User Manual

AB *Allen-Bradley*

ControlLogix Configurable Flowmeter Module

Catalog Numbers 1756-CFM

Important User Information

Solid-state equipment has operational characteristics differing from those of electromechanical equipment. Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls (publication SGI-1.1 available from your local Rockwell Automation® sales office or online at http://www.rockwellautomation.com/literature/) describes some important differences between solid-state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid-state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

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Throughout this manual, when necessary, we use notes to make you aware of safety considerations.

⚠	**WARNING:** Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.
⚠	**ATTENTION:** Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence.
⚡	**SHOCK HAZARD:** Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.
♨	**BURN HAZARD:** Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.

This manual contains new and updated information. Changes throughout this revision are marked by change bars, as shown to the right of this paragraph.

New and Updated Information

This table contains the changes made to this revision.

Topic	Page
The Gross Rate for the Prover Function has been updated.	48
The Configurable Output Behaviors section has been added.	58
The Attention and Warning tables have been updated.	61
Detailed filtering information has been added to the Configurable Flowmeter Module Configuration Tags table.	122 and 124
The Configure Output Behavior with RSLogix 5000 Version 16 and Earlier appendix has been added.	147

Notes:

Table of Contents

Chapter 4

Installing the Configurable Flowmeter Module

This manual describes how to install, configure, and troubleshoot your ControlLogix® Configurable Flowmeter module.

Who Should Use This Manual

You must be able to program and operate an Allen-Bradley® ControlLogix controller to efficiently use your Configurable Flowmeter module.

Additional Resources

These documents contain additional information concerning related products from Rockwell Automation.

Resource	Description
1756 ControlLogix I/O Technical Data, publication 1756-TD002	Provides specifications for the ControlLogix controllers, I/O modules, specialty modules, chassis, power supplies and accessories.
ControlLogix System User Manual, publication 1756-UM001	Detailed description of how to use your ControlLogix operating system.
ControlLogix Digital I/O Modules User Manual, publication 1756-UM058	Detailed description of how to install and use ControlLogix digital I/O Modules.
ControlLogix Analog I/O Modules User Manual, publication 1756-UM009	Detailed description of how to install and use ControlLogix analog I/O Modules.
ControlLogix High-speed Counter Module Installation Instructions, publication 1756-IN018	Detailed description of how to install and use the ControlLogix High-speed Counter Module.
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Certifications website, http://www.ab.com	Provides declarations of conformity, certificates, and other certification details.

You can view or download publications at http://www.rockwellautomation.com/literature/. To order paper copies of technical documentation, contact your local Allen-Bradley distributor or Rockwell Automation sales representative.

Notes:

What is the Configurable Flowmeter Module?

What this Chapter Contains   This chapter describes the ControlLogix Configurable Flowmeter (1756-CFM) module. It also describes what you must know and do before using the module.

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Understanding Module Input Capabilities	15
Understanding Module Output Capabilities	15
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The ControlLogix CFM module is an intelligent I/O module that performs high-speed flowmetering for industrial applications. The CFM module is a single-slot module that interfaces between a Logix controller and external I/O devices.

The module interfaces with the following output types:

- Magnetic Pickup
- TTL
- Preamps

Using a ControlLogix CFM Module

ControlLogix CFM modules mount in a ControlLogix chassis and use a Removable Terminal Block (RTB) or a Bulletin 1492 Interface Module cable that connects to an IFM to connect all field-side wiring.

Before you install and use your module you should have already:

- installed and grounded a 1756 chassis and power supply. To install these products, refer to the ControlLogix Chassis and Power Supplies Installation Instructions, publication 1756-IN005.

- ordered and received an RTB or IFM and its components for your application.

IMPORTANT   RTBs and IFMs are not included with your module.

Module Features

The following are some of the features available on the ControlLogix CFM module that allow greater system applicability.

- 2 Configurable Flowmetering channels
- Flowmeter inputs
- Gate inputs
- 2 current-sourcing outputs
- Removal and insertion under power
- CE marked
- UL listed
- CSA certified for Class I Division 2 hazardous locations

For a complete listing and detailed explanation of all the features available on the ControlLogix CFM module, see Configurable Flowmeter Module Features and Operational Modes on page 25.

Physical Features
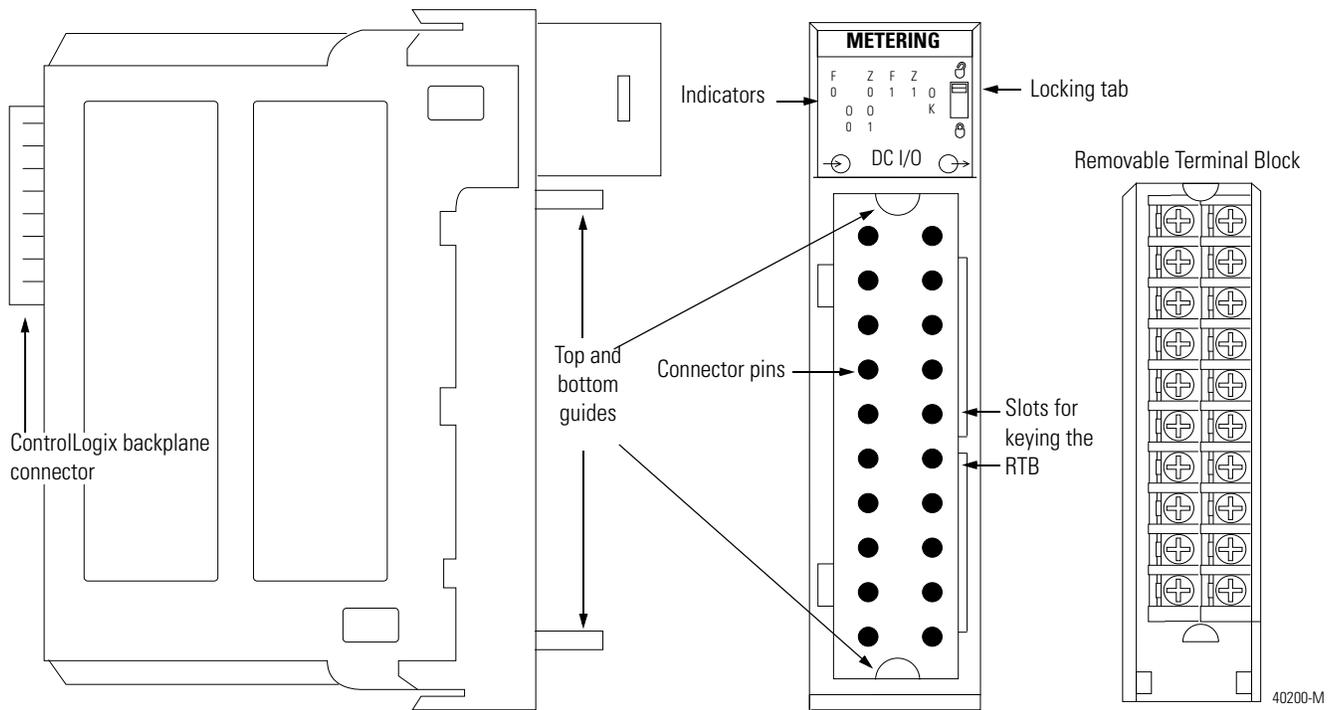
ControlLogix backplane connector - The backplane connector interface for the ControlLogix system connects the module to the ControlLogix backplane.

Connectors pins - Input/output, power and grounding connections are made to the module through these pins with the use of an RTB or IFM.

Locking tab - The locking tab anchors the RTB or IFM cable on the module, maintaining wiring connections.

Slots for keying - Mechanically keys the RTB to prevent inadvertently making the wrong wire connections to your module.

Status indicators - Indicators display the status of communication, module health and input/output devices. Use these indicators to help in troubleshooting.

Top and bottom guides - Guides provide assistance in seating the RTB or IFM cable onto the module.

Typical Applications

You can use the CFM module in power management, automotive, food and beverage, and oil and gas industries for various flow and/or turbine metering applications.

This figure shows a CFM module in a turbine shaft speed monitoring application. In this example, the 1756-CFM module is operating in high resolution frequency mode. Other examples are shown in Chapter 3 to reflect the various operational modes available on the 1756-CFM module.
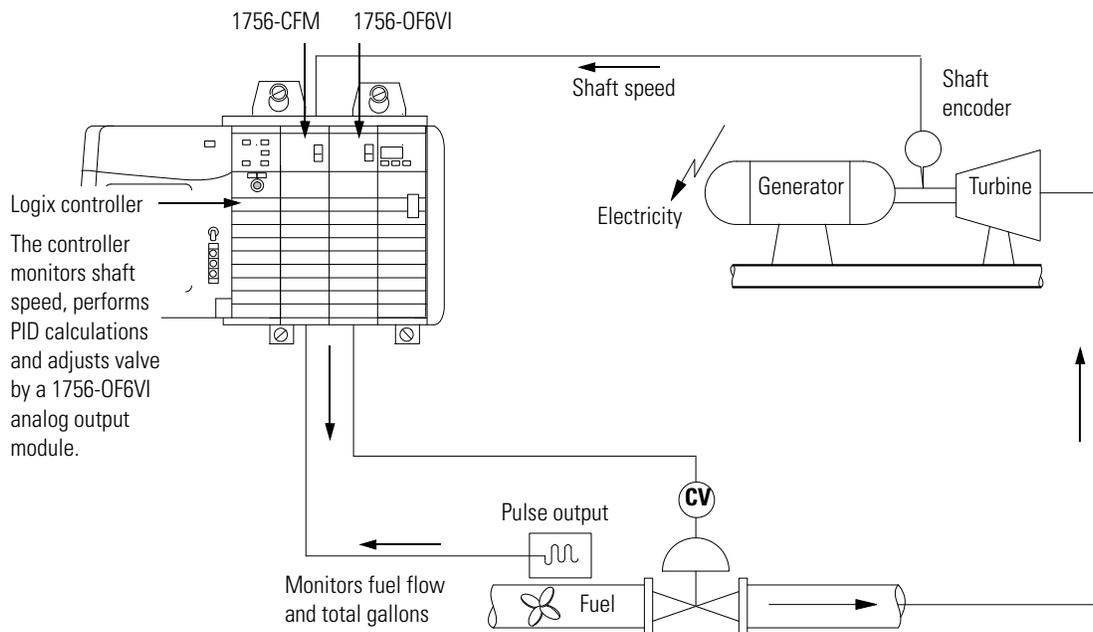
For a detailed explanation of how the CFM module works with other portions of a ControlLogix control system, see Chapter 2, Configurable Flowmeter Operation in the ControlLogix System.

Understanding Module Input Capabilities

The CFM module accepts input for up to two channels (mode dependent). Each of the input channels can connect to:

- Magnetic Pickup - 50mV trigger
- TTL output - 1.3V trigger
- Preamp outputs - 4V trigger

You configure the CFM module's two input channels for your specific application(s). Each input channel has two input selections:

- Flowmeter Input (F0 & F1) - Connect input device to this input.
- Gate Input (Z0 & Z1) - Accepts 4-40V DC input pulses from open collectors or external contact closures. These inputs are used in Totalizer mode to:
  - interface to a prover when a prover is enabled.

Understanding Module Output Capabilities

The CFM module has two assignable outputs. These outputs are designed for applications that require fast response. The outputs:

- are electrically fused/current limited to 4A; the total output combination is limited to 7A.
- can be assigned to any input channel with user-defined trigger parameter (see Table 1).
- are current sourcing at 10-31.2V DC (1A maximum per output).
- must be connected to an external power supply.
- may be forced ON or OFF by the program.

| IMPORTANT | You can assign both outputs to a given channel; however, you cannot use the same output with two different channels. |

Table 1 - Assign the CFM Module's Outputs

In this operational mode	You can assign outputs that are configured to trigger
Totalizer	Frequency (acceleration) Prover status Fill control
High-Resolution Frequency	Frequency Frequency rate of change (acceleration)

Using Module Identification and Status Information

Each ControlLogix CFM module maintains specific identification information that separates it from all other modules. This information assists you in tracking all the components of your system.

For example, you can track module identification information to be aware of exactly what modules are located in any ControlLogix rack at any time. While retrieving module identity, you can also retrieve the module's status.

Each module maintains the following information:

Table 2 - Module Identification and Status Information

Module Identification	Description
Product Type	Module's product type, such as Digital I/O or Analog I/O module
Catalog Code	Module's catalog number
Major Revision	Module's major revision number
Minor Revision	Module's minor revision number

Status	Module's status. Returns the following information:
	• Controller ownership (if any)
	• Whether module has been configured
	• Device Specific Status, such as:
	  – Self-Test
	  – Flash update in progress
	  – Communications fault
	  – Not owned (outputs in program mode)
	  – Internal fault (need flash update)
	  – Run mode
	  – Program mode (output mods only)
	• Minor recoverable fault
	• Minor unrecoverable fault
	• Major recoverable fault
	• Major unrecoverable fault

Vendor ID	Module manufacturer vendor, for example Allen-Bradley
Serial Number	Module serial number
Length of ASCII Text String	Number of characters in module's text string
ASCII Text String	Number of characters in module's text string

> **IMPORTANT**   You must perform a WHO service to retrieve this information.

Configurable Flowmeter Operation in the ControlLogix System

What This Chapter Contains

This chapter describes how the CFM module works within the ControlLogix system.

In traditional industrial applications, controllers poll Flowmeter modules to obtain their status. Controllers also send commands to the Flowmeter modules. Retrieving Flowmeter status and sending commands occurs during the normal I/O program scan.

ControlLogix CFM modules do not follow the traditional operational manner. Instead, they use the Producer/Consumer Model (see page 33 for more information) to produce data without having been polled by a controller first.

1756-CFM modules follow these basic operational steps, as shown in Figure 2.

1. The Logix controller establishes a connection to the CFM module and downloads configuration via ladder logic and message instructions.

2. Flowmeters transmit input signals to the CFM module.

3. The 1756-CFM module calculates volume from accumulated pulse counts as engineering units.

4. Rather than being scanned by an owner-controller, the 1756-CFM module periodically multicasts its status to the controller. (see .) The 1756-CFM module also multicasts its status to controllers connected by a listen-only connection ().

5. The Logix owner-controller processes the data it received from the 1756-CFM module and returns the appropriate data.

Figure 2 - 1756-CFM Basic Operational Steps
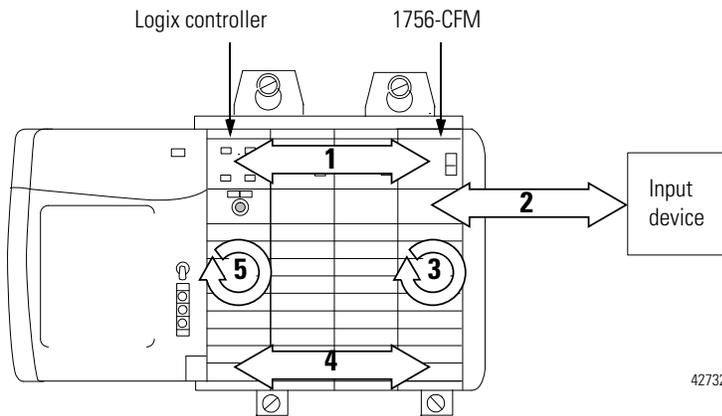
IMPORTANT	A 1756-CFM module's communication, or multicasting, behavior varies depending upon whether it operates in the local chassis or in a remote chassis. The following sections detail the differences in data transfers between these set-ups.

Ownership

Every CFM module in the ControlLogix system must be owned by a Logix5550® Controller. The owner-controller:

- stores configuration data for every CFM module that it owns.
- can be local or remote in regard to the I/O module's position.
- sends configuration data to the CFM module to define the module's behavior within the control system.

Each CFM module continuously maintains communication with its owner during normal operation. When connections are severed or compromised, the CFM module performs as configured, either setting all outputs to reset (ON or OFF) or continuous operations.

Other controllers may also listen to the CFM module (while another controller owns the module) through a listen-only connection. For more information on listen-only connections, see .

Using RSNetWorx and RSLogix 5000 Software

The I/O configuration portion of RSLogix™ 5000 software generates configuration data structures and tags for that CFM module, whether the module is located in a local or remote chassis. A remote chassis, also known as networked, contains the CFM module but not the module's owner-controller.

After creating the CFM module, you can write specific configuration in the module's data structures; you must access the module tags to change information in the data structures. This process is explained in detail in Chapter 5, Configuring the Configurable Flowmeter Module.

IMPORTANT	Application-specific configuration data is transferred to the controller during the program download and sent to the CFM module during the initial power-up. After CFM module operation has begun, you must use ladder logic and message instructions to make configuration changes.

CFM Modules in Local Chassis

CFM modules in the same chassis as the owner-controller are ready to run as soon as the configuration data has been downloaded.

CFM Modules in Remote Chassis

You must run RSNetWorx™ software to enable CFM modules in the networked chassis. Running RSNetWorx software transfers configuration data to networked modules and establishes a Network Update Time (NUT) for ControlNet. The NUT is compliant with the desired communications options specified for each module during configuration.

Follow these general guidelines when configuring CFM modules:

1. Configure all CFM modules for a given controller using RSLogix 5000 software and download that information to the controller.

2. If the CFM configuration data references a module in a remote chassis, run RSNetWorx software.

IMPORTANT	RSNetWorx software **must** be run whenever a new module is added to a networked chassis. When a module is permanently removed from a remote chassis, we recommend that RSNetWorx software be run to optimize the allocation of network bandwidth.

Connections

Logix controllers make connections to 1756-CFM modules to exchange data. The controller can make either of the following connections to a 1756-CFM module:

- Direct Connections - Only one controller can make this connection to a CFM module.
- Listen-Only Connections - Multiple controllers can make this connection to a CFM module simultaneously.

Direct Connections

A **direct connection** is a real-time data transfer link between the controller and the device that occupies the slot that the configuration data references. When module configuration data is downloaded to an owner-controller, the controller attempts to establish a direct connection to each of the modules referenced by the data. One of the following events occurs:

- If the data is appropriate to the module found in the slot, a connection is made and operation begins.

- If the configuration data is not appropriate, the data is rejected and an error message displays in the software. In this case, the configuration data can be inappropriate for any of a number of reasons. For example, a module's configuration data may be appropriate except for a mismatch in electronic keying that prevents normal operation.

The controller maintains and monitors its connection with a module. Any break in the connection, such as removal of the module from the chassis while under power, causes the controller to set fault status bits in the data area associated with the module. The RSLogix 5000 software may monitor this data area to announce the modules' failures.

IMPORTANT	The typical Logix controller can make and maintain up to 250 connections. Each 1756-CFM module requires 1 connection.

Listen-Only Connections

Any controller in the system can **listen** to the data from any CFM module even if the controller does not own the module (in other words, it does not have to hold the module's configuration data to listen to the module).

During the CFM module creation process in RSLogix 5000 software, you can specify the 'Listen-Only' Communication Format. For more information on Communication Format, see .

Choosing 'Listen-Only' mode allows the controller and module to establish communications without the controller sending any configuration data. In this instance, another controller owns the CFM module.

IMPORTANT	Controllers using the Listen-Only mode continue to receive data multicast from the CFM module as long as a connection between an owner and CFM module is maintained.
	If the connection between all owners and the CFM module is broken, the module stops multicasting data and connections to all 'Listening controllers' are also broken.

Configurable Flowmeter Modules in a Local Chassis

CFM modules multicast their data periodically. Multicast frequency depends on the options chosen during configuration and where in the control system the module physically resides. The data consumer (an owner-controller) is responsible for knowing that the format of the new data is integers.

Requested Packet Interval (RPI)

This configurable parameter instructs the module to multicast its channel and status data to the local chassis backplane at specific time intervals.

The RPI instructs the module to multicast the **current contents** of its on-board memory when the RPI expires, (i.e. the module does not update its channels prior to the multicast) as shown in this figure.

On-Board Memory

| Status Data |
| Flowmeter 0 |
| Flowmeter 1 |

| Ch 0 |
| Ch 1 |
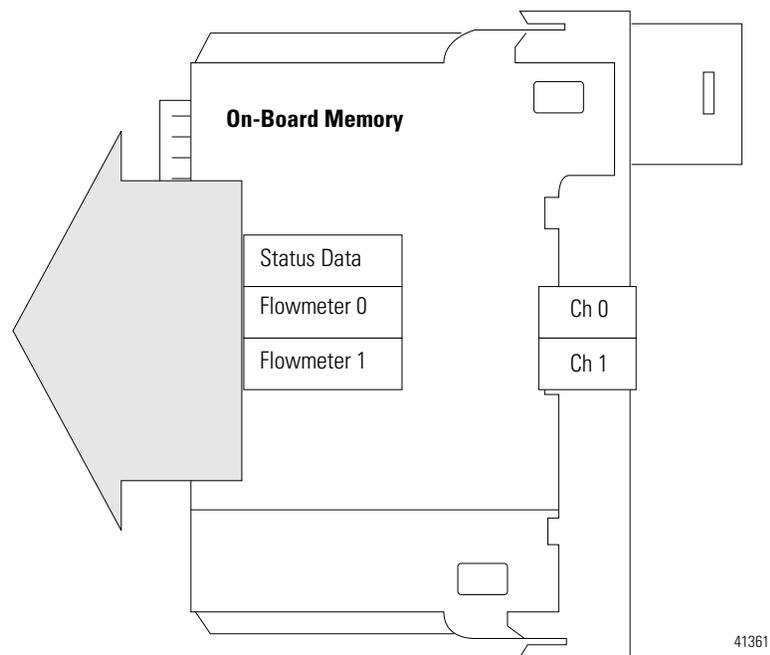
41361

IMPORTANT   You set the RPI value during the initial module configuration and can adjust it the controller is in Program mode.

The minimum RPI is determined by channel usage. For each channel using High Resolution Frequency mode, add 5 ms to the minimum RPI. For each channel using Totalizer Mode, add 50 ms to the minimum RPI.

For example, if one channel uses High Resolution Frequency mode and the other goes unused, the minimum RPI = 5 ms. If one channel uses High Resolution Frequency mode and the other uses Totalizer mode, the minimum RPI = 55 ms.

Configurable Flowmeter Modules in a Remote Chassis

If an CFM module resides in a networked chassis, the role of the RPI changes slightly with respect to getting data to the owner.

The RPI not only defines when the module multicasts data **within its own chassis** (as described in the previous section), but also determines how often the owner-controller will receive it over the network.

When an RPI value is specified for an CFM module in a remote chassis, in addition to instructing the module to multicast data within its own chassis, the RPI also "reserves" a spot in the stream of data flowing across the ControlNet network.

The timing of this "reserved" spot may or may not coincide with the exact value of the RPI, but the control system guarantees that the owner controller receives data **at least as often** as the specified RPI.

See for a better understanding of the data flow with a CFM module in a remote chassis.

Figure 2 - CFM Module in Remote Chassis with RPI Reserving a Spot in Flow of Data
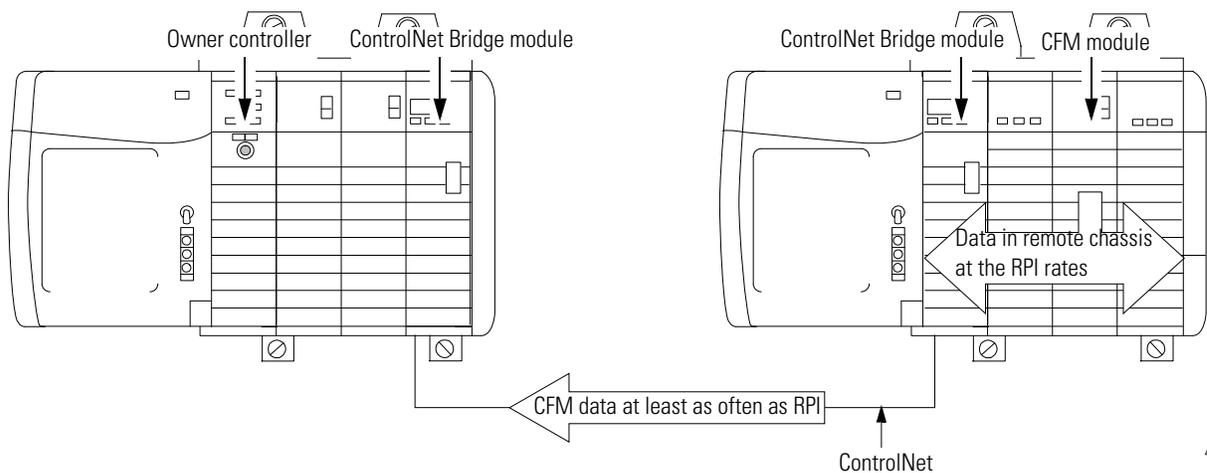
Configurable Flowmeter Module Features and Operational Modes

What this Chapter Contains

This chapter describes the ControlLogix Configurable Flowmeter module's features and operational modes.

Topic	Page
Understanding General Module Features	25
Electronic Keying	27
Choosing an Operational Mode	35
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Operating in Totalizer Mode	41
Using the Totalizer Mode Prover Function	42
Using the Totalizer Mode Filler Function	50
Configurable Output Behaviors	58

This chapter only provides a general description of each feature, whether general or operational mode-specific. For examples of how to use these features in your module's configuration, see .

Understanding General Module Features

The following general module features are available with the ControlLogix CFM module.

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Configurable Flowmetering Channels	34
Flowmeter Inputs	34
Gate Inputs	34
User-Defined Preset and Rollover Values	35
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Removal and Insertion Under Power (RIUP)

All ControlLogix CFM modules may be inserted and removed from the chassis while power is applied. This feature allows greater availability of the overall control system because, while the module is being removed or inserted, there is no additional disruption to the rest of the controlled process.

Module Fault Reporting

ControlLogix CFM modules provide both hardware and software indication when a module fault has occurred. Each module's LED fault indicator and RSLogix 5000 software will graphically display this fault and include a fault message describing the nature of the fault.

This feature allows you to determine how your module has been affected and what action should be taken to resume normal operation.

Fully Software Configurable

The RSLogix 5000 software uses a custom, easily understood interface to write configuration. All module features are enabled or disabled through the I/O configuration portion of the software.

You can also use the software to interrogate any module in the system to retrieve:

- serial number
- revision information
- catalog number
- vendor identification
- error/fault information
- diagnostic counters.

By eliminating such tasks as setting hardware switches and jumpers, the software makes module configuration easier and more reliable.

Electronic Keying

The electronic keying feature automatically compares the expected module, as shown in the RSLogix 5000 I/O Configuration tree, to the physical module before I/O communication begins. You can use electronic keying to help prevent communication to a module that does not match the type and revision expected.

For each module in the I/O Configuration tree, the user-selected keying option determines if, and how, an electronic keying check is performed. Typically, three keying options are available:

- Exact Match
- Compatible Keying
- Disable Keying

You must carefully consider the benefits and implications of each keying option when selecting between them. For some specific module types, fewer options are available.

Electronic keying is based on a set of attributes unique to each product revision. When a Logix5000™ controller begins communicating with a module, this set of keying attributes is considered.

Table 3 - Keying Attributes

Attribute	Description
Vendor	The manufacturer of the module, for example, Rockwell Automation/Allen-Bradley.
Product Type	The general type of the module, for example, communication adapter, AC drive, or digital I/O.
Product Code	The specific type of module, generally represented by its catalog number, for example, 1756-IB16I.
Major Revision	A number that represents the functional capabilities and data exchange formats of the module. Typically, although not always, a later, that is higher, Major Revision supports at least all of the data formats supported by an earlier, that is lower, Major Revision of the same catalog number and, possibly, additional ones.
Minor Revision	A number that indicates the module's specific firmware revision. Minor Revisions typically do not impact data compatibility but may indicate performance or behavior improvement.

You can find revision information on the General tab of a module's Properties dialog box.

Figure 3 - General Tab

IMPORTANT	Changing electronic keying selections online may cause the I/O communication connection to the module to be disrupted and may result in a loss of data.

Exact Match

Exact Match keying requires all keying attributes, that is, Vendor, Product Type, Product Code (catalog number), Major Revision, and Minor Revision, of the physical module and the module created in the software to match precisely to establish communication. If any attribute does not match precisely, I/O communication is not permitted with the module or with modules connected through it, as in the case of a communication module.

Use Exact Match keying when you need the system to verify that the module revisions in use are exactly as specified in the project, such as for use in highly-regulated industries. Exact Match keying is also necessary to enable Automatic Firmware Update for the module via the Firmware Supervisor feature from a Logix5000 controller.

EXAMPLE   In this scenario, Exact Match keying prevents I/O communication.

The module configuration is for a 1756-IB16D module with module revision 3.1. The physical module is a 1756-IB16D module with module revision 3.2. In this case, communication is prevented because the Minor Revision of the module does not match precisely.

Module Configuration
Vendor = Allen-Bradley
Product Type = Digital Input Module
Catalog Number = 1756-IB16D
Major Revision = 3
Minor Revision = 1
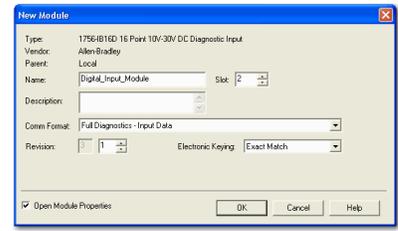
Communication is prevented.
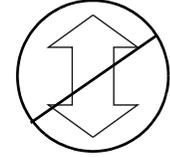
Physical Module

Vendor = Allen-Bradley
Product Type = Digital Input Module
Catalog Number = 1756-IB16D
Major Revision = 3
Minor Revision = 2
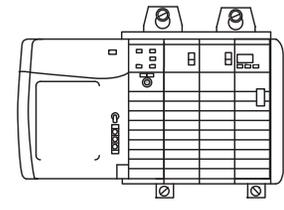
IMPORTANT   Changing electronic keying selections online may cause the I/O Communication connection to the module to be disrupted and may result in a loss of data.

Compatible Keying

Compatible Keying indicates that the module determines whether to accept or reject communication. Different module families, communication adapters, and module types implement the compatibility check differently based on the family capabilities and on prior knowledge of compatible products. Release notes for individual modules indicate the specific compatibility details.

Compatible Keying is the default setting. Compatible Keying allows the physical module to accept the key of the module configured in the software, provided that the configured module is one the physical module is capable of emulating. The exact level of emulation required is product and revision specific.

With Compatible Keying, you can replace a module of a certain Major Revision with one of the same catalog number and the same or later, that is higher, Major Revision. In some cases, the selection makes it possible to use a replacement that is a different catalog number than the original. For example, you can replace a 1756-CNBR module with a 1756-CN2R module.

When a module is created, the module developers consider the module's development history to implement capabilities that emulate those of the previous module. However, the developers cannot know future developments. Because of this, when a system is configured, we recommend that you configure your module using the earliest, that is, lowest, revision of the physical module that you believe will be used in the system. By doing this, you can avoid the case of a physical module rejecting the keying request because it is an earlier revision than the one configured in the software.

EXAMPLE

In this scenario, **Compatible Keying prevents I/O communication**:

The module configuration is for a 1756-IB16D module with module revision 3.3. The physical module is a 1756-IB16D module with module revision 3.2. In this case, communication is prevented because the minor revision of the module is lower than expected and may not be compatible with 3.3.

Module Configuration
Vendor = Allen-Bradley
Product Type = Digital Input Module
Catalog Number = 1756-IB16D
Major Revision = 3
Minor Revision = 3
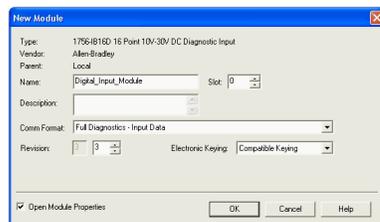
Communication is prevented.
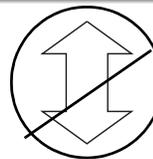
Physical Module
Vendor = Allen-Bradley
Product Type = Digital Input Module
Catalog Number = 1756-IB16D
Major Revision = 3
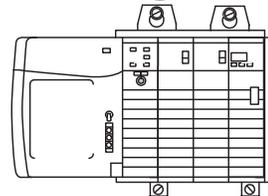
<table>
<tr><td>**EXAMPLE**</td><td>In this scenario, **Compatible Keying allows I/O communication**:

The module configuration is for a 1756-IB16D module with module revision 2.1. The physical module is a 1756-IB16D module with module revision 3.2. In this case, communication is allowed because the major revision of the physical module is higher than expected and the module determines that it is compatible with the prior major revision.</td></tr>
</table>

Module Configuration
Vendor = Allen-Bradley
Product Type = Digital Input
Module
Catalog Number = 1756-IB16D
Major Revision = 2
Minor Revision = 1
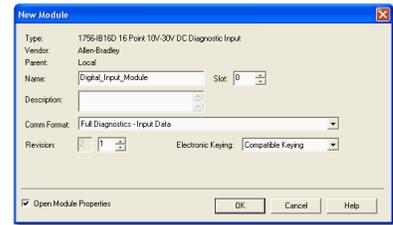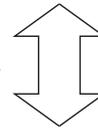
Communication is allowed.

Physical Module
Vendor = Allen-Bradley
Product Type = Digital Input
Module
Catalog Number = 1756-IB16D
Major Revision = 3
Minor Revision = 2
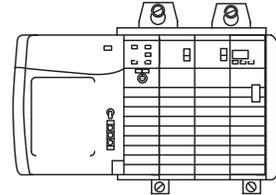
<table>
<tr><td>**IMPORTANT**</td><td>Changing electronic keying selections online may cause the I/O communication connection to the module to be disrupted and may result in a loss of data.</td></tr>
</table>

Disabled Keying

Disabled Keying indicates the keying attributes are not considered when attempting to communicate with a module. Other attributes, such as data size and format, are considered and must be acceptable before I/O communication is established. With Disabled Keying, I/O communication may occur with a module other than the type specified in the I/O Configuration tree with unpredictable results. We generally do not recommend using Disabled Keying.

ATTENTION	
⚠	Be extremely cautious when using Disabled Keying; if used incorrectly, this option can lead to personal injury or death, property damage, or economic loss.

If you use Disabled Keying, you must take full responsibility for understanding whether the module being used can fulfill the functional requirements of the application.

| EXAMPLE	In this scenario, **Disable Keying prevents I/O communication**:
	The module configuration is for a 1756-IA16 digital input module. The physical module is a 1756-IF16 analog input module. In this case, communication is prevented because the analog module rejects the data formats that the digital module configuration requests.

Module Configuration
Vendor = Allen-Bradley
Product Type = Digital Input
Module
Catalog Number = 1756-IA16
Major Revision = 3
Minor Revision = 1
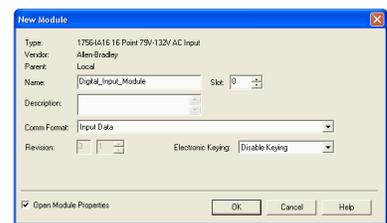
Communication is prevented.
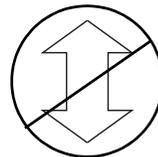
Physical Module
Vendor = Allen-Bradley
Product Type = Analog Input
Module
Catalog Number = 1756-IF16
Major Revision = 3
Minor Revision = 2
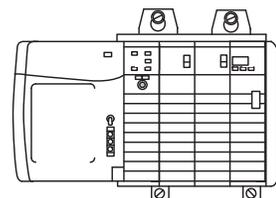
EXAMPLE	In this scenario, **Disable Keying allows I/O communication**:

The module configuration is for a 1756-IA16 digital input module. The physical module is a 1756-IB16 digital input module. In this case, communication is allowed because the two digital modules share common data formats.

Module Configuration
Vendor = Allen-Bradley
Product Type = Digital Input
Module
Catalog Number = 1756-IA16
Major Revision = 2
Minor Revision = 1
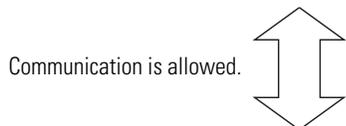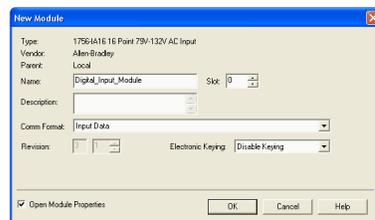
Communication is allowed.

Physical Module
Vendor = Allen-Bradley
Product Type = Digital Input
Module
Catalog Number = 1756-IB16
Major Revision = 3
Minor Revision = 2
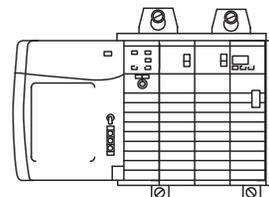
IMPORTANT	Changing electronic keying selections online may cause the I/O communication connection to the module to be disrupted and may result in a loss of data.

Producer/Consumer Model

By using the Producer/Consumer model, ControlLogix CFM modules can produce data without having been polled by a controller first. The modules produce the data and any other owner controller device can decide to consume it.

Module Status Information

The ControlLogix CFM module has status indicators on the front of the module that allow you to check the module health and operational status.

The following status can be checked with the LED indicators:

- **Input point status** - display indicates a particular points status, including specific indicators for the input F and Z points for each channel
- **Output point status** - display indicates the status of two output points on the module

For an example of the status indicators, see .

Configurable Flowmetering Channels

The CFM module offers two configurable Flowmetering channels. Each channel uses two Flowmeter inputs (F0 & F1) and two corresponding gate inputs (Z0 & Z1).

Flowmeter Inputs

Two Flowmeter inputs (F0 & F1) are available on your CFM module. The inputs are capable of receiving the following input signals:

- +/- 30V peak from passive Magnetic Pickups
- 5V DC logic (TTL compatible)
- 12-24V DC powered preamp outputs

Gate Inputs

The CFM module offers two gate inputs (Z0 & Z1). You can wire the inputs for single-ended or differential applications and can accept signals at 5V DC or 12-24V DC.

IMPORTANT	The Z0 and Z1 inputs can have different voltages connected to them simultaneously.

User-Defined Preset and Rollover Values

The CFM module has a maximum count of 2,147,483,647, but you can define the rollover values below this limit.

Current-Sourcing Outputs

Two current-sourcing outputs are available on the CFM module. Each output:

- can be tied to any Flowmeter input.
- operates in the 10-31.2V DC range (1A maximum per output).
- operates at 5V DC level (3-20mA maximum per output).

Choosing an Operational Mode

The CFM module counts pulses from Flowmeters and operates in the following modes:

- High Resolution Frequency Mode
- Totalizer Mode

You must choose an operational mode for your 1756-CFM module in the RSLogix 5000 software.

Operating in High Resolution Frequency Mode

In High Resolution Frequency mode, the CFM module calculates frequency over a user-defined time period up to 2 seconds. Frequency sampling begins on the leading edge of the first pulse and ends on the next pulse to occur after the sampling period expires.

This figure shows a CFM module in a turbine shaft speed monitoring application in high resolution frequency mode.
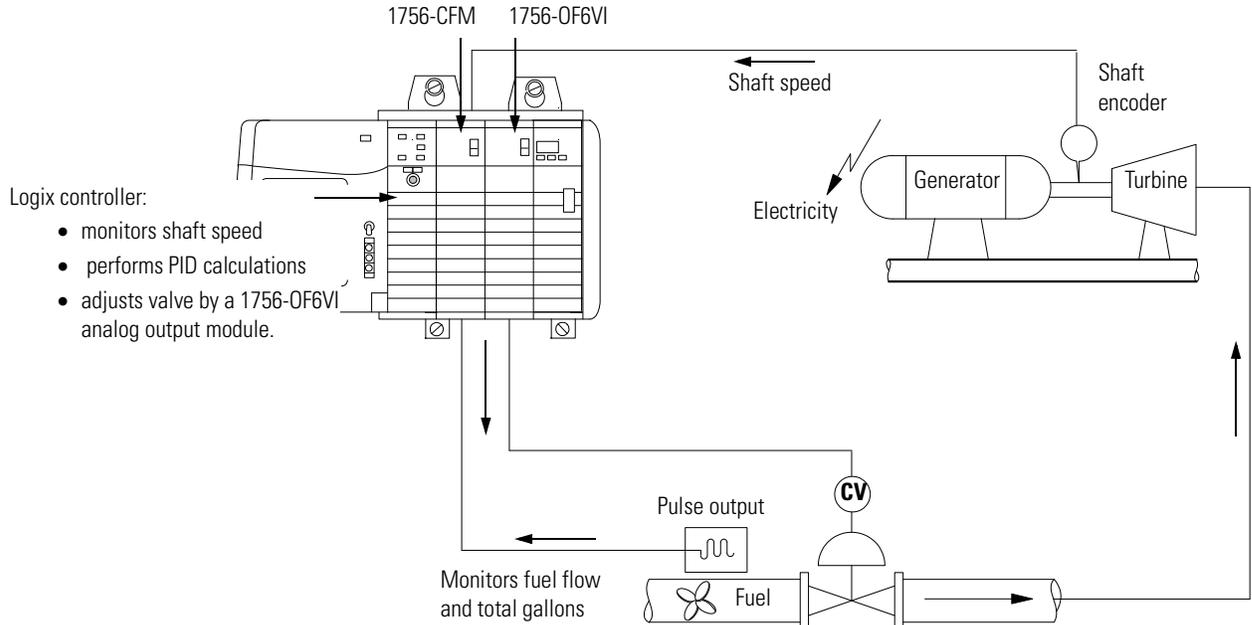
You must calculate a resolution for this mode. Use the following equation to calculate resolution.

$$\text{Resolution} = \frac{F_{in}\,(250 \times 10^{-9})}{T_{sample}}$$

Where:
- F_{in} is the input frequency
- T_{sample} is the sample time period

This table lists sample F_{in} and T_{sample} values and the corresponding resolution.

Table 4 - Sample Resolutions

F_{in}	T_{sample}	Resolution
60Hz	0.033 seconds	0.00045Hz
5000Hz	0.020 seconds	0.0625Hz
50,000Hz	0.050 seconds	0.25Hz

The values listed in Table 4 are listed for example purposes. Specific values will change according to your application.

Terminal Usage in High Resolution Frequency Mode

In Frequency mode, F0 and F1 are used as inputs.

Output Operation in Frequency Mode

In Frequency mode, outputs can:

- operate normally
- be forced ON or OFF.
- be tied to the frequency flowmeter input (i.e. F1).

Module Features Used in High Resolution Frequency Mode

The following module features are available in High Resolution Frequency mode.

Module Feature	Page
Low Frequency Clear	38
Sample Time	38
Acceleration Calculation	39
Meter Factor	39
Trigger On	39
Tie to Counter	39
Highest Allowed Frequency	40
Acceleration Alarm Value	40
Frequency Average	40
Acceleration	40

Low Frequency Clear

Use Low Frequency Clear to set a minimum frequency level. Any frequencies detected below this level will be set 0.

Sample Time

Use Sample Time to determine the length of time each sample uses. The maximum sample time is 2 seconds.

Acceleration Calculation

Acceleration Calculation is derived by using the rate of change of frequency over a specified number of samples (1 to 255). This moving average produces quick responses when the number of samples = 1 and stable, but slower, responses when the number of samples =255.

The default number of samples used = 255, but a typical application uses 50 samples. There are significant differences between response times. For example, the quick response offer acceleration calculations more often but is more likely to set off the Acceleration Alarm for calculation spikes at low frequencies. The stable responses are slower but ignore acceleration spikes in favor of definitive operational trends.

IMPORTANT   Acceleration Calculation values can be entered on the bit level or byte level. If you are entering values at the byte level, you must use -1 to represent 255. If you are entering values on the bit level, you can use the actual number value.

Meter Factor

Meter Factor is used to calibrate the frequency (Hz) to a user-defined standard. For example, the CFM module may read 59.9Hz while the standard is set for 59.7Hz. In this case, the meter factor (default = 1.0) should be changed to 0.99666 to correct the reading.

Trigger On

Use Trigger On to determine what state triggers an output to energize in high resolution frequency mode (i.e. an output can be configured to turn ON if the Frequency Average reaches a particular frequency.

- Frequency - Input exceeds MaxAllowedFreq.
- Acceleration - Input speed accelerates beyond AccelAlarmValue.

IMPORTANT   For the Trigger On feature, Frequency and Acceleration are tied to the Overspeed Alarm and Acceleration Alarm respectively. The alarms remain latched ON once set and can only be reset if you toggle the Alarm Enable bits.

Tie to Counter

Choose which output is connected to which flowmeter input.

Highest Allowed Frequency

Use Highest Allowed Frequency to set the trigger point for
Frequency. In other words, set this value so that when the input reaches it, the
outputs are energized. This value is also used for
the Overspeed Alarm.

Acceleration Alarm Value

Use Acceleration Alarm to set the trigger point for Acceleration.
In other words, set this value so that when the input reaches it,
the outputs are energized. This value is also used for the
Acceleration Alarm.

Frequency Average

With Frequency Average, the CFM divides meter counts by a user-defined
sample interval (up to 2 seconds) to determine the Frequency Average.

Acceleration

Use Acceleration to determine an acceleration value over a user-defined
number of samples.

Alarms in High Resolution Frequency Mode

High Resolution Frequency mode offers the following alarms:

- Overrange Alarm
- Overspeed Alarm
- Acceleration Alarm

You must enable each alarm. When any of the alarms occur, it is latched and
remains on until the user resets the alarm.

Sample Configuration for High Resolution Frequency Mode

To see a sample configuration for a 1756-CFM module using high resolution
frequency mode, including the use of all the features mentioned in the
previous section, see .

Operating in Totalizer Mode

In Totalizer mode, the 1756-CFM module counts pulses and scales them to engineering units. Every effort is made to store the least significant count even when the least significant unit of the total is larger. The CFM module calculates three forms of calculated frequency:

- Frequency over a fixed period
- Frequency over a requested number of samples
- Moving average of the frequency

All of the forms mentioned above are available in totalizer mode. In this mode, the module also offers the following functions:

- Prover Function
- Filler Function

These functions are described later in this chapter.

Nonresettable Totalizer

Configure the CFM module for Nonresettable Totalizer mode to make sure the total counts value is not reset during normal module operation. The CFM module stores total count values up to 2^{31}-1 (2,147,483,647) counts.

> **IMPORTANT** The total count value can be reset in Nonresettable Totalizer mode if power is cycled to the module for any reason (e.g. module is removed from and reinserted to the chassis).

Terminal Usage in Totalizer Mode

In Totalizer mode, F0 and F1 are used as inputs. Z0 and Z1 are used as prover signals.

Output Operation in Totalizer Mode

In Totalizer mode, outputs:

- can operate normally or be forced ON or OFF.
- can be tied to either flowmeter input. If one channel is configured for trickle operation, both outputs are tied to that flowmeter input.

Using the Totalizer Mode Prover Function

In the Totalizer Mode Prover function, the CFM module interfaces to a prover and counts pulses using a Flowmeter or positive displacement meter. The module then scales pulse count to engineering units. The CFM module can also use this mode to calculate frequency over a user-defined time period, where frequency is calculated as counts per unit time.

Either module output can be tied to either flowmeter input with the Prover function, and output operation can occur independently from new data from the Logix owner-controller.

With the Prover function, the totalizer is active all the time, but the Prover function must first be enabled and started to activate the Prover Total. Once the Prover function is started, only the gate signal or a user-override (i.e. clearing the Prover Enable bit) can eliminate the function. However, the Gross Volume, Net Volume, and Fill Total will continue to accumulate as long as the flow input frequency is enabled and is greater than Low Frequency Clear.

This figure shows a 1756-CFM module in a petrochemical flow and custody transfer application while operating in the totalizer mode prover function.
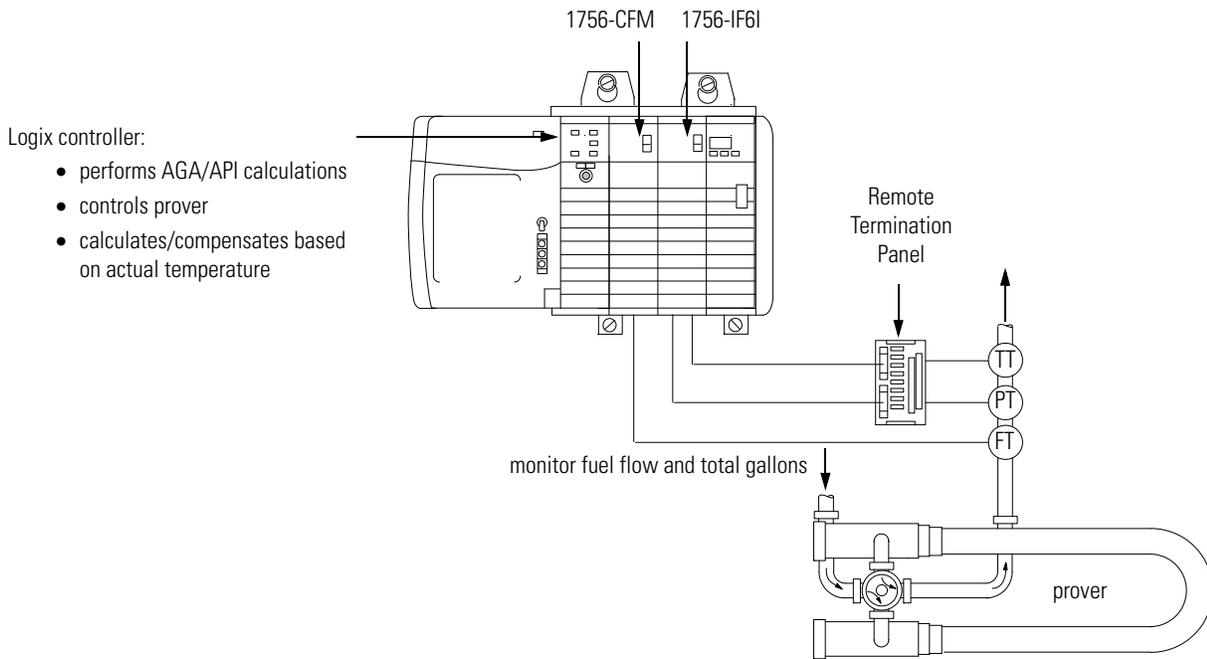
42731

Using a Prover

A prover is used for the calibration of liquid meters in custody transfer applications. This calibration is done by comparing a metered throughput to a known volume in the prover. When enabled, the prover total updates while the spheroid moves between two detectors and is then compared to the predetermined volume of the prover section to ascertain the meter factor.

If you are using the Totalizer or Nonresettable Totalizer mode for capturing meter counts during a prover calibration, you have the option of selecting either of these types of provers:

- Unidirectional - With a unidirectional prover, the CFM module:

  – begins updating Prover Total when the spheroid passes the first detector
  – stops updating Prover Total when the spheroid passes the second detector

- Bidirectional - With a bidirectional prover, the CFM module:

  – begins updating Prover Total when the spheroid passes the first detector
  – stops counting when the spheroid passes the second detector (Prover Total is updated at this time - intermediate value returned)
  – continues updating when the spheroid returns past the second detector
  – stops updating when the spheroid returns past the first detector (Prover Total Count Value is updated at this time)

This figure shows an example of a spheroid and detectors.
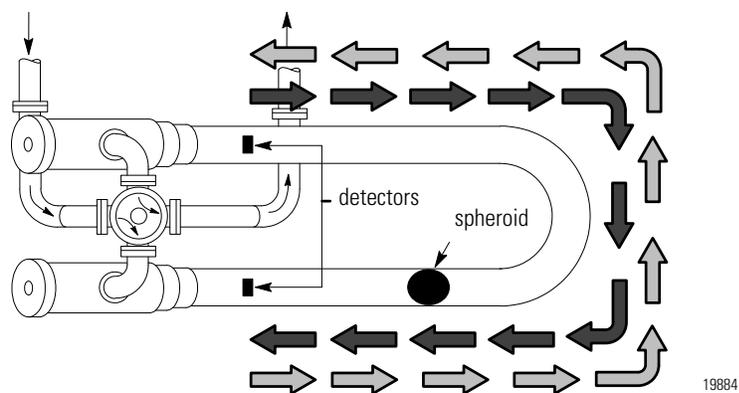
Features Available with the Prover Function

The following module features are available with the Totalizer Mode Prover function.

Module Feature	Page
Prover Direction	44
Low Frequency Clear	44
Trigger On	45
Tie to Counter	45
Total Overflow	45
Total Overrange	45
Total Overspeed	46
Total Acceleration	46
Prover Total	46
Total Counts	46
Frequency Average	46
Frequency Period	47
Speed	47
Acceleration	47
Gross Volume	47
Net Volume	47
Gross Rate	48
Net Rate	49

Prover Direction

You can operate the CFM module as a unidirectional or bidirectional prover. Use Prover Direction to configure the CFM module for the prover type used in your application.

Low Frequency Clear

Use Low Frequency Clear to set a minimum frequency level.
Any counts detected below this level will not be used in count calculations.

Trigger On

Use Trigger On to determine what flowmeter state triggers the output to energize. For example, you can configure the CFM module to trigger an output when the flowmeter reaches a particular frequency (count).

The following events may trigger output 0 when using the flowmeter function:

- Frequency - flowmeter exceeds a certain frequency (count)
- Acceleration - flowmeter accelerates beyond a particular rate
- Prover Run State - flowmeter is operating in the run state
- Prover Range State - flowmeter is enabled and not complete
- Full Flow - flowmeter is in full flow mode
- Trickle Flow - flowmeter is in trickle flow mode

Tie to Counter

Choose which output is connected to which flowmeter input.

Total Overflow

Use Total Overflow to monitor when the total counts has exceeded the rollover value. The rollover value is a user-defined value set during configuration. Three events must occur for you to use this feature:

- Overflow is enabled
- You set a rollover value
- The count total exceeds the rollover value

When the rollover value is exceeded, the Total Overflow bit is toggled to indicate the event and the Overflow Alarm is set.

Total Overrange

Use Total Overrange to monitor when a flowmeter exceeds the maximum frequency (100kHz). The maximum frequency period is calculated by the number of pulses being counted by the CFM per second. When the frequency period exceeds 100kHz, and the Overrange Alarm is enabled, the Overrange Alarm is set.

Total Overspeed

Use Total Overspeed to monitor when a flowmeter exceeds the Highest Allowed Frequency. With this feature, the CFM module calculates speed by the number of pulses counted in a user-defined sampling period. When the speed exceeds Highest Allowed Frequency, and the Overspeed Alarm is enabled, the Overspeed Alarm is set.

Total Acceleration

Use Total Acceleration to monitor when a flowmeter exceeds the maximum acceleration rate. The acceleration rate is calculated by using a three-point difference formula with unevenly spaced points. The acceleration calculation indicates the number of samples used in the calculation.

Prover Total

Use Prover Total to monitor the raw counts received during the Prover portion of the cycle. The Prover Total represents a net total count value obtained by applying a K-factor and CCF or AGA 7 compensation to the raw count.

Total Counts

Use Total Counts to monitor the total number of counts the CFM module has received since it was last reset to zero.

Frequency Average

Use Frequency Average when Frequency Period must be averaged over multiple samples (meter samples). You must configure the CFM module with a user-defined number of Meter Samples to use this feature. This uses the total counts over the total time per a user-defined number of meter samples. (A meter sample is approximately 20.0 ms.)

Frequency Period

Use Frequency Period to determine the frequency over a user-defined sample time.

Speed

To use the Speed feature, you must set a resolution. The module uses the resolution to determine the number of counts used in the Speed calculation.

For example, if you set the resolution at 0.00001, the module requires 100,000 counts. In this case, the module examines the previous samples stored in its buffers until 100,000 counts are found. The counts are divided by the time it took to accumulate them and the resulting value is the module speed.

Acceleration

Use Acceleration to determine an acceleration value over a user-defined number of samples.

Gross Volume

Use Gross Volume to convert total counts to volumetric units. The module employs a user-defined K-factor in the conversion. For example, you can configure the CFM module so that 4 counts = 1 pint. The module can then convert the total number of counts received to a total number of pints.

Net Volume

The Net Volume value represents the Gross Volume value with a AGA 7 or Logix compensation applied. This value is calculated at an application's base (i.e. standard) operating conditions.

Gross Rate

Use Gross Rate to convert total counts to rate units. The module employs a user-defined K-factor in the conversion. The K-factor is a divisor, and the time interval is divided by this number, as shown below.

$$\text{Gross Rate} = \frac{\text{Total Counts in Meter Sample}}{\text{K-factor}} \times \text{Meter Factor}$$

- If the input frequency is below 100Hz, the K-factor used is always 10.0 for frequencies interpolated between 0-100Hz.

- If the input frequency is between 100Hz and 200Hz, the K-factor is interpolated as follows:

$$\text{K-factor} = (f_{in} - 100.0) \times \frac{(71.0 - 25.0)}{(200.0 - 100.0)} \times 25.0$$

- If the input frequency is between 200Hz and 300Hz, the K-factor is interpolated as follows:

$$\text{K-factor} = (f_{in} - 200.0) \times \frac{(111.0 - 71.0)}{(300.0 - 200.0)} \times 71.0$$

- If the input frequency is greater than 300Hz, the K-factor used is always 100.0. There is no K-factor calculation over 300Hz.

To use Gross Rate, you must set the K-factor values in Module Tags, as shown below.

Name	Style	Data type	Value	Change during operation
C.Operations[0].kFactStruct.kFactorForChan[0]	Float	REAL	25.0[1]	Yes
C.Operations[0].kFactStruct.kFactorForChan[1]	Float	REAL	25.0[1]	Yes
C.Operations[0].kFactStruct.kFactorForChan[2]	Float	REAL	71.0	Yes
C.Operations[0].kFactStruct.kFactorForChan[3]	Float	REAL	111.0	Yes
C.Operations[0].kFactStruct.kFactorForChan[4]-C.Operations[0].kFactStruct.kFactorForChan[12]	Float	REAL	0	Yes
C.Operations[0].kFactStruct.FreqAtKFactor[0]	Float	REAL	0.0	Yes
C.Operations[0].kFactStruct.FreqAtKFactor[1]	Float	REAL	100.0	Yes
C.Operations[0].kFactStruct.FreqAtKFactor[2]	Float	REAL	200.0	Yes
C.Operations[0].kFactStruct.FreqAtKFactor[3]	Float	REAL	300.0	Yes
C.Operations[0].kFactStruct.FreqAtKFactor[4]-C.Operations[0].kFactStruct.FreqAtKFactor[12]	Float	REAL	0	Yes

[1]   To avoid discontinuity when interpolating Gross Rate, make sure the values in C.Operations[0].kFactStruct.kFactorForChan[0] and C.Operations[0].kFactStruct.kFactorForChan[1] match.

IMPORTANT   For more information on setting values in the Module Tags, see <u>Configuring the Configurable Flowmeter Module 5 on page 77</u>.

Net Rate

Use Net Rate in a fashion similar to Gross Rate. The key difference between Gross Rate and Net Rate is that Net Volume also uses a user-defined compensation factor (i.e. AGA 7 or Logix compensation) to convert net counts to net rate units.

Prover Status

Prover Status notifies you of the following prover states:

- Prover not active
- Prover waiting for 1st start
- Prover waiting for 1st stop
- Prover waiting for 2nd start
- Prover waiting for 2nd stop
- Prover complete

Alarms with the Prover Function

The CFM module offers the following alarms when operating with the Prover function:

- Overflow Alarm
- Overrange Alarm
- Overspeed Alarm
- Acceleration Alarm

You must enable each alarm. When any of the alarms occur, it is latched and remains on until you reset the alarm. (Toggle the alarm enable bit to reset the alarm.)

Sample Configuration for Totalizer Mode Prover Function

To see a sample configuration for a 1756-CFM module using totalizer mode prover function, including the use of all the features mentioned in the previous section, see <u>page 101</u>.

Using the Totalizer Mode Filler Function

The Totalizer Mode Filler function performs the basic operations of a fill application, including the following basic steps:

- Set a target fill volume
- Start filling
- Stop filling when the target volume is reached

Within the basic operations mentioned above, the Filler function provides multiple features that can be configured to adjust the fill application for specific circumstances. Those features are described later in this chapter.

The filler function requires a ladder program transition to start the fill cycle. Similar to the Prover function, the totalizer is active all the time, but the Filler function must be first enabled, and started to activate the Fill Total.

This figure shows a 1756-CFM module in a brewery flow monitoring application while operating in the totalizer mode filler function. The application shown requires additional ladder logic.
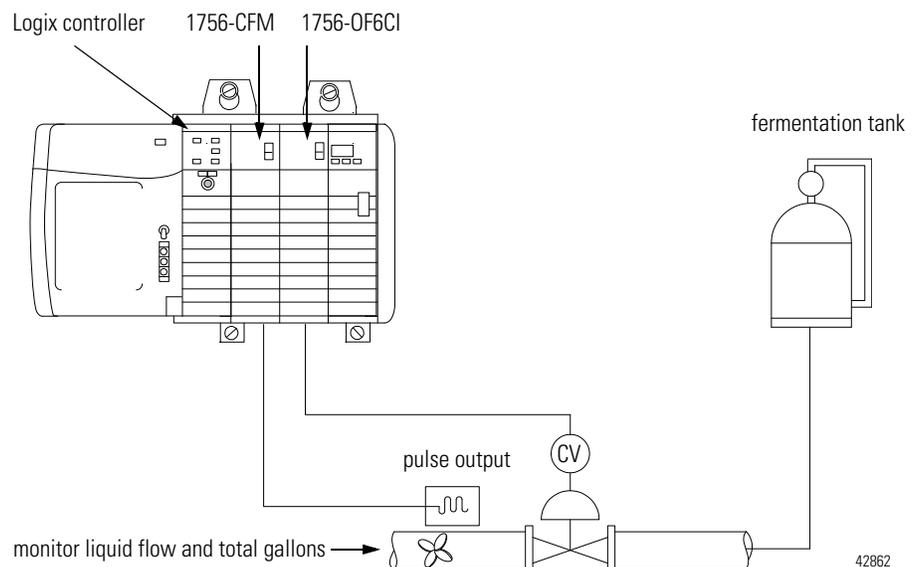
Trickle Function for Totalizer Mode

The trickle function is used with the filler function to improve volume repeatability in a filling application. The trickle function requires two filling lines and an optional discrete module to activate the trickle valve. Activation of the valve should be sized for worst case volume at least 100 ms based on typical program scan = 5 ms and an output module RPI = 25 ms.

For most of the filling process, the full flow state is assigned to one of the module's outputs. For more repeatable fills or to prevent overfills, the pretrigger feature helps make sure that the full flow valve turns off before it reaches the Fill Transition or Fill Total Target volume.

When the filling application reaches the user-defined Fill Transition point, the trickle totalizer mode changes the application from the full flow line to the trickle flow line. This slower line allows the application to finish the filling process without any waste.

For more information on the Fill Transition feature, see .

The filler function can be used in any of the following conditions:

- Starting with the trickle flow
- Filling with the full flow only
- Restarting the timed trickle flow
- Starting the trickle flow prior to the fill transition
- Restarting full flow while in trickle flow

Using the Trickle feature in previously mentioned conditions requires specific configuration changes.

Configurable Features Available with the Totalizer Mode Filler Function

The following configurable features are available with the Totalizer Mode Filler function:

Module Features	Page
Low Frequency Clear	52
PreTrigger	53
Fill Mode	53
Trigger On	53
Tie to Counter	53
Fill Enable	53
Fill Start	54
Fill Hold	54
Fill State	54
Fill Total	55
Total Counts	55
Gross Volume	55
Net Volume	55
Net Rate	57
Fill Total Target	57
Fill Transition	57
Fill Transition Timer	57

Low Frequency Clear

Use Low Frequency Clear to set a minimum frequency level. Any frequencies detected below this level will not be used in count calculations.

Low Frequency Clear uses two tags to configure channel 0.

- Local:X.C.Ch0LowFreqClear
- Local:X.C.Operations[0].MinDetectableFreq

PreTrigger

PreTrigger works only on the Full Flow state. PreTrigger turns OFF the Full Flow state when it determines that the Fill Transition or Fill Total Target will be met before the next update. You must assign a channel to the local module output for this feature to provide repeatable operation.

Fill Mode

Use Fill Mode to choose volume or time for Trickle mode operation.

Trigger On

Use Trigger On to determine what state triggers output 0 to energize. For example, you can configure the CFM module to trigger an output when the prover reaches a particular frequency.

The following events may trigger an output in Filler mode:

- Frequency - Input exceeds a certain frequency (latched).
- Acceleration - Input accelerates at a particular rate (latched).
- Full Flow State - Module is operating in the full flow state.
- Trickle Flow State - Module is operating in trickle state.

Tie to Counter

Choose which output is connected to which channel's totalizer. There are two outputs on each module.

Fill Enable

Use Fill Enable to reset the Fill Total value. This feature does not reset the Gross Volume or Net Volume. You must use the reset for the Totalizer to reset those values.

Fill Start

Fill Start starts the Fill upon transition from 0 to 1. Reset the Fill Enable to reset this feature. If any outputs are connected to the channel, they will transition back to reset and close the valve.

Fill Hold

Use the Fill Hold feature to shutdown the:

- full flow valve

  or

- trickle flow valve.

Setting the Fill Hold feature changes the Fill State to 0 and causes the Fill function to continue even when the Fill Start has been reset.

Fill State

Use Fill State to monitor the current state of the CFM module. The following fill states are possible:

- Filler not active or In Hold
- Filler Enabled only, waiting for start
- Timed Trickle Flow complete, not filled
- Full Flow Active (or Running)
- Timed Trickle Flow Active
- Full Flow Active
- Trickle Flow Active
- Fill complete (7 in module tags)

> **TIP** Use the Fill States to operate a trickle flow valve connected to an optional digital output module.

Fill Total

Use Fill Total to determine the current total in an ongoing fill application. During the fill cycle, use Net Volume to check the Fill Total.

Total Counts

Use Total Counts for the accumulated raw counts the CFM module has received since its last reset. The total counts may be used for applications that employ a different methodology to calculate Gross and Net Volumes.

Gross Volume

Use Gross Volume to convert total counts to volumetric units. The module employs a user-defined K-factor in the conversion. For example, you can configure the CFM module so that 4 counts = 1 pint. A meter factor is also available for calibration.

Net Volume

Use Net Volume to apply a user-defined compensation factor (i.e. AGA 7 or Logix compensation) to the Gross Volume. This feature uses the following equation:

$$\text{Net Volume} = \frac{\text{Total Counts in Meter Sample}}{\text{K-factor}} \times \text{Meter Factor} \times \text{CCF}$$

Gross Rate

Use Gross Rate to convert total counts to rate units. The module employs a user-defined K-factor in the conversion. The K-factor is a divisor, and the time interval is divided by this number, as shown below.

$$\text{Gross Rate} = \frac{\text{Total Counts in Meter Sample}}{\text{K-factor}} \times \text{Meter Factor}$$

- If the input frequency is below 100Hz, the K-factor used is always 10.0 for frequencies interpolated between 0-100Hz.

- If the input frequency is greater than 100Hz-200Hz, the K-factor is interpolated as follows:

$$\text{K-factor} = (f_{in} - 100.0) \times \frac{(71.0 - 25.0)}{(200.0 - 100.0)} \times 25.0$$

- If the input frequency is greater than 200Hz-300Hz, the K-factor is interpolated as follows:

$$\text{K-factor} = (f_{in} - 200.0) \times \frac{(111.0 - 71.0)}{(300.0 - 200.0)} \times 71.0$$

- If the input frequency is greater than 300Hz, the K-factor used is always 100.0. There is no K-factor calculation over 100Hz.

To use Gross Rate, you must set the K-factor values in Module Tags, as shown below.

Name	Style	Data type	Value	Change during operation
C.Operations[0].kFactStruct.kFactorForChan[0]	Float	REAL	25.0[1]	Yes
C.Operations[0].kFactStruct.kFactorForChan[1]	Float	REAL	25.0[1]	Yes
C.Operations[0].kFactStruct.kFactorForChan[2]	Float	REAL	71.0	Yes
C.Operations[0].kFactStruct.kFactorForChan[3]	Float	REAL	111.0	Yes
C.Operations[0].kFactStruct.kFactorForChan[4]-C.Operations[0].kFactStruct.kFactorForChan[12]	Float	REAL	0	Yes
C.Operations[0].kFactStruct.FreqAtKFactor[0]	Float	REAL	0.0	Yes
C.Operations[0].kFactStruct.FreqAtKFactor[1]	Float	REAL	100.0	Yes
C.Operations[0].kFactStruct.FreqAtKFactor[2]	Float	REAL	200.0	Yes
C.Operations[0].kFactStruct.FreqAtKFactor[3]	Float	REAL	300.0	Yes
C.Operations[0].kFactStruct.FreqAtKFactor[4]-C.Operations[0].kFactStruct.FreqAtKFactor[12]	Float	REAL	0	Yes

[1] To avoid discontinuity when interpolating Gross Rate, make sure the values in C.Operations[0].kFactStruct.kFactorForChan[0] and C.Operations[0].kFactStruct.kFactorForChan[1] match.

IMPORTANT   For more information on setting values in the Module Tags, see <u>Configuring the Configurable Flowmeter Module 5 on page 77</u>.

Net Rate

Use Net Rate to convert Net Volume to a rate using the following equation:

$$Net\ Volume = \frac{Total\ Counts\ in\ Meter\ Sample}{K\text{-}factor\ x\ Sample\ Interval} \ x\ Meter\ Factor\ x\ CCF$$

Fill Total Target

Fill Total Target is the user-defined final volume (in engineering units) for a total fill.

Fill Transition

Fill Transition is the user-defined Net Volume value to switch from full flow to trickle flow.

Fill Transition Timer

After the transition from full flow to trickle flow, the Fill Transition Timer value determines how long the trickle will last (i.e. this feature sets the time that the trickle valve is open or ON).

Alarms with the Filler Function

The CFM module offers the following alarms when operating the Filler function:

- Overflow Alarm - TotalCounts > RollOver Value
- Overrange Alarm - FreqPeriod > 100kHz
- Overspeed Alarm - Speed > Highest Allowed Frequency
- Acceleration Alarm - Acceleration > Acceleration Alarm Value

You must enable each alarm. When any of the alarms occur, it is latched and remains on until you reset the alarm. (Toggle the alarm enable bit to reset the alarm.)

Sample Configuration for Totalizer Mode Filler Function

To see a sample configuration for a 1756-CFM module using totalizer mode filler function, including the use of all the features mentioned in the previous section, see .

Configurable Output Behaviors

Firmware revision 2.4 enables you to configure the 1756-CFM module outputs to turn on or off at specified frequency counts.

Three types of behaviors, listed in the Frequency Values and Resulting Behaviors table, can be configured with the use of firmware revision 2.4. Use this table as a reference when determining on/off frequency values later in the configuration procedure.

Table 5 - On/Off Frequency Behaviors

Frequency Value	Behavior
FreqOn = 0.0 FreqOff = 0.0	Typical behavior when firmware revision 1.*x* is used. If the C.OutputSetup[*X*].TriggerOn value is 1, a frequency count corresponding to the TriggerOn frequency activates the Ch[*X*]Overspeed Alarm, which latches and requires additional programming to unlatch.
FreqOff greater than FreqOn	The specified channel turns off when the frequency count is at or above the specified FreqOff value. The specified channel turns on when the frequency count is at or above the FreqOn value. For example: FreqOff = 60 FreqOn = 20 ▢ = On
FreqOn greater than FreqOff	The specified channel turns on when the frequency count is at or above the specified FreqOn value. The specified channel turns off when the frequency count is at or below the specified FreqOff value. For example: FreqOn = 60 FreqOff = 20 ▢ = On
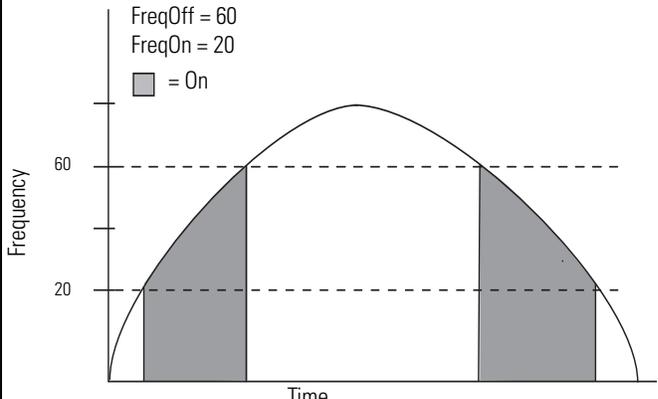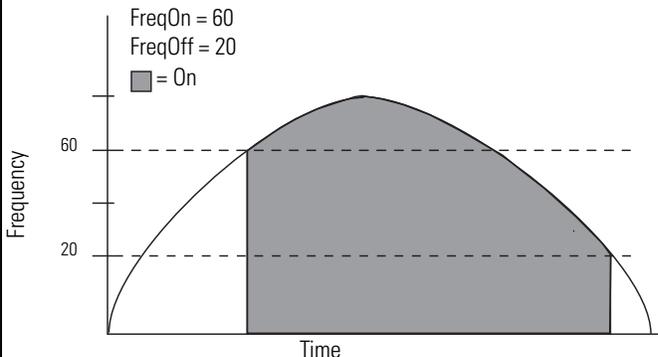
How To Enable Output Behavior Configuration

To enable output behavior configuration for a 1756-CFM module with firmware revision 2.4, select one of these options.

- If you are using RSLogix 5000 software version 16 or earlier, see .
- If you are using RSLogix 5000 software version 17 or later, add a new module to your I/O Configuration folder and complete the following steps.

1. On the Select Module screen, select the 1756-CFM module and click OK.

The Select Major Revision window opens.
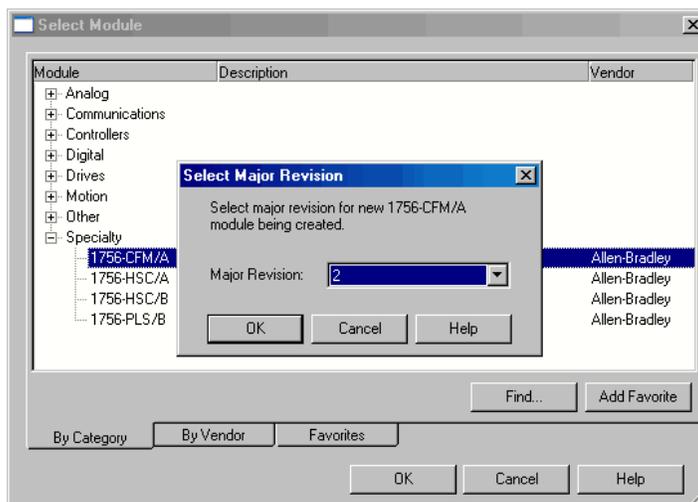
2. Verify that Major Revision 2 is chosen and click OK.

The New Module dialog box opens with Major Revision 2 chosen.
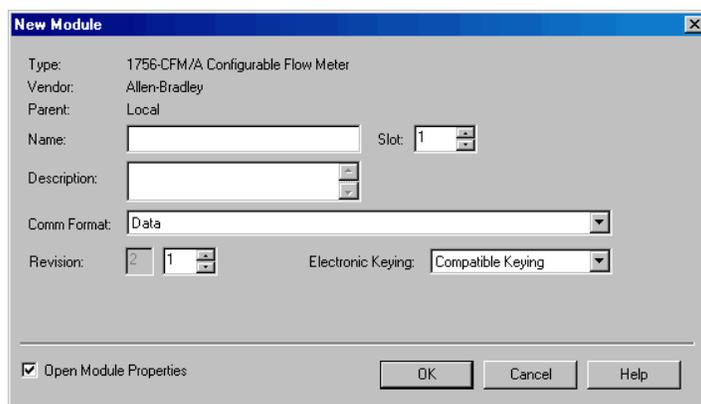
Output Behavior configuration is enabled.

Notes:

Installing the Configurable Flowmeter Module

What this Chapter Contains

This chapter describes how to install the ControlLogix Configurable Flowmeter module.

For information on	See page
Power Requirements	63
Installing the Module	64
Keying the Removable Terminal Block/Interface Module	65
Wiring the Removable Terminal Block	66
Wiring the Module	69
Assembling the Removable Terminal Block and Housing	73
Installing the Removable Terminal Block on the Module	73
Removing the Removable Terminal Block from the Module	74
Removing the Module	76

ATTENTION

Environment and Enclosure

This equipment is intended for use in a Pollution Degree 2 industrial environment, in overvoltage Category II applications (as defined in IEC 60664-1), at altitudes up to 2000 m (6562 ft) without derating.

This equipment is considered Group 1, Class A industrial equipment according to IEC/CISPR 11. Without appropriate precautions, there may be difficulties with electromagnetic compatibility in residential and other environments due to conducted and radiated disturbances.

This equipment is supplied as open-type equipment. It must be mounted within an enclosure that is suitably designed for those specific environmental conditions that will be present and appropriately designed to prevent personal injury resulting from accessibility to live parts. The enclosure must have suitable flame-retardant properties to prevent or minimize the spread of flame, complying with a flame spread rating of 5VA, V2, V1, V0 (or equivalent) if nonmetallic. The interior of the enclosure must be accessible only by the use of a tool. Subsequent sections of this publication may contain additional information regarding specific enclosure type ratings that are required to comply with certain product safety certifications.

In addition to this publication, see the following:

- Industrial Automation Wiring and Grounding Guidelines, publication <u>1770-4.1</u>, for additional installation requirements
- NEMA Standard 250 and IEC 60529, as applicable, for explanations of the degrees of protection provided by enclosures

North American Hazardous Location Approval

The following information applies when operating this equipment in hazardous locations.	Informations sur l'utilisation de cet equipement en environnements dangereux.
Products marked "CL I, DIV 2, GP A, B, C, D" are suitable for use in Class I Division 2 Groups A, B, C, D, Hazardous Locations and nonhazardous locations only. Each product is supplied with markings on the rating nameplate indicating the hazardous location temperature code. When combining products within a system, the most adverse temperature code (lowest "T" number) may be used to help determine the overall temperature code of the system. Combinations of equipment in your system are subject to investigation by the local Authority Having Jurisdiction at the time of installation.	Les produits marques "CL I, DIV 2, GP A, B, C, D" ne conviennent qu'a une utilisation en environnements de Classe I Division 2 Groupes A, B, C, D dangereux et non dangereux. Chaque produit est livre avec des marquages sur sa plaque d'identification qui indiquent le code de temperature pour les environnements dangereux. Lorsque plusieurs produits sont combines dans un systeme, le code de temperature le plus defavorable (code de temperature le plus faible) peut etre utilise pour determiner le code de temperature global du systeme. Les combinaisons d'equipements dans le systeme sont sujettes a inspection par les autorites locales qualifiees au moment de l'installation.
WARNING ⚠	**EXPLOSION HAZARD -** • Do not disconnect equipment unless power has been removed or the area is known to be nonhazardous. • Do not disconnect connections to this equipment unless power has been removed or the area is known to be nonhazardous. Secure any external connections that mate to this equipment by using screws, sliding latches, threaded connectors, or other means provided with this product. • Substitution of components may impair suitability for Class I, Division 2. • If this product contains batteries, they must only be changed in an area known to be nonhazardous.	**AVERTISSEMENT** ⚠	**RISQUE D'EXPLOSION –** • Couper le courant ou s'assurer que l'environnement est classe non dangereux avant de debrancher l'equipement. • Couper le courant ou s'assurer que l'environnement est classe non dangereux avant de debrancher les connecteurs. Fixer tous les connecteurs externes relies a cet equipement a l'aide de vis, loquets coulissants, connecteurs filetes ou autres moyens fournis avec ce produit. • La substitution de composants peut rendre cet equipement inadapte a une utilisation en environnement de Classe I, Division 2. • S'assurer que l'environnement est classe non dangereux avant de changer les piles.

ATTENTION ⚠	Prevent Electrostatic Discharge This equipment is sensitive to electrostatic discharge, which can cause internal damage and affect normal operation. Follow these guidelines when you handle this equipment: • Touch a grounded object to discharge potential static. • Wear an approved grounding wriststrap. • Do not touch connectors or pins on component boards. • Do not touch circuit components inside the equipment. • Use a static-safe workstation, if available. • Store the equipment in appropriate static-safe packaging when not in use.

> **ATTENTION**
>
> The ControlLogix system has been agency certified using only the ControlLogix RTBs (catalog numbers 1756-TBNH and 1756-TBSH). Any application that requires agency certification of the ControlLogix system using other wiring termination methods may require application specific approval by the certifying agency.

Power Requirements

This module receives power from the 1756 chassis power supply and requires 2 sources of power from the backplane:

- 300mA at 5.1V DC
- 16mA at 24V DC

Add this current/power value (1.7W) to the requirements of all other modules in the chassis to prevent overloading the power supply.

Installing the Module

You can install or remove the module while chassis power is applied.

> **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.
>
> Be sure that power is removed or the area is nonhazardous 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.

> **WARNING**
>
> ⚠
>
> When you connect or disconnect the Removable Terminal Block (RTB) with field side power applied, an electrical arc can occur. This could cause an explosion in hazardous location installations.
>
> Be sure that power is removed or the area is nonhazardous before proceeding.

1. Align the circuit board with the top and bottoms chassis guides.

Printed
Circuit
Board

20861–M
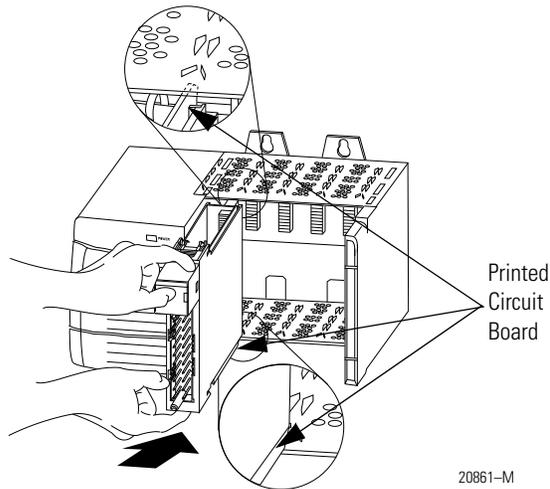
2. Slide the module into the chassis until the module locking tabs click.

Locking tab

20862–M
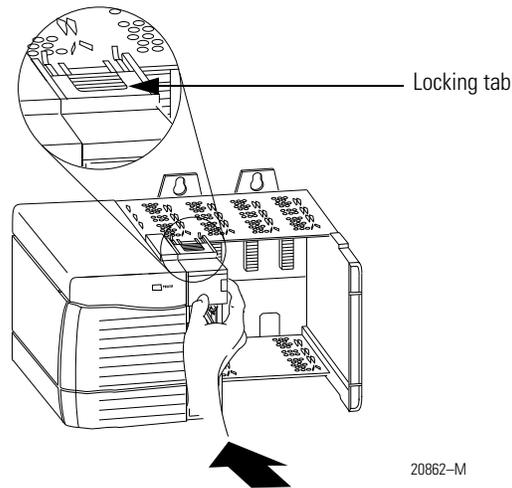
Keying the Removable Terminal Block/Interface Module

Wedge-shaped keying tabs and U-shaped keying bands came with your RTB to prevent connecting the wrong wires to your module.

Key positions on the module that correspond to unkeyed positions on the RTB. For example, if you key the first position on the module, leave the first position on the RTB unkeyed.

Key the Module

1. Insert the U-shaped band as shown in this figure.

U-shaped bands

20850–M
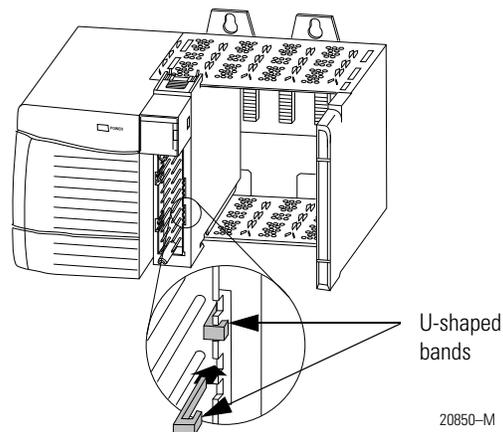
2. Push the band until it snaps in place.

Key the RTB/IFM

1. Insert the wedge-shaped tab with the rounded edge first, as shown in this figure.

Wedge-shaped tab

20851–M
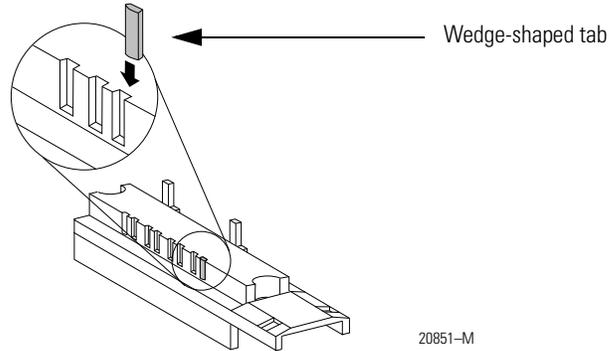
2. Push the tab until it stops.

Reposition the tabs to rekey future module applications.

Wiring the Removable Terminal Block

Wire the RTB with a 8mm (5/16 in.) maximum flat-bladed screwdriver before installing it onto the module.

Shielded cable is required with this module. We recommend using Belden 8761 cable to wire the module. The RTB terminations can accommodate 10.33…2.1 mm² (22…14 AWG) shielded wire.

> **WARNING**
>
> If you connect or disconnect wiring while the field-side power is on, an electrical arc can occur. This could cause an explosion in hazardous location installations. Be sure that power is removed or the area is nonhazardous before proceeding.

Connect Grounded End of the Cable

1. Ground the drain wire, as shown in this figure.

> **IMPORTANT** We recommend grounding the drain wire at the field-side. If you cannot ground at the field-side, ground at an earth ground on the chassis as shown.

A. Remove a length of cable jacket from the connecting cable.

B. Pull the foil shield and bare drain wire from the insulated wire.
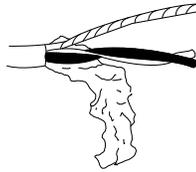
C. Twist the foil shield and drain wire together to form a single strand.

D. Attach a ground lug and apply heat shrink tubing to the exit area.

20104-M

E. Connect the drain wire to a chassis mounting tab.

Use any chassis mounting tab that is designated as a functional signal ground.

Chassis mounting tab

4M or 5M (#10 or #12) star washer

Drain wire with ground lug
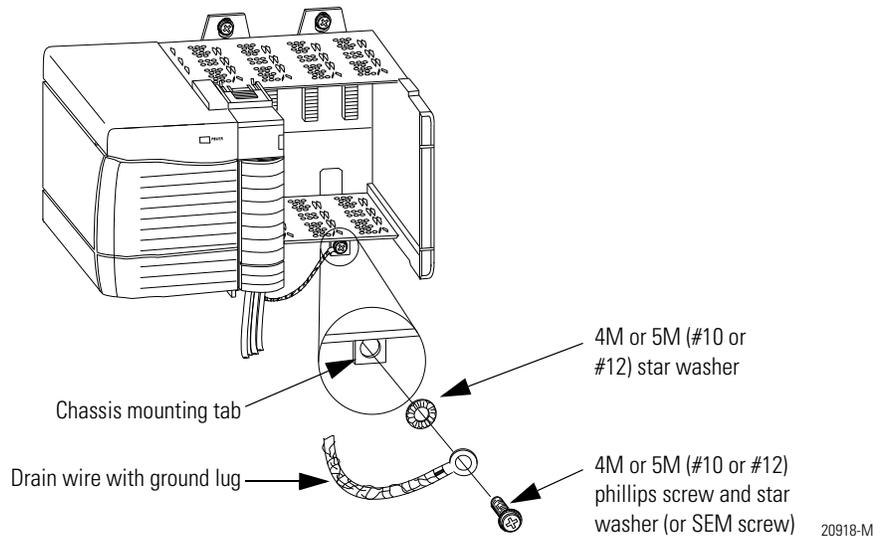
4M or 5M (#10 or #12) phillips screw and star washer (or SEM screw)   20918-M

2. Connect the insulated wires to the field-side.

Connect Ungrounded End of the Cable

1. Cut the foil shield and drain wire back to the cable casing and apply shrink wrap.

2. Connect the insulated wires to the RTB as shown in the next section.

Connect Wires to the RTBs

There are two types of RTBs available for use with the
1756-CFM module:

- 1756-TBSH Spring Clamp RTB
- 1756-TBNH NEMA Screw RTB

1756-TBSH Spring Clamp RTB

1. Strip 11mm (7/16 in.) maximum length of wire.

2. Insert the screwdriver into the inner hole of the RTB, as shown in this figure.

Screwdriver

Wire

20863–M
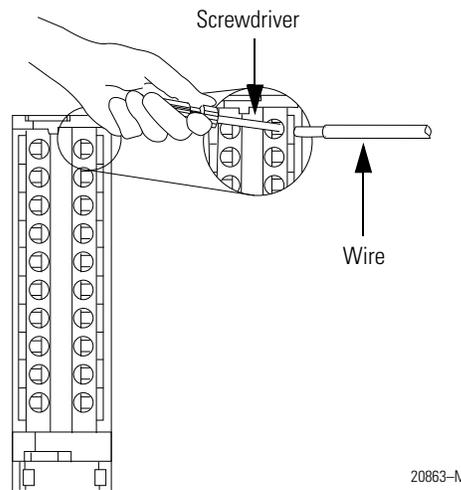
3. Insert the wire into the open terminal and remove the screwdriver.

1756-TBNH NEMA Screw RTB

1. Strip 8mm (5/16 in.) maximum length of wire.

2. Turn the terminal screw counterclockwise.

Figure 5.1

42516
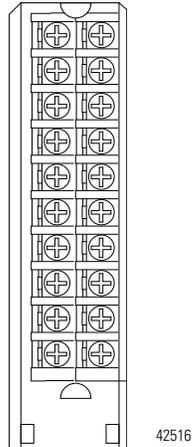
3. Wrap wire around the terminal.

4. Turn the terminal screw clockwise until it tightens on the wire.

Wiring the Module

You can only connect wiring to your module through an RTB or IFM. In this chapter, we show how to wire the 1756-CFM for three applications.

- Standard Flowmeter Wiring Example
- Standard Prover/Detector Wiring Example
- Standard Output Wiring Example

Standard Flowmeter Wiring Example

Z0 12-24V DC	2	1 Z1 12-24V DC
Z0 5V DC	4	3 Z1 5V DC
Z0 Return	6	5 Z1 RET
F0	8	7 F1
F0 Return	10	9 F1 Return
Not used	12	11 Not used
Not used	14	13 Not used
Output 0	16	15 Output 1
Customer VCC	18	17 Customer Common
Customer VCC	20	19 Customer Common

Flowmeter Device + −

Shield ground

42568
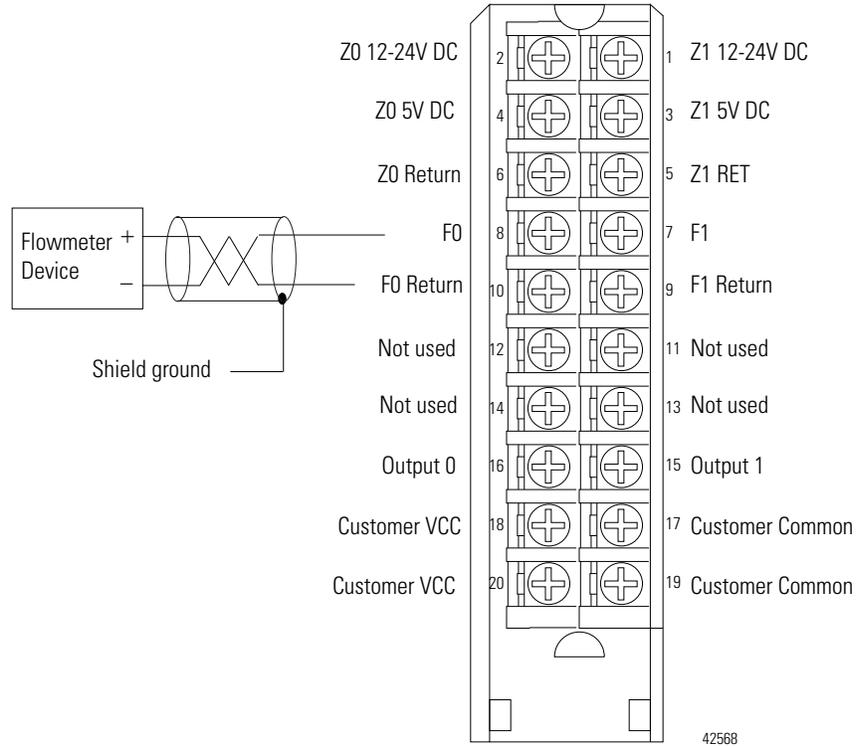
NOTES: **1.** This wiring diagram can be used in applications with 50mV (magnetic pickup), 1.3V (TTL) or 4V (preamp level) thresholds. You must use the RSLogix 5000 software to choose the appropriate threshold level for your specific application.

2. If separate power sources are used, do not exceed the specified isolation voltage.

Standard Prover/Detector Wiring Example

Detector #1 ⟶   Detector #2

12-24V DC

Z0 12-24V DC	2	1	Z1 12-24V DC
Z0 5V DC	4	3	Z1 5V DC
Z0 Return	6	5	Z1 RET
F0	8	7	F1
F0 Return	10	9	F1 Return
Not used	12	11	Not used
Not used	14	13	Not used
Output 0	16	15	Output 1
Customer VCC	18	17	Customer Common
Customer VCC	20	19	Customer Common

Shield ground

Flowmeter Device + −

Shield ground
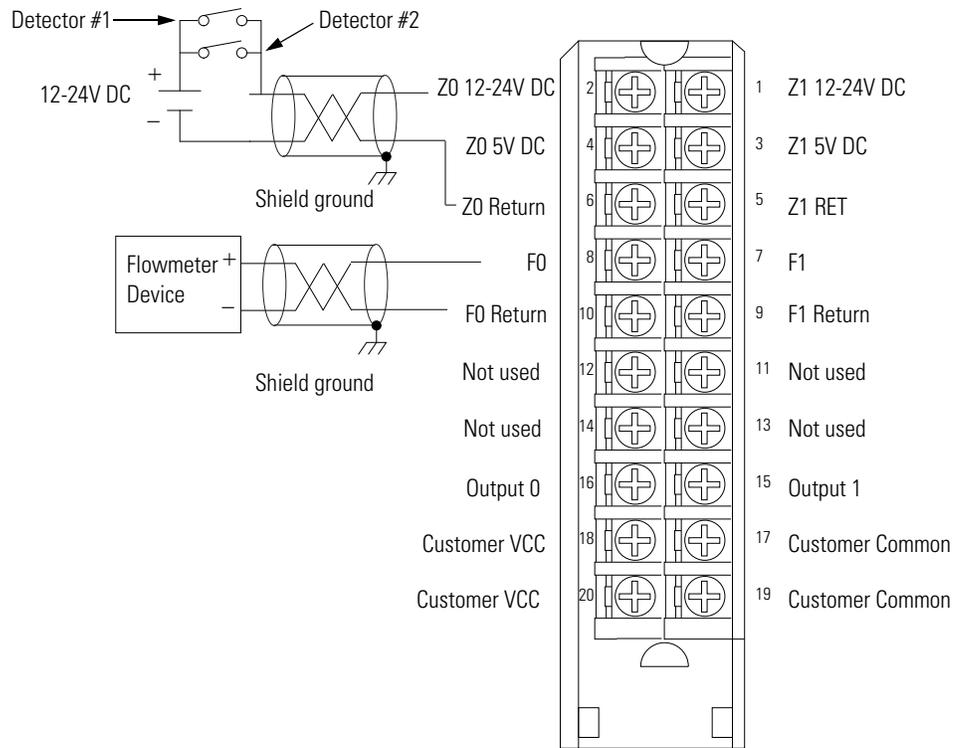
42569

NOTE:
1. Detectors #1 and #2 must be wired in parallel.
2. Customer VCC may be used to power detectors. In this case, though, the maximum current on the wiring arm must be less than 4A.
3. The wiring example above shows a 12-24V DC standard prover connected to the module. If you use a 5V DC standard prover, make sure the positive wire is connected to the 5V terminal (e.g. Z0 5V DC).
4. If separate power sources are used, do not exceed the specified isolation voltage.

Standard Output Wiring Example

Z0 12-24V DC	2 ⊕ ⊕ 1	Z1 12-24V DC
Z0 5V DC	4 ⊕ ⊕ 3	Z1 5V DC
Z0 Return	6 ⊕ ⊕ 5	Z1 RET
F0	8 ⊕ ⊕ 7	F1
F0 Return	10 ⊕ ⊕ 9	F1 Return
Not used	12 ⊕ ⊕ 11	Not used
Not used	14 ⊕ ⊕ 13	Not used
Output 0	16 ⊕ ⊕ 15	Output 1
Customer VCC	18 ⊕ ⊕ 17	Customer Common
Customer VCC	20 ⊕ ⊕ 19	Customer Common

42570
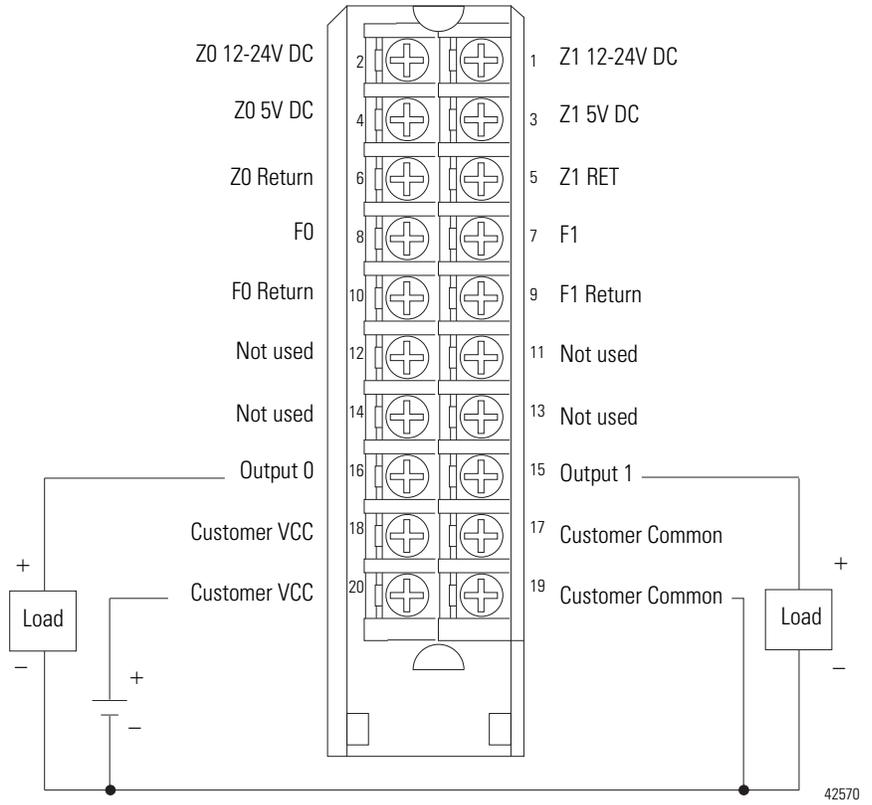
NOTE: If separate power sources are used, do not exceed the specified isolation voltage.

After completing field-side wiring, secure the wires in the strain relief area with a cable-tie.

Assembling the Removable Terminal Block and Housing

1. Align the grooves at the bottom of the housing with the side edges of the RTB.

Groove

Side edge of the RTB

Groove

Strain relief area

Side edge of the RTB

20852-M
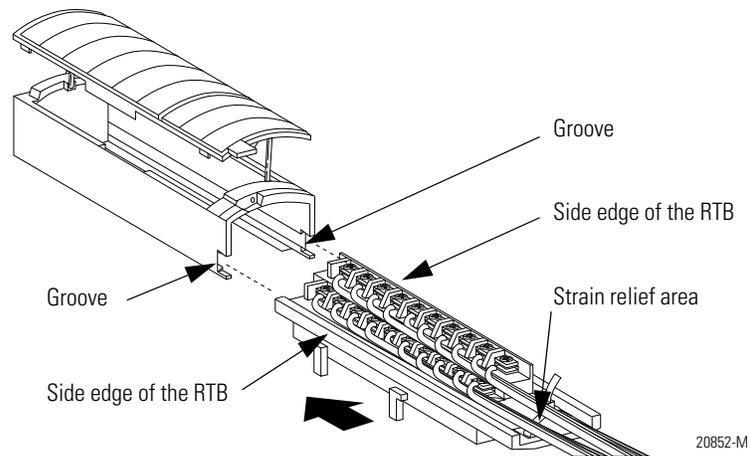
2. Slide the RTB into the housing until it snaps into place.

Installing the Removable Terminal Block on the Module

WARNING

When you connect or disconnect the Removable Terminal Block (RTB) with field side power applied, an electrical arc can occur. This could cause an explosion in hazardous location installations.

Be sure that power is removed or the area is nonhazardous before proceeding.

Before installing the RTB, make certain:

- field-side wiring of the RTB has been completed.
- the RTB housing is snapped into place on the RTB.
- the RTB housing door is closed.
- the locking tab at the top of the module is unlocked.

1. Align the side, top and bottom RTB guides with the side, top and bottom module guides.

Module top guide

RTB side guides

20853–M
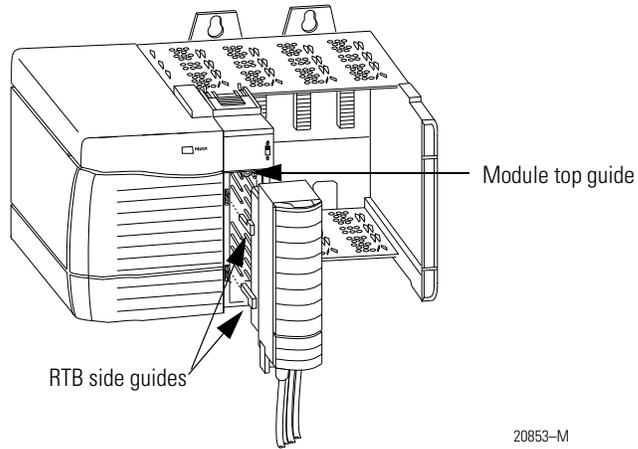
2. Press quickly and evenly to seat the RTB on the module until the latches snap into place.

3. Slide the locking tab down to lock the RTB onto the module.

Locking tab

20854–M
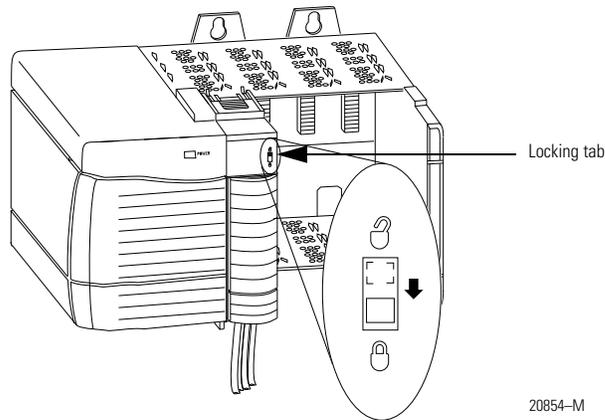
Removing the Removable Terminal Block from the Module

WARNING

When you connect or disconnect the Removable Terminal Block (RTB) with field side power applied, an electrical arc can occur. This could cause an explosion in hazardous location installations.

Be sure that power is removed or the area is nonhazardous before proceeding.

Before removing the module, you must remove the RTB.

1. Unlock the locking tab at the top of the module.
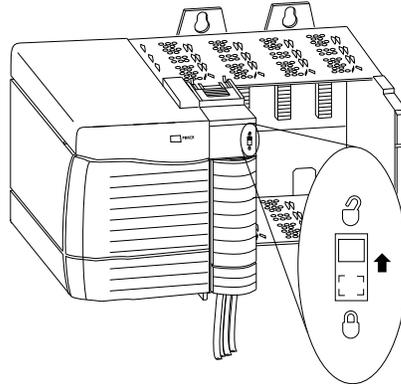
42517

2. Open the RTB door and pull the RTB off the module, as shown in Figure 5.2.

Figure 5.2
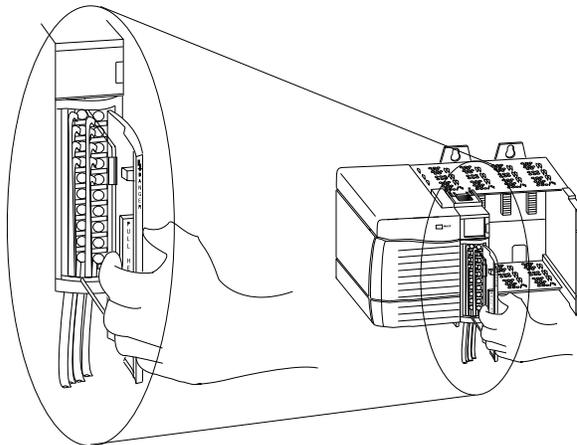
20855–M

Removing the Module

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.
⚠	Be sure that power is removed or the area is nonhazardous 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.

1. Push in the locking tabs.
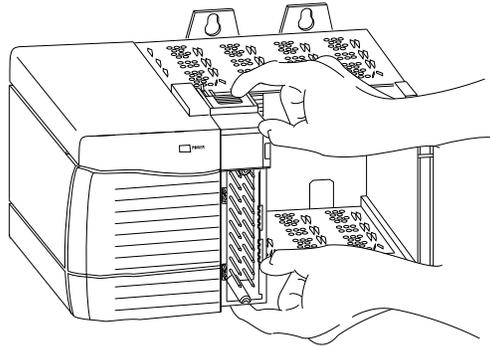
20856–M

2. Pull the module out of the chassis.
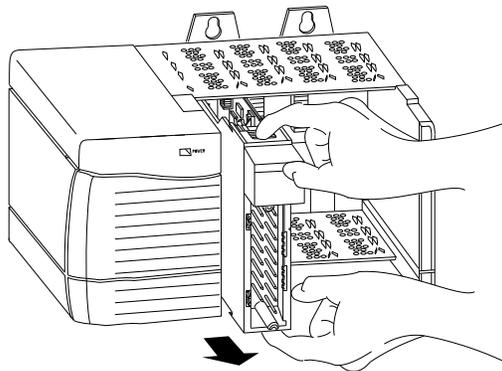
20857–M

Configuring the Configurable Flowmeter Module

What this Chapter Contains

This chapter describes how to configure the ControlLogix Configurable Flowmeter module using the RSLogix 5000 software.

You must configure your module upon installation. It will not work with the ladder program until it has been configured.

Using this Chapter

This chapter is broken into two sections:

- Overview of the Configuration Process - Includes a detailed explanation of how to perform each task mentioned in the overview

- Examples of how to configure your CFM module for any of the following operational modes:

  - High resolution frequency mode
  - Totalizer mode using the prover function
  - Totalizer mode using the filler function

This chapter is intended to teach you how to configure the CFM module for basic operation in each of the modes mentioned above. You should be able to use the building blocks learned in this chapter to write more detailed configuration for your CFM module in your specific application.

> **IMPORTANT** The examples offered in this chapter only list the tags that need to be changed for specific operational modes. For a complete listing of configuration, input and output tags, see Appendix B.

Overview of the Configuration Process

When you create a CFM module, module-defined data structures and tags are created in RSLogix 5000 software. The information contained in these structures determines your CFM module's behavior.

The owner-controller sends configuration information to the CFM module in one of the following ways:

- RSLogix 5000 project goes online - Typically, this is the method in which initial configuration is sent. When the project goes online, a program is downloaded to the controller, and connections are made to all devices that controller owns, including any CFM modules. When a connection is established, the configuration for that particular module is transferred.

- Message instructions - Typically, this method is used after module operation has begun and additional configuration changes are necessary.

> **IMPORTANT** This chapter assumes you have created a Logix controller in a RSLogix 5000 project.

Figure 5 - Overview of the Configuration Process

See <u>page 80</u>

New Module

1. Select a module from the list
2. Choose a Major Revision

See <u>page 81</u>

Naming Screen
Name
Description
Slot number
Comm. format
Minor revision

To **Alter Default** Configuration

See page <u>84</u>

RPI Screen
Set RPI
Inhibit module

To **Use Default** Configuration

Change configuration before module operation begins

See page <u>84</u>

FINISH

FINISH   See page <u>83</u>

See page <u>85</u>

Change Configuration via the Tag Editor

See page <u>87</u>

Go online to download new configuration

Change configuration after module operation has begun

See page <u>85</u>

Change configuration via the Tag Editor

See page <u>89</u>

Send new configuration via message instruction

42863

Creating a New Module

After you have started the RSLogix 5000 software and created a controller, you must create a new CFM module. The wizard allows you to create a new module and set communications options.

IMPORTANT	You must be offline when you create a new module.

---

1. Go offline.

If you are not offline, use this pull-down menu to go offline
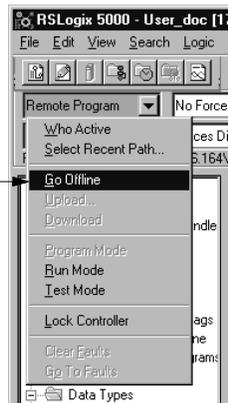
2. Select a CFM module.

A. Select I/O Configuration.

B. Click on the right mouse button to display the menu.
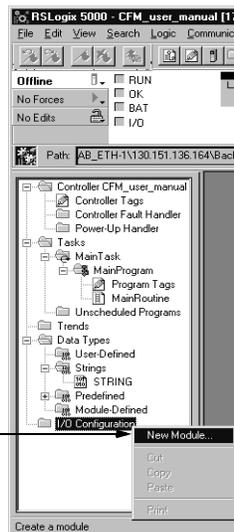
A screen appears with a list of possible new modules for your application.

A. Select a 1756-CFM module

Make sure the Major Revision number matches the label on the side of your module

B. Click here
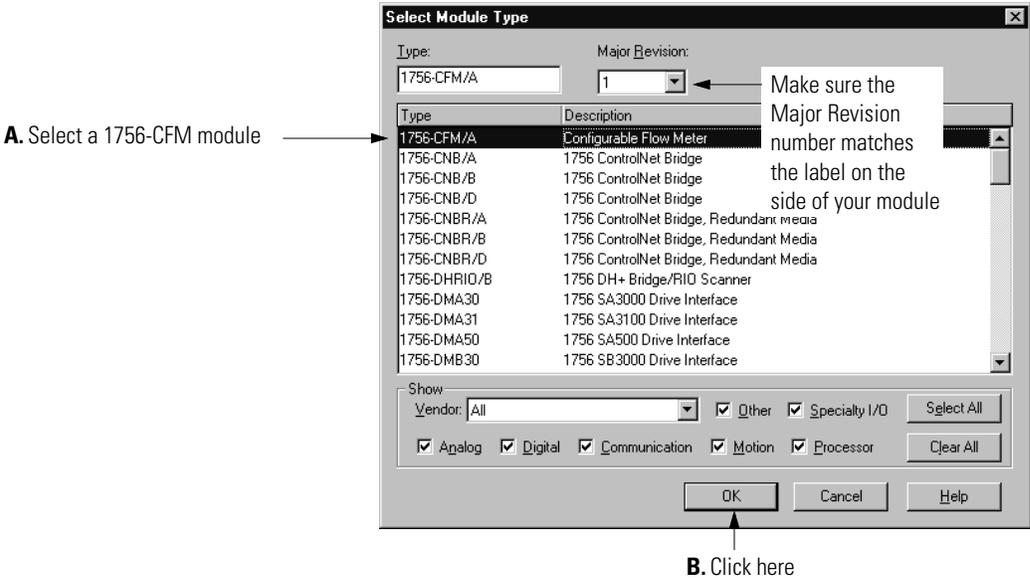
The new module creation wizard appears.

A. Type a name (optional).

B. Type a description (optional).

C. Choose a Communications Format. For a detailed description of this field see page 82.

D. Make sure the Minor Revision number matches the label on the side of your module

E. Choose an Electronic Keying method. For a detailed explanation of this field, go to page 27.

If you want to adjust the communications options, click here Go to page 84.

If you want to use default configuration, click here and you are finished configuring your module Go to page 83.

Communications Format

The communications format determines what type of data is transferred between the CFM module and its owner-controller. This feature also defines the connection between the controller writing the configuration and the module itself.

The following communications formats are available for your CFM module:

- **Data** - Use this format for a controller that you want to own the CFM module and control its configuration data.

  Only one controller can use the Data communications format when connecting to a CFM module.

- **Listen-only Data** - Use this format for any controller that you want to listen to the CFM module but not own it.

  Multiple controllers can use the Listen-only Data communications format when connecting to the CFM module. These controllers do not own the CFM module's configuration and lose their connection to the module if the owner-controller loses

> **TIP** ▶ When you select a Listen-only Communications Format, only the General and Connection tabs appear when you view a module's properties in RSLogix 5000 software.

The screen below shows the choices available.
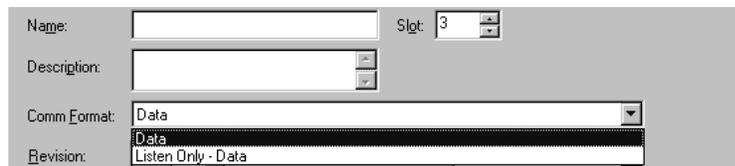
Name:		Slot: 3
Description:		
Comm Format:	Data	
	Data	
Revision:	Listen Only - Data	

> **IMPORTANT** Once the module is created, the communications format cannot be changed. The module must be deleted and recreated.

Electronic Keying

When you create a new CFM module, you can choose how specific the keying must be when a module is inserted into the CFM module's slot in the chassis.

The screen below shows the choices available.

For more information, see .

Using the Default Configuration

If you want to use the default configuration, click on Finish as shown below. See to download the default configuration information and begin module operation.
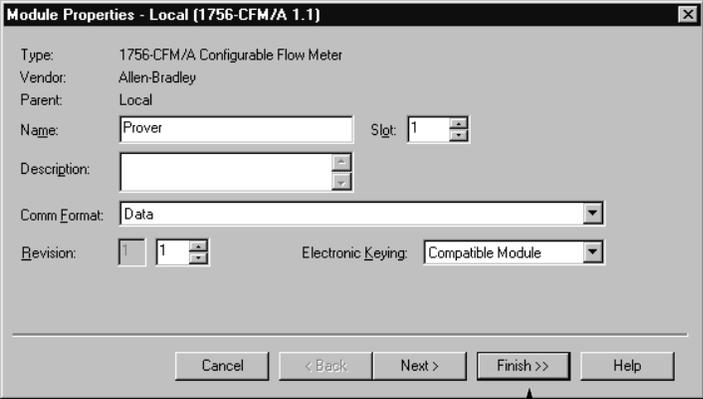
Click here and you will accept the CFM module's default configuration. Go to to learn how to download configuration.

Altering the Default Configuration

If you want to alter or view the default configuration, click on Next. On the next wizard screen, you can change the CFM module's configuration as shown below.

Adjust the **Requested Packet Interval** here.

Inhibit the connection to the module here

If you want a **Major Fault on the Controller** to occur if there is connection failure with the I/O module, click here

IMPORTANT: Minimum RPI values:

- 50 ms for one channel in totalizer mode
- 100 ms for two channels in totalizer mode
- 5 ms for one channel in high resolution frequency mode
- 10 ms for two channels in high resolution frequency mode
- 55 ms for one channel in each mode
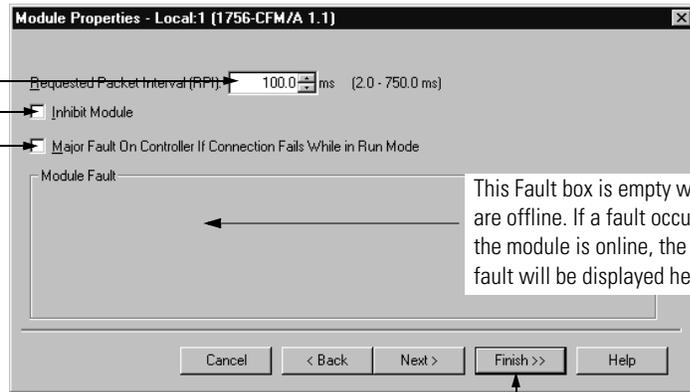
This Fault box is empty when you are offline. If a fault occurs while the module is online, the type of fault will be displayed here

Click here to finish this portion of configuration and move to the Tag Editor, see .

After you are finished with the screen above, you must access the module tags, via the Tag Editor, to make additional configuration changes, see .

IMPORTANT
Two additional wizard screens appear during initial module configuration. The screens are used during online application monitoring but are shown below to give you an accurate description of the screens that appear during initial configuration.
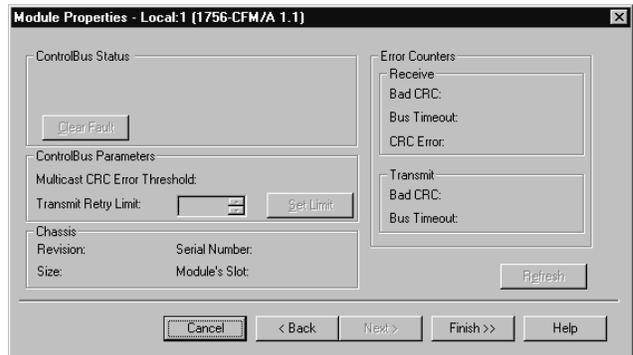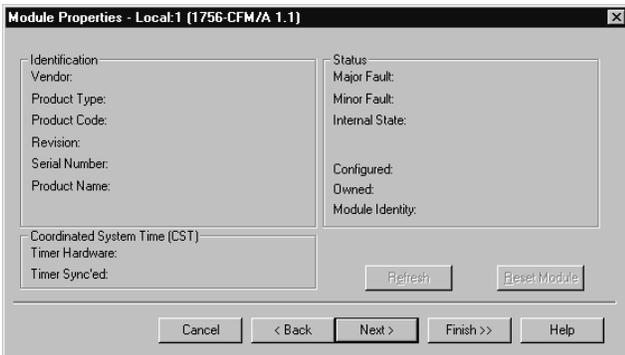
Accessing the Tags

When you access tags to change configuration or monitor the I/O data exchange, you have two options:

- **Monitor tags** - This option allows you to view tags and change their values.
- **Edit tags** - This option allows you to add or delete tags but not to change their values.

1. Access the tags.
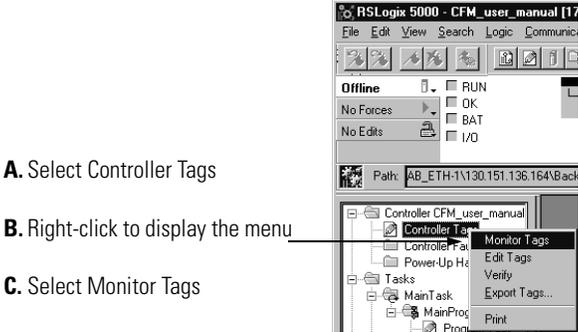
A. Select Controller Tags

B. Right-click to display the menu

C. Select Monitor Tags

2. View tags here.

Click on the tag name of the data structure you want to see
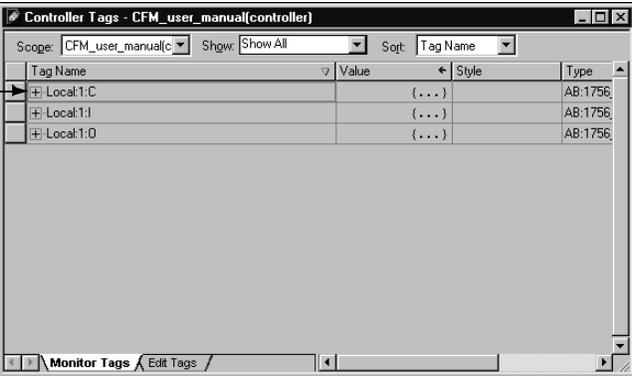
Configuration information is listed for each channel on the module.
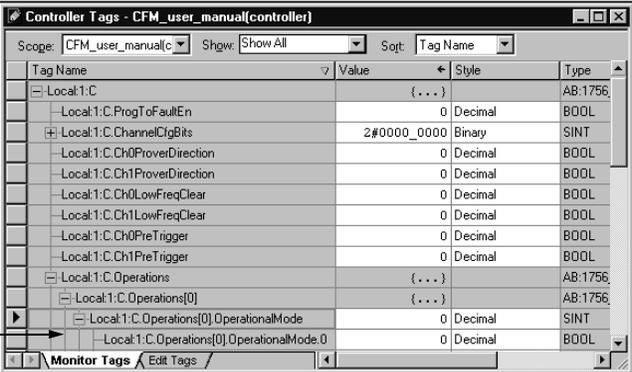
Changing Configuration Information at the Tags

Some configurable features are changed on a module-wide basis and some on a point-by-point basis.

Configurable Features

There are two ways to change the configuration:

- Use a pull-down menu.
- Highlight the value of a particular feature for a particular point and type a new value.

Pull-down Menu

A. Click on the far left side of the Value column and a pull-down menu appears.
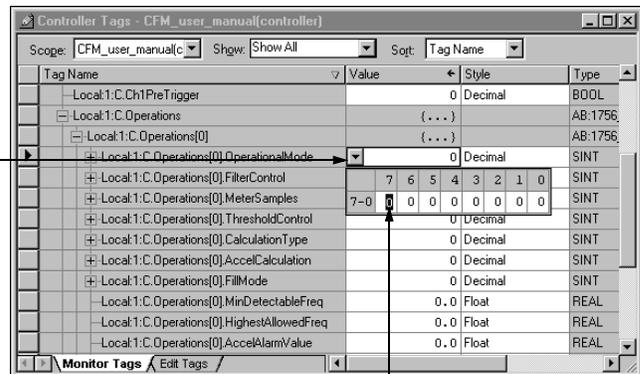
B. Highlight the point that needs to be changed and type a valid new value.

Highlight Value

A. Highlight the value of the feature you want to change.

B. Type in the valid new value.
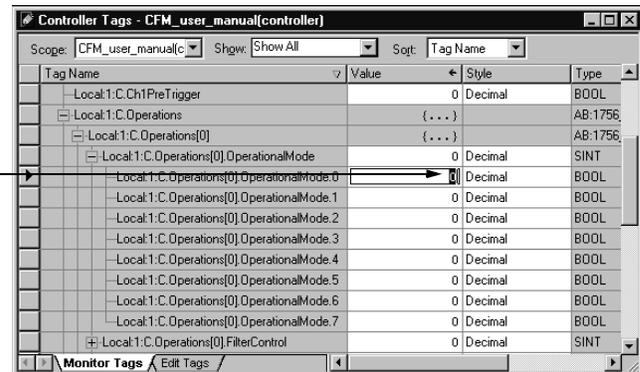
Downloading Configuration Data

After you have changed the configuration data for an CFM module, the change does not actually take affect until you download the new program which contains that information. This downloads the entire program to the controller overwriting any existing programs.

1. Download the configuration data.

A. Click on the triangle to see the pull-down menu.

B. Click on Download.
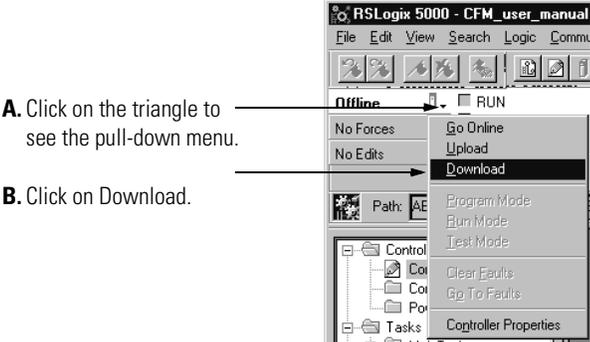
RSLogix 5000 software verifies the download process with this pop-up screen.

Click here to download new data
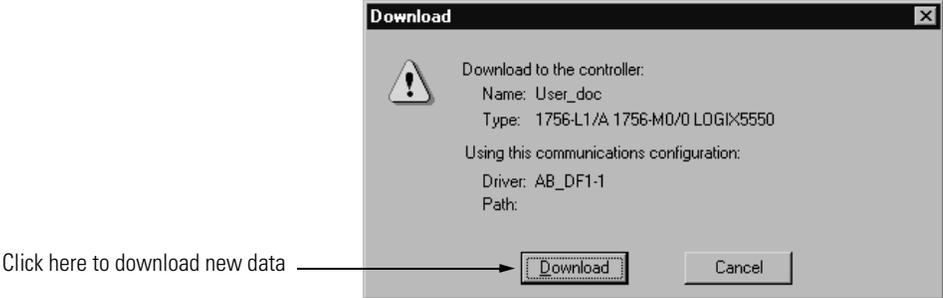
This completes the download process.

Changing Configuration During CFM Module Operation

After the CFM module has begun operation, you can only change configuration by using ladder logic and message instructions.

Follow these steps to change CFM module configuration during operation:

1. Access the CFM data structures through the tag monitor to make specific configuration changes, see .

2. Use ladder logic and a configuration message instruction to send the configuration changes to the CFM module, see below through .

Using Ladder Logic

You must use ladder logic to perform the following operations on your CFM module:

- change configuration
- perform run time services

Ladder logic uses message instructions to exchange data between the controller and CFM module. You can access the ladder logic by double-clicking on the Main Routine portion of the MainProgram.

Double-click here to enter the Main Routine

Using Message Instructions

Ladder logic uses message instructions to change the CFM module configuration during module operation.

Message instructions maintain the following characteristics:

- messages use unscheduled portions of system communications bandwidth

- one service is performed per instruction

- performing module services does not impede module functionality, such as counting incoming pulses

Processing Real-Time Control and Module Services

Because message instructions use unscheduled portions of systems communications bandwidth, the services requested of an CFM module are not guaranteed to occur within a specific time period. Although the module response typically occurs in less than a second, there is no specific time interval that reflects this response.

One Service Performed Per Instruction

Message instructions only cause a module service to be performed once per execution. For example, if a message instruction sends new configuration data to the CFM module, the message instruction must be reexecuted to update send the configuration data in the future.

Creating a New Tag

Ladder logic is written in the Main Routine section of RSLogix 5000 software.

1. Access the Main Routine.

Double-click here to
enter the Main Routine

2. Add a message instruction to Rung 0.

A. Right-click on the rung to see
the pull-down menu.

B. Click on Add Ladder Element.
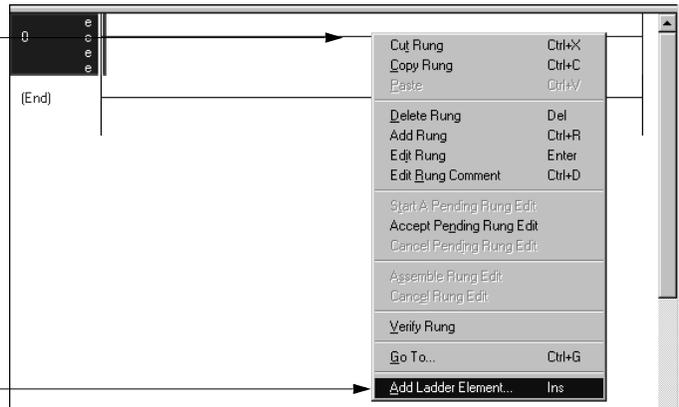
3. Choose a Message element from the Choose Ladder
Element screen.

A. Choose the Message element.

B. Click here.
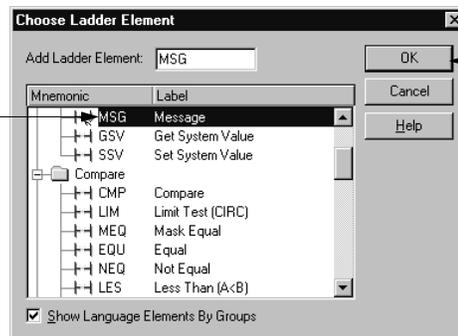
4. Create a tag for the message instruction.

A. Right-click on the question mark (?) to see the pull-down menu.

B. Click on New Tag.


```
                                          ┌─MSG────────
0                                         │ Message                    ─<EN>─
                                          │ Message Control   ┌──────────────────────────────┐
                                          │                   │ New Tag...                    │
                                          │                   ├──────────────────────────────┤
                                          │                   │ Cut Instruction      Ctrl+X   │
                                          │                   │ Copy Instruction     Ctrl+C   │
                                          │                   │ Paste                Ctrl+V   │
 (End)                                    │                   ├──────────────────────────────┤
                                          │                   │ Delete Instruction   Del      │
                                          │                   │ Add Ladder Element... Ins     │
                                          │                   │ Edit Instruction     Enter    │
                                          │                   │ Edit Main Operand Description Ctrl+D │
                                          │                   ├──────────────────────────────┤
                                          │                   │ Remove Force                  │
                                          │                   ├──────────────────────────────┤
                                          │                   │ Go To...             Ctrl+G   │
                                          │                   └──────────────────────────────┘
```
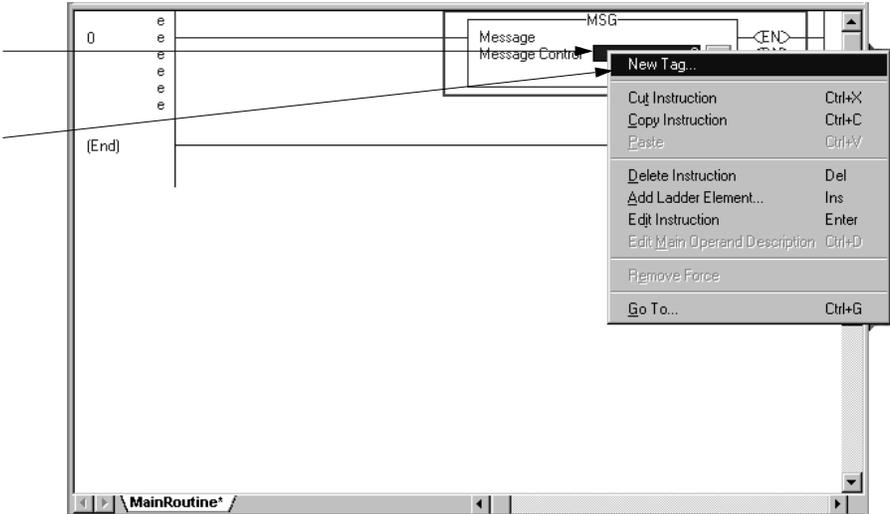
Fill in the following information when the New Tag pop-up screen appears:

IMPORTANT	We suggest you name the tag to indicate what module service is sent by the message instruction. For example, the message instruction below is used to write configuration.

Name the tag here.

Enter an optional description here.

Choose the **Base** Tag Type here.

Choose the **Message** Data Type here.

Choose the **Controller** Scope here.
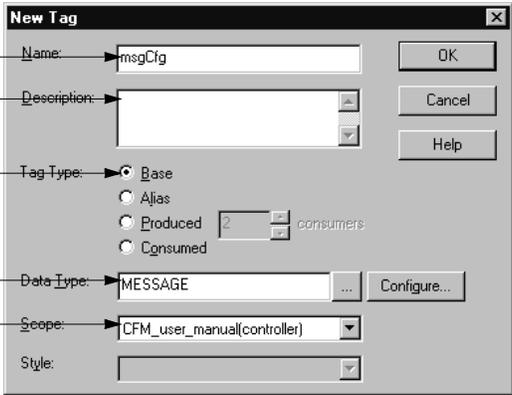
IMPORTANT: Message tags can only be created with the Controller Scope.

Enter Message Configuration

After creating a new tag, you must enter message configuration.

Click here to see the message configuration pop-up screens
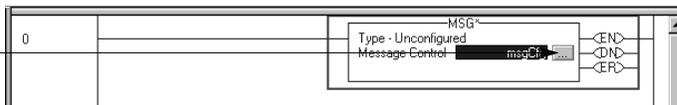
Enter message configuration on the following screens:

- Configuration Pop-Up Screen
- Communications Pop-Up Screen
- Tag Pop-Up Screen

A description of the purpose and set-up of each screen follows.

Configuration Pop-Up Screen

This screen provides information on what module service to perform and where to perform it.

For example, the screen below shows the information needed to send a configuration message (module service) to a 1756-CFM module (where to perform service).

Message Type is CIP Generic

Service Code is 4c
Class Name is 4
Instance Name is 16
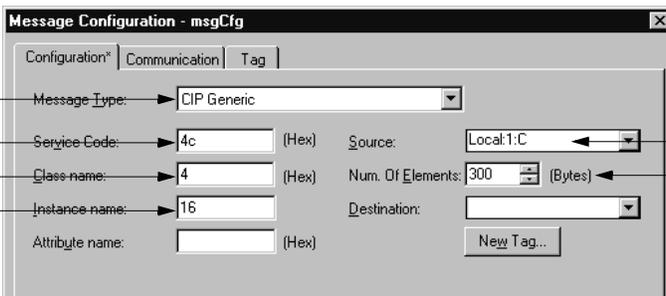
Source is Local:1:C

Num. Of Elements is 300

This table contains information that must be entered on the configuration screen to perform the example CFM module service:

Field	Select
Service Code	4c
Class Name	4
Instance Name	16
Source	Local:1:C (dependent on module location)
Number of Elements	300
Destination	N/A

Communications Pop-Up Screen

This pop-up screen provides information on the path of the message instruction. For example, the slot number of a 1756-CFM module distinguishes exactly which module a message is designated for.
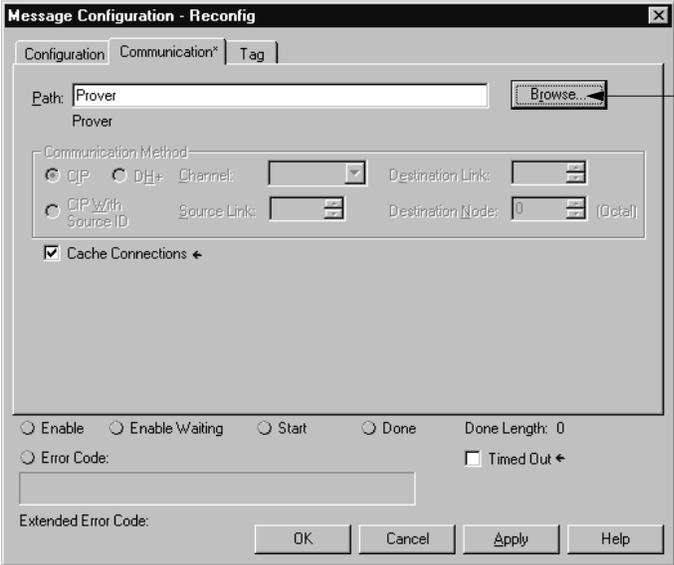
Use the Browse button to choose the CFM module that you want to send configuration changes to.

Tag Pop-Up Screen

This screen provides an opportunity to change some characteristics of the newly created tag. Access this screen to change a tag's:

- Name
- Description
- Style
- Number of consumers

IMPORTANT	You must add a second Apply rung to the ladder logic to send configuration to the CFM module.

Configuring CFM Modules in a Remote Chassis

ControlLogix ControlNet Interface modules (1756-CNB or 1756-CNBR) are required to communicate with CFM modules in a remote chassis.

You must configure the communications module in the local chassis and the remote chassis before adding new I/O modules to the program.

1. Create a 1756-CNB or 1756-CNBR module in the local chassis.
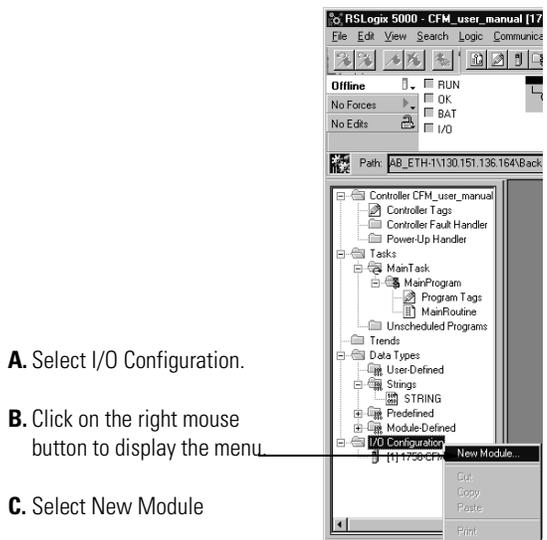
A. Select I/O Configuration.

B. Click on the right mouse button to display the menu

C. Select New Module

2. Choose a 1756-CNB or 1756-CNBR module on the Select Module Type screen.

3. Configure the 1756-CNB or 1756-CNBR module.

   For more information on the ControlLogix ControlNet Interface modules, see the ControlLogix ControlNet Interface User Manual, publication 1756-6.5.3.

4. Create a 1756-CNB or 1756-CNBR module for the remote chassis.

A. Select the local communications module.

B. Click on the right mouse button and select New Module.
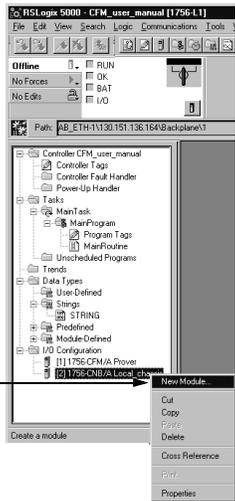
Notice that the remote 1756-CNB module is added to the Controller Organizer through the local 1756-CNB module.

5. Choose a 1756-CNB or 1756-CNBR module on the Select Module Type screen.

6. Configure the remote 1756-CNB or 1756-CNBR module.

7. Add remote CFM modules to your configuration through the remote 1756-CNB or 1756-CNBR module.

A. Select the remote communications module.

B. Click on the right mouse button and select New Module.
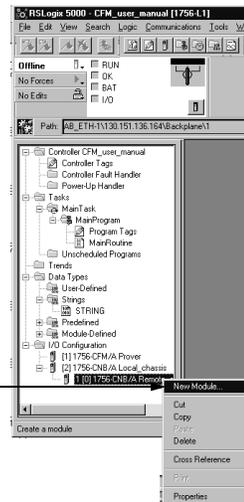
8. Configure remote CFM modules using the same procedures detailed earlier in this chapter to configure local CFM modules.

IMPORTANT   You must run RSNetWorx for ControlNet software for the owner-controller to establish connections, and send configuration information, with the remote CFM module.

Sample Configuration for High Resolution Frequency Mode

High resolution frequency mode provides speed control of machinery such as turbines where shutdown on acceleration or speed is required independent of the owner-controller. Speed is calculated without the K-factor but includes the meter factor and CCF for special calculations.

When using this mode, you may calculate resolution by using the following equation to calculate resolution.

$$\text{Resolution} = \frac{F_{in}\,(250 \times 10^{-9})}{T_{sample}}$$

Where:
- F_{in} is the input frequency
- T_{sample} is the sample time period

Table 6 - Sample Resolutions

F_{in}	T_{sample}	Resolution
60Hz	0.033 seconds	0.00045Hz
5000Hz	0.020 seconds	0.0625Hz
50,000Hz	0.050 seconds	0.25Hz

The values listed in Table 6 are listed for example purposes. Specific values will change according to your application.

This section offers a sample configuration to configure your CFM module for high resolution frequency mode. In this configuration, channel 0 is configured and channel 1 is left unused.For a detailed explanation of the features available in this mode, see .

Follow the steps below to configure your CFM module for high resolution frequency mode.

1. Create a new module, see .

2. Set all communications options, including:
   - name
   - communication format
   - slot number
   - minor revision
   - electronic keying
   - RPI - For this application, the minimum RPI = 5 ms

   See pages to .

3. Access the module tags via the Tag Editor, see .

4. Change **only** the tags listed in . You can ignore all other tags; they do not affect high resolution frequency mode

Table 7 - Tag Changes Required for High Resolution Frequency Mode

Name	Style	Data type	Definition	Enter this Value
C.Ch0LowFreqClear	Decimal	BOOL	Enables the minimum detectable frequency level for Channel 0. Set the bit to 1 to enable it	1
C.Operations[0].OperationalMode	Decimal	SINT	Sets the module's operational mode. 0 = OFF 1 = Totalizer Mode 2 = Non-Resettable Totalizer Mode 3 = High Resolution Frequency Mode	3
C.Operations[1].OperationalMode	Decimal	SINT	Sets the module's operational mode. 0 = OFF 1 = Totalizer Mode 2 = Non-Resettable Totalizer Mode 3 = High Resolution Frequency Mode	0
C.Operations[0].AccelCalculation	Decimal	SINT	Number of past samples to use to calculate an acceleration value. Sample range is 0 to 255.	50
C.Operations[0].MeterFactor	Float	REAL	Calibration Adjust for metering reading applied after K-factor correction. Typically, this factor is between 0.8 and 1.2 but the module restricts the value$\geq$0.	0
C.Operations[0].FilterResolution	Float	REAL	Sets resolution of the Speed calculation based on the raw counts 0 = default of 0.00001 0.00001 = resolution of $\pm$ 1 count of 100,000 raw counts.	0.00001

Table 7 - Tag Changes Required for High Resolution Frequency Mode

Name	Style	Data type	Definition	Enter this Value
C.Operations[0].SampleTime	Float	REAL	Sets time for a sample to be taken. (2.0 second maximum sample time for high resolution frequency mode and 5.0 second maximum sample time for totalizer mode)	0.033
C.Operations[0].HighestAllowedFreq	Float	REAL	User-defined value between MinDetectableFreq and 120,000 When the frequency reaches this level, it sets the Overspeed alarm limit	3700
C.Operations[0].AccelAlarmValue	Float	REAL	Sets Acceleration alarm limit -Maximum acceleration (cycles per second^2) <AccelAlarmValue< +Maximum acceleration (cycles per second^2)	100
C.OutputSetup[0].TriggerOn	Decimal	SINT	Sets when output 0 energizes 0 = No Action 1 = Frequency 2 = Acceleration 3 = Full Flow State (N/A in this mode) 4 = Trickle Flow State (N/A in this mode) 5 = Prover Run State (N/A in this mode) 6 = Prover Range State (N/A in this mode)	0
C.OutputSetup[0].TieToCounter			Ties a channel to output 0 0 = No connection 1 = Connect Channel0 to Output0 2 = Connect Channel1 to Ouput0	0
O.Total[0].CombinedCorrectionFactor	Float	REAL	0 = Default value of 1.0 Use this value to convert from Hz to RPMs. Results are displayed in Frequency Average only	60
O.Total[0].Overrange	Decimal	BOOL	Enables the Overrange alarm on output connected to channel 1. When the Frequency Average exceeds 100KHz, this alarm is set. 0 = No Alarm 1 = Alarm Enabled	0

Table 7 - Tag Changes Required for High Resolution Frequency Mode

Name	Style	Data type	Definition	Enter this Value
O.Total[0].Overspeed	Decimal	BOOL	Enables the Overspeed alarm on output connected to channel 0. When the Speed exceeds the Highest Allowed Frequency value, this alarm is set. 0 = No Alarm 1 = Alarm Enabled	1
O.Total[0].Acceleration	Decimal	BOOL	Enables the Acceleration alarm on output connected to channel 0. When the absolute acceleration exceeds the Acceleration Alarm value, this alarm is set. 0 = No Alarm 1 = Alarm Enabled	1
I.Status[0].FreqAverage	Float	REAL	Displays frequency averaged over the Meter samples on channel 0	
I.Status[0].Acceleration	Float	REAL	Displays acceleration on channel 0 as calculated by using AccelCalculation samples	
I.Ch0OverrangeAlarm	Decimal	BOOL	Displays whether overrange alarm was set on channel 0 0 = alarm was not set 1 = alarm was set	
I.Ch1AccelerationAlarm	Decimal	BOOL	Displays whether acceleration alarm was set on channel 0 0 = alarm was not set 1 = alarm was set	
I.Ch1OverspeedAlarm	Decimal	BOOL	Displays whether overspeed alarm was set on channel 0 0 = alarm was not set 1 = alarm was set	

5. Use ladder logic and a message instructions to send the new configuration to your CFM module, see .

Sample Configuration for Totalizer Mode Prover Function

In the Totalizer Mode Prover function, the CFM module interfaces to a prover and counts pulses using a Flowmeter or positive displacement meter. The module then scales pulse count to engineering units. The CFM module also calculates frequency over a user-defined time period.

When using totalizer mode (with prover or fill function), you may apply a K-factor as a function of frequency, as shown below.

This section offers a sample configuration to configure your CFM module for totalizer mode prover function. In this configuration, channel 0 is configured and channel 1 is left unused. For a detailed explanation of the features available in this mode, see .

Follow the steps below to configure your CFM module for totalizer mode prover function.

1. Create a new module, see .

2. Set all communications options, including:
   - name
   - communication format
   - slot number
   - minor revision
   - electronic keying
   - RPI - For this application, the minimum RPI = 50 ms

   See pages to .

3. Access the module tags via the Tag Editor, see .

4. Change **only** the tags listed in . Ignore all other tags; they do not affect totalizer mode prover function.

Table 8 - Tag Changes Required for Totalizer Mode Using Prover Function

Name	Style	Data type	Definition	Enter this Value
C.ProgToFaultEn	Decimal	BOOL	Sets outputs to selected Fault state when the owner-controller is in Program mode. 0 = outputs use Program mode setting 1 = outputs use fault mode settings	0
C.Operations[0].FilterControl.0	Decimal	SINT	bit 0 = 1 - apply filter to F0 bit 1 = 1 - apply filter to G0 bit 2 = 1 - apply 1second debounce to G0	0
C.Operations[0].MeterSamples	Decimal	SINT		50
C.Operations[0].ThresholdControl	Decimal	SINT	Sets flowmeter input threshold control 0 = 50mV threshold (magnetic pickup) 1 = 1.3V threshold (TTL) 2 = 4.0V threshold (PreAmp)	0
C.Operations[0].CalculationType	Decimal	SINT	Sets calculation type 0 = Counts/K-factor x MeterFactor correction x CCF 1 = Counts/K-factor x MeterFactor correction x AGA 7 compensation or CCF if CCF is not equal to 0.0	0
C.Operations[0].AccelCalculation	Decimal	SINT	Number of past samples to use to calculate an acceleration value. Sample range is 0 to 255.	50
C.Operations[0].MinDetectableFreq	Float	REAL	User-defined value from 0 - 120,000. Sets FreqAverage, FreqPeriod, Speed, GrossRate, and NetRate reading to 0 when calculated value is less than value entered. GrossVolume, and NetVolume do not increment below this value even though TotalCounts increments over time.	5
C.Operations[0].HighestAllowedFreq	Float	REAL	User-defined value between MinDetectableFreq and 120,000 When the frequency reaches this level, it sets the overspeed alarm limit	3700
C.Operations[0].AccelAlarmValue	Float	REAL	Sets Acceleration alarm limit -Maximum acceleration (cycles per second^2) <AccelAlarmValue< +Maximum acceleration (cycles per second^2)	100

Table 8 - Tag Changes Required for Totalizer Mode Using Prover Function

Name	Style	Data type	Definition	Enter this Value
C.Operations[0].MeterFactor	Float	REAL	Calibration Adjust for metering reading applied after K-factor correction. Typically, this factor is between 0.8 and 1.2 but the module restricts the value≥0.	1.0
C.Operations[0].FilterResolution	Float	REAL	Sets resolution of the Speed calculation based on the raw counts 0 = default of 0.00001 0.00001 = resolution of ± 1 count of 100,000 raw counts.	0.166
C.Operations[0].SampleTime	Float	REAL	Sets time for a sample to be taken. (2.0 second maximum sample time for high resolution frequency mode and 5.0 seconds for totalizer mode)	0.5
C.Operations[0].kFactStruct.kFactorForChan[0]	Float	REAL	K-factor 0 for Channel 0 when frequency is ≤ FreqAtKFactor[1]	600.0
C.Operations[0].kFactStruct.kFactorForChan[1]	Float	REAL	This tag is an ordered pair with tag C.Operations[0].kFactStruct.FreqAtKFactor [1]	600.0
C.Operations[0].kFactStruct.kFactorForChan[2]	Float	REAL	This tag is an ordered pair with tag C.Operations[0].kFactStruct.FreqAtKFactor [2]	550.0
C.Operations[0].kFactStruct.kFactorForChan[3]	Float	REAL	This tag is an ordered pair with tag C.Operations[0].kFactStruct.FreqAtKFactor [3]	0.0
C.Operations[0].kFactStruct.kFactorForChan[4]	Float	REAL	This tag is an ordered pair with tag C.Operations[0].kFactStruct.FreqAtKFactor [4]	0.0
C.Operations[0].kFactStruct.kFactorForChan[5]	Float	REAL	This tag is an ordered pair with tag C.Operations[0].kFactStruct.FreqAtKFactor [5]	0.0
C.Operations[0].kFactStruct.kFactorForChan[6]	Float	REAL	This tag is an ordered pair with tag C.Operations[0].kFactStruct.FreqAtKFactor [6]	0.0
C.Operations[0].kFactStruct.kFactorForChan[7]	Float	REAL	This tag is an ordered pair with tag C.Operations[0].kFactStruct.FreqAtKFactor [7]	0.0
C.Operations[0].kFactStruct.kFactorForChan[8]	Float	REAL	This tag is an ordered pair with tag C.Operations[0].kFactStruct.FreqAtKFactor [8]	0.0
C.Operations[0].kFactStruct.kFactorForChan[9]	Float	REAL	This tag is an ordered pair with tag C.Operations[0].kFactStruct.FreqAtKFactor [9]	0.0
C.Operations[0].kFactStruct.kFactorForChan[10]	Float	REAL	This tag is an ordered pair with tag C.Operations[0].kFactStruct.FreqAtKFactor [10]	0.0

Table 8 - Tag Changes Required for Totalizer Mode Using Prover Function

Name	Style	Data type	Definition	Enter this Value
C.Operations[0].kFactStruct.kFactorForChan[11]	Float	REAL	This tag is an ordered pair with tag C.Operations[0].kFactStruct.FreqAtKFactor [11]	0.0
C.Operations[0].kFactStruct.kFactorForChan[12]	Float	REAL	This tag is an ordered pair with tag C.Operations[0].kFactStruct.FreqAtKFactor [12]	0.0
C.Operations[0].kFactStruct.FreqAtKFactor[0]	Float	REAL		100.0
C.Operations[0].kFactStruct.FreqAtKFactor[1]	Float	REAL	Freq[1] for KFactor [1]	0.0
C.Operations[0].kFactStruct.FreqAtKFactor[2]	Float	REAL	Freq[2] for KFactor [2]	500.0
C.Operations[0].kFactStruct.FreqAtKFactor[3]	Float	REAL	Freq[3] for KFactor [3]	0.0
C.Operations[0].kFactStruct.FreqAtKFactor[4]	Float	REAL	Freq[4] for KFactor [4]	0.0
C.Operations[0].kFactStruct.FreqAtKFactor[5]	Float	REAL	Freq[5] for KFactor [5]	0.0
C.Operations[0].kFactStruct.FreqAtKFactor[6]	Float	REAL	Freq[6] for KFactor [6]	0.0
C.Operations[0].kFactStruct.FreqAtKFactor[7]	Float	REAL	Freq[7] for KFactor [7]	0.0
C.Operations[0].kFactStruct.FreqAtKFactor[8]	Float	REAL	Freq[8] for KFactor [8]	0.0
C.Operations[0].kFactStruct.FreqAtKFactor[9]	Float	REAL	Freq[9] for KFactor [9]	0.0
C.Operations[0].kFactStruct.FreqAtKFactor[10]	Float	REAL	Freq[10] for KFactor [10]	0.0
C.Operations[0].kFactStruct.FreqAtKFactor[11]	Float	REAL	Freq[11] for KFactor [11]	0.0
C.Operations[0].kFactStruct.FreqAtKFactor[12]	Float	REAL	Freq[12] for KFactor [12]	0.0
C.OutputSetup[0].FaultMode	Decimal	SINT	Sets the state of output 0 when communications are lost with the owner-controller in Fault Mode 0 = Continue operation 1 = Reset Output 0 to OFF when in Fault Mode 2 = Set Output 0 to ON when in Fault Mode	1
C.OutputSetup[0].ProgMode	Decimal	SINT	Sets the state of output 0 when communications are lost with the owner-controller in Program Mode 0 = Continue operation 1 = Reset Output 0 to OFF when in Program Mode 2 = Set Output 0 to ON when in Program Mode	0
C.OutputSetup[0].DynamicError	Decimal	SINT	Sets the state of output 0 when a dynamic error occurs 0 = Continue operation 1 = Reset Output 0 to OFF on Error 2 = Set Output 0 to ON on Error	0

Table 8 - Tag Changes Required for Totalizer Mode Using Prover Function

Name	Style	Data type	Definition	Enter this Value
C.OutputSetup[0].TriggerOn	Decimal	SINT	Sets when output 0 energizes 0 = No Action 1 = Frequency 2 = Acceleration 3 = Full Flow State (N/A in this mode) 4 = Trickle Flow State (N/A in this mode) 5 = Prover Run State 6 = Prover Range State	0
C.OutputSetup[0].TieToCounter			Ties a channel to output 0 0 = No connection 1 = Connect Channel0 to Output0 2 = Connect Channel1 to Ouput0	0
C.Ch0ProverDirection	Decimal	BOOL	Defines the direction of a prover connected to Channel 0. 0 = unidirectional prover 1 = bidirectional prover	0
C.Ch0LowFreqClear	Decimal	BOOL	Enables the minimum detectable frequency level for Channel 0. Set the bit to 1 to enable it	1
C.Operations[0].OperationalMode	Decimal	SINT	Sets the module's operational mode. 0 = OFF 1 = Totalizer Mode 2 = Non-Resettable Totalizer Mode 3 = High Resolution Frequency Mode	2
O.OutputControl[0].0	Decimal	BOOL	Manually sets the operation of outputs connected to channel 0. 0 = Module operation of outputs 1 = Override Output0 to 0 2 = Override Output0 to 1	0
O.Total[0].ProverEnable	Decimal	BOOL	Enables the prover operation on output connected to channel 0. Once this bit is enabled, the module waits for output Z_0 to energize before beginning prover operations. 0 = Prover operation is disabled 1 = Prover operation is enabled	0
O.Total[0].Overrange	Decimal	BOOL	Enables the Overrange alarm on output connected to channel 0. When the Frequency Period exceeds 100KHz, this alarm is set. 0 = No Alarm 1 = Alarm Enabled	0
O.Total[0].Overflow	Decimal	BOOL	Enables the Overflow alarm on output connected to channel 0. When the Total Counts exceeds the Roll Over value, this alarm is set. 0 = No Alarm 1 = Alarm Enabled	0

Table 8 - Tag Changes Required for Totalizer Mode Using Prover Function

Name	Style	Data type	Definition	Enter this Value
O.Total[0].Overspeed	Decimal	BOOL	Enables the Overspeed alarm on output connected to channel 0. When the Speed exceeds the Highest Allowed Frequency value, this alarm is set. 0 = No Alarm 1 = Alarm Enabled	1
O.Total[0].Acceleration	Decimal	BOOL	Enables the Acceleration alarm on output connected to channel 0. When the absolute acceleration exceeds the Acceleration Alarm value, this alarm is set. 0 = No Alarm 1 = Alarm Enabled	1
I.Status[0].ProverState	Decimal	SINT	Displays status of the prover operation on channel 0 0 = Prover Not Active 1 = Prover waiting for 1st start 2 = Prover waiting for 1st stop 3 = Prover waiting for 2nd start 4 = Prover waiting for 2nd stop 5 = Prover Complete	
I.Status[0].TotalCounts	Decimal	DINT	Displays actual pulses counted by the counter connected to the channel 0	
I.Status[0].FreqAverage	Float	REAL	Displays frequency averaged over the Meter samples on channel 0	
I.Status[0].FreqPeriod	Float	REAL	Displays frequency using sample time on channel 0	
I.Status[0].Speed	Float	REAL	Displays frequency using filter resolution on channel 0	
I.Status[0].Acceleration	Float	REAL	Displays acceleration on channel 0 as calculated by using AccelCalculation samples	
I.Status[0].GrossVolume	Float	REAL	Σ (ΔTotal Counts during each Sample/K-factor x MeterFactor as occurs on channel 0	
I.Status[0].NetVolume	Float	REAL	Σ (ΔTotal Counts during each Sample/K-factor x MeterFactor x CCF) as occurs on channel 0	
I.Status[0].GrossRate	Float	REAL	ΔTotal Counts in Meter Sample/ (K-factor x Sample Interval) x Meter Factor as occurs on channel 0	
I.Status[0].NetRate	Float	REAL	ΔTotal Counts in Meter Sample/ (K-factor x Sample Interval) x Meter Factor x CCF as occurs on channel 0	

**Table 8 - Tag Changes Required for Totalizer Mode Using Prover Function**

Name	Style	Data type	Definition	Enter this Value
I.Status[0].ProverTotal	Float	REAL	Corrected/compensated volume received on Channel 0 during prover cycle. Prover total resets when the ProverEnable transitions from 0-1. Prover total concurrently accumulates with net volume, and must be saved if subtracted from the NetVolume for single and multiple prover verifications.	
I.Ch0AccelerationAlarm	Decimal	BOOL	Displays whether acceleration alarm was set on channel 0 0 = alarm was not set 1 = alarm was set	
I.Ch0OverspeedAlarm	Decimal	BOOL	Displays whether overspeed alarm was set on channel 0 0 = alarm was not set 1 = alarm was set	
I.Ch0OverrangeAlarm	Decimal	BOOL	Displays whether overrange alarm was set on channel 0 0 = alarm was not set 1 = alarm was set	
I.Ch0OverflowAlarm	Decimal	BOOL	Displays whether overflow alarm was set on channel 0 0 = alarm was not set 1 = alarm was set	

5. Use ladder logic and a message instructions to send the new configuration to your CFM module, see .

Sample Configuration for Totalizer Mode Filler Function

In the Totalizer Mode Filler function, the CFM module interfaces to a prover and counts pulses using a Flowmeter or positive displacement meter. The module then scales pulse count to engineering units. The CFM module also interpolates the K-Factors between frequencies 1-12.

When using totalizer mode (with prover or fill function), you may apply a K-factor as a function of frequency, as shown below.
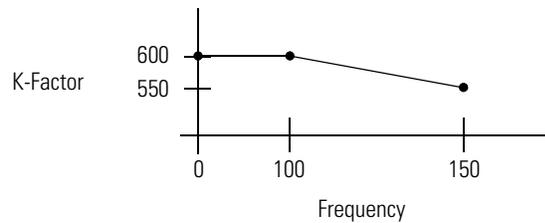
This section offers a sample configuration to configure your CFM module for totalizer mode prover function. In this configuration, channel 0 is configured and channel 1 is left unused. For a detailed explanation of the features available in this mode, see page 50.

Follow the steps below to configure your CFM module for totalizer mode filler function.

1. Create a new module, see page 80.

2. Set all communications options, including:
   - name
   - communication format
   - slot number
   - minor revision
   - electronic keying
   - RPI - For this application, the minimum RPI = 5 ms

   See pages 81 to 84.

3. Access the module tags via the Tag Editor, see page 85.

4. Change **only** the tags listed in <u>Table 9</u>. Ignore all other tags; they do not affect totalizer mode using the prover function.

Table 9 - Tag Changes Required for Totalizer Mode Using Filler Function

Name	Style	Data type	Definition	Enter this Value
C.ProgToFaultEn	Decimal	BOOL	Sets outputs to selected Fault state when the owner-controller is in Program mode. 0 = outputs use Program mode setting 1 = outputs use fault mode settings	0
C.Operations[0].FilterControl.0	Decimal	SINT	bit 0 = 1 - apply filter to F0 bit 1 = 1 - apply filter to G0 bit 2 = 1 - apply 1second debounce to G0	0
C.Operations[0].MeterSamples	Decimal	SINT		50
C.Operations[0].ThresholdControl	Decimal	SINT	Sets flowmeter input threshold control 0 = 50mV threshold (magnetic pickup) 1 = 1.3V threshold (TTL) 2 = 4.0V threshold (PreAmp)	0
C.Operations[0].CalculationType	Decimal	SINT	Sets calculation type 0 = Counts/K-factor x MeterFactor correction x CCF 1 = Counts/K-factor x MeterFactor correction x AGA 7 compensation or CCF if CCF is not equal to 0.0	0
C.Operations[0].AccelCalculation	Decimal	SINT	Number of past samples to use to calculate an acceleration value. Sample range is 0 to 255.	50
C.Operations[0].MinDetectableFreq	Float	REAL	User-defined value from 0 - 120,000. Sets FreqAverage, FreqPeriod, Speed, GrossRate, and NetRate reading to 0 when calculated value is less than value entered. GrossVolume, and NetVolume do not increment below this value even though TotalCounts increments over time.	5
C.Operations[0].HighestAllowedFreq	Float	REAL	User-defined value between MinDetectableFreq and 120,000 When the frequency reaches this level, it sets the Overspeed alarm limit	3700
C.Operations[0].AccelAlarmValue	Float	REAL	Sets Acceleration alarm limit -Maximum acceleration (cycles per second^2) <AccelAlarmValue< +Maximum acceleration (cycles per second^2)	100
C.Operations[0].MeterFactor	Float	REAL	Calibration Adjust for metering reading applied after K-factor correction. Typically, this factor is between 0.8 and 1.2 but the module restricts the value$\geq$0.	

Table 9 - Tag Changes Required for Totalizer Mode Using Filler Function

Name	Style	Data type	Definition	Enter this Value
C.Operations[0].FilterResolution	Float	REAL	Sets resolution of the Speed calculation based on the raw counts 0 = default of 0.00001 0.00001 = resolution of $\pm$ 1 count of 100,000 raw counts.	0.166
C.Operations[0].SampleTime	Float	REAL	Sets time for a sample to be taken. (2.0 second maximum sample time for high resolution frequency mode and 5.0 seconds for totalizer mode)	0.5
C.Operations[0].kFactStruct.kFactorForChan[0]	Float	REAL	K-factor 0 for Channel 0 when frequency is $\leq$ FreqAtKFactor[1]	600.0
C.Operations[0].kFactStruct.kFactorForChan[1]	Float	REAL	This tag is an ordered pair with tag C.Operations[0].kFactStruct.FreqAtKFactor [1]	600.0
C.Operations[0].kFactStruct.kFactorForChan[2]	Float	REAL	This tag is an ordered pair with tag C.Operations[0].kFactStruct.FreqAtKFactor [2]	550.0
C.Operations[0].kFactStruct.kFactorForChan[3]	Float	REAL	This tag is an ordered pair with tag C.Operations[0].kFactStruct.FreqAtKFactor [3]	0.0
C.Operations[0].kFactStruct.kFactorForChan[4]	Float	REAL	This tag is an ordered pair with tag C.Operations[0].kFactStruct.FreqAtKFactor [4]	0.0
C.Operations[0].kFactStruct.kFactorForChan[5]	Float	REAL	This tag is an ordered pair with tag C.Operations[0].kFactStruct.FreqAtKFactor [5]	0.0
C.Operations[0].kFactStruct.kFactorForChan[6]	Float	REAL	This tag is an ordered pair with tag C.Operations[0].kFactStruct.FreqAtKFactor [6]	0.0
C.Operations[0].kFactStruct.kFactorForChan[7]	Float	REAL	This tag is an ordered pair with tag C.Operations[0].kFactStruct.FreqAtKFactor [7]	0.0
C.Operations[0].kFactStruct.kFactorForChan[8]	Float	REAL	This tag is an ordered pair with tag C.Operations[0].kFactStruct.FreqAtKFactor [8]	0.0
C.Operations[0].kFactStruct.kFactorForChan[9]	Float	REAL	This tag is an ordered pair with tag C.Operations[0].kFactStruct.FreqAtKFactor [9]	0.0
C.Operations[0].kFactStruct.kFactorForChan[10]	Float	REAL	This tag is an ordered pair with tag C.Operations[0].kFactStruct.FreqAtKFactor [10]	0.0
C.Operations[0].kFactStruct.kFactorForChan[11]	Float	REAL	This tag is an ordered pair with tag C.Operations[0].kFactStruct.FreqAtKFactor [11]	0.0
C.Operations[0].kFactStruct.kFactorForChan[12]	Float	REAL	This tag is an ordered pair with tag C.Operations[0].kFactStruct.FreqAtKFactor [12]	0.0
C.Operations[0].kFactStruct.FreqAtKFactor[0]	Float	REAL		0.0
C.Operations[0].kFactStruct.FreqAtKFactor[1]	Float	REAL	Freq[1] for KFactor [1]	100.0
C.Operations[0].kFactStruct.FreqAtKFactor[2]	Float	REAL	Freq[2] for KFactor [2]	500.0
C.Operations[0].kFactStruct.FreqAtKFactor[3]	Float	REAL	Freq[3] for KFactor [3]	0.0
C.Operations[0].kFactStruct.FreqAtKFactor[4]	Float	REAL	Freq[4] for KFactor [4]	0.0

Table 9 - Tag Changes Required for Totalizer Mode Using Filler Function

Name	Style	Data type	Definition	Enter this Value
C.Operations[0].kFactStruct.FreqAtKFactor[5]	Float	REAL	Freq[5] for KFactor [5]	0.0
C.Operations[0].kFactStruct.FreqAtKFactor[6]	Float	REAL	Freq[6] for KFactor [6]	0.0
C.Operations[0].kFactStruct.FreqAtKFactor[7]	Float	REAL	Freq[7] for KFactor [7]	0.0
C.Operations[0].kFactStruct.FreqAtKFactor[8]	Float	REAL	Freq[8] for KFactor [8]	0.0
C.Operations[0].kFactStruct.FreqAtKFactor[9]	Float	REAL	Freq[9] for KFactor [9]	0.0
C.Operations[0].kFactStruct.FreqAtKFactor[10]	Float	REAL	Freq[10] for KFactor [10]	0.0
C.Operations[0].kFactStruct.FreqAtKFactor[11]	Float	REAL	Freq[11] for KFactor [11]	0.0
C.Operations[0].kFactStruct.FreqAtKFactor[12]	Float	REAL	Freq[12] for KFactor [12]	0.0
C.OutputSetup[0].FaultMode	Decimal	SINT	Sets the state of output 0 when communications are lost with the owner-controller in Fault Mode 0 = Continue operation 1 = Reset Output 0 to OFF when in Fault Mode 2 = Set Output 0 to ON when in Fault Mode	1
C.OutputSetup[0].ProgMode	Decimal	SINT	Sets the state of output 0 when communications are lost with the owner-controller in Program Mode 0 = Continue operation 1 = Reset Output 0 to OFF when in Program Mode 2 = Set Output 0 to ON when in Program Mode	0
C.OutputSetup[0].DynamicError	Decimal	SINT	Sets the state of output 0 when a dynamic error occurs 0 = Continue operation 1 = Reset Output 0 to OFF on Error 2 = Set Output 0 to ON on Error	0
C.OutputSetup[0].TriggerOn	Decimal	SINT	Sets when output 0 energizes 0 = No Action 1 = Frequency 2 = Acceleration 3 = Full Flow State 4 = Trickle Flow State 5 = Prover Run State (N/A in this mode) 6 = Prover Range State (N/A in this mode)	0
C.OutputSetup[0].TieToCounter			Ties a channel to output 0 0 = No connection 1 = Connect Channel0 to Output0 2 = Connect Channel1 to Ouput0	0
C.Operations[0].OperationalMode	Decimal	SINT	Sets the module's operational mode. 0 = OFF 1 = Totalizer Mode 2 = Non-Resettable Totalizer Mode 3 = High Resolution Frequency Mode	1

Table 9 - Tag Changes Required for Totalizer Mode Using Filler Function

Name	Style	Data type	Definition	Enter this Value
C.Ch0LowFreqClear	Decimal	BOOL	Enables the minimum detectable frequency level for Channel 0. Set the bit to 1 to enable it	1
C.Ch0PreTrigger	Decimal	BOOL	Enables the PreTrigger on Channel 0 for full flow. Set the bit to 1 to enable it	1
C.Operations[0].FillMode	Decimal	SINT	Sets the Trickle mode to complete on fill total target or time. 0 = Fill total target (Engineering units) 1 = Time (seconds)	0
O.OutputControl[0].0	Decimal	BOOL	Manually sets the operation of outputs connected to channel 0. 0 = Module operation of outputs 1 = Override Output0 to 0 2 = Override Output0 to 1	0
O.Total[0].FillEnable	Decimal	BOOL	Enables the filling operation on output connected to channel 0. 0 = Fill operation is disabled 1 = Fill operation is enabled.	0
O.Total[0].FillStart	Decimal	BOOL	Begins filling operation when Fill Enable is enabled on output connected to channel 0. 0 = Do not begin filling 1 = Begin filling	0
O.Total[0].FillHold	Decimal	BOOL	Holds/pauses filling operation on output connected to channel 0 0 = Continue filling operation 1 = Hold/pause filling operation	0
O.Total[0].FillTotalTarget	Float	REAL	Target for Fill Complete, except when Fill Transition is greater than this value.	100
O.Total[0].FillTransition	Float	REAL	When fill cycle is started, trickle flow is initiated when the Fill Total is equal to or greater than this value. Full flow is initiated when the Fill Total is less than this value.	75
O.Total[0].FillTransitionTimer	Float	REAL	When timed trickle flow is selected, the status remains ON for this time during this state. The value must be changed prior to entering the trickle flow state.	1.0
O.Total[0].Overrange	Decimal	BOOL	Enables the Overrange alarm on output connected to channel 0. When the Frequency Period exceeds 100KHz, this alarm is set. 0 = No Alarm 1 = Alarm Enabled	0

Table 9 - Tag Changes Required for Totalizer Mode Using Filler Function

Name	Style	Data type	Definition	Enter this Value
O.Total[0].Overflow	Decimal	BOOL	Enables the Overflow alarm on output connected to channel 0. When the Total Counts exceeds the Roll Over value, this alarm is set. 0 = No Alarm 1 = Alarm Enabled	0
O.Total[0].Overspeed	Decimal	BOOL	Enables the Overspeed alarm on output connected to channel 0. When the Speed exceeds the Highest Allowed Frequency value, this alarm is set. 0 = No Alarm 1 = Alarm Enabled	1
O.Total[0].Acceleration	Decimal	BOOL	Enables the Acceleration alarm on output connected to channel 0. When the absolute acceleration exceeds the Acceleration Alarm value, this alarm is set. 0 = No Alarm 1 = Alarm Enabled	1
I.Status[0].FillState	Decimal	SINT	Displays current state of module for channel 0. The following states are possible: 0 = Filler not active 1 = Filler Enabled only, waiting for start 2 = Timed Trickle Flow complete, not filled 3 = Full Flow (Fill mode =1) 4 = Timed Trickle Flow (Fill mode =1) 5 = Full Flow (Fill mode =0) 6 = Fill Total Target Trickle Flow (Fill mode = 0) 7 = Fill complete	

Table 9 - Tag Changes Required for Totalizer Mode Using Filler Function

Name	Style	Data type	Definition	Enter this Value
I.Status[0].TotalCounts	Decimal	DINT	Displays actual pulses counted by the counter connected to the channel 0	
I.Status[0].FillTotal	Float	REAL	Same calculation as Net Volume during fill cycle.	
I.Status[0].GrossVolume	Float	REAL	Σ (ΔTotal Counts during each Sample/K-factor x Meter Factor as occurs on channel 0	
I.Status[0].NetVolume	Float	REAL	Σ (ΔTotal Counts during each Sample/K-factor x MeterFactor x CCF) as occurs on channel 0	
I.Status[0].GrossRate	Float	REAL	ΔTotal Counts in Meter Sample/ (K-factor x Sample Interval) x Meter Factor as occurs on channel 0	
I.Status[0].NetRate	Float	REAL	ΔTotal Counts in Meter Sample/ (K-factor x Sample Interval) x Meter Factor x CCF as occurs on channel 0	
I.Ch0AccelerationAlarm	Decimal	BOOL	Displays whether acceleration alarm was set on channel 0 0 = alarm was not set 1 = alarm was set	
I.Ch0OverspeedAlarm	Decimal	BOOL	Displays whether overspeed alarm was set on channel 0 0 = alarm was not set 1 = alarm was set	
I.Ch0OverrangeAlarm	Decimal	BOOL	Displays whether overrange alarm was set on channel 0 0 = alarm was not set 1 = alarm was set	
I.Ch0OverflowAlarm	Decimal	BOOL	Displays whether overflow alarm was set on channel 0 0 = alarm was not set 1 = alarm was set	

5. Use ladder logic and a message instructions to send the new configuration to your CFM module, see .

Troubleshooting the Configurable Flowmeter Module

What this Appendix Contains

This appendix describes how to troubleshoot the ControlLogix Configurable Flowmeter module.

For information on	See page
Using the Status Indicators	115
Using RSLogix 5000 Software to Troubleshoot Your Module	117

Using the Status Indicators

The CFM module offers status indicators to show the health of your module. The indicators show individual I/O status (green) for each point and a bi-colored LED for module "OK" (red/green).

METERING

F Z F Z
0 0 1 1   O
                K
   0 0
   0 1

→⊕   DC I/O   ⊕→
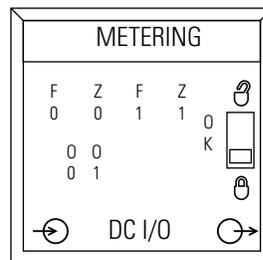
42571

During power up, an indicator test is done and the following occurs:

- The "OK" indicator turns red for 1 second
- If the module passes the self-test, the "OK" indicator turns to flashing green.

Table 10 - CFM Module Status Indicators

LED indicators	This display	Means	Take this action
OK	Steady green light	The inputs are being multicast and in normal operating state.	None
OK	Flashing green light	The module has passed internal diagnostics but is not actively controlled.	Configure the module.
OK	Flashing red light	Previously established communication has timed out.	Check controller and chassis communication
OK	Steady red light	The module must be replaced.	Replace the module.
Input (F, Z)	Off	The input is turned off. The input is not in use. A wire is disconnected.	If you need to use the input, check wiring connections
Input (F, Z)	Steady yellow	The input is in normal operating state.	None
Output (0, 1)	Off	The output is turned off. The output is not in use.	If you need to use the output, check wiring connections and your ladder logic application.
Output (0, 1)	Steady yellow	The output is in normal operating state.	None

Using RSLogix 5000 Software to Troubleshoot Your Module

In addition to the LED display on the module, RSLogix 5000 software will alert you to fault conditions. You will be alerted in one of four ways:

- Warning signal on the main screen next to the module-This occurs when the connection to the module is broken
- Fault message in a screen's status line
- Notification in the Tag Editor - General module faults are also reported in the Tag Editor. Diagnostic faults are only reported in the Tag Editor
- Status on the Module Info Page

The screens below display fault notification in RSLogix 5000 software.

Warning signal on main screen

Warning icon when a communications fault occurs or if the module is inhibited

Warning signal - The module in slot 1 has a communications fault
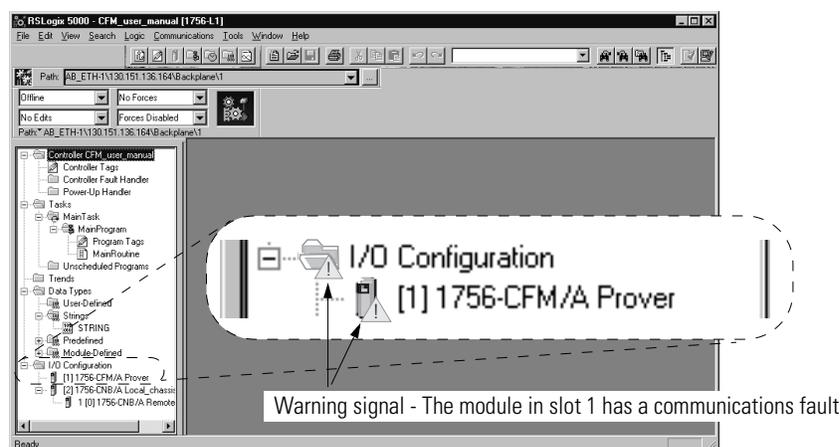
Fault message in status line

Status section lists Major and Minor Faults and the Internal State of the module

Status line provides information on the connection to the module

Notification in Tag Editor

A value of 1 shows a fault for this input point.

Determining Fault Type

When you are monitoring a module's configuration properties in RSLogix 5000 software and receive a Communications fault message, the Connection page lists the type of fault.

The fault type is listed here
In this example, Error 16#0011 means Counter 0 was set to an invalid Operational Mode
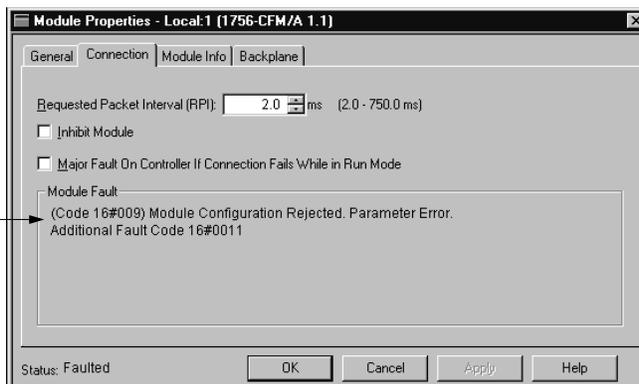
Using Error Codes

Errors are displayed

- on the Connection tab of the Module Properties section in RSLogix 5000 software

  and

- in the .EXERR field of the message variable when your reconfigure the module.

Table 11 - Configurable Flowmeter Configuration Error Codes

Error Code	Definition
1	BAD_OPERATIONAL_MODE
2	BAD_FILTER_VALUE
3	BAD_THRESHOLD_VALUE
4	BAD_CALCULATION_TYPE
5	BAD_FILL_MODE_VALUE
6	BAD_MINIMUM_FREQ_VALUE
7	BAD_HIGHEST_ALLOWED_FREQ
8	BAD_ACCELERATION_ALARM_VALUE
9	BAD_METER_FACTOR_VALUE
a	BAD_FILTER_RESOLUTION_VALUE
b	BAD_SAMPLE_TIME_VALUE
c	BAD_KFACTOR_VALUE
d	BAD_KFACTOR_FREQ_VALUE
e	BAD_FAULT_MODE_VALUE
f	BAD_PROGMODE_VALUE

Table 12 - Configurable Flowmeter Consumer Error Codes

Error Code	Definition
10	BAD_DYNAMIC_ERROR_VALUE
11	BAD_TRIGGER_ON_VALUE
12	BAD_COUNTER_TIE_VALUE
19	BAD_CCF_VALUE
20	BAD_BASE_TEMPERATURE_VALUE
21	BAD_FLOWINGTEMP_VALUE
22	BAD_ATMOSPHERICPRESSURE_VALUE
23	BAD_STATICGAUGEPRESSURE_VALUE
24	BAD_BASE_PRESSURE_VALUE
25	BAD_BASECOMPRESSIBILITY_VALUE
26	BAD_FLOWINGCOMPRESS_VALUE
27	BAD_FILL_TOTAL_TARGET_VALUE
28	BAD_FILL_TRANSITION_VALUE
29	BAD_FILL_TRANSITION_TIMER_VALUE
30	OUTPUT_CONTROL_ERROR

Software Configuration Tags

This appendix lists the following categories of CFM data structures:

- **Configuration** - This structure is used to write CFM configuration upon insertion and to make changes during module operation.

- **Input** - This structure displays the current operational status of the CFM module.

- **Output** - This structure is used to modify module operation and override the outputs.

Configuration Structure

You must use the Configuration tags to alter CFM module configuration. This table lists and defines CFM Configuration tags:

Table 13 - Configurable Flowmeter Module Configuration Tags

Name	Style	Data type	Definition
C.ProgToFaultEn	Decimal	BOOL	Sets outputs to selected Fault state when the owner-controller is in Program mode. 0 = outputs use Program mode setting 1 = outputs use fault mode settings
C.ChannelCfgBits for Channel 0	Binary	SINT	
C.Ch0ProverDirection	Decimal	BOOL	Defines the direction of a prover connected to Channel 0. 0 = unidirectional prover 1 = bidirectional prover
C.Ch1ProverDirection	Decimal	BOOL	Defines the direction of a prover connected to Channel 1. 0 = unidirectional prover 1 = bidirectional prover
C.Ch0LowFreqClear	Decimal	BOOL	Enables the minimum detectable frequency level for Channel 0. Set the bit to 1 to enable it
C.Ch1LowFreqClear	Decimal	BOOL	Enables the minimum detectable frequency level for Channel 1. Set the bit to 1 to enable it

Table 13 - Configurable Flowmeter Module Configuration Tags

Name	Style	Data type	Definition
C.Ch0PreTrigger	Decimal	BOOL	Enables the PreTrigger on Channel 0 for full flow. Set the bit to 1 to enable it
C.Ch1PreTrigger	Decimal	BOOL	Enables the PreTrigger on Channel 1 for full flow. Set the bit to 1 to enable it
C.Operations[0].OperationalMode	Decimal	SINT	Sets the module's operational mode. 0 = OFF 1 = Totalizer Mode 2 = Non-Resettable Totalizer Mode 3 = High Resolution Frequency Mode
C.Operations[0].FilterControl	Decimal	SINT	The following values placed in the appropriate word invoke the following filters. 0x01 = Hardware (sub 100Hz RC) filter for F0 0x02 = Hardware (sub 100Hz RC) filter for G0 0x03 = 2 Hardware filters (sub 100Hz RC) for F0 and G0 0x04 = Firmware filter, 1 second debounce filter used for prover applications for G0 (ignore/disable the gate for 1 second after an initial pulse) 0x06 = both the Hardware and Firmware filters for G0 0x07 = all filters above: Hardware (sub 100Hz RC) for F0 and G0 and the Firmware, 1 second debounce on prover for G0
C.Operations[0].MeterSamples	Decimal	SINT	
C.Operations[0].ThresholdControl	Decimal	SINT	Sets module threshold control 0 = 50mV threshold 1 = 1.3V (TTL) threshold 2 = 4.0V threshold
C.Operations[0].CalculationType	Decimal	SINT	Sets calculation type 0 = Counts/K-factor x MeterFactor correction x CCF 1 = Counts/K-factor x MeterFactor correction x AGA 7 compensation of CCF if CCF is not equal to 0.0
C.Operations[0].AccelCalculation	Decimal	SINT	Number of past samples to use to calculate an acceleration value. Sample range is 0 to 255.
C.Operations[0].FillMode	Decimal	SINT	Sets the Trickle mode for engineering units or time. 0 = Engineering units 1 = Time
C.Operations[0].MinDetectableFreq	Float	REAL	User-defined value from 0 - 100,000. Sets FreqAverage, FreqPeriod, Speed, GrossRate, and NetRate reading to 0 when calculated value is less than value entered. GrossVolume, and NetVolume do not increment below this value even though TotalCounts increments over time.
C.Operations[0].HighestAllowedFreq	Float	REAL	User-defined value between MinDetectableFreq and 120,000 When the frequency reaches this level, it sets the Overflow alarm limit

Table 13 - Configurable Flowmeter Module Configuration Tags

Name	Style	Data type	Definition
C.Operations[0].AccelAlarmValue	Float	REAL	Sets Acceleration alarm limit -Maximum acceleration (cycles per second^2) <AccelAlarmValue< +Maximum acceleration (cycles per second^2)
C.Operations[0].MeterFactor	Float	REAL	Calibration Adjust for metering reading applied after K-factor correction. Typically, this factor is between 0.8 and 1.2 but the module restricts the value$\geq$0.
C.Operations[0].FilterResolution	Float	REAL	Sets resolution of the Speed calculation based on the raw counts 0 = default of 0.00001 0.00001 = resolution of $\pm$ 1 count of 100,000 raw counts.
C.Operations[0].SampleTime	Float	REAL	Sets time for a sample to be taken. 0 - 5.0 seconds (2.0 second maximum sample time for High Resolution mode)
C.Operations[0].kFactStruct.kFactorForChan[0]	Float	REAL	K-factor 0 for Channel 0 when frequency is $\leq$ FreqAtKFactor[1]
C.Operations[0].kFactStruct.kFactorForChan[1]	Float	REAL	This tag is an ordered pair with tag C.Operations[0].kFactStruct.FreqAtKFactor [1]
C.Operations[0].kFactStruct.kFactorForChan[2]	Float	REAL	This tag is an ordered pair with tag C.Operations[0].kFactStruct.FreqAtKFactor [2]
C.Operations[0].kFactStruct.kFactorForChan[3]	Float	REAL	This tag is an ordered pair with tag C.Operations[0].kFactStruct.FreqAtKFactor [3]
C.Operations[0].kFactStruct.kFactorForChan[4]	Float	REAL	This tag is an ordered pair with tag C.Operations[0].kFactStruct.FreqAtKFactor [4]
C.Operations[0].kFactStruct.kFactorForChan[5]	Float	REAL	This tag is an ordered pair with tag C.Operations[0].kFactStruct.FreqAtKFactor [5]
C.Operations[0].kFactStruct.kFactorForChan[6]	Float	REAL	This tag is an ordered pair with tag C.Operations[0].kFactStruct.FreqAtKFactor [6]
C.Operations[0].kFactStruct.kFactorForChan[7]	Float	REAL	This tag is an ordered pair with tag C.Operations[0].kFactStruct.FreqAtKFactor [7]
C.Operations[0].kFactStruct.kFactorForChan[8]	Float	REAL	This tag is an ordered pair with tag C.Operations[0].kFactStruct.FreqAtKFactor [8]
C.Operations[0].kFactStruct.kFactorForChan[9]	Float	REAL	This tag is an ordered pair with tag C.Operations[0].kFactStruct.FreqAtKFactor [9]
C.Operations[0].kFactStruct.kFactorForChan[10]	Float	REAL	This tag is an ordered pair with tag C.Operations[0].kFactStruct.FreqAtKFactor [10]
C.Operations[0].kFactStruct.kFactorForChan[11]	Float	REAL	This tag is an ordered pair with tag C.Operations[0].kFactStruct.FreqAtKFactor [11]
C.Operations[0].kFactStruct.kFactorForChan[12]	Float	REAL	This tag is an ordered pair with tag C.Operations[0].kFactStruct.FreqAtKFactor [12]
C.Operations[0].kFactStruct.FreqAtKFactor[0]	Float	REAL	
C.Operations[0].kFactStruct.FreqAtKFactor[1]	Float	REAL	Freq[1] for KFactor [1]
C.Operations[0].kFactStruct.FreqAtKFactor[2]	Float	REAL	Freq[2] for KFactor [2]
C.Operations[0].kFactStruct.FreqAtKFactor[3]	Float	REAL	Freq[3] for KFactor [3]

Table 13 - Configurable Flowmeter Module Configuration Tags

Name	Style	Data type	Definition
C.Operations[0].kFactStruct.FreqAtKFactor[4]	Float	REAL	Freq[4] for KFactor [4]
C.Operations[0].kFactStruct.FreqAtKFactor[5]	Float	REAL	Freq[5] for KFactor [5]
C.Operations[0].kFactStruct.FreqAtKFactor[6]	Float	REAL	Freq[6] for KFactor [6]
C.Operations[0].kFactStruct.FreqAtKFactor[7]	Float	REAL	Freq[7] for KFactor [7]
C.Operations[0].kFactStruct.FreqAtKFactor[8]	Float	REAL	Freq[8] for KFactor [8]
C.Operations[0].kFactStruct.FreqAtKFactor[9]	Float	REAL	Freq[9] for KFactor [9]
C.Operations[0].kFactStruct.FreqAtKFactor[10]	Float	REAL	Freq[10] for KFactor [10]
C.Operations[0].kFactStruct.FreqAtKFactor[11]	Float	REAL	Freq[11] for KFactor [11]
C.Operations[0].kFactStruct.FreqAtKFactor[12]	Float	REAL	Freq[12] for KFactor [12]
C.Operations[1].OperationalMode	Decimal	SINT	Sets the module's operational mode. 0 = OFF 1 = Totalizer Mode 2 = Non-Resettable Totalizer Mode 3 = High Resolution Frequency Mode
C.Operations[1].FilterControl	Decimal	SINT	The following values placed in the appropriate word invoke the following filters. 0x01 = Hardware (sub 100Hz RC) filter for F1 0x02 = Hardware (sub 100Hz RC) filter for G1 0x03 = 2 Hardware filters (sub 100Hz RC) for F1 and G1 0x04 = Firmware filter, 1 second debounce filter used for prover applications for G1 (ignore/disable the gate for 1 second after an initial pulse) 0x06 = both the Hardware and Firmware filters for G1 0x07 = all filters above: Hardware (sub 100Hz RC) for F1 and G1 and the Firmware, 1 second debounce on prover for G1
C.Operations[1].MeterSamples	Decimal	SINT	
C.Operations[1].ThresholdControl	Decimal	SINT	Sets module threshold control 0 = 50mV threshold 1 = 1.3V (TTL) threshold 2 = 4.0V threshold
C.Operations[1].CalculationType	Decimal	SINT	Sets calculation type 0 = Counts/K-factor x MeterFactor correction x CCF 1 = Counts/K-factor x MeterFactor correction x AGA 7 compensation of CCF if CCF is not equal to 0.0
C.Operations[1].AccelCalculation	Decimal	SINT	Number of past samples to use to calculate an acceleration value.
C.Operations[1].FillMode	Decimal	SINT	Sets the Trickle mode for engineering units or time. 0 = Engineering units 1 = Time
C.Operations[1].MinDetectableFreq	Float	REAL	User-defined value from 0 - 100,000. Sets FreqAverage, FreqPeriod, Speed, GrossRate, and NetRate reading to 0 when calculated value is less than value entered. GrossVolume, and NetVolume do not increment below this value even though TotalCounts increments over time.

Table 13 - Configurable Flowmeter Module Configuration Tags

Name	Style	Data type	Definition
C.Operations[1].HighestAllowedFreq	Float	REAL	User-defined value between MinDetectableFreq and 120,000 When the frequency reaches this level, it sets the Overflow alarm limit
C.Operations[1].AccelAlarmValue	Float	REAL	Sets Acceleration alarm limit -Maximum acceleration (cycles per second^2) <AccelAlarmValue< +Maximum acceleration (cycles per second^2)
C.Operations[1].MeterFactor	Float	REAL	Calibration Adjust for metering reading applied after K-factor correction. Typically, this factor is between 0.8 and 1.2 but the module restricts the value$\geq$0.
C.Operations[1].FilterResolution	Float	REAL	Sets resolution of the Speed calculation based on the raw counts 0 = default of 0.00001 0.00001 = resolution of $\pm$ 1 count of 100,000 raw counts.
C.Operations[1].SampleTime	Float	REAL	Sets time for a sample to be taken. 0 - 5.0 seconds (2.0 second maximum sample time for High Resolution mode)
C.Operations[1].kFactStruct.kFactorForChan[0]	Float	REAL	K-factor 0 for Channel 1 when frequency is $\leq$ FreqAtKFactor[1]
C.Operations[1].kFactStruct.kFactorForChan[1]	Float	REAL	This tag is an ordered pair with tag C.Operations[1].kFactStruct.FreqAtKFactor [1]
C.Operations[1].kFactStruct.kFactorForChan[2]	Float	REAL	This tag is an ordered pair with tag C.Operations[1].kFactStruct.FreqAtKFactor [2]
C.Operations[1].kFactStruct.kFactorForChan[3]	Float	REAL	This tag is an ordered pair with tag C.Operations[1].kFactStruct.FreqAtKFactor [3]
C.Operations[1].kFactStruct.kFactorForChan[4]	Float	REAL	This tag is an ordered pair with tag C.Operations[1].kFactStruct.FreqAtKFactor [4]
C.Operations[1].kFactStruct.kFactorForChan[5]	Float	REAL	This tag is an ordered pair with tag C.Operations[1].kFactStruct.FreqAtKFactor [5]
C.Operations[1].kFactStruct.kFactorForChan[6]	Float	REAL	This tag is an ordered pair with tag C.Operations[1].kFactStruct.FreqAtKFactor [6]
C.Operations[1].kFactStruct.kFactorForChan[7]	Float	REAL	This tag is an ordered pair with tag C.Operations[1].kFactStruct.FreqAtKFactor [7]
C.Operations[1].kFactStruct.kFactorForChan[8]	Float	REAL	This tag is an ordered pair with tag C.Operations[1].kFactStruct.FreqAtKFactor [8]
C.Operations[1].kFactStruct.kFactorForChan[9]	Float	REAL	This tag is an ordered pair with tag C.Operations[1].kFactStruct.FreqAtKFactor [9]
C.Operations[1].kFactStruct.kFactorForChan[10]	Float	REAL	This tag is an ordered pair with tag C.Operations[1].kFactStruct.FreqAtKFactor [10]
C.Operations[1].kFactStruct.kFactorForChan[11]	Float	REAL	This tag is an ordered pair with tag C.Operations[1].kFactStruct.FreqAtKFactor [11]
C.Operations[1].kFactStruct.kFactorForChan[12]	Float	REAL	This tag is an ordered pair with tag C.Operations[1].kFactStruct.FreqAtKFactor [12]
C.Operations[1].kFactStruct.FreqAtKFactor[0]	Float	REAL	

Table 13 - Configurable Flowmeter Module Configuration Tags

Name	Style	Data type	Definition
C.Operations[1].kFactStruct.FreqAtKFactor[1]	Float	REAL	Freq[1] for KFactor [1]
C.Operations[1].kFactStruct.FreqAtKFactor[2]	Float	REAL	Freq[2] for KFactor [2]
C.Operations[1].kFactStruct.FreqAtKFactor[3]	Float	REAL	Freq[3] for KFactor [3]
C.Operations[1].kFactStruct.FreqAtKFactor[4]	Float	REAL	Freq[4] for KFactor [4]
C.Operations[1].kFactStruct.FreqAtKFactor[5]	Float	REAL	Freq[5] for KFactor [5]
C.Operations[1].kFactStruct.FreqAtKFactor[6]	Float	REAL	Freq[6] for KFactor [6]
C.Operations[1].kFactStruct.FreqAtKFactor[7]	Float	REAL	Freq[7] for KFactor [7]

Table 13 - Configurable Flowmeter Module Configuration Tags

Name	Style	Data type	Definition
C.Operations[1].kFactStruct.FreqAtKFactor[8]	Float	REAL	Freq[8] for KFactor [8]
C.Operations[1].kFactStruct.FreqAtKFactor[9]	Float	REAL	Freq[9] for KFactor [9]
C.Operations[1].kFactStruct.FreqAtKFactor[10]	Float	REAL	Freq[10] for KFactor [10]
C.Operations[1].kFactStruct.FreqAtKFactor[11]	Float	REAL	Freq[11] for KFactor [11]
C.Operations[1].kFactStruct.FreqAtKFactor[12]	Float	REAL	Freq[12] for KFactor [12]
C.OutputSetup[0].FaultMode	Decimal	SINT	Sets the state of output 0 when communications are lost with the owner-controller in Fault Mode 0 = Continue operation 1 = Reset Output 0 to OFF when in Fault Mode 2 = Set Output 0 to ON when in Fault Mode
C.OutputSetup[0].ProgMode	Decimal	SINT	Sets the state of output 0 when communications are lost with the owner-controller in Program Mode 0 = Continue operation 1 = Reset Output 0 to OFF when in Program Mode 2 = Set Output 0 to ON when in Program Mode
C.OutputSetup[0].DynamicError	Decimal	SINT	Sets the state of output 0 when a dynamic error occurs 0 = Continue operation 1 = Reset Output 0 to OFF on Error 2 = Set Output 0 to ON on Error
C.OutputSetup[0].TriggerOn	Decimal	SINT	Sets when output 0 energizes 0 = No Action 1 = Frequency 2 = Acceleration 3 = Full Flow State 4 = Trickle Flow State 5 = Prover Run State 6 = Prover Range State
C.OutputSetup[0].TieToCounter			Ties a channel to output 0 0 = No connection 1 = Connect Channel0 to Output0 2 = Connect Channel1 to Ouput0
C.OutputSetup[1].FaultMode	Decimal	SINT	Sets the state of output 1 when communications are lost with the owner-controller in Fault Mode 0 = Continue operation 1 = Reset Output 0 to OFF when in Fault Mode 2 = Set Output 0 to ON when in Fault Mode
C.OutputSetup[1].ProgMode	Decimal	SINT	Sets the state of output 1 when communications are lost with the owner-controller in Program Mode 0 = Continue operation 1 = Reset Output 0 to OFF when in Program Mode 2 = Set Output 0 to ON when in Program Mode

Table 13 - Configurable Flowmeter Module Configuration Tags

Name	Style	Data type	Definition
C.OutputSetup[1].DynamicError	Decimal	SINT	Sets the state of output 1 when a dynamic error occurs 0 = Continue operation 1 = Reset Output 0 to OFF on Error 2 = Set Output 0 to ON on Error
C.OutputSetup[1].TriggerOn	Decimal	SINT	Sets when output 1 energizes 0 = No Action 1 = Frequency 2 = Acceleration 3 = Full Flow State 4 = Trickle Flow State 5 = Prover Run State 6 = Prover Range State
C.OutputSetup[1].TieToCounter			Ties a channel to output 1 0 = No connection 1 = Connect Channel0 to Output 1 2 = Connect Channel1 to Output 1

Input Tags

You must use the Input tags to monitor CFM module status. Table 14 lists and defines CFM Input tags:

Table 14 - Configurable Flowmeter Module Input Tags

Name	Style	Data type	Definition
I.Fault	Hex	DINT	Display if a fault has occurred on the module. 0 = no fault has occurred 1 = a fault has occurred
I.ChannelStatus	Hex	DINT	
I.Output0State	Decimal	BOOL	Displays the state of output 0 0 = OFF 1 = ON
I.Output1State	Decimal	BOOL	Displays the state of output 1 0 = OFF 1 = ON
I.Output0IsOverridden	Decimal	BOOL	Displays whether output 0 was manually overridden 0 = output was not overridden 1 = output was overridden
I.Output1IsOverridden	Decimal	BOOL	Displays whether output 1 was manually overridden 0 = output was not overridden 1 = output was overridden
I.Ch0WasReset	Decimal	BOOL	Displays whether channel 0 was reset 0 = output was not reset 1 = output was reset

Table 14 - Configurable Flowmeter Module Input Tags

Name	Style	Data type	Definition
I.Ch1WasReset	Decimal	BOOL	Displays whether channel 1 was reset 0 = output is not overridden 1 = output is overridden
I.Ch0AccelerationAlarm	Decimal	BOOL	Displays whether acceleration alarm was set on channel 0 0 = alarm was not set 1 = alarm was set
I.Ch0OverspeedAlarm	Decimal	BOOL	Displays whether overspeed alarm was set on channel 0 0 = alarm was not set 1 = alarm was set
I.Ch0OverrangeAlarm	Decimal	BOOL	Displays whether overrange alarm was set on channel 0 0 = alarm was not set 1 = alarm was set
I.Ch0OverflowAlarm	Decimal	BOOL	Displays whether overflow alarm was set on channel 0 0 = alarm was not set 1 = alarm was set
I.Ch1AccelerationAlarm	Decimal	BOOL	Displays whether acceleration alarm was set on channel 1 0 = alarm was not set 1 = alarm was set
I.Ch1OverspeedAlarm	Decimal	BOOL	Displays whether overspeed alarm was set on channel 1 0 = alarm was not set 1 = alarm was set
I.Ch1OverrangeAlarm	Decimal	BOOL	Displays whether overrange alarm was set on channel 1 0 = alarm was not set 1 = alarm was set
I.Ch1OverflowAlarm	Decimal	BOOL	Displays whether overflow alarm was set on channel 1 0 = alarm was not set 1 = alarm was set
I.Ch0ConsumerErrorAlarm	Decimal	BOOL	Displays whether the consumer error alarm was set on channel 0 0 = alarm was not set 1 = alarm was set
I.Ch1ConsumerErrorAlarm	Decimal	BOOL	Displays whether the consumer error alarm was set on channel 1 0 = alarm was not set 1 = alarm was set
I.Status[0].ProverState	Decimal	SINT	Displays status of the prover operation on channel 0 0 = Prover Not Active 1 = Prover waiting for 1st start 2 = Prover waiting for 1st stop 3 = Prover waiting for 2nd start 4 = Prover waiting for 2nd stop 5 = Prover Complete

Table 14 - Configurable Flowmeter Module Input Tags

Name	Style	Data type	Definition
I.Status[0].FillState	Decimal	SINT	Displays current state of module for channel 0. The following states are possible: 0 = Filler not active 1 = Filler Enabled only, waiting for start 2 = Timed Trickle Flow complete, not filled 3 = Full Flow for Fill function 4 = Timed Trickle Flow for Fill function 5 = Engineering units for Full Flow 6 = Engineering units for Trickle Flow 7 = Fill complete
I.Status[0].ConsumerErrorCode	Decimal	INT	See page 120
I.Status[0].TotalCounts	Decimal	DINT	Displays actual pulses counted by the counter connected to the channel 0
I.Status[0].FreqAverage	Float	REAL	Displays frequency averaged over the Meter samples on channel 0
I.Status[0].FreqPeriod	Float	REAL	Displays frequency using sample time on channel 0
I.Status[0].Speed	Float	REAL	Displays frequency using filter resolution on channel 0
I.Status[0].Acceleration	Float	REAL	Displays acceleration on channel 0 as calculated by using AccelCalculation samples
I.Status[0].FillTotal	Float	REAL	Fill total in engineering units
I.Status[0].GrossVolume	Float	REAL	Σ (ΔTotal Counts during each Sample/K-factor x Meter Factor as occurs on channel 0
I.Status[0].NetVolume	Float	REAL	Σ (ΔTotal Counts during each Sample/K-factor x MeterFactor x CCF) as occurs on channel 0
I.Status[0].GrossRate	Float	REAL	ΔTotal Counts in Meter Sample/ (K-factor x Sample Interval) x Meter Factor as occurs on channel 0
I.Status[0].NetRate	Float	REAL	ΔTotal Counts in Meter Sample/ (K-factor x Sample Interval) x Meter Factor x CCF as occurs on channel 0
I.Status[0].ProverTotal	Float	REAL	Displays total counts (in engineering units) received on channel 0 in prover operation. Total resets when the ProverEnable feature is enabled. This value operates concurrently with NetVolume, and must be saved if subtracted from the NetVolume for single and multiple prover verifications.
I.Status[1].ProverState	Decimal	SINT	Displays status of the prover operation on channel 1 0 = Prover Not Active 1 = Prover waiting for 1st start 2 = Prover waiting for 1st stop 3 = Prover waiting for 2nd start 4 = Prover waiting for 2nd stop 5 = Prover Complete

Table 14 - Configurable Flowmeter Module Input Tags

Name	Style	Data type	Definition
I.Status[1].FillState	Decimal	SINT	Displays current state of module for channel 1. The following states are possible: 0 = Filler not active 1 = Filler Enabled only, waiting for start 2 = Timed Trickle Flow complete, not filled 3 = Full Flow for Fill function 4 = Timed Trickle Flow for Fill function 5 = Engineering units for Full Flow 6 = Engineering units for Trickle Flow 7 = Fill complete
I.Status[1].ConsumerErrorCode	Decimal	INT	See page 120
I.Status[1].TotalCounts	Decimal	DINT	Displays actual pulses counted by the counter connected to the channel 1
I.Status[1].FreqAverage	Float	REAL	Displays frequency averaged over the Meter samples on channel 1
I.Status[1].FreqPeriod	Float	REAL	Displays frequency using sample time on channel 1
I.Status[1].Speed	Float	REAL	Displays frequency using filter resolution on channel 1
I.Status[1].Acceleration	Float	REAL	Displays acceleration on channel 1 as calculated by using AccelCalculation samples
I.Status[1].FillTotal	Float	REAL	Fill total in engineering units
I.Status[1].GrossVolume	Float	REAL	Σ (ΔTotal Counts during each Sample/K-factor x Meter Factor as occurs on channel 1
I.Status[1].NetVolume	Float	REAL	Σ (ΔTotal Counts during each Sample/K-factor x MeterFactor x CCF) as occurs on channel 1
I.Status[1].GrossRate	Float	REAL	ΔTotal Counts in Meter Sample/ (K-factor x Sample Interval) x Meter Factor as occurs on channel 1
I.Status[1].NetRate	Float	REAL	ΔTotal Counts in Meter Sample/ (K-factor x Sample Interval) x Meter Factor x CCF as occurs on channel 1
I.Status[1].ProverTotal	Float	REAL	Displays total counts received on channel 1 in prover operation. Total resets when the ProverEnable feature is enabled. This value operates concurrently with NetVolume, and must be saved if subtracted from the NetVolume for single and multiple prover verifications.
I.CSTTimestamp[0]	Decimal	DINT	
I.CSTTimestamp[1]	Decimal	DINT	

Output Tags

You must use the Output tags to change CFM module configuration during operation. Table 15 lists and defines CFM Output tags:

Table 15 - Configurable Flowmeter Module Output Tags

Name	Style	Data type	Definition
O.Total[0].AlarmEnables	Binary	SINT	
O.Total[0].Overrange	Decimal	BOOL	Enables the Overrange alarm on output connected to channel 0. When the Frequency Period exceeds 100KHz, this alarm is set. 0 = No Alarm 1 = Alarm Enabled
O.Total[0].Overflow	Decimal	BOOL	Enables the Overflow alarm on output connected to channel 0. When the Total Counts exceeds the Roll Over value, this alarm is set. 0 = No Alarm 1 = Alarm Enabled
O.Total[0].Overspeed	Decimal	BOOL	Enables the Overspeed alarm on output connected to channel 0. When the Speed exceeds the Highest Allowed Frequency value, this alarm is set. 0 = No Alarm 1 = Alarm Enabled
O.Total[0].Acceleration	Decimal	BOOL	Enables the Acceleration alarm on output connected to channel 0. When the absolute acceleration exceeds the Acceleration Alarm value, this alarm is set. 0 = No Alarm 1 = Alarm Enabled
O.Total[0].Control	Binary	SINT	
O.Total[0].Reset	Decimal	BOOL	Rising edge resets the count
O.Total[0].Load	Decimal	BOOL	Reserved
O.Total[0].ProverEnable	Decimal	BOOL	Enables the prover operation on output connected to channel 0. Once this bit is enabled, the module waits for output Z_0 to energize before beginning prover operations. 0 = Prover operation is disabled 1 = Prover operation is enabled
O.Total[0].FillEnable	Decimal	BOOL	Enables the filling operation on output connected to channel 0. 0 = Fill operation is disabled 1 = Fill operation is enabled.
O.Total[0].FillStart	Decimal	BOOL	Begins filling operation when Fill Enable is enabled on output connected to channel 0. 0 = Do not begin filling 1 = Begin filling
O.Total[0].FillHold	Decimal	BOOL	Holds/pauses filling operation on output connected to channel 0 0 = Continue filling operation 1 = Hold/pause filling operation

Table 15 - Configurable Flowmeter Module Output Tags

Name	Style	Data type	Definition
O.Total[0].RollOverValue	Decimal	DINT	Sets the user-defined rollover value on output connected to channel 0. Range of 0 - 2,147,483,647
O.Total[0].CombinedCorrectionFactor	Float	REAL	Unitless factor that is multiplied by Gross Rate with results shown as NetRate of channel 0. This value must be set to 1.0 when not used or gross rate will be 0. Calculation Type must be set to 0 to use this factor.
O.Total[0].BaseTemperature	Float	REAL	Temperature in °F of output connected to channel 0
O.Total[0].FlowingTemperature	Float	REAL	Temperature in °F of output connected to channel 0
O.Total[0].AtmosphericPressure	Float	REAL	Pressure in psia of output connected to channel 0
O.Total[0].StaticGaugePressure	Float	REAL	Pressure in psig of output connected to channel 0
O.Total[0].BasePressure	Float	REAL	Pressure in psig of output connected to channel 0
O.Total[0].BaseCompressibility	Float	REAL	Default = 1
O.Total[0].FlowingCompressibility	Float	REAL	Default = 1
O.Total[0].FillTotalTarget	Float	REAL	Target for Fill Complete, except when Fill Transition is greater than this value.
O.Total[0].FillTransition	Float	REAL	When fill cycle is started, trickle flow is initiated when the Fill Total is equal to or greater than this value. Full flow is initiated when the Fill Total is less than this value.
O.Total[0].FillTransitionTimer	Float	REAL	When timed trickle flow is selected, the status remains ON for this time during this state. The value must be changed prior to entering the trickle flow state.
O.Total[1].AlarmEnables	Binary	SINT	
O.Total[1].Overrange	Decimal	BOOL	Enables the Overrange alarm on output connected to channel 1. When the Frequency Period exceeds 100KHz, this alarm is set. 0 = No Alarm 1 = Alarm Enabled
O.Total[1].Overflow	Decimal	BOOL	Enables the Overflow alarm on output connected to channel 1. When the Total Counts exceeds the Roll Over value, this alarm is set. 0 = No Alarm 1 = Alarm Enabled
O.Total[1].Overspeed	Decimal	BOOL	Enables the Overspeed alarm on output connected to channel 1. When the Speed exceeds the Highest Allowed Frequency value, this alarm is set. 0 = No Alarm 1 = Alarm Enabled
O.Total[1].Acceleration	Decimal	BOOL	Enables the Acceleration alarm on output connected to channel 1. When the absolute acceleration exceeds the Acceleration Alarm value, this alarm is set. 0 = No Alarm 1 = Alarm Enabled

Table 15 - Configurable Flowmeter Module Output Tags

Name	Style	Data type	Definition
O.Total[1].Control	Binary	SINT	
O.Total[1].Reset	Decimal	BOOL	
O.Total[1].Load	Decimal	BOOL	
O.Total[1].ProverEnable	Decimal	BOOL	Enables the prover operation on output connected to channel 1. Once this bit is enabled, the module waits for output Z_0 to energize before beginning prover operations. 0 = Prover operation is disabled 1 = Prover operation is enabled
O.Total[1].FillEnable	Decimal	BOOL	Enables the filling operation on output connected to channel 1. 0 = Fill operation is disabled 1 = Fill operation is enabled.
O.Total[1].FillStart	Decimal	BOOL	Begins filling operation when Fill Enable is enabled on output connected to channel 1. 0 = Do not begin filling 1 = Begin filling
O.Total[1].FillHold	Decimal	BOOL	Holds/pauses filling operation on output connected to channel 1. 0 = Continue filling operation 1 = Hold/pause filling operation
O.Total[1].RollOverValue	Decimal	DINT	Sets the user-defined rollover value on output connected to channel 1. Range of 0 - 2,147,483,647
O.Total[1].CombinedCorrectionFactor	Float	REAL	Unitless factor that is multiplied by Gross Rate with results shown as NetRate of channel 1. This value must be set to 1.0 when not used or gross rate will be 0. Calculation Type must be set to 0 to use this factor.
O.Total[1].BaseTemperature	Float	REAL	Temperature in °F of output connected to channel 1.
O.Total[1].FlowingTemperature	Float	REAL	Temperature in °F of output connected to channel 1.
O.Total[1].AtmosphericPressure	Float	REAL	Pressure in psia of output connected to channel 1.
O.Total[1].StaticGaugePressure	Float	REAL	Pressure in psig of output connected to channel 1.
O.Total[1].BasePressure	Float	REAL	Pressure in psig of output connected to channel 1.
O.Total[1].BaseCompressibility	Float	REAL	Default = 1
O.Total[1].FlowingCompressibility	Float	REAL	Default = 1
O.Total[1].FillTotalTarget	Float	REAL	Target for Fill Complete, except when Fill Transition is greater than this value.
O.Total[1].FillTransition	Float	REAL	When fill cycle is started, trickle flow is initiated when the Fill Total is equal to or greater than this value. Full flow is initiated when the Fill Total is less than this value.

Table 15 - Configurable Flowmeter Module Output Tags

Name	Style	Data type	Definition
O.Total[1].FillTransitionTimer	Float	REAL	
O.OutputControl[0].0 (A series of tags similar to this one are used repeatedly for outputs 0 - 31 connected to channel 0. The name changes in each occurrence for the specific output. For example, output 1 is named: O.OutputControl[0].1 Only output 0 is listed here but all exist in the RSLogix 5000 software.)	Decimal	BOOL	Manually sets the operation of outputs connected to channel 0. 0 = Module operation of outputs 1 = Override Output0 to 0 2 = Override Output0 to 1
O.OutputControl[1].0 (A series of tags similar to this one are used repeatedly for outputs 0 - 31 connected to channel 1. The name changes in each occurrence for the specific output. For example, output 1 is named: O.OutputControl[1].1 Only output 0 is listed here but all exist in the RSLogix 5000 software.)	Decimal	BOOL	Manually sets the operation of outputs connected to channel 1. 0 = Module operation of outputs 1 = Override Output0 to 0 2 = Override Output0 to 1

Notes:

Schematics

What This Appendix Contains

Use this appendix to understand the internal logic of the CFM module.

Follow the wiring practices described in your system-level installation manual when wiring your I/O devices. This includes:

- routing conductors
- grounding practices
- use of shielded cables

Input Circuits

The CFM module input logic consists of:

- flowmeter input circuits
- gate input circuits

Flowmeter Inputs

The flowmeter input circuit combines operational amplifier principles with solid state devices to provide constant logic pulses internal to the CFM module. The circuit is designed to interface with both active or passive sensor inputs by accepting any pulse output device (such as turbine flowmeter, magnetic pickup or digital pickup).
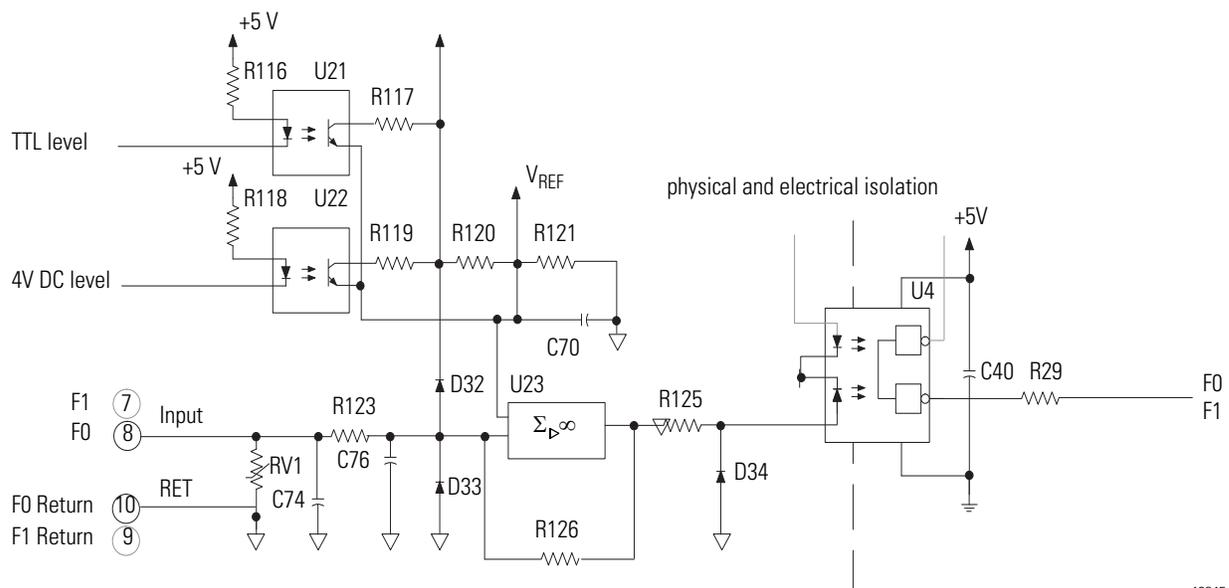
42845

Gate Inputs

Gate inputs are used for running prover and store count values. There is one gate associated with each flowmeter input circuit (G0 corresponds to F0).
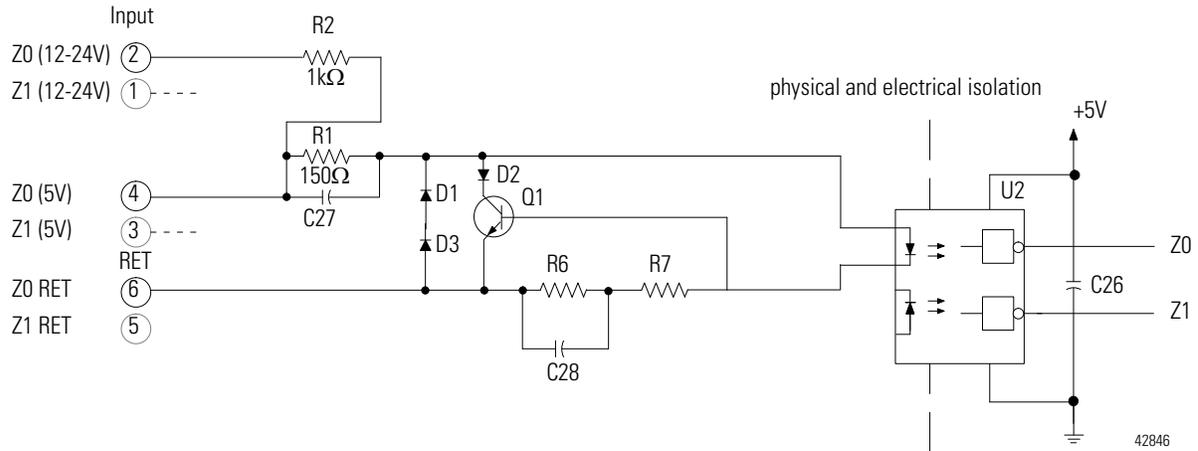
To turn on a gate circuit, you must source current through the input resistors sufficient to turn on the opto-isolator in the circuit. If no connection is made to the pair of gate terminals, no current will flow through the photodiode of the opto-isolator and that gate will be OFF (the corresponding input status indicator is OFF).

The input current magnitude can be determined by:

CASE A – for 5V DC operation

$$\text{gate input current} = \frac{(\text{gate input voltage} - 2V^{1})}{150\Omega^{(\text{See note 2})}}$$

Examples
1. If gate input voltage = 5V DC

$$\text{gate input current} = \frac{(5V-2V)}{150\Omega}$$

gate input current = 20mA

CASE B – for 10 to 31.2 V DC operation

$$\text{gate input current} = \frac{(\text{gate input voltage} - 2V^{1})}{1150\Omega^{2}}$$

Examples
1. If gate input voltage = 10V DC

$$\text{gate input current} = \frac{(10V-2V)}{1150\Omega^{(\text{See note 2})}}$$

gate input current = 7mA

Examples
1. If gate input voltage = 5V DC

$$\text{gate input current} = \frac{(31.2V-2V)}{1150\Omega^{(\text{See note 2})}}$$

gate input current = 25.4mA

[1]. There is approximately a 2V drop across (Q1 + the photodiode).
[2]. The operating range of the input is 5-10mA and Q1 functions as an overcurrent protection circuit. If an open collector device with pull-up is used, the value of the pull-up must be added to the Ω value shown in the denominator.

Output Circuits

The CFM module provides two output circuits.

Discrete Outputs

The CFM module's outputs are comprised of isolated power MOSFETs. These devices operate in current sourcing mode, and are capable of delivering up to 1A (@ 10-31.2V DC) and 20mA (@ 5V DC).

42847
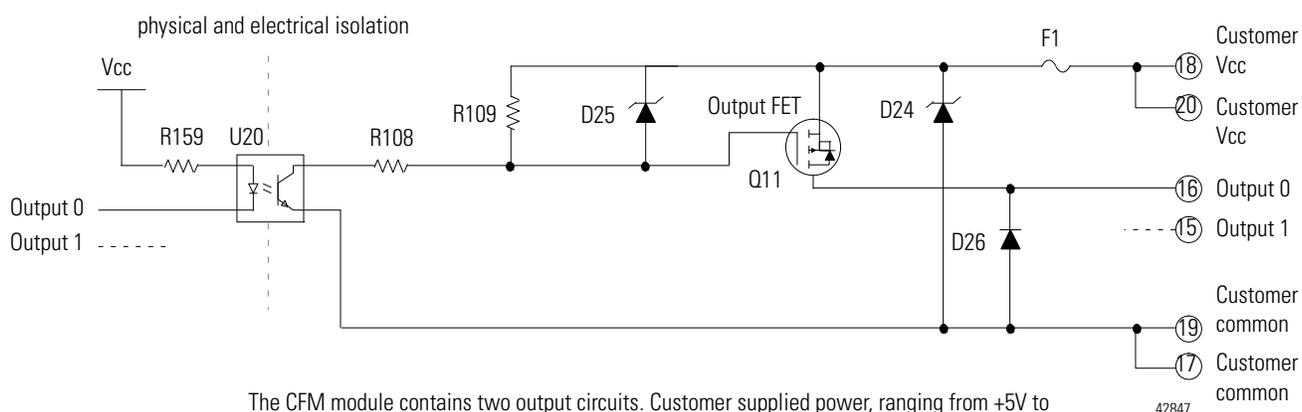
The CFM module contains two output circuits. Customer supplied power, ranging from +5V to +31.2V DC, is connected internally (through terminals #18 and 20) to the power output transistors. When an output is turned on, current flows into the source, out of the drain, through the load connected to the ground of the customer supply (customer return). Diode D26 protects the power output transistor Q11 from damage due to inductive loads.

Output transistor Q11 is thermally protected power MOSFET and will turn off @ 4A (approximately). After an output goes into thermal shutdown, you must fix the cause of the shutdown and toggle the output OFF and ON to reenergize the output.

Notes:

Frequency Accuracy

Use this appendix to calculate the frequency accuracy for high resolution frequency mode and totalizer mode.

Frequency Accuracy in High Resolution Frequency Mode

There are two steps to calculating frequency accuracy in high resolution frequency mode.

1. Calculate frequency accuracy.

2. Determine the application's operating conditions and add the error for those conditions to the value obtained in step 1.

   The following values must be added to your frequency accuracy results in totalizer mode:

   - Crystal error - 0.005% @ 25°C
   - Drift and crystal error - 0.01% from 0° to 60°C

Calculate Frequency Accuracy

When calculating frequency accuracy in high resolution frequency mode, you must know:

- sample time period
- input frequency

Use one of two equations to calculate the firmware error, in high resolution frequency mode.

Choose the equation according to the frequency of your application.

- If your application has a frequency in the following range:

    – 1Hz to $1/T_s$

    use the equation below:

    $$Accuracy = \frac{F_{in}}{40{,}000}$$

- If your application has a frequency in the following range:

    – greater than $1/T_s$ to 120kHz

    use the equation below:

    $$Accuracy = \frac{1}{T_s} \times \frac{1}{40{,}000}$$

EXAMPLE   Based on the equations listed above, if your application uses a $T_s = 0.1$ seconds, the "cut off" frequency for choosing an equation is 10Hz because $1/T_s$ (or $1/0.1$) = 10.

In other words, if your application uses a $T_s = 0.1$ seconds, for frequencies 1Hz to 10Hz, use the following equation:

$$Accuracy = \frac{F_{in}}{40{,}000}$$

For frequencies greater than 10Hz to 1kHz, use the following equation.

$$Accuracy = \frac{1}{T_s} \times \frac{1}{40{,}000}$$

Frequency Accuracy in Totalizer Mode

There are two steps to calculating frequency accuracy in totalizer mode.

1. Calculate frequency accuracy.

2. Determine the application's operating conditions and add the error for those conditions to the value obtained in step 1.

   The following values must be added to your frequency accuracy results in totalizer mode:

   - Crystal error - 0.005% @ 25°C
   - Drift and crystal error - 0.01% from 0° to 60°C

Calculate Frequency Accuracy

You can calculate frequency accuracy in totalizer mode for:

- Frequency Period
- Speed
- Frequency average

Frequency Period

For frequency period, you must know:

- User-defined sample time period (T_s)
- Application frequency (F_{in})
- Number of accumulated counts in sample time (Counts)

Use the following equation to calculate frequency accuracy in totalizer mode for frequency period:

$$\text{Accuracy} = \frac{(1) \times (100)}{(T_s) \times (F_{in})}$$

EXAMPLE   For example, in an application with the following conditions:

- 0.5s time period
- 123Hz frequency
- 25°C operating temperature

accuracy is determined with the following equation:

$$\text{Accuracy} = \frac{(1) \times (100)}{(0.5) \times (123)} + 0.005\%$$

$\text{Accuracy} = 1.626 + 0.005$

Value is added to accuracy to account for the crystal error

$\text{Accuracy} = +/- 1.631\%$

Speed

For speed, you must know the filter resolution. Use the following equation to calculate frequency accuracy in totalizer mode for speed:

$$\text{Accuracy} = \text{Resolution} \times 100$$

EXAMPLE   For example, in an application with the following conditions:

- 0.001 filter resolution
- 25°C operating temperature

accuracy is determined with the following equation:

$\text{Accuracy} = (0.001 \times 100) + 0.005$

$\text{Accuracy} = 0.1 + 0.005$

Value is added to accuracy to account for the crystal error

$\text{Accuracy} = +/- 0.105\%$

Frequency Average

For frequency average, you must know:

- Application frequency (F_{in})
- Number of accumulated in sample time (Counts)

Use the following equation to calculate frequency accuracy in totalizer mode for frequency period:

$$\text{Accuracy} = \frac{(1) \times (100)}{(0.02) \times (\text{Number of meter samples}) \times (F_{in})}$$

EXAMPLE

For example, in an application with the following conditions:

- 25 meter samples
- 123Hz frequency
- 60°C operating temperature

accuracy is determined with the following equation:

$$\text{Accuracy} = \frac{(1) \times (100)}{(0.02) \times (25) \times (123)} + 0.01$$

Value is added to accuracy to account for the crystal error over the temperature range

Accuracy = 1.626 + 0.01

Accuracy = +/- 1.636%

Notes:

Configure Output Behavior with RSLogix 5000 Version 16 and Earlier

If you have a 1756-CFM module with firmware revision 2.4 and are using RSLogix 5000 software, version 16 or earlier, use this procedure to enable and configure the output behavior. If you do not want to use the output behavior features available in firmware revision 2.4, you do not need to complete this procedure. For an explanation of the output behavior features, see Configurable Output Behaviors on page 58.

IMPORTANT	Use these configuration procedures only if you are configuring your 1756-CFM module by using RSLogix 5000 software version 16 or earlier.

To complete the configuration, you must download and open the CFM_GenericProfileExample.ACD file from one of the following locations:

- As packaged with the1756-CFM firmware revision 2.4 firmware kit provided at http://www.rockwellautomation/support.
- In the RSLogix 5000 software version 16 quick start page:
  - To open the file, click the Controller Projects tab. Then choose Open Sample Project > V16 > Rockwell Automation > CFM_GenericProfileExample.ACD.

Once you have downloaded and opened the CFM_GenericProfileExmple.ACD file, complete the configuration procedure that matches your application.

If you are using the module in	Go to
A new application	Configure the 1756-CFM for Use in a New Application on page 148.
An existing application	Configure a 1756-CFM Module for Use in an Existing Application on page 152.

Configure the 1756-CFM for Use in a New Application

Complete this procedure if you are using the 1756-CFM module and the configurable on/off feature in a new application.

Add the 1756-Generic Profile to the Program

1. In RSLogix 5000 software, create a new project named CFM_DEMO.

2. Specify the controller type, revision number, chassis type, and slot number according to your ControlLogix controller chassis.

3. In the I/O Configuration folder, add a new module.

4. Use the Generic 1756 Module profile listed in Other module types.

5. In the New Module dialog box, enter the Connection Parameter information exactly as displayed below.

Enter the slot number that matches the location of the 1756-CFM module in your ControlLogix chassis.

New Module		
Type:	1756-MODULE Generic 1756 Module	
Parent:	Local	
Name:	CFM_New	Connection Parameters
Description:		Assembly Instance: / Size:
		Input: 160 / 28 (32-bit)
		Output: 130 / 30 (32-bit)
Comm Format:	Data - REAL	Configuration: 3 / 308 (8-bit)
Slot:	1	Status Input:
		Status Output:

☐ Open Module Properties   [OK] [Cancel] [Help]

6. Click OK.

   The Module Properties dialog box opens.

7. Set the module RPI to 100.

8. Click OK.

   The 1756-Generic module is now in the I/O configuration.

Copy and Paste the Tags and Logic from the Example to Your Program

1. Minimize the CFM_DEMO project and open a new instance of RSLogix 5000 software.

2. Open CFM_GenericProfileExample.ACD.

3. In the controller organizer of the CFM_GenericProfileExample project, expand the User-Defined data types.
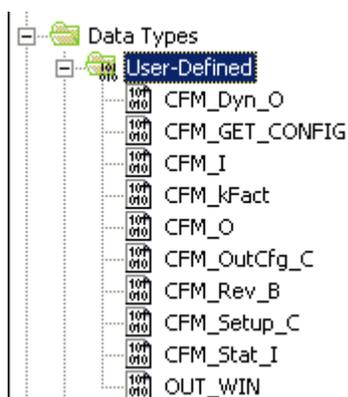
4. Copy one of the User-Defined data types.

   You must select and copy each of the User-Defined data types individually.

5. In the CFM_DEMO project, paste the copied User-Defined data type into the User-Defined data type folder.
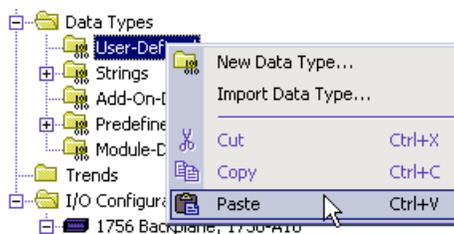
6. Repeat steps four and five until all of the User-Defined data types contained in the CFM_GenericProfileExample project have been pasted in the CFM_DEMO project.

7. In the CFM_GenericProfileExample project, copy the following data tags located in the Controller Tag folder.

Name	△	Value	←	Force Mas ←	Style	Data Type	
⊞-CFM_B_C		{...}		{...}		CFM_Rev_B	
⊞-CFM_Config		0			Decimal	DINT	
⊞-CFM_IN		{...}		{...}		CFM_I	
⊞-CFM_OUT		{...}		{...}		CFM_O	

8. In the CFM_DEMO project, paste the copied data tags into the Controller Tags folder by using the Edit Tags tab.

9. In the CFM_GenericProfileExample project, copy ladder logic rung 1 located in the Main Routine folder.

```
                                        User defined copy of
                                          AB:1756_CFM:I:0
                  ──COP──                    ──COP──                    ──COP──
                  Copy File                  Copy File                  Copy File
   1              Source      CFM_B_C        Source  Local:5:I          Source  CFM_OUT
                  Dest   Local:5:C.Data[0]   Dest       CFM_IN          Dest    Local:5:O
                  Length            308      Length          1          Length          1
```
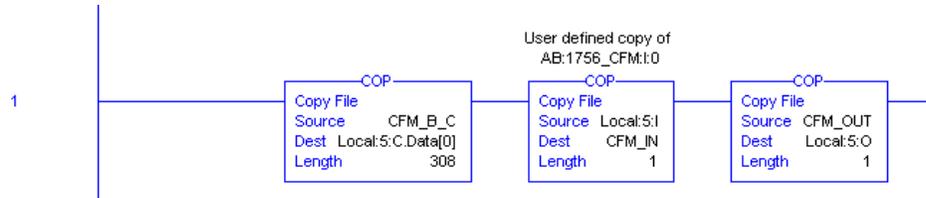
10. In the CFM_DEMO project, paste the copied rung into the Main Routine folder.

11. Change the Local:5 tag references to correspond to the location of your 1756-CFM module in your chassis.

12. Accept the pasted rung.

13. Delete the empty rung.

Specify the Configurable On/Off Behavior

1. In the CFM_DEMO program, select the Controller Tag folder and view the Monitor Tags tab.

2. Expand the CFM_B_C tag until you reach the CFM_B_C.OutputWindow data tags.

Name	△	Value	←	Force Mas ←	Style	Data Type
⊟·CFM_B_C		{...}		{...}		CFM_Rev_B
├·CFM_B_C.ProgToFaultEn		0			Decimal	BOOL
⊞·CFM_B_C.ChannelCfgBits		2#0000_0000			Binary	SINT
├·CFM_B_C.Ch0ProverDirection		0			Decimal	BOOL
├·CFM_B_C.Ch1ProverDirection		0			Decimal	BOOL
├·CFM_B_C.Ch0LowFreqClear		0			Decimal	BOOL
├·CFM_B_C.Ch1LowFreqClear		0			Decimal	BOOL
├·CFM_B_C.Ch0PreTrigger		0			Decimal	BOOL
├·CFM_B_C.Ch1PreTrigger		0			Decimal	BOOL
⊞·CFM_B_C.Operations		{...}		{...}		CFM_Setup_C[2]
⊟·CFM_B_C.OutputSetup		{...}		{...}		CFM_OutCfg_C[2]
⊞·CFM_B_C.OutputSetup[0]		{...}		{...}		CFM_OutCfg_C
⊞·CFM_B_C.OutputSetup[1]		{...}		{...}		CFM_OutCfg_C
⊟·CFM_B_C.OutputWindow		{...}		{...}		OUT_WIN[2]
⊟·CFM_B_C.OutputWindow[0]		{...}		{...}		OUT_WIN
├·CFM_B_C.OutputWindow[0].FreqOn		6000.0			Float	REAL
├·CFM_B_C.OutputWindow[0].FreqOff		4000.0			Float	REAL
⊟·CFM_B_C.OutputWindow[1]		{...}		{...}		OUT_WIN
├·CFM_B_C.OutputWindow[1].FreqOn		6000.0			Float	REAL
├·CFM_B_C.OutputWindow[1].FreqOff		4000.0			Float	REAL

3. In the Value column of CFM_B_C.OutputWindow FreqOn and FreqOff data tags, enter the desired On and Off frequency limits.

    See for more information about determining your On/Off frequency limits.

IMPORTANT   Test the configuration before implementing the changes into your production process.

Configure a 1756-CFM Module for Use in an Existing Application

Complete this configuration process if you are using the 1756-CFM module with an existing application.

Add the 1756-Generic Profile to the Program

1. In RSLogix 5000 software, open a project that contains programming for an existing 1756-CFM module.

2. In the I/O configuration, delete the existing 1756-CFM module.

3. In the I/O configuration, add a new module.

   Use the generic 1756 module profile listed in Other module types.

4. Name the new module according to your preference.

5. In the New Module dialog box, enter the Connection Parameters and Comm Format exactly as displayed below.

Enter the slot number that matches the location of the 1756-CFM module in your ControlLogix chassis.
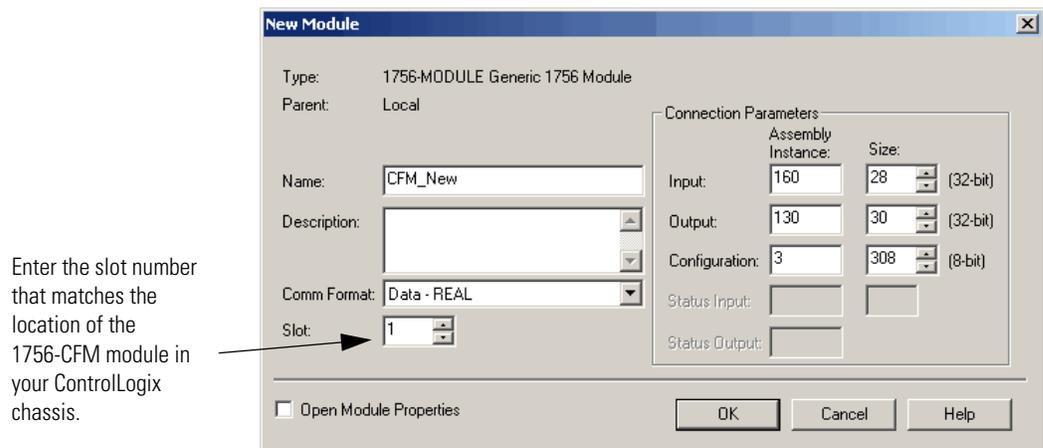
6. Click OK.

   The Module Properties dialog box displays.

7. Set the module RPI to 100.

8. Click OK.

   The 1756-Generic module is now in the I/O configuration.

Copy and Paste the Tags and Logic from the Example to Your Program

1. Minimize the previously existing project and open a new instance of RSLogix 5000 software.

2. Open the CFM_GenericProfileExample.ACD.

3. In the controller organizer of the CFM_GenericProfileExample project, expand the User-Defined data types.
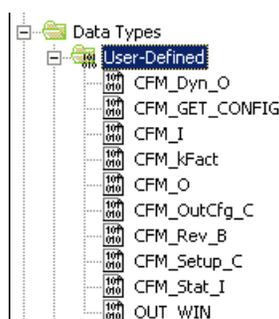
4. Copy one of the User-Defined data types.

   You must select and copy each of the User-Defined data types individually.
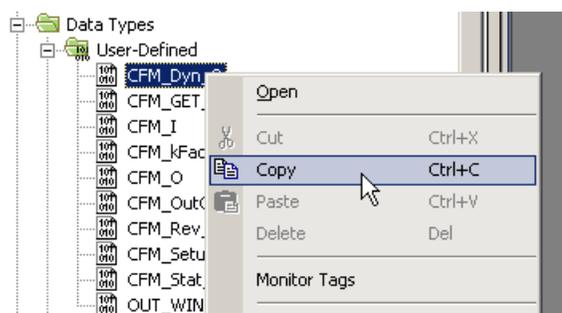
5. In the previously existing project, paste the copied User-Defined data type into the User-Defined data type folder.
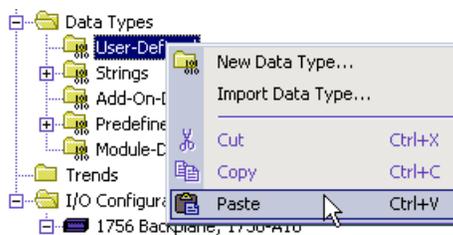
6. Repeat steps four and five until all of the User-Defined data types contained in the CFM_GenericProfileExample project have been pasted into the previously existing project.

7. In the CFM_GenericProfile project, copy the following Controller Tag data tags.

Name	△	Value	←	Force Mas ←	Style	Data Type	
⊞-CFM_B_C		{...}		{...}		CFM_Rev_B	
⊞-CFM_Config		0			Decimal	DINT	
⊞-CFM_IN		{...}		{...}		CFM_I	
⊞-CFM_OUT		{...}		{...}		CFM_O	

8. In the other RSLogix 5000 project, paste the copied data tags into the Controller Tags folder.

9. In the CFM_GenericProfileExample project, copy ladder logic rung 1 located in the Main Routine folder.

```
                                              User defined copy of
                                               AB:1756_CFM:I:0
                    ──COP──                 ──COP──                    ──COP──
                    Copy File               Copy File                 Copy File
 1        ─────────┤Source    CFM_B_C├──────┤Source   Local:5:I├──────┤Source   CFM_OUT├──────
                    Dest  Local:5:C.Data[0]  Dest       CFM_IN         Dest     Local:5:O
                    Length         308       Length         1          Length          1
```
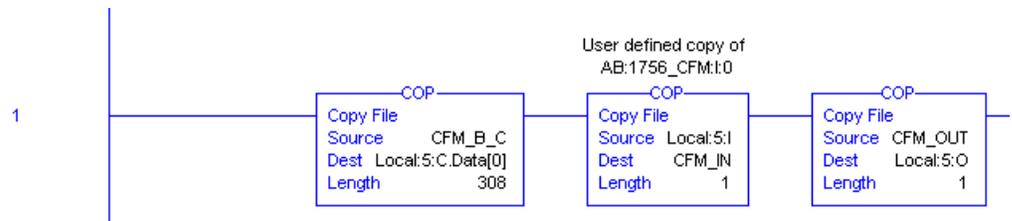
10. In the other open RSLogix project, paste the copied rung into the Main Routine folder.

11. Accept the pasted rung.

12. Delete the empty rung.

Specify the Configurable On/Off Behavior

1. In the previously existing program, select the Controller Tag folder and view the Monitor Tags tab.

2. Expand the CFM_B_C tag until you reach the CFM_B_C.OutputWindow data tags.

Name	△	Value	←	Force Mas ←	Style	Data Type
⊟-CFM_B_C		{...}		{...}		CFM_Rev_B
├-CFM_B_C.ProgToFaultEn		0			Decimal	BOOL
⊞-CFM_B_C.ChannelCfgBits		2#0000_0000			Binary	SINT
├-CFM_B_C.Ch0ProverDirection		0			Decimal	BOOL
├-CFM_B_C.Ch1ProverDirection		0			Decimal	BOOL
├-CFM_B_C.Ch0LowFreqClear		0			Decimal	BOOL
├-CFM_B_C.Ch1LowFreqClear		0			Decimal	BOOL
├-CFM_B_C.Ch0PreTrigger		0			Decimal	BOOL
├-CFM_B_C.Ch1PreTrigger		0			Decimal	BOOL
⊞-CFM_B_C.Operations		{...}		{...}		CFM_Setup_C[2]
⊟-CFM_B_C.OutputSetup		{...}		{...}		CFM_OutCfg_C[2]
⊞-CFM_B_C.OutputSetup[0]		{...}		{...}		CFM_OutCfg_C
⊞-CFM_B_C.OutputSetup[1]		{...}		{...}		CFM_OutCfg_C
⊟-CFM_B_C.OutputWindow		{...}		{...}		OUT_WIN[2]
⊟-CFM_B_C.OutputWindow[0]		{...}		{...}		OUT_WIN
├-CFM_B_C.OutputWindow[0].FreqOn		6000.0			Float	REAL
└-CFM_B_C.OutputWindow[0].FreqOff		4000.0			Float	REAL
⊟-CFM_B_C.OutputWindow[1]		{...}		{...}		OUT_WIN
├-CFM_B_C.OutputWindow[1].FreqOn		6000.0			Float	REAL
└-CFM_B_C.OutputWindow[1].FreqOff		4000.0			Float	REAL

3. In the Value column of the CFM_B_C.OutputWindow data tags, enter the desired the On and Off frequency limits.

   See Table 5 on page 58 for more information about determining your On/Off frequency limits.

4. Edit existing tag references throughout the project so they link to the appropriate, newly-added, user-defined tags.

   For example, if the tag reference is Local:5:I.Status.FreqAverage, change it to the corresponding user-defined tag, CFM_IN.Status.FreqAverage.

IMPORTANT   Test the configuration before implementing the changes into your production process.

Notes:

The following terms and abbreviations are used throughout this manual. For definitions of terms not listed here, refer to the Allen-Bradley Industrial Automation Glossary, publication AG-7.1.

Broadcast Data transmissions to all addresses

Communications format Format that defines the type of information transferred between an I/O module and its owner controller. This format also defines the tags created for each I/O module

Compatible match An electronic keying protection mode that requires the physical module and the module configured in the software to match according to vendor, catalog number and major revision. In this case, the minor revision of the module must be greater than or equal to that of the configured slot

Connection The communication mechanism from the controller to another module in the control system

Coordinated System Time (CST) Timer value which is kept synchronized for all modules within a single ControlLogix backplane chassis. The CST is a 64 bit number with μs resolution

Direct connection An I/O connection where the controller establishes an individual connection with I/O modules

Disable keying Option that turns off all electronic keying to the module. Requires no attributes of the physical module and the module configured in the software to match

Download The process of transferring the contents of a project on the workstation into the controller

Electronic keying A system feature which makes sure that the physical module attributes are consistent with what was configured in the software

Exact match An electronic keying protection mode that requires the physical module and the module configured in the software to match identically, according to vendor, catalog number, major revision and minor revision

Field side Interface between user field wiring and I/O module

High Resolution Frequency Mode Operational mode in which CFM module measures incoming pulses over a user-defined time period up to 2 seconds

Inhibit A ControlLogix process that allows you to configure an I/O module but prevent it from communicating with the owner controller. In this case, the controller does not establish a connection

Listen-only connection An I/O connection that allows a controller to monitor I/O module data without owning the module

Major revision	A module revision that is updated any time there is a functional change to the module resulting in an interface change with software
Minor revision	A module revision that is updated any time there is a change to the module that does not affect its function or software user interface (e.g. bug fix)
Multicast	Data transmissions which reach a specific group of one or more destinations
Network update time (NUT)	The smallest repetitive time interval in which the data can be sent on a ControlNet network. The NUT may be configured over the range from 2ms to 100ms using RSNetWorx software
Nonresettable Totalizer Mode	Operational mode in which CFM module counts pulses from a Flowmeter and scales them into volume (engineering units). In this mode, though, the count total cannot be reset during normal module operation.
Owner controller	The controller that creates and stores the primary configuration and communication connection to a module
Producer/consumer	Intelligent data exchange system devices in which the CFM module produces data without having been polled first
Program mode	In this mode, the controller program is not executing. Inputs are actively producing data. Outputs go to their configured program mode state
Prover	Device used for the calibration of liquid meters in custody transfer applications. Calibration compares a metered throughput to a known volume in the prover.
Remote connection	An I/O connection where the controller establishes an individual connection with I/O modules in a remote chassis
Removable terminal block (RTB)	Field wiring connector for I/O modules
Removal and insertion under power (RIUP)	ControlLogix feature that allows a user to install or remove a module or RTB while power is applied
Requested packet interval (RPI)	A configurable parameter which defines when the module will multicast data
Run mode	In this mode, the controller program is executing Inputs are actively producing data. Outputs are actively controlled
Service	A system feature that is performed on user demand
System side	Backplane side of the interface to the I/O module
Tag	A named area of the controller's memory where data is stored like a variable

Totalizer Mode   Operational mode in which CFM module counts pulses from a Flowmeter and scales them into volume (engineering units).

Trickle   Operational mode in which the CFM module controls two lines in a filling application, a full flow and a trickle flow. The trickle flow line provides users greater accuracy by slowly finishing the fill process.

Notes:

Rockwell Automation Support

Rockwell Automation provides technical information on the Web to assist you in using its products. At http://www.rockwellautomation.com/support, you can find technical manuals, technical and application notes, sample code and links to software service packs, and a MySupport feature that you can customize to make the best use of these tools. You can also visit our Knowledgebase at http://www.rockwellautomation.com/knowledgebase for FAQs, technical information, support chat and forums, software updates, and to sign up for product notification updates.

For an additional level of technical phone support for installation, configuration, and troubleshooting, we offer TechConnect℠ support programs. For more information, contact your local distributor or Rockwell Automation representative, or visit http://www.rockwellautomation.com/support/.

Installation Assistance

If you experience a problem within the first 24 hours of installation, review the information that is contained in this manual. You can contact Customer Support for initial help in getting your product up and running.

United States or Canada	1.440.646.3434
Outside United States or Canada	Use the Worldwide Locator at http://www.rockwellautomation.com/support/americas/phone_en.html, or contact your local Rockwell Automation representative.

New Product Satisfaction Return

Rockwell Automation tests all of its products to ensure that they are fully operational when shipped from the manufacturing facility. However, if your product is not functioning and needs to be returned, follow these procedures.

United States	Contact your distributor. You must provide a Customer Support case number (call the phone number above to obtain one) to your distributor to complete the return process.
Outside United States	Please contact your local Rockwell Automation representative for the return procedure.

Documentation Feedback

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