to all flow rates. The EAFC Manager's initial default table is populated in this way with a meter factor of 1.

15 Installing the Module in the Rack

If you have not already installed and configured your processor and power supply, please do so before installing the MVI69E-AFC. Refer to the processor documentation for installation instructions.

Warning: You must follow all safety instructions when installing this or any other electronic devices. Failure to follow safety procedures could result in damage to hardware or data, or even serious injury or death to personnel. Refer to the documentation for each device you plan to connect to verify that suitable safety procedures are in place before installing or servicing the device.

After you have checked the placement of the jumpers, insert the MVI69E-AFC into the rack. Use the same technique recommended by the processor manufacturer to remove and install MVI69E-AFC modules.

Warning: When you insert or remove the module while backplane power is on, an electrical arc can occur. This could cause an explosion in hazardous location installations. Verify that power is removed or the area is non-hazardous before proceeding. Repeated electrical arcing causes excessive wear to contacts on both the module and its mating connector. Worn contacts may create electrical resistance that can affect module operation.

Note: If you insert the module improperly, the system may stop working, or may behave unpredictably.

15.1 Module Initialization

When the module is powered up for the first time, both the **OK** and **ERR** NVRAM LEDs are illuminated. This indicates that the module is in the *Cold Start* state and is not yet ready to perform calculations. The following steps initialize the module:

- Configure Site Parameters
- Enable at least one meter
- Set the processor to RUN mode

After these three steps are accomplished, the state is changed from *Cold Start* to *Released*. This indicates that that module is ready to perform flow calculations. When in the *Released* state, the **OK** LED is ON and the **ERR** LED is off.

When the module is ready, you will use EAFC Manager to monitor meter operation, archives, and events.

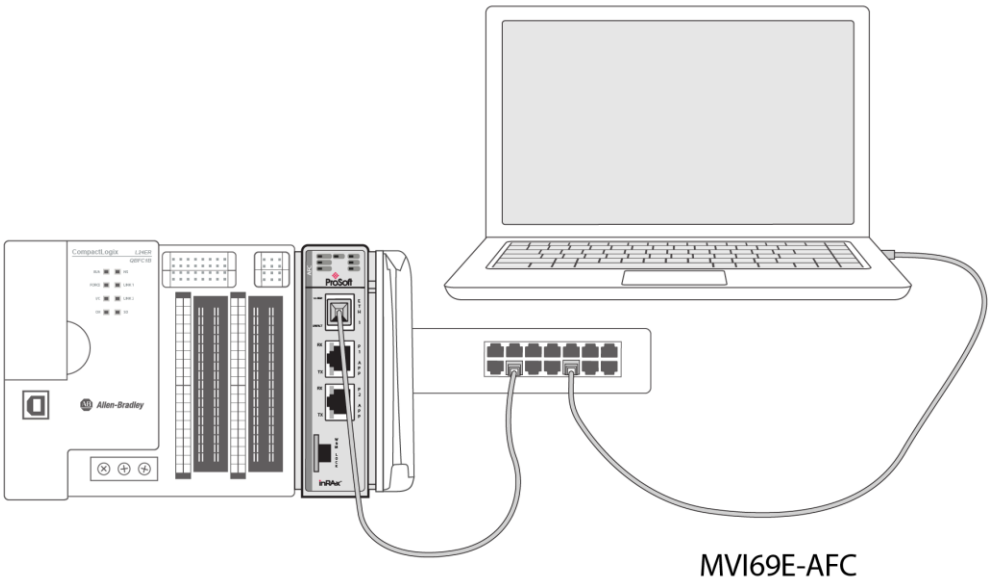
16 Connecting the MVI69E-AFC Module to the EAFC Manager

There are two ways to connect EAFC Manager (running on a PC) to the MVI69E-AFC; Ethernet or Serial. The top port (eth0) is used to create Ethernet connections. Serial 1 and Serial 2 are both available for serial connections.

You will need the correct cables to connect the MVI69E-AFC to the computer running EAFC Manager. The null-modem cable as well as any required adapter cables are included in the box with the module.

Ethernet Connection

Connect one end of an Ethernet cable to the Ethernet port on the module.



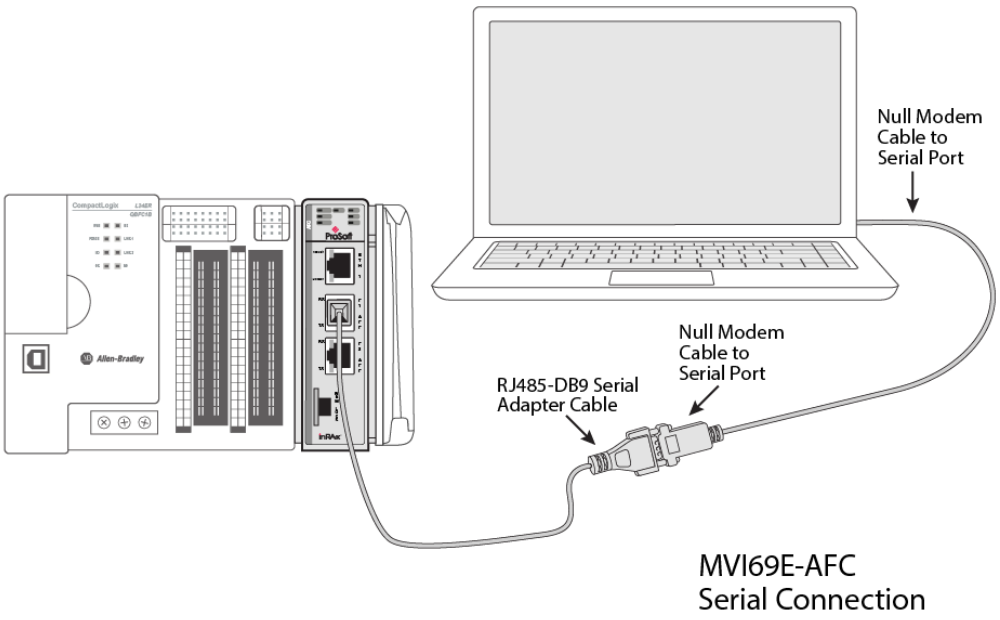
Connect the other end of the cable to the network. The PC running EAFC Manager must be on the same network.

Serial Connection

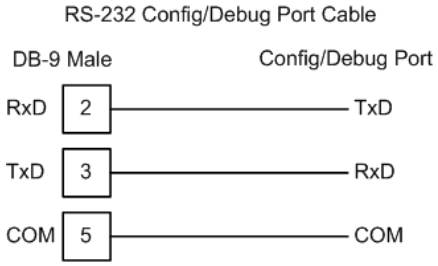
You can configure the module using serial connections or via an Ethernet connection. This section describes how to connect your PC to one of the serial ports on the module.

1. Connect the DB-9 adapter to a serial port of the MVI69E-AFC (P1 or P2). Refer to the port labels on the front of the module to find the correct port.
2. Connect the null-modem cable to the DB-9 adapter cable on the module, and to an available serial port on your computer.

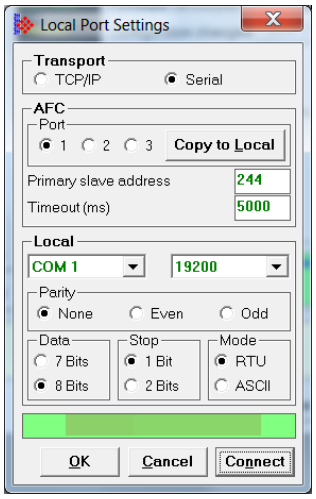
Note: Some desktop and notebook computers are not equipped with a serial port. In this case, you may require a USB to Serial adapter cable, with drivers. Not all USB to Serial adapters will work correctly with this application. If you encounter problems, please contact ProSoft Technical Support for recommendations.



The null-modem cable that is supplied with the module uses the following cabling scheme:



3 Start EAFC Manager, and select the port settings at **COMMUNICATIONS / LOCAL PORT SETTINGS**. The default serial communication settings are shown in the following illustration.

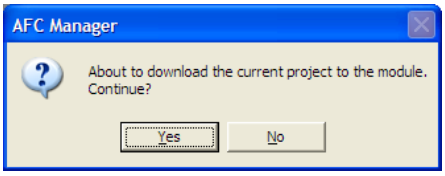


4 The EAFC *Manager* will establish communication with the module. Open the *Project* menu and then select **SITE CONFIGURATION** to open the *Site Configuration* dialog box.

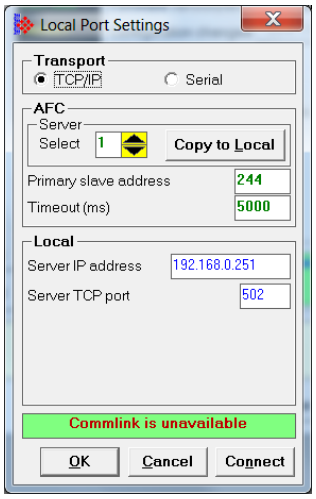
5 On the *Site Configuration* dialog box, click the **READ** button. You should see the word "Success" in the *Result* area of the dialog box.

17 Downloading the Project to the Module

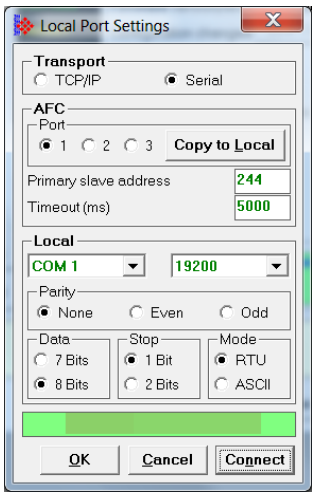
1 In EAFC Manager, click **PROJECT / DOWNLOAD PROJECT**.



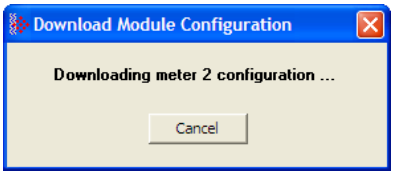
This action opens the *Local Port Settings* window. If you are downloading via the network, click **TCP/IP**:



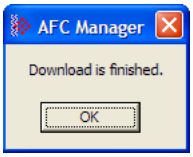
If you are downloading through one of the serial ports, click **SERIAL**.



2 Enter the port parameters to use, and then click **DONE**.
3 During the download operation, the following progress window is displayed:



4 When the file transfer is complete, the following window is displayed:

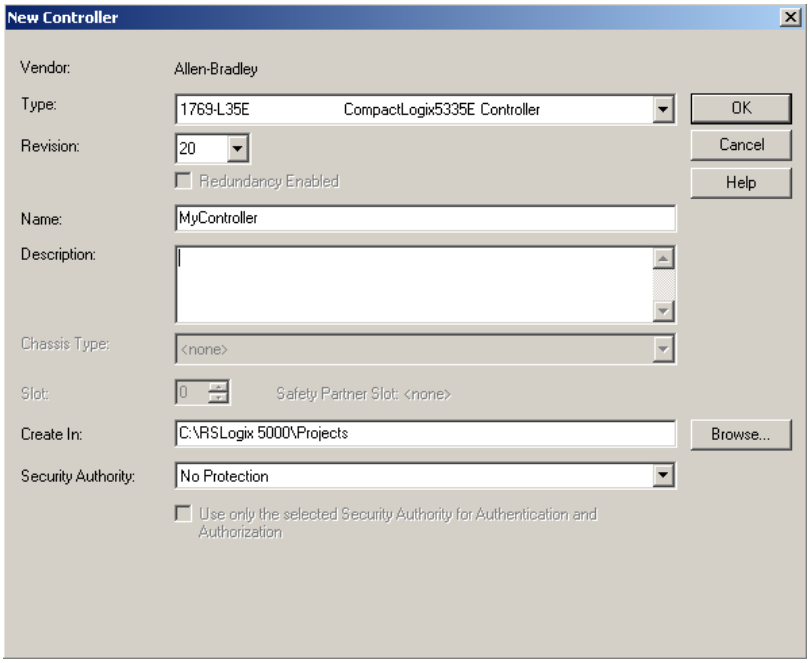


Troubleshooting Tip: If the EAFC Manager displays an "Illegal Data Value" message, it typically indicates an invalid meter type or product group configuration. The module does not accept a configuration file that attempts to change a meter type or product group for a meter that is currently enabled. Disable all meters, change the meter types and product groups, and then enable the meters again.

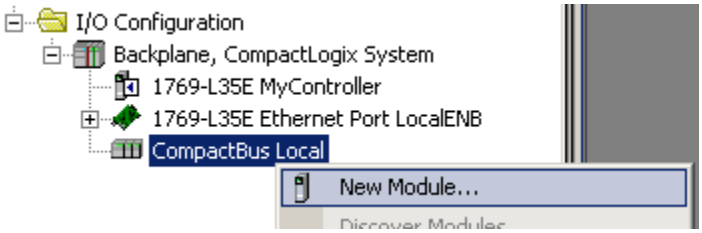
18 Creating an RSLogix Project and Importing the AOIs

18.1 Create your RSLogix Project

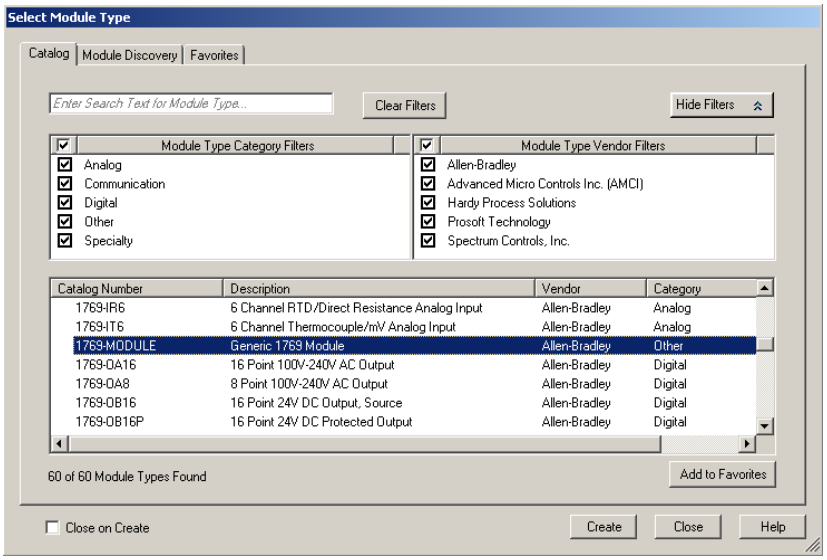
1 Create a new RSLogix/Studio 5000 project.



2 In the *Controller Organization* window, expand the *I/O Configuration* folder.
3 Right-click on the **CompactBus Local** icon to open a shortcut menu.
4 On the shortcut menu, choose **NEW MODULE…**

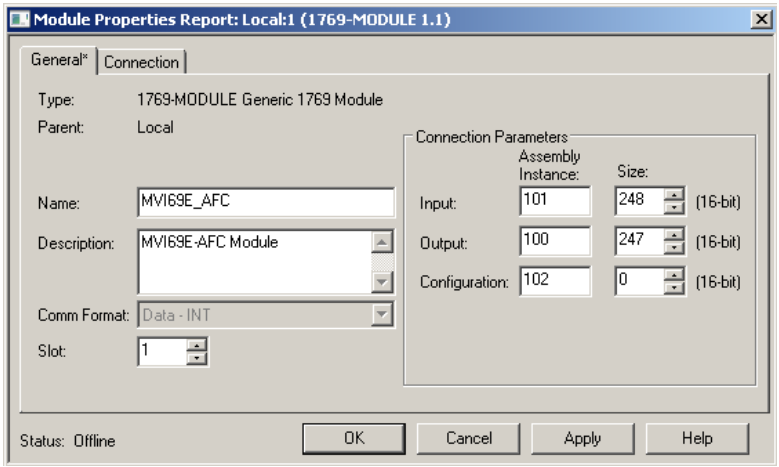


5 In the *Select Module Type* dialog box, select **1769-MODULE**. Click the **CREATE** button.

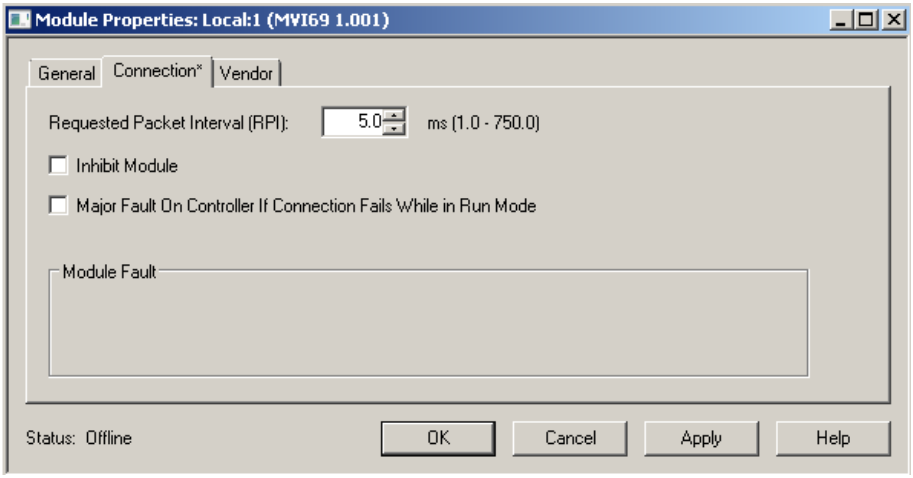


6 Enter the *Name* and select the *Slot* location of the module. In addition, enter the following values:

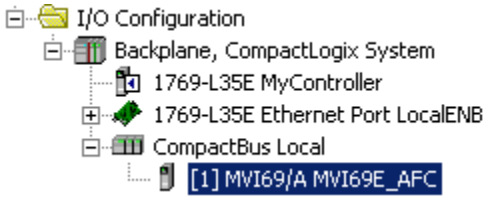
Parameter	Value
Name	MVI69E_AFC
Comm Format	Data-INT
Input Assembly Instance	101
Input Size	248
Output Assembly Instance	100
Output Size	247
Configuration Assembly Instance	102
Configuration Size	0



7 Click on the *Connection* tab to adjust the *Requested Packet Interval (RPI)* setting for your application. 5ms is the recommended default RPI time, do not use an RPI setting below 5ms. Click **OK**.



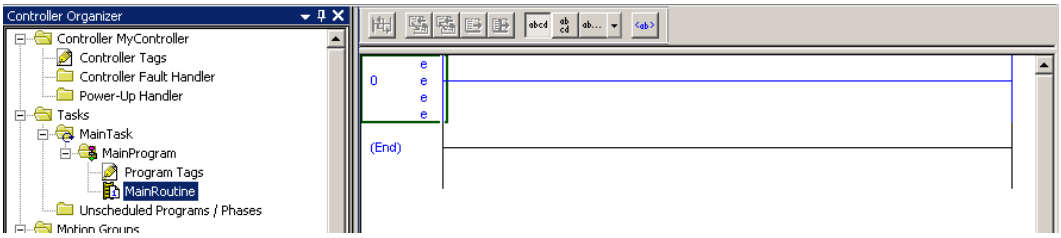
8 The MVI69E-AFC module is now visible in the I/O Configuration folder.



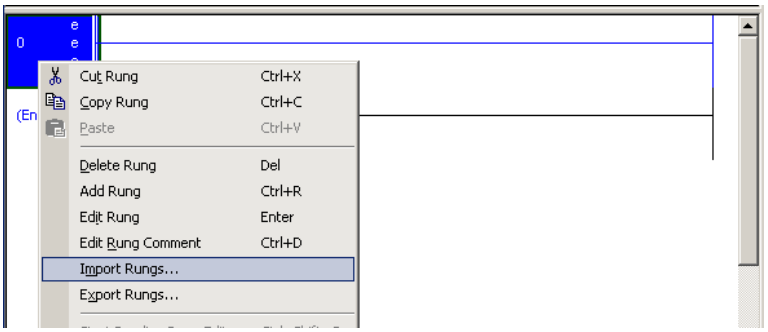
18.2 Importing the Meter-Specific and Main AOI Rungs

You can import multiple meter-specifc Add-On rungs in a routine. These rungs must precede the Main AOI69EAFC instruction. The meter-specific AOIs can all be on a single rung, but the main AOI instruction must be on a separate rung.

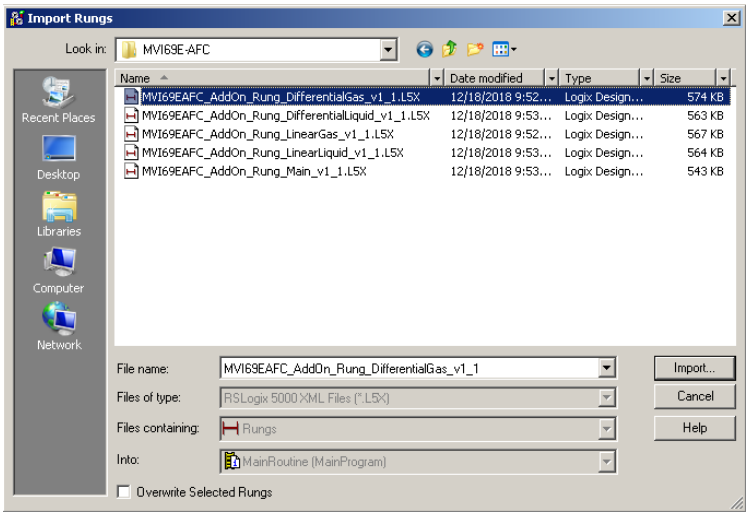
1 Expand the *Tasks* folder, and double-click the **MAINPROGRAM** icon.



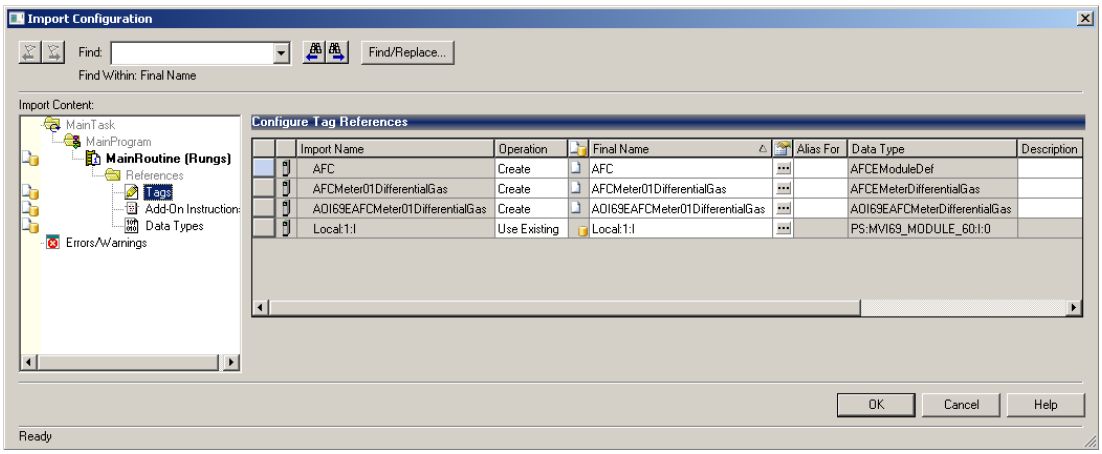
2 Click the right mouse button to open a shortcut menu, and then choose **IMPORT RUNGS**. This action opens the *Import Rung* dialog box.



3 In the *Import Rung* dialog box, select the meter type specific rung that you will use in your project, and then click **IMPORT**. The meter-specific AOI must be imported before the Main AOI.



4 When the following window opens, select the *Tags* section as shown below:



Edit the default AOI rung. The 4 tags are as follows:

- **AFC** – This tag must match the tag of the MAIN AOI that you will import last. This is the main tag for all of the functions of the module. This will contain a Data Type of *AFCEModuleDef*, and will import all of the User Defined Data Types required for the communication between the module and the CompactLogix processor.

- **AFCMeterX** – This is the tag that contains all information pertaining to a particular meter run. The User Defined Data Type is dependent on the type of meter you are importing (shown above is differential gas).

- **AOI69EAFCMeterX…** – This is a unique tag for each meter run in your project. It is required for the operation of the AOI, and contains the enabled in, enabled out, and meter number parameters.

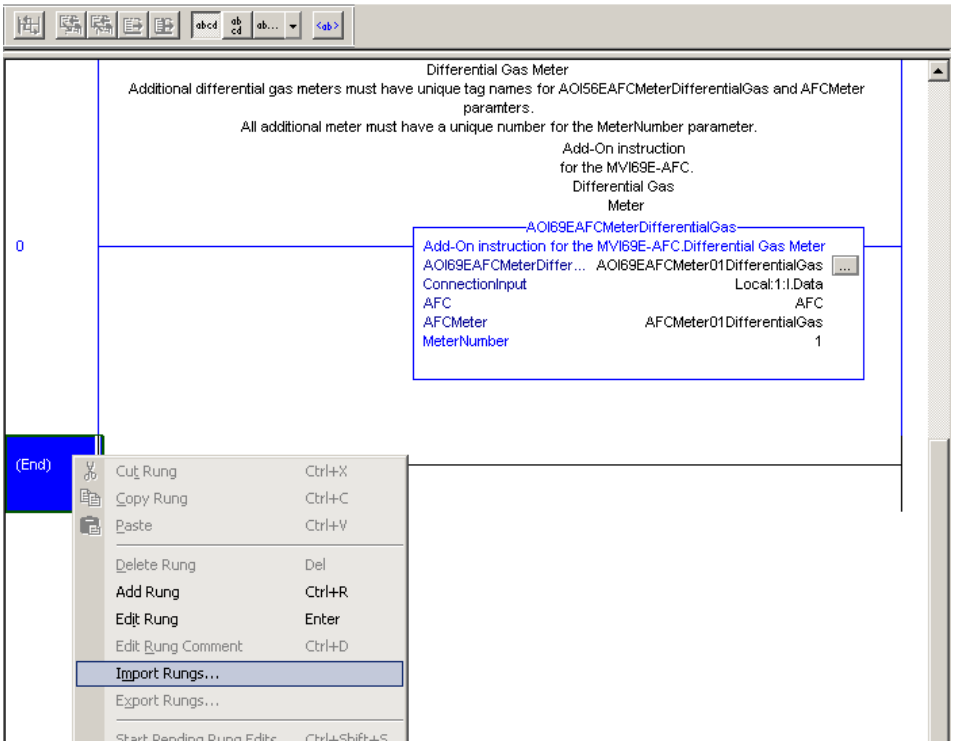
- **Local:1:I** – This tag will reflect the slot number that the module resides in your CompactLogix rack (in this sample, slot 1). If your module is in slot 4 instead, you will change this tag to Local:4:I.

5 Once the meter AOI is imported, you must update the *Meter Number* parameter, which can only be done after the AOI is imported. Each meter must have unique meter numbers.

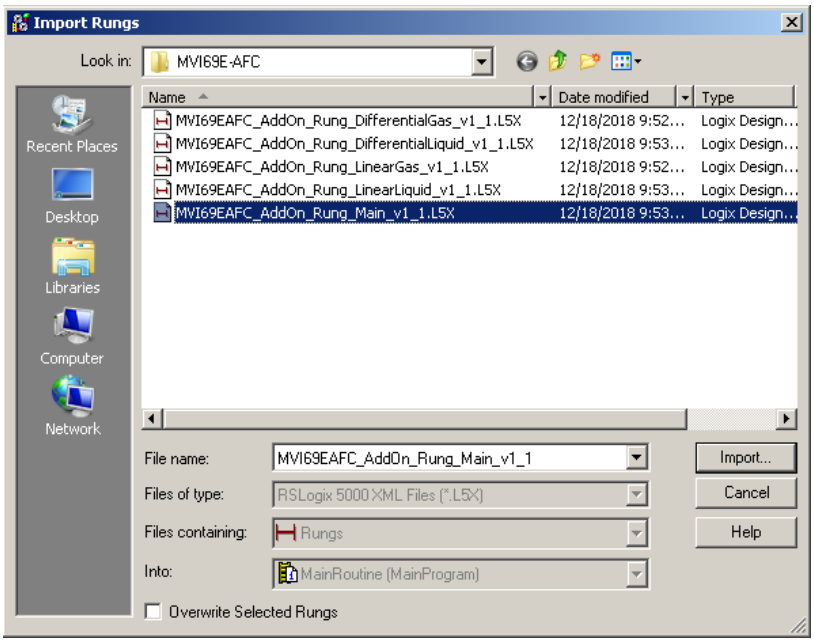
6 Click **OK**.

7 Repeat the steps above for additional meter-specific AOI's.

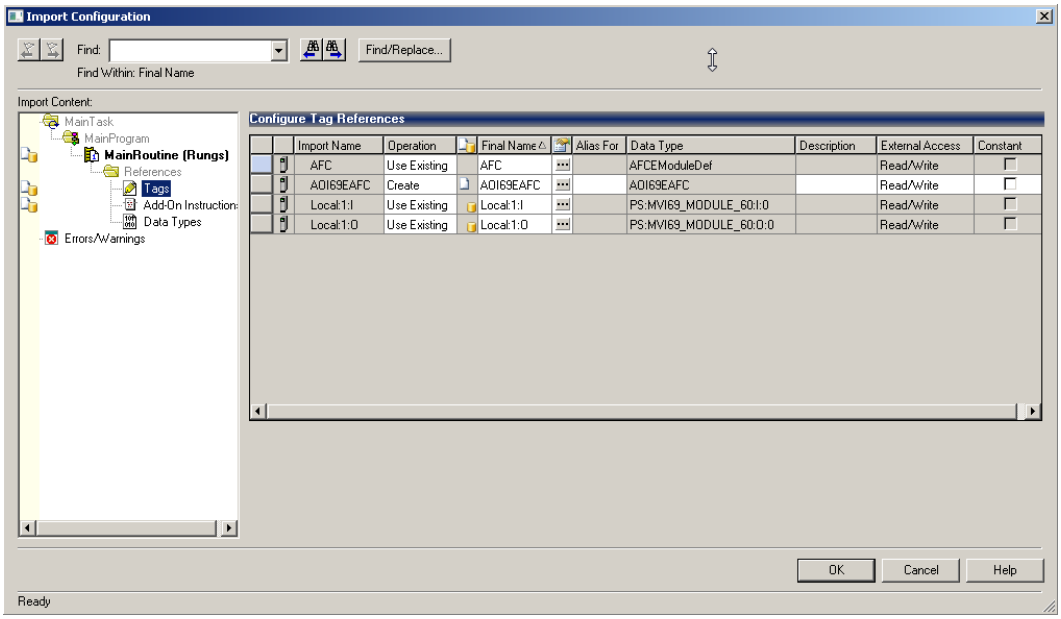
8 When finished importing the necessary meter-specific rungs for your project, import the **MAIN MVI69E-AFC Add-On Instruction**. Right-click on the rung below the last meter-specific AOI. Click on **IMPORT RUNGS**.



9 Select the **MVI69EAFC_AddOn_Rung_Main_v1_x** file and click **IMPORT**.



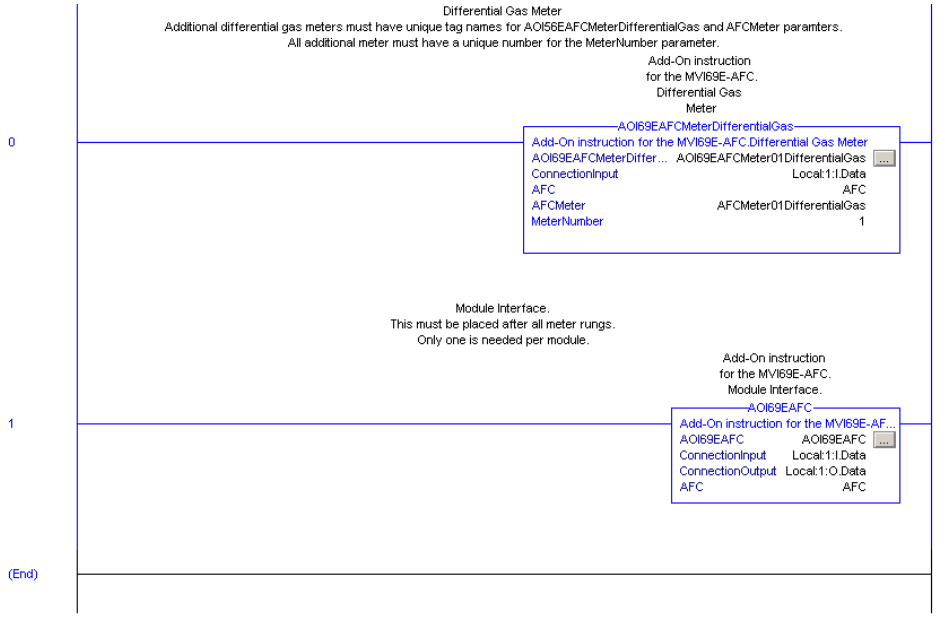
10 Select the *Tags* section to display the following menu:



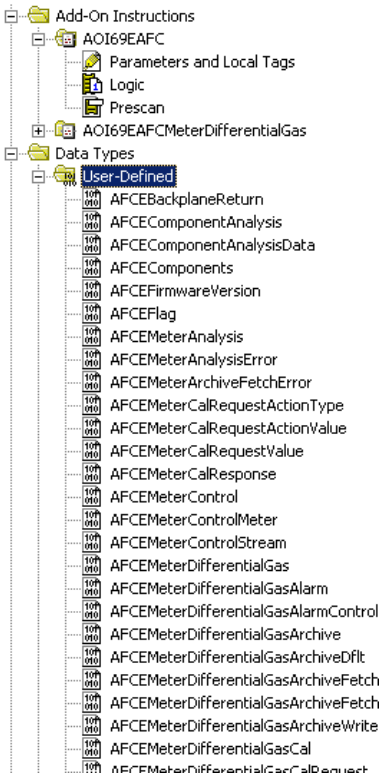
The tags shown here are as follows:

- **AFC** – This should match the tag name used when importing the meter specific Add-On Instructions. It will be of data type *AFCEModuleDef*.
- **AOI69EAFC** – This tag contains the enable in and enable out bits needed for the main Add-On Instruction.
- **Local:1:I** – This will represent the slot of the module (in this case slot 1). If your module is located in another slot in the CompactLogix chassis, edit in the *Final Name* column to reflectt your application.
- **Local:1:O** – Again slot dependent. Edit to reflect the location of the module in your CompactLogix application.

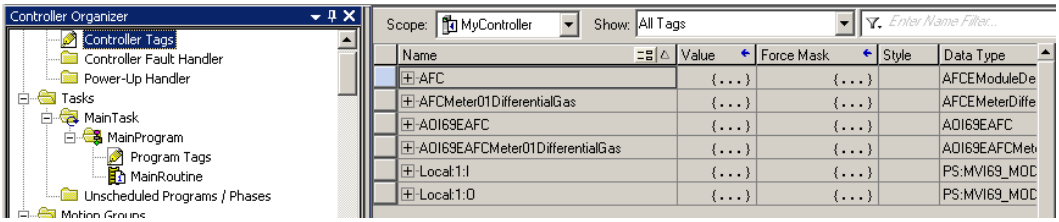
11 When the import is complete, the Add-On Instructions appear similar to the following example:



The procedure has imported User-Defined data types that will be used by the sample program.



The procedure imports the controller tags that will be used by the sample program.

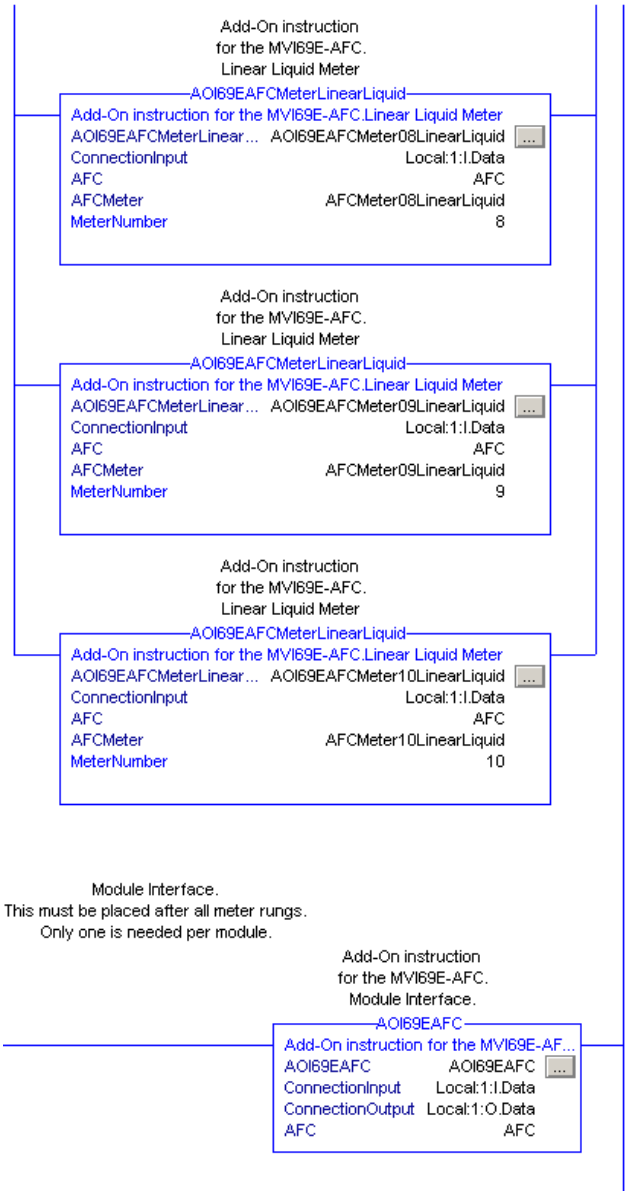


12 The import procedure is now complete. Save your project.

Note: An example containing all meter runs and meter types is provided as a .ACD file. This utilizes additional processor memory when not using all meter types, so while it is not recommended to use this as a base, it is available as a sample from our website.

18.3 Configuring the AOIs

Now that all of the AOI's are in the project, you may now configure the ladder for the rest of your application. Below is a partial screen shot of the sample .ACD file:

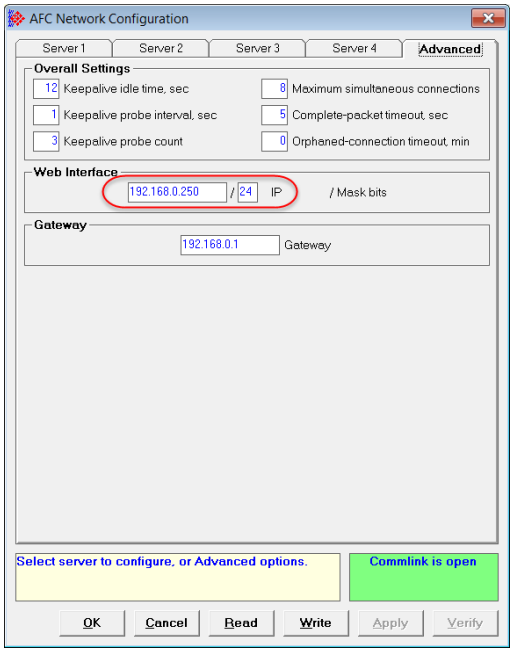


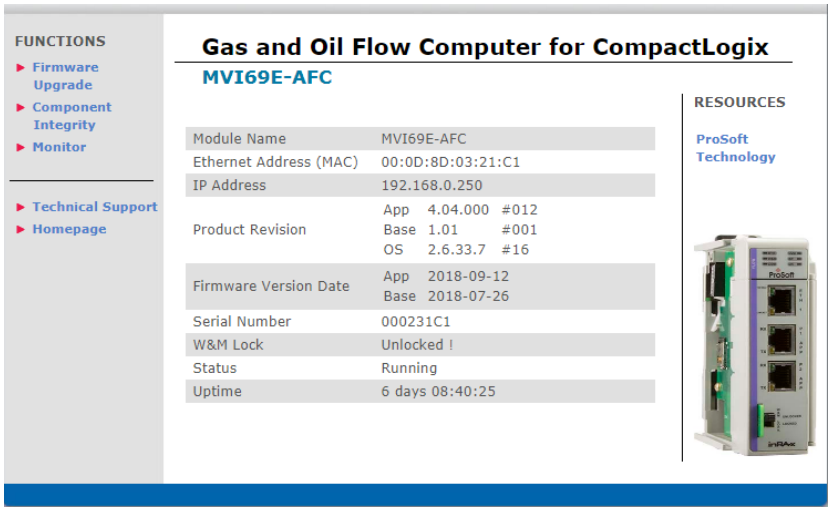
19 MVI69E-AFC Web Page

The MVI69E-AFC web page is accessible through any browser simply by typing the module's IP address.

From this page, you can view general information about the module as well as upgrade the firmware.

To access this webpage, ensure that you use the **Web Interface** IP address configured under **Site Configuration > Network > Advanced**.





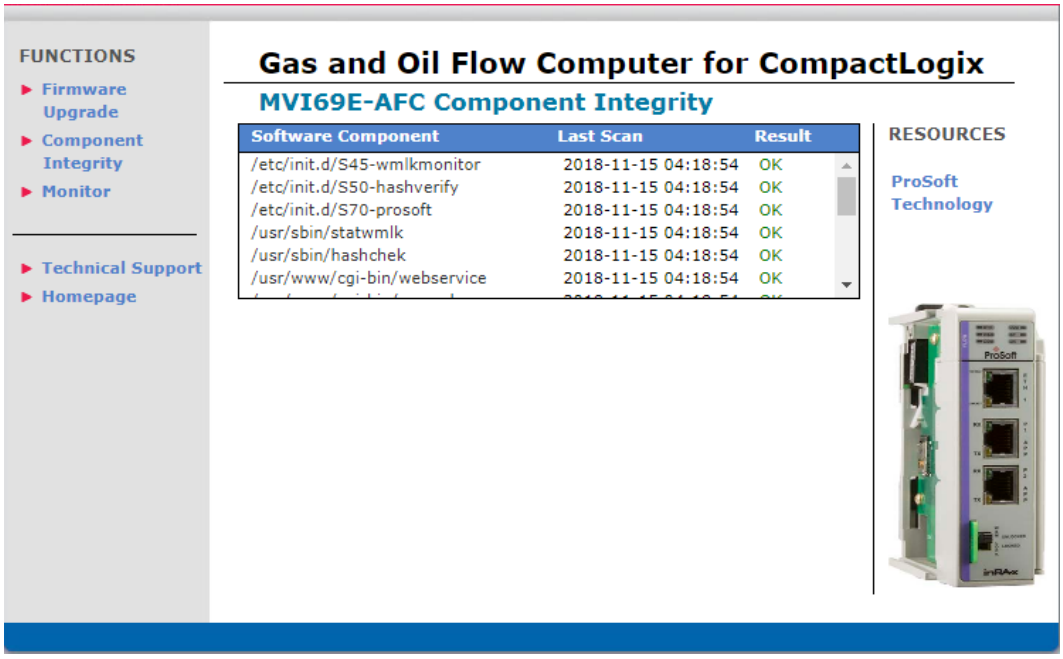
19.1 Firmware Upgrade Link

Click on the *Firmware Upgrade* link to upgrade firmware if instructed to do so from the support group.

19.2 Component Integrity Link

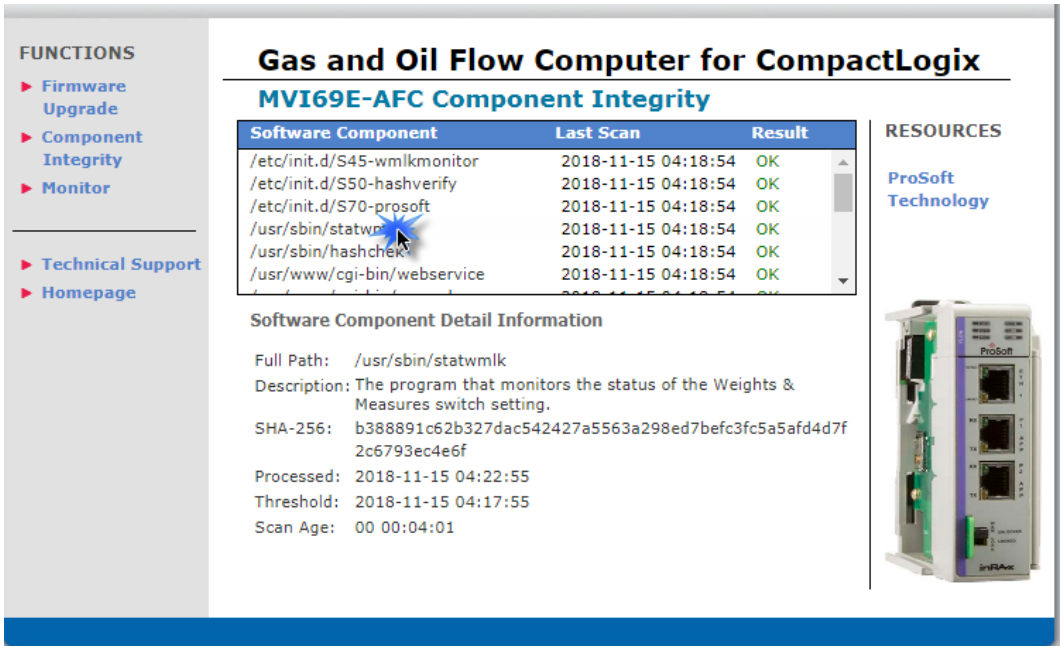
Click on the *Component Integrity* link to view the following information:

- **Software Component** – The Software Component column displays the list of legally relevant software identifiers. On the right side of the table, a vertical scroll is provided to scan this listing.
- **Last Scan** – The Last Scan column displays the timestamp (UTC) of the last scan of the software component by the hash checking process.
- **Result** – The Result column displays the outcome of the last scan of the software component by the hash checking process.



19.2.1 Software Component Detail Information

Hover or click on the relevant software component identifier in the table to view the software component detail information.



The software component detail information displays the following information:

Parameter	Description
Full Path	The complete legally relevant software component identifier.
Description	The legal description of the software component identifier.
SHA-256	The SHA-256 hash code of the legally relevant software as calculated during the firmware-image build process..
Processed	The operating system timestamp (UTC) when the hash code results were processed. The processed timestamp is based upon the viewing device date and time running the web browser software.
Threshold	The page processed timestamp minus 5 minutes.
Age	The page processed timestamp minus the last scan timestamp.

19.2.2 Component Integrity Page Operation

The ProSoft MVI69E-AFC hash checking is performed by an internal process which scans each legally relevant software component once every 4 minutes and 30 seconds. The outcome of this scan is stored in a result file. The hash checking process runs continuously and is independent of all other processes that run on the module.

Each minute, or on manual refresh, the component integrity web page performs a web service transaction which reads the result from the internal hash checking process.

The ProSoft MVI69E-AFC legally relevant software identifiers are unique for each legally relevant software component. The table however, is limited in width. When the legally relevant software identifier is too long to display in the software component column, the legally relevant software identifier in the table is shortened to fit the table column width. When this occurs, the legally relevant software component identifier is prefized with ".." characters. The full legally relevant software component identifier is always displayed in the detail information section.

On each process interval, if the age of the software component last scan timestamp is older than 5 minutes, the last scan timestamp is displayed in red.

The following table details the displayed software component scan result codes:

Result Code	Result Code Description
OK	The software component was successfully processed by the internal hash checking process, and the calculated hash code by the hash checking process matched the calculated hash code during the firmware-image build process.
Mismatch	The software component was successfully processed by the internal hash checking process, but the calculated hash code by the hash checking process did not match the calculated hash code during the firmware-image build process.
Missing	The software component was not found and therefore could not be scanned.
Err<nn>	An error occurred when the internal hash checking process attempted to scan the software component, so the hash code could not be calculated. <nn> is the error code reported by the operating system function call that failed for use by ProSoft Technical Support.

19.2.3 Verification

The ProSoft MVI69E-AFC Enhanced Liquid & Gas Flow Computer for CompactLogix® module consists of two firmware images; the “base” firmware-image which supplies an environment and component files that have more general utility that what is needed for measurement and flow computation, and the “application” firmware-image that adjusts/enhances the “base” environment and components the directly implement the measurement and flow computation. Both firmware images are required for full implementation of the ProSoft MVI69E-AFC Enhanced Liquid & Gas Flow Computer for CompactLogix® module. Both firmware images contain legally relevant software components.

The ProSoft MVI69E-AFC Enhanced Liquid & Gas Flow Computer for CompactLogix® module legally relevant software documentation contains the following information for each legally relevant software component within each firmware-image:

Legally relevant software component identifier

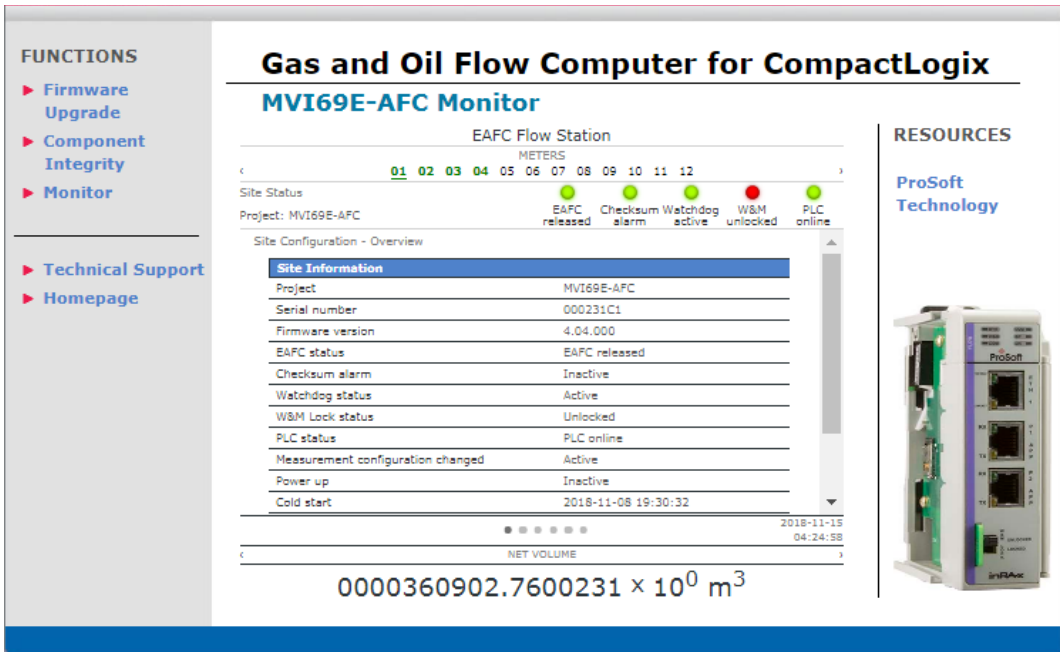
Legal description

Calculated SHA-256 hash code during the firmware-image build process

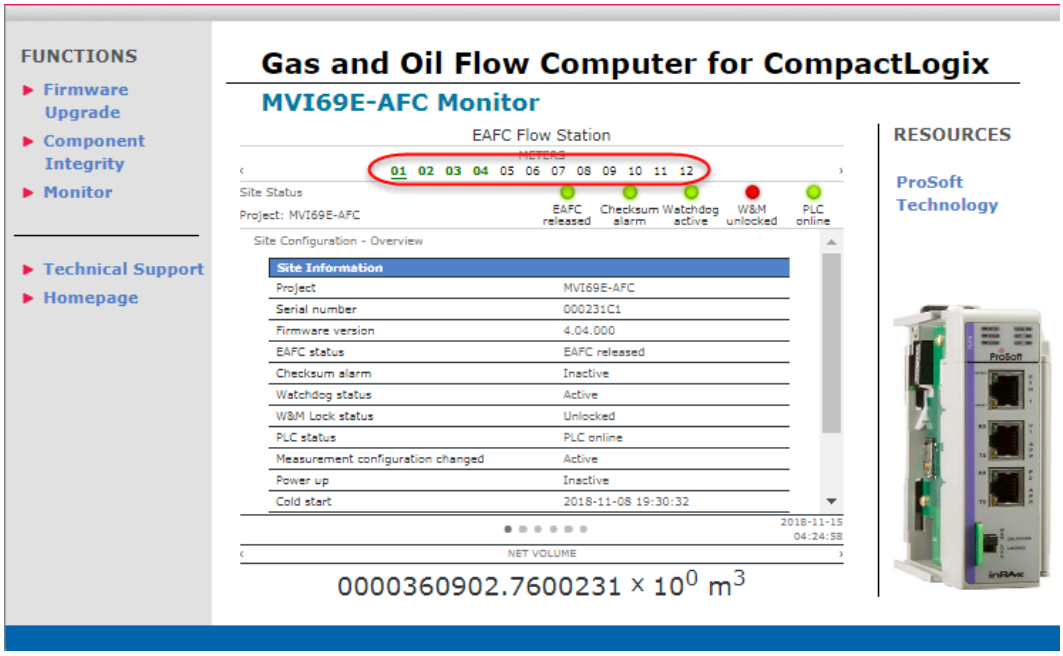
The ProSoft MVI69E-AFC Enhanced Liquid & Gas Flow Computer for CompactLogix® module legally relevant software documentation is provided for full manual verification of all legally relevant software components.

19.3 Monitor

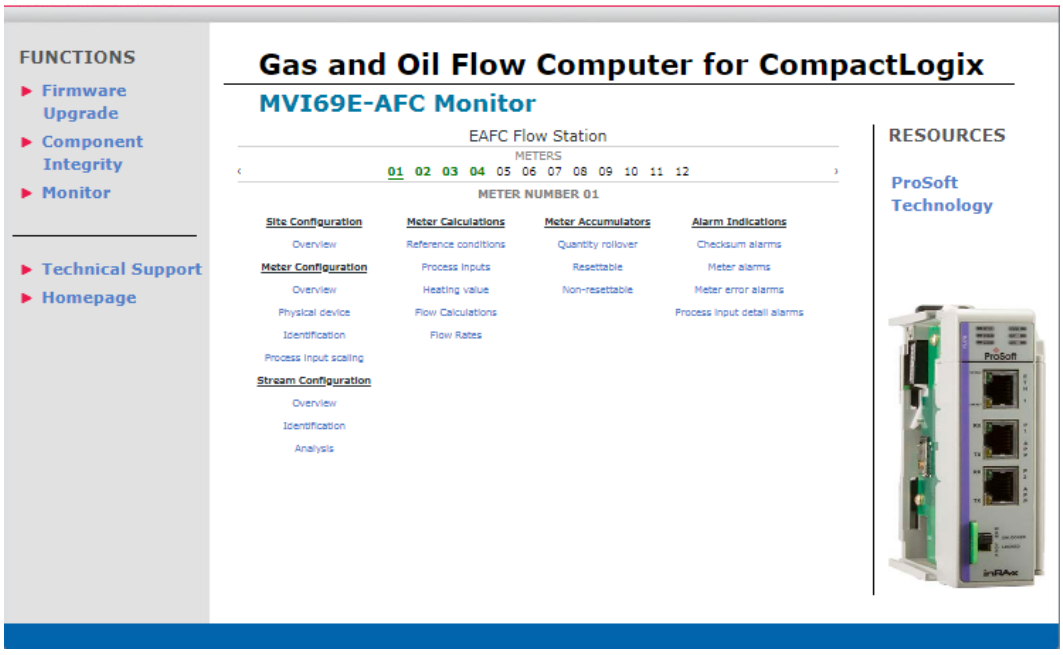
Click on the *Monitor* link from the web page to display information about what is going on inside the module.



Information is viewable for each of the 12 available meters. Click on the appropriate meter for data that pertains to that meter.



If you hover or click over a meter, links appear under the appropriate headings.

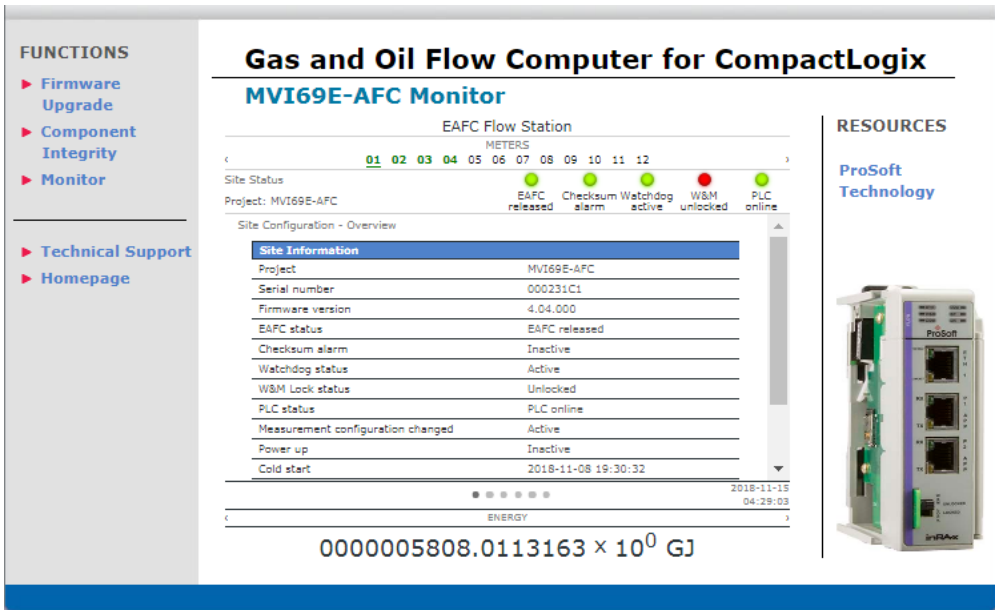


Click on any of the links under the appropriate heading.

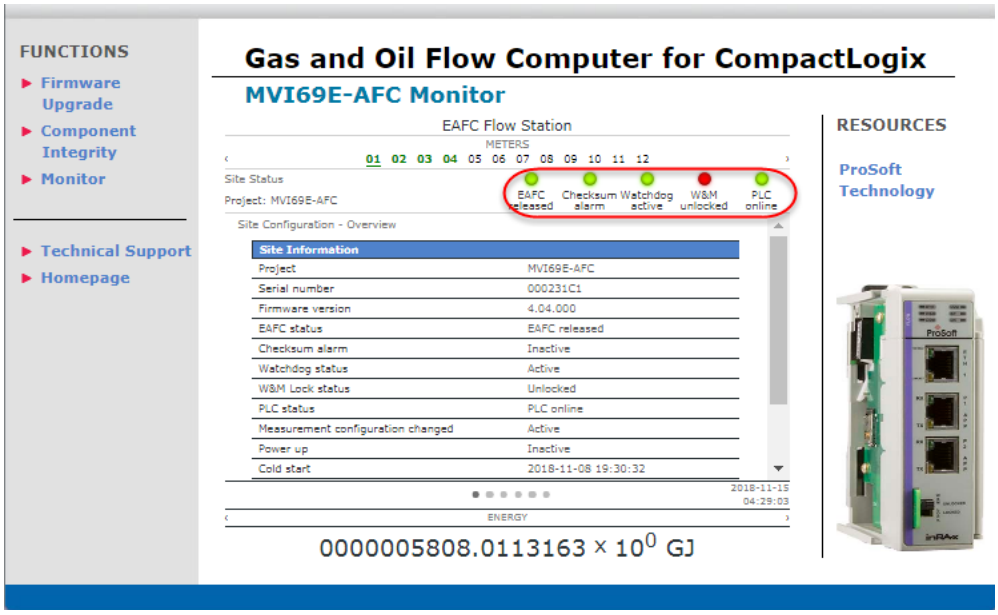
19.3.1 Site Configuration

Site Configuration Overview

Click on the *Overview* link to display the following information:



Site status LED indicators are displayed just under the meter selection links.



These alarms are displayed on the Site Header, Meter Header, and alarm indication sections

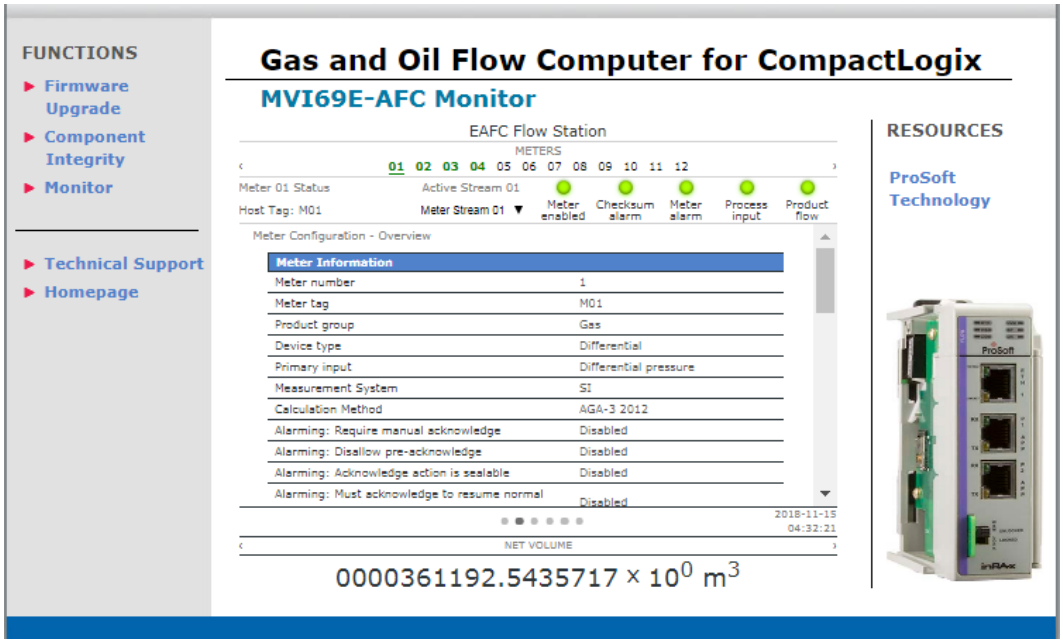
Site Header LEDs

Site Header	Value	Text	LED Color
EAFC released status	False	EAFC released	Red
	True		Green
	Error		Black
Checksum alarm	False	Checksum alarm	Green
	True		Red
	Error		Black
Watchdog status	False	Watchdog inactive	Red
	True	Watchdog active	Green
	Error	Watchdog status	Black
W&M lock switch	False	W&M unlocked	Red
	True	W&M locked	Green
	Error	W&M status	Black
PLC offline status	False	PLC online	Green
	True	PLC offline	Red
	Error	PLC status	Black

Site Information is located directly below the Site Status LEDs:

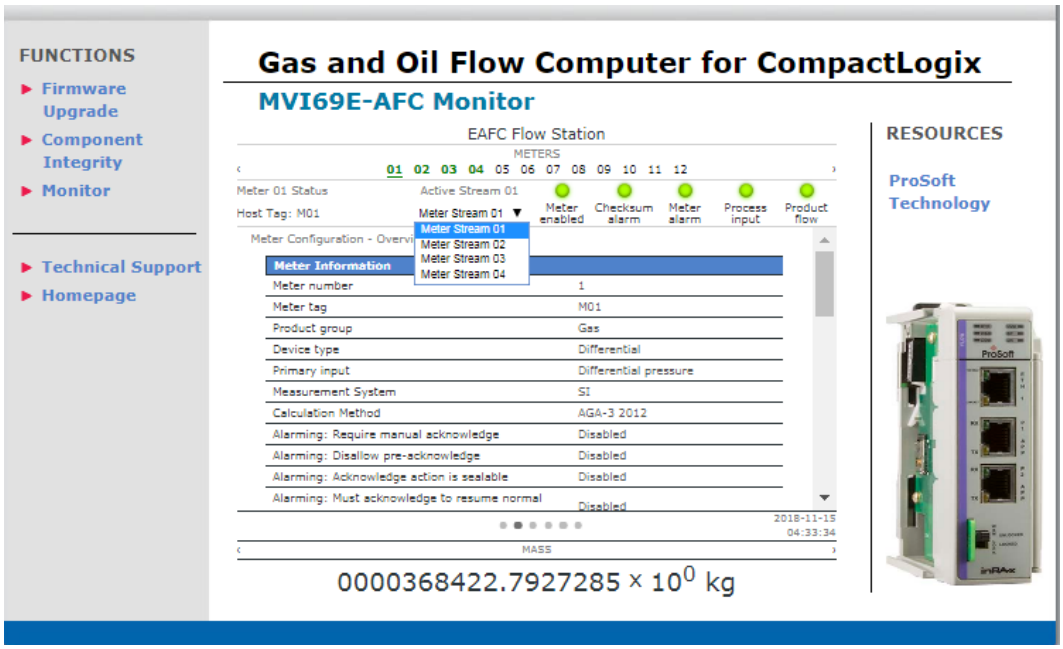
Parameter	Description
Project	Displays the current project name
Serial Number	Displays the serial number of the device
Firmware version	Displays the current firmware version on the module.
EAFC status	
Checksum alarm	Displays active or inactive.
Watchdog status	
W&M Lock status	
PLC Status	Indicates the state of the PLC
Measurement configuration changed	
Power Up	Indicates whether or not the module is powered up.
Cold Start	
Warm Start	
Accuracy class	
Climatic and Mechanical class	

19.3.2 Meter Configuration



Selecting Meter Streams

You can select specific streams per meter from any of the meter pages. Simply select the appropriate meter stream from the drop-down list as shown.



Meter Configuration Links

Meter Configuration contains the following links:

- Overview
- Physical Device
- Identification
- Process Input Scaling

Click on any of the links for meter configuration information.

Overview

The Meter Configuration page displays the following information:

Meter Configuration - Overview

Meter Information	
Meter number	1
Meter tag	M01
Product group	Gas
Device type	Differential
Primary input	Differential pressure
Measurement System	SI
Calculation Method	AGA-3 2012

Physical Device

The Physical Device page displays the following information:

Meter Configuration - Physical Device

Metering device characteristics		
Physical device	Orifice plate (AGA 3 [2012])	
Orifice plate diameter	0 mm	
Orifice plate temperature	20 °C	293.1500 °K
Orifice plate material	0.0000167000 /°C	[Stainless Steel]
Meter tube diameter	0 mm	
Meter tube temperature	20 °C	293.1500 °K
Meter tube material	0.0000112000 /°C	[Carbon Steel]
Low flow threshold	0 kPa	

Identification

The Identification page displays the following data:

Meter Configuration - Identification

Meter nameplate information
Meter general type
Meter manufacturer
Meter model
Meter serial number
Meter size
Nominal K-factor

Process Input Scaling

The Process Input Scaling page displays the following data:

Meter Configuration - Process Input Scaling

Process Input	Transmitter Minimum	Transmitter Maximum	Calibration Low	Calibration High	Alarm Low Limit	Alarm High Limit
Diff press (kPa)	0	0	0	0	0	0
Temperature (°C)	15	15	15	15	15	15
Temperature (°K)	288.1500	288.1500	288.1500	288.1500	288.1500	288.1500
Pressure (kPag)	0	0	0	0	0	0
Pressure (barg)	1.0132	1.0132	1.0132	1.0132	1.0132	1.0132

19.3.3 Stream Configuration

Stream Configuration contains the following links:

- Overview
- Identification
- Analysis

Click on any of the links for Stream Configuration data.

Overview

Meter Stream Configuration - Overview

Meter stream 1 characteristics		
Meter active stream number	1	(Site stream number 1)
Meter displayed stream number	1	(Site stream number 1)
Isentropic exponent	1.3198	
Default relative density	0.60000002	
Default heating value	0 MJ/kg	
Default Fpv	1	
Viscosity	0.010268 centipoise	

Identification

Meter Stream Configuration - Identification

Meter stream 1 nameplate information
Product description

Analysis

Meter Stream Configuration - Analysis

Meter stream 1 component analysis					
C1	0	CO	0	C8	0
N_2	0	O_2	0	C9	0
CO_2	0	i-C4	0	C10	0
C2	0	n-C4	0	He	0
C3	0	i-C5	0	Ar	0
H_2O	0	n-C5	0	neo-C5	
H_2S	0	C6	0	U_x	
H_2	0	C7	0	U_y	

19.3.4 Meter Calculations

Meter Calculations provide the following data:

- Reference Conditions
- Process Inputs
- Heating value
- Flow Calculations
- Flow Rates

Click on any of the links for Meter Calculation information.

Reference Conditions

Meter Calculations - Reference conditions

Reference Conditions	
Reference temperature	15 °C
	288.1500 °K
Reference pressure	101.325 kPaa
	2.0265 barg
Barometric pressure	101.325 kPaa
	1.0132 bara

Process Inputs

Meter Calculations - Process Inputs

Process Input	Last Raw	Scaled Average
Differential pressure	0	0 kPa
Temperature	0	0 °C
		273.1500 °K
Pressure (downstream)	0	0 kPag
		1.0132 barg

Heating Value

Meter Calculations - Heating Value

Analysis Characterization - Heating Value	
Meter active stream number	1 (Site stream number 1)
Relative density calculation method	AGA-8 / ISO 12213
Relative density @ reference	0.60000002
Gas density @ reference	0.73524779
Default relative density @ reference	0.60000002
Heating value calculation method	AGA-8 / ISO 12213
Default heating value	0 MJ/kg
Molar heating value	0 MJ/kmol
Mass heating value	0 MJ/kg
Volumetric heating value	0 MJ/m^3
Wobbe index	0

Flow Calculations

Meter Calculations - Flow Calculations

Flow Calculations	
Meter active stream number	1 (Site stream number 1)
Temperature, absolute	0 °C
	273.1500 °K
Pressure, absolute	0 kPaa
	0.0000 bara
Compressibility @ reference	1
Molar density @ reference	0
Compressibility, flowing	0
Molar density, flowing	0
Supercompressibility	0
Extension	0
Beta ratio	0

Flow Rates

Meter Calculations - Flow Rates

Quantity	Flow Rate - Meter is currently disabled
Gross volume flow rate	-1 m^3/h
Net volume flow rate	-1 m^3/h
Energy flow rate	-1 GJ/h
Mass flow rate	-1 kg/h

19.3.5 Meter Accumulators

Meter Accumulators provide the following data:

- Quantity Rollover
- Resettable
- Non-Resettable

Click any link for detailed information.

Quantity Rollover

Meter Accumulators - Rollover

Quantity Type	Accumulator Rollover
Volume	100000000 × 10^{0} m^3
Energy	100000000 × 10^{0} GJ
Mass	100000000 × 10^{0} kg

Resettable

Meter Accumulators - Resettable

Quantity	Accumulator	Reset Options
[1]Net Volume	0000000000.000000 × 10^{0} m^3	END OF DAY END OF HOUR UPON EVENT
[2]Gross Volume	0000000000.000000 × 10^{0} m^3	END OF DAY END OF HOUR UPON EVENT
[3]Gross Standard Volume		
[4]Mass	0000000000.000000 × 10^{0} kg	END OF DAY END OF HOUR UPON EVENT

Contract Period	Contract Period End	Time Remaining
Hour	1970-01-01 00:00:00	00:00:00
Day	1970-01-01 00:00:00	00:00:00

Non-Resettable

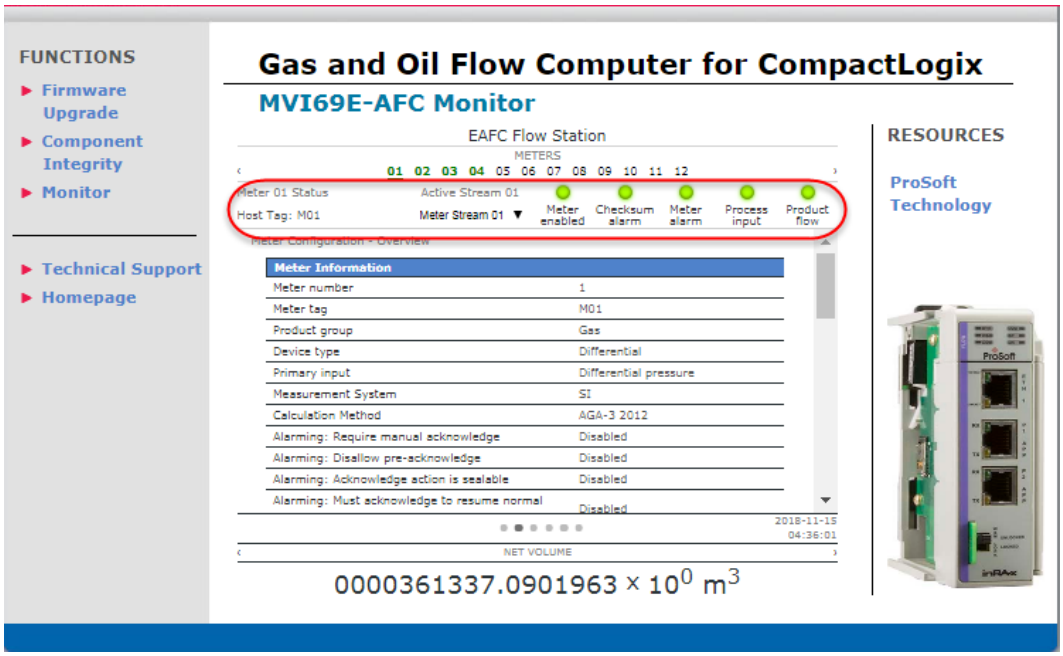
Meter Non-Resettable Accumulators

Quantity	Accumulator
	0000000000.000000 × 10^{0} m^3
Net Volume	0000000000.000000 × 10^{0} m^3
Energy	0000000000.000000 × 10^{0} GJ
Mass	0000000000.000000 × 10^{0} kg

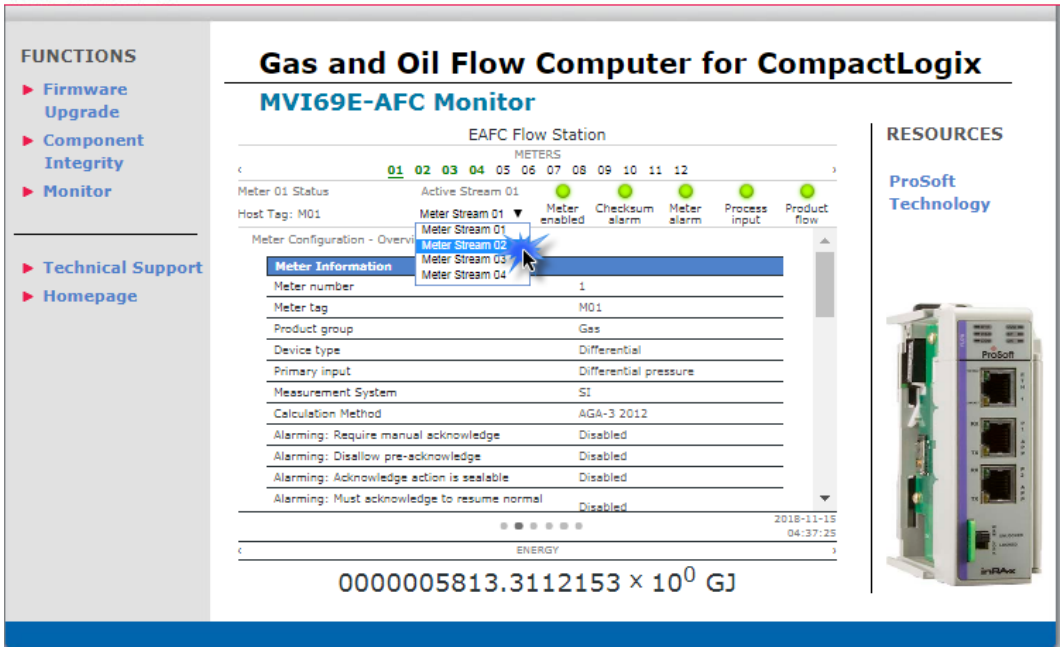
Quantity	✗ (In Error) Alarm Accumulator
Gross Volume	0000000000.0000000 × 10^{0} m^3

19.3.6 Meter Status

The meter status area provides alarm information for the selected meter and stream.



In this example, the Active Stream indicates the active stream for Meter 1. You can change the meter stream by selecting the requested stream from the Meter Stream dropdown.



Meter enable

Displays meter enable/disable state.

Checksum Alarms

Click to display details on the following:

- Alarm Indicators – Checksum Alarms

Alarm Indications - Checksum Alarms

Checksum Alarm	Status
Meter configuration	✓
Meter accumulators	✓
Meter previous prove summary	✓
Meter user-specified archivables	✓
Meter archive accumulators	✓
Meter archive status	✓
Meter archive detail (daily)	✓
Meter archive detail (hourly)	✓

Meter alarm

- Alarm Indicators – Meter Alarms

Alarm Indications - Meter Alarms

Meter Alarm	Status
Differential pressure input failure	✓
Differential pressure input out of range	✓
Differential pressure input outside threshold limits	✓
Temperature input failure	✓
Temperature input out of range	✓
Temperature input outside threshold limits	✓
Pressure input failure	✓
Pressure input out of range	✓

- Alarm Indicators – Meter Errors

Alarm Indications - Meter Errors

Meter Error	Status
Compressibility calculation error	✓
Accumulator overflow	✓
Static pressure exception	✓
Analysis/heating value characterization error	✓
Orifice characterization error	✓

Process Input

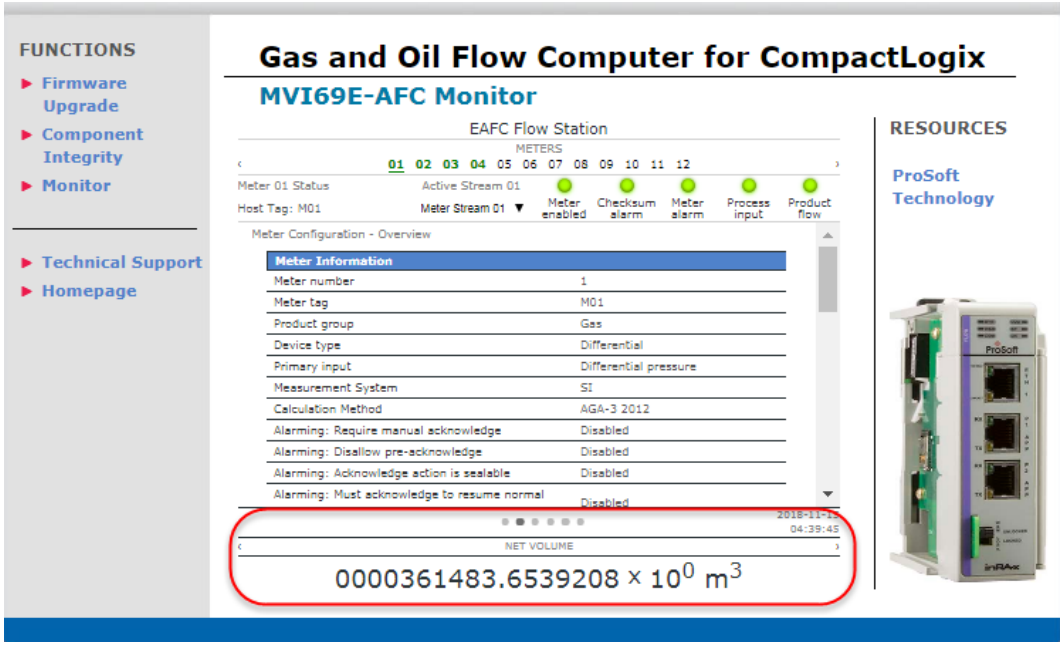
- Alarm Indicators – Process Input Detail Alarms

Alarm Indications - Process Input Detail Alarms

Process Input Detail Alarm	Status
Differential pressure transmitter failure	✓
Differential pressure sample rate too low	✓
Differential pressure range limit exceeded, lo (backplane)	✓
Differential pressure range limit exceeded, hi (backplane)	✓
Differential pressure invalid input format	✓
Differential pressure range limit exceeded, lo (local)	✓
Differential pressure range limit exceeded, hi (local)	✓
Differential pressure alarm threshold exceeded, lo	✓

19.3.7 Data Displays

In addition to the information provided above, the web page displays current data along the bottom of the page.



This information displayed automatically changes every few seconds and displays:

- Gross Volume
- Net Volume
- Energy
- Mass

20 What's Next?

Congratulations! Your MVI69E-AFC is now configured and running. There are a number of features and customizations that you can set up and use. The *MVI69E-AFC Reference Guide* contains a wealth of information that will help you get the most out of your module.

The MVI69E-AFC Reference Guide contains information on how to:

- Configure primary and virtual Modbus slave addresses
- Disable pass-thru mode
- Configure whitelist options
- Access data
- Read site configuration status
- Configure parameters common to all modules
- Use the Modbus Dictionary
- Configure archives
- Set up and view events
- Set up and view alarms
- Perform transmitter calibrations and view results
- Perform diagnostics and troubleshooting
- Perform meter proving

In addition, the MVI69E-AFC Reference Guide provides further information on:

- Modbus communication
- Modbus database information
- Modbus communication parameters
- Modbus transaction sequencing and constraints
- Product groups
- Calculation results
- Molar Analysis
- Measurement standards
- Metering according to meter type
- Enron Modbus Implementation
- Function Block Interface
- Cable connections

21 Support, Service and Warranty

21.1 Contacting Technical Support

ProSoft Technology, Inc. is committed to providing the most efficient and effective support possible. Before calling, please gather the following information to assist in expediting this process:

1. Product Version Number
2. System architecture
3. Network details

If the issue is hardware related, we will also need information regarding:

1. Module configuration and associated ladder files, if any
2. Module operation and any unusual behavior
3. Configuration/Debug status information
4. LED patterns
5. Details about the serial, Ethernet or Fieldbus devices interfaced to the module, if any.

Note: *For technical support calls within the United States, ProSoft's 24/7 after-hours phone support is available for urgent plant-down issues. Detailed contact information for all our worldwide locations is available on the following page.*

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21.2 Warranty Information

For complete details regarding ProSoft Technology's TERMS & CONDITIONS OF SALE, WARRANTY, SUPPORT, SERVICE, and RETURN MATERIAL AUTHORIZATION INSTRUCTIONS, please see the documents at: www.prosoft-technology/legal

Documentation is subject to change without notice.

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